



(11)

**EP 3 270 400 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**17.01.2018 Bulletin 2018/03**

(51) Int Cl.:  
**H01H 25/06 (2006.01)**

(21) Application number: **17181451.0**

(22) Date of filing: **14.07.2017**

(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**

(72) Inventors:  
• **TAN, Kaijiu**  
Huizhou City (CN)  
• **SHU, Chang**  
Shenzhen City (CN)

(74) Representative: **Parker, Andrew James**  
**Meissner Bolte Patentanwälte**  
**Rechtsanwälte Partnerschaft mbB**  
**Postfach 86 06 24**  
**81633 München (DE)**

(30) Priority: **14.07.2016 CN 201610552385**  
**11.08.2016 US 201615234503**

(71) Applicant: **Tymphany HK Limited**  
**Hong Kong (CN)**

(54) **A MULTIPLE KNOB STRUCTURE**

(57) The invention provides a new-type multiple knob structure comprising a knob top module, a bearing module and a knob bottom module. Thereinto, a knob top module includes head cover, silicone keyboard and head annular PCB from top to bottom; a bearing module includes bearing holder and bearing; a knob bottom module includes bottom cover and bottom PCB. More particularly, a vertical press module is provided in this invention. The vertical press module is comprised of head cover, silicone keyboard, head annular PCB and bearing holder. The vertical press module is mounted on the periphery of the bearing, and it is mounted on the bottom cover with bolts. The new-type multiple knob structure with simple structure and low cost is suitable for knobs with varisized diameters, meeting requirements of the knob structure's application on electrical switch and regulating equipment.

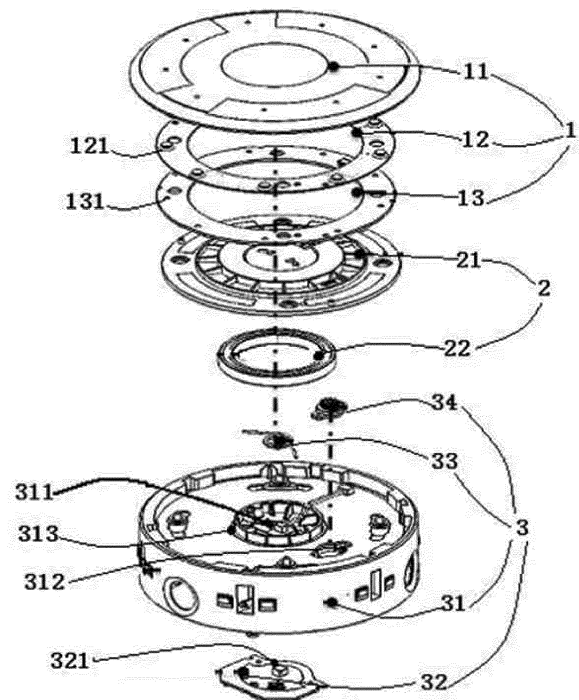


FIG. 1

**EP 3 270 400 A1**

## Description

### CROSS REFERENCE TO RELATED APPLICATION

**[0001]** This application is related to and claims the benefit of Chinese Patent Application Number CN201610552385.1 filed on 14 July 2016, the contents of which are herein incorporated by reference in their entirety.

### FIELD OF THE INVENTION

**[0002]** The invention generally relates to the technology field of knob modules, especially relating to a new-type multiple knob structure.

### BACKGROUND OF THE INVENTION

**[0003]** Knob, is an electrical component for manual control in an electronic system. Generally, a knob is part of an electrical switch or regulating equipment. According to functional requirement and shape, knobs are classified into three types, circular knob, multilateral knob and pointer knob etc.

**[0004]** At present, knob structures with double bearings and rotating potentiometer are commonly produced and used in the technology field of knob modules. To achieve vertical movement and rotation movement along the axis of knob, a structure of linear bearing is setup to the knob structure with double bearings, on the basis of normal bearing structure. However, the requirement of precision is high when manufacturing the knob structure with double bearings. Hence, production costs of knob structures with double bearings would be high. It can be rotated and pressed in knob structures with a rotating potentiometer. Knob structures with a rotating potentiometer are suitable for knobs with a minor diameter. However, it is not easy to rotate and press the knob when a knob structure with rotating potentiometer is applied to the knob with major diameter. It would also be shaky and not steady when rotating and pressing the knob. Users often complain about experiencing poor knob control. Both the knob structures mentioned above limit the application on electrical switch and regulating equipment.

