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(54) Title: LIGHTING DEVICE

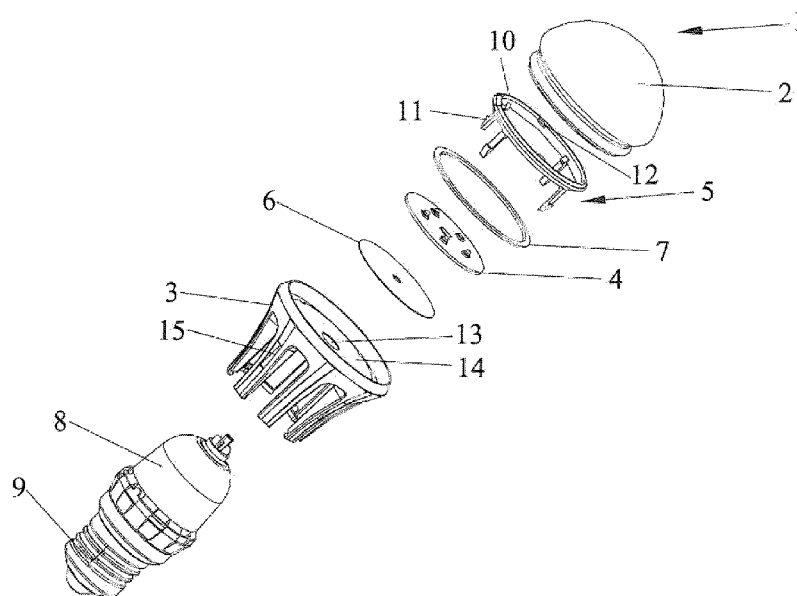


Figure 1

(57) Abstract: The present invention relates to a lighting device (1), comprising a lamp housing (2), a circuit board (4) provided with a light source and a heat sink (3), the circuit board (4) being provided on the heat sink (3) and the light from the light source being emitted

[Continued on next page]

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through the lamp housing (2), wherein a mechanical locking means (5) is provided between the lamp housing (2) and the heat sink (3) for mechanically connecting both, The lighting device according to the present invention not only can avoid defects caused by silicone. It can save the time on assembling.

## Description

### Lighting Device

#### Technical Field

- 5 The present invention relates to a lighting device, and in particular, to an LED lighting device.

#### Background Art

- 10 A lot of LED bulb lamps are disclosed in the prior art. The glass sphere and the heat sink are connected with silicone in the existing technologies. There are some shortcomings using silicone, for instance, a good consistence is lacked between the glass sphere and the heat sink, and the glass sphere would possibly drop down and hurt the customer if the bonding is not steady; besides, a special storage space for silicone is needed during the process of fabricating the lamp when the silicone is used. Moreover, the silicone should be cured for bonding, while the curing takes a  
15 lot of time, e.g. one hour. Further, the silicone is expensive. In the prior art, the heat sink and the circuit board provided with the light source are connected with screw, but the screw connection would become partially slipping during manufacturing and transporting and also it is necessary to arrange a screw hole in the heat sink.

#### Summary of the Invention

- 20 Therefore, the object of the present invention lies in providing a novel lighting device, with which the glass sphere and heat sink can be bonded without silicone. And further in the lighting device of the present invention, the heat sink and circuit board provided with the light source are connected without screw so as to avoid the defect of partial slipping.
- 25 The object of the present invention is accomplished with a lighting device, wherein the lighting device comprises a lamp housing, a circuit board provided with a light source and a heat sink, the circuit board being provided on the heat sink and the light from the light source being emitted through the lamp housing, wherein a separate mechanical locking means is provided between the lamp housing and the  
30 heat sink for mechanically connecting both "Mechanical connection" refers to connections by means of shape matching and force transmission.

The present invention discards the bonding method of using silicone, while inventively introduces the mechanical connecting method to implement connection and locking between the lamp housing and heat sink. Thereby, the defects brought by using silicone and bonding method are overcome.

5 According to an improved embodiment of the present invention, the mechanical locking means comprises a lamp housing side connecting portion, a heat sink side connecting portion. Preferably in particular, the mechanical locking means comprises an annular body as the lamp housing side connecting portion, a plurality of hooks extending perpendicularly from the annular body as the heat sink side  
10 connecting portion. The mechanical locking means is correspondingly designed considering the shape of the lamp housing and the shape of the heat sink. "Extending perpendicularly" herein includes extending approximately perpendicularly or extending completely perpendicularly;

15 According to an improved embodiment of the present invention, the mechanical locking means depresses and hold the circuit board onto the heat sink. The mechanical locking means in the present invention concurrently has two functions, i.e. both implementing the mechanical connection between the lamp housing and heat sink, and realizing the function of holding the circuit board on the heat sink, so as to provide a completely novel design and accomplish a lighting device with a  
20 simple structure and good performance.

