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

(11) **EP 3 223 295 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.09.2017 Bulletin 2017/39

(21) Application number: **15860233.4**

(22) Date of filing: **03.11.2015**

(51) Int Cl.:
H01H 25/04 *(2006.01)*

(86) International application number:
PCT/CN2015/093711

(87) International publication number:
WO 2016/078510 (26.05.2016 Gazette 2016/21)

(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

(30) Priority: **20.11.2014 CN 201410670628**

(71) Applicant: **Schneider Electric (Australia) Pty Limited**
New South Wales 2113 (AU)

(72) Inventors:
- **MENG, Huanbin**
  Shenzhen 518000 (CN)
- **ZHANG, Dahai**
  Shenzhen 518000 (CN)

(74) Representative: **Manitz Finsterwald Patentanwälte PartmbB**
Martin-Greif-Strasse 1
80336 München (DE)

(54) **SWITCH DEVICE**

(57) A switch device, comprising: a base body (1), a plurality of switching units (2) mounted on the base body, an operation panel (3) operable to slant in a plurality of different directions with respect to the base body and separately press each of the plurality of the switching units through a support rod (4) flexibly connected to the base body, and a reset mechanism (5) configured to drive the operation panel to restore from any slant state to a balanced state with respect to the base body; in the balanced state, the operation panel does not press any one of the plurality of the switch units. The switch device has a pleasing appearance and is easy to operate.

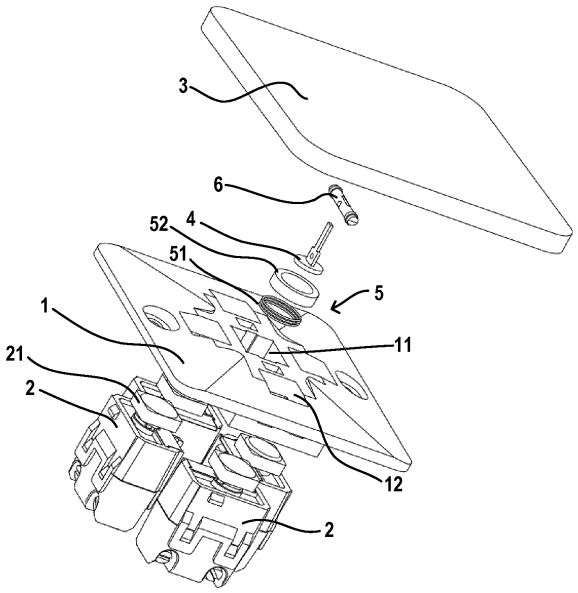

Fig.1

EP 3 223 295 A1

Description

Field of Disclosure

[0001] Embodiments of the present disclosure relate to a switch device, and particularly to a switch device for controlling multiple switch units.

Background of the disclosure

[0002] The current mechanical switch device usually uses one switch button to control one switch unit, and at most uses one switch button to control two switch units. To achieve control of multiple switch units in one switch device, multiple switch buttons are usually disposed parallelly in one switch device to operate different switch units. There is a gap among the multiple switch buttons which are arranged together, the width of each gap may be varied and the slanting angle of each switch button may also be inconsistent. This causes unpleasing appearance of the switch device. Moreover, arrangement of the multiple switch buttons on a limited surface of the switch device will cause the surface area of each button smaller, which is harmful for the user's convenient and accurate operation on the buttons.

[0003] Therefore, it is desirable to provide a switch device that can control multiple switch units, and has a pleasing appearance and easy-to-operate characteristic.

Summary of the disclosure

[0004] An object of the present disclosure is to provide a switch device which is used to solve at least a portion of above problems.

[0005] According to an embodiment of the present disclosure, there is provided a switch device, comprising: a base body on which multiple switch units are installed; an operation panel movably connected with the base body via a support rod such that the operation panel can be operated to slant in several different directions relative to the base body to respectively press each of said multiple switch units; and a reset mechanism configured to drive the operation panel to restore from any slant state relative to the base body to a balanced state. In this balanced state, the operation panel does not press any one of the multiple switch units.

[0006] According to another embodiment of the present disclosure, a first end of the support rod is fixed to a center of the operation panel, a second end of the support rod extends into a support slot at the center of the base body, and the support rod is rotatably supported in the support slot such that the support rod can swing along with the slant motion of the operation panel.

[0007] According to another embodiment of the present disclosure, a first shaft is pivotally supported on the base body, a through slot is provided on the first shaft in an axial direction of the first shaft, the support rod passes through the through slot and is pivotally supported on the first shaft via a second shaft on the support rod, and an axial direction of the first shaft is perpendicular to the axial direction of the second shaft.

[0008] According to another embodiment of the present disclosure, the reset mechanism includes a spring and a reset pad located in the support slot and has a contact plate on the second end of the support rod. Furthermore the spring forces the reset pad to abut against the contact plate, and the reset pad is movably guided in the support slot in a direction perpendicular to a plane of the operation panel in the balanced state.

[0009] According to another embodiment of the disclosure, a periphery of the contact plate is circular, and on a side of the contact plate in contact with the reset pad a boss is provided on the circular periphery of the contact plate to contact the reset pad.

[0010] According to another embodiment of the present disclosure, the reset mechanism includes a leaf spring in the support slot and has a contact plate at the second end of the support rod; and the leaf spring abuts against the contact plate.

[0011] According to another embodiment of the present disclosure, the second end of the support rod has a ball head, which is positioned on the base body by a positioning seat to form a spherical hinge.

[0012] According to another embodiment of the disclosure, a contact plate is arranged between the first end and second end of the support rod, the reset mechanism comprises a spring located in the support slot, and the spring is held between a positioning seat and the contact plate.

[0013] According to another embodiment of the present disclosure, a guide slot is provided on the base body, and the support rod is guided by the guide slot.

