(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 312 863 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.04.2018 Bulletin 2018/17

(51) Int Cl.:
H01H 21/22 *(2006.01)* ***H01H 23/00*** *(2006.01)*

(21) Application number: **16195228.8**

(22) Date of filing: **24.10.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **DAV**
94046 Créteil Cedex (FR)

(72) Inventor: **HEGEDUS, Bence**
8200 VESZPREM (HU)

(74) Representative: **Delplanque, Arnaud**
VALEO Comfort and Driving Assistance
76, rue Auguste Perret
Z.I. Europarc
94046 Créteil Cedex (FR)

(54) SWITCH DEVICE IN PARTICULAR FOR A USE IN A PUSH PULL WINDOW LIFTER MECHANISM

(57) The present invention relates to a switch device (1) comprising:
• a hinge knob body (2),
• a printed circuit board (6) presenting a printed circuit and at least a first and a second rubber domes (5, 5') whose can close partially or completely a part of the printed circuit, and
• at least one plunger (4), such that a pivoting movement of the hinge knob body (2) can be transmitted to at least one of said rubber domes (5, 5'),
the at least one plunger (4) comprises:
• a pushing surface (41) configured to cooperate with a protrusion (42),
• a base plate (43) configured to be in contact with said rubber domes (5, 5'),
• a lever member (44) inclined with respect to said base plate (43), to transmit a pivoting movement to the base plate (43), and
• a connection member (45) having a first end (451) and a second end (453), configured such that the hinge knob body (2) and the plunger (4) form only one piece.

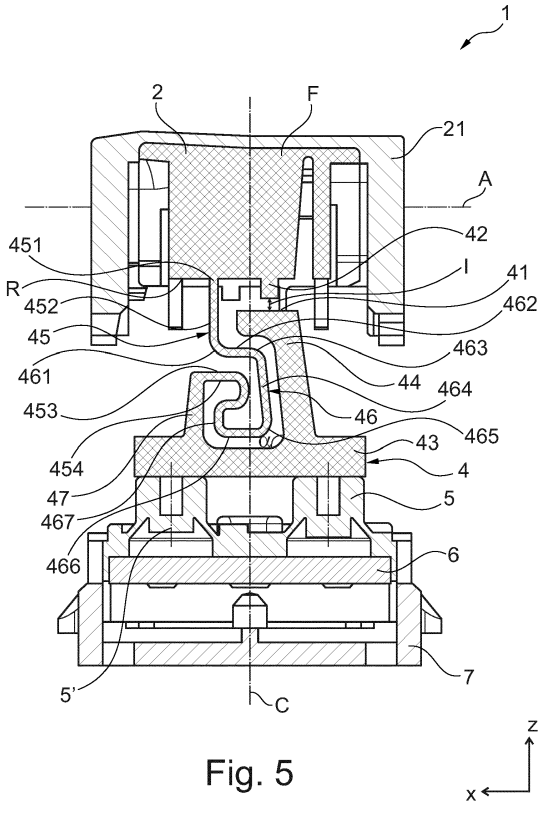

Fig. 5

EP 3 312 863 A1

Description

[0001] The present invention relates to switch devices for a use for example in a push pull window lifter mechanism and in particular for a use as a power window switch of, for example, an automotive vehicle. More precisely, the present invention relates to a pentaposition switch device for a use as a power window switch in an automobile.

[0002] Nowadays, a lot of automobiles are equipped with windows that are opened or closed with a motor which is generally an electric motor controlled by one or more switches in order to increase user's comfort. Those switches present hinge knob bodies configured to be moved by the user and which are generally disposed on sides of a door of the automobile in order to transmit the information to the electric motor to move up or down the window according to the movement of said hinge knob body.

[0003] Those windows have to be opened or closed as expected by the user. In order to facilitate the opening or the closing at user's convenience, such switches are generally pentaposition switches. More precisely, such switches present a rest position in which the switch does not allow any movement of the window and two two-stage clicks. In the first-stage click, which corresponds to a slight pressure, the window moves down or up as long as the user pushes or pulls the hinge knob body. This first-stage click can be seen as a manual operation click. The second-stage click corresponds to a heavy pressure on the hinge knob body, in this case, the window will automatically move completely up or down without the need for the user to maintain his pressure on the hinge knob body. This second-stage click can be seen as an automatic operation click.

[0004] It is known from the document JP-A-2002-334631 a power window switch of an automobile which provides a two-stage operation click; a manual operation is performed in a first-stage operation click, an automatic operation is performed in a second-stage operation click. The switch disclosed in this document has a driving member integrally mounted on a hinge knob body which moves so as to pivot on a concavity as a fulcrum, thereby pressing a switch operation part in contact with two rubber domes which are in contact with two fixed contacts of a printed wiring substrate. In order to perform the two-stage operation with the switch device according to this document, a position at which the switch operation part is pressed is eccentrically disposed from the idle position between the two rubber domes so as to make different distances from the rubber dome to each operation part, whereby the first and second-stage operation is performed.

[0005] However, since the rubber dome have the same shape, it is very difficult for the rubber domes to correspond to various application forces.

[0006] Furthermore, a power switch device of an automotive vehicle which is a pentaposition switch device is known from the document US7084359. An exploded view of such a switch device is illustrated referring to figure 1. The switch device 100 disclosed in this document comprises a hinge knob body 120 having a pivoting axis A, a housing 130, two plungers 140, a keypad membrane 150, a printed circuit board 160 and a rear cover 170.

[0007] Referring to figure 2, the keypad membrane 150 comprises rubber domes 105 which are adjacent to each other. Those rubber domes 105 are disposed on a base 151 which present different thicknesses. More precisely the base 151 presents parts which are thicker than other parts. Thicker parts 154 are the parts for small application forces and thinner parts 156 are the parts for heavy application forces. According to this document, the thicker parts 154 are configured to act as a manual operation click as defined here above and the thinner parts 156 are configured to act as an automatic operation click.

[0008] However, the production of such a switch device 100 can be expensive because it is necessary to have specific molds for all pieces composing this switch device 100. Furthermore, the assembling operator or machine would need more time to assemble such a switch device 100 due to the number of pieces composing this switch device 100. Moreover, such a switch device 100 would need some place in the X/Y direction for its movement because of the configuration of the base 151 supporting the rubber domes 105. Finally, such a switch device 100 uses a complex base 151 on the keypad membrane 150 with the different thicknesses which seems complex and expensive to produce.

[0009] An objective of the present invention is to at least partially overcome the different drawbacks of the prior art mentioned here above.

[0010] An other objective of the present invention, different from the preceding, is to provide a switch device with less number of parts than the switch devices known from the prior art, so its manufacturing and assembling would be less expensive and easier.