According to an improved embodiment of the present invention, the mechanical locking means comprising a depressing portion used to depress and holds the circuit board so as to implement functions in two aspects above.. Preferably in particular, in case that the mechanical locking means comprises an annular body as  
25 the lamp housing side connecting portion, the mechanical locking means comprising traverse bars extending horizontally or inclinedly downwardly from the annular body as the depressing portion . The degree of "extending inclinedly downwardly" herein is inclination degree facilitating to depress the circuit board.

A mechanical locking means may be provided with one, two, or three of annular  
30 body, the hooks and traverse bars. In a preferred embodiment, A mechanical locking means may be provided with annular body, the hooks and traverse bars in a case of spherical lamp housing. Possibility of good connection with the spherical lamp housing is provided with the annular body. Connection with the heat sink and pressurization to the circuit board are implemented, respectively, with the hooks

and traverse bars extending from the annular body. This mechanical locking means has a simple structure and reliable connection performance. Preferably, the annular body is provided to be able to extend into the lamp housing and to be flexibly against the inner wall of the lamp housing. The annular body can be provided to be a complete ring or a ring with an opening. The inner wall of the lamp housing also can be adjusted accordingly into a shape suited to accommodate the annular body.

Preferably, the heat sink is a cup that is open at one side and provided with a supporting surface with a central opening at the other side, the side wall of the heat sink is provided with a plurality of hook locking holes corresponding to the plurality of hooks. The hooks can slide along the inner side wall of the heat sink until they are locked in the hook locking holes.

Preferably, the lighting device further comprises a power supply and a thermal conductive pad, wherein the power supply is accommodated in the heat sink and extends out through the opening on the supporting surface to be conductively connected with the circuit board provided on the supporting surface; and the circuit board depresses the thermal conductive pad so as to further depress and hold the heat sink, thereby both conductive connection of the lighting device and depression to the heat sink are taken into consideration.

Preferably, the lighting device further comprises a buffer ring provided on the supporting surface of the heat sink, so as to avoid damage possibly caused by shaking between the lamp housing and the heat sink.

According to another solution of the present invention, the mechanical locking means is made in one piece so as to facilitate the processing and reduce the fabricating costs.

Preferably, the mechanical locking means is made by means of plastic injection molding, which further reduces the fabricating costs.

Preferably, there are at least four hooks so as to strengthen the mechanical connection.

The lighting device according to the present invention not only can avoid defects caused by silicone but also can avoid shortcomings brought by screw connection between the heat sink and the circuit board provided with the light source. It can

save the time on assembling, avoid the slipping problem of screw connection, provide a reliable connection and guarantee sufficient location of the circuit board on the heat sink.

### **Brief Description of the Drawings**

5 The present invention will be illustratively described hereinafter in detail with reference to the figures. The same element or element with the same function is represented by the same reference sign. As shown in the figures:

Fig. 1 is an exploded view of the lighting device according to the present invention;

10 Fig. 2 is a view of the lighting device after assembling according to the present invention;

Fig. 3 is a schematic view of an example of the mechanical locking means according to the present invention;

Fig. 4 is a schematic view of the heat sink of the lighting device according to the present invention;

15 Fig. 5 is a schematic view of the first stage of assembling the lighting device according to the present invention;

Fig. 6 is a schematic view of the second stage of assembling the lighting device according to the present invention' and

20 Fig. 7 is a schematic view of the third stage of assembling the lighting device according to the present invention.

### **Detailed Description of the Embodiments**

Fig. 1 is an exploded view of the lighting device 1 according to the present invention. The lighting device 1 comprises a lamp housing 2, a heat sink 3, a circuit 4 provided with a light source (the light source is LED in this example), a mechanical locking means 5, a thermal conductive pad 6, a buffer ring 7, a power supply 8 and a socket 9. The socket 9 is provided with the power supply 8, the circuit board 4 is supplied with power via the portion of the power supply 8 running through the heat

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sink and makes the light source emit light, and the light emitted from the light source goes out through the lamp housing 2. All the lamp housing 2, circuit board 4, power supply 8 and socket 9 are designed in the same manner as in the prior art, and details therefore will not be given herein. The applicant hereinafter will illustrate  
5 in detail the mechanical locking means 5 and structures such as heat sink 3, thermal conductive pad 6, buffer ring 7 provided.

