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(54) METHOD FOR ASSEMBLING LED FILAMENT AND CIRCUIT BOARD AND LEAD FRAME THEREOF

(57) A method (10) for assembling an LED filament (23) and a circuit board (24), wherein an LED filament (23) and a lead frame (21) are provided firstly, the lead frame (21) comprising a first section (211), a second section (212) and a third section (213) each extending from opposite ends of the first section (211) at an angle (216, 217) with the first section (211), and a fourth section (214) extending from the third section (213) towards the second section (212) and forming a third angle (218), the fourth section (214) not being connected with the second section (212), the LED filament (23) being welded on a notch (215) defined by the second section (212) and the fourth section (214) afterwards, then the third section (213) being cut off so that the lead frame (21) forms two free ends (220, 221) being connected on a circuit board (24).

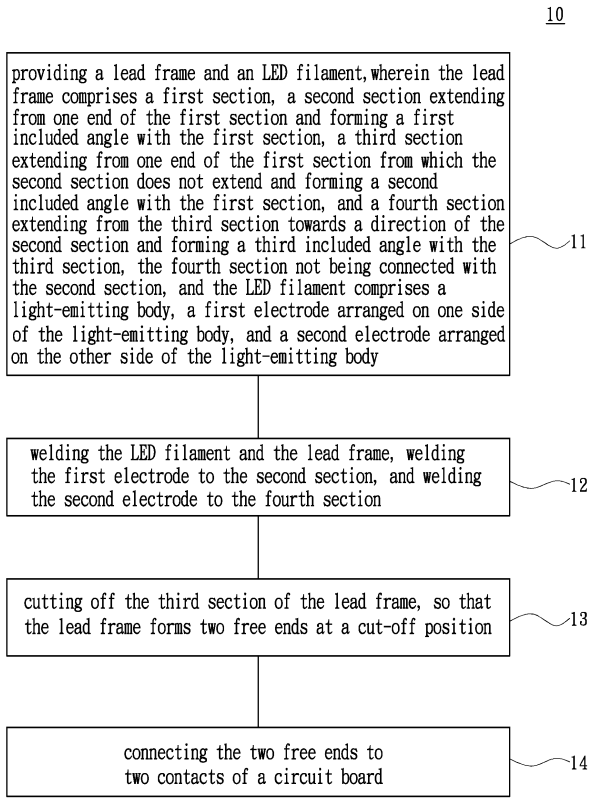

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a method for assembling an LED filament and a circuit board and a lead frame thereof, in particular to a method for enabling the LED filament to be welded without repeated positioning by using the lead frame and the lead frame structure thereof.

BACKGROUND OF THE INVENTION

[0002] The existing LED filament can be divided into an in-line LED filament and a surface mount type LED filament, and, compared with the in-line LED filament, the surface mount type LED filament has the advantages of larger luminous power, smaller volume and the like and is favored by the world.

[0003] Current patents TW M587244, US 10,274,141B, CN 107448790A, CN 108087734A and CN 209084724U etc. disclose the use of surface mount type LED filaments as lamp filaments. Only when the foresaid patents are used for assembling the LED filament and the circuit board, the implementation means of directly welding the LED filament and the guide wire is adopted. In particular, in the conventional welding process, the positive electrode pin and the negative electrode pin of the LED filament need to be aligned with the two guide wires respectively, that is, after the pin of one electrode of the LED filament is aligned with one guide wire thereof and welded, the pin of the other electrode of the LED filament needs to be aligned with the other guide wire and then welded, so that the LED filament and the guide wire can be assembled. However, it can be found that the conventional method causes the LED filament to be positioned multiple times during the welding process, so that the manufacturing process is complicated.

[0004] Further, patent EP 3306178B discloses a technique in which the surface mount type LED filament is welded to the guide wire only by the pin of only one electrode, the pin of the other electrode of the LED filament is directly welded to the circuit board. The pin of the electrode of the LED filament and the guide wire still adopt the conventional direct welding implementation, so that the pin of the LED filament still needs to be repeatedly positioned in the welding process, and the production steps are complicated. In addition, the length specification of the electrode pin of the current surface mount type LED filament is only 3 mm-10 mm. If a guide wire is not additionally used for welding, it is easy for the pin of the LED filament to be too short, and the electrode pin needs to be aligned and welded to the circuit board more accurately during welding so as to avoid the situation that the LED filament and the circuit board are not really assembled. Meanwhile, due to the fact that the pins of the surface mount type LED filament are too short, a contact position on the circuit board is limited.

[0005] In addition, patent TW 1613392 discloses that when patent TW 1613392 is implemented, the two guide wires are firstly fixed by using a fixing block, and then the two guide wires are welded with the LED filament, but this manner is not favorable for controlling an assembling position of the guide wires relative to the LED filament. For example, when a fixing position of the fixing block is too high, a length of an area where the guide wires can be assembled with the LED filament is insufficient, and the two guide wires cannot be matched with positions of the pins of the positive and negative electrodes of the LED filament for welding. If the length of the fixing block is adjusted to conform to the length of the LED filament, the manufacturing process is more complicated, and production is not facilitated.

SUMMARY OF THE INVENTION

[0006] The object of the invention is to solve the problem that a conventional LED filament needs to be aligned with a guide wire for multiple times in a welding stage.

[0007] In order to achieve the above object, the invention provides a method for assembling an LED filament and a circuit board including:

step one: providing a lead frame and an LED filament, wherein the lead frame comprises a first section, a second section extending from one end of the first section and forming a first included angle with the first section, a third section extending from one end of the first section from which the second section does not extend and forming a second included angle with the first section, and a fourth section extending from the third section towards a direction of the second section and forming a third included angle with the third section, the fourth section not being connected with the second section, and the LED filament comprises a light-emitting body, a first electrode arranged on one side of the light-emitting body, and a second electrode arranged on the other side of the light-emitting body;

step two: welding the LED filament and the lead frame, welding the first electrode to the second section, and welding the second electrode to the fourth section;

step three: cutting off the third section of the lead frame, so that the lead frame forms two free ends at a cut-off position; and

step four: connecting the two free ends to two contacts of a circuit board.

[0008] In one embodiment, the lead frame comprises a fifth section extending from the second section towards a direction of the fourth section and forming a fourth included angle with the second section, the fifth section not being connected with the fourth section, the first electrode being welded to the fifth section. Further, the fifth section is located on an extension line of the fourth section.

[0009] In one embodiment, portions of the first section and the fourth section adjacent to the third section, respectively, are simultaneously cut off during cutting off the third section in step three.

[0010] In one embodiment, a portion of the first section adjacent to the third section and a portion of the fourth section adjacent to the third section form a bending respectively, and the lead frame is cut to form two hook welding parts arranged at a bending position of the first section and a bending position of the fourth section.

[0011] In addition to the foregoing, the present invention also provides a lead frame for assembling an LED filament and a circuit board, comprising: a first section; a second section extending from one end of the first section and forming a first included angle with the first section; a third section extending from one end of the first section from which the second section does not extend and forming a second included angle with the first section; and a fourth section extending from the third section towards a direction of the second section and forming a third included angle with the third section, the fourth section not being connected with the second section; the lead frame defining a notch provided with the LED filament between the second section and the fourth section, and the lead frame defining a segment which is cut off after the LED filament and the lead frame are completely welded on the basis of the third section.

[0012] In one embodiment, the lead frame comprises a fifth section extending from the second section towards a direction of the fourth section and forming a fourth included angle with the second section, and the notch is defined by the fifth section and the fourth section together. Further, the fifth section is located on an extension line of the fourth section.

[0013] As disclosed in the foregoing summary, compared with the conventional art, the present invention has the following characteristics: in the present invention, by using the lead frame, the LED filament can be rapidly welded without repeatedly aligning. Meanwhile, the lead frame of the present invention can be directly provided with the first electrode and the second electrode of the LED filament, so that the welding position of the lead frame does not need to be adjusted again in the welding process of the present invention, and the process steps are reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a schematic flow diagram of the steps of an embodiment of the present invention.

Fig. 2 is a schematic diagram of a lead frame structure of a first embodiment of the present invention.

Fig. 3 is a schematic assembly diagram of step two of a first embodiment of the present invention.

Fig. 4 is a schematic assembly diagram of step three of a first embodiment of the present invention.

Fig. 5 is a schematic assembly diagram of step three of a second embodiment of the present invention.

Fig. 6 is a schematic assembly diagram of step four of a first embodiment of the present invention.

Fig. 7 is a schematic implementation diagram of the structure of a first embodiment of the present invention matched with a bulb outer cover and a lamp holder.

Fig. 8 is a schematic implementation diagram of the structure of a second embodiment of the present invention matched with a bulb outer cover and a lamp holder.

Fig. 9 is a schematic diagram of a lead frame structure of a third embodiment of the present invention.

Fig. 10 is a schematic assembly diagram of step two of a third embodiment of the present invention.

Fig. 11 is a schematic assembly diagram of step three of a third embodiment of the present invention.

Fig. 12 is a schematic assembly diagram of step three of a forth embodiment of the present invention.

Fig. 13 is a schematic assembly diagram of step four of a forth embodiment of the present invention.

Fig. 14 is a schematic diagram of a lead frame structure of a fifth embodiment of the present invention.

