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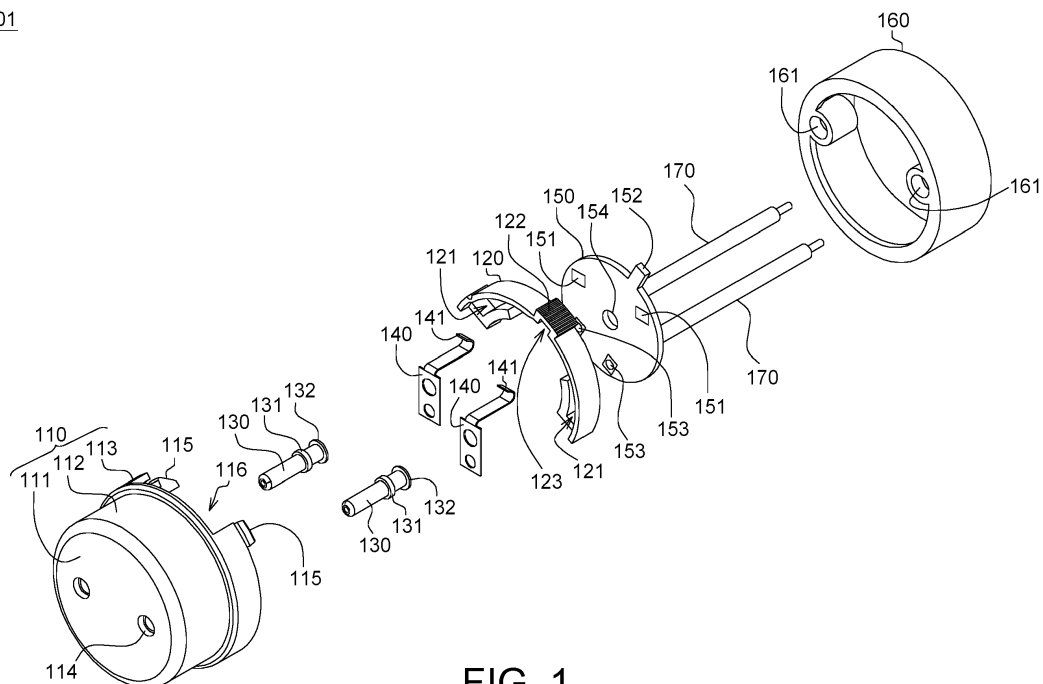
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(54) **LAMP TUBE AND END CAP STRUCTURE THEREOF**

(57) A lamp tube (100) and an end cap structure (101) thereof are provided. The end cap structure (101) includes a first cover (110), a rotatable body (120), at least one electrode pin (130) and a circuit board (150). The rotatable body (120) is disposed on the first cover (110). The at least one electrode pin (130) is disposed on the

first cover (110) for receiving an external power (200). The circuit board (150) is disposed within the first cover (110). The circuit board (150) has at least one contact point (151). The at least one contact point (151) and the at least one electrode pin (130) are electrically connected or insulated via the rotation of the rotatable body (120).

101



**FIG. 1**

**Description**

## TECHNICAL FIELD

**[0001]** The disclosure relates in general to a lamp tube, and more particularly to a lamp tube and an end cap structure with manual switching function thereof.

## BACKGROUND

**[0002]** To comply with the design of the fluorescent lamp base, each of the two ends of the lamp tube has two electrode pins through which the lamp tube is electrically connected to the power slot disposed on the lamp base to form a power supply circuit for providing power to the lamp tube.

**[0003]** However, during the installation or un-installation of the lamp tube when the electrode pins disposed on one side of the lamp tube are already electrically connected to the power slot on the one side but the electrode pins disposed on the other side of the lamp tube have not been loaded to the power slot disposed on the other side, if the user touches the electrode pins exposed on the other side of the lamp tube with his/her hand, it is possible that the user may be electrocuted once the electric current flowing through the human body is grounded and forms an electric loop.

## SUMMARY

**[0004]** The disclosure is directed to a lamp tube and an end cap structure with manual switching function thereof to assure the user's safety during the installation or un-installation of the lamp tube.

**[0005]** According to one embodiment of the disclosure, an end cap structure is provided. The end cap structure includes a first cover, a rotatable body, at least one electrode pin and a circuit board. The rotatable body is disposed on the first cover. The at least one electrode pin is disposed on the first cover for receiving an external power. The circuit board is disposed within the first cover. The circuit board has at least one contact point. The at least one contact point and the at least one electrode pin are electrically connected or insulated via the rotation of the rotatable body.