The lighting device 1 in the present invention comprises the mechanical locking means 5 as shown in the figure (in conjunction with Fig. 3). The mechanical locking means 5 is mainly used to connect the lamp housing 2 and the heat sink 3 in a  
10 mechanical manner. Therefore, the mechanical locking means comprises a lamp housing side connecting portion 10 for connecting the lamp housing 2 and a heat sink side connecting portion 11 for connecting the heat sink 3. Besides, the mechanical locking means 5 further has the function of biasing the circuit board 4 so as to depress the circuit board 4 to the heat sink 3, thus a depressing portion 12  
15 is provided so as to implement holding of the circuit board 4 on the heat sink 3. Therefore, the mechanical locking means 5 in the present invention has functions in two aspects, namely, not only overcoming the defects brought by connecting the lamp housing 2 and the heat sink 3 with silicone and connecting the circuit board and the heat sink 3 with screw connection, but also producing the technical effects  
20 of simplifying the structure and improving the connecting function. An annular element is provided in this exemplary example, comprising an annular body as the lamp housing side connecting portion 10. A plurality of hooks extending perpendicularly downwardly from the annular body as the heat sink side connecting portion 11 and traverse bars extending horizontally or inclinedly downwardly from  
25 the annular body 10 as the depressing portion 12 are further provided. The annular element in this exemplary example is skillfully designed considering the specific shape of the lamp housing. To be matched with this mechanical locking means, the heat sink 3 correspondingly is further provided in the present invention. Details will be given hereinafter in conjunction with Fig. 4. Other specific structures of the  
30 mechanical locking mechanisms also can be considered in the other examples.

Fig. 2 is a view of the lighting device 1 after assembling according to the present invention. It can be seen from Fig. 2 that the hooks 11 of the mechanical locking means 5 are locked in the hook locking holes 15 of the heat sink 3 after assembling.

35 Fig. 3 is a schematic view of an example of the mechanical locking means 5

according to the present invention. The mechanical locking means 5 is made in one piece, and preferably, made by means of plastic injection molding. In this example, the mechanical locking means 5, made from PET, mainly comprises three parts, i.e. annular element 10 that can be pushed into the lamp housing and be flexibly  
5 against the inner wall of the lamp housing 2, hooks 11 locked in the hook locking holes 15 on the side wall of the heat sink along the inner wall of the heat sink 3, and traverse bars 12 substantially extending radially and pressurizing the circuit board. The traverse bars 12 can be horizontal or slightly inclined downwardly. There are preferably at least four hooks in order to assure the locking strength. The number of  
10 the traverse bars 12 is preferably to be at least two.

Fig. 4 is a schematic view of the heat sink 3 of the lighting device 1 according to the present invention. The heat sink 3 is a cup that is open at one end and provided with a supporting surface 14 with a central opening 13 at the other end. In this example, the heat sink 3 is open downwardly; the power supply 8 therefore can be  
15 accommodated in the heat sink 3, the power supply 8 extends out through the opening 13 on the supporting surface 14 to be conductively connected with the circuit board 4, etc. provided on the supporting surface 14. The heat sink 3 is provided in such a manner that the hooks 11 of the mechanical locking means 5 can extend along the inner wall of the heat sink 3 until they are locked in the hook  
20 locking holes 15. The heat sink 3 can be made from the metal material such as aluminum and is fabricated by casting.

Fig. 5, Fig. 6 and Fig. 7 are schematic views of the first, second and third stages of assembling the lighting device 1 according to the present invention. Firstly, the thermal conductive pad 6 is bonded onto the supporting surface 14 of the heat sink  
25 3 and the circuit board 4 is depressed on the heat sink 3, wherein the thermal conductive pad 6 is provided to be adhesive on both sides and have a central opening so as to contact the power supply 8 for conduction (Fig 5); then, the annular element 5 is pushed into the lamp housing 2 to be against the inner surface of the lamp housing 2; (Fig 6) and finally, the buffer ring 7 is put therein and the  
30 lamp housing with the annular element 5 is pushed along the inner wall of the heat sink 3 until the hooks 11 of the mechanical locking means 5 are locked in the hook locking holes 15. (Fig 7)