Fig. 15 is a schematic assembly diagram of step two of a fifth embodiment of the present invention.

Fig. 16 is a schematic assembly diagram of step three of a fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The detailed description and technical contents of the present invention will be described with reference to the drawings as follows:

With reference to Figs. 1, 2, 3, 4 and 5, the present invention provides a method 10 for assembling an LED filament and a circuit board. Initially in the implementation of method 10, step one 11 for performing a material preparation is first proceeded, providing a lead frame 21 and an LED filament 23. Specifically, the lead frame 21 comprises electrically conductive characteristics, and the lead frame 21 comprises a first section 211, a second section 212 extending from the first section 211, a third section 213 extending from one end of the first section 211 where the second section 212 is not provided, and a fourth section 214 extending from the third section 213 towards a direction of the second section 212, wherein the second section 212 is not connected with the fourth section 214. The second section 212 and the fourth section 214 together define a notch 215. Further, the lead frame 21 is integrally formed and is able to be bent to form the first section 211, the second section 212, the third section 213 and the fourth section 214 . Meanwhile, a first included angle 216 is sandwiched between the second section 212 and the first section 211. A second included angle 217 exists between the third section 213 and the first section 211. The fourth section 214 forms a

third included angle 218 with the third section 213.

[0016] On the other hand, the LED filament 23 comprises a light-emitting body 231, a first electrode 232 arranged on one side of the light-emitting body 231, and a second electrode 233 arranged on the other side of the light-emitting body 231, wherein the light-emitting body 231, the first electrode 232 and the second electrode 233 are arranged in a linear manner so that the LED filament 23 is strip-shaped. The light-emitting body 231 is provided with a plurality of grains (not shown in the drawings). The plurality of grains are driven to generate a light source and enable the light-emitting body 231 to have a 360-degree light-emitting characteristic. In addition, the first electrode 232 and the second electrode 233 are used for receiving electricity and driving the light-emitting body 231 to emit light. The first electrode 232 and the second electrode 233 are respectively a positive electrode and a negative electrode, and it is noteworthy that the invention does not limit the first electrode 232 to be the positive electrode or the negative electrode, necessarily, and the polarity of the first electrode 232 can be designed according to implementation requirements. Similarly, the second electrode 233 is not constrained in polarity either, and the polarity of the second electrode 233 depends on the first electrode 232.

[0017] Accordingly, referring to Fig. 1, 2, 3, 4, 5, 6 and. 7, step two 12 is entered, and the LED filament 23 and the lead frame 21 are welded. Specifically, the LED filament 23 is disposed on the notch 215 of the lead frame 21. The first electrode 232 of the LED filament 23 is welded to the second section 212, and the second electrode 233 is welded to the fourth section 214. When the welding operation is proceeded in step two 12, the LED filament 23 and the lead frame 21 is assembled through electric welding such as spot welding in the present invention. Step three 13 is entered, a segment 219 defined on the basis of the third section 213 where is cut off. For example, the third section 213 may be cut off at step three 13 only, as depicted in Fig. 4. Alternatively, in the process of cutting off the third section 213, portions of the first section 211 and the fourth section 214 are respectively adjacent to the third section 213, to be cut off simultaneously, as depicted in Fig. 5. After the segment 219 is cut off from the lead frame 21 in step three 13, a length of the first section 211 and a length of the fourth section 214 meet subsequent operation requirements. For example, a length to be cut off from the first section 211 and the fourth section 214 can be determined according to an inner height of a bulb outer cover 25 to be matched up in subsequent implementation. After the segment 219 is cut off from the lead frame 21, the lead frame 21 forms two guide wires respectively and independently connected with the LED filament 23, and the lead frame 21 forms two free ends 220, 221 at a cut-out position. Then, step four 14 is entered, connecting the two free ends 220, 221 on two contacts 241, 242 of a circuit board 24. After the two free ends 220, 221 are assembled with the circuit board 24, an electrode polarity of the LED filament 23 corresponding to each free end 220 (221) conforms to a polarity of the contact 241 (242), which allows the circuit board 24 to drive the LED filament 23 via the two free ends 220,221.

[0018] Accordingly, the LED filament 23 of the present invention can be rapidly welded without repeatedly aligning by using the lead frame 21,. Meanwhile, the lead frame 21 forms the notch 215 which is capable of directly providing for disposal of the first electrode 232 and the second electrode 233 of the LED filament 23, so that the welding position of the lead frame 21 does not need to be adjusted again during the welding process in the present invention, and the process steps are able to be reduced. In addition, according to step three 13 of the present invention, after the third section 213 of the lead frame 21 is cut off, the lead frame 21 can be directly formed into two independent guide wires for transmitting power to the LED filament 23. Compared with the prior art, the present invention allows the lead frame 21 to provides a positioning function of the LED filament 23 and a function of transmitting power simultaneously, and no additional structure or process steps are needed, so that the LED filament 23 and the circuit board 24 can be assembled conveniently.

[0019] Further, with reference to Figs. 6 and 8, after the present invention finished the fabrication of the LED filament 23 and the circuit board 24, the LED filament 23, the lead frame 21 and the circuit board 24 form a separate assembly 201 to be used in combination with an external component. For example, the separate assembly 201 can be matched with the external component to form an LED bulb 20. The LED bulb 20 includes the bulb outer cover 25 and a lamp holder 26 assembled with the bulb outer cover 25, the bulb outer cover 25 comprising an open end 251 which is providing the LED filament 23, the lead frame 21 and the circuit board 24 for penetration therein, the lamp holder 26 is welded to two power lines 243 of the circuit board 24, and the lamp holder 26 is assembled with the open end 251 at the same time, thereby closing the bulb outer cover 25 to limit assembling positions of the LED filament 23, the lead frame 21 and the circuit board 24. Accordingly, in one embodiment, the second included angle 217 and the third included angle 218 of the present invention may be designed to be 90 degrees, and the first included angle 216 may be designed according to an inner space of the bulb outer cover 25 to be matched up for use. For example, when the inner space of the bulb outer cover 25 is an elongated shape, the first included angle 216 may be set to be an acute angle or an obtuse angle, as depicted in Fig. 8. When the inner space of the bulb outer cover 25 is designed to be an inflated pattern, the first included angle 216 may be set at a right angle, as shown in Fig. 7. Notably, it is not intended to limit the first included angle 16 herein, the angle degree of the first included angle 216 can be adjusted according to practical requirements, i.e., the first included angle 216 can be greater than 0 degree and less than 180 degrees.

[0020] Thus, with reference to Figs. 9, 10 and 11, it can be seen from the foregoing that the main function of the lead frame 21 is to provide rapid positioning of the LED filament 23. On the basis of the same technical conception, implementation embodiments of the lead frame 21 of the present invention are not limited as described above. In another embodiment, the first section 211 and the fourth section 214 of the lead frame 21 may be bent in the same direction respectively, as depicted in Fig. 9. With reference to Figs. 1, 11, 12 and 13, in the present embodiment, a bending position of the first section 211 and a bending position of the fourth section 214 are both located on the extension line 226. The method 10 of the present invention in step three 13, a portion of the first section 211 adjacent to the third section 213 and a portion of the fourth section 214 adjacent to the third section 213 can be further cut off, so as to allow the lead frame 21 forming the two guide wires, and the lead frame 21 respectively form a hook welding part 224 (225) at the bending position of the first section 211 and the bending position of the fourth section 214 of the lead frame 21. The two hook welding parts 224 and 225 are bent in the same direction of the lead frame 21, each hook welding part 224 (225) is hooked on one contact 241 (242) of the circuit board 24 and then welded on the contact 241 (242).

[0021] As previously described, in another embodiment, with reference to Figs. 14, 15 and 16, the lead frame 21 may also include a fifth section 222 extending from the second section 212. As indicated in the preceding paragraph, the fifth section 222 is also integrally formed on the lead frame 21, the fifth section 222 extending from the second section 212 towards a direction of the fourth section 214 without being connected with the fourth section 214. In this embodiment, the fifth section 222 and the fourth section 214 together define the notch 215, allowing the fifth section 222 to be welded with the first electrode 232 of the LED filament 23. Further, the fifth section 222 is located on an extension line of the fourth section 214. Further, the fifth section 222 forms a fourth included angle 223 with the second section 212. In one embodiment, the fourth included angle 223 is also designed to be 90 degrees.

Claims

1. A method (10) for assembling an LED filament and a circuit board including:

step one (11): providing a lead frame (21) and an LED filament (23), wherein the lead frame (21) comprises a first section (211), a second section (212) extending from one end of the first section (211) and forming a first included angle (216) with the first section (211), a third section (213) extending from one end of the first section (211) from which the second section (212) does not extend and forming a second included angle (217) with the first section (211), and a fourth section (214) extending from the third section (213) towards a direction of the second section (212) and forming a third included angle (218) with the third section (213), the fourth section (214) not being connected with the second section (212), and the LED filament (23) comprises a light-emitting body (231), a first electrode (232) arranged on one side of the light-emitting body (231), and a second electrode (233) arranged on the other side of the light-emitting body (231);

step two (12): welding the LED filament (23) and the lead frame (21), welding the first electrode (232) to the second section (212), and welding the second electrode (233) to the fourth section (214);

step three (13): cutting off the third section (213) of the lead frame (21), so that the lead frame (21) forms two free ends (220, 221) at a cut-off position; and

step four (14): connecting the two free ends (220, 221) to two contacts (241, 242) of a circuit board (24).