**[0006]** According to another embodiment of the disclosure, a lamp tube is provided. The lamp tube includes a tube, the said end cap structure and a second end cap structure. The tube has a first end portion and a second end portion. The said end cap structure is disposed on the first end portion. The second end cap structure is disposed on the second end portion.

**[0007]** The above and other aspects of the disclosure will become better understood with regard to the following detailed description of the preferred but non-limiting embodiment(s). The following description is made with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]**

FIG. 1 is a schematic diagram of an end cap structure of a lamp tube according to an embodiment of the disclosure.

FIGS. 2A and 2B respectively are an assembly diagram of the end cap structure of FIG. 1.

FIG. 3A is an internal schematic diagram of the end cap structure of FIG. 2A.

FIG. 3B is an internal schematic diagram of the end cap structure of FIG. 2B.

FIGS. 4A and 4B are circuit diagrams of a lamp tube and a power supply circuit according to an embodiment of the disclosure.

**[0009]** In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

## DETAILED DESCRIPTION

**[0010]** A number of embodiments are disclosed below for elaborating the disclosure. However, the embodiments of the disclosure are for detailed descriptions only, not for limiting the scope of protection of the disclosure. The same reference numerals are used to indicate the elements with the same or similar functions.

**[0011]** Referring to FIG. 1, a schematic diagram of an end cap structure 101 of a lamp tube according to an embodiment of the disclosure is shown. The end cap structure 101 includes a first cover 110, a rotatable body 120, two electrode pins 130, two conductive elastic pieces 140, a circuit board 150, a second cover 160 and two signal wires 170. The first cover 110 includes an end surface 111, a cylindrical surface 112 and an annular piece 113. The end surface 111 has two receiving holes 114 for receiving the two electrode pins 130, such that the two electrode pins 130 are protruded outside the end surface 111. The inner diameters of the two receiving holes 114 are substantially equivalent to or slightly larger than the outer diameter of the two columnar electrode pins 130, such that the two electrode pins 130 respectively pass through the two receiving holes 114. To fix the two electrode pins 130 in the two receiving holes 114, an engaging structure

**[0012]** (such as a snap ring 131 or a retaining groove) is formed on the outer surface of each electrode pin 130

and the inner surface of the corresponding receiving hole 114 for tightly fixing the two electrode pins 130 on the end surface 111.

**[0013]** As indicated in FIG. 1, the cylindrical surface 112 is connected between the end surface 111 and the annular piece 113 in one piece. The outer diameter of the cylindrical surface 112 is slightly smaller than the outer diameter of the annular piece 113 to form a stepped protruded surface between the cylindrical surface 112 and the annular piece 113. Besides, two positioning pieces 115 are disposed under the annular piece 113, wherein the two positioning pieces 115 are separated from the annular piece 113 by a predetermined gap. Furthermore, two positioning grooves 121 are disposed under the rotatable body 120 and are corresponding to the two positioning pieces 115 for receiving the two positioning pieces 115. Therefore, when the two positioning pieces 115 are respectively inserted into the two positioning grooves 121, the rotatable body 120 is supported by the two positioning pieces 115 and can rotate with respect to the annular piece 113.

**[0014]** In the above embodiments, the outer diameter of the cylindrical surface 112 is slightly smaller than that of the annular piece 113, but the disclosure is not limited thereto. In another embodiment (not shown), the outer diameter of the cylindrical surface 112 can be slightly larger than that of the annular piece 113 to form a stepped recessed surface between the cylindrical surface 112 and annular piece 113. When the annular piece 113 with smaller outer diameter is used, the rotatable body 120 is directly disposed on the outer surface of the annular piece 113 and does not need to be positioned via the two positioning pieces 115. Furthermore, through proper sliding design, the rotatable body 120 can rotate with respect to the annular piece 113. Therefore, the rotatable body 120 of FIG. 1 positioned using two positioning pieces 115 is merely one of the implementations of the disclosure, and is not for limiting the disclosure.

**[0015]** The function of the rotatable body 120 is like a switch (referring to the switch SW of FIG. 4B) for the user to manually switch the power. Refer to FIG. 1. The annular piece 113 includes a recess 116. The rotatable body 120 includes a sliding lump 122. The sliding lump 122 is received in the recess 116. The user may apply a force on the sliding lump 122 for sliding the sliding lump 122 in the recess 116 along a sliding direction (the length direction of the recess 116) as indicated in FIGS. 2A and 2B.

