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(54) Light emitting device

(57) A light emitting device (100) comprising a base (110), a driver (130), a heat sink (140), a flexible substrate (150) and a light source (120) is provided. The driver (130) is disposed on the base (110). The heat sink (140) is disposed on the base (110) and has a lateral surface surrounding the driver (130). The flexible substrate (150) surrounds the lateral surface of the heat sink (140) and is disposed thereon. The light source (120) is disposed on the flexible substrate (150) for emitting a light in multi-directions.

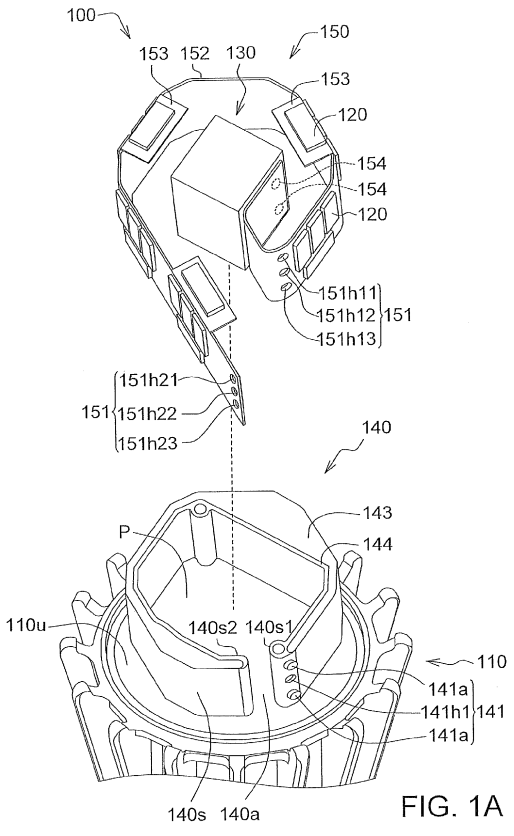

FIG. 1A

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates in general to a light emitting device, and more particularly to a side-view light emitting device.

Description of the Related Art

[0002] Conventional light emitting diode (LED) lamp comprises a base, a printed circuit board (PCB) and an LED, wherein the PCB is horizontally placed on the base, and the LED is disposed on the circuit board so that the LED emits a light upwardly.

[0003] However, since the PCB can only be horizontally placed on the base, the direction and the visual angle of the light emitted by the LED are thus restricted.

SUMMARY OF THE INVENTION

[0004] The invention is directed to a light emitting device, in which the flexible substrate has flexibility, so that the direction of a light emitted by the light source disposed on the flexible substrate can be more flexible.

[0005] According to an embodiment of the present invention, a light emitting device comprising a base, a driver, a heat sink, a flexible substrate and a light source is provided. The driver is disposed on the base. The heat sink is disposed on the base and has a lateral surface surrounding the driver. The flexible substrate surrounds the lateral surface of the heat sink and is disposed thereon. The light source is disposed on the flexible substrate for emitting a light in multi-directions.

[0006] The above and other aspects of the invention 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

[0007] FIG. 1A shows a decomposition diagram of a light emitting device according to an embodiment of the invention;

[0008] FIG. 1B shows an assembly diagram of the light emitting device of FIG. 1A;

[0009] FIG. 2 shows an external appearance of the light emitting device of FIG. 1A with a reflective sheet;

[0010] FIG. 3A shows a decomposition diagram of a light emitting device according to another embodiment of the invention;

[0011] FIG. 3B shows an assembly diagram of the light emitting device of FIG. 3A;

[0012] FIG. 4A shows a decomposition diagram of a light emitting device according to another embodiment of the invention;

[0013] FIG. 4B shows an assembly diagram of the light emitting device of FIG. 4A.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Referring to both FIG. 1A and FIG. 1B, a decomposition diagram and an assembly diagram of a light emitting device according to an embodiment of the invention are respectively shown. The light emitting device 100 comprises a base 110, a light source 120, a driver 130, a heat sink 140 and a flexible substrate 150.

[0015] The base 110 may be formed by metal for dissipating the heat generated by the light source 120. Alternatively, the base 110 may also be formed by a ceramic material.

[0016] The light source 120 comprises a plurality of light emitting units disposed on the flexible substrate 150. The light source 120, such as an LED, refers to any active or passive elements capable of emitting electromagnetic radiation.

[0017] The driver 130 is disposed on an upper surface 110u of the base 110 and is electrically connected to the flexible substrate 150 for driving the light source 120 disposed on the flexible substrate 150 to or not to emit a light.

[0018] The heat sink 140 is disposed on the base 110 and surrounds the driver 130. In an embodiment, the heat sink 140 has a lateral surface 140s having a first terminal portion 140s1 and a second terminal portion 140s2 opposite to each other. The lateral surface 140s surrounds the driver 130, and an opening 140a is formed between the first terminal portion 140s1 and the second terminal portion 140s2.

[0019] In an embodiment, as indicated in FIG. 1A, the heat sink 140 comprises a heat conducting member 143 and an insulator 144, wherein the insulator 144 encompasses an inner lateral surface of the heat conducting member 143, and further extends from the inner lateral surface to encompass the terminal portions of the heat conducting member 143 located at two opposite sides of the opening 140a. The heat conducting member 143 is formed by a material with high thermal conductivity such as aluminum or copper. The insulator 144 is formed by such as plastics. The heat conducting member 143 and the insulator 144 are integrally formed in one piece. Alternatively, the heat conducting member 143 is combined with the insulator 144 by way of engaging. The driver 130 is disposed on the base 110 (FIG. 1 B). The insulator 144 is located between the heat conducting member 143 and the driver 130 for electrically isolating the heat conducting member 143 from the driver 130.