2. The method (10) for assembling an LED filament and a circuit board of claim 1, wherein the lead frame (21) comprises a fifth section (222) extending from the second section (212) towards a direction of the fourth section (214) and forming a fourth included angle (223) with the second section (212), the fifth section (222) not being connected with the fourth section (214), the first electrode (232) being welded to the fifth section (222).

3. The method (10) for assembling an LED filament and a circuit board of claim 2, wherein the fifth section (222) is located on an extension line of the fourth section (214).

4. The method (10) for assembling an LED filament and a circuit board of claim 1 or 2 or 3, wherein portions of the first section (211) and the fourth section (214) adjacent to the third section (213), respectively, are simultaneously cut off during cutting off the third section (213) in step three (13).

5. The method (10) for assembling an LED filament and a circuit board of claim 4, wherein a portion of the first section (211) adjacent to the third section (213) and a portion of the fourth section (214) adjacent to the third section (213) form a bending respectively, and the lead frame (21) is cut to form two hook welding parts (224, 225) arranged at a bending position of the first section (211) and a bending position of the fourth section (214).

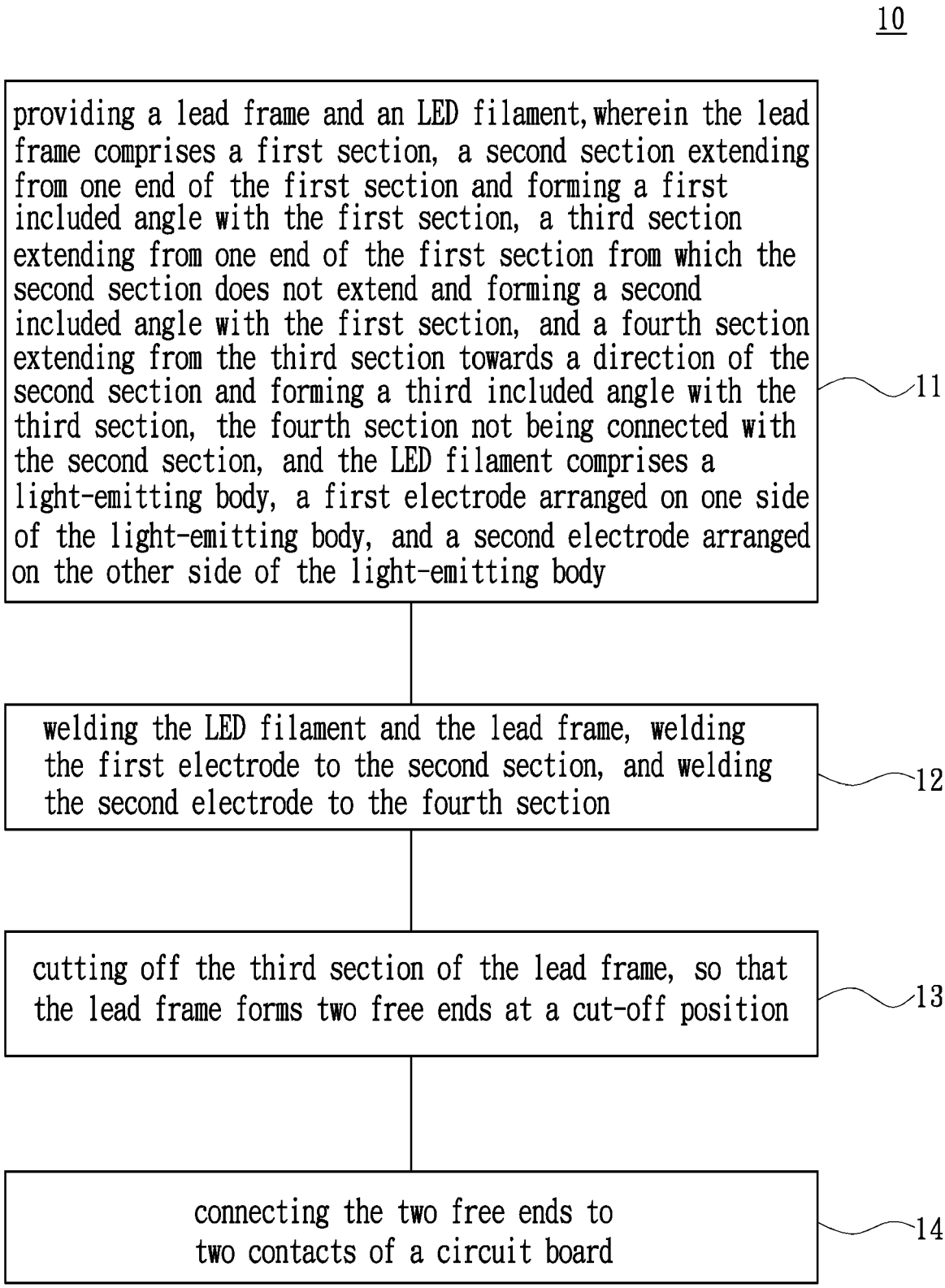
6. A lead frame (21) for assembling an LED filament and a circuit board, comprising:

a first section (211);
a second section (212), extending from one end of the first section (211) and forming a first included angle (216) with the first section (211);
a third section (213), extending from one end of the first section (211) from which the second section (212) does not extend, the third section (213) forming a second included angle (217) with the first section (211); and
a fourth section (214), extending from the third section (213) towards a direction of the second section (212) and forming a third included angle (218) with the third section (213), the fourth section (214) not being connected with the second section (212);
wherein the lead frame (21) defines a notch (215) provided with the LED filament (23) between the second section (212) and the fourth section (214), and the lead frame (21) defines a segment (219) which is cut off after the LED filament (23) and the lead frame (21) are completely welded on the basis of the third section (213).

7. The lead frame (21) for assembling an LED filament and a circuit board of claim 6, wherein the lead frame (21) comprises a fifth section (222) extending from the second section (212) towards a direction of the fourth section (214) and forming a fourth included angle (223) with the second section (212), and the notch (215) is defined by the fifth section (222) and the fourth section (214) together.

8. The lead frame (21) for assembling an LED filament and a circuit board of claim 7, wherein the fifth section (222) is located on an extension line of the fourth section (214).

9. The lead frame (21) for assembling an LED filament and a circuit board of claim 6 or 7 or 8, wherein a portion of the first section (211) adjacent to the third section (213) and a portion of the fourth section (214) adjacent to the third section (213) form a bending respectively, and the lead frame (21) is cut to form two hook welding parts (224, 225) arranged at a bending position of the first section (211) and a bending position of the fourth section (214).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providing a lead frame and an LED filament, wherein the lead frame comprises a first section, a second section extending from one end of the first section and forming a first included angle with the first section, a third section extending from one end of the first section from which the second section does not extend and forming a second included angle with the first section, and a fourth section extending from the third section towards a direction of the second section and forming a third included angle with the third section, the fourth section not being connected with the second section, and the LED filament comprises a light-emitting body, a first electrode arranged on one side of the light-emitting body, and a second electrode arranged on the other side of the light-emitting body
11
welding the LED filament and the lead frame, welding the first electrode to the second section, and welding the second electrode to the fourth section
12
cutting off the third section of the lead frame, so that the lead frame forms two free ends at a cut-off position
13
connecting the two free ends to two contacts of a circuit board
14