[0011] Another objective, different from the preceding objectives, is to provide a switch device which needs less place in the X/Y direction for its movement in order to reduce the size of such a switch device.

[0012] Another objective of the present invention, different from the preceding objectives, is to provide a switch device lighter than the switch devices known from the prior art without impacting the resistance of such a device.

[0013] The present invention concerns a switch device, in particular for a use in a window lifter system for an automobile vehicle, comprising:

- a hinge knob body mounted movable on a pivoting axis between at least a rest position and one end position and presenting a front face and a rear face,
- a printed circuit board presenting a printed circuit and at least a first and a second rubber domes, said first and second rubber domes being adjacent and

disposed on the printed circuit on a line parallel to the pivoting axis, said line being distant from the pivoting axis, said printed circuit board being configured such that the rubber domes can close partially or completely a part of the printed circuit, and

- at least one plunger located between the rear face of the hinge knob body and said first and second rubber domes, such that a pivoting movement of the hinge knob body can be transmitted to at least one of said first and second rubber domes to close partially or completely a part of the printed circuit

characterized in that the at least one plunger comprises:

- a pushing surface configured such that the pushing surface can cooperate with a protrusion located at the rear face of the hinge knob body,
- a base plate substantially parallel to the pushing surface and configured to be in contact with said first and second rubber domes,
- a lever member connecting the pushing surface and the base plate, said lever member being inclined with respect to said base plate, in order to transmit a pivoting movement to said base plate, when the protrusion presses onto the pushing surface, causing the compression of a first rubber dome to close partially a part of the printed circuit in a first position of said hinge knob body between said rest and said end position and causing the compression of both rubber domes in said end position, and
- a connection member having a first end and a second end, the first end being connected with the hinge knob body, and the second end being connected with the plunger such that the hinge knob body and the plunger form only one piece, the connection member being configured such that it allows an interstice between the protrusion and the pushing surface when the hinge knob body is in a rest position.

[0014] The hinge knob body and the plunger form only one piece, so the fabrication of such piece would need only one mold. Thus, the fabrication of this piece is less expensive in comparison to prior art switches. Furthermore, this would need less assembling steps are needed to obtain the switch device, thus enabling a gain in productivity.

[0015] Moreover, the first and the second rubber domes are identical, enabling the achieving of a very simple system to close at least partially a part of a printed circuit board. Thus enabling a simplification of the window lifter switches.

[0016] The switch device according to the present invention can have one or more of the following characteristics taken separately or in combination.

[0017] The connection member presents two anchoring parts, corresponding respectively to the first and second ends of said connection member, and one elastically working part connecting said first and second ends.

[0018] The elastically working part presents a curved shape, having a first right angled part connected to the first end of the connection member followed by a second right angled part which is followed by a third right angled part, and a S-formed part connected to the second end of said connection member ensuring the holding in contact of the base plate onto the first and the second rubber domes when the hinge knob body is in a rest position.

[0019] The curved shape of the elastically working part has a first part connecting the first right angled part and the second right angled part is disposed parallel and adjacent to the pushing surface, a second part connecting the second right angled part and the third right angled part disposed parallel and adjacent to the lever member, and a third part connecting the third right angled part and the S-formed part is disposed parallel and adjacent to the base plate.

[0020] The base plate has a first side supporting the lever member and a second side configured to be in contact with the first and second rubber domes, said first side of the base plate comprises furthermore an upright projection configured to be connected with the second end of the connection member.

[0021] The pushing surface, the lever member, the base plate, and the upright projection form a cavity configured for receiving the connection member.

[0022] The lever member is oriented upwards and inclined in a center direction on the base plate with respect to a perpendicular direction of the base plate.

[0023] According to a particular aspect of the invention, the lever member forms an angle comprised between 70 and less than 85°, in particular 80°, with the base plate.

[0024] The vertical projection of the protrusion is located between said first and second rubber domes.

[0025] According to a particular aspect of the invention, the vertical projection of the protrusion is located nearer to the first rubber dome than to the second rubber dome.

[0026] The protrusion and the first end of the connection member connected with the hinge knob body are symmetric according to a center plan of the switch device.

[0027] According to a particular aspect of the present invention, the first and second rubber domes are disposed on a keypad membrane, said keypad membrane being in contact with the printed circuit board, said keypad membrane being configured such that it can allow the rubber domes to close partially or completely a part of the printed circuit.

[0028] The hinge knob body comprises two plungers disposed on both sides of the pivoting axis of the hinge knob body, said two plungers being symmetrically installed with respect to the pivoting axis of the hinge knob body, one plunger being configured to be in contact with a first set of first and second rubber domes to close partially or completely a part of the printed circuit when the hinge knob body is pulled, and the other plunger being configured to be in contact with a second set of first and second rubber domes to close partially or completely a part of the printed circuit when the hinge knob body is

pushed.

[0029] Other features and advantages would appear by reading the following description and with the annexed drawings in which:

- Figure 1 is a schematic exploded view of a switch device according to the prior art,
- Figure 2 is a schematic representation in perspective of a keypad membrane according to the prior art,
- Figure 3 is a schematic exploded view of a switch device according to the present invention,
- Figure 4 is a rear schematic view in perspective of a hinge knob body according to the present invention,
- Figure 5 is a cross-sectional view of the switch device when the hinge knob body is in a rest position taken from an X-axis,
- Figure 6A is a cross-sectional view along the Y-axis of the switch device when the hinge knob body is in a rest position,
- Figure 6B is a cross-sectional view along the X-axis of the switch device when the hinge knob body is in the rest position,
- Figure 7A is a cross-sectional view along the Y-axis of the switch device when the hinge knob body is in a first position,
- Figure 7B is a cross-sectional view along the X-axis of figure 7A,
- Figure 8A is a cross-sectional view along the Y-axis of the switch device when the hinge knob body is in an end position, and
- Figure 8B is a cross-sectional view along the X-axis of figure 8A.

[0030] On the drawings, the same elements have the same numeral references.

[0031] The following embodiments are examples. Even if the specification refers to one or more embodiments, this does not necessary imply that each reference concerns the same embodiment, or that the technical features may only be applied to one and only embodiment. Simple technical features of different embodiments may be combined or interchanged in order to obtain other embodiments.

[0032] In the following specification, reference is made to a first and a second rubber dome, or a first and second set of rubber domes for example. It is a simple indexing to differentiate and name differently identical elements. This indexing does not imply any priority of an element with regard to the other, and the man skilled in the art can easily interchange such designations without getting out of the scope of the present invention. Furthermore, this indexing does not imply any temporary order to appreciate the operation of the switch device.