**[0005]** Therefore, there is a need to design and manufacture a knob structure with simple structure and lower cost, and is suitable for knobs with varisized diameters, as this is an urgent technical issue that engineers now face, and needs to be solved.

### BRIEF SUMMARY

**[0006]** To solve the problems mentioned above, the invention provides a new-type multiple knob structure with multifunction, whose structure is simple and production cost is low. The multiple knob structure is suitable for knobs with varisized diameters, meeting requirements of the knob structure's application on electrical

switch and regulating equipment.

**[0007]** In order to achieve the above and other objectives of the invention, the invention provides a technical solution as below,

**[0008]** A new-type multiple knob structure comprising:

a knob top module, which includes head cover, silicone keyboard and head annular PCB from top to bottom;

a bearing module, which includes bearing holder and bearing;

a knob bottom module, which includes bottom cover and bottom PCB.

**[0009]** Generally, when engineers design this multiple knob structure, they usually merge the vertical press function and rotation function into the same piece of printed circuit board. In the process of research and development of the invention, engineers of the invention tried to setup the vertical press function on the head annular PCB and setup the rotation function on the bottom PCB. They found out that it simplifies the integration manufacturing procedure of PCB and it achieves different functions on different places of the knob. What is more important is that it optimizes knob structure and improves consumer's experience when vertical pressing and rotating the knob.

**[0010]** More particularly, the knob bottom module may also include a torsional spring and/or a rotation damper; the torsional spring may be mounted on installing groove of the bottom cover; the rotation damper may be mounted on rotation damper installing groove of the bottom cover.

**[0011]** To further describe the invention, a bearing seat may be setup on the middle axle of the bottom cover, the bearing may be mounted on the bearing seat of the bottom cover.

**[0012]** As single bearing is setup as the main bearing structure of the invention's multiple knob structure, it reduces production costs and avoids using knob structure with double bearings, whose production cost would be high.

**[0013]** More particularly, a vertical press module may be provided in this invention. The vertical press module may be comprised of head cover, and/or silicone keyboard, and/or head annular PCB and/or bearing holder.

**[0014]** The vertical press module may be mounted on the periphery of the bearing, and may be mounted on the bottom cover with bolts.

**[0015]** The bearing, torsional spring and rotation damper may be setup on the knob structure jointly. When rotating the knob clockwise or anticlockwise 30 degrees, it can trigger the knob to work, and the knob can spring-back automatically under the action of torsional spring and rotation damper.

**[0016]** To further describe the invention, nine buttons may be setup on the silicone keyboard, and nine button

triggers may be setup on the head annular PCB, the buttons may correspond to the button triggers. When consumers press any point of the head cover, the knob can be triggered to work. It meets the requirement of achieving the vertical press function easily.

**[0017]** To further describe the invention, a slide switch may be setup on the bottom PCB of the knob bottom module, the slide switch may trigger the knob to rotate.

**[0018]** Comparing to conventional knob structure, the advantages of the invention are as below:

A new-type multiple knob structure provided by the invention is suitable for applying in knobs with vari-sized diameters, meanwhile its structure is simple and only a single bearing with lower cost is setup as the main bearing structure. Therefore, it can meet the requirements of the knob structure's application on electrical switch and regulating equipment.

**[0019]** The knob structure provided by the invention simplifies the integration manufacturing procedure of PCB and it achieves different functions on different places of the knob, which is the vertical press function setup on the head annular PCB and the rotation function setup on the bottom PCB, respectively. It is more important that it optimizes knob structure and improves consumer's experience when vertical pressing and rotating the knob.

**[0020]** The knob structure provided by the invention, where nine buttons may be setup on the silicone keyboard, and nine button triggers may be setup on the head annular PCB. The buttons may correspond to the button triggers. Whenever consumers press any point of the head cover, the knob can be triggered to work. It saves labor and meets the requirement of achieving the vertical press function easily.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0021]**

FIG. 1 is an exploded view of a new-type multiple knob structure in accordance with an embodiment of the invention.

FIG. 2 is a pressing diagrammatic drawing of a new-type multiple knob structure in accordance with an embodiment of the invention.

FIG. 3 is a rotating diagrammatic drawing of a new-type multiple knob structure in accordance with an embodiment of the invention.

#### DETAILED DESCRIPTION

**[0022]** In order to fully comprehend the features and efficacy of the present invention, a detailed description is described by the following substantial embodiments in conjunction with the accompanying drawings. The de-

scription is as below.