Fig. 1

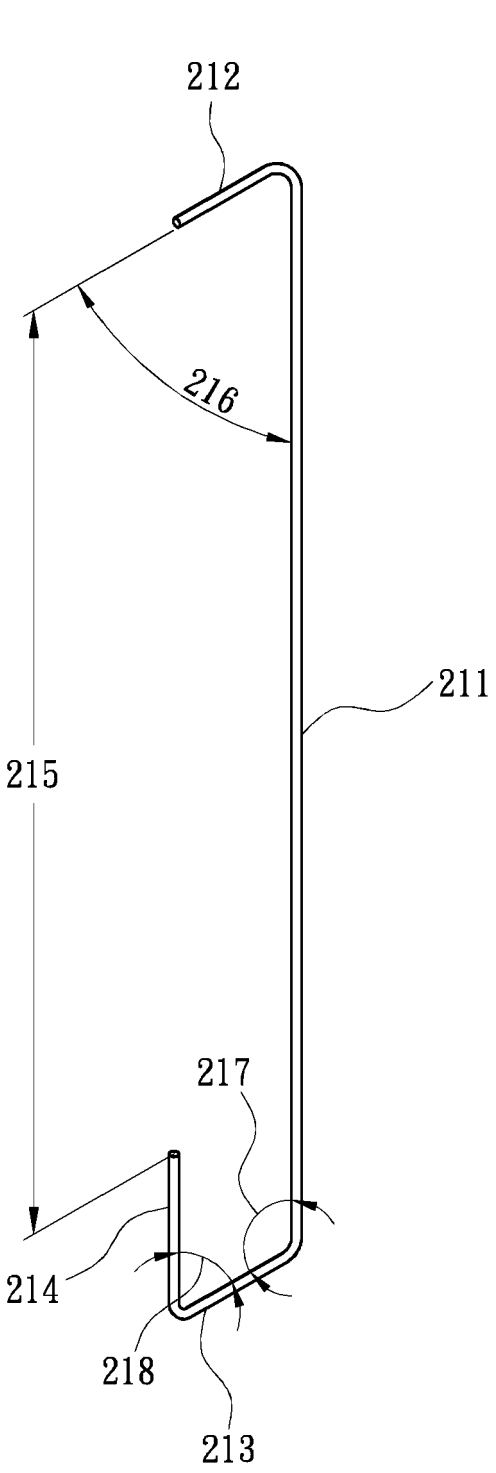

Fig. 2

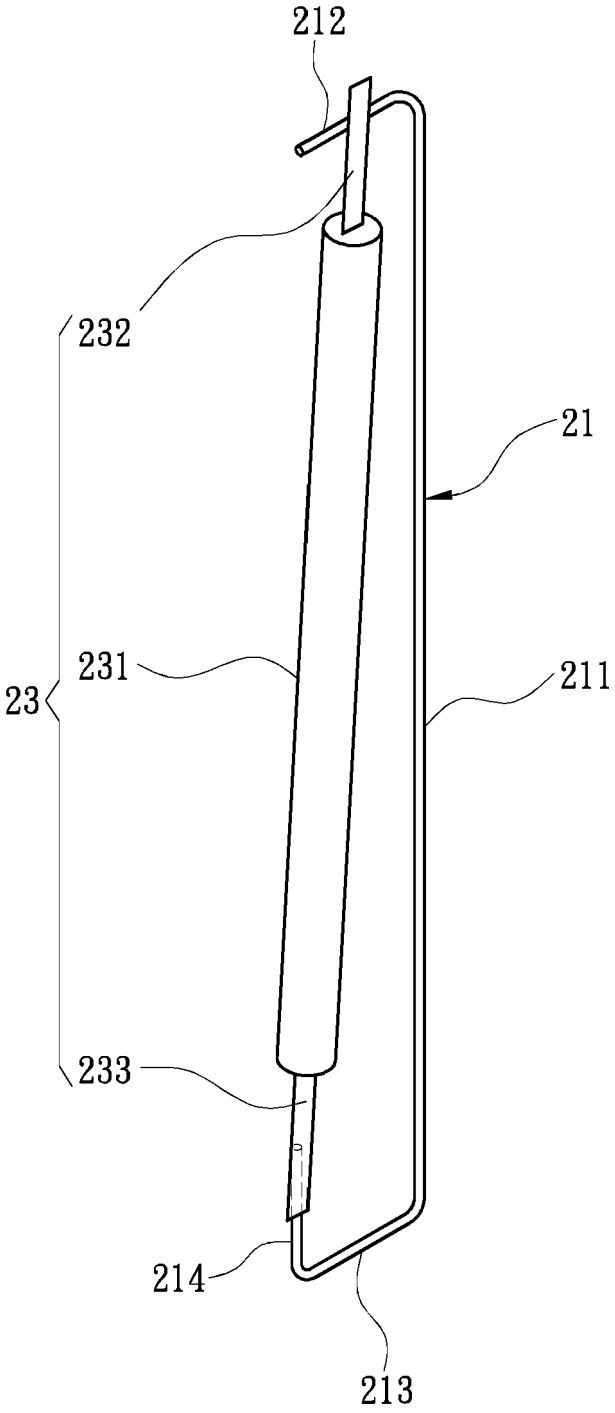

Fig. 3

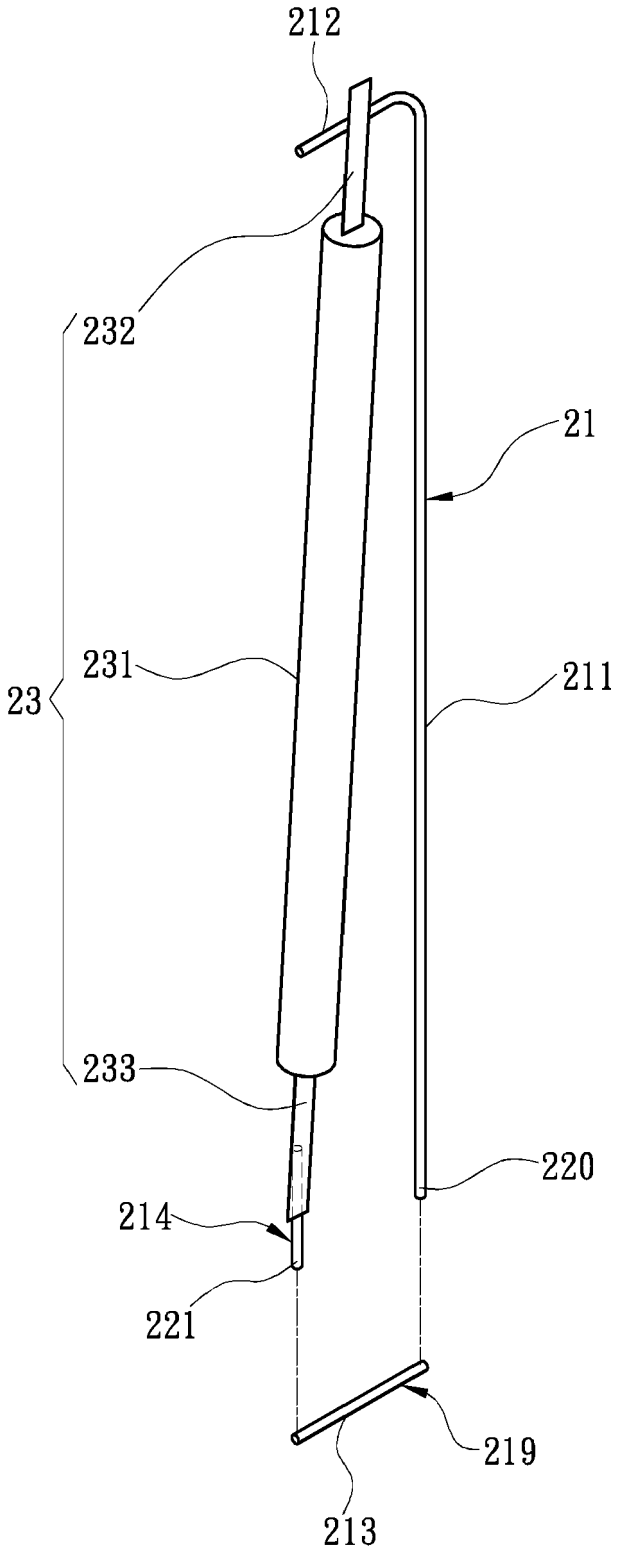

Fig. 4