[0020] The heat sink 140 has at least one first engaging portion 141 disposed on the insulator 144 located at a first terminal portion 140s1 of the heat sink 140. In another embodiment, the first engaging portions 141 are disposed on an outer lateral surface of the heat conducting member 143. The flexible substrate 150 has at least one second engaging portion 151 corresponding to the

first engaging portions 141. The flexible substrate 150 is engaged with the first engaging portions 141 of the heat sink 140 by the second engaging portions 151. The first engaging portions 141 of the heat sink 140 may be realized by protrusions, recesses or a combination thereof, wherein the recesses may be realized by screw holes, through holes or a blind hole. The second engaging portion 151 of the flexible substrate 150 may be realized by protrusions, recesses or a combination thereof, wherein the recesses may be realized by through holes or screw holes.

[0021] In an embodiment, as indicated in FIG. 1A, the first engaging portions 141 of the heat sink 140 are composed of two protrusions 141 a and an inner screw hole 141h1, while the second engaging portions 151 of the flexible substrate 150 are composed of a combination of recesses 151h11, 151h12, 151h13, 151h21, 151 h22 and 151 h23. The three recesses 151h11, 151 h12 and 151 h13 are located at one end of the flexible substrate 150. The three recesses 151 h21, 151 h22 and 151 h23 are located at another end of the flexible substrate 150. The recesses may be realized by through holes. The cross-sections of the protrusions are such as a circle, an ellipse or a polygon. The polygon is such as a triangle, a rectangle or a hexagon, and the cross-sections of the recesses are similar to that of the protrusions. The cross-sections of the first engaging portions 141 and the second engaging portions 151 may be completely identical with or different from each other. In addition, the outer diameter of the protrusion is slightly larger than that of the recess so that the protrusion is tightly received in the recess. In another embodiment, the first engaging portions 141 of the heat sink 140 are all realized by recesses, and the second engaging portions 151 of the flexible substrate 150 are all realized by protrusions. In another embodiment, the first engaging portions 141 of the heat sink 140 are all realized by protrusions, and the second engaging portions 151 of the flexible substrate 150 are all realized by recesses.

[0022] The number of the first engaging portions 141 and the number of the second engaging portions 151 are not restricted by the exemplifications in the embodiments of the invention.

[0023] One end of the flexible substrate 150 comprises two electrical endpoints 154 for connecting the anode and the cathode (not illustrated) of the driver 130, so that the flexible substrate 150 is pre-assembled in the driver 130. In addition, the flexible substrate 150 may be formed by an organic or inorganic material, and may be realized by a single-layered or multi-layered substrate structure.

[0024] Referring to FIG. 1B, an assembly diagram of a light emitting device of FIG. 1A is shown. Since the flexible substrate 150 is pre-assembled in the driver 130, the driver 130 and the flexible substrate 150 may be disposed on the base 110 in the same assembly procedure. The heat sink 140 has an opening 140a. After the driver 130 is assembled to a space P formed by the heat sink 140, the flexible substrate 150 extends outwards through the opening 140a, surrounds a lateral surface 140s of the heat sink 140 and is disposed thereon. The light source 120 surrounding and disposed on the lateral surface 140s of the heat sink 140 (as if the light source 120 surrounds around an axis vertical to the upper surface 110u) is capable of emitting a light in a full circumferential manner, not only increasing the visual angle of the light emitting device 100 but also being conformed to the energy star specification. In another embodiment, after the flexible substrate 150 and the driver 130 are respectively assembled, the flexible substrate 150 is connected to the anode and the cathode (not illustrated) of the driver 130 through the opening 140a, extends outwards through the opening 140a, surrounds the lateral surface 140s of the heat sink 140 to dispose thereon.

[0025] To put it in greater details, after the driver 130 and the flexible substrate 150 are disposed on the base 110, the flexible substrate 150 extends outwards through the opening 140a. Then, the second engaging portions 151, having been engaged with the first engaging portions 141 located on the first terminal portion 140s1 of the heat sink 140 (that is, the through holes 151h11 and 151h13 are correspondingly engaged with two protrusions 141 a, and the through holes 151h12 correspond to an inner screw hole 141h1), surround the lateral surface 140s of the heat sink 140. Lastly, one end of the flexible substrate 150 returns to the first terminal portion 140s1 of the heat sink 140 to overlap another end of the flexible substrate 150, so that the through holes 151h21 and 151h23 are engaged with two protrusions 141 a, and the through holes 151h22 overlaps the through hole 151h12. A locking element (not illustrated) passes the through holes 151 h22 and 151h12 and the inner screw hole 141h1, and then is locked on the heat sink 140.

[0026] The flexible substrate 150 comprises a body 152 and at least one lateral wing 153. The lateral wings 153 are connected to an edge of the body 152 such as an upper rim. The light source 120 may be disposed on the lateral wings 153. The lateral wings 153 of the flexible substrate 150 may be folded to encompass a portion of the terminal surface 140e of the heat sink 140, so that the light source 120 disposed thereon may emit a light upwardly.

[0027] Referring to FIG. 2, an external appearance of the light emitting device of FIG. 1A with a reflective sheet is shown. In the present embodiment, the light emitting device 100 further comprises a reflective sheet 160 laminated on the terminal surface 140e of the heat sink 140 for encompassing the driver 130 and the heat sink 140 and preventing impurities from damaging the driver 130.