#### Embodiment 1

**[0023]** Referring to FIG. 1, it is an exploded view of a new-type multiple knob structure in accordance with the embodiment of the invention. The invention provides a new-type multiple knob structure.

**[0024]** The knob structure comprise a knob top module 1, a bearing module 2 and a knob bottom module 3.

**[0025]** Therein the knob top module 1 includes head cover 11, silicone keyboard 12 and head annular PCB 13 from top to bottom; the bearing module 2 includes bearing holder 21 and bearing 22; the knob bottom module 3 includes bottom cover 31 and bottom PCB 32.

**[0026]** More particularly, the knob bottom module 3 may also include torsional spring 33 and/or rotation damper 34; torsional spring 33 may be mounted on installing groove 311 of the bottom cover 31; rotation damper 34 may be mounted on rotation damper installing groove 312 of the bottom cover 31.

**[0027]** In the process of research and development of the invention, engineers tried to setup the vertical press function on the head annular PCB 13 and setup the rotation function on the bottom PCB 32. They found out that it simplifies the integration manufacturing procedure of PCB and it achieves different functions on different places of the knob. It is important that it optimizes knob structure and improves consumer's experience when vertical pressing and rotating the knob.

**[0028]** In this embodiment, the bearing 22 may be mounted on a bearing seat 313 of the bottom cover 31, the bearing seat 313 may be setup on the middle axle of the bottom cover 31.

**[0029]** Now referring to FIG. 3, it is a rotating diagrammatic drawing of a new-type multiple knob structure in accordance with an embodiment of the invention. To further describe the rotation function of the invention, the bearing 22, and/or torsional spring 33 and/or rotation damper 34 may be setup on the knob structure jointly.

When rotating the knob clockwise or anticlockwise 30 degrees, it can trigger the knob to work, and the knob can springback automatically under the action of torsional spring 33 and rotation damper 34. Any other rotation angle may be set for triggering the knob to work; for example 10°, 20°, 40° or 50°. 30° is a preferred value.

**[0030]** For ease of illustration, a vertical press module may also be provided by the invention, it may comprise of head cover 11, and/or silicone keyboard 12, and/or head annular PCB 13 and/or bearing holder 21;

**[0031]** The vertical press module may be mounted on the periphery of the bearing 22. To further describe the location of the vertical press module, it may be mounted on the bottom cover 31 with bolts.

**[0032]** Turning now to FIG. 2, it is a pressing diagrammatic drawing of a new-type multiple knob structure in accordance with an embodiment of the invention. In this embodiment, nine buttons 121 may be setup on the sil-

icone keyboard 12, nine button triggers 131 may be setup on the wherein head annular PCB 13.

**[0033]** It will be understood by those skilled in the art, that the nine pieces of buttons 121 may correspond to the nine pieces of button triggers 131. Of course, the invention is not limited to nine buttons 121. Other numbers of buttons may be used - for example 5, 6, 7, 8, 10, 11, 12 or 13; with advantageously a corresponding equal number of button triggers 131. 9 is a particularly preferred and advantageous number for the functioning of the knob.

**[0034]** A slide switch 321 may be setup on the bottom PCB 32 of the knob bottom module 3 as illustrated in FIG. 1. The slide switch 321 can trigger the knob to rotate.

**[0035]** The new-type multiple knob structure provided by the invention is suitable for applying in knobs with varisized diameters, meanwhile its structure is simple and only a single bearing with lower cost is setup as the main bearing structure. Therefore, it can meet the requirements of the knob structure's application on electrical switch and regulating equipment.

**[0036]** The present invention is disclosed by the preferred embodiment in the aforementioned description; however, it is contemplated for one skilled at the art that the embodiments are applied only for an illustration of the present invention rather than are interpreted as a limitation for the scope of the present invention. It should be noted that the various substantial alternation or replacement equivalent to these embodiments shall be considered as being covered within the scope of the present invention. Therefore, the protection scope of the present invention shall be defined by the claims.

## Claims

### 1. A multiple knob structure comprising:

a knob top module, which includes a head cover, silicone keyboard and head annular PCB from top to bottom;  
a bearing module, which includes bearing holder and bearing;  
a knob bottom module, which includes bottom cover and bottom PCB.