## List of reference signs

	1	lighting device
	2	lamp housing
	3	heat sink
5	4	circuit board
	5	mechanical locking means
	6	conductive pad
	7	buffer ring
	8	power supply
10	9	socket
	10	lamp housing side connecting portion
	11	heat sink side connecting portion
	12	depressing portion
	13	opening
15	14	supporting surface
	15	hook locking hole

**Claims**

1. A lighting device, comprising a lamp housing (2), a circuit board (4) provided with a light source and a heat sink (3), the circuit board (4) being provided on the heat sink (3) and a light from the light source being emitted through the lamp housing (2), wherein a separate mechanical locking means (5) is provided between the lamp housing (2) and the heat sink (3) for mechanically connecting both.
2. The lighting device (1) according to claim 1, wherein the mechanical locking means (5) comprises a lamp housing side connecting portion (10), a heat sink side connecting portion (11).
3. The lighting device (1) according to claim 2, wherein the mechanical locking means (5) comprises an annular body as the lamp housing side connecting portion (10), a plurality of hooks extending perpendicularly from the annular body as the heat sink side connecting portion (11).
4. The lighting device (1) according to one of claim 1-3, wherein the mechanical locking means (5) depresses and holds the circuit board (4) to the heat sink (3).
5. The lighting device (1) according to claim 4, wherein the mechanical locking means (5) comprising a depressing portion (12) used to depress and holds the circuit board (4).
6. The lighting device (1) according to claim 5, wherein the mechanical locking means (5) comprising traverse bars (12) extending horizontally or inclinedly downwardly from the annular body as the depressing portion (12).
7. The lighting device (1) according to claim 3, wherein the annular body is provided to be able to extend into the lamp housing (2) and to be flexibly against an inner wall of the lamp housing (2).
8. The lighting device (1) according to claim 3, wherein the heat sink (3) is in a cup that is open at one side and provided with a supporting surface (14) with a central opening (13) at the other side, and a side wall of the heat sink (3) is provided with a plurality of hook locking holes (15) corresponding to the plurality of hooks.
9. The lighting device (1) according to claim 8, wherein further comprising a power supply (8) and a thermal conductive pad (6), the power supply (8) being accommodated in the heat sink (3) and extending out through the opening (13) on the supporting surface (14) to be conductively connected with the circuit board (4) on the supporting surface (14), the circuit board (4) depress and hold the heat sink (3) by pressing the thermal conductive pad (6).

10. The lighting device (1) according to claim 8, wherein further comprising a buffer ring (7) provided on the supporting surface (14) of the heat sink (3).
- 5 11. The lighting device (1) according to any one of claims 1-3, wherein the mechanical locking means (5) is made in one piece.
12. The lighting device (1) according to any one of claims 1-3, wherein the mechanical locking means (5) is made by means of plastic injection molding.
- 10 13. The lighting device (1) according to claim 3, wherein there are at least four hooks.

