(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 073 175 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.09.2016 Bulletin 2016/39

(51) Int Cl.:
F21K 99/00 *(2016.01)* *F21Y 111/00* *(2016.01)*
F21Y 115/10 *(2016.01)*

(21) Application number: **16156859.7**

(22) Date of filing: **23.02.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **11.08.2015 TW 104126163**

(71) Applicant: **Liquidleds Lighting Corp.**
Taipei (TW)

(72) Inventor: **HUANG, David**
Taipei (TW)

(74) Representative: **Pallini Gervasi, Diego et al**
Notarbartolo & Gervasi GmbH
Bavariaring 21
80336 Munich (DE)

(54) LIGHT-EMITTING DIODE LIGHT BULB STRUCTURE

(57) A light-emitting diode (LED) light bulb structure includes a glass stem (20), a first power wire (21), a second power wire (22), a first conducting bar (31), a second conducting bar (32), a first light-emitting module (40), and a second light-emitting module (50). Each of the first light-emitting module (40) and the second light-emitting module (50) has a top bar assembly, a bottom bar assembly and multiple LED filaments (41, 43, 45, 47). Both ends of each of the top bar assembly and the bottom bar assembly are respectively connected with the first conducting bar (31) and the second conducting bar (32). The LED filaments (41, 43, 45, 47) are mounted between the top and bottom bar assemblies to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments (41, 43, 45, 47) and the top bar assembly and the bottom bar assembly.

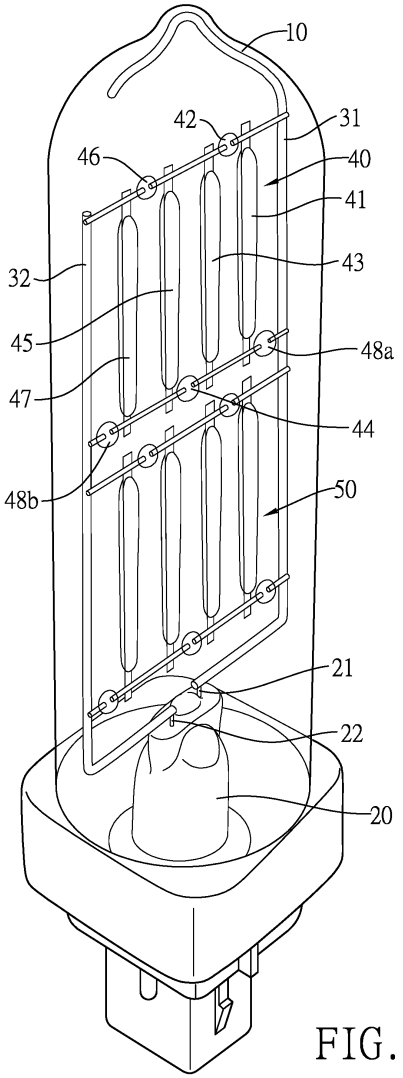

FIG.1A

EP 3 073 175 A1

Description

1. Field of the Invention

[0001] The present invention relates to a light-emitting diode (LED) light bulb structure and, more particularly, to an LED filament light bulb with a mounting structure of multiple layers of juxtaposed LED filaments.

2. Description of the Related Art

[0002] The techniques associated with LED light bulb structure never stop their footstep in progress. Current LED light bulbs in the market usually have multiple series-parallel connected LEDs for the purpose of higher luminance. Printed circuit board has been brought into play in the current technique to facilitate the arrangement of circuit loops. For example, as disclosed in Taiwan Utility Model Patent No. M389204, entitled "LED lamp" , two circuit boards with LED lamp modules thereon are cross-connected and are taken as LED filaments of the LED lamp. However, beside heat dissipation issue in such technique, luminance of the LED lamp is lowered because light emitted from the LED lamp is partially blocked by the circuit boards.

[0003] Another current technique associated with LED light bulb pertains to a type of LED filament light bulb. With reference to Fig. 5, a conventional LED filament light bulb includes a glass body 10a, a glass stem 20a, a first power wire 21 a, a second power wire 22a, a glass bar 100, a glass head 120, multiple filaments 101~108, a first lower loop frame 124, a second lower loop frame 126 and two upper loop frames 122a, 122b.

[0004] The glass body 10a is sealed, is vacuumed internally, and is filled with inert gas for heat dissipation. The glass stem 20a is mounted inside the glass body 10a and is located on a bottom of the glass body 10a. The first power wire 21a and the second power wire 22a are mounted in the glass stem 20a and protrude beyond the glass stem 20a. Exposed portions of the first power wire 21a and the second power wire 22a are respectively connected to the first lower loop frame 124 and the second lower loop frame 126. The glass bar 100 is formed on and vertically protrudes from a top end of the glass stem 20a. The glass head 120 is mounted on a top of the glass bar 100 and is coupled to the upper loop frames 122a, 122b through four sticks for the upper loop frames 122a, 122b to surround the glass head 120. Top ends of one half of the multiple filaments 101~104 are coupled to one of the upper loop frames 122a, and bottom ends of the half of the multiple filaments 101~104 are coupled to the first lower loop frame 124. Top ends of the other half of the multiple filaments 105~108 are coupled to the other upper loop frame 122b and bottom ends of the half of the multiple filaments 105~108 are coupled to the second lower loop frame 126.