[0014] According to another embodiment of the present disclosure, at least two switch units are distributed asymmetrically relative to a center of the operation panel.

[0015] The switch device of the various embodiments of the present disclosure provides a single switch panel that can pivot and reset in various directions such that multiple switch units can be controlled only through the single switch panel. The single switch panel of the switch device avoids existence of the potential gap and unevenness among the multiple switch panels. Therefore, the switch device of the present disclosure has a more pleasing appearance. Moreover, since the single switch panel can have a relatively larger operating surface, the user can position and operate the switching panel more easily. This makes the operation of the switch device of the disclosure more convenient.

Brief description of drawings

[0016] The above and other objects and characteristics of the present disclosure shall be made more apparent in conjunction with the following detailed description with reference to the accompanying figures. In the fig-

ures,

Fig. 1 is an exploded view of a switch device according to an embodiment of the present disclosure;
Fig. 2 shows a base body of the switch device in Fig. 1;
Fig. 3 shows a first shaft of the switch device in Fig. 1;
Fig. 4 shows a support rod of the switch device in Fig. 1;
Fig. 5 shows a cross-sectional view of the switch device in Fig. 1, in which the operation panel is in a balanced position;
Fig. 6 shows a cross-sectional view of the switch device in Fig 1, in which the operation panel is in an slanted state;
Fig. 7 shows operable positions of the operation panel of the switch device in Fig. 1;
Fig. 8 is an exploded view of a switch device according to another embodiment of the present disclosure;
Fig. 9 is a partially enlarged view of the cross section of the switch device in Fig. 8;
Fig. 10 shows the base body of the switch device in Fig. 8;
Fig. 11 shows a positioning seat of the switch device in Fig. 8.

[0017] Throughout the above figures, the same reference numbers are understood as designating the same, similar or corresponding characteristics or functions.

Detailed Description of Preferred Embodiments

[0018] Reference will be made to embodiments of the present disclosure, and one or more examples of embodiments are shown in the figures. Embodiments are provided through the description of the present disclosure and are not intended to limit the present disclosure. For example, the features shown or described as part of one embodiment may be used in another embodiment to generate further embodiments. The present disclosure is intended to include these and other modifications and changes that are within the scope and spirit of the present disclosure.

[0019] Fig. 1 is an exploded view of the switch device according to one embodiment of the present disclosure. The switch device includes a base body 1, and a support slot 11 perpendicular to an end face of the base body 1 is disposed at a center of the base body 1. Multiple through holes 12 are distributed around the support slot 11, at least one switch unit 2 (four switch units are shown in Fig. 1) may be mounted to the base body 1, and an operable portion 21 of the switch unit 2 extends out of the base body 1 through the through hole 12. Each switch unit 2 is a known push button switch unit, and its operable portion 21 is a button. The characteristic of this type of push button switch unit is that when the button is pressed for the first time, the switch unit is closed; when the button is pressed again, the switch unit is opened. Each switch unit 2 may be connected to a separate circuit to control the on-off of the circuit.

[0020] The switch device further includes an operation panel 3. The operation panel 3 is made of a hard material, for instance, the hard plastic. The operation panel 3 is movably connected to the base body 1 through the support rod 4. The support rod 4 is also made of a hard material, preferably being made of metal.

[0021] Specifically, a first end of the support rod 4 is fixed to the center of the operation panel 3, and its second end extends into the support slot 11 at the center of the base body 1. A side wall 112 of the support slot 11 of the base body 1 is provided with a support hole 13 (see Fig. 2). With reference to Fig. 3, a shaft end 60 of two ends of a first shaft 6 extends into the support hole 13, and a shaft shoulder 62 thereon abuts against the side wall 112, such that the first shaft 6 is rotatably positioned on the base body 1 and goes across the support slot 11 in an axial direction of the first shaft. The first shaft 6 is provided with a through slot 61 in the axial direction of the first shaft 6. The support rod 4 passes through the through slot 61 and is pivotally supported in a shaft hole 63 on the first shaft 6 via a second shaft 41 (see Fig. 4) on the support rod 4, and the axial direction of the first shaft 6 is arranged perpendicular to the axial direction of the second shaft 41. Thus, the support rod 4 may swing in the axial direction of the first shaft 6 in the through slot 61 on the first shaft 6. At the same time, since the first shaft 6 is also pivotally supported on the base body 1, the support rod 4 may also rotate with the first shaft 6 relative to the base body 1. Advantageously, a portion 43 of the support rod 4 located in the through slot 61 has a larger width to facilitate arrangement of the second shaft 41 and facilitate guidance of the support rod 4 in the through slot 61 in the swing direction to avoid torsion.

[0022] Since the first shaft 6 and the second shaft 41 are perpendicular to each other, the support rod 4 supported by the two shafts may therefore achieve rotation in any direction by collaboration of the rotation motion of the two shafts. Thus, when the operation panel 3 is pressed and slanted in any direction, the support rod 4 can swing with the operation panel 3 without limiting the slant of the operation panel 3. At the same time, the operation panel 3 is also supported on the base body 1 through the support rod 4 and the two shafts without being disengaged therefrom.

[0023] Since the operation panel 3 may be pressed in any direction to be slanted, the operation panel 3 may use its surface facing the base body 1 to contact and press the respective switch units located in different orientations relative to the center of the operation panel 3. Therefore, each switch unit 2 is no longer limited to be distributed only at a position that is reachable by the turning of the operation panel 3 around one shaft, but can be distributed in any orientation around the center of the operation panel 3 as needed. Particularly, at least two of the switch units 2 may not be centrosymmetrically distributed relative to the center of the operation panel 3.