**[0016]** Referring to FIGS. 2A and 2B, two assembly diagrams of the end cap structure 101 of FIG. 1 are shown. The main difference between FIGS. 2A and 2B lies in the position of the sliding lump 122. As disclosed above, the first cover 110 includes an annular piece 113, and the rotatable body 120 is disposed on the annular piece 113 along a sliding direction. Additionally, the end cap structure 101 may further include a second cover 160, and the second cover 160 and the first cover 110 can be assembled together and fixed on the first cover

110. In an embodiment, the annular piece 113 is disposed on one side of the first cover 110 and is fixed between the first cover 110 and the second cover 160. In another embodiment (not shown), the annular piece 113 can be disposed on one side of the second cover 160 opposite to the first cover 110 and is fixed between the first cover 110 and the second cover 160. Therefore, the annular piece 113 of FIG. 1 is merely one of the implementations, and is not for limiting the disclosure.

**[0017]** The rotatable body 120 is disposed between the first cover 110 and the second cover 160, and the sliding lump 122 is exposed in the recess 116 of the annular piece 113. When the second cover 160 and the first cover 110 are assembled and fixed on the first cover 110, the recess 116 will become a closed recess once the open side of the recess 116 is covered by one side-wall 162 of the second cover 160 and becomes a closed side.

**[0018]** The width W of the sliding lump 122 is substantially the same as the width W of the closed recess 116, but the length L1 of the sliding lump 122 is smaller than the length L2 of the closed recess 116 (for example, the length L1 of the sliding lump 122 is about 1/2~1/3 of the length L2 of the closed recess 116), such that the sliding lump 122 will slide from one end of the closed recess 116 (referring to FIG. 2A) to the other end of the closed recess 116 (referring to FIG. 2B).

**[0019]** The said second cover 160 can be an annular body with two fixing holes 161, and the second cover 160 can pass through two fixing holes 161 and lock on the first cover 110 by using a locking element such as screws (not illustrated). In an embodiment, the second cover 160 can be one single assembly independently assembled on the first cover 110, which can be assembled on an end portion of the lamp tube through the second cover 160 as indicated in the lamp tube 100 of FIG. 4A. In another embodiment, the second cover 160 can be an end portion of the lamp tube, and the first cover 110 can be directly assembled on an end portion of the tube through the second cover 160. Therefore, the second cover 160 of FIG. 1 being independently assembled is merely one of the implementations of the disclosure, and is not for limiting the disclosure.

**[0020]** Refer to FIG. 2A. When the sliding lump 122 of the rotatable body 120 is located at one end of the closed recess 116, the power is switched to an off state. Meanwhile, the external power cannot be provided via the two electrode pins 130. Refer to FIG. 2B. When the sliding lump 122 of the rotatable body 120 is located at the other end of the closed recess 116, the power is switched to an on state. Meanwhile, the external power can be provided via the two electrode pins 130. Therefore, the end cap structure 101 of the present embodiment has a manual switching function for turning on/off the power.

**[0021]** Refer to FIGS. 3A and 3B. FIG. 3A is an internal schematic diagram of the end cap structure 101 of FIG. 2A. FIG. 3B is an internal schematic diagram of the end cap structure 101 of FIG. 2B. In FIG. 3A, the rotatable body 120 and the circuit board 150 of FIG. 1 are assem-

bled together, and the circuit board 150 has at least one contact point 151. When the quantity of the electrode pin 130 is one, one corresponding contact point 151 contacting or not contacting the electrode pin 130 will do. When the quantity of the electrode pin 130 is two, either one or more than one corresponding contact point 151 will do, and the quantity of the contact point 151 does not have to be two. However, the disposition of two contact points 151 further assures the electrical connection between at least one electrode pin 130 and at least one contact point 151.

**[0022]** Besides, one end of the two signal wires 170 can be electrically connected to the circuit board 150 via two pads 153, and the other end of the two signal wires 170 is connected to a driver 104 for providing a power to the driver 104. As indicated in FIG. 4A, the driver 104 is disposed in the body of the lamp tube for driving a light emitting element such as a light emitting diode unit.

