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(54) SWITCH WITH ELASTIC RETURN MEANS FOR VEHICLE DOORS OR TRUNKS

SCHALTER MIT ELASTISCHEN RÜCKSTELLMITTELN, FÜR FAHRZEUGTÜREN ODER FAHRZEUGKOFFERRÄUME

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Description

[0001] This invention relates to an opening switch for the doors or rear hatches of vehicles, of the type which the user operates manually to cause the door latch to open after the latch has been released through the corresponding locking mechanism.

BACKGROUND TO THE INVENTION

[0002] Switches which are used in the rear hatches and side doors of vehicles comprising a body enclosed beneath by a flexible membrane, especially of elastomer material, are known. When the user presses on the flexible membrane with his fingers it causes the latch of the lock to open (cf. DE-A-100 20 172).

[0003] A switch of this type comprises a lever operating a microswitch; the said lever can be moved between two positions, a first open position in which it is separated from the said microswitch and a second closed position in which it is in contact with the said microswitch when the user presses on the flexible membrane, and when the pressure ceases it returns to its initial resting position as a result of elastic return means.

[0004] Known switches have conventional helical metal springs for the function of returning the operating lever.

[0005] In practice it has been found that the inclusion of conventional springs for returning the operating lever gives rise to yet another complication in assembly of the switch and affects its cost.

DESCRIPTION OF THE INVENTION

[0006] The object of he switch for opening the doors or rear hatches of a vehicle according to claim 1 of this invention is to overcome the disadvantages presented by the switches known in the art, providing a switch which is easier to assemble and is of lower cost.

[0007] The opening switch for the doors or rear hatches of a vehicle according to this invention comprises elastic return means which comprise at least two flexible spring members of plastics material incorporated with the operating lever as a single part.

[0008] As the operating lever and the spring members constitute a single part, the cost of manufacturing the switch is reduced because of the fewer parts which have to be produced. At the same time assembly is simplified and made cheaper because it is not necessary to fit springs in the assembly as is the case with known switches.

[0009] Furthermore, when it is necessary to dismantle the switch, loss of the springs and a consequent need to replace them is avoided.

[0010] According to one embodiment of the invention the elastic return means comprise spring members in the form of curved wings incorporated into a zone close to the centre of the said operating lever which extend to the extremities thereof.

[0011] According to another embodiment of the invention the elastic return means comprise two spring members in the shape of curved springs incorporated into a zone close to the extremities of the said operating lever and which extend to the centre thereof.

[0012] According to another embodiment of the invention the elastic return means comprise two spring members in the form of bellows incorporated in zones close to the extremities of the said operating lever.

[0013] In accordance with these embodiments the microswitch and the operating lever with the incorporated springs are housed within a body which is closed by a flexible membrane on which a user presses to cause the operating lever to move from the said first position to the said second position.

[0014] According to the invention the switch comprises a cover connected to the body.

[0015] Preferably the cover comprises tangs on its outer surface for connection with matching openings made in the body.

[0016] According to another embodiment the body comprises clips on its upper surface which connect with matching openings made in the cover. Likewise this comprises a perimetral seal fitted between the cover and the body.

[0017] This structural configuration is appropriate when it is necessary to seal the switch against water or moisture originating from the interior of the vehicle or the switch embellisher.

[0018] The cover is moulded onto the assembly comprising the cable ends connected to the two metal blades soldered to the microswitch.

[0019] Additionally the body comprises tangs on its outer surface for mounting on the frame of the door or rear hatch of the vehicle.

[0020] According to another embodiment the elastic return means comprise springs in the form of curved U-shaped wings, these wings being incorporated at one extremity into a zone close to the centre of the said operating lever and joined together at the other extremity by means of a bar provided with supporting clips for connection to matching openings made in a printed circuit board.

[0021] Preferably the microswitch is located on the printed circuit board, this printed circuit board being connected within a cover.

[0022] In this case the operating lever is directly connected to the printed circuit board with the help of the supporting clips without transmitting forces to it.

[0023] Advantageously the operating lever comprises securing members to support ribs located within the cover.

[0024] These securing members prevent the transmission of permissible greater forces to the microswitch, thus ensuring that it operates satisfactorily.

[0025] Preferably the operating lever with the incorporated springs and the securing members are housed within a body which is closed by a flexible membrane on

which a user presses to cause movement of the operating lever from the said first position to the said second position.

[0026] Advantageously the body comprises attachment members for attaching it to the cover.

[0027] In this way it is ensured that the switch is leaktight because the said flexible membrane is moulded over the body and kept under pressure by the said fixing members over the cover.

[0028] Preferably the part comprising the operating lever and the spring members is of polyoxymethylene (POM) or any elastic plastics such as butyl polyterephthalate (BPT), polyamide (PA), polypropylene (PP), etc.

[0029] Advantageously the operating lever includes a push-button incorporated in the same part designed to come into contact with the microswitch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] In order to assist the description of what has been set forth above drawings are appended in which four practical embodiments of the switch for opening the doors or rear hatches of a vehicle according to the invention are illustrated diagrammatically and purely by way of non-restrictive examples, in which drawings:

Figure 1 is a perspective and exploded view of a switch according to a first embodiment of the invention,

Figure 2 is a transverse cross-section through the switch in the resting position according to a first embodiment of the invention,

Figure 3 is a transverse cross-section of the switch in Figure 2 in the operating position,

Figure 4 is a transverse cross-section of the switch in the resting position according to a second embodiment of the invention,

Figure 5 is a transverse cross-section of the switch in the resting position according to a third embodiment of the invention.