As a result, on the premise of space permission and convenient operation convenience, it is possible to install any number of switch units 2 around the support slot 11 in the base body 1, and the operation panel 3 may be pressed and slant towards each of the switch units 2 and drive the switch unit 2. Advantageously, the switch device may include one to eight switch units 2. Moreover, the multiple switch units 2 may advantageously be distributed evenly around the center of the operation panel 3 to maximize the included angle among between the respective adjacent switch units, thereby avoiding misoperation when of possibly pressing the multiple switch units 2 at the same time might be pressed at the same time bywhen the operation panel 3 when the operation panel 3 slants in one direction.

[0024] The switch device further includes a reset mechanism 5 to drive the operation panel 3 to restore from any slant state relative to the base body 1 to a balanced state. The balanced state means a state in which the operation panel 3 does not press any of the multiple switch units 2.

[0025] In the embodiment shown in Figs. 1-6, the reset mechanism 5 includes a spring 51 and a reset pad 52 located in the support slot 11. One end of the spring 51 abuts against the bottom wall 111 of the support slot 11, and the other end abuts against a side of the reset pad 52. A contact plate 42 is provided on the second end of the support rod 4. The spring 51 is preloaded to force the other side of the reset pad 52 abutting against the contact plate 42. An end face of the reset pad 52 has the shape and size substantially the same as the end face of the support slot 11 such that the reset pad 52 is movably guided in a direction perpendicular to the plane of the operation panel 3 in the balanced state (i.e., the axial of the support slot 11). Advantageously, a groove may be provided on the periphery of a side of the reset pad 52 in contact with the spring 51 so as to be fixed with the spring 51 (especially a spiral spring). On one side of the reset pad 52 in contact with the contact plate 42 may be formed an inwardly recessed receiving cavity to receive the contact plate 42. Advantageously, the periphery of the contact plate 42 is circular and the circular periphery of the contact plate 42 on the side in contact with the reset pad 52 may have an annular boss 421. As such, regardless of the direction in which the support rod 4 is slanted with the operation panel 3, the annular boss 421 on the contact plate 42 is in contact with the reset pad 52 on only one point on the edge thereof. This will help to correctly reset the operation panel by the reset pad 52, as will be described later in more detail.

[0026] As shown in Fig. 5, when the user does not press the operation panel 3, the spring 51 loads the contact panel 42 through the reset pad 52 in the axial direction of the support slot 11 and perpendicular to the end face of the base body 1. Since the force-receiving direction of the contact plate 42 is perpendicular to the end face of the base body 1, the support rod 4 will be maintained in the axial direction of the support slot 11 and in a direction perpendicular to the end face of the base body 1. As a result, the operation panel 3 fixed with the first end of the support rod 4 is thus maintained at a position parallel to the end face of the base body 1. At this time, since one side of the operation panel 3 facing the base body 1 is flat, the distances between the side and the buttons 21 of the respective switch units 2 are the same, such that the operation panel 3 does not press the button 21 of any switch unit 2, that is, in a balanced state. It is feasible to arrange the position of each switch unit 2 in a way of enabling the top of each button 21 just contact the operation panel 3 or slightly pressed by the operation panel 3 without reaching the stroke of switching the switch unit 2 in the balanced state, or. As an alternative, it is also possible to achieve such contact or slightly pressed state by providing an additional pad between the operation panel 3 and the button 21. As such, the operation panel 3 may be supported by each button 21 around its center, thereby avoiding the shaking of the operation panel 3.

[0027] As shown in Fig. 6, when the user applies a force F1 to the operation panel 3 towards the direction of a switch unit 2, the operation panel 3 slants towards the force applying direction, and drives the button 21 of the corresponding switch unit 2 at the position to be pressed, such that the switch unit 2 switches from the opened state to the closed state, or from the closed state to the opened state. At this time, the support rod 4 slants as the operation panel 3 slants, and drives the contact plate 42 to slant to press the reset pad 52 at a point in the slant direction on the periphery thereof. The reset pad 52, as guided by the support slot 11, presses the spring 51 downwardly along the support slot 11 to accumulate the restoring force.

[0028] When the user no longer presses the operation panel, the restoring force of the spring 51 lifts the reset pad 52. The reset pad 52 applies a restoring force to the contact plate 42 at the point in contact with the contact plate 42, such that the contact plate 42, together with the support rod 4 and the operation panel 3, rotate in the opposite direction to the slant direction until the contact plate 42 rotates to a position parallel to the end face of the reset pad 52. At this time, the reset pad 52 evenly applies the restoring force to the contact plate 42 on the entire periphery of the contact plate 42, instead of only on a point. Since a resultant moment received by the contact plate 42 is zero, the contact plate 42 will no longer rotate and will be kept in a balanced position instead. As a result, the operation panel 3 returns to the aforesaid balanced position, to facilitate the next pressing operation.

[0029] When the operation panel 3 is pressed again, it is feasible to select to press the same switch unit 2 as in the previous operation, or press any switch unit 2 different from the one in the previous operation. Since the first shaft 6 and the second shaft 41 rotate in combination, the force-applying point for applying the force F2 on the operation panel 3 upon pressing next time may be at a

position not centrosymmetrical with the point for applying the force F1 at the previous time about the center of the operation panel 3, for example at a position after rotation about the center by 90 degree (as shown in Fig. 7), such that the operation panel 3 slants in any direction asymmetric with the previous slant direction to operate other switch units 2.

[0030] The spring 51 of the reset mechanism 5 may also be any other element, such as a leaf spring, that can achieve the elastic restoring force. In the case that the spring 51 is a leaf spring, the reset pad 52 may be omitted, and the leaf spring 51 is directly in contact with the contact plate 42. Since the leaf spring 51 has a larger surface area, it can be assured that it is always in contact with the contact plate 42 and always exerts a restoring force.