[0033] In the following specification it is intended by "X-axis" a horizontal axis as arbitrary represented on the drawings, "Y-axis" an other horizontal axis as arbitrary represented on the drawings, and "Z-axis" a vertical axis as arbitrary represented on the drawings, said arbitrary representations corresponding to the general configuration of the installed switch device into a car element.

[0034] In the following specification, the term "rest position" is intended to be a neutral position corresponding to a center position of the hinge knob body in which the switch device does not allow any movement of the window when the hinge knob body is released. In the rest position, no contact is for example closed such that an electrical motor of a window lift system cannot be powered.

[0035] In the following specification the term "end position" corresponds to the position of the hinge knob body when it is completely pushed or completely pulled, thus allowing an automatic operation of the window lift system.

[0036] Furthermore, it is intended by "adjacent" in the further specification, one element lying near to another element.

[0037] In the following specification, the term "elastically working part" is intended to be a part made of a rigid or semi-rigid material and able to be elastically deformable.

[0038] Moreover, it is intended by "upwards" in the following specification an orientation according to the Z-axis and top-oriented, said Z-axis being arbitrary represented on the drawings, said arbitrary representation corresponding to the general configuration of the installed switch device into a car element.

[0039] Finally, it is intended in the following specification by the term "center plan of the switch device" a plan passing through the center of the switch device and perpendicular to the pivoting axis of the hinge knob body.

[0040] Referring now to figures 3, 4, and 5, there is represented an exploded view of a switch device 1, in particular for a use in a window lifter system for an automobile vehicle. The switch device comprises:

- a hinge knob body 2 mounted movable on a pivoting axis A between at least a rest position and one end position and presenting a front face F holding a finger grip 21 having a case shape whose bottom is opened and a rear face R,
- a housing 3 configured such that it can hold the hinge knob body,
- a printed circuit board 6 presenting a printed circuit and at least a first and a second rubber domes 5, 5', said first and second rubber domes 5, 5' being adjacent and disposed on the printed circuit on a line parallel to the pivoting axis A, said line being distant from the pivoting axis A, said printed circuit board 6 being configured such that the rubber domes 5, 5' can close partially or completely a part of the printed circuit,
- at least one plunger 4 located between the rear face R of the hinge knob body 2 and said first and second rubber domes 5, 5', such that a pivoting movement of the hinge knob body 2 can be transmitted to at least one of said first and second rubber domes 5,

5' to close partially or completely a part of the printed circuit, and

- a rear cover 7 configured such that it allows the installation of said switch device 1 into a car element.

[0041] According to the particular embodiment of figure 3, the first and second rubber domes 5, 5' are disposed or integrated on a keypad membrane 50. According to this particular embodiment, the keypad membrane 50 is in contact with the printed circuit board 6. Furthermore, the keypad membrane 50 is configured to allow the rubber domes 5, 5' to close partially or completely a part of the printed circuit.

[0042] In the particular embodiment of figure 3, the hinge knob body 2 holds two plungers 4, and more particularly, the hinge knob body 2 and the plungers 4 are made in a unique piece thus ensuring the diminution of the number of pieces composing such a switch device 1, and so enabling the diminution of the fabrication costs due to the reduction of the number of molds necessary to made this switch device 1 and to the reduction of the assembling steps to obtain the finished product.

[0043] According to this embodiment, the switch device 1 can be pushed or pulled by a user's finger due to the finger grip 21, thus enabling the partial or complete-closing of a part of the circuit board, and so the activation of the window lifter system to move up or down the desired window commanded by said window lifter system. According to this embodiment, the finger grip 21 can be made of plastic or any other material to ensure the comfort of the user when he moves the hinge knob body 2, and eventually to satisfy to esthetic needs.

[0044] Referring now to figure 5, the first and second rubber domes are directly disposed on the printed circuit board 6, and the at least one plunger 4 connected to the hinge knob body 2 comprises:

- a pushing surface 41 configured such that the pushing surface 41 can cooperate with a protrusion 42 located at the rear face R of the hinge knob body 2,
- a base plate 43 substantially parallel to the pushing surface 41 and configured to be in contact with said first and second rubber domes 5, 5',
- a lever member 44 connecting the pushing surface 41 and the base plate 43, said lever member 44 being inclined with respect to said base plate 43, in order to transmit a pivoting movement to said base plate 43, when the protrusion 42 presses onto the pushing surface 41, causing the compression of a first rubber dome 5 to close partially a part of the printed circuit in a first position of said hinge knob body 2 between said rest and said end position and causing the compression of both rubber domes 5, 5' in said end position, and
- a connection member 45 having a first end 451 and a second end 453, the first end 451 being connected with the hinge knob body 2, and the second end 453 being connected with the plunger 4 such that the hinge knob body 2 and the plunger 4 form only one piece, the connection member 45 being configured such that it allows an interstice I between the protrusion 42 and the pushing surface 41 when the hinge knob body 2 is in a rest position.

[0045] According to the particular embodiment of figure 5, the base plate 43 has a first side supporting the lever member 44 and a second side configured to be in contact with the first and second rubber domes 5, 5'. The first side of the base plate 43 comprises furthermore an upright projection 47 configured to be connected with the second end 453 of the connection member 45. Moreover, according to the embodiment of figure 5, the base plate 43 is larger than the pushing surface 41. Furthermore, the base plate 43 is centered with a center plan C of the switch device 1.

[0046] According to the embodiment of figure 5, the lever member 44 is oriented upwards and inclined in a center direction on the base plate 43 with respect to a perpendicular direction of the base plate 43. More precisely, the lever member 44 forms an angle α comprised between 70 and less than 85° with the base plate 43. According to the particularly embodiment of figure 5, the lever member 44 forms an angle α of 80° with the base plate 43. Advantageously, such orientation of the lever member 44 allows a good transmissions of the compression forces to the first rubber dome 5 when the hinge knob body is moved. Moreover, this orientation of the lever member 44 allows the pivoting of the base plate 43 to press onto the second rubber dome 5' when the hinge knob body 2 is in its end position thus enabling to close completely a part of the printed circuit to allow an automatic operation of the window lifter system. Incidentally, if the angle between the lever member 44 and the base plate 43 is greater than 90°, the pivoting movement of the base plate 43 would not be possible due to heavy compression forces.

[0047] According to the embodiment of figure 5, the pushing surface 41, the lever member 44, the base plate 43, and the upright projection 47 form a cavity configured to receive the connection member 45. The connection member 45 disposed in this cavity helps the pivoting movement of the base plate 43. Furthermore, the presence of such a cavity enables the reduction of the weight of the switch device 1 without impacting the resistance of this device.