2. The knob structure as claimed in claim 1, wherein the knob bottom module also includes a torsional spring and rotation damper; the torsional spring is mounted on installing groove of the bottom cover, the rotation damper is mounted on rotation damper installing groove of the bottom cover.

3. The knob structure as claimed in claim 1 or claim 2, wherein the bearing is mounted on a bearing seat of the bottom cover, the bearing seat is setup on the middle axle of the bottom cover.

4. The knob structure as claimed in any of claims 1 to 3, further comprising a vertical press module comprised of the head cover, silicone keyboard, head annular PCB and bearing holder; wherein the vertical press module is mounted on the periphery of the bearing, and the vertical press module is mounted on the bottom cover with bolts.

5. The knob structure as claimed in any of the claims 1 to 4, in particular claim 4; wherein the vertical press module is mounted on the periphery of the bearing, and the vertical press module is mounted on the bottom cover with bolts

6. The knob structure as claimed in any of claims 1 to 5, wherein between 5 and 13; preferably between 6 and 12; preferably between 7 and 11, more preferably between 8 and 10 and most preferably nine buttons are setup on the silicone keyboard, and between 5 and 13; preferably between 6 and 12; preferably between 7 and 11, more preferably between 8 and 10 and most preferably nine button triggers are setup on the head annular PCB, the buttons corresponding to the button triggers.

7. The knob structure as claimed in any of claims 1 to 5, in particular claim 2, wherein a slide switch is setup on the bottom PCB of the knob bottom module, the slide switch triggers the knob to rotate.