[0031] Figs. 8-11 show a switch device according to another embodiment of the present disclosure. Unlike the foregoing embodiment, a spherical hinge is used in the present embodiment instead of two orthogonal shafts in the above-described embodiment, to realize pivoting support of the operation panel in any direction.

[0032] In the present embodiment, the second end of the support rod 4 has a ball head 44. A hemispherical ball seat 113 is formed at the bottom of the support slot 11 of the base body 1. The ball head 44 is accommodated in the ball seat 113 (see Figs. 9 and 10). A positioning seat 7 passes through the support rod 4 and engages with the base body 1, and has a hemispherical ball head cover on one side facing the ball head 44. The ball head 44 is enclosed in a spherical cavity formed by the ball seat 113 and the ball head cover to form a spherical hinge. The positioning seat 7 may be secured to base body 1 by snap-fitting elastic legs 71 thereon with a snap-fitting slot 114 (see Figs. 10 and 11) on the side wall of the support slot 11 of the base body 1. Through this spherical hinge, the support rod 4 may likewise slant in any direction along with the operation panel 3 without hindering the slant of the operation panel 3. At the same time, the spherical hinge also connects the operation panel 3 to the base body 1 such that it would not disengage from the base body 1.

[0033] In the present embodiment, the contact plate 42 is provided between a first end and a second end of the support rod 4, and it may be formed integrally with the support rod 4, or may be sleeved around the support rod 4 and positioned through a stopper 45 on the support rod 4. The reset mechanism 5 includes a spring 51 located in the support slot 11. The spring 51 is maintained between the positioning seat 7 and the contact plate 42, thereby applying a restoring force to the support rod 4 and the operation panel 3 through the contact plate 42. On the positioning seat 7, a spring slot 72 (see Fig. 11) may be provided to hold one end of the spring 51.

[0034] Similar to the embodiment described in Figs. 1-7, when a position of the operation panel 3 corresponding to a certain switch unit 2 is pressed, the operation panel 3 slants towards the switch unit 2 and press the button 21 of the switch unit 2. At this time, the support rod 4 slants along with the operation panel 3 to drive the contact plate 42 to slant. The slanted contact plate 42 compresses the spring 51 towards one side to accumulate the restoring force. When the user no longer presses the operation panel 3, a side of the spring 51 which is compressed more provides the restoring force to the contact plate 42 at a position in contact with the contact plate 42, to produce a moment to drive the contact plate 42 together with the support rod 4 and the operation panel 3 to rotate in a direction opposite to the slant direction, until the contact plate 42 is perpendicular to the vertical direction of the spring 51. At this time, the spring 51 does not provide a restoring force to the contact plate 42, or provides the contact plate 42 with a restoring force evenly distributed around the periphery of the support rod 4 to zero the resultant moment of the contact plate 42. As a result, the contact plate 42 will no longer rotate but be kept in a balanced position. Thus, the operation panel 3 returns to the balanced position as described previously, to facilitate the next pressing operation.

[0035] As for various embodiments of the present disclosure, a guide slot (not shown) may also be provided on the base body 1. The support rod 4 is guided through the guide slot. The guide slot is arranged to extend only along connection lines of the positions of the buttons 21 of the installed multiple switch units 2 and the center of the panel, such that when the user presses the operation panel 3, since the support rod 4 can only slant along the path of the guide slot, the operation panel 3 is guided to only slant towards the button 21 of one of the multiple switch units 2 to press the button 21. This avoids the slant of the operation panel in an incorrect slant direction of not pressing any switch unit 2 or simultaneously pressing multiple switch units 2 due to the improper pressing position on the operation panel 3, and makes the operation of the switch device more accurate and reliable. As for one (or two), three, four, six or eight switch units distributed evenly around the center of the operation panel, the guide slot is formed as a straight-line slot, triple-linear and radial slot, cross slot, six or eight linear and radial slot through an orthographic projection position of the center of the operation panel 3. Preferably, the guide slot may be formed on a cover covering the end of the support slot 11 of the base body 1.

[0036] The switch device of the various embodiments of the present disclosure provides a single switch panel 3 that can pivot and reset in various directions, such that multiple switch units can be controlled only through the single switch panel 3. The single switch panel of the switch device avoids existence of the potential gap and unevenness among the multiple switch panels. Therefore, the switch device of the present disclosure has a more pleasing appearance. Moreover, since the single switch panel can have a relatively larger operating surface, the user can position and operate the switching panel more easily. This makes the operation of the switch device of the disclosure more convenient.

[0037] It should be understood that the switch device

of the present disclosure is adapted to be installed in the slots on planes such as walls and panels, for domestic, commercial or industrial places. The various switch units in the switch device can be used to respectively control the lighting circuit, power supply, electrical equipment, and so on.

[0038] It should be appreciated that the above embodiments illustrate the principle of the present invention, but is not intended to limit the scope of the present invention; and it should be appreciated by those skilled in the art that medications and variations may be adopted without departing from the spirit and scope of the present invention. These modifications and variations are considered in the scope of the present invention and the appended claims. The protection scope of the present invention is defined by the appended claims. In addition, any reference sign in claims should not be construed as limiting the claims. Sue of the verb "comprise" and its variants does not exclude existence of elements or steps besides those recited in claims. The indefinite articles "a" or "an" preceding an element or step does not exclude existence of a plurality of such elements.

Claims

1. A switch device, comprising:

a base body (1) on which multiple switch units (2) are installed;
an operation panel (3) movably connected with the base body (1) via a support rod (4) such that the operation panel (3) can be operated to slant in several different directions relative to the base body (1) to respectively press each of said multiple switch units (2); and
a reset mechanism (5) configured to drive the operation panel (3) to restore from any slant state relative to the base body (1) to a balanced state, the operation panel (3) not pressing any one of the multiple switch units (2) in this balanced state.