[0048] According to the particular embodiment of figure 5, the connection member 45 presents two anchoring parts 452, 454, corresponding respectively to the first and second ends 451, 453 of said connection member 45, and one elastically working part 46 connecting said first and second ends 451, 453. The elastic working part 46 prevents the connection member 45 from breaking because of the compression forces it has to support due to its use.

[0049] According to this embodiment, the elastically working part 46 presents a curved shape, having a first

right angled part 461 connected to the first end 451 of the connection member 45 followed by a second right angled part 463 which is followed by a third right angled part 465, and a S-formed part 467 connected to the second end 453 of said connection member 45 ensuring the contact between the base plate 43 and the first and the second rubber domes 5, 5' when the hinge knob body 2 is in a rest position. More precisely, the curved shape of the elastically working part 46 has a first part 462 connecting the first right angled part 461 and the second right angled part 463 is disposed parallel and adjacent to the pushing surface 41, a second part 464 connecting the second right angled part 463 and the third right angled part 465 disposed parallel and adjacent to the lever member 44, and a third part 466 connecting the third right angled part 465 and the S-formed part 467 is disposed parallel and adjacent to the base plate 43.

[0050] According to another embodiment, non-disclosed in the drawings, the elastically working part 46 presents a curved W-shape, the bottom of the W facing lever 44. Alternatively, the bottom of the W faces plunger 4. In another embodiment, the top of the W faces lever 44. In other embodiment, working part 46 presents a curved shape which shows one or several succeeding U forms in any orientation possible allowing the connection via said working part of connection member 45 and upright projection 47.

[0051] Moreover, according to the particular embodiment of figure 5, the protrusion 42 is eccentrically disposed according to the center plan C of the switch device 1. The protrusion 42 has a vertical projection according to the Z-axis of the switch device 1, and this vertical projection of the protrusion 42 is located between said first and second rubber domes 5, 5'. More precisely and according to this embodiment, the vertical projection of the protrusion 42 is located nearer to the first rubber dome 5 than to the second rubber dome 5'. In this position, the protrusion 42 will press on the pushing surface 41 near its connection point with the lever member 44. Thus enabling a low dissipation of the compression forces created by the pivoting of the hinge knob body 2.

[0052] Furthermore, according to the particular embodiment of figure 5, the protrusion 42 and the first end 451 of the connection member 45 connected with the hinge knob body 2 are symmetric according to the center plan C of the switch device 1.

[0053] Now referring to figure 4, the hinge knob body 2 comprises two plungers 4A, 4B disposed on both sides of the pivoting axis A of the hinge knob body 2. The two plungers 4A, 4B are symmetrically installed with respect to the pivoting axis A of the hinge knob body 2.

[0054] Figures 6A to 8B are representing different cross-sectional views of the hinge knob body 2 at different stages of its movement.

[0055] According to this embodiment, one plunger 4A is configured to be in contact with a first set 5A of first and second rubber domes 5, 5' to close partially or completely a part of the printed circuit when the hinge knob body 2 is pulled for example, and the other plunger 4B is configured to be in contact with a second set 5B of first and second rubber domes 5, 5' to close partially or completely a part of the printed circuit when the hinge knob body 2 is pushed for example.

[0056] As can be seen on figures 6A and 6B, the hinge knob body 2 is in its rest position. In this position, the base plate 43 of each plunger 4A, 4B is in contact with the first and the second rubber domes 5, 5' and an interstice is present between the pushing surface 41 and the protrusion 42 due to the connection member 45. In this rest position, the window lifter system is off, because none of the rubber domes 5, 5' is compressed onto the printed circuit. Thus, the printed circuit is completely open and the window cannot be moved.

[0057] Now referring to figures 7A and 7B, the hinge knob body 2 is in a first position. According to the particular embodiment of figure 7A, the hinge knob body 2 is pulled in its first position. So only one plunger 4A will intervene during this pivoting movement. Thus, only the first set 5A of first and second rubber domes 5, 5' will have the possibility to be compressed onto the printed circuit.

[0058] Referring to figure 7B, the protrusion 42 pushes onto the base plate 41, thus allowing the plunger 4A to compress the first rubber dome 5 onto the printed circuit thus enabling the first rubber dome 5 to close partially a part of the printed circuit. When the hinge knob body 2 is in its first position, the window lifter system is activated in manual operation, it implies that the window will move up or down as long as the user will maintain the hinge knob body 2 in its first position. For the particular embodiment of figure 7B, the part of the printed circuit which is closed correspond to a part allowing a manual raise of the window for example.

[0059] Now referring to figures 8A and 8B, the hinge knob body 2 is in its end position. According to the particular embodiment of figure 8A, the hinge knob body 2 is pulled in its end position. As illustrated on figure 8A, only the first plunger 4A is operated. Thus, only the first set 5A of first and second rubber domes 5, 5' can be compressed.

[0060] Referring to figure 8B, both rubber domes 5, 5' are compressed against the printed circuit due to the pivoting movement of the base plate 43, thus closing completely a part of the printed circuit. The pivoting movement of the base plate 43 is possible due to heavy application forces when the hinge knob body 2 is in its end position. The particular disposition of the lever member 44 allows this pivoting movement of the base plate 43 for heavy application forces. Moreover, this pivoting movement of the base plate 43 can be enhanced by the connection member 45 due to its working part 46 in a curved shape. When the hinge knob body 2 is in its end position, it allows the window lifter system to be activated in automatic operation, it implies that the window will completely move up or down without the need for the user to maintain the hinge knob body 2. Furthermore, the user can stop this

movement of the window by counter-clicking on the hinge knob body 2 for example. For the particular example of figures 8A and 8B, the part of the printed circuit which is closed correspond to a part allowing an automatic raise of the window for example.

[0061] Naturally, when the hinge knob body 2 is pushed, the plunger 4B will act during the pivoting movement of the hinge knob body 2, and the second set 5B of first and second rubber domes 5, 5' is able to close partially or completely a part of the printed circuit. The closed part can for example correspond to a command to move down the window according to the pressure applied on the hinge knob body 2 by the user, said pressure corresponding to the position (first position or end position) of said hinge knob body 2.

[0062] In the particular embodiments illustrated by figures 6A to 8B, the plunger 4 moves only in a vertical direction without inclination, the hinge knob body 2 is pressed while varying stroke until a load is applied on the rubber domes 5, 5'. In this way, since the plunger 4 is vertically pressed, it is difficult to apply a load on the rubber domes 5, 5' in an oblique direction, thereby preventing damage of the rubber domes 5, 5'.