[0005] However, the conventional LED filament light bulb has the following drawbacks.

1. As a center support, the glass bar 100 is fragile and is vulnerable to support the overall weight of the multiple LEDs and an associated structure and withstand vibration arising from the overall weight. Suppose that an increase in luminance is a concern. In view of the structural limitation, LED filaments fail to be added by means of multiple LED modules stacked to each other. Therefore, the number of LEDs can't be increased through the modular approach.
2. As LED circuit prefers to have parallel connection, according to the conventional filament light bulb in Fig. 5, parallel circuit connection is not easy to be implemented because the LEDs 101~108 are far from the first power wire 21a and the second power wire 22a.
3. To increase the number of LEDs, more breakpoints must exist. Such necessity results in a loose structure that causes a shakable power wire connection structure and vibration of the filaments, rendering the entire filament-supporting structure insecure.

[0006] An objective of the present invention is to provide an LED light bulb structure with at least one light-emitting module, in which the at least one light-emitting module is arranged in a modular form and stacked to each other for easy expansion thereof and multiple LED filaments in each light-emitting module are connected in series to ensure increase in luminance and LED light bulb structures customized in terms of different luminance and different wattage according to desired shapes of the lamp body.

[0007] To achieve the foregoing objective, the light-emitting diode (LED) light bulb structure includes a glass stem, a first power wire, a second power wire, a first conducting bar, a second conducting bar and a first light-emitting module.

[0008] The first power wire and the second power wire are mounted in the glass stem with one end of each of the first power wire and the second power wire protruding beyond the glass stem.

[0009] The first conducting bar has one end thereof connected with the end of the first power wire protruding beyond the glass stem.

[0010] The second conducting bar has one end thereof connected with the end of the second power wire protruding beyond the glass stem.

[0011] The first light-emitting module has a top horizontal bar assembly, a bottom horizontal bar assembly, multiple fixing balls and multiple LED filaments.

[0012] One end of each of the top horizontal bar assembly and the bottom horizontal bar assembly is connected with the first conducting bar, and the other end of each of the horizontal bar assembly and the bottom horizontal bar assembly is connected with the second conducting bar.

[0013] The multiple fixing balls are mounted on the top horizontal bar assembly and the bottom horizontal bar assembly and are spaced apart to form multiple break-

points.

[0014] The multiple LED filaments are mounted between the top horizontal bar assembly and the bottom horizontal bar assembly to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments and the top horizontal bar assembly and the bottom horizontal bar assembly.

[0015] Given the design of the modular light-emitting modules and the conducting bars providing supporting and conducting functions, the light-emitting modules are more structurally stable and can be expanded based on users' demands, thereby enhancing luminance of the stackable light-emitting modules, facilitating the manufacture of the LED light bulbs, and effectively raising the production yield of the LED light bulbs. Additionally, the multiple fixing balls serve both as breakpoints of the power supply circuit loop and as elements good for building the light-emitting modules with higher structural strength.

[0016] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

IN THE DRAWINGS

[0017]

Fig. 1A is a perspective view of a first embodiment of an LED light bulb structure in accordance with the present invention;

Fig. 1B is a schematic side view of a first light-emitting module of the LED light bulb structure in Fig. 1A;

Fig. 2 is an effective circuit diagram illustrating alternating U turns containing LEDs in Fig. 1B;

Fig. 3 is a schematic view illustrating an internal structure of one of the fixing balls of the LED light bulb structure in Fig. 1B;

Fig. 4 is a perspective view of a second embodiment of an LED light bulb structure in accordance with the present invention; and

Fig. 5 is a perspective view of a conventional filament light bulb.

[0018] The present invention is to provide a mounting structure of multiple layers of light-emitting diode (LED) filaments inside an LED filament light bulb. The mounting structure can be expanded by using a modular arrangement with multiple LED modules stacked to each other, thereby effectively enhancing luminance of the LED filament light bulb and tailoring to the design of the LED filament light bulb with different lengths and sizes.

[0019] With reference to Figs. 1A and 1B, a first embodiment of an LED light bulb structure in accordance with the present invention includes a first light-emitting module 40, a glass body 10, a glass stem 20, a first power wire 21, a second power wire 22, a first conducting bar 31 and a second conducting bar 32.

[0020] The glass body 10 is sealed by internally vacuuming the glass body 10 and internally filling inert gas for heat dissipation. The glass stem 20 is mounted inside the glass body 10 and is located on a bottom of the glass body 10. The first power wire 21 and the second power wire 22 are mounted in the glass stem 20 and serve to connect to a power source underneath the glass stem 20. One end of each of the first power wire 21 and the second power wire 22 extends beyond the glass stem 20. The first conducting bar 31 is mounted on and protrudes upwards from a top of the glass stem 20. The second conducting bar 32 is mounted on and protrudes upwards from the top of the glass stem 20.

[0021] With further reference to Fig. 1A, the first light-emitting module 40 includes a top horizontal bar assembly and a bottom horizontal bar assembly. One end of each of the top horizontal bar assembly and the bottom horizontal bar assembly is connected with the first conducting bar 31, and the other end of each of the top horizontal bar assembly and the bottom horizontal bar assembly is connected with the second conducting bar 32. The first light-emitting module 40 includes multiple LED filaments 41, 43, 45, 47. The multiple LED filaments 41, 43, 45, 47 are mounted between the top horizontal bar assembly and the bottom horizontal bar assembly and are spaced apart from each other and constitute a series-connected structure in collaboration with the top horizontal bar assembly and the bottom horizontal bar assembly.