**[0023]** In FIG. 3A, at least one contact point 151 and at least one electrode pin 130 can be electrically insulated via the rotation of the rotatable body 120, such that the power is switched to an off state. Moreover, in FIG. 3B, at least one contact point 151 and at least one electrode pin 130 can be electrically connected via the rotation of the rotatable body 120, such that the power is switched to an on state.

**[0024]** In an embodiment, the rotatable body 120 includes a positioning opening 123, and the circuit board 150 includes a plate 152 as indicated in FIG. 1. The plate 152 is extended towards the positioning opening 123 and embedded into the positioning opening 123, such that the rotatable body 120 and the circuit board 150 are assembled together as indicated in FIG. 3A. The positions of the positioning opening 123 and the plate 152 are exchangeable. That is, in another embodiment (not shown), the rotatable body 120 includes a plate 152, and the circuit board 150 includes a positioning opening 123. The plate 152 is extended towards the positioning opening 123 and embedded in the positioning opening 123, such that the rotatable body 120 and the circuit board 150 are assembled together. The embedding structure formed by the positioning opening 123 and the plate 152 can be replaced by a similar structure such as an engaging structure or a locking structure, and the disclosure does not have specific restrictions.

**[0025]** Moreover, at least one conductive elastic piece 140 is disposed between the circuit board 150 and the at least one electrode pin 130. When the quantity of the electrode pin 130 is one, only a corresponding conductive elastic piece 140 needs to contact the electrode pin 130. When the quantity of the electrode pin 130 is two, two conductive elastic pieces 140 need to contact the two electrode pins 130 respectively. In FIG. 3A, one end of the two conductive elastic pieces 140 is connected to the snap ring 132 of the two electrode pins 130, and the other end is extended to the circuit board 150 and forms a bending portion 141, which provides an elastic force for pressing the circuit board 150. In FIG. 3A, the two con-

ductive elastic pieces 140 do not contact the two contact points 151, such that the power is switched to an off state. Moreover, as indicated in FIG. 3B, the circuit board 150 is rotated along with the rotation of the rotatable body 120 and makes the two conductive elastic pieces 140 contact the two contact points 151, such that the power can be switched to an on state.

**[0026]** The center of the said circuit board 150 has a hole 154 allowing a shaft (not illustrated) to pass through and be positioned at a central position of the first cover 110, such that the circuit board 150 can be supported by the shaft and fixed on the first cover 110, and can further be rotated with respect to the shaft for switching the power state.

**[0027]** In the above embodiments, the circuit board 150 is driven to rotate by the rotatable body 120, such that the contact point 151 of the circuit board 150 can be displaced. In another embodiment, the first cover 110 can replace the said rotatable body 120 if the first cover 110 has rotation function. The difference lies in that the circuit board 150 is fixed on the second cover 160 and does not need to be driven, the electrode pin 130 and the conductive elastic pieces 140 are driven by the first cover 110 and displaced when the first cover 110 rotates. Thus, the two conductive elastic pieces 140 will or will not contact the two contact points 151, and the power state will be switched accordingly.

**[0028]** Referring to FIGS. 4A and 4B, two circuit diagrams of a lamp tube 100 and a power supply circuit 10 according to an embodiment of the disclosure are shown. The lamp tube 100 includes a tube 103, a first end cap structure 101 and a second end cap structure 102. The first end cap structure 101, that is, the end cap structure with manual switching function as disclosed in above embodiments, is disposed on the first end portion E1 of the tube 103, and the second end cap structure 102 is disposed on the second end portion E2 of the tube 103 but does not have the manual switching function. The electrode pin 130 of the first end cap structure 101 is electrically connected to a first power wire PW1 of the power supply circuit 10 and the electrode pin 130 of the second end cap structure 102 is electrically connected to a second power wire PW2 of the power supply circuit 10 for providing an external power 200 to the lamp tube 100. The external power 200 can be an alternating current power or a direct current power.

**[0029]** As indicated in FIG. 4A, the power supply circuit 10 can be an alternating current circuit powered via two ends of the lamp tube 100. When an internal power wire PW3 of the lamp tube 100 is electrically connected to the second power wire PW2 via the manual switch SW, the driver 104, on receiving the external power 200, is driven and turned on by an electric current, such that the lamp tube 100 is conducted in the power supply circuit 10. As indicated in FIG. 4B, when the internal power wire PW3 of the lamp tube 100 is electrically insulated from the second power wire PW2 via the manual switch SW, the external power 200 connected to the driver 104 is cut off,

such that the lamp tube 100 is not conducted in the power supply circuit 10.