[0063] Moreover, referring to figures 6A to 8B, the first and second rubber domes 5, 5' are identical. Thus the printed circuit or the keypad membrane 50 holding those rubber domes does not need to have a specific configuration in order to selectively close partially or completely a part of the printed circuit according to the pivoting movement of the hinge knob body 2.

[0064] The here-above embodiments are illustrative and not restrictive embodiments. Obviously, many modifications and variations of the present invention are possible in the light of the above teachings without deviating from its inventive concept. It is therefore to be understood that the invention may be practiced otherwise than as specifically described.

[0065] Thus the reduction of the production costs of a switch device 1 is possible due to the switch device 1 of the present invention. Effectively, this switch device 1 contains less pieces than the switch devices known from the prior art. So, less molds would be needed and the assembling step could be performed faster. Moreover, the switch device 1 of the present invention is lighter than the known switch devices because of the cavity of the plunger, without reducing its resistance properties to the compression forces because of the particular structure of the connection member 45, and in particular its working part 46. Finally, the switch device 1 according to the present invention can be operable with a printed circuit or a keypad member having a planar structure, thus requiring less place in the X/Y direction of the hinge knob body 2.

Claims

1. A switch device (1), in particular for a use in a window lifter system for an automobile vehicle, comprising:

- a hinge knob body (2) mounted movable on a pivoting axis (A) between at least a rest position and one end position and presenting a front face (F) and a rear face (R),
- a printed circuit board (6) presenting a printed circuit and at least a first and a second rubber domes (5, 5'), said first and second rubber domes (5, 5') being adjacent and disposed on the printed circuit on a line parallel to the pivoting axis (A), said line being distant from the pivoting axis (A), said printed circuit board (6) being configured such that the rubber domes (5, 5') can close partially or completely a part of the printed circuit, and
- at least one plunger (4) located between the rear face (R) of the hinge knob body (2) and said first and second rubber domes (5, 5'), such that a pivoting movement of the hinge knob body (2) can be transmitted to at least one of said first and second rubber domes (5, 5') to close partially or completely a part of the printed circuit

characterized in that the at least one plunger (4) comprises:

- a pushing surface (41) configured such that the pushing surface (41) can cooperate with a protrusion (42) located at the rear face (R) of the hinge knob body (2),
- a base plate (43) substantially parallel to the pushing surface (41) and configured to be in contact with said first and second rubber domes (5, 5'),
- a lever member (44) connecting the pushing surface (41) and the base plate (43), said lever member (44) being inclined with respect to said base plate (43), in order to transmit a pivoting movement to said base plate (43), when the protrusion (42) presses onto the pushing surface (41), causing the compression of a first rubber dome (5) to close partially a part of the printed circuit in a first position of said hinge knob body (2) between said rest and said end position and causing the compression of both rubber domes (5, 5') in said end position, and
- a connection member (45) having a first end (451) and a second end (453), the first end (451) being connected with the hinge knob body (2), and the second end (453) being connected with the plunger (4) such that the hinge knob body (2) and the plunger (4) form only one piece, the connection member (45) being configured such that it allows an interstice (I) between the protrusion (42) and the pushing surface (41) when the hinge knob body (2) is in a rest position.

2. Switch device (1) according to claim 1, **characterized in that** the connection member (45) presents two anchoring parts (452, 454), corresponding respectively to the first and second ends (451, 453) of said connection member (45), and one elastically working part (46) connecting said first and second ends (451, 453).

3. Switch device (1) according to claim 2, **characterized in that** said elastically working part (46) presents a curved shape, having a first right angled part (461) connected to the first end (451) of the connection member (45) followed by a second right angled part (463) which is followed by a third right angled part (465), and a S-formed part (467) connected to the second end (453) of said connection member (45) ensuring the holding in contact of the base plate (43) onto the first and the second rubber domes (5, 5') when the hinge knob body (2) is in a rest position.

4. Switch device (1) according to any one of claims 1 to 3, **characterized in that** the base plate (43) has a first side supporting the lever member (44) and a second side configured to be in contact with the first and second rubber domes (5, 5'), said first side of the base plate (43) comprises furthermore an upright projection (47) configured to be connected with the second end (453) of the connection member (45).

5. Switch device (1) according to claim 4, **characterized in that** the pushing surface (41), the lever member (44), the base plate (43), and the upright projection (47) form a cavity configured for receiving the connection member (45).

6. Switch device (1) according to any one of the preceding claims, **characterized in that** the lever member (44) is oriented upwards and inclined in a center direction on the base plate (43) with respect to a perpendicular direction of the base plate (43).

7. Switch device (1) according to claim 6, **characterized in that** the lever member (44) forms an angle (α) comprised between 70 and less than 85°, in particular 80°, with the base plate (43).

8. Switch device (1) according to any one of the preceding claims, **characterized in that** the vertical projection of the protrusion (42) is located between said first and second rubber domes (5, 5').

9. Switch device (1) according to claim 8, **characterized in that** the vertical projection of the protrusion (42) is located nearer to the first rubber dome (5) than to the second rubber dome (5').

10. Switch device (1) according to any one of the preceding claims, **characterized in that** the protrusion (42) and the first end (451) of the connection member (45) connected with the hinge knob body (2) are symmetric according to a center plan (C) of the switch device (1).

11. Switch device (1) according to any one of the preceding claims, **characterized in that** the first and second rubber domes (5, 5') are disposed on a keypad membrane (50), said keypad membrane (50) being in contact with the printed circuit board (6), said keypad membrane (50) being configured such that it can allow the rubber domes (5, 5') to close partially or completely a part of the printed circuit.

12. Switch device (1) according to any one of claims 1 to 11, **characterized in that** the hinge knob body (2) comprises two plungers (4A, 4B) disposed on both sides of the pivoting axis (A) of the hinge knob body (2), said two plungers (4A, 4B) being symmetrically installed with respect to the pivoting axis (A) of the hinge knob body (2), one plunger (4A) being configured to be in contact with a first set (5A) of first and second rubber domes (5, 5') to close partially or completely a part of the printed circuit when the hinge knob body (2) is pulled, and the other plunger (4B) being configured to be in contact with a second set (5B) of first and second rubber domes (5, 5') to close partially or completely a part of the printed circuit when the hinge knob body (2) is pushed.