[0022] The first conducting bar 31 is L-shaped. A top end of the first conducting bar 31 is bent to extend toward the second conducting bar 32 and a middle portion of the top end of the first conducting bar 31 is curved to increase a structural strength of the first conducting bar 31. A bottom end of the first conducting bar 31 is connected with the first power wire 21. The second conducting bar 32 is L-shaped and a bottom end of the second conducting bar 32 is connected with the second power wire 22. The first conducting bar 31 and the second conducting bar 32 form a support frame for the first light-emitting module 40 and a second light-emitting module 50. Meanwhile, the first conducting bar 31 and the second conducting bar 32 are made of a metal material, which is preferred to be a nickel-iron alloy. Besides the support function, the first conducting bar 31 and the second conducting bar 32 can also function as conducting paths for the power source in connection with the first conducting bar 31 and the second conducting bar 32 to transmit power to the first light-emitting module 40 and the second light-emitting module 50.

[0023] As to detailed description of the first light-emitting module 40, with reference to Figs. 1B and 2, the top horizontal bar assembly has multiple upper bars 34a, 34c, 34e disconnected from each other and the bottom horizontal bar assembly has multiple lower bars 34b, 34d disconnected from each other. A fixing ball 42, 46 is connected between each two adjacent upper bars 34a, 34c, 34e, a fixing ball 44 is connected between the two lower bars, a fixing ball 48a is connected between the first conducting bar 31 and an adjacent lower bar 34b, and a fixing

ball 48b is connected between the second conducting bar 32 and an adjacent lower bar 34d. With reference to Fig. 2, the multiple fixing balls 42, 44, 46, 48a, 48b correspond to multiple breakpoints to form a single alternating U-shaped circuit loop in the first light-emitting module 40 for current to pass through the LED filaments 41, 43, 45, 47 and the top horizontal bar assembly and the bottom horizontal bar assembly.

[0024] The top bars 34a, 34c, 34e of the top horizontal bar assembly and the lower bars 34b, 34d of the lower horizontal bar assembly are made of a metal material, which is preferred to be a nickel-plated iron wire, for the purpose of having desired hardness and being a good conductor. The fixing balls 42, 44, 46, 48a, 48b are made of glass.

[0025] The present embodiment may further include at least one second light-emitting module 50 having an identical structure as the at least one first light-emitting module 40.

[0026] Given the at least one first light-emitting module 40, the at least one light-emitting module is stacked to each other in an upward direction as a building under construction supported by reinforced concrete columns, and may include multiple second light-emitting modules 50. In other words, the present invention can effectively enhance lumen of the LED filament light bulb and facilitate the manufacture of light bulbs with high luminance. Meanwhile, the first conducting bar 31 and the second conducting bar 32 are securely connected with the top bars 34a, 34c, 34e, the lower bars 34b, 34d and the fixing balls 42, 44, 46, 48a, 48b to provide a single circuit loop for lighting up the LED filaments 41, 43, 45, 47 and ensure a modular, stable and robust hardware supporting structure.

[0027] With reference to Fig. 3, a structure of the fixing ball 42 is shown. The fixing ball 42 serves to disconnect circuit loops, stands for one breakpoint, and is used to reinforce the hardware supporting structure. The fixing ball 42 is securely connected with two metal wires A, B. The metal wire A is divided into two sections A1, A2, in which the section A1 is a Dument wire buried in the fixing ball 42 and the section A2 is made of nickel-plated iron and is securely connected with the section A1. Similarly, the metal wire B is divided into two sections B1, B2, in which the section B1 is a Dument wire buried in the fixing ball 42 and the section B2 is made of nickel-plated iron and is securely connected with the section B1. In the present invention, the metal wires A1, B1 include but are not limited to Dument wire, and the metal wires A2, B2 include but are not limited to nick-iron alloy wires.

[0028] With reference to Fig. 4, based on the idea of a single circuit loop, a second embodiment of an LED filament light bulb in accordance with the present invention differs from the foregoing embodiment in a third light-emitting module 60 and a fourth light-emitting module 90.

[0029] The third light-emitting module 60 includes an upper ring 60a, a lower ring 60b, multiple fixing balls 71-77 and multiple LED filaments 61-68. The first conducting bar 31 and the second conducting bar 32 are securely connected with two portions of the upper ring 60a and two portions of the lower ring 60b. The fixing balls 71-80 are respectively formed on the upper ring 60a and the lower ring 60b, are spaced apart from each other, and are taken as breakpoints on the upper ring 60a and the lower ring 60b. The LED filaments 61-68 are securely connected between the upper ring 60a and the lower ring 60b to form an alternating U-shaped circuit loop for current to flow through the series-connected LED filaments and the upper ring 60a and the lower ring 60b. Two portions of the upper ring 60a are securely connected with two upper brackets 36a, 36b. One of the upper brackets 36a is securely connected with the first conducting bar 31. The other upper bracket 36b is securely connected with the second conducting bar 32. Two portions of the lower ring 60b are securely connected with two lower brackets 37a, 37b. One of the lower brackets 37a is securely connected with the first conducting bar 31. The other lower bracket 37b is securely connected with the second conducting bar 32. Please note that the upper brackets 36a, 36b and the lower brackets 37a, 37b are provided for the purpose of supporting the upper ring 60a and the lower ring 60b instead of electrically connecting the upper ring 60a and the lower ring 60b with the first conducting bar 31 and the second conducting bar 32. Similarly, the fourth light-emitting module 90 is structurally the same as the third light-emitting module 60.