[0028] The reflective sheet 160 has at least one notch 160r. After the lateral wings 153 are folded for encompassing the terminal surface 140e of the heat sink 140, the lateral wings 153are received in the notches 160r, so that the light source 120 disposed on the lateral wings 153 is directed upwards and is able to emit a light upwardly. The reflective sheet 160 is formed by a highly reflective metal or non-metal.

[0029] Referring to FIG. 3A, a decomposition diagram of a light emitting device according to another embodiment of the invention is shown. The light emitting device 200 comprises a base 110, a light source 120, a driver 130, a heat sink 240 and a flexible substrate 250.

[0030] The heat sink 240 comprises a plurality of first engaging portions composed of a plurality of first sub-engaging portions 2411 and a plurality of second sub-engaging portions 2412. The first sub-engaging portions 2411 and the second sub-engaging portions 2412 may be realized by protrusions or recesses or a combination thereof. The recesses are realized by such as screw holes, through holes or blind holes. As indicated in FIG. 3A, all of the first sub-engaging portions 2411 and the second sub-engaging portions 2412 are realized by protrusions. The first sub-engaging portions 2411 and the second sub-engaging portions 2412 are disposed on the insulator 144 of the first terminal portion 240s1 and the second terminal portion 240s2 of the heat sink 240. In another embodiment, the first sub-engaging portions 2411 and the second sub-engaging portions 2412 are disposed on an outer lateral surface of the heat conducting member 143. The flexible substrate 250 comprises a plurality of second engaging portions composed of a plurality of third sub-engaging portions 2511 and a plurality of fourth sub-engaging portions 2512. The third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 respectively correspond to the first sub-engaging portions 2411 and the second sub-engaging portions 2412. The third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 respectively are located at two opposite ends of the flexible substrate 250. The third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 may be realized by protrusions or recesses or a combination thereof. As indicated in FIG. 3A, all of the third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 are realized by recesses such as through holes in which the protrusions are engaged.

[0031] Referring to FIG. 3B, an assembly diagram of the light emitting device of FIG. 3A is shown. After the driver 130 is disposed on the base 110, the insulator 144 encompasses an inner lateral surface of the heat conducting member 143, and extends from the inner lateral surface to encompass the terminal portions of the heat conducting member 143 located at two opposite sides of the opening 140a (FIG. 3A). The third sub-engaging portions 2511 of the flexible substrate 250, after having engaged with the first sub-engaging portions 2411 on the first terminal portion 240s1, surrounds the lateral surface of the heat sink 240 to reach the second terminal portion 240s2, so that the fourth sub-engaging portions 2512 of the flexible substrate 250 is engaged with the second sub-engaging portions 2412 on the second terminal portion 240s2 for fixing the flexible substrate 250 on the heat sink 240.

[0032] Referring to FIG. 4A, a decomposition diagram of a light emitting device according to another embodiment of the invention is shown. The light emitting device 300 comprises a base 110, a light source 120, a driver 130, a heat sink 340 and a flexible substrate 350.

[0033] In the present embodiment, the driver 130 and the flexible substrate 350 may be assembled respectively. For example, the driver 130 is assembled on the base 110 first and then the flexible substrate 350 is assembled on the heat sink 340. Or, the flexible substrate 350 is assembled on the heat sink 340 first and then the driver 130 is assembled on the base 110.

[0034] The flexible substrate 350 comprises a body 152, at least one lateral wing 153 and a connection portion 355, wherein the connection portion 355 connects an edge of the body 152 and the driver 130.

[0035] One end of the connection portion 355 comprises two electrical endpoints 154 respectively connecting an anode 131 and a cathode 132 of the driver 130. The anode 131 and the cathode 132 of the driver 130 are located at the terminal surface 130e of the driver 130 so that the anode 131 and the cathode 132 are exposed and are conveniently connected to the connection portion 355.

[0036] The heat sink 340 is a close-looped heat sink. To put it in greater details, the heat sink 340 comprises a heat conducting member 343 and an insulator 344. The insulator 344 encompasses an inner lateral surface of the heat conducting member 343, and an insulating junction 344a is extended from the inner lateral surface to encompass the terminal portions located at two sides of the heat conducting member 343 to form a close-looped heat sink. The heat conducting member 343 and the insulator 344 are formed by materials similar to that of the heat conducting member 143 and the insulator 144 respectively, and the similarities are not repeated here.

[0037] The heat sink 340 comprises a plurality of first engaging portion composed of a plurality of first sub-engaging portions 2411 and a plurality of second sub-engaging portions 2412. The first sub-engaging portions 2411 and the second sub-engaging portions 2412 may be realized by protrusions or recesses or a combination thereof. The recesses are realized by such as screw holes, through holes or blind holes. As indicated in FIG. 3A, all of the first sub-engaging portions 2411 and the second sub-engaging portions 2412 are realized by protrusions. The first sub-engaging portions 2411 and the second sub-engaging portions 2412 are disposed on an insulating junction 344a of the heat sink 340. In another embodiment, the first sub-engaging portions 2411 and the second sub-engaging portions 2412 are disposed on an outer lateral surface of the heat conducting member 343. The first sub-engaging portions 2411 and the second sub-engaging portions 2412 are respectively disposed on two opposite sides of the insulating junction 344a of the insulator 344. The flexible substrate 350 comprises a plurality of second engaging portions composed of a plurality of third sub-engaging portions 2511 and a plurality of fourth sub-engaging portions 2512 respectively corresponding to the first sub-engaging portions

2411 and the second sub-engaging portions 2412. The third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 are respectively located at two opposite ends of the flexible substrate 350. The third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 are realized by protrusions or recesses or a combination thereof. As indicated in FIG. 3A, all of the third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 are realized by recesses such as through holes in which the protrusions are engaged.