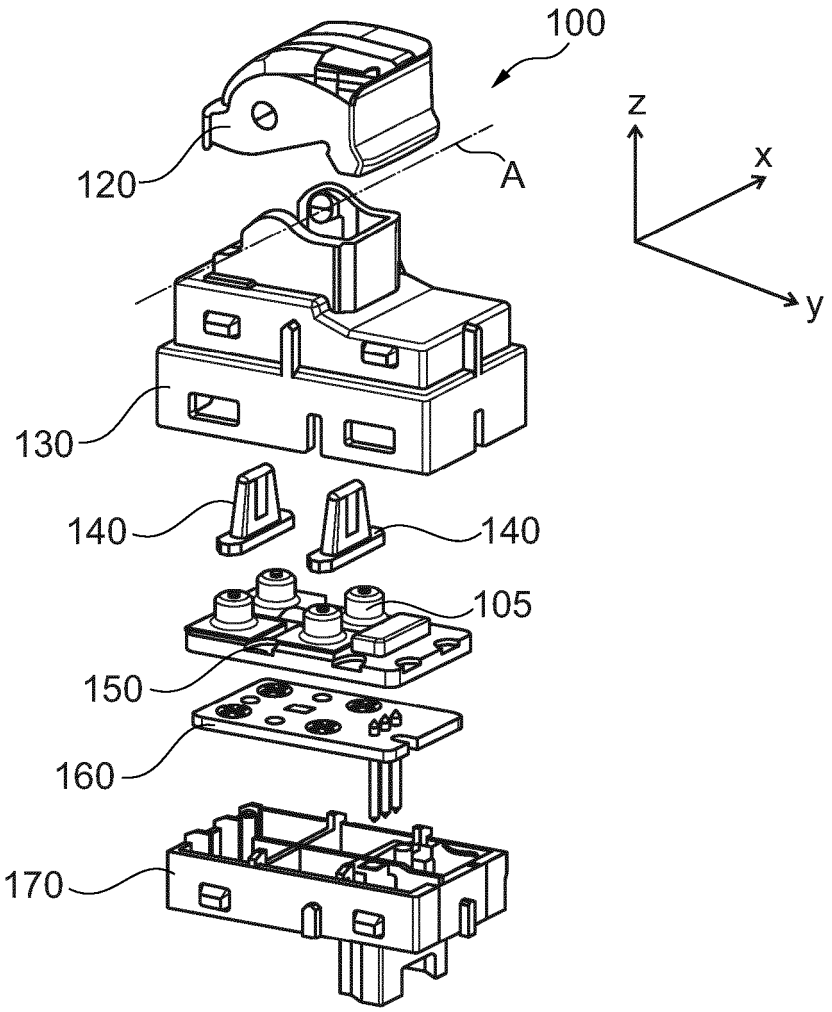
100
120
A
z
x
y
130
140
140
105
150
160
170