2. The switch device according to claim 1, wherein a first end of the support rod (4) is fixed to a center of the operation panel (3), and a second end of the support rod (4) extends into a support slot (11) at the center of the base body (1), and
the support rod (4) is rotatably supported in the support slot (11) such that the support rod (4) can swing along with the slant motion of the operation panel (3).

3. The switch device according to claim 2, wherein a first shaft (6) is pivotally supported on the base body (1), a through slot (61) is provided on the first shaft (6) in an axial direction of the first shaft (6), the support rod (4) passes through the through slot (61) and is pivotally supported on the first shaft (6) via a second shaft (41) on the support rod (4), and an axial direction of the first shaft (6) is perpendicular to an axial direction of the second shaft (41).

4. The switch device according to claim 3, wherein the reset mechanism (5) includes a spring (51) and a reset pad (52) located in the support slot (11) and has a contact plate (42) on the second end of the support rod (4); and
wherein the spring (51) forces the reset pad (52) to abut against the contact plate (42), and the reset pad (52) is movably guided in the support slot (11) in a direction perpendicular to a plane of the operation panel (3) in the balanced state.

5. The switch device according to claim 4, wherein a periphery of the contact plate (42) is circular, and on a side of the contact plate in contact with the reset pad (52) a boss (421) is provided on the circular periphery of the contact plate to contact the reset pad (52).

6. The switch device according to claim 3, wherein the reset mechanism (5) includes a leaf spring (51) located in the support slot (11) and has a contact plate (42) at the second end of the support rod (4); and the leaf spring (51) abuts against the contact plate (42).

7. The switch device according to claim 2, wherein the second end of the support rod (4) has a ball head (44) which is positioned on the base body (1) by a positioning seat (7) to form a spherical hinge.

8. The switch device according to claim 7, wherein a contact plate (42) is arranged between the first end and second end of the support rod (4), the reset mechanism (5) comprises a spring (51) located in the support slot (11), and the spring (51) is held between the positioning seat (7) and the contact plate (42).

9. The switch device according to any of claims 1-8, wherein a guide slot is provided on the base body (1), and the support rod (4) is guided by the guide slot.

10. The switch device according to any of claims 1-9, wherein at least two switch units (2) are distributed asymmetrically relative to a center of the operation panel (3).