[0030] It can be understood from the above disclosure that the lamp tube and the end cap structure thereof disclosed in the above embodiments of the disclosure avoid the user touching exposed electrode pins and being electrocuted during the installation or un-installation of the lamp tube by manually switching the switch to an off state. After the installation of the lamp tube is completed, the lamp tube is manually switched to an on state to receive an external power. Thus, the user's safety can be assured during the installation or un-installation of the lamp tube.

[0031] It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed embodiments. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims and their equivalents.

### Claims

1. An end cap structure (101) of a lamp tube (100), **characterized in that** the end cap structure (101) comprises:
  - a first cover (110);
  - a rotatable body (120) disposed on the first cover (110);
  - at least one electrode pin (130) disposed on the first cover (110) for receiving an external power (200); and
  - a circuit board (150) disposed within the first cover (110), wherein the circuit board (150) has at least one contact point (151) electrically connected with or insulated from the at least one electrode pin (130) via the rotation of the rotatable body (120).
2. The end cap structure according to claim 1, wherein the first cover (110) comprises an annular piece (113) on which the rotatable body (120) is disposed along a sliding direction.
3. The end cap structure according to claim 2, further comprising a second cover (160), wherein the annular piece (113) is disposed on a side of the first cover (110) or an opposite side of the second cover (160) corresponding to the side of the first cover (110) and is fixed between the first cover (110) and the second cover (160).
4. The end cap structure according to claim 2 or 3, wherein the annular piece (113) comprises a recess (116), the rotatable body (120) comprises a sliding lump (122) received in the recess (116), and a length of the sliding lump (122) is smaller than a length of the recess (116) in the sliding direction.
5. The end cap structure according to claim 4, wherein one of the rotatable body (120) and the circuit board (150) comprises a positioning opening (123), and another one of the rotatable body (120) and the circuit board (150) comprises a plate (152) extended towards the positioning opening (123) and embedded in the positioning opening (123).
6. The end cap structure according to claim 1, further comprising at least one conductive elastic piece (140), wherein one end of the at least one conductive elastic piece (140) is fixed and connected to the at least one electrode pin (130), and the other end of the at least one conductive elastic piece (140) is extended to the circuit board (150) and contacts or does not contact the at least one contact point (151).
7. A lamp tube (100), **characterized in that** the lamp tube (100) comprising:
  - a tube (103) having a first end portion (E1) and a second end portion (E2);
  - an end cap structure (101) according to any of claims 1 to 6, wherein the end cap structure (101) is disposed on the first end portion (E1); and
  - a second end cap structure (102) disposed on the second end portion (E2).
8. The lamp tube according to claim 7, wherein two ends of the lamp tube (100) connect a power supply circuit (10), when the at least one contact point (151) and the at least one electrode pin (130) are electrically connected, the lamp tube (100) is conducted in the power supply circuit (10) to receive the external power (200), and when the at least one contact point (151) and the at least one electrode pin (130) are electrically insulated, the external power is cut off such that the lamp tube (100) is not conducted in the power supply circuit (10).
9. The lamp tube according to claim 7, wherein the power supply circuit is an alternating current circuit powered via two ends of the lamp tube (100).