[0038] Referring to FIG. 4B, an assembly diagram of the light emitting device of FIG. 4A is shown. After the flexible substrate 350 encompasses a lateral surface 140s of the heat sink 340 (FIG. 4A), the third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 of the flexible substrate 350 are respectively engaged with the first sub-engaging portions 2411 and the second sub-engaging portions 2412 of the heat sink 240 for fixing the flexible substrate 350 on the heat sink 240.

[0039] In another embodiment, like the implementation of FIG. 1A, one end of the flexible substrate 350 may overlap another end of the flexible substrate 350, so that the third sub-engaging portions 2511 and the fourth sub-engaging portions 2512 together are engaged on the first sub-engaging portions 2411. According to such design, the second sub-engaging portions 2412 can be omitted.

[0040] In an embodiment, a portion of the sub-engaging portions may be realized by screw holes for selectively locking the flexible substrate 350 on the heat sink 340.

[0041] In an embodiment, the heat sinks 140, 240and 340 are formed by insulating and heat dissipating plastics. For example, some metal oxide powders, carbon, fiber or ceramic powders are added to the plastics. In another embodiment, the heat sink 140, 240, 340 may be formed by metal, and the driver 130 is encompassed by an insulating material such as an insulating heat-shrinkable tube.

[0042] While the invention has been described by way of example and in terms of the preferred embodiment (s), it is to be understood that the invention is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

Claims

1. A light emitting device, comprising:

a base;
a driver disposed on the base;
a heat sink disposed on the base and having a lateral surface surrounding the driver;
a flexible substrate connected to the driver, wherein the flexible substrate surrounds a lateral surface of the heat sink and is disposed thereon; and
a light source disposed on the flexible substrate.

2. The light emitting device according to claim 1, wherein the heat sink has a first engaging portion located on the lateral surface, the flexible substrate has a second engaging portion correspondingly engaged with the first engaging portion for fixing the flexible substrate on the lateral surface of the heat sink.

3. The light emitting device according to claim 2, wherein the first engaging portion and the second engaging portion are realized by protrusions, recesses or a combination thereof.

4. The light emitting device according to claim 3, wherein the cross-section of the protrusion is a circle, an ellipse or a polygon.

5. The light emitting device according to claim 1, wherein the heat sink has an opening through which the flexible substrate is connected to the driver.

6. The light emitting device according to claim 1, wherein the heat sink is a close-looped heat sink.

7. The light emitting device according to claim 1, wherein the heat sink has a first sub-engaging portion and a second sub-engaging portion respectively located on a first terminal portion and a second terminal portion of the lateral surface, the flexible substrate has a third sub-engaging portion and a fourth sub-engaging portion correspondingly engaged with the first sub-engaging portion and the second sub-engaging portion respectively.

8. The light emitting device according to claim 7, wherein the third sub-engaging portion of the flexible substrate, after having been engaged with the first sub-engaging portion on the first terminal portion, surrounds the lateral surface of the heat sink to reach the second terminal portion, so that the fourth sub-engaging portion of the flexible substrate is engaged with the second sub-engaging portion on the second terminal portion.

9. The light emitting device according to claim 7, wherein the first sub-engaging portion, the second sub-engaging portion, the third sub-engaging portion and the fourth sub-engaging portion are realized by protrusions, recesses or a combination thereof.

10. The light emitting device according to claim 1, wherein the heat sink comprises:

a heat conducting member; and

an insulator encompassing the inner lateral surface of the heat conducting member.

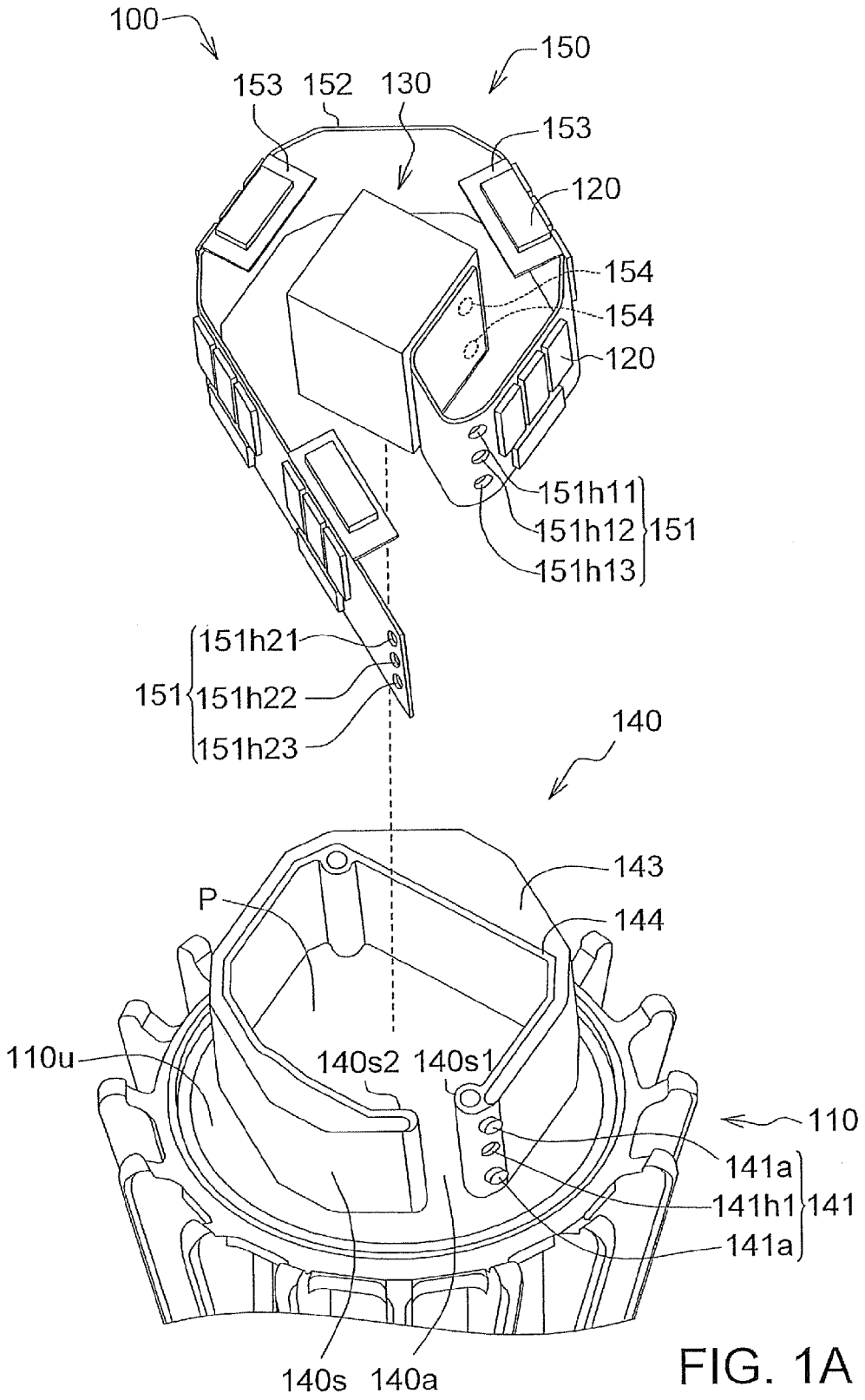
11. The light emitting device according to claim 1, wherein the heat sink is formed by heat dissipating plastics.