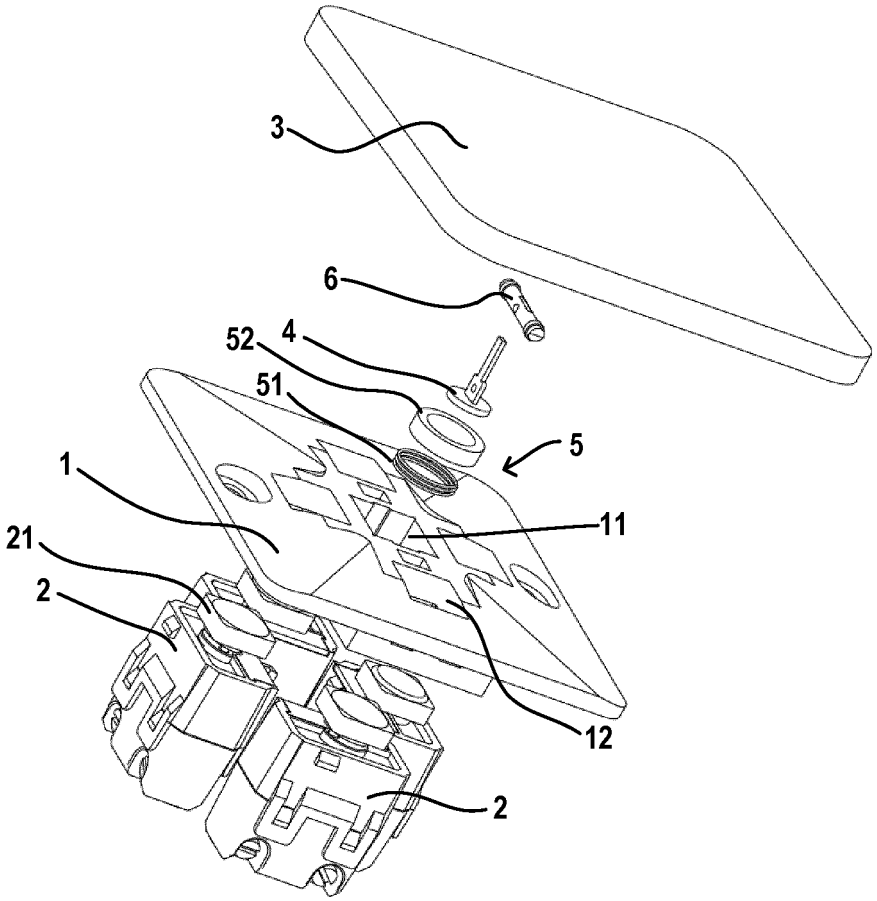

Fig.1

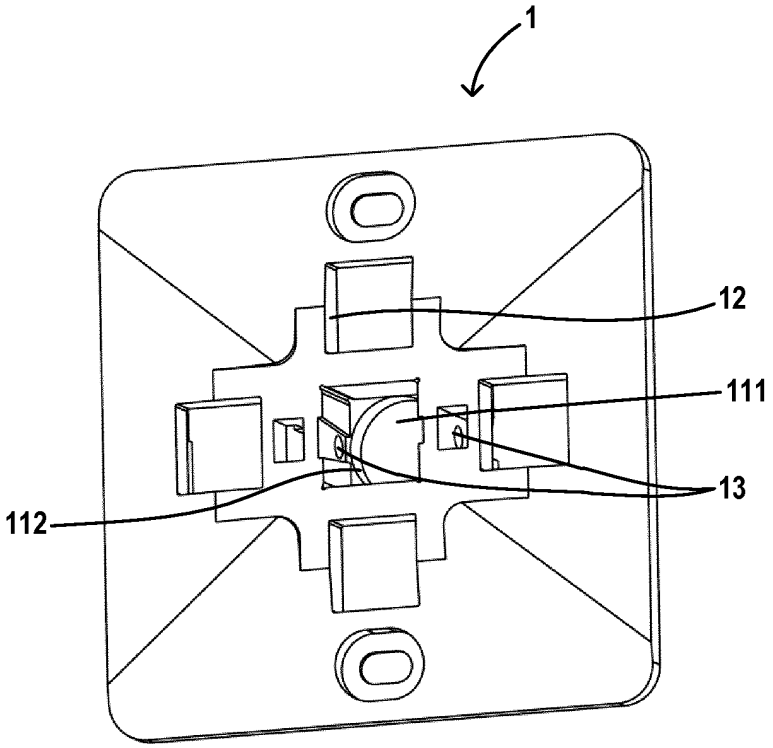

Fig.2

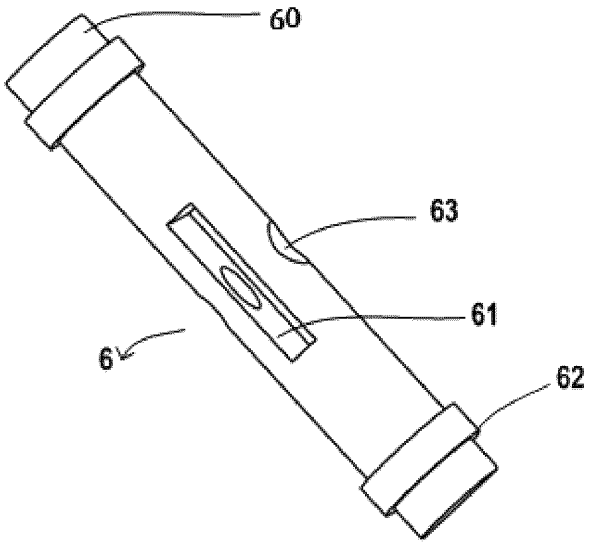

Fig.3

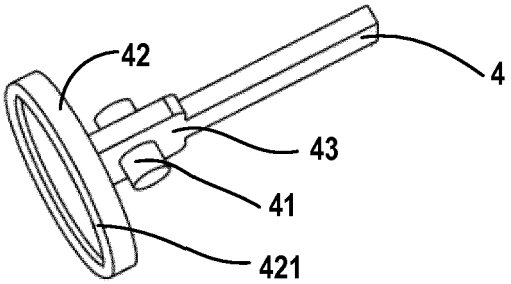

Fig.4

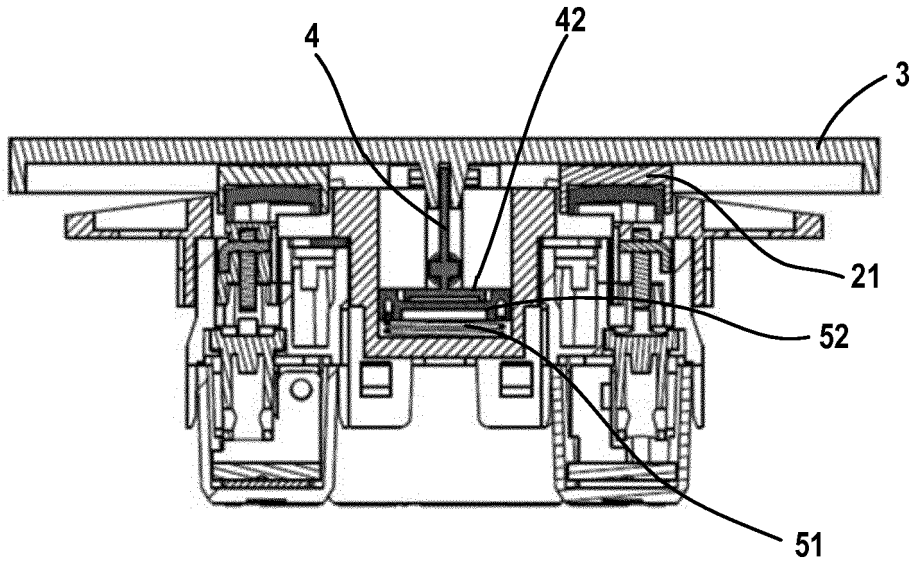

Fig.5

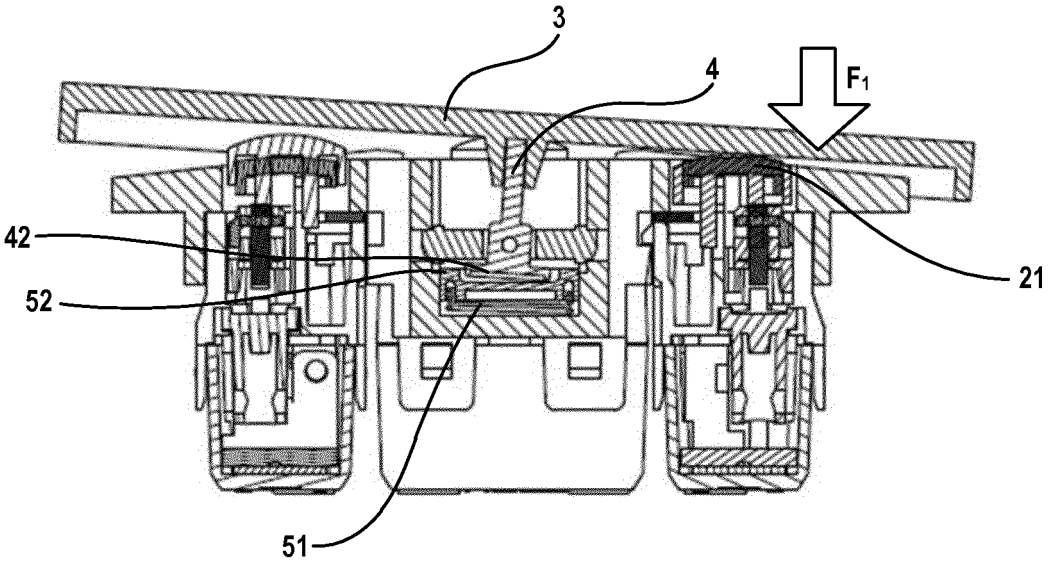

Fig.6

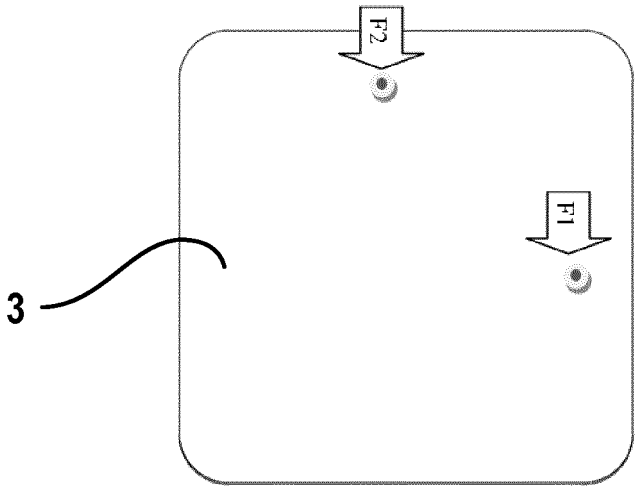

Fig.7

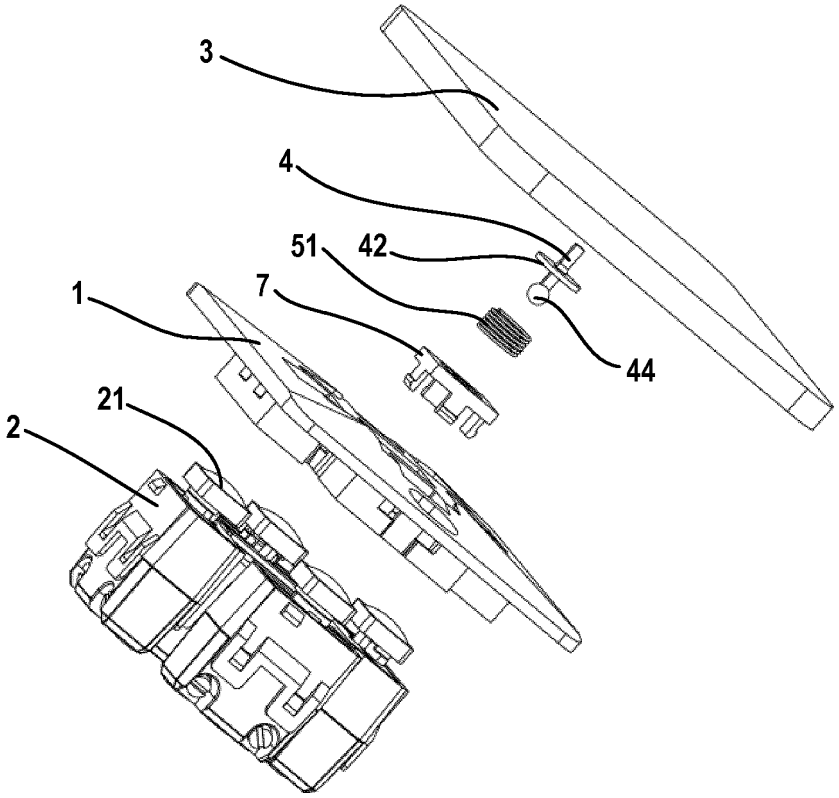

Fig.8

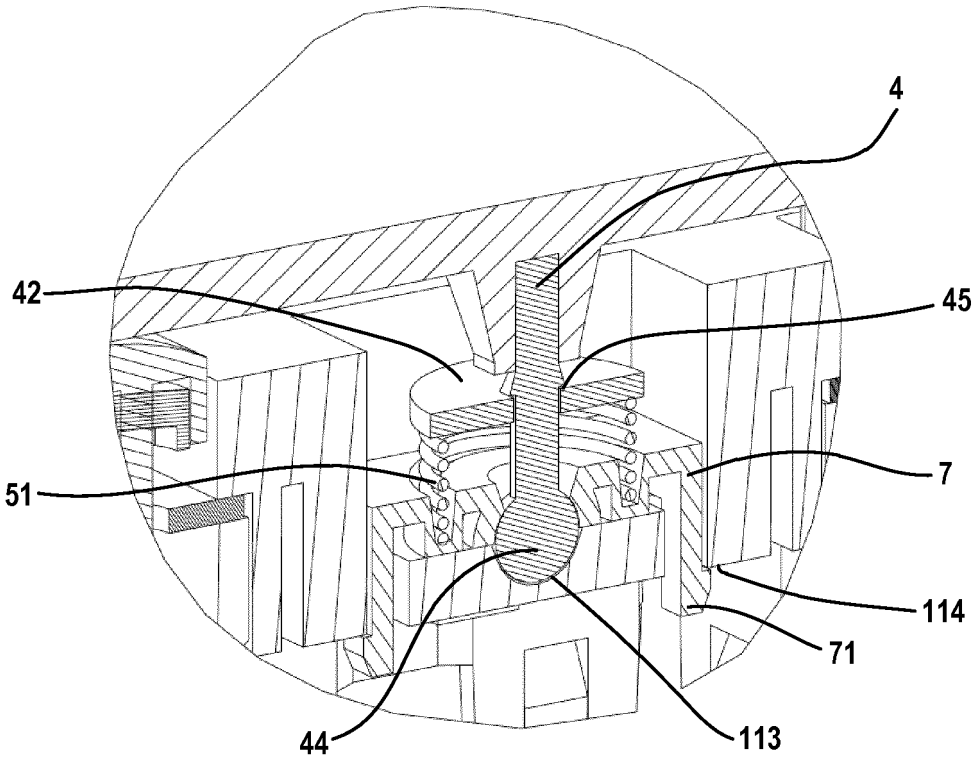

Fig.9

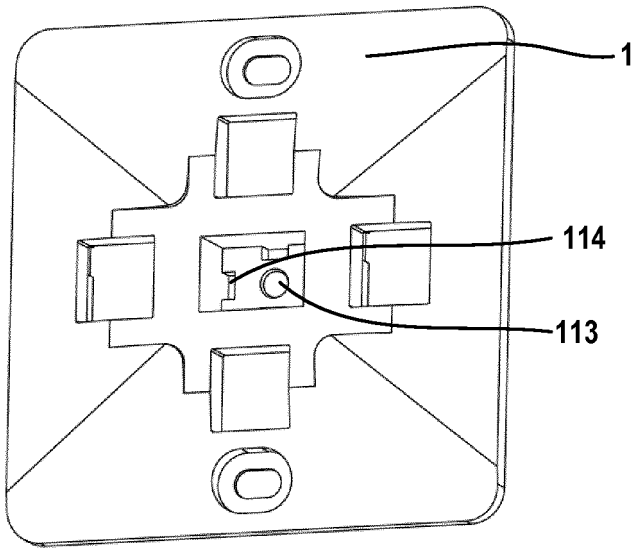

Fig.10

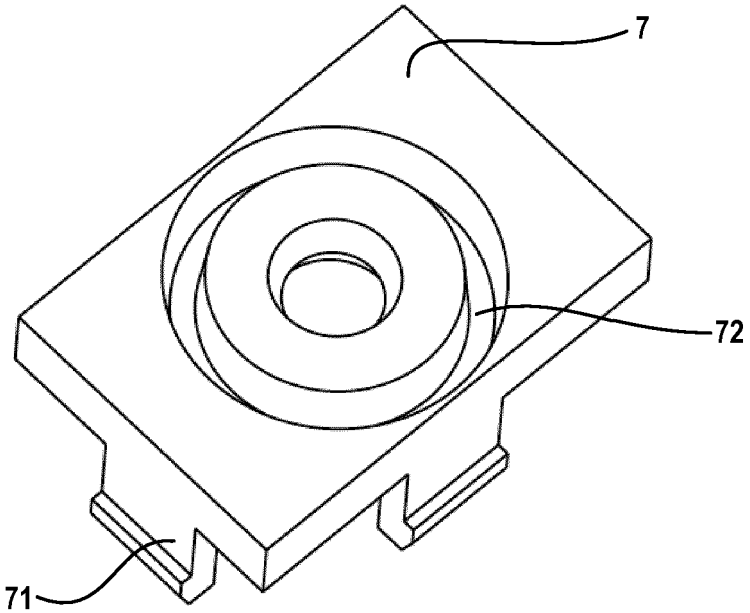

Fig.11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/093711

A. CLASSIFICATION OF SUBJECT MATTER

H01H 25/04 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI: switch, panel, shaft, reset, restore, rebound, spring, spherical.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 101390178 A (HOSIDEN CORP) 18 March 2009 (18.03.2009) description, pages 12-22 and figures 1-11	1-2, 7-10