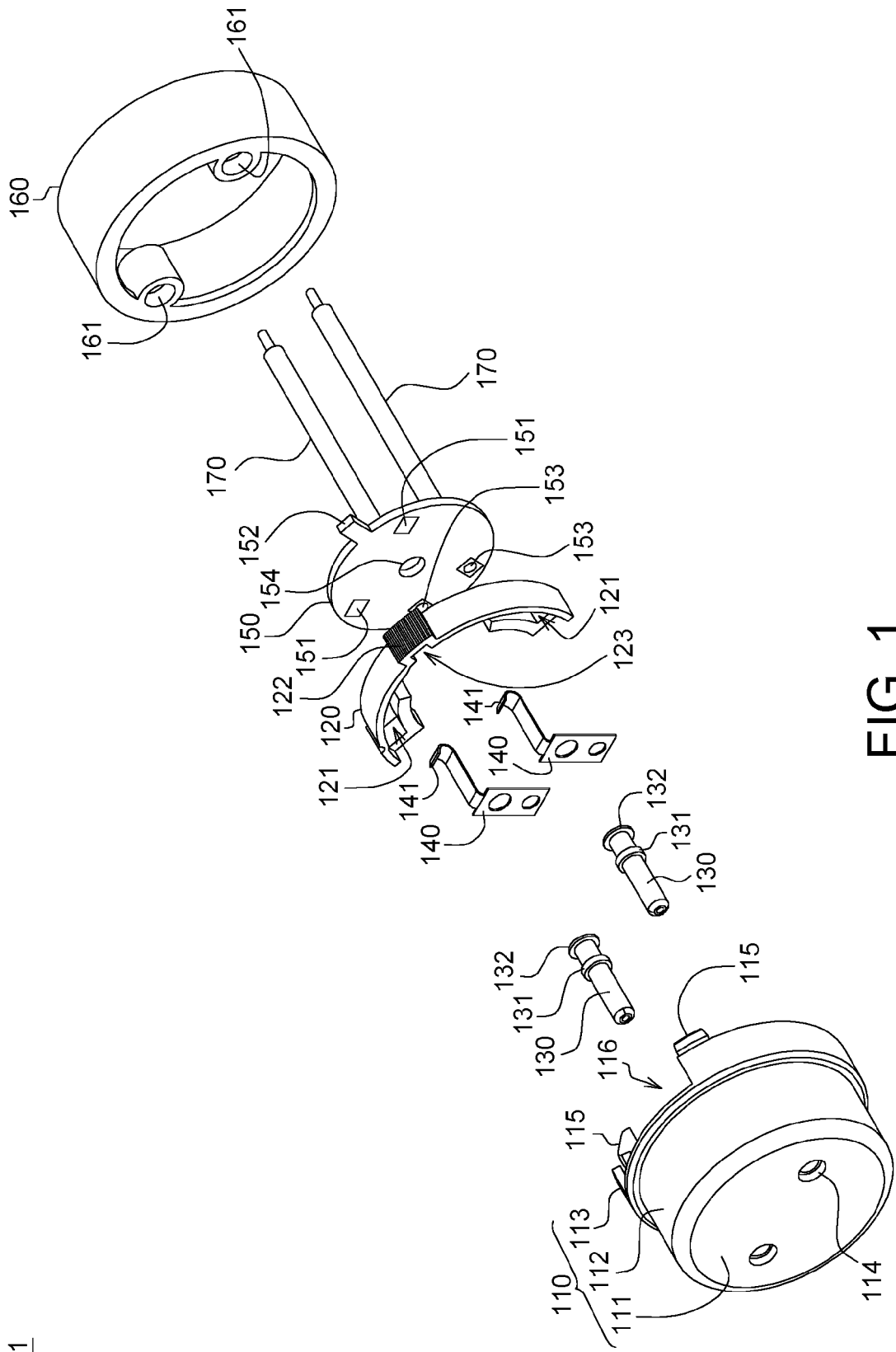


FIG. 1

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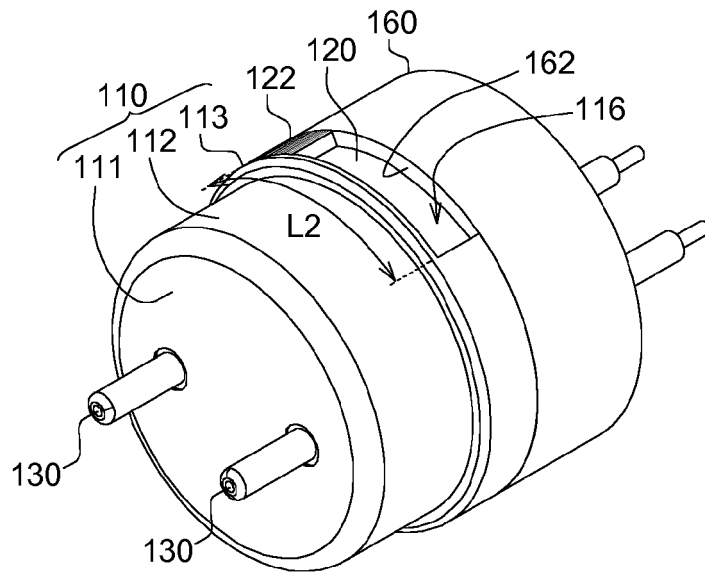