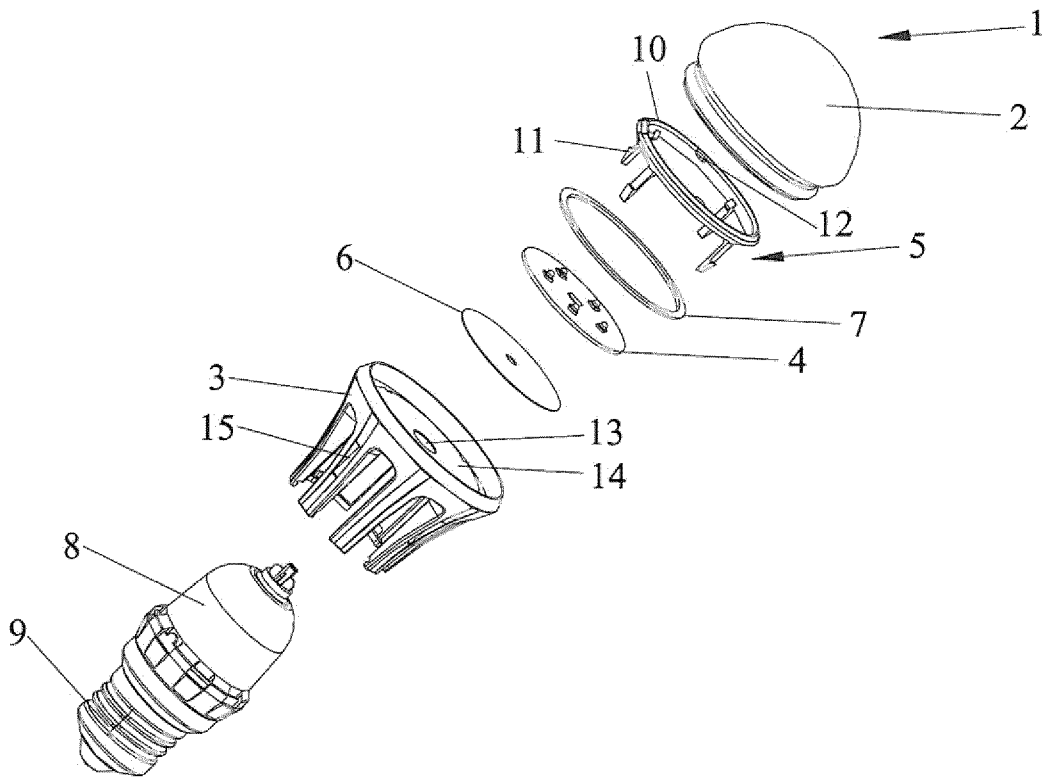
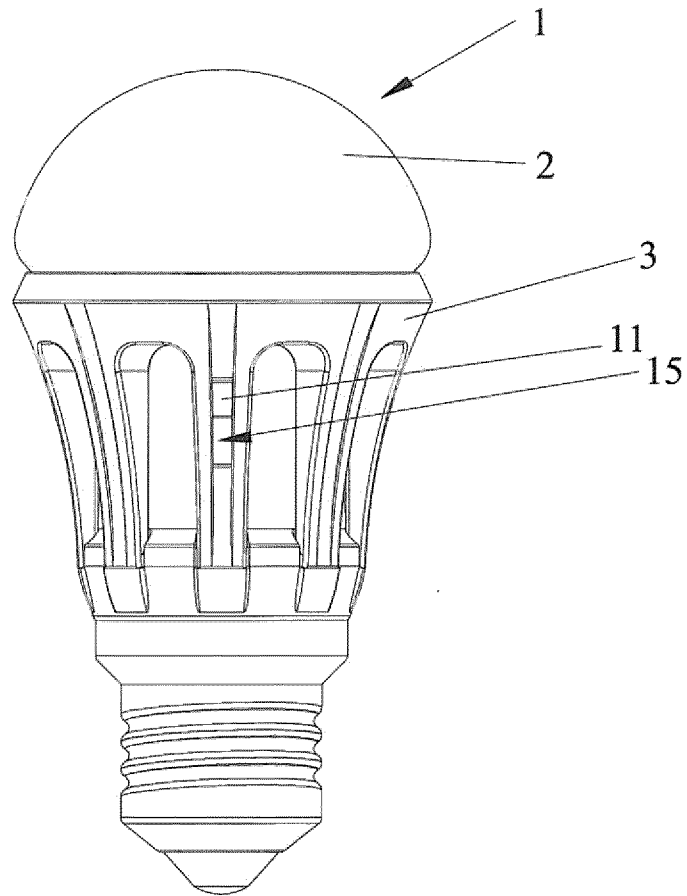
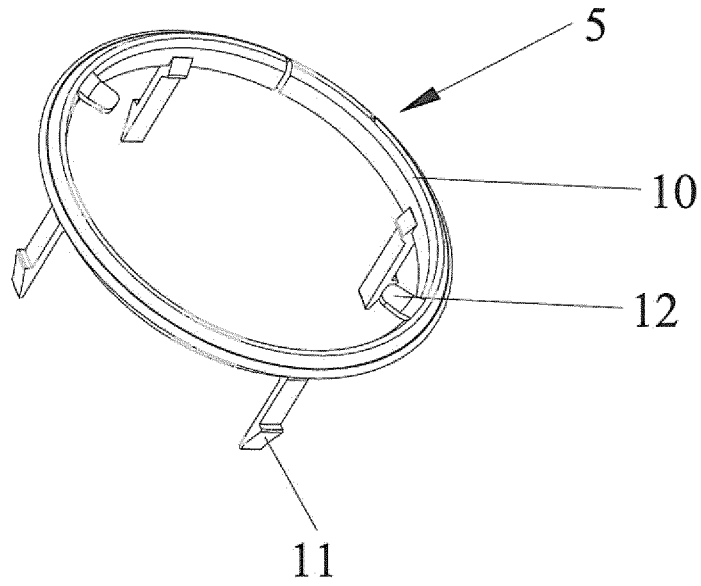