A	CN 2874753 Y (SHENZHEN HANGSHENG ELECTRON CO LTD) 28 February 2007 (28.02.2007) the whole document	1-10
A	US 4896003 A (HSIEH MAN CHING) 23 January 1990 (23.01.1990) the whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 February 2016	06 February 2016
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer LI, Li Telephone No. (86-10) 62411773

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/093711

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101390178 A	18.03.2009	JP 4511479 B2	28.07.2010
		CN 101390178 B	03.08.2011
		JP 2007227004 A	06.09.2007
		KR 1425500 B1	01.08.2014
		JP 4511481 B2	28.07.2010
		US 8541701 B2	24.09.2013
		KR 20130113539 A	15.10.2013
		EP 1988559 B1	21.05.2014
		EP 2755221 A2	16.07.2014
		JP 4511480 B2	28.07.2010
		KR 1489721 B1	04.02.2015
		JP 2007227007 A	06.09.2007
		US 8283583 B2	09.10.2012
		EP 2755220 A3	27.08.2014
		JP 2007227005 A	06.09.2007
		US 2009050465 A1	26.02.2009
		US 2012292166 A1	22.11.2012
		EP 2755221 A3	27.08.2014
		KR 1425499 B1	01.08.2014
		WO 2007097194 A1	30.08.2007
		EP 1988559 A1	05.11.2008
		EP 2755219 A2	16.07.2014
		JP 4439478 B2	24.03.2010
		EP 2755219 A3	27.08.2014
		KR 20080106241 A	04.12.2008
		KR 20130113537 A	15.10.2013
		KR 20130113538 A	15.10.2013
		KR 1361741 B1	12.02.2014
		EP 2755220 A2	16.07.2014
		CA 2642326 A1	30.08.2007
		TW 200802466 A	01.01.2008
		TW I383417 B	21.01.2013
		JP 2007227006 A	06.09.2007
CN2874753Y	28.02.2007	None	
US4896003A	23.01.1990	None	

Form PCT/ISA /210 (patent family annex) (July 2009)