Figure 6 is a perspective exploded view of a switch according to a fourth embodiment of the invention,

Figure 7 is a perspective view of the switch in Figure 6 fitted and in its resting position,

Figure 8 is a perspective view of the lower part of the cover for the switch in Figure 6, showing the cable ends connected to two metal blades soldered to the microswitch,

Figure 9 is a perspective and exploded view of a switch according to a fifth embodiment of the invention,

Figure 10 is a perspective view of the switch in Figure 9 fitted and in the resting position, and

Figure 11 is a transverse cross-section through the operating lever connected to the printed circuit board of the switch in Figure 9.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0031] Figures 1 to 3 show a first embodiment of switch 1 for opening the doors or rear hatches of a vehicle.

[0032] Opening switch 1 comprises a body 2 which is closed beneath by a flexible membrane 3 and is closed at the top by a cover 4.

[0033] Within body 2 there is a lever 5 to operate a microswitch 6. Said lever 5 can be moved between two positions, a first open position in which it is separated from said microswitch 6 (see Figure 2) and a second closed position in which it is in contact with said microswitch 6 (see Figure 3).

[0034] It also comprises elastic means for returning lever 5 from the said second position to the said first position. Said elastic return means include two flexible spring members 7 of plastics material incorporated with lever 5 as a single part.

[0035] In this case the two spring members 7 have a configuration in the form of curved wings incorporated into a zone close to the centre of said lever 5 and which extend to the extremities thereof.

[0036] Preferably the part incorporating lever 5 and spring members 7 is a polyoxymethylene, or any elastic plastics material such as PBT, PP or PA.

[0037] In addition to this, lever 5 includes a press button 8 incorporated into the same part which is intended to come into contact with microswitch 6.

[0038] The operation of switch 1 according to the invention is described below:

[0039] When a user presses on flexible membrane 3 this causes lever 5 to move and in turn operates microswitch 6 closing the switch's circuit (see Figure 3) which makes it possible to open the door or the rear hatch of the vehicle.

[0040] Once the user ceases to apply pressure spring members 7 move said lever 5 to its initial position (see Figure 2).

[0041] In addition to this, cover 4 comprises tangs 9 on its outer surface for connection to matching openings 10 made in body 2.

[0042] Additionally body 2 comprises tangs 11 on its outer surface for assembly to the frame of the door or rear hatch of the vehicle.

[0043] Figure 4 illustrates a second embodiment of opening switch 1 according to the invention.

[0044] In this case the elastic return means comprise two spring members 7a in the form of curved wings incorporated into a zone close to the extremities of said

lever 5 which extend to the centre thereof.

[0045] Figure 5 illustrates a third embodiment of opening switch 1 according to the invention.

[0046] In this case the elastic return means comprise spring members in the form of bellows 7b which are incorporated in the zones close to the extremities of said lever 5.

[0047] Figures 6 to 8 show a fourth embodiment of the opening switch 1 according to the invention.

[0048] In this case body 2 comprises clips 9a on its outer surface for connection to matching openings 10a made in cover 4. It also includes a perimetral seal 12 fitted between cover 4 and body 2.

[0049] This structural configuration is appropriate when it is necessary to seal the switch against water or moisture proceeding from the interior of the vehicle or the switch embellisher.

[0050] As can be seen in Figure 8, cover 4 is moulded onto the assembly formed by cable ends 13 attached to two metal blades 14 soldered to microswitch 6.

[0051] Figures 9 to 11 show a fifth embodiment of the opening switch 1 according to the invention.

[0052] In this case the elastic return means comprise springs in the form of U-shaped curved wings 7c, these wings 7c being incorporated at one extremity into a zone close to the centre of said operating lever 5 and joined together at the other extremity by means of a bar 15 provided with supporting clips 16 for connection to matching openings made in a printed circuit plate 17.

[0053] Microswitch 6 is located on printed circuit plate 17, this printed circuit plate 17 being connected to the interior of a cover (which is not shown for greater clarity).

[0054] Operating lever 5 also comprises securing members 18 to support ribs located within the interior of the said cover.

[0055] Operating lever 5 with incorporated springs 7c and securing members 18 are housed within a body 2 which is closed by a flexible membrane 3 onto which a user presses to cause operating lever 5 to move from the said first position to the said second position. Likewise body 2 comprises attachment members 19 for attaching it to the cover.

[0056] The switch is fitted in the following way:

[0057] First printed circuit board 17 is placed within the cover on one side in a longitudinal direction, nesting within the ribs of the said cover.

[0058] Then operating lever 5 is placed in the lower part of the cover, being securely fixed to printed circuit board 17 through supporting clips 16.

[0059] Finally body 2 with flexible membrane 3 moulded thereon is connected to the cover by connection members 19, ensuring that the switch is leaktight.

[0060] In this way a switch is obtained which has a reduced number of parts, is easier to fit and operate satisfactorily, because in this case the travel of operating lever 5 is limited by being enclosed by the aforesaid supporting ribs for printed circuit board 17, thus preventing forces from being transmitted to microswitch 6.

[0061] In addition to the configurations described above the invention provides for other configurations of spring members incorporated in the lever, such as springs of the helical type.

Claims

1. Opening switch (1) for the doors or rear hatches of a vehicle which comprises a lever (5) operating a microswitch (6) which can be moved between two positions, a first open position in which it is separate from the said microswitch (6) and a second enclosed position in which it is in contact with the said microswitch (6), and elastic means for returning the operating lever (5) from the said second position to the said first position, the elastic return means comprise at least two flexible spring members (7, 7a, 7b, 7c) of plastics material incorporated with the operating lever (5) as a single part, the microswitch (6) and the operating lever (5) with the incorporated springs (7, 7a, 7b) being housed within a body (2), said switch comprising a cover (4) attached to the body (2), and being **characterised in that** the cover (4) is moulded onto the assembly comprising the cable ends (13) attached to two metal blades (14) soldered to the microswitch (6).

2. Switch (1) according to claim 1, **characterised in that** the elastic return means comprise two spring members (7) in the form of curved wings incorporated into the zone close to the centre of the said operating lever (5) and which extend to the extremities thereof.