12. The light emitting device according to claim 1, wherein the heat sink is formed by metal, and the driver is encompassed by an insulating material.

13. The light emitting device according to claim 1, wherein the flexible substrate comprises a body and at least one lateral wing connected to an edge of the body, the body surrounds the lateral surface of the heat sink, and the lateral wing encompasses a portion of a terminal surface of the heat sink.

14. The light emitting device according to claim 13, further comprising another light source located on the lateral wing.

15. The light emitting device according to claim 1, wherein one end of the flexible substrate overlaps another end of the flexible substrate.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151h13
151h21
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151h23
140
143
P
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140s2
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141a
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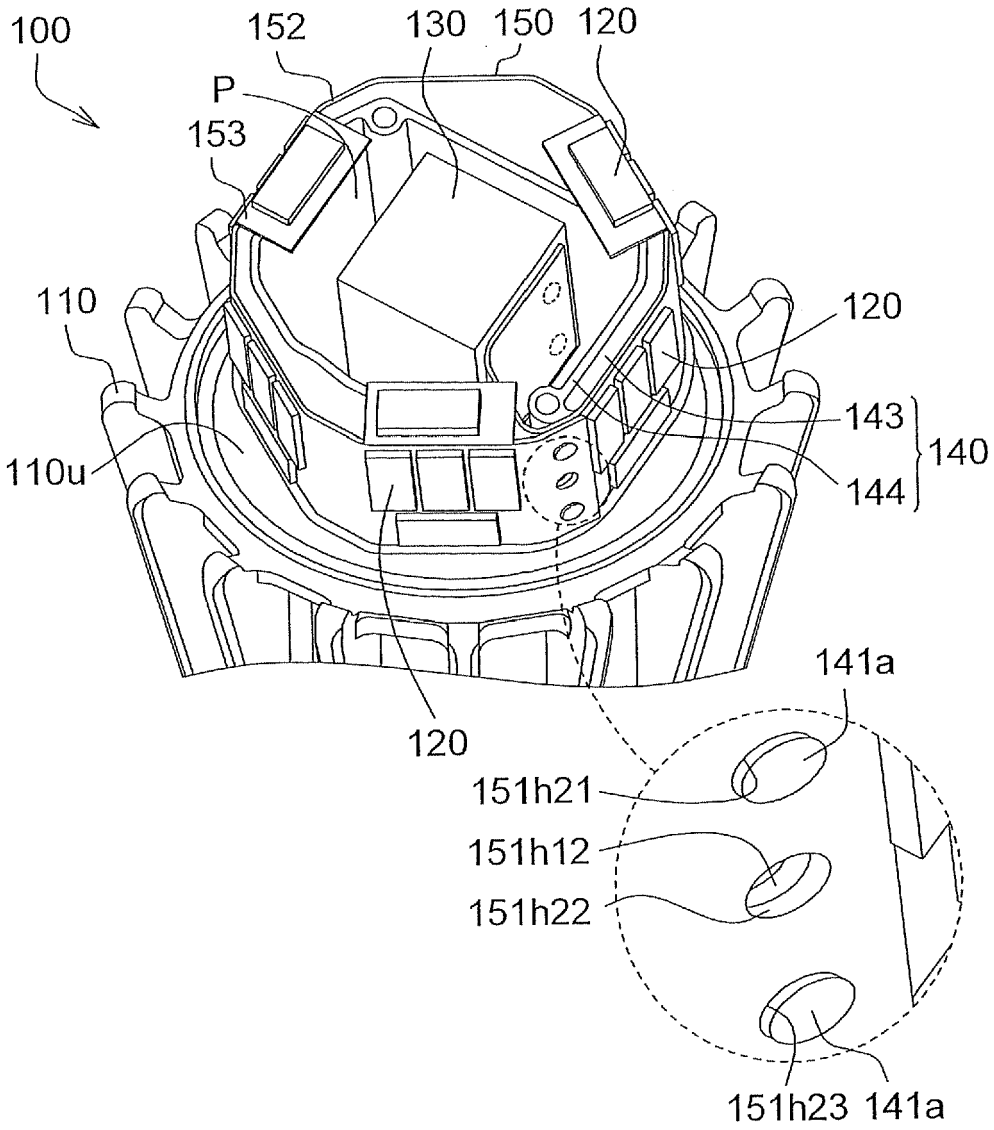
FIG. 1A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151h23
141a