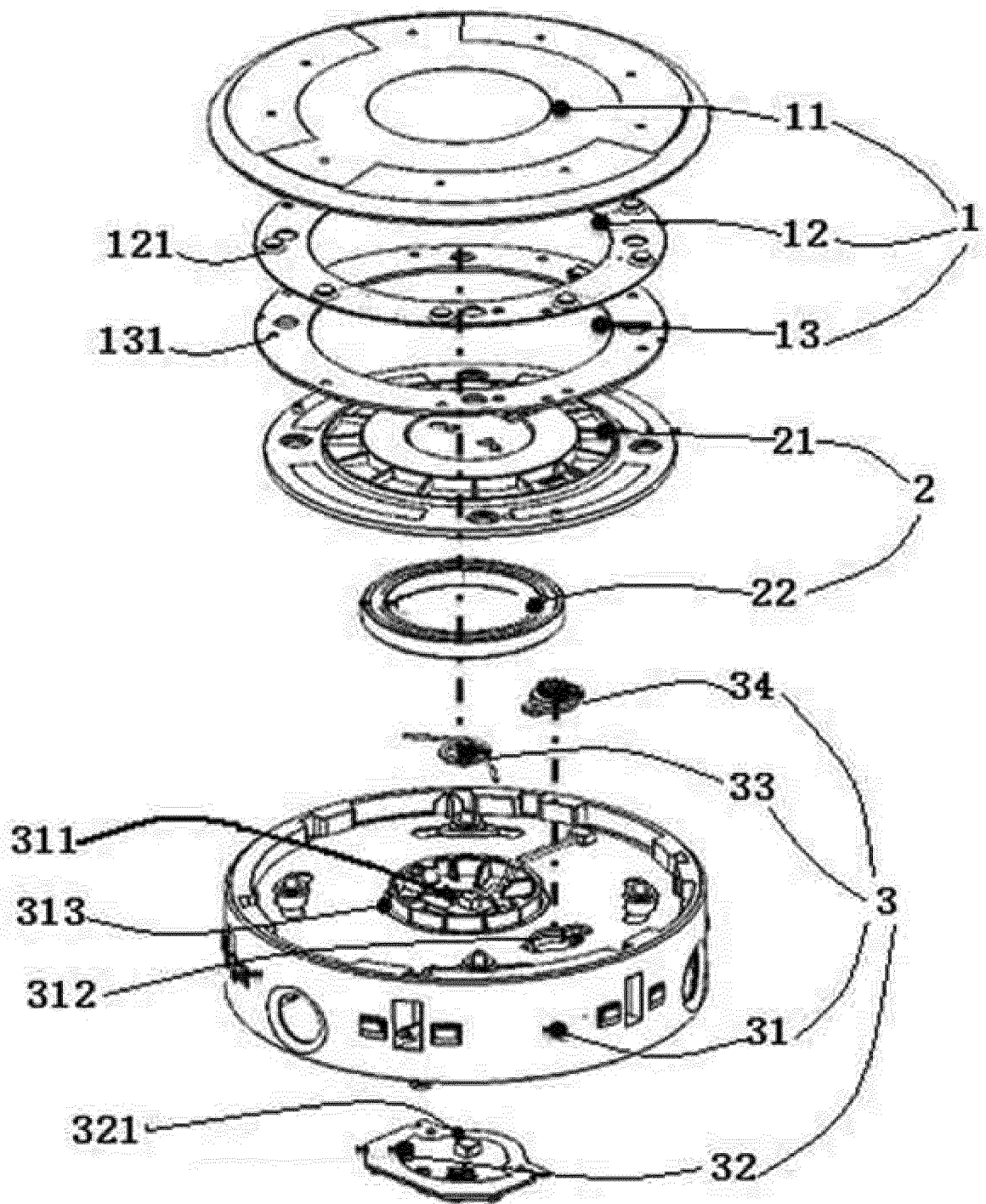


FIG. 1

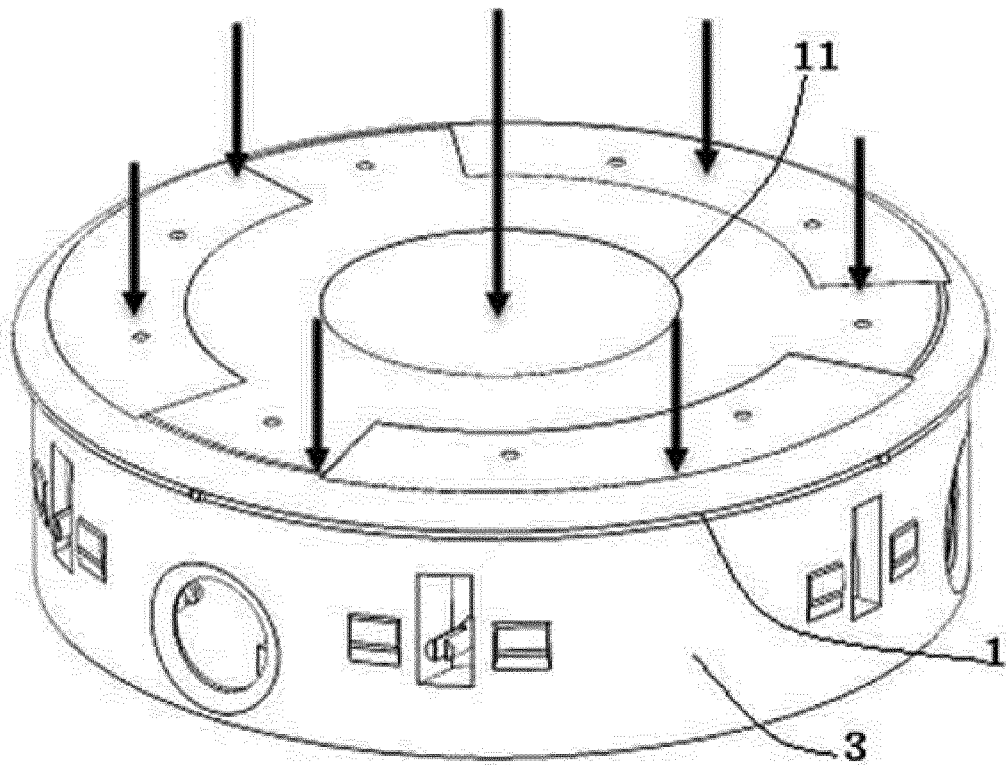


FIG. 2

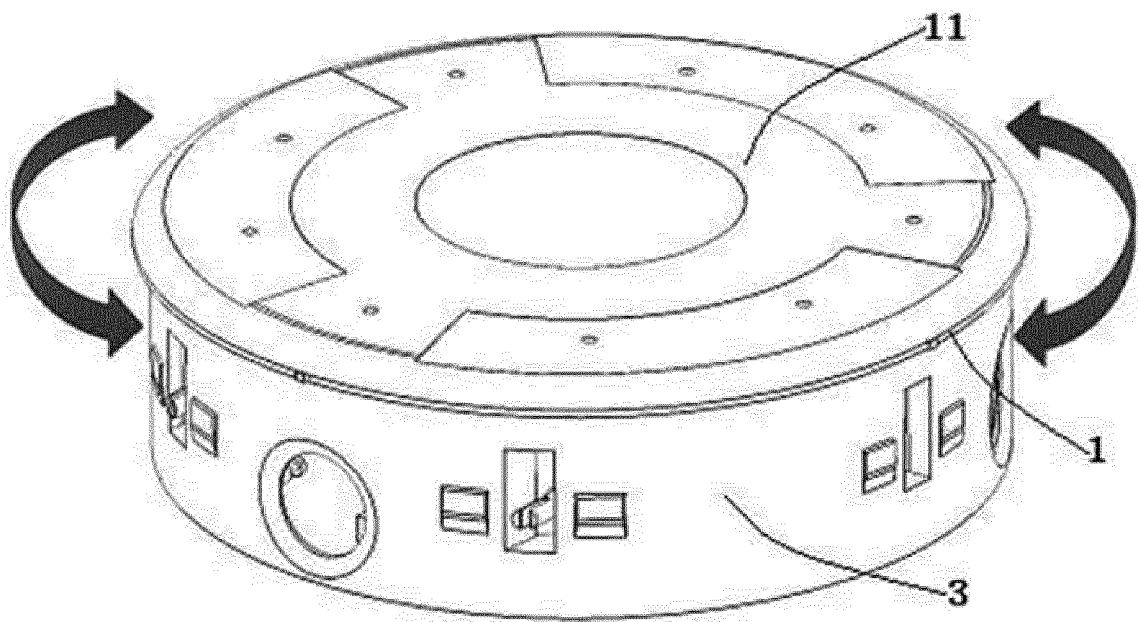


FIG. 3



## EUROPEAN SEARCH REPORT

 Application Number  
 EP 17 18 1451

5

10

15

20

25

30

35

40

45

50

55

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                              |                                  |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE 10 2010 042709 A1 (PREH GMBH [DE])<br>2 February 2012 (2012-02-02)                                                        | 1-6                              | INV.<br>H01H25/06                       |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * abstract; figure 1 *<br>* paragraph [0019] - paragraph [0023] *                                                            | 7                                |                                         |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2005/173624 A1 (KAWANO KENJI [JP] ET AL) 11 August 2005 (2005-08-11)<br>* abstract; figures 1,2 *<br>* paragraph [0042] * | 7                                |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FR 2 937 434 A1 (DAV [FR])<br>23 April 2010 (2010-04-23)<br>* figure 1 *                                                     | 1                                |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2015/279580 A1 (OKAZAKI RYOJI [JP])<br>1 October 2015 (2015-10-01)<br>* figure 4 *                                        | 1                                |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP 2 639 806 A1 (ABB AG [DE])<br>18 September 2013 (2013-09-18)<br>* figures 4-7 *                                           | 1                                |                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                              |                                  | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                              |                                  | H01H                                    |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                              | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                              | 7 December 2017                  | Bilard, Stéphane                        |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : 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 17 18 1451