3. Switch (1) according to claim 1, **characterised in that** the elastic return means comprise two spring members (7a) in the form of curved wings incorporated into a zone close to the extremities of the said operating lever (5) and which extend to the centre thereof.

4. Switch (1) according to claim 1, **characterised in that** the elastic return means comprise two spring members in the form of bellows (7b) incorporated into zones close to the extremities of the said operating lever (5).

5. Switch (1) according to any one of claims 2 to 4, **characterised in that** the body (2) is closed by a flexible membrane (3) on which a user presses to cause movement of the operating lever (5) from the said first position to the said second position.

6. Switch (1) according to any one of preceding claims, **characterised in that** the cover (4) comprises tangs (9) on its outer surface for attachment to matching openings (10) made in the body (2).

7. Switch (1) according to any one of preceding claims 1 to 5, **characterised in that** the body (2) comprises clips (9a) on its outer surface for attachment to matching openings (10a) made in the cover (4).

8. Switch (1) according to claim 7, **characterised in that** it comprises a perimetral seal (12) fitted between the cover (4) and the body (2).

9. Switch (1) according to any one of the preceding claims, **characterised in that** the body (2) comprises tangs (11) on its outer surface for connection to the frame of the door or rear hatch of the vehicle.

10. Switch (1) according to claim 1, **characterised in that** the elastic return means comprise two springs in the form of U-shaped curved wings (7c), the said wings (7c) being incorporated at one extremity into a zone close to the centre of the said operating lever (5) and which are joined together at the other extremity by a bar (15) provided with supporting clips (16) for attachment to matching openings made in a printed circuit board (17).

11. Switch (1) according to claim 10, **characterised in that** the microswitch (6) is located to the interior of a cover which is connected the printed circuit board (17).

12. Switch (1) according to any one of claims 10 to 11, **characterised in that** the operating lever (5) comprises securing members (18) for supporting ribs located within the cover.

13. Switch (1) according to any one of claims 10 to 12, **characterised in that** the operating lever (5) with the incorporated springs (7c) and the securing members (18) are housed within a body (2) which is closed by a flexible membrane (3) on which the user presses to cause the operating lever (5) to move from the said first position to the said second position.

14. Switch (1) according to any one of claims 10 to 13, **characterised in that** the body (2) comprises attachment members (19) for attachment to the cover.

15. Switch (1) according to any one of the preceding claims, **characterised in that** the part comprising the operating lever (5) and the springs (7, 7a, 7b, 7c) is of polyoxymethylene.

16. Switch (1) according to any one of the preceding claims, **characterised in that** the operating lever (5) includes a push-button (8) incorporated into the same part which is intended to come into contact with the microswitch (6).

Patentansprüche

1. Öffnungsachalter (1) für die Türen oder Heckklappen eines Fahrzeugs, der einen einen Mikroschalter (6) betätigenden Hebel (5), der zwischen zwei Positionen bewegt werden kann, einer ersten offenen Position, in der er vom Mikroschalter (6) getrennt ist, und einer zweiten umschlossenen Position, in der er mit dem Mikroschalter (6) in Kontakt ist, und elastische Mittel zum Rückstellen des Betätigungshebels (5) aus der zweiten Position in die erste Position umfasst, wobei die elastischen Rückstellmittel mindestens zwei flexible Federelemente (7, 7a, 7b, 7c) aus Kunststoffmaterial umfassen, die in den Betätigungshebel (5) als Einzelteil eingegliedert sind, wobei der Mikroschalter (6) und der Betätigungshebel (5) mit den eingegliederten Federn (7, 7a, 7b) in einem Körper (2) untergebracht sind, wobei der Schalter eine am Körper (2) angebrachte Abdeckung (4) umfasst, **dadurch gekennzeichnet, dass** die Abdeckung (4) auf die Anordnung angeformt ist, die die Kabelenden (13) umfasst, die an zwei an den Mikroschalter (6) angelöteten Metallblättern (14) angebracht sind.

2. Schalter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die elastischen Rückstellmittel zwei Federelemente (7) in der Form von gebogenen Flügeln umfassen, die in den Bereich nahe der Mitte des Betätigungshebels (5) eingegliedert sind und sich zu dessen Enden erstrecken.

3. Schalter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die elastischen Rückstellmittel zwei Federelemente (7a) in der Form von gebogenen Flügeln umfassen, die in einen Bereich nahe den Enden des Betätigungshebels (5) eingegliedert sind und sich zu dessen Mitte erstrecken.

4. Schalter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die elastischen Rückstellmittel zwei Federelemente in der Form eines Balgs (7b) umfassen, der in Bereichen nahe den Enden des Betätigungshebels (5) eingegliedert ist.

5. Schalter (1) nach einem der Ansprüche 2 - 4, **dadurch gekennzeichnet, dass** der Körper (2) durch eine flexible Membran (3) verschlossen ist, auf die ein Benutzer drückt, um eine Bewegung des Betätigungshebels (5) aus der ersten Position in die zweite Position zu veranlassen.

6. Schalter (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Abdeckung (4) auf ihrer Außenfläche Lappen (9) zum Anbringen an passenden, im Körper (2) ausgeführten Öffnungen (10) umfasst.

7. Schalter (1) nach einem der vorhergehenden Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Körper (2) auf seiner Außenfläche Clips (9a) zum Anbringen an passenden, in der Abdeckung (4) ausgeführten Öffnungen (10a) umfasst,

8. Schalter (1) nach Anspruch 7, **dadurch gekennzeichnet, dass** er zwischen der Abdeckung (4) und dem Körper (2) eine Umfangsdichtung (12) umfasst.

9. Schalter (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Körper (2) auf seiner Außenfläche Lappen (11) zum Verbinden mit dem Rahmen der Tür oder Heckklappe des Fahrzeugs umfasst.