[0030] The design adopting modular light-emitting modules and the first conducting bar 31 and the second conducting bar 32 with both supporting and conducting functions allows to stack multiple light-emitting modules for luminance increase, facilitate the manufacture, and raise the production yield. The curved portion of the first conducting bar 31 adaptive to a shape of the glass body 10 enhances structural stability of the LED filament light bulb. A shape of the first conducting bar 31 can be adjusted according to the shape of the glass body 10. Besides being the breakpoints of the alternating U-shape loop, the fixing balls 44, 46, 48a, 48b, 71-77 also increase a combined strength of the hardware supporting structure.

[0031] Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only. Changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

Claims

1. A light-emitting diode (LED) light bulb structure, **characterized in** comprising:

a glass stem (20);
a first power wire (21) and a second power wire (22) mounted in the glass stem (20) with one end of each of the first power wire (21) and the second power wire (22) protruding beyond the glass stem (20);
a first conducting bar (31) having one end thereof connected with the end of the first power wire (21) protruding beyond the glass stem (20);
a second conducting bar (32) having one end thereof connected with the end of the second power wire (22) protruding beyond the glass stem (20);
a first light-emitting module (40) having:

a top horizontal bar assembly and a bottom horizontal bar assembly, wherein one end of each of the top horizontal bar assembly and the bottom horizontal bar assembly is connected with the first conducting bar (31), and the other end of each of the horizontal bar assembly and the bottom horizontal bar assembly is connected with the second conducting bar (32);
multiple fixing balls (42, 44, 46, 48a, 48b) mounted on the top horizontal bar assembly and the bottom horizontal bar assembly and spaced apart to form multiple breakpoints; and
multiple LED filaments (41, 43, 45, 47) mounted between the top horizontal bar assembly and the bottom horizontal bar assembly to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments and the top horizontal bar assembly and the bottom horizontal bar assembly.

2. The LED light bulb structure as claimed in claim 1, further comprising:

at least one second light-emitting module, each one of the at least one second light-emitting module having:

a top horizontal bar assembly and a bottom horizontal bar assembly, wherein one end of each of the top horizontal bar assembly and the bottom horizontal bar assembly of the second light-emitting module is connected with the first conducting bar, and the other end of each of the horizontal bar assembly and the bottom horizontal bar assembly of the second light-emitting module is connected with the second conducting bar;
multiple fixing balls mounted on the top horizontal bar assembly and the bottom horizontal bar assembly of the second light-emitting module and spaced apart to form multiple breakpoints; and
multiple LED filaments mounted between the top horizontal bar assembly and the bottom horizontal bar assembly of the second light-emitting module to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments of the second light-emitting module and the top horizontal bar assembly and the bottom horizontal bar assembly of the second light-emitting module.

3. The LED light bulb structure as claimed in claim 1, wherein the multiple fixing balls of the first light-emitting module are made of glass.

4. The LED light bulb structure as claimed in claim 2, wherein the multiple fixing balls of the at least one second light-emitting module are made of glass.

5. A light-emitting diode (LED) light bulb structure, comprising:

a glass stem (20);
a first power wire (21) and a second power wire (22) mounted in the glass stem (20) with one end of each of the first power wire (21) and the second power wire (22) protruding beyond the glass stem (20);
a first conducting bar (31) having one end thereof connected with the end of the first power wire (21) protruding beyond the glass stem (20);
a second conducting bar (32) having one end thereof connected with the end of the second power wire (22) protruding beyond the glass stem (20);
a first light-emitting module (60) having:

an upper ring (60a) and a lower ring (60b), wherein a portion of each of the upper ring (60a) and the lower ring (60b) is connected with the first conducting bar (31), and another portion of each of the upper ring (60a) and the lower ring (60b) is connected with the second conducting bar (32); and
multiple fixing balls (71-77) respectively mounted on the upper ring (60a) and the lower ring (60b) and spaced apart to form multiple breakpoints; and
multiple LED filaments (61-68) mounted between the upper ring (60a) and the lower ring (60b) to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments (61-68) and the upper ring (60a) and the lower ring (60b).

6. The LED light bulb structure, further comprising:

at least one second light-emitting module (80), each one of the at least one second light-emitting module (80) having:

an upper ring (60a) and a lower ring (60b), wherein a portion of each of the upper ring (60a) and the lower ring (60b) of the second light-emitting module (80) is connected with the first conducting bar (31), and another portion of each of the upper ring (60a) and the lower ring (60b) of the second light-emitting module (80) is connected with the second conducting bar (32);
multiple fixing balls respectively mounted on the upper ring (60a) and the lower ring (60b) of the second light-emitting module (80) and spaced apart to form multiple breakpoints; and
multiple LED filaments mounted between the upper ring (60a) and the lower ring (60b) of the second light-emitting module (80) to form an alternating U-shaped series-connected circuit loop passing through the multiple LED filaments and the upper ring (60a) and the lower ring (60b) of the second light-emitting module (80).