5

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.

07-12-2017

10

15

20

25

30

35

40

45

50

55

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| DE 102010042709 A1                        | 02-02-2012          | CN 102870068 A             | 09-01-2013          |
|                                           |                     | DE 102010042709 A1         | 02-02-2012          |
|                                           |                     | WO 2012013573 A1           | 02-02-2012          |
| US 2005173624 A1                          | 11-08-2005          | JP 2005228822 A            | 25-08-2005          |
|                                           |                     | US 2005173624 A1           | 11-08-2005          |
| FR 2937434 A1                             | 23-04-2010          | EP 2350781 A1              | 03-08-2011          |
|                                           |                     | FR 2937434 A1              | 23-04-2010          |
|                                           |                     | WO 2010046372 A1           | 29-04-2010          |
| US 2015279580 A1                          | 01-10-2015          | AU 2013349215 A1           | 23-04-2015          |
|                                           |                     | JP 6217073 B2              | 25-10-2017          |
|                                           |                     | JP 2014103986 A            | 09-06-2014          |
|                                           |                     | US 2015279580 A1           | 01-10-2015          |
|                                           |                     | WO 2014080549 A1           | 30-05-2014          |
| EP 2639806 A1                             | 18-09-2013          | CN 103325637 A             | 25-09-2013          |
|                                           |                     | DE 102012005474 A1         | 19-09-2013          |
|                                           |                     | EP 2639806 A1              | 18-09-2013          |
|                                           |                     | ES 2639109 T3              | 25-10-2017          |
|                                           |                     | RU 2013109060 A            | 10-09-2014          |

**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**

- CN 201610552385 [0001]