Fig. 1

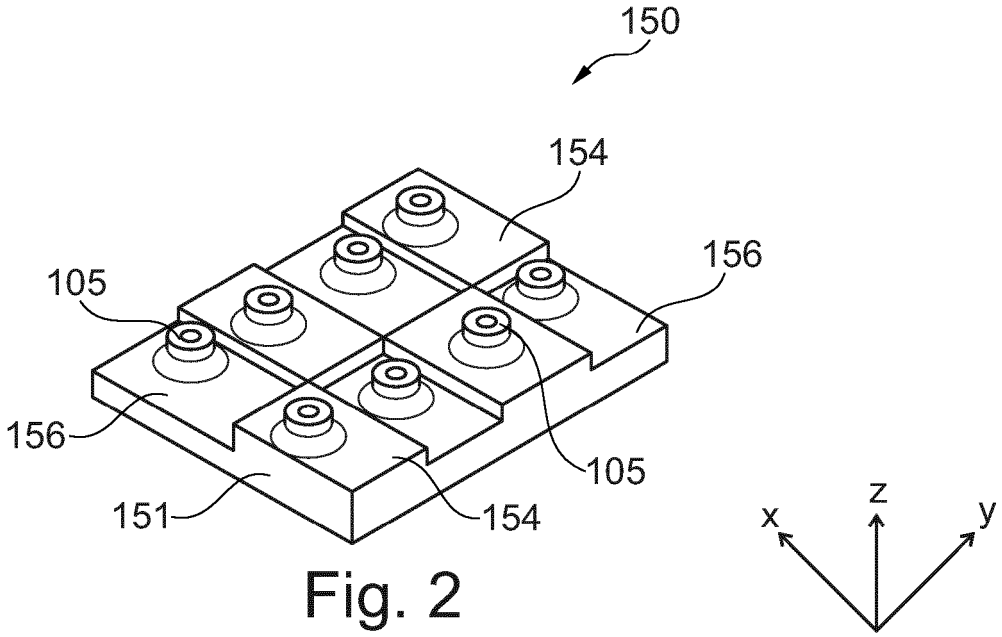
150
154
156
105
156
105
151
154
x
z
y

Fig. 2

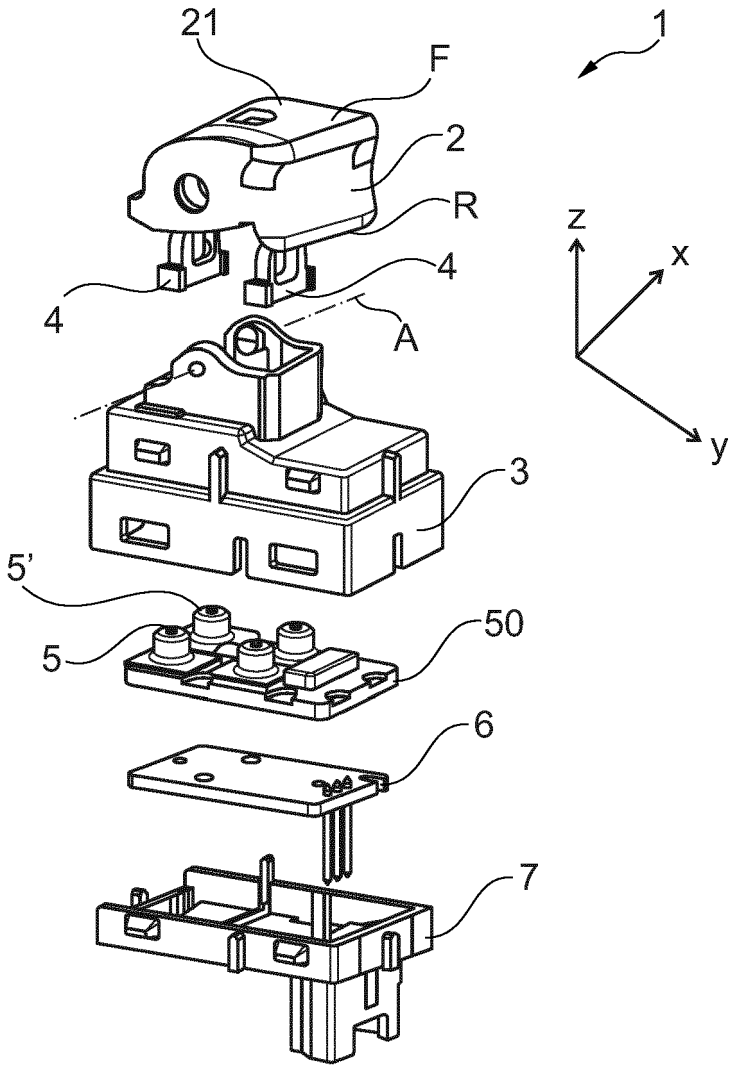

Fig. 3

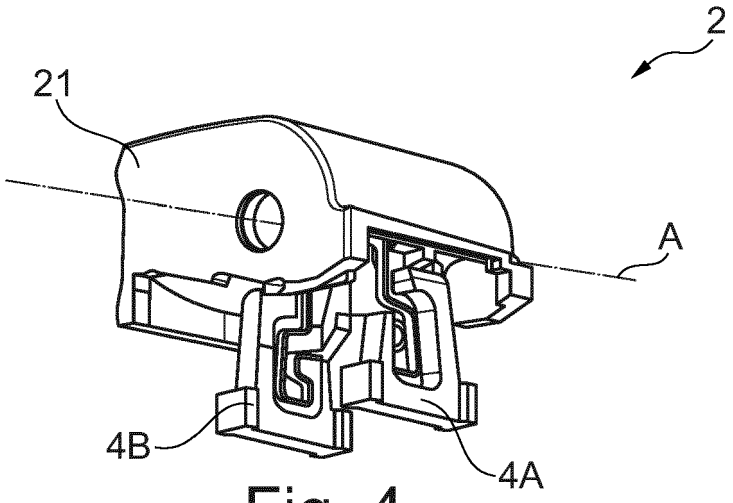

Fig. 4

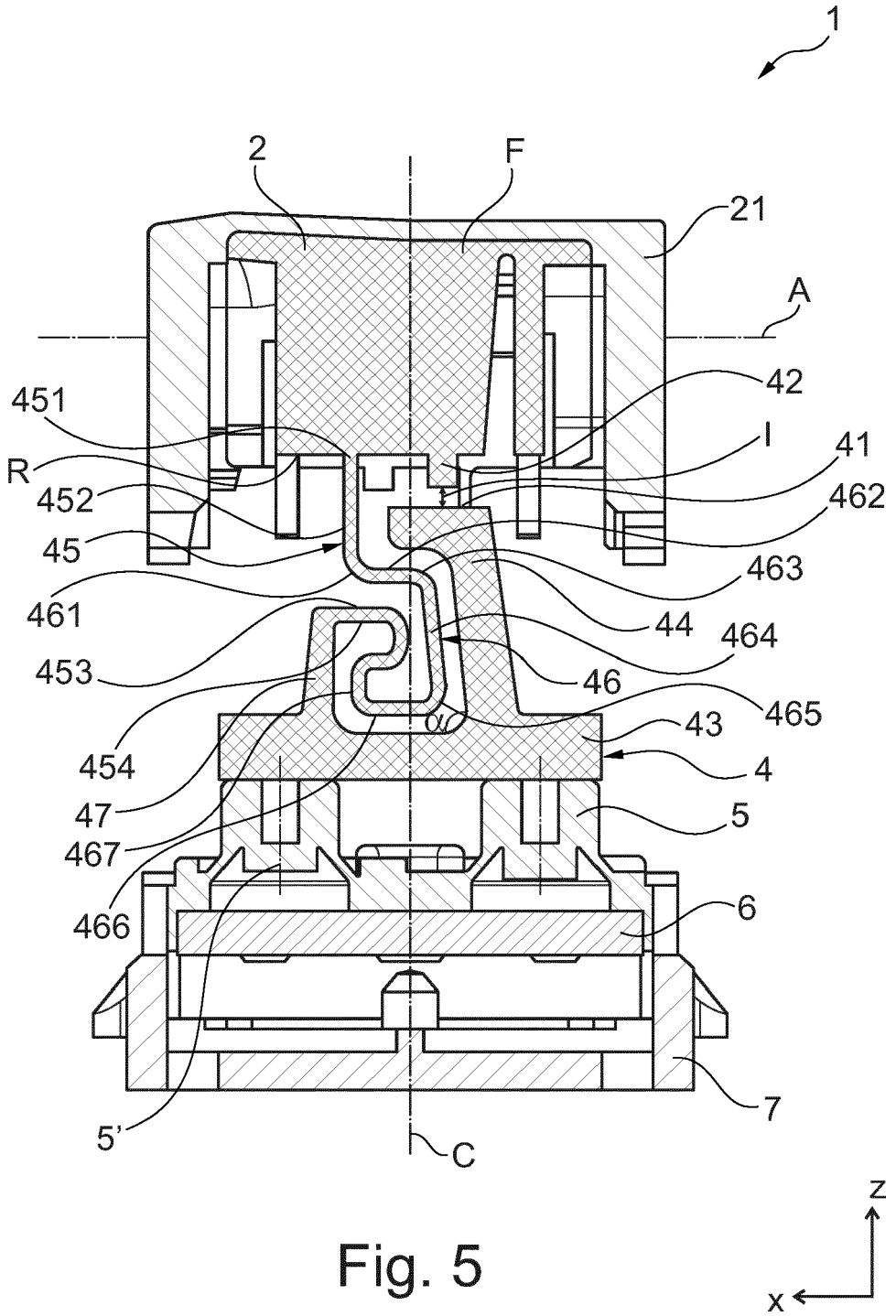
1
2
F
21
A
42
451
I
41
R
452
462
45
463
461
44
464
453
46
465
43
454
4
47
5
467
6
466
7
5'
C
z
x