7. The LED light bulb structure as claimed in claim 5, wherein the multiple fixing balls of the first light-emitting module (60) are made of glass.

8. The LED light bulb structure as claimed in claim 6, wherein the multiple fixing balls of the at least one second light-emitting module (80) are made of glass.

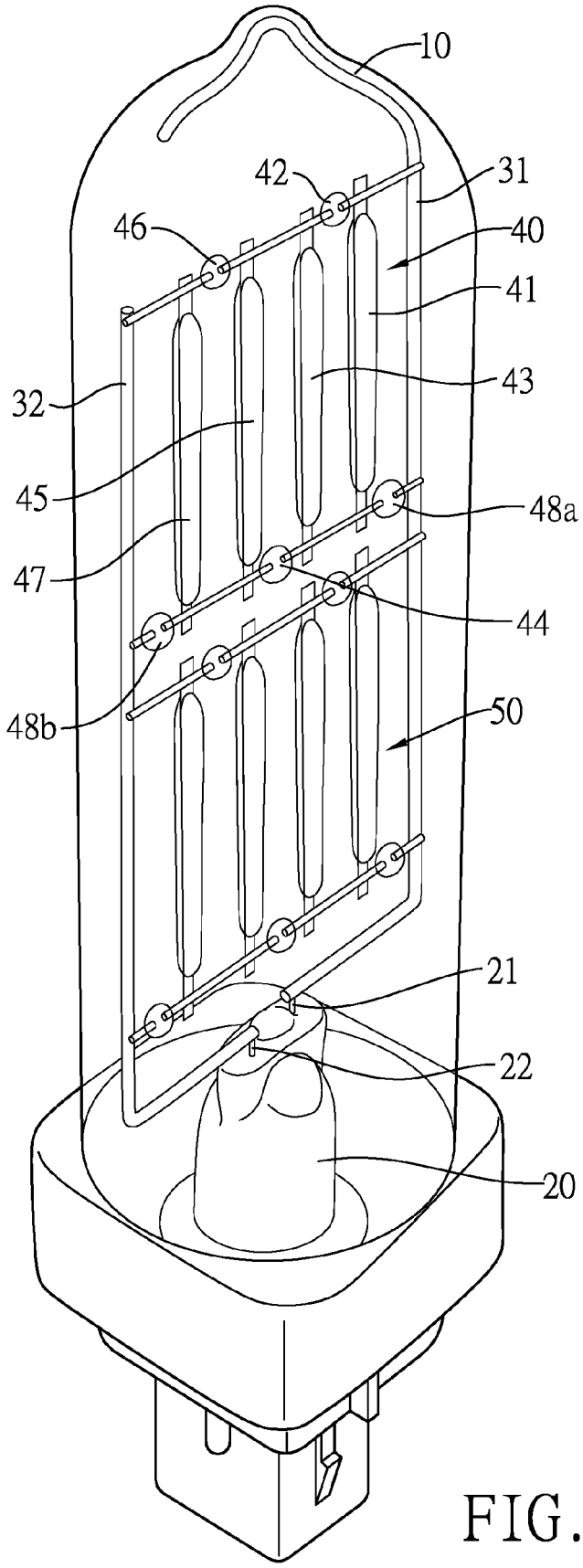

FIG. 1A

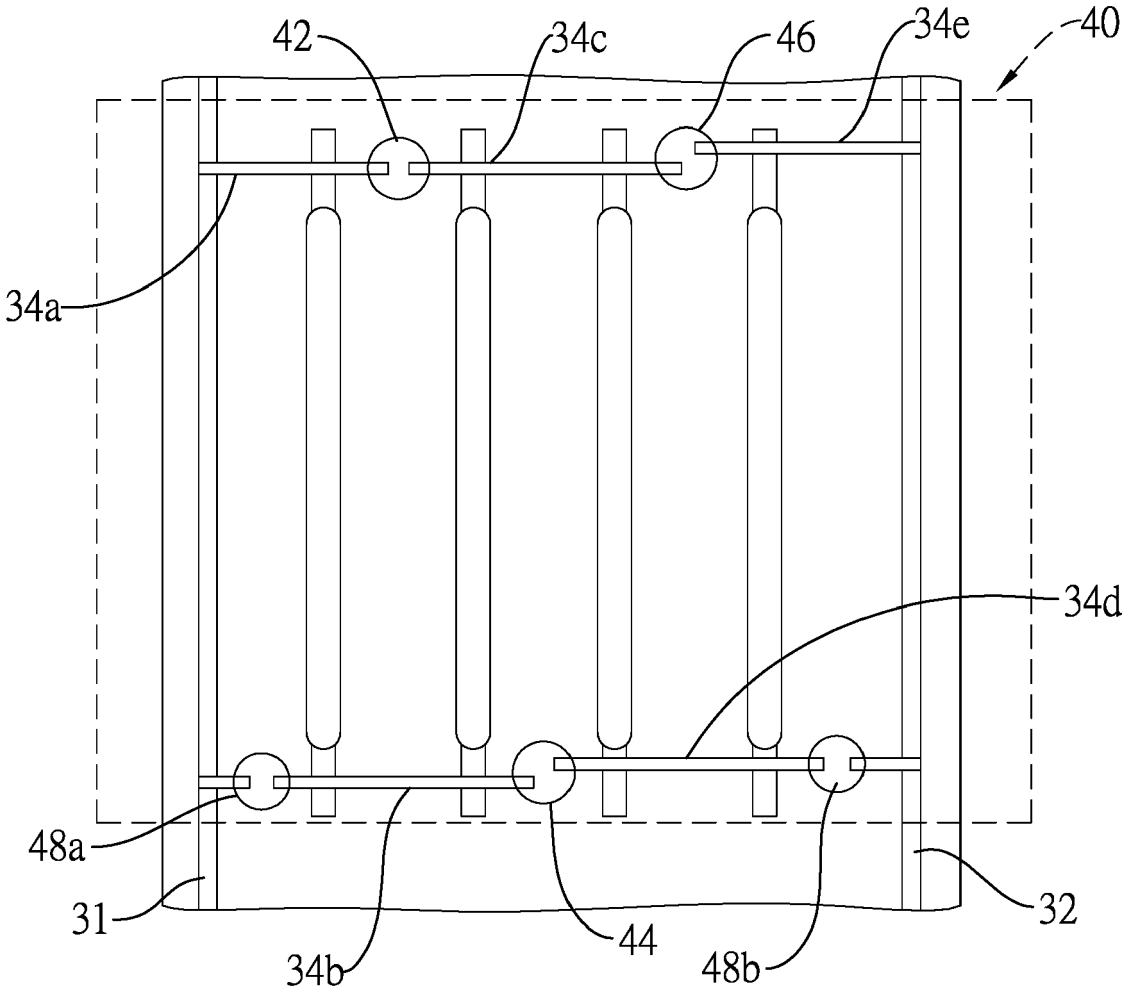

FIG. 1B

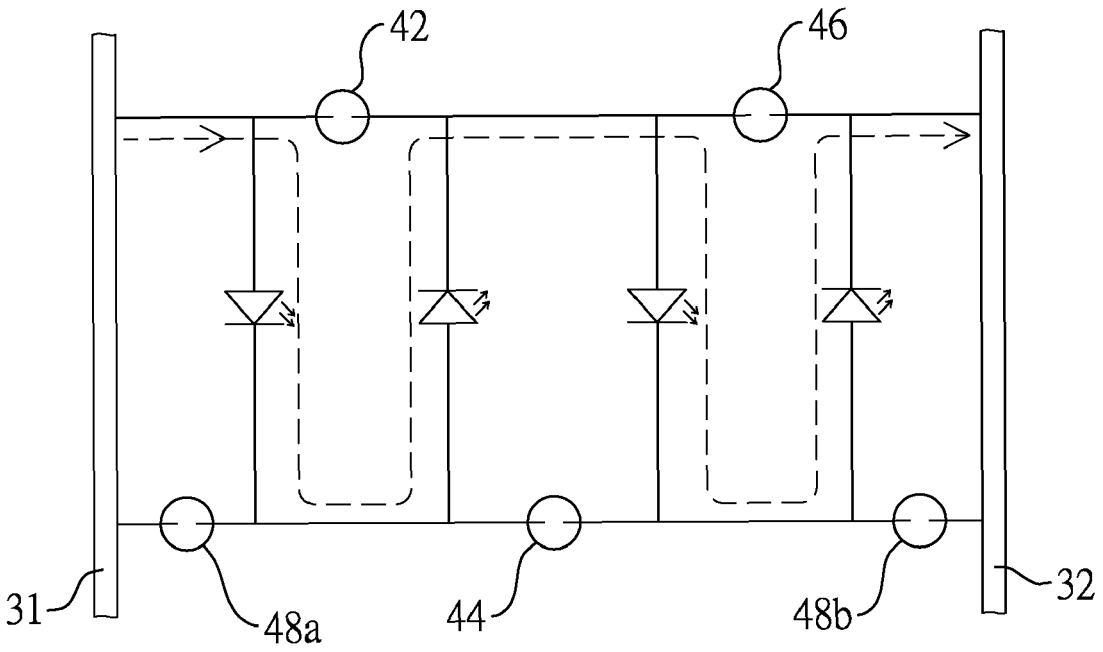