10. Schalter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die elastischen Rückstellmittel zwei Federn in der Form von U-förmigen gebogenen Flügeln (7c) umfassen, die an einem Ende in einen Bereich nahe der Mitte des Betätigungshebels (5) eingegliedert sind und am anderen Ende über eine Stange (15) verbunden sind, die zum Anbringen an passenden, in einer Leiterplatte (17) ausgeführten Öffnungen mit Stützclips (16) versehen sind.

11. Schalter (1) nach Anspruch 10, **dadurch gekennzeichnet, dass** der Mikroschalter (6) zum Inneren einer Abdeckung hin angeordnet ist, die mit der Leiterplatte (17) verbunden ist.

12. Schalter (1) nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** der Betätigungshebel (5) Befestigungselemente (18) für in der Abdeckung angeordnete Stützrippen umfasst.

13. Schalter (1) nach einem der Ansprüche 10 bis 12, **dadurch gekennzeichnet, dass** der Betätigungshebel (5) mit den eingegliederten Federn (7c) und die Befestigungselemente (18) in einem Körper (2) untergebracht sind, der durch eine flexible Membran (3) verschlossen ist, auf die ein Benutzer drückt, um eine Bewegung des Betätigungshebels (5) aus der ersten Position in die zweite Position zu veranlassen.

14. Schalter (1) nach einem der Ansprüche 10 bis 13, **dadurch gekennzeichnet, dass** der Körper (2) Anbringelemente (19) zum Anbringen an der Abdekkung umfasst.

15. Schalter (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der den Betätigungshebel (5) und die Federn (7, 7a, 7b, 7c) umfassende Teil aus Polyoxymethylen ist.

16. Schalter (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Betätigungshebel (5) eine Drucktaste (8) aufweist, die in demselben Teil eingegliedert ist, der mit dem Mikroschalter (6) in Kontakt kommen soll.

Revendications

1. Commutateur d'ouverture (1) destiné aux portes ou aux hayons d'un véhicule qui comprend un levier (5) actionnant un microcommutateur (6) qui peut être déplacé entre deux positions, à savoir une première position ouverte à laquelle il est séparé dudit microcommutateur (6) et une seconde position refermée à laquelle il est en contact avec ledit microcommutateur (6), et des moyens élastiques destinés à rappeler le levier d'actionnement (5) de ladite seconde position à ladite première position, les moyens de rappel élastiques comprennent au moins deux éléments à ressorts flexibles (7, 7a, 7b, 7c) en matière plastique intégrés au levier d'actionnement (5) sous la forme d'une pièce unique, le microcommutateur (6) et le levier d'actionnement (5), avec les ressorts intégrés (7, 7a, 7b) étant logés à l'intérieur d'un corps (2), ledit commutateur comprenant un capot (4) fixé au corps (2), et étant **caractérisé en ce que** le capot (4) est moulé sur l'assemblage comprenant les extrémités de câble (13) fixées à deux larmes métalliques (14) soudées au microcommutateur (6).

2. Commutateur (1) selon la revendication 1, **caractérisé en ce que** les moyens de rappel élastiques comprennent deux éléments à ressorts (7) sous la forme d'ailettes incurvées intégrées à la zone proche du centre dudit levier d'actionnement (5) et qui s'étendent vers les extrémités de ce dernier.

3. Commutateur (1) selon la revendication 1, **caractérisé en ce que** les moyens de rappel élastiques comprennent deux éléments à ressorts (7a) sous la forme d'ailettes incurvées intégrées à une zone proche des extrémités dudit levier d'actionnement (5) et qui s'étendent vers le centre de ce dernier.

4. Commutateur (1) selon la revendication 1, **caractérisé en ce que** les moyens de rappel élastiques comprennent deux éléments à ressorts sous la forme de soufflets (7b) intégrés à des zones proches des extrémités dudit levier d'actionnement (5).

5. Commutateur (1) selon l'une quelconque des revendications 2 à 4, **caractérisé en ce que** le corps (2) est fermé par une membrane flexible (3) sur laquelle un utilisateur appuie pour provoquer un mouvement du levier d'actionnement (5) de ladite première position à ladite seconde position.

6. Commutateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le capot (4) comprend des tenons (9) sur sa surface ex-

térieure pour la fixation à des ouvertures correspondantes (10) ménagées dans le corps (2).

7. Commutateur (1) selon l'une quelconque des revendications 1 à 5 précédentes, **caractérisé en ce que** le corps (2) comprend des colliers (9a) sur sa surface extérieure pour la fixation à des ouvertures correspondantes (10a) ménagées dans le capot (4).

8. Commutateur (1) selon la revendication 7, **caractérisé en ce qu'**il comprend un joint d'étanchéité périphérique (12) ajusté entre le capot (4) et le corps (2).

9. Commutateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le corps (2) comprend des tenons (11) sur sa surface extérieure pour le raccordement au châssis de la porte ou du hayon du véhicule.

10. Commutateur (1) selon la revendication 1, **caractérisé en ce que** les moyens de rappel élastiques comprennent deux ressorts sous la forme d'ailettes incurvées en U (7c), lesdites ailettes (7c) étant intégrées au niveau d'une extrémité à une zone proche du centre dudit levier d'actionnement (5) et étant jointes l'une à l'autre au niveau de l'autre extrémité par une barre (15) munie de colliers de support (16) pour la fixation à des ouvertures correspondantes ménagées dans une carte de circuit imprimé (17).

11. Commutateur (1) selon la revendication 10, **caractérisé en ce que** le microcommutateur (6) est situé à l'intérieur d'un capot qui est relié à la carte de circuit imprimé (17).

12. Commutateur (1) selon l'une quelconque des revendications 10 à 11, **caractérisé en ce que** le levier d'actionnement (5) comprend des éléments de fixation (18) destinés à supporter des nervures situées à l'intérieur du capot.