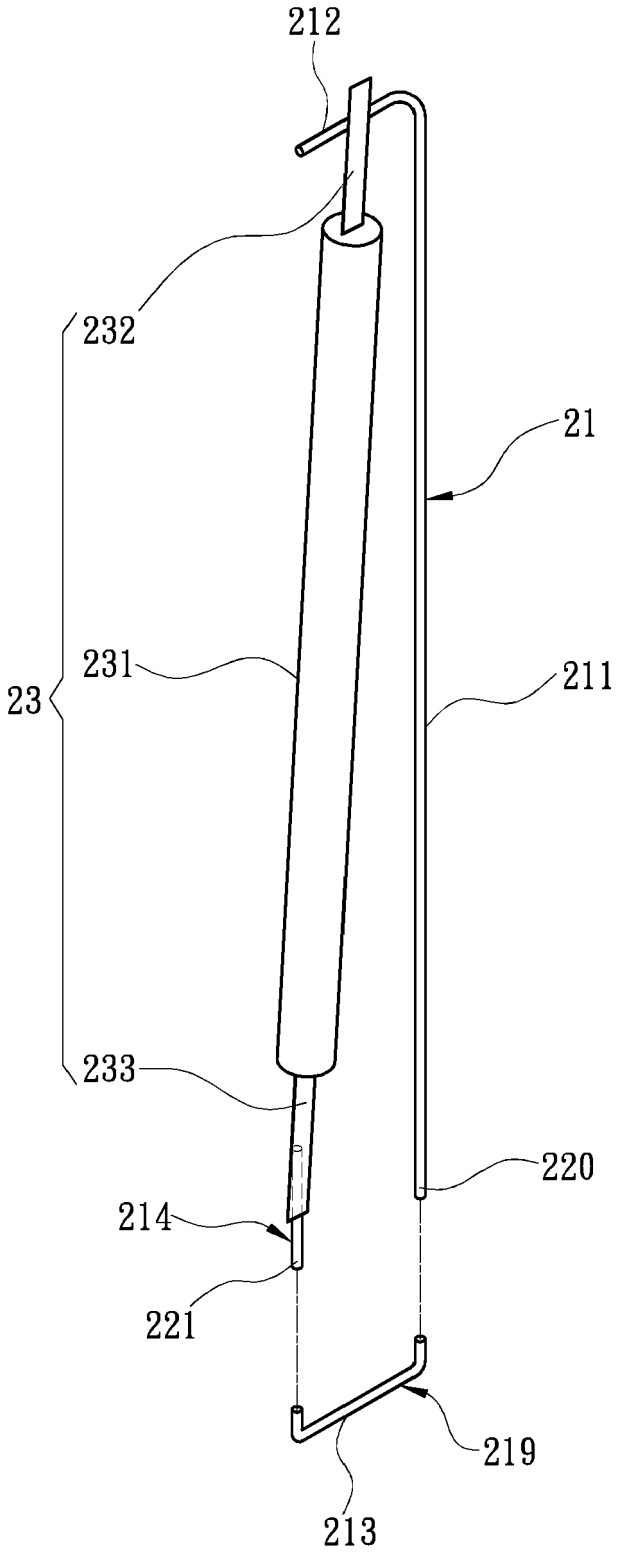

Fig. 5

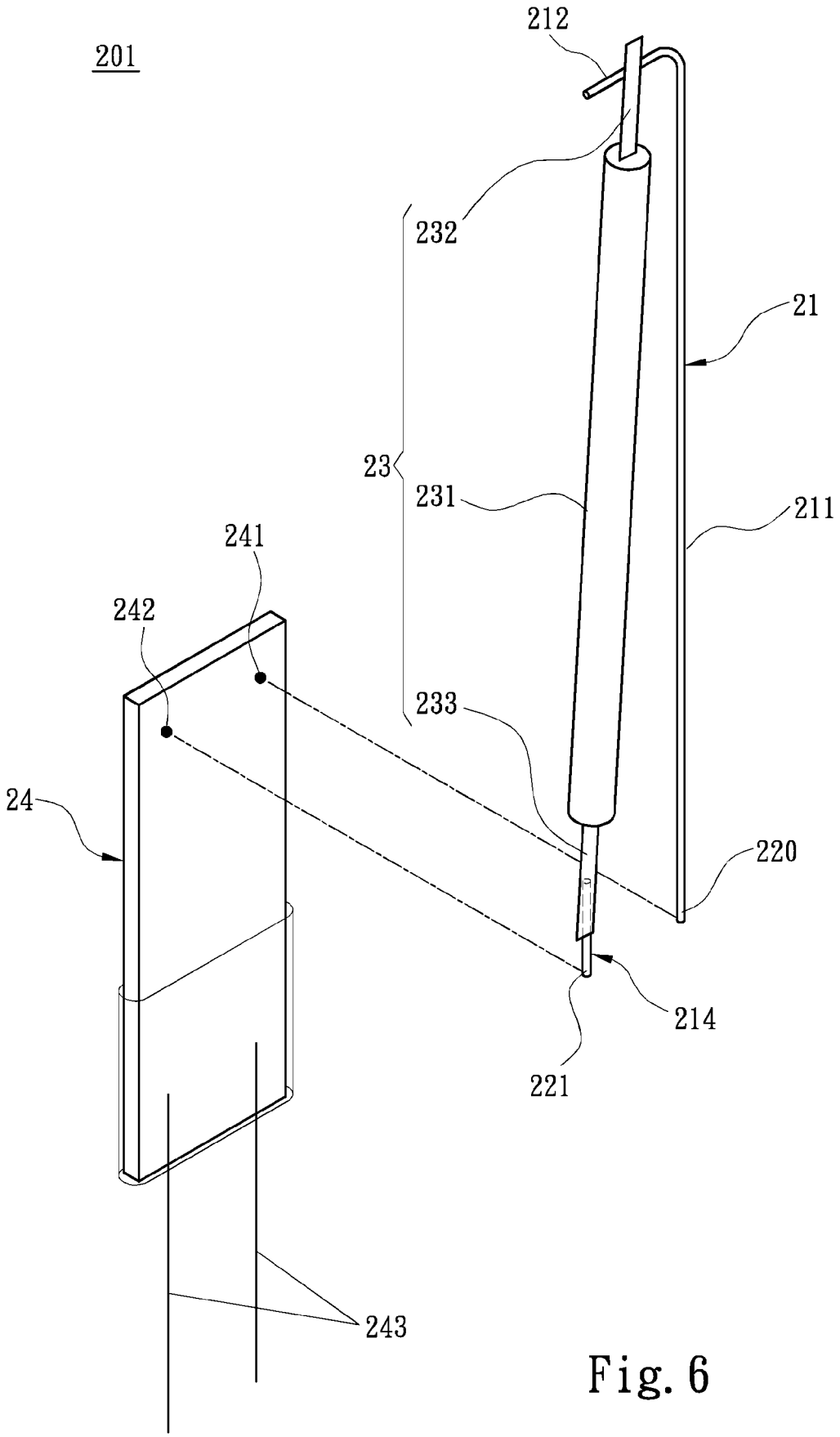

Fig. 6

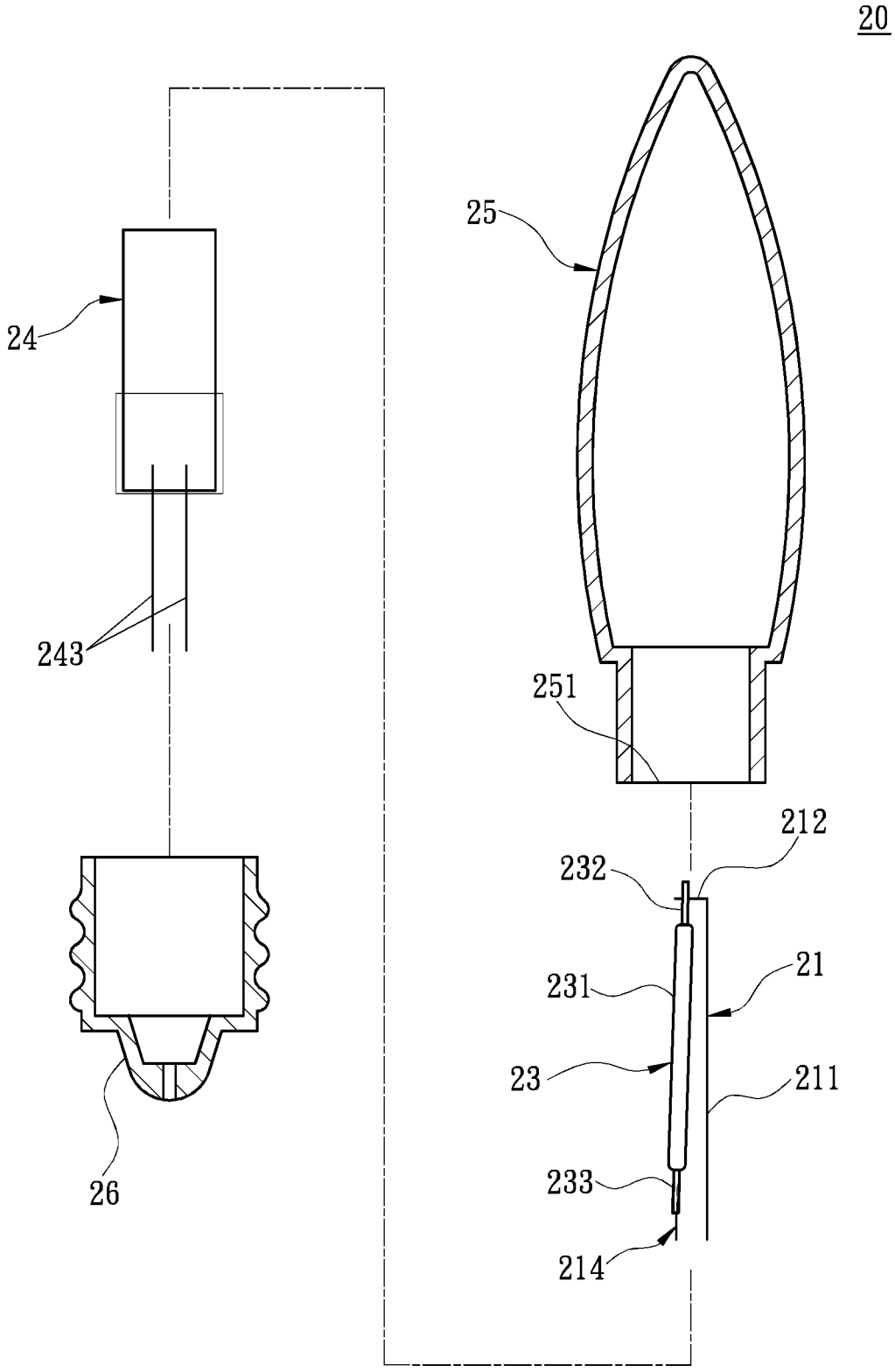

Fig. 7

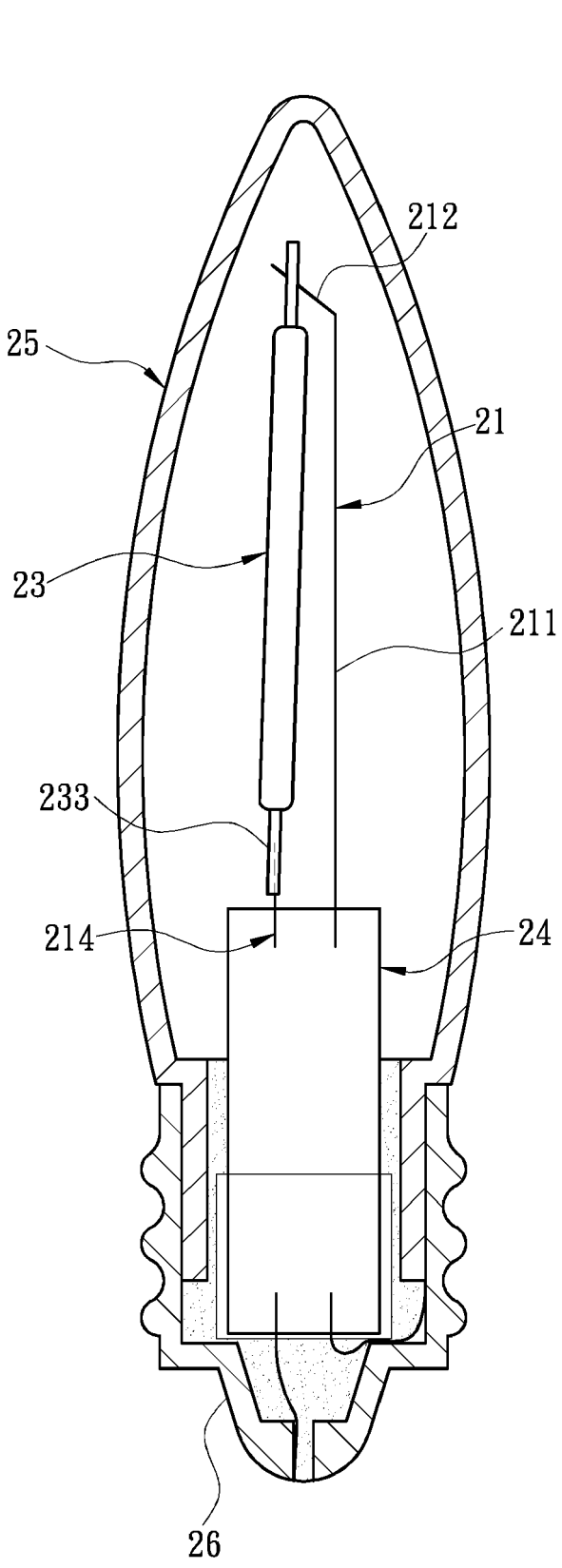