FIG. 1B

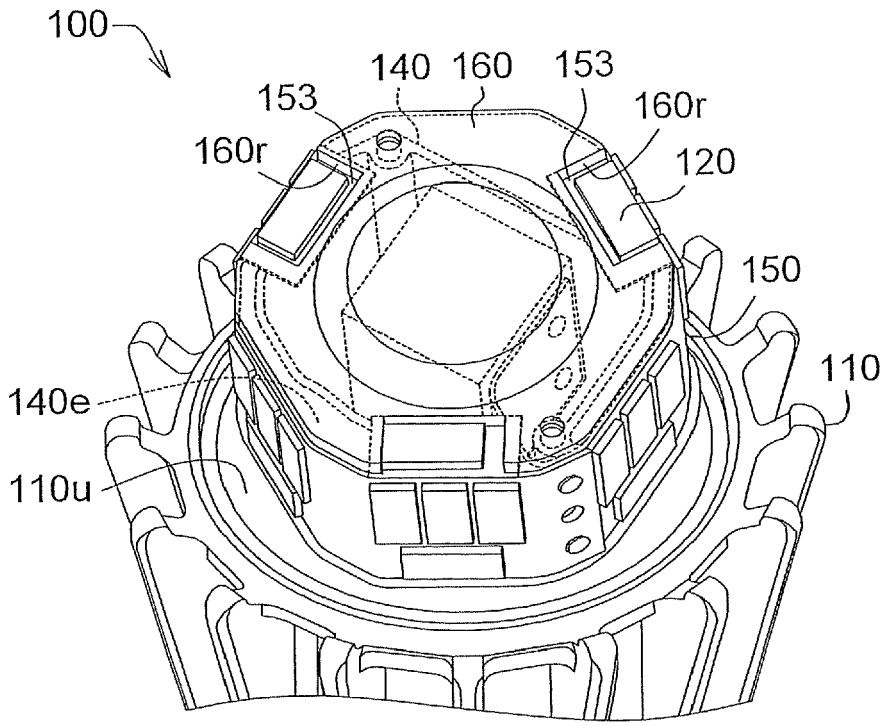
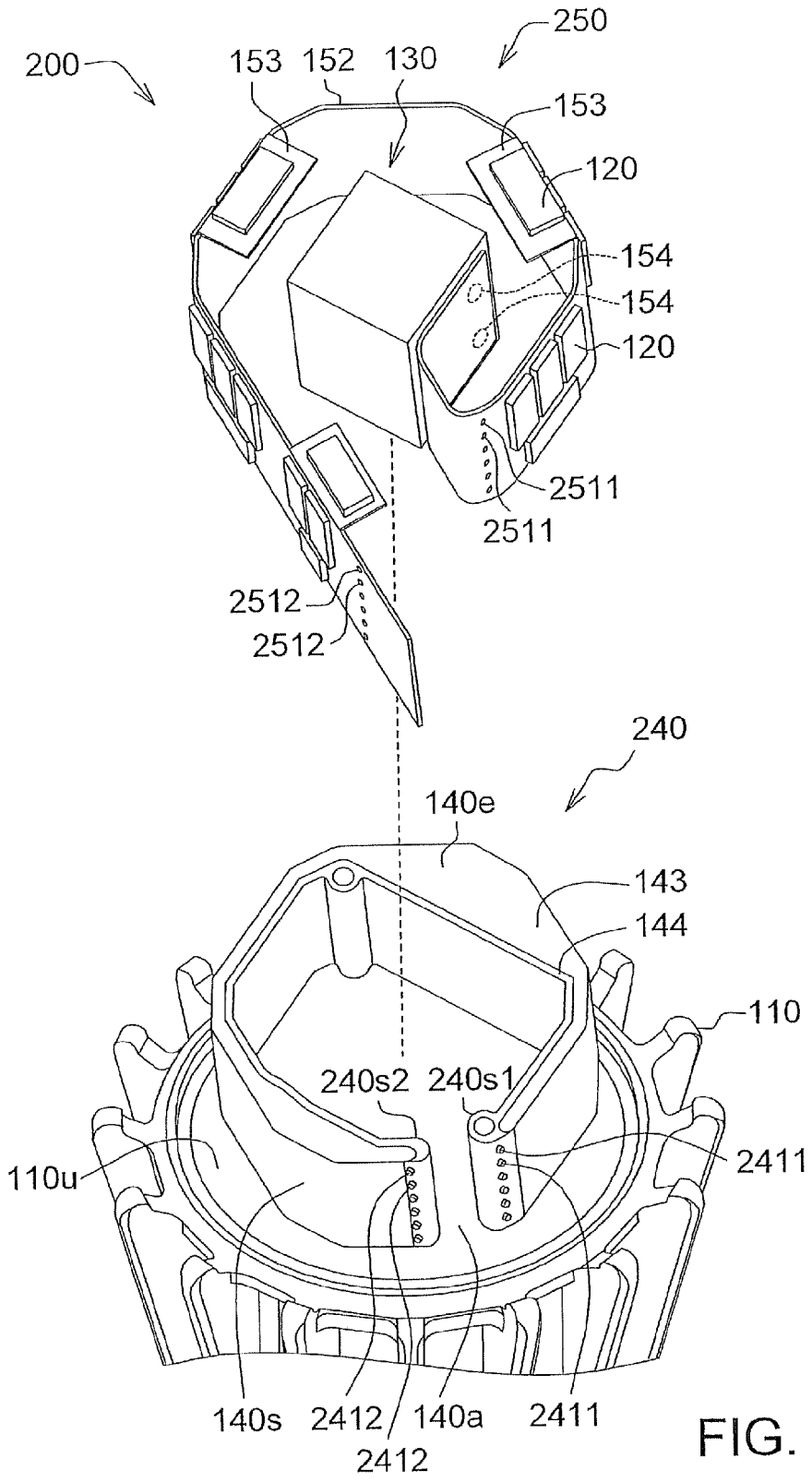