13. Commutateur (1) selon l'une quelconque des revendications 10 à 12, **caractérisé en ce que** le levier d'actionnement (5), avec les ressorts intégrés (7c) et les éléments de fixation (18), sont logés à l'intérieur d'un corps (2) qui est fermé par une membrane flexible (3) sur laquelle l'utilisateur appuie pour provoquer le déplacement du levier d'actionnement (5) de ladite première position à ladite seconde position.

14. Commutateur (1) selon l'une quelconque des revendications 10 à 13, **caractérisé en ce que** le corps (2) comprend des éléments de fixation (19) pour la fixation au capot.

15. Commutateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la pièce comprenant le levier d'actionnement (5) et les ressorts (7, 7a, 7b, 7c) est constituée de polyoxyméthylène.

16. Commutateur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le levier d'actionnement (5) comprend un bouton poussoir (8) intégré à la même pièce que celle destinée à venir au contact du microcommutateur (6).

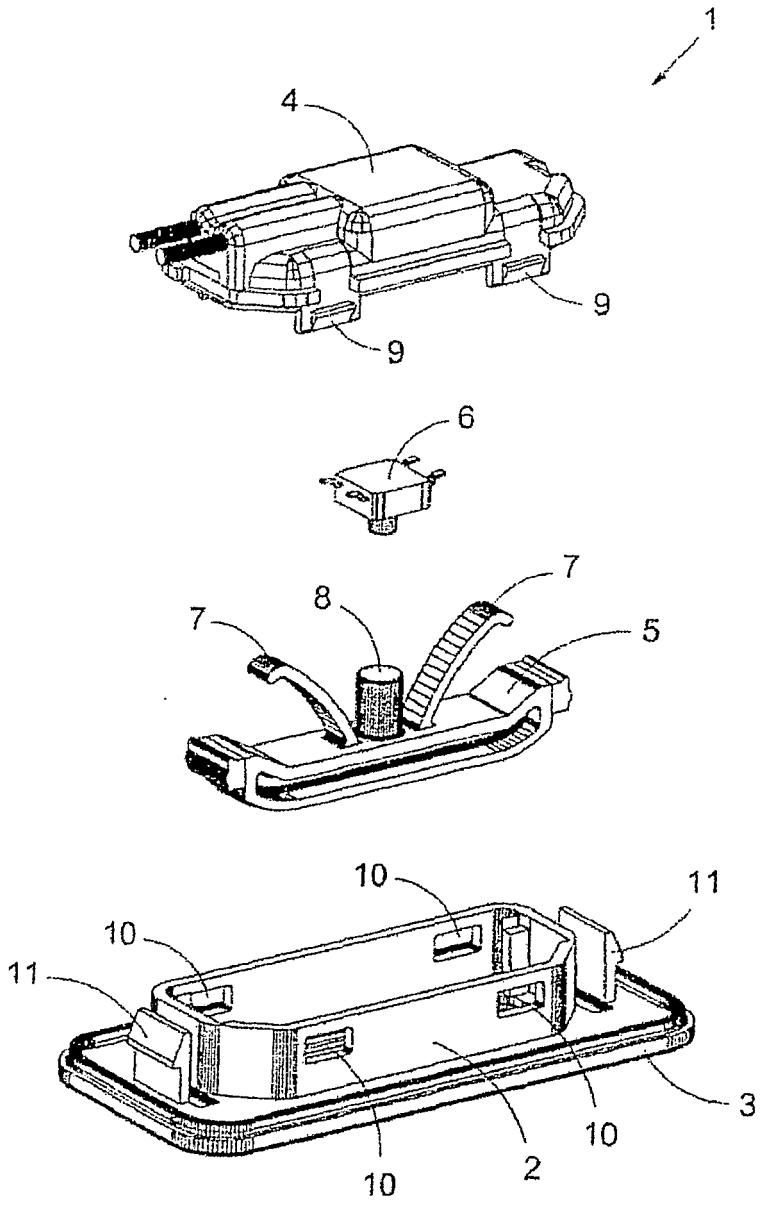


FIG. 1

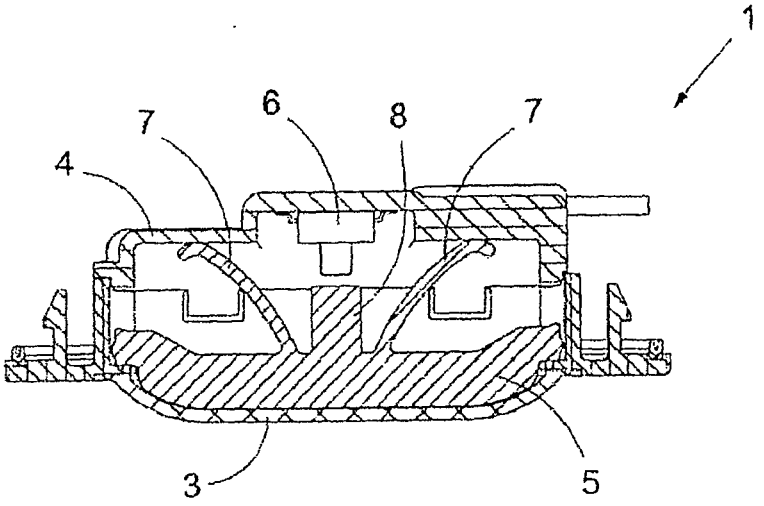


FIG. 2

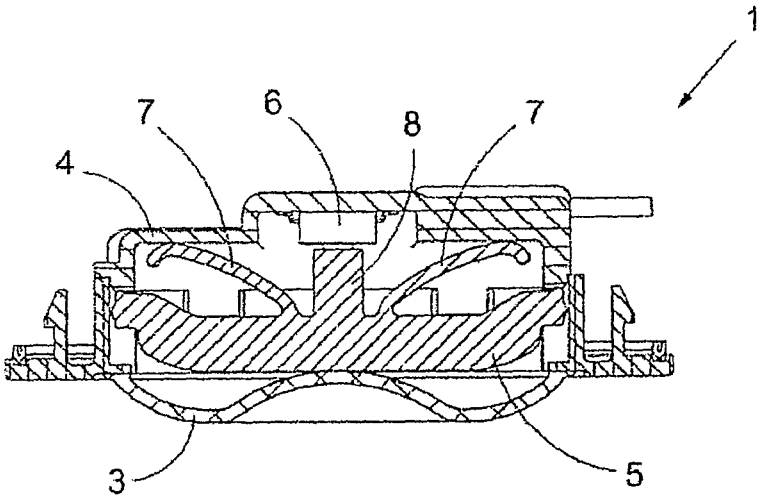


FIG. 3

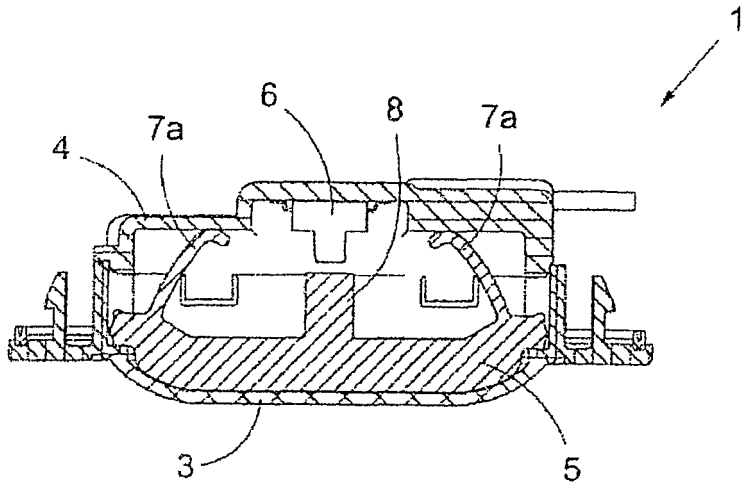


FIG. 4

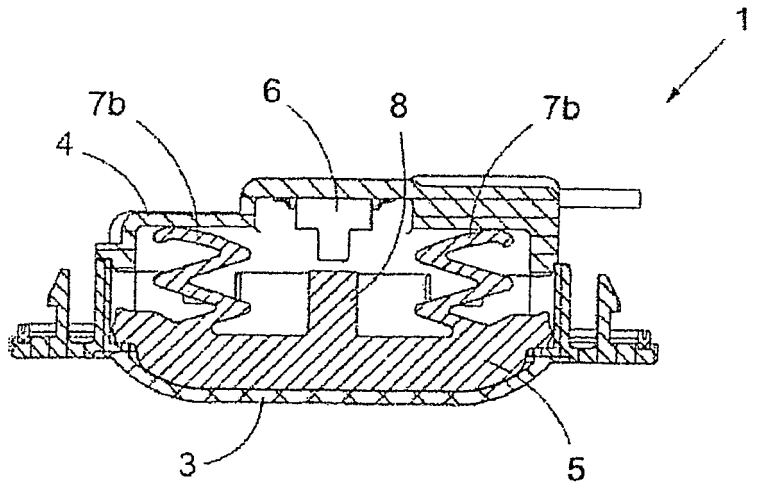