Fig. 8

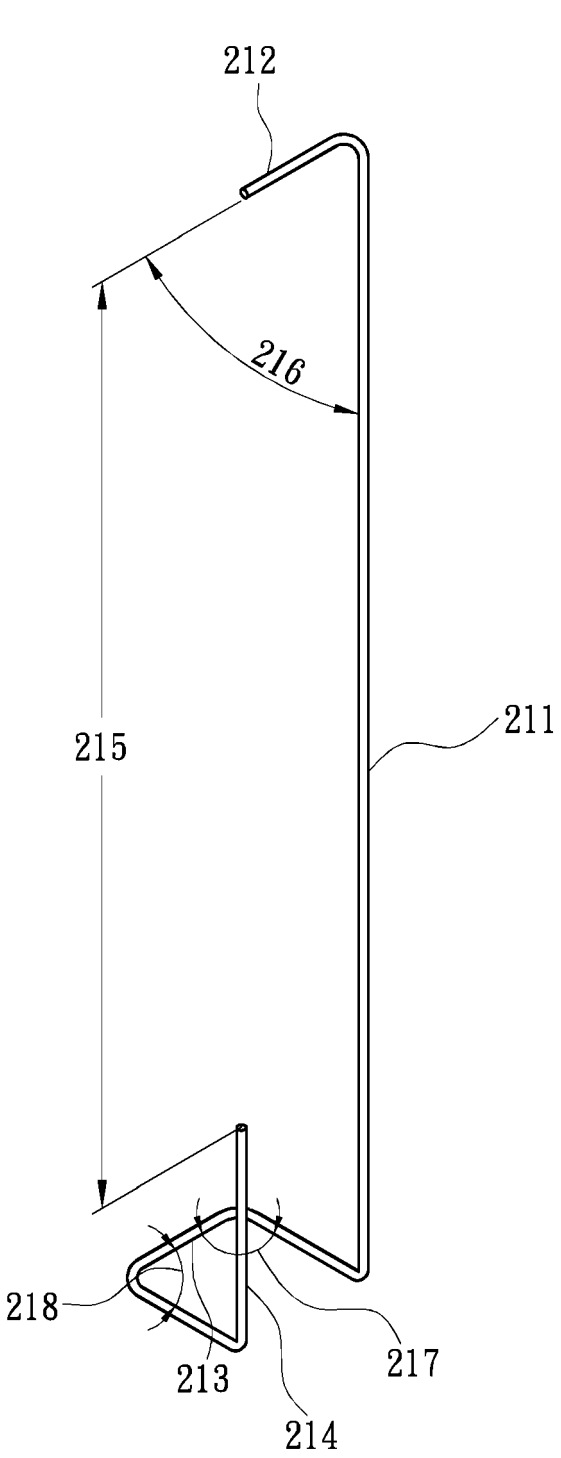

Fig. 9

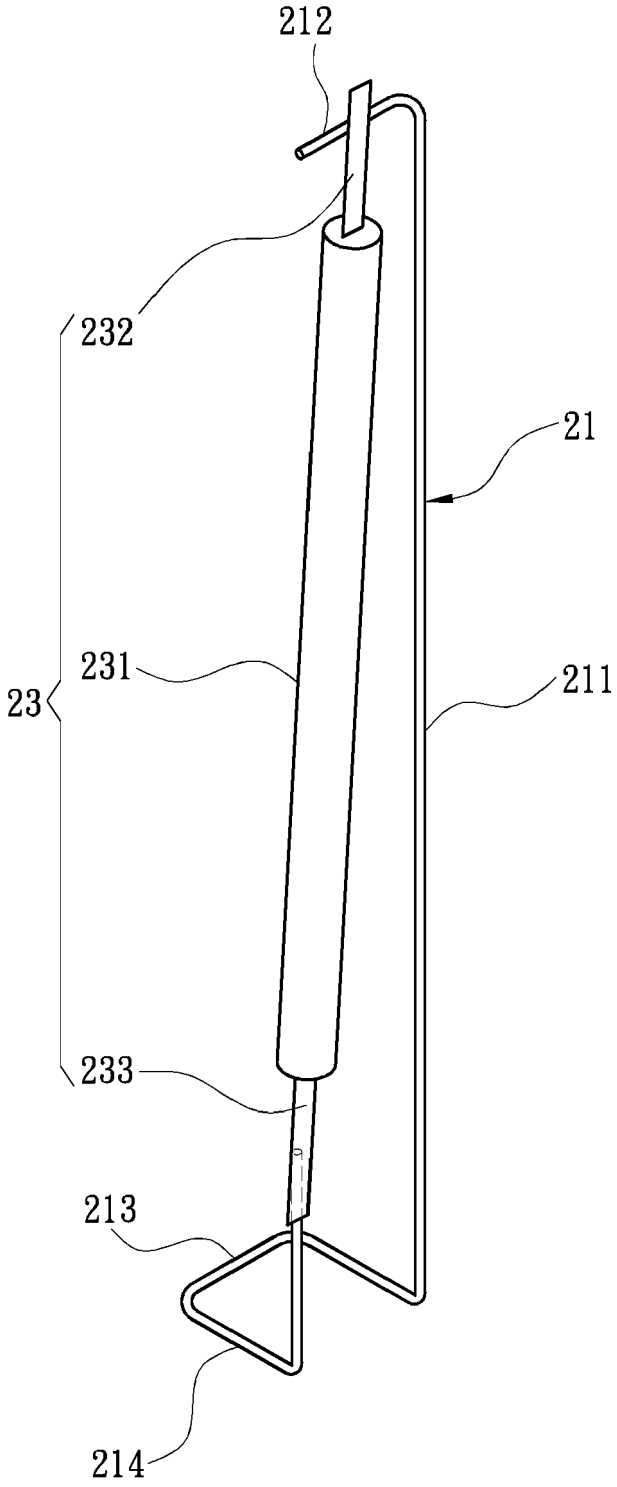

Fig. 10

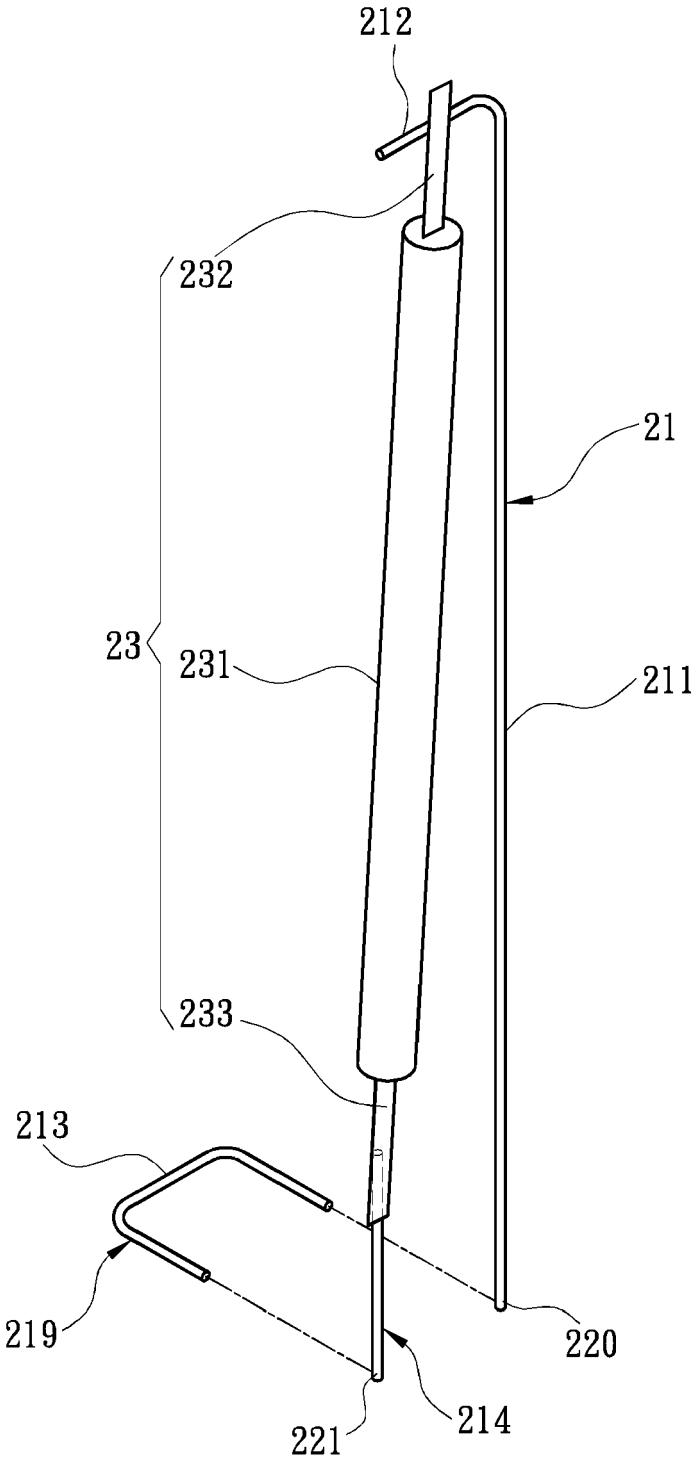