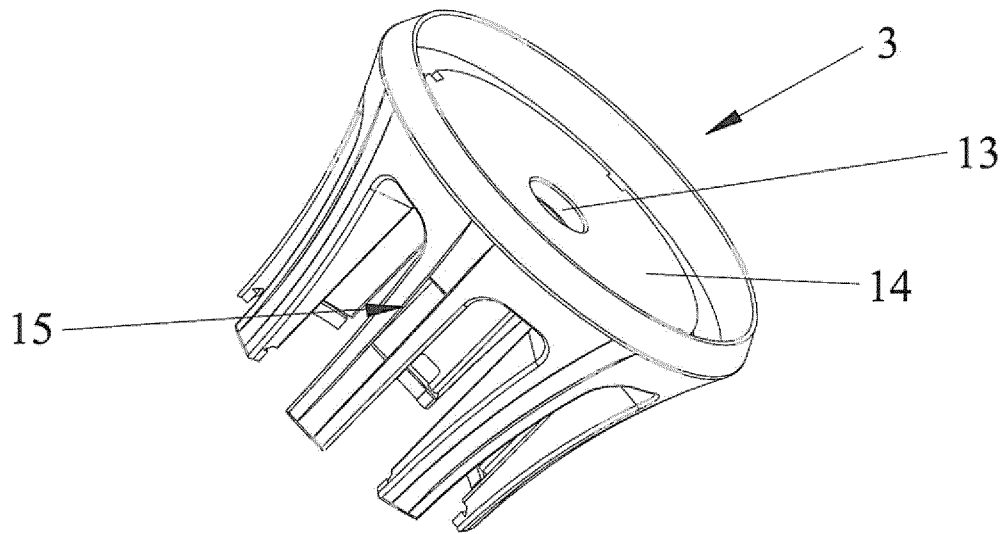
Figure 1



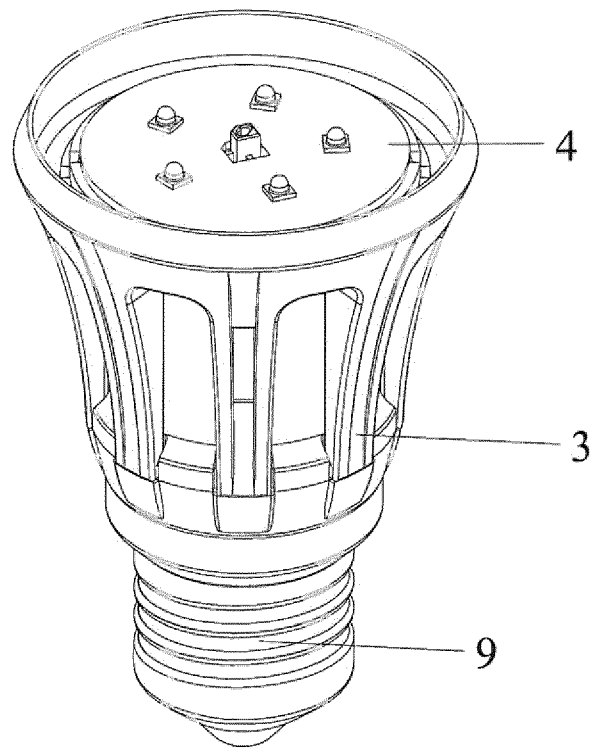
**Figure 2**



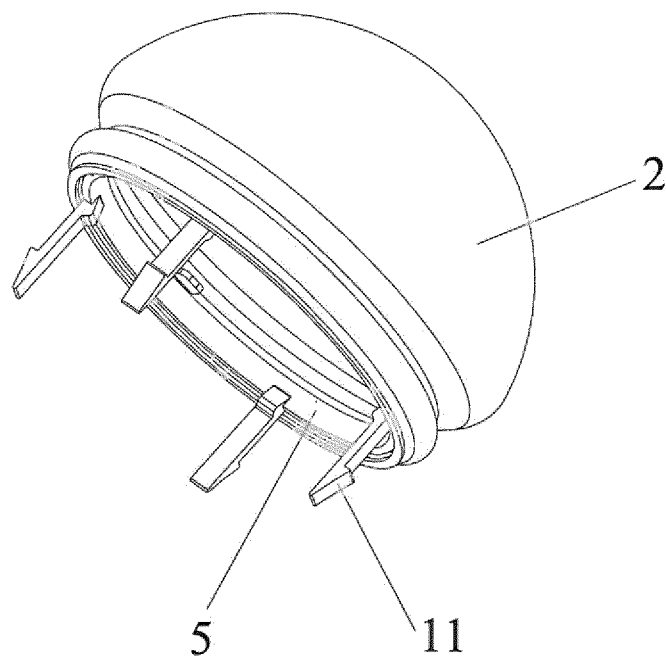
**Figure 3**



**Figure 4**

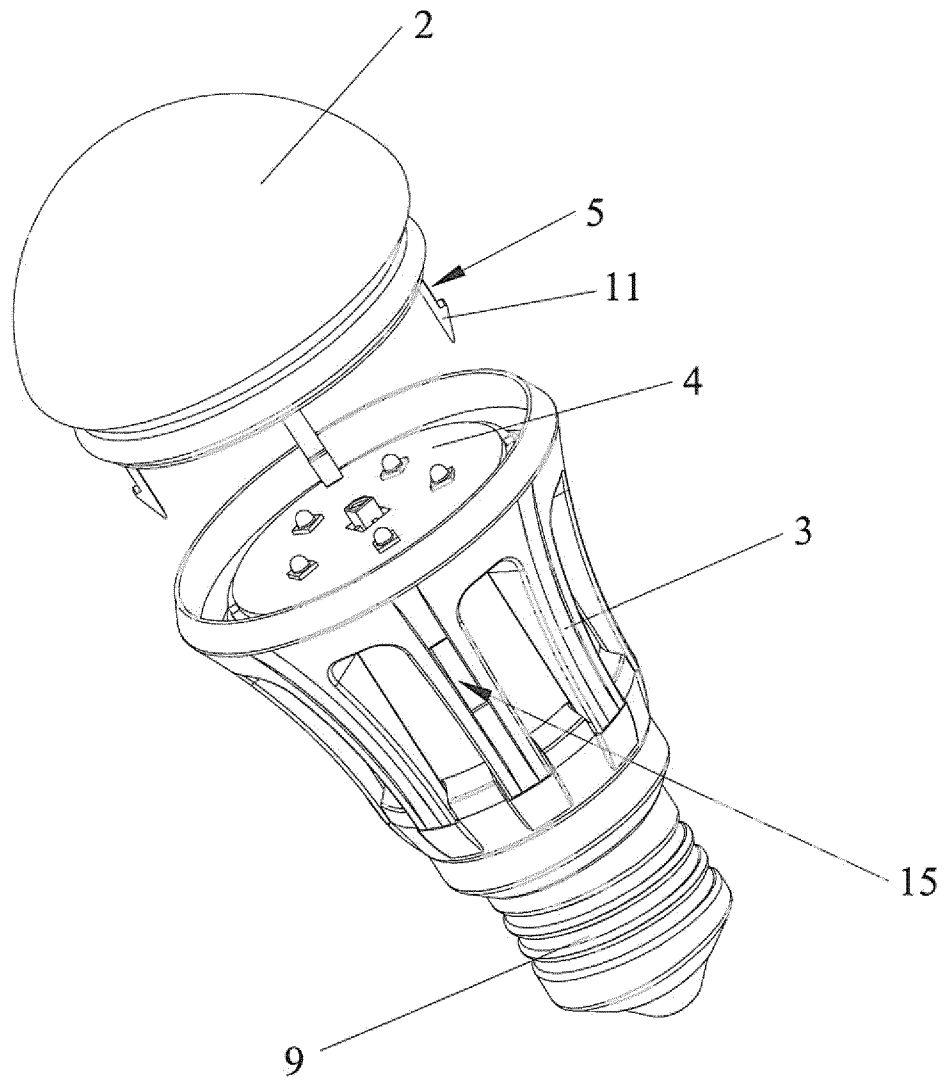


**Figure 5**



**Figure 6**





**Figure 7**

INTERNATIONAL SEARCH REPORT

International application No  
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A. CLASSIFICATION OF SUBJECT MATTER  
 INV. F21V17/16 F21V19/00  
 ADD. F21Y101/02 F21V29/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 F21V F21K

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EPO-Internal, WPI Data

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## INTERNATIONAL SEARCH REPORT

International application No  
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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