FIG. 5

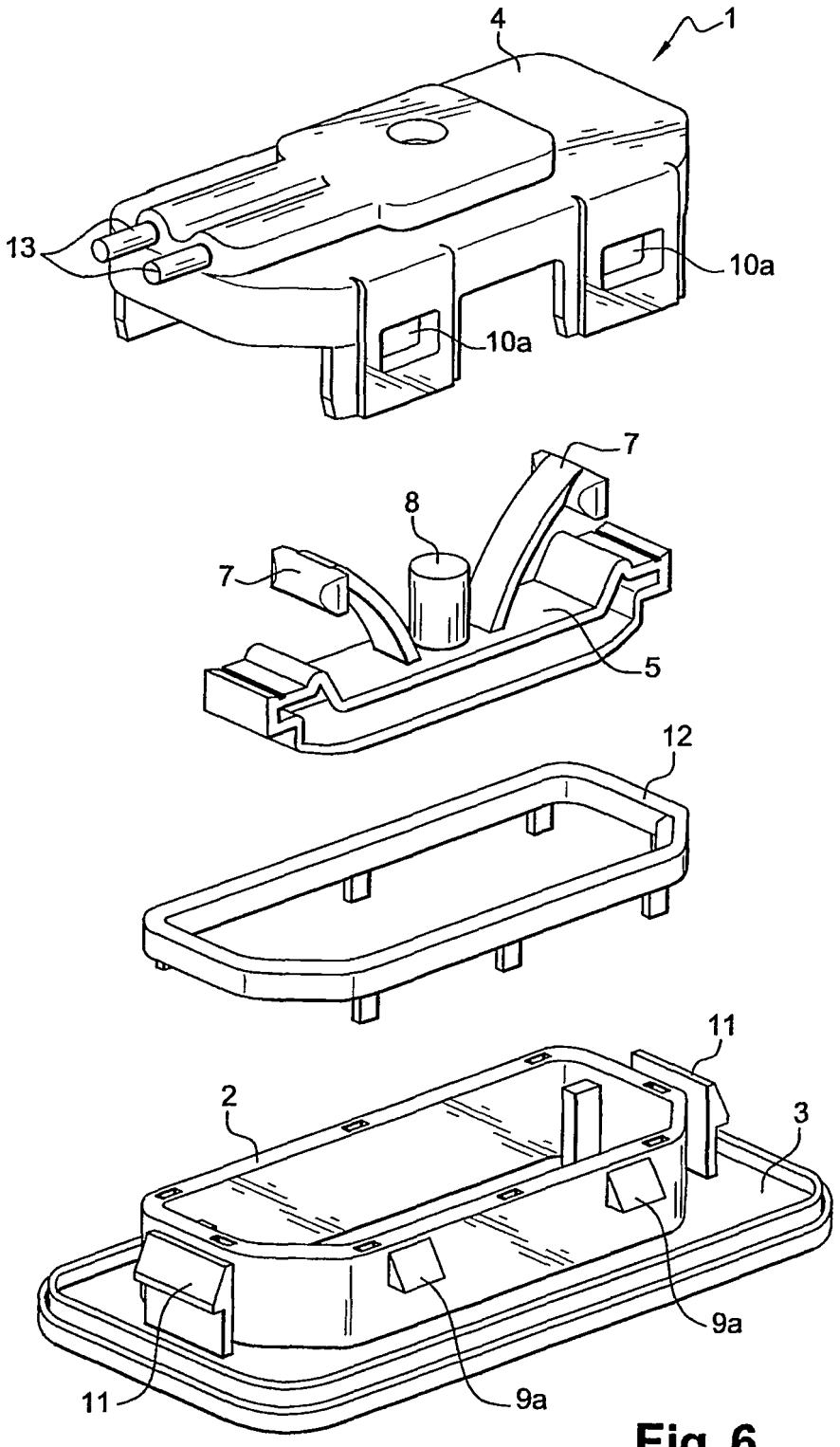


Fig. 6

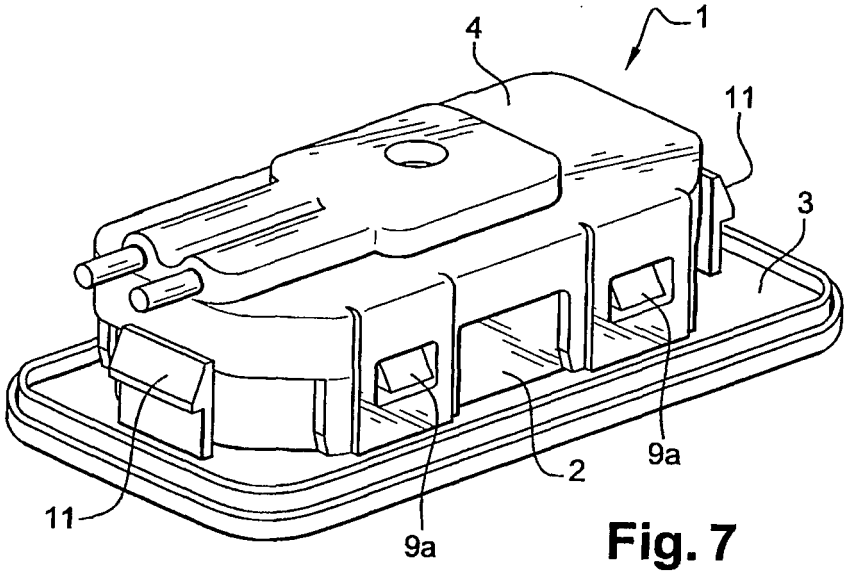


Fig. 7

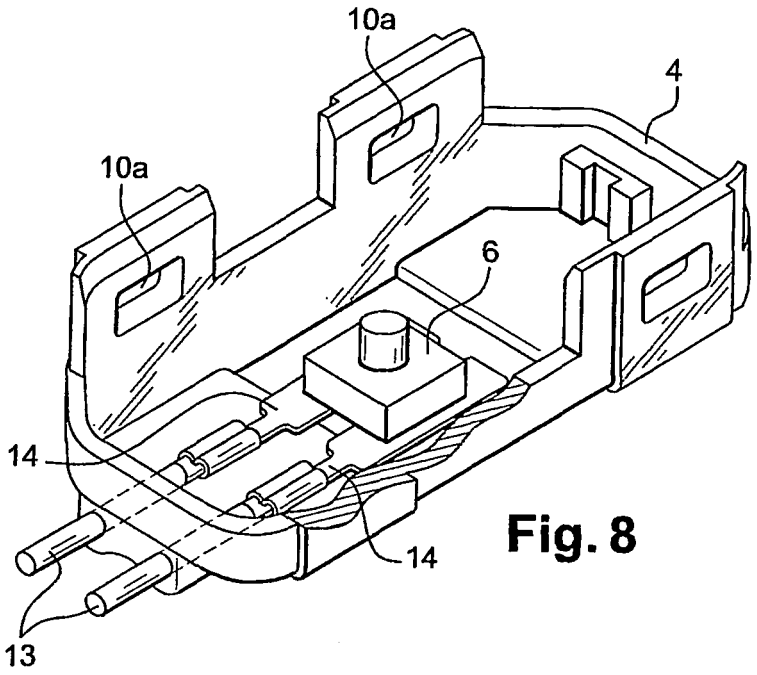


Fig. 8

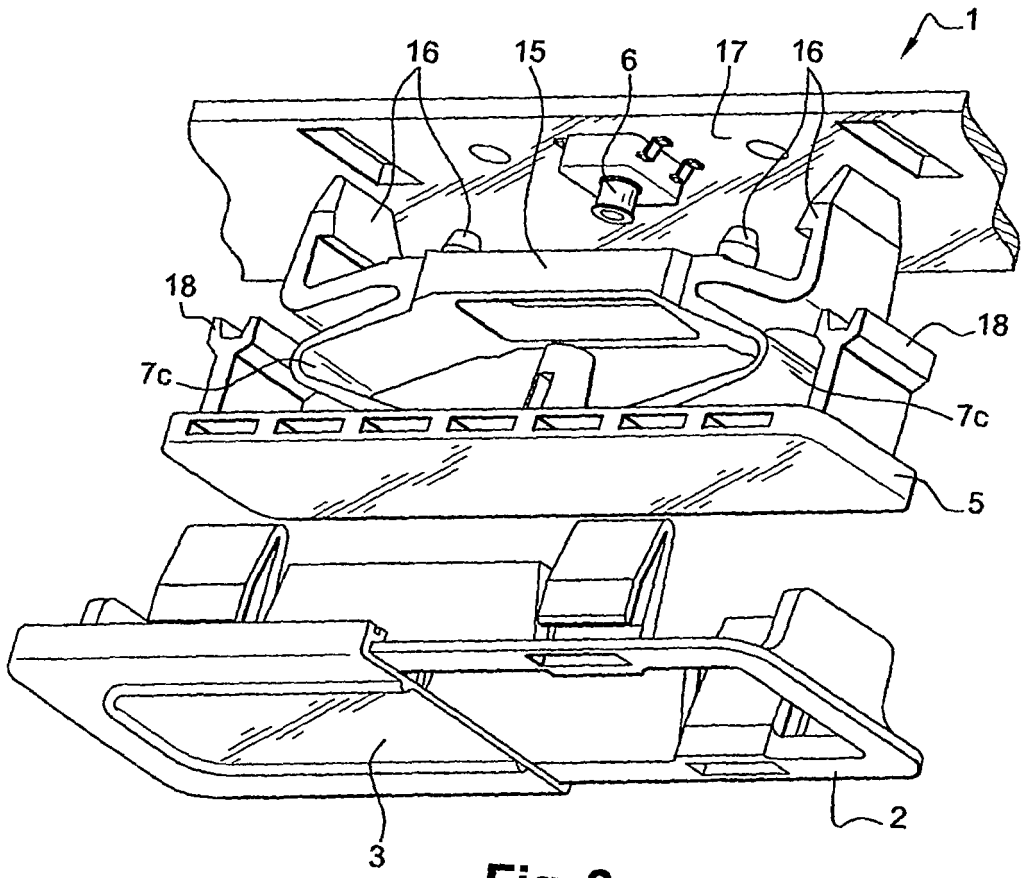


Fig. 9

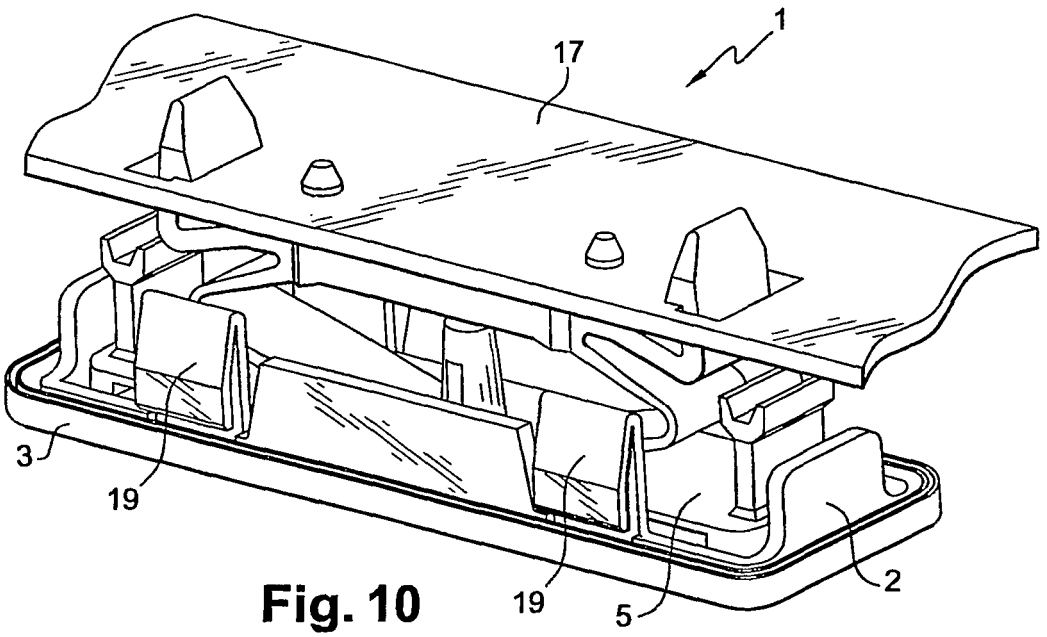


Fig. 10

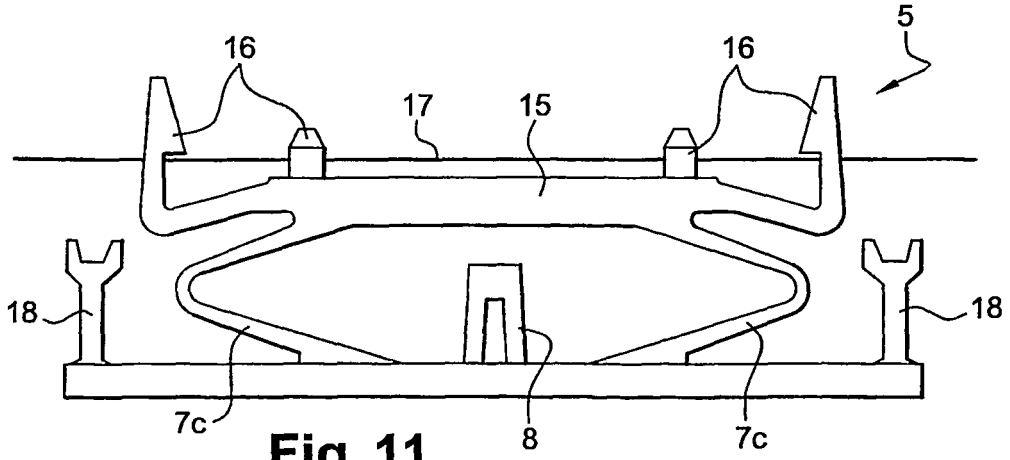


Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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