Fig. 11

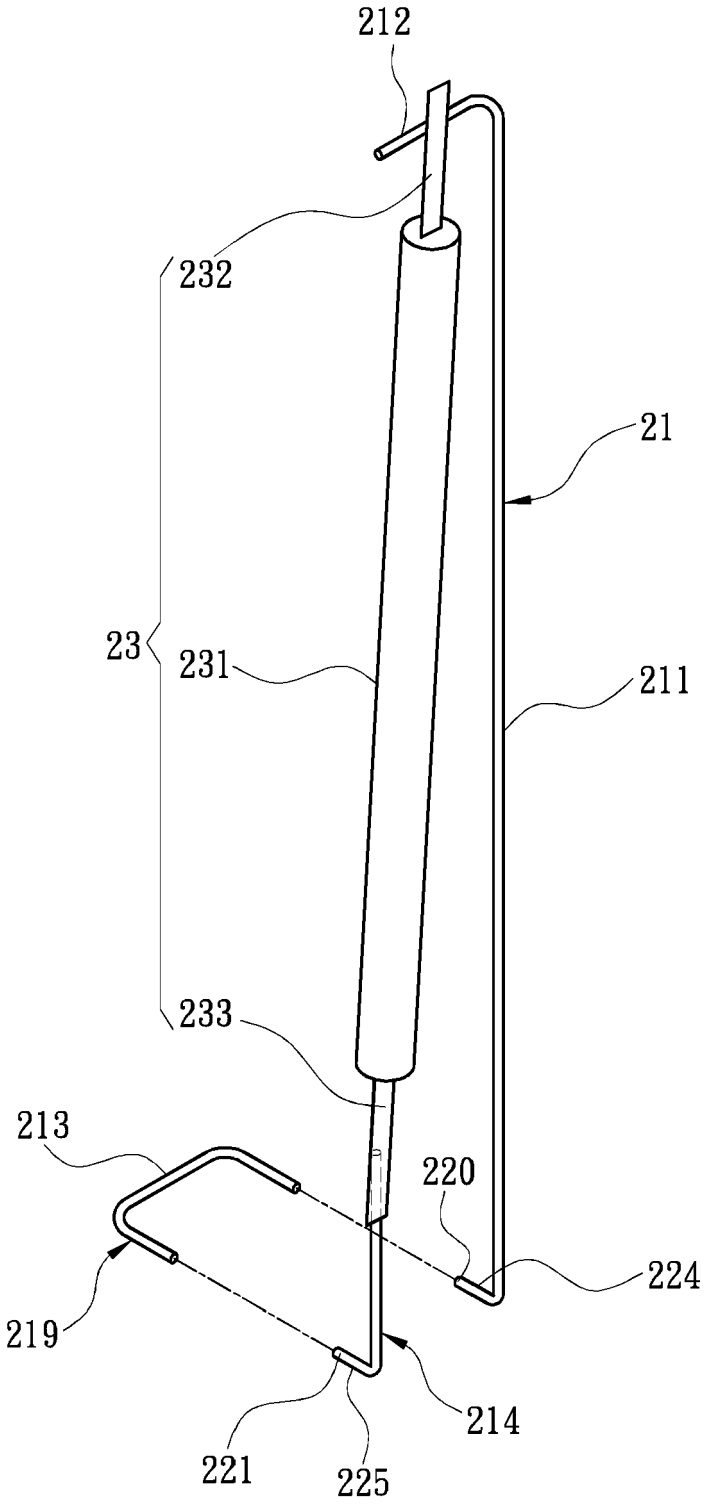

Fig. 12

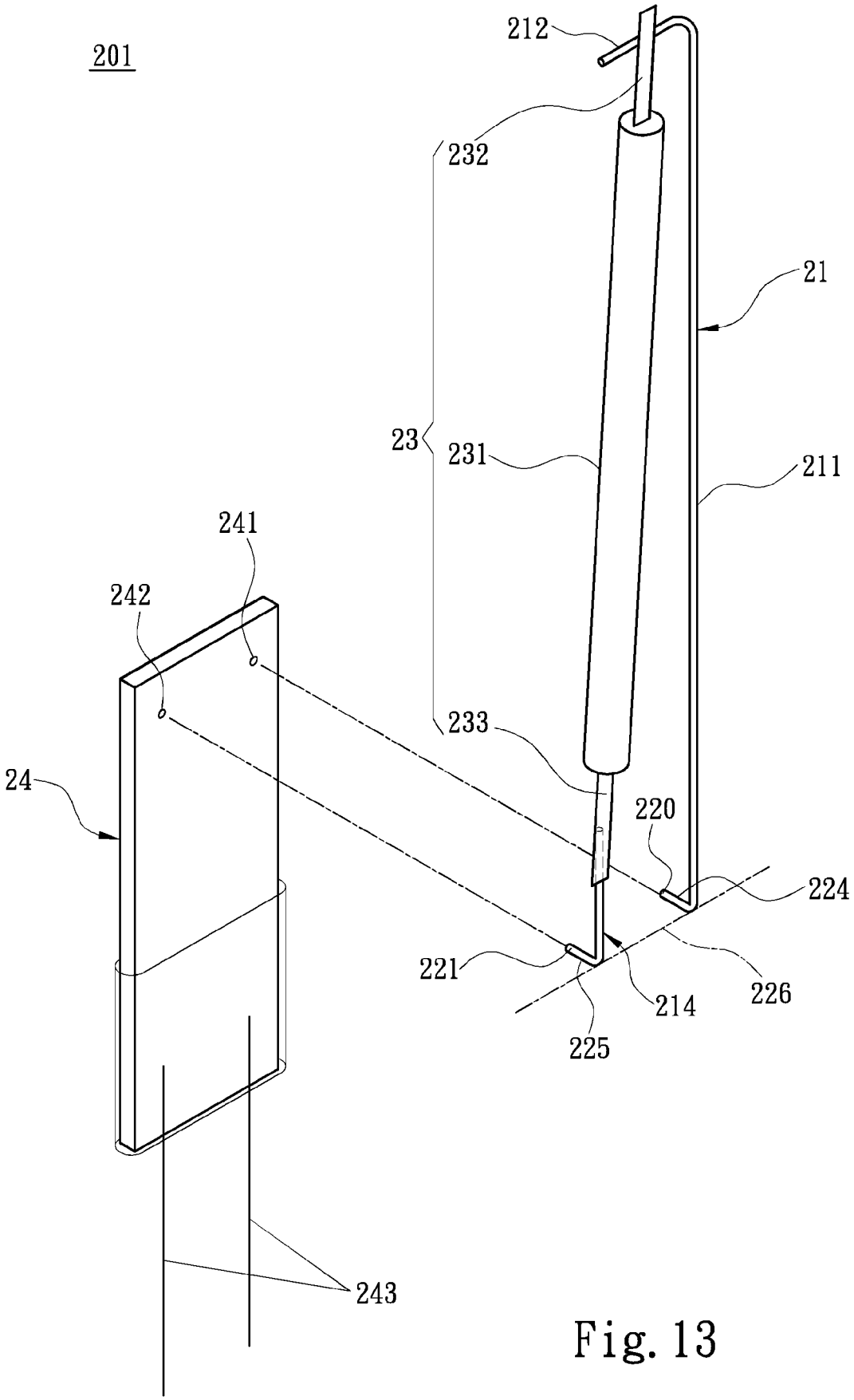
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Fig. 13