FIG. 2

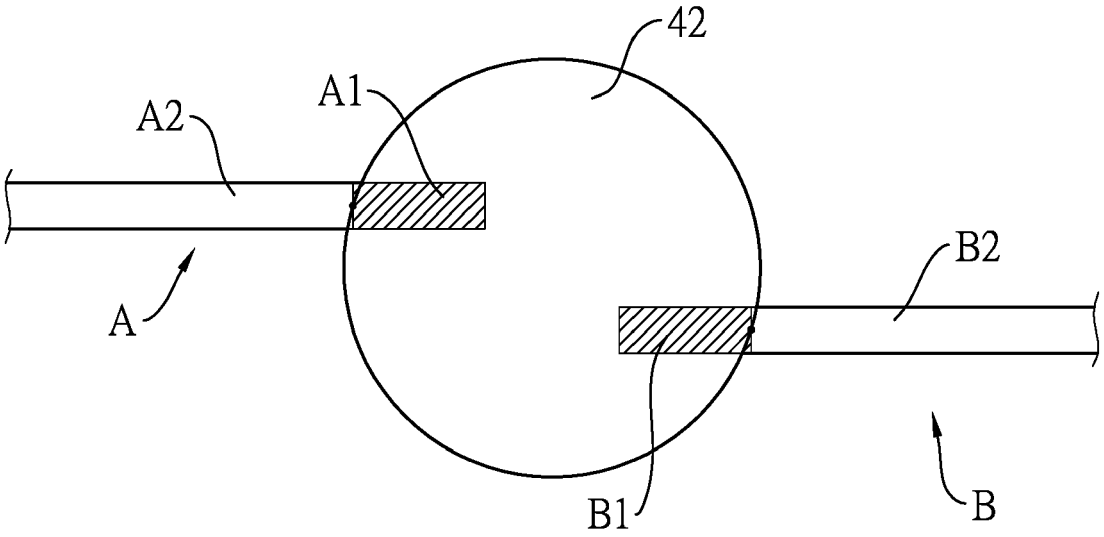

FIG. 3

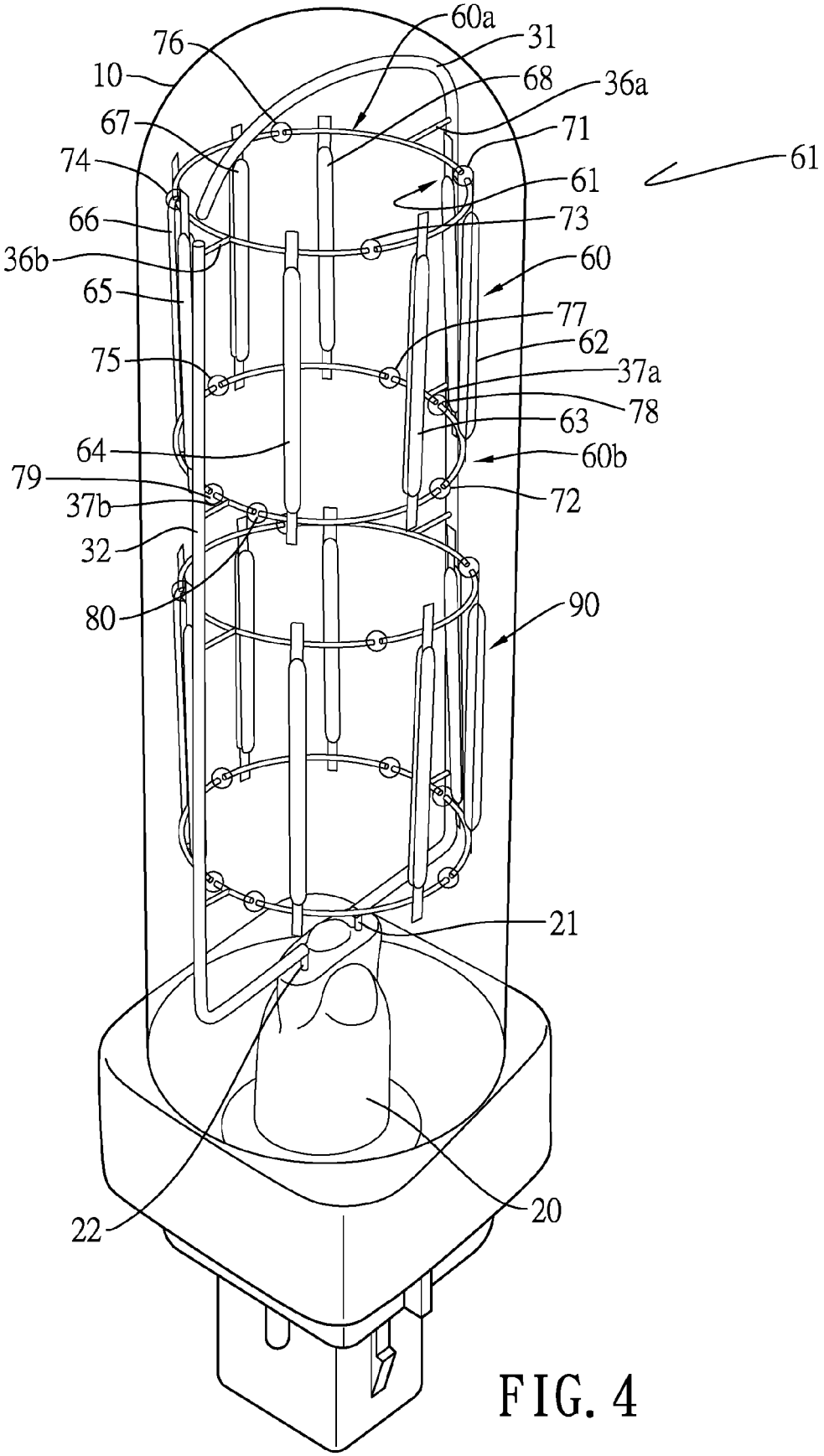
60a
31
76
10
68
36a
67
71
74
61
61
66
73
36b
60
65
77
62
75
37a
78
63
64
60b
79
72
37b
32
90
80
21
22
20