FIG. 2A

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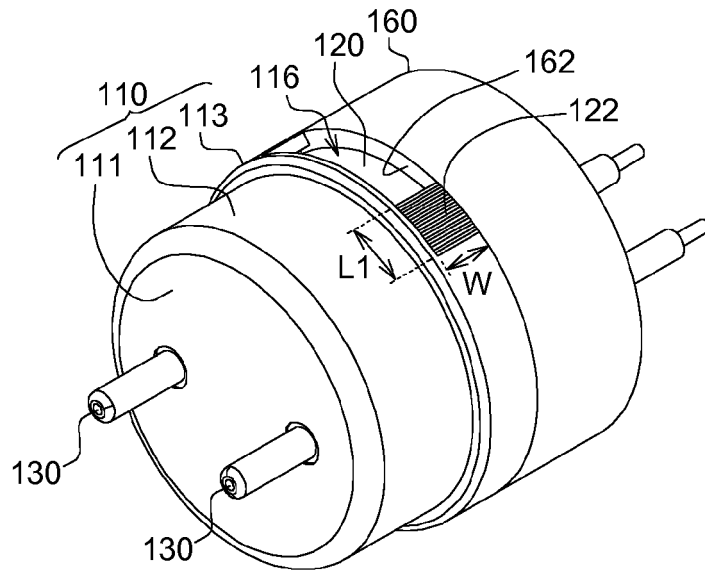