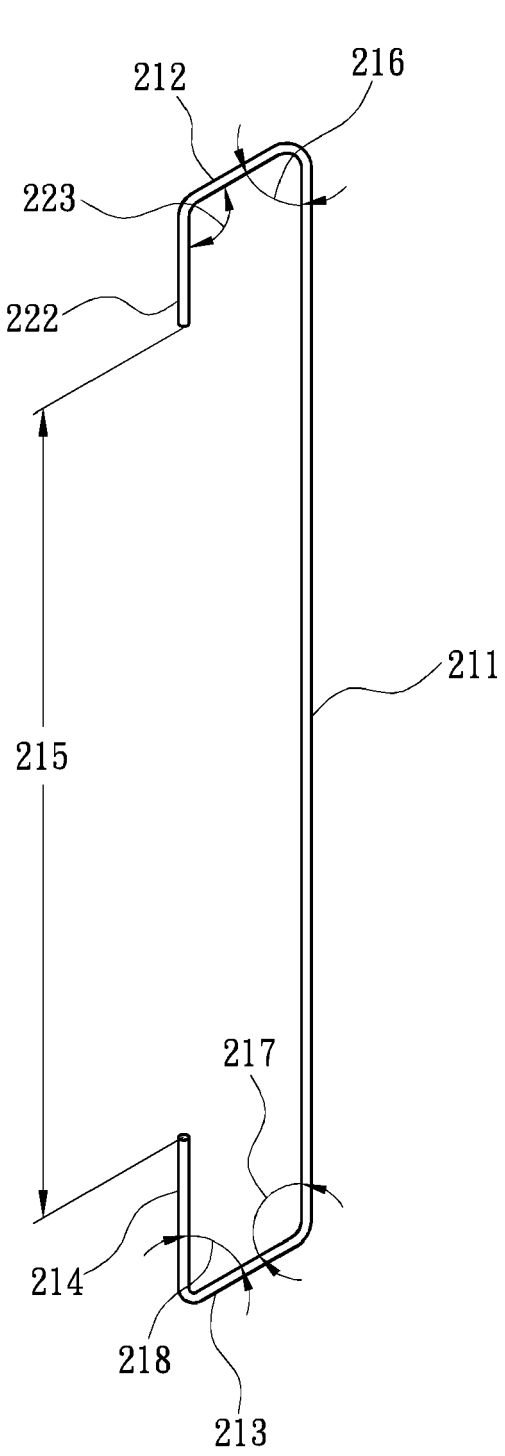

Fig. 14

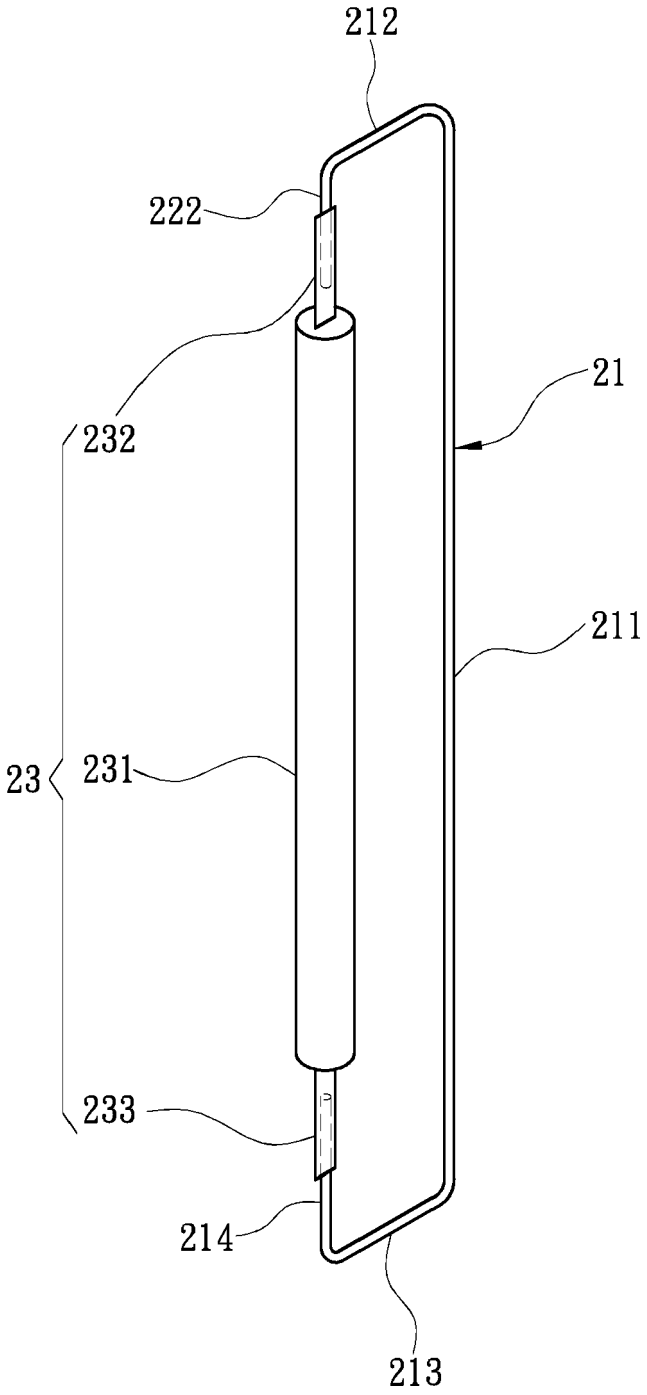

Fig. 15

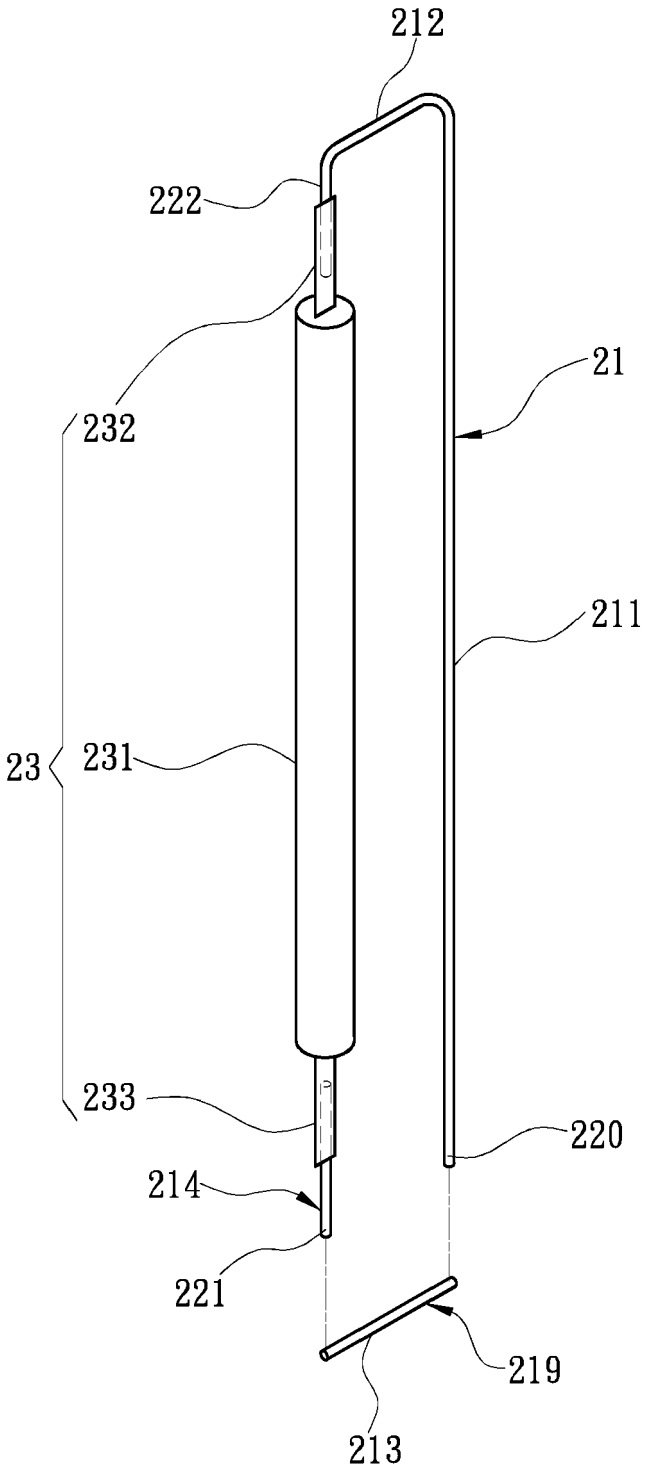

Fig. 16

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 9059

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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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F21K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 October 2020	Menn, Patrick

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