FIG. 4

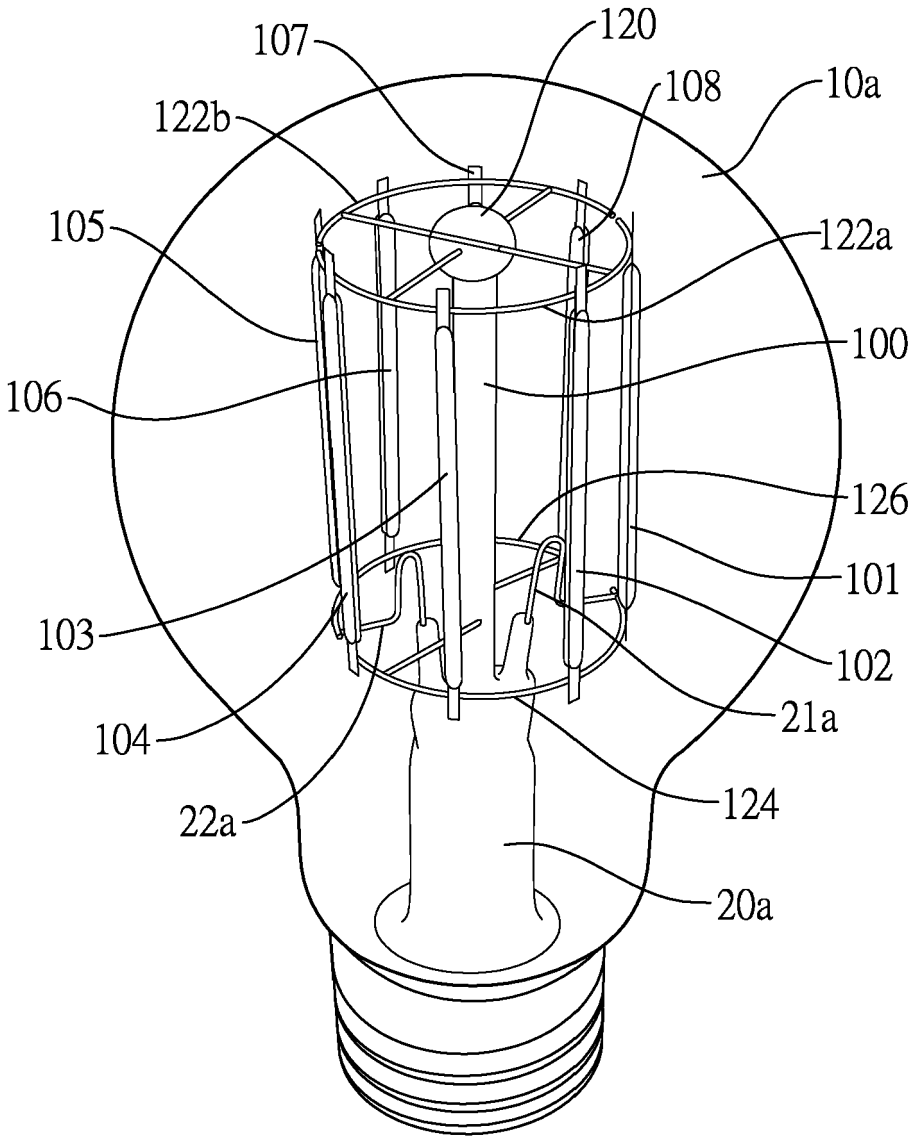
107
120
108
10a
122b
105
122a
100
106
126
101
103
102
21a
104
124
22a
20a

FIG. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 15 6859

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 236 907 A2 (LIQUIDLEDS LIGHTING CORP [KY]) 6 October 2010 (2010-10-06) * paragraph [0013] - paragraph [0023] * * figure 4 *	1-8	INV. F21K99/00 ADD. F21Y111/00 F21Y115/10
A	US 2014/375201 A1 (SU HWA [TW] ET AL) 25 December 2014 (2014-12-25) * paragraph [0022] - paragraph [0035] * * figures 1-4 *	1-8	
A	CN 103 899 943 A (ZHEJIANG LEDISON OPTOELECTRONICS CO LTD) 2 July 2014 (2014-07-02) * the whole document *	1-8	
A	US 2013/058080 A1 (GE SHICHAO [CN] ET AL) 7 March 2013 (2013-03-07) * paragraph [0134] - paragraph [0175] * * figures 1-5 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

F21K
F21Y
F21S

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 May 2016	Demirel, Mehmet

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
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 16 15 6859

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-05-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2236907 A2	06-10-2010	EP 2236907 A2	06-10-2010
		JP 2010245037 A	28-10-2010
		TW 201037212 A	16-10-2010
		US 2010253221 A1	07-10-2010
US 2014375201 A1	25-12-2014	CN 104235646 A	24-12-2014
		TW 201527691 A	16-07-2015
		US 2014375201 A1	25-12-2014
CN 103899943 A	02-07-2014	CN 103899943 A	02-07-2014
		HK 1198667 A1	22-05-2015
US 2013058080 A1	07-03-2013	AU 2011300999 A1	02-05-2013
		CA 2810658 A1	15-03-2012
		DK 2535640 T3	30-03-2015
		EP 2535640 A1	19-12-2012
		ES 2531050 T3	10-03-2015
		HK 1174089 A1	31-07-2015
		JP 5689524 B2	25-03-2015
		JP 2013522850 A	13-06-2013
		JP 2015053269 A	19-03-2015
		KR 20130079524 A	10-07-2013
		PT 2535640 E	27-02-2015
		RU 2013114922 A	20-10-2014
		SG 188483 A1	30-04-2013
		US 2013058080 A1	07-03-2013
		WO 2012031533 A1	15-03-2012

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- TW M389204 **[0002]**