FIG. 2B

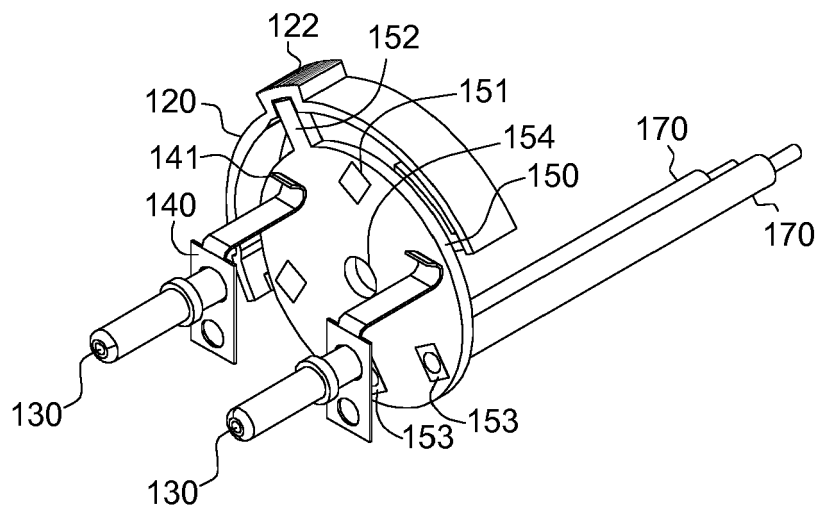


FIG. 3A

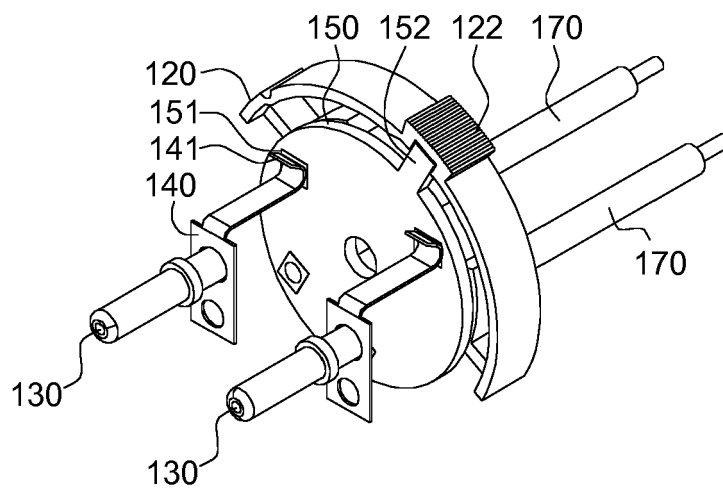


FIG. 3B



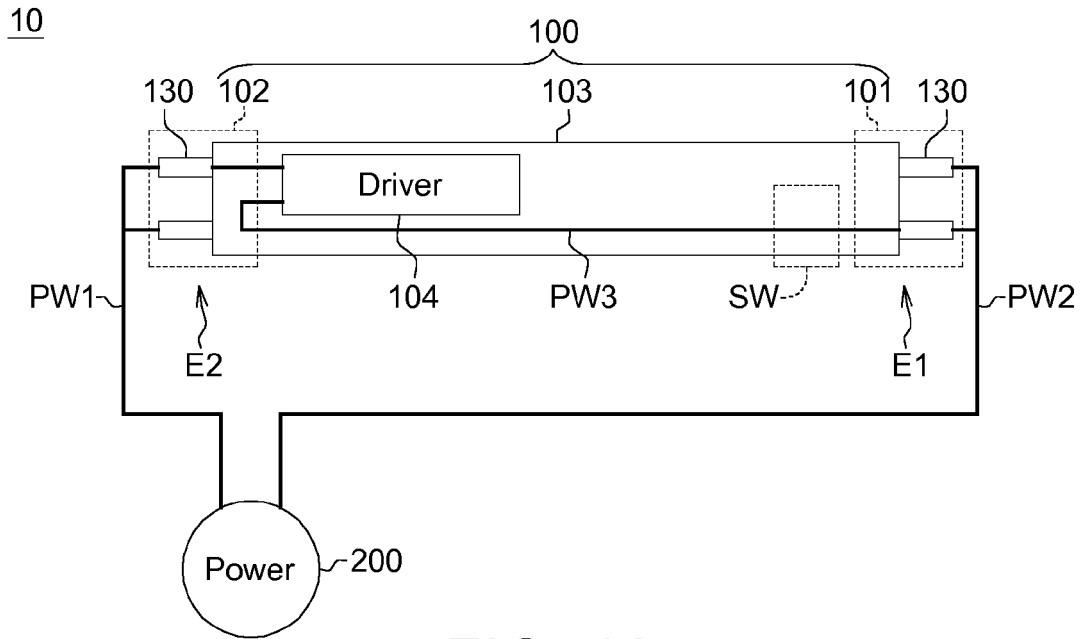


FIG. 4A

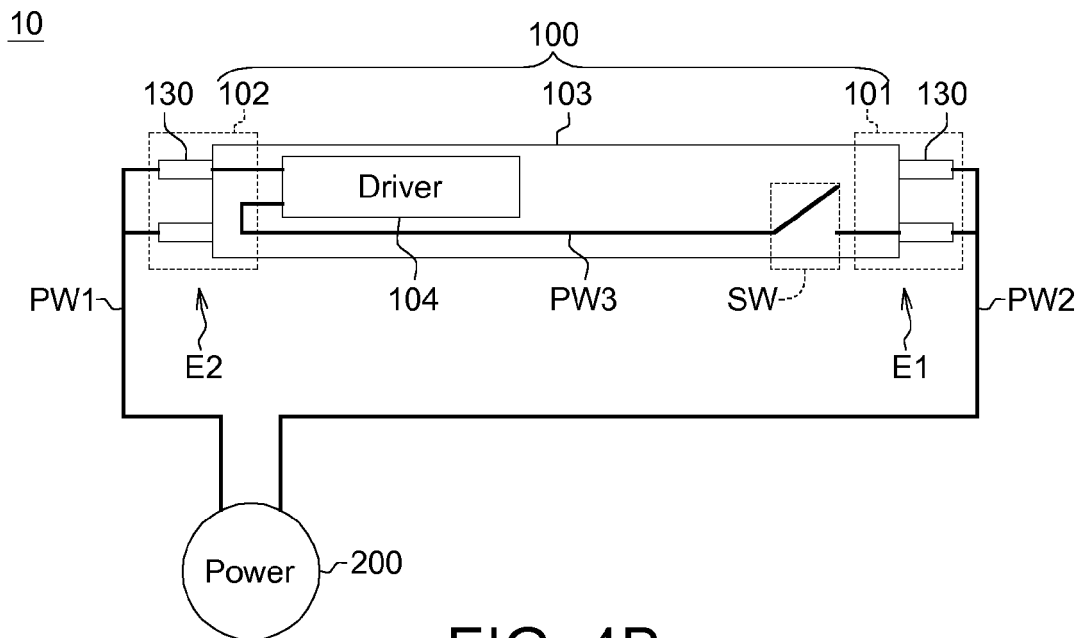


FIG. 4B



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 Application Number  
 EP 16 18 7041

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                                                               |                                                                                                                                                                                                                                                                              |                                                                                                 |
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| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                 | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC)                                                         |
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| Place of search<br>The Hague                                                                                                                                                                                                                           |                                                                                                                                                                                               | Date of completion of the search<br>14 November 2016                                                                                                                                                                                                                         | Examiner<br>Vida, Gyorgy                                                                        |
| 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 |                                                                                                                                                                                               | 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 |                                                                                                 |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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