FIG. 2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2512
2512
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240s2
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110u
140s
2412
140a
2411
2412

FIG. 3A

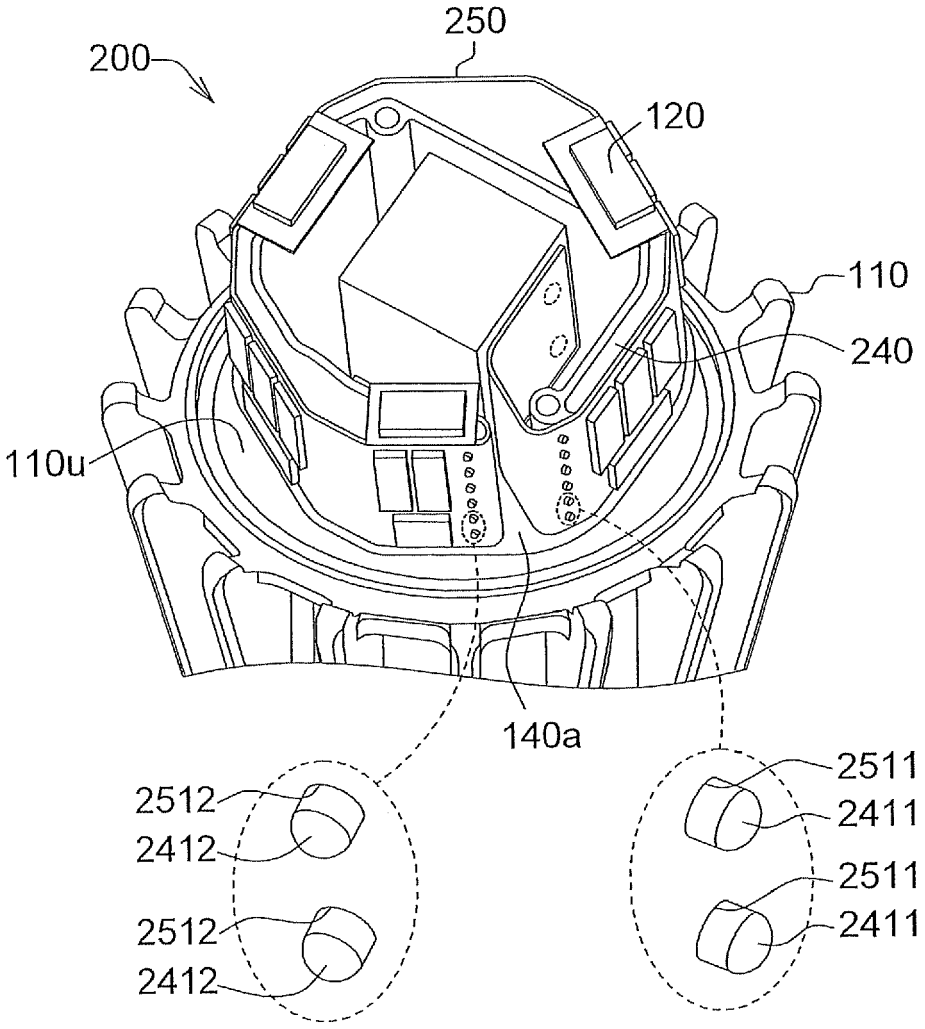
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FIG. 3B