Fig. 5

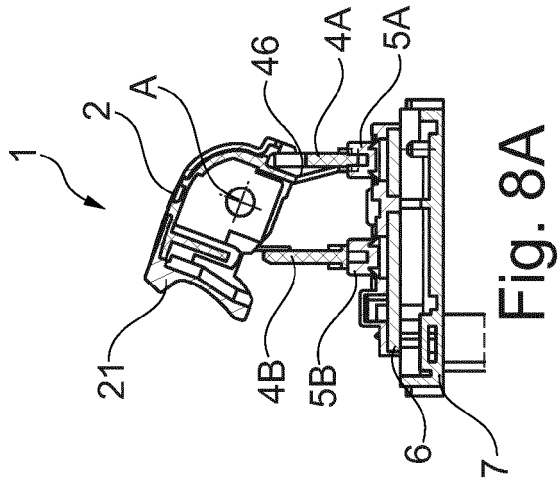

Fig. 8A

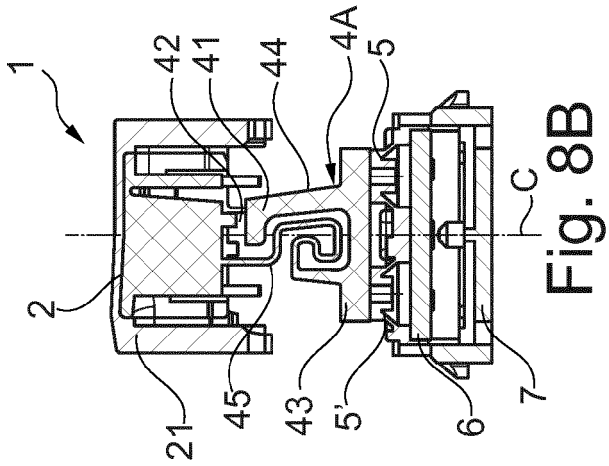

Fig. 8B

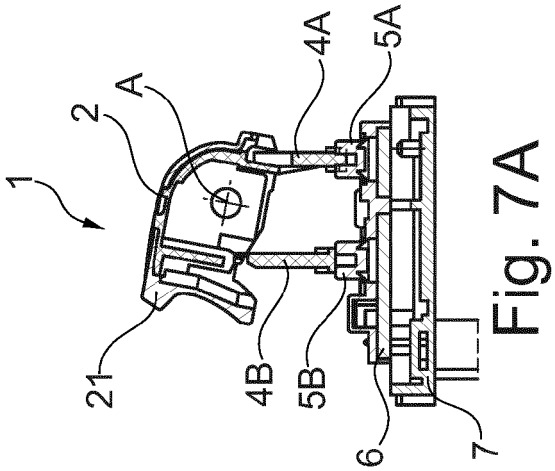

Fig. 7A

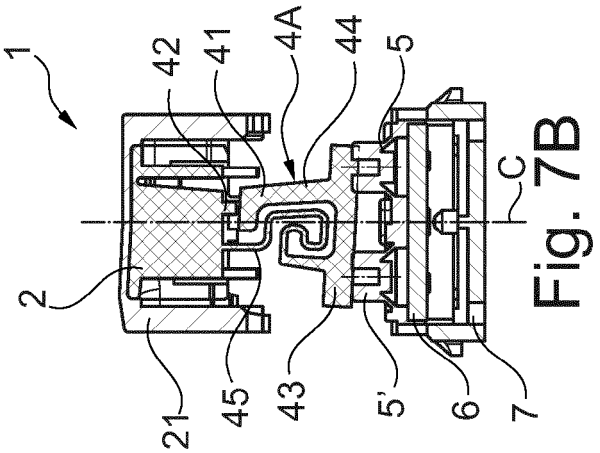

Fig. 7B

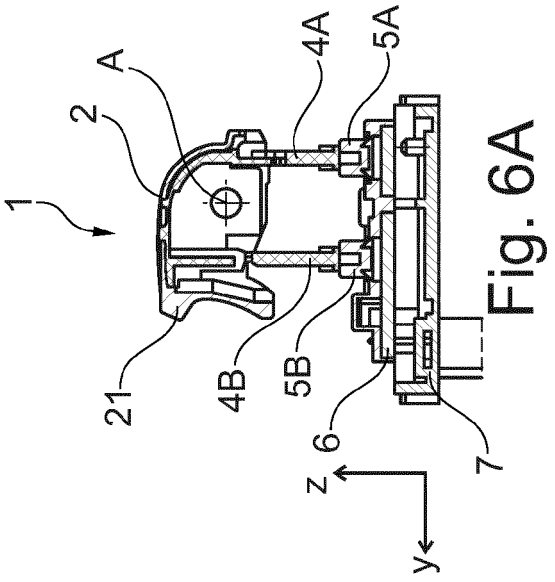

Fig. 6A

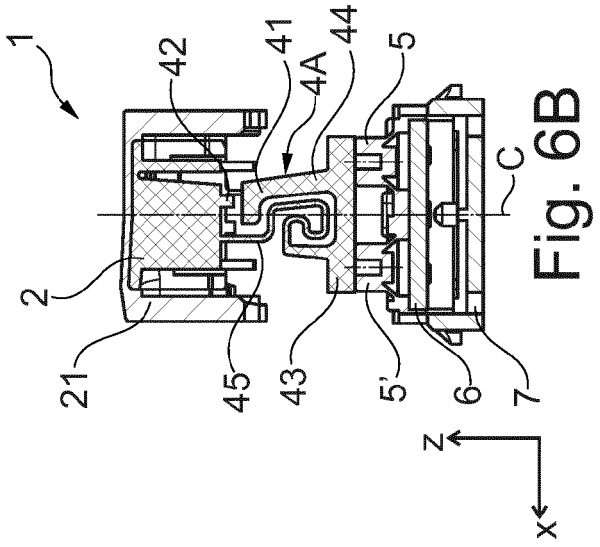

Fig. 6B

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 19 5228

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2008/283381 A1 (ATAKA RYUJI [JP]) 20 November 2008 (2008-11-20) * paragraphs [0045] - [0072]; figures 4-8 *	1-12	INV. H01H21/22 H01H23/00
A	US 2002/066650 A1 (SERIZAWA YASUYOSHI [JP] ET AL) 6 June 2002 (2002-06-06) * paragraphs [0040] - [0047]; figure 1 *	1-12	
A	EP 1 294 001 A2 (BITRON SPA [IT]) 19 March 2003 (2003-03-19) * paragraphs [0008] - [0016]; figures 1-5 *	1-12	
A	US 2005/109591 A1 (VAN VOOREN GREGORY P [US] ET AL) 26 May 2005 (2005-05-26) * paragraphs [0044] - [0060]; figure 3 *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)
H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 February 2017	Bräckelmann, Gregor

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 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 19 5228

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-02-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008283381 A1	20-11-2008	CN 101308731 A	19-11-2008
		JP 4857188 B2	18-01-2012
		JP 2008287978 A	27-11-2008
		US 2008283381 A1	20-11-2008
US 2002066650 A1	06-06-2002	DE 10159856 A1	04-07-2002
		JP 2002175746 A	21-06-2002
		US 2002066650 A1	06-06-2002
EP 1294001 A2	19-03-2003	BR 0203968 A	03-06-2003
		EP 1294001 A2	19-03-2003
		ES 2527689 T3	28-01-2015
		IT TO20010877 A1	14-03-2003
		MX PA02008955 A	19-08-2004
US 2005109591 A1	26-05-2005	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2002334631 A **[0004]**
- US 7084359 B **[0006]**