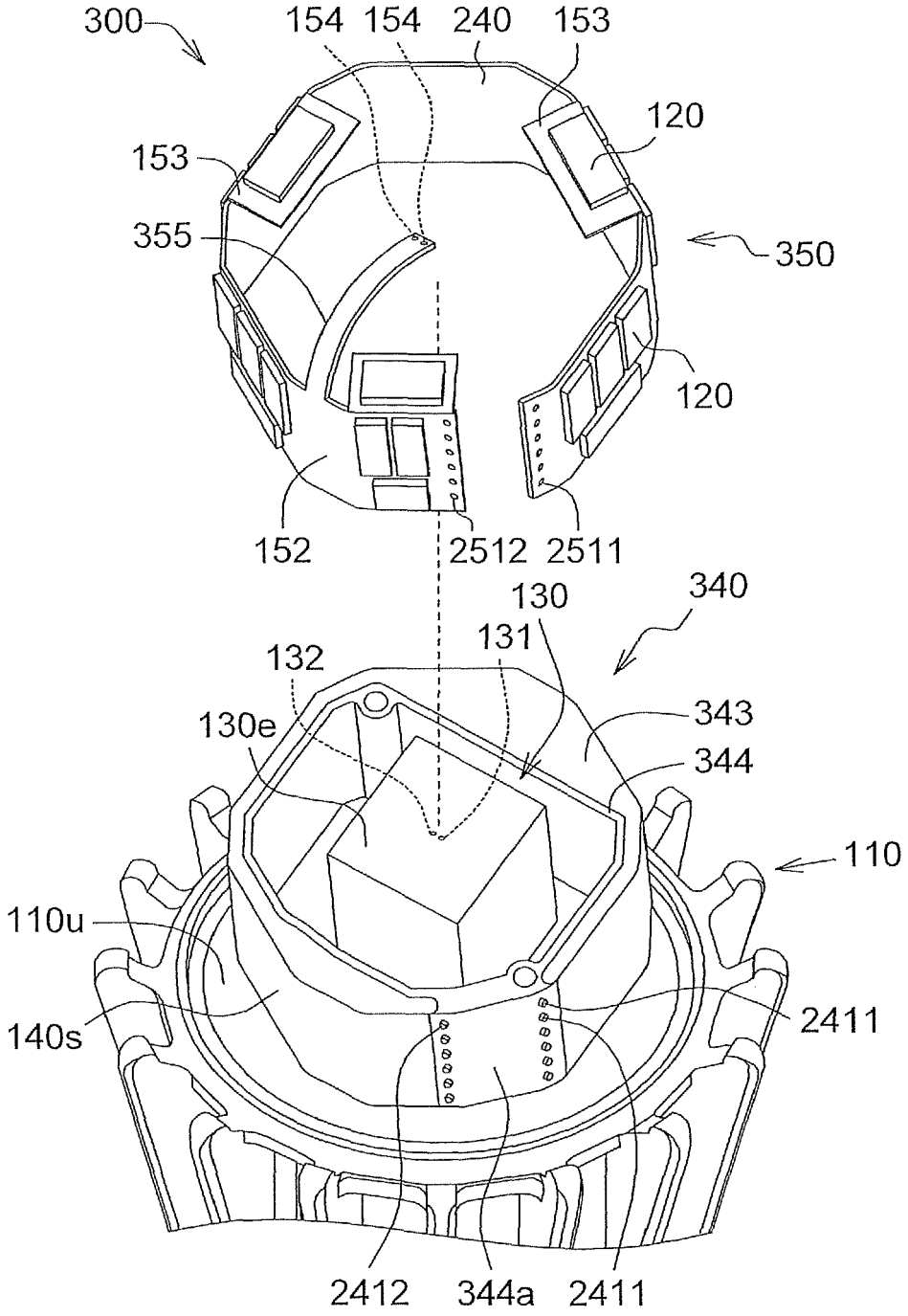
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FIG. 4A

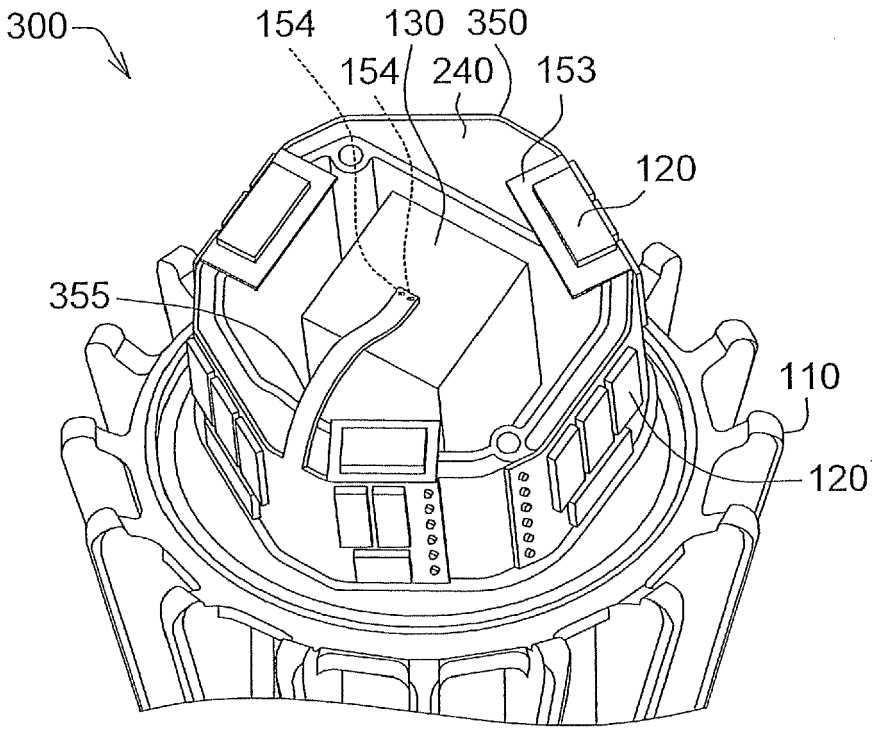

FIG. 4B

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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 4608

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 Y	EP 2 413 029 A2 (LEADRAY ENERGY CO LTD [TW]) 1 February 2012 (2012-02-01) * figures 3, 4 * * paragraphs [0016], [0017] * * claim 1 * -----	1,6, 10-12 2-5,7-9, 13-15	INV. F21K99/00 F21V19/00 F21V23/00 F21V29/00
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A	US 2005/174769 A1 (YONG GAO [CN] ET AL) 11 August 2005 (2005-08-11) * figures 5-7 * * claims 1-4 * -----	1-15	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 June 2013	Vida, Gyorgy

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 19 4608

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
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26-06-2013

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