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(54) Title: LED LAMP USING MID TECHNOLOGY

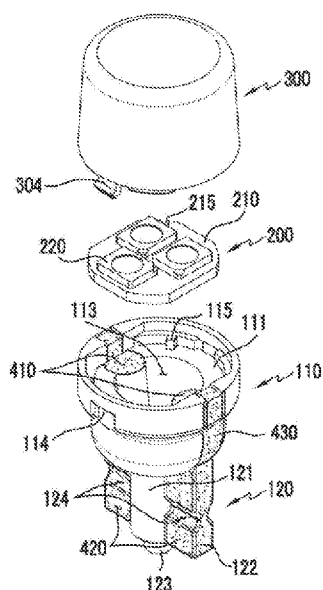


FIG. 4

(57) Abstract: The present disclosure relates to an LED lamp which has a structure capable of enhancing design freedom and simplifying a manufacturing process by applying MID technology, and the LED lamp of the present disclosure includes: a housing including a light source accommodation portion having a light source seating surface protruding inward, and a socket fastening portion having a fastening rib extending downward from the light source accommodation portion; a pair of light source mounting pads which are formed on a surface of the light source seating surface of the housing to have a light source mounted thereon; a pair of socket connection pads which are formed on a surface of the fastening rib of the housing to be connected to a socket electrode; a pair of traces which are formed along a surface of the housing to connect the light source mounting pads and the socket connection pads; and a light source unit which is seated on the light source mounting pads of the light source seating surface.

SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,  
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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## LED LAMP USING MID TECHNOLOGY

### RELATED APPLICATIONS

[0001] This application claims priority to Korean Application No. 10-2016-0180808, filed December 28, 2016, which is incorporated herein by reference in its entirety.

### TECHNICAL FIELD

[0002] The present disclosure relates to a light emitting diode (LED) lamp, and more particularly, to an LED lamp which has a structure capable of enhancing design freedom and simplifying a manufacturing process using molded interconnection device (MID) technology.

### BACKGROUND ART

[0003] The light emitting diode (hereinafter, referred to as "LED") refers to an optoelectronic device that has a junction structure of P-type and N-type semiconductors, and emits light energy due to combination of electrons and holes when a voltage is applied. The LEDs are replacing halogen lamps as light sources of various lighting devices since they consume less power, provide enhanced brightness, and have a long lifespan in comparison to normal halogen lamps. Furthermore, as an LED of white light develops in recent years, its application field rapidly expands, and the LED is widely used as a light source of a vehicle lamp as well as an indoor lamp or a portable lighting device.

[0004] Lamps normally used in vehicles are primarily used for a lighting function for viewing objects, a signal/warning function for informing other vehicles or other road users of a driving state of a driver's vehicle, and a decoration function for decorating vehicles. Representative lamps for the lighting function are ceiling lamps inside vehicles or number plate lighting lamps outside vehicles.

[0005] FIGS. 1 and 2 are an exploded perspective view and an assembly cross-sectional

view, respectively, showing a related-art vehicle LED lamp which is used for vehicle number plate lighting. As shown in the drawings, the related-art LED lamp includes a substrate 10, a thermal conductive cover 20, a diffusion tube 30, and a pair of lead wires 40.

[0006] The substrate 10 may have a plurality of elements including an LED 11 mounted thereon, has a predetermined circuit printed thereon to drive the LED 11, and is seated and supported on an upper end of the thermal conductive cover 20. The thermal conductive cover 20 is divided into an upper end body 21 for allowing the substrate 10 to be seated thereon, and a lower end body 22 for guiding the lead wires 40 and exposing the same to the outside. The diffusion tube 30 is formed in a hemispherical shape and is fastened to the upper end of the thermal conductive cover 20 to protect the LED 11 and to solve a spot phenomenon. The pair of lead wires 40 have upper ends connected to the bottom surface of the substrate 10, and protrude to the outside through a pair of penetrating holes 23 formed in the thermal conductive cover 20, and have lower ends bent in opposite directions to each other and inserted into wire seating recesses 24 of the thermal conductive cover 20.

[0007] The LED lamp configured as described above is fastened to a lamp socket (not shown), and the pair of lead wires 40 exposed to the outside are electrically connected with an external power source, such that the LED lamp is lit. In particular, as the LED lamp replaces an existing halogen lamp, there are effects that power consumption and heat generation can be reduced and the lifespan of the lamp extends.

[0008] However, the LED lamp should be provided with the lead wires 40 in order to be electrically connected with an external lamp socket, and the lead wires 40 should be electrically connected to the LED 11 through the substrate 10. Therefore, the related-art LED lamp has problems that numerous components are required to configure a lamp module and thus a manufacturing cost increases, and a manufacturing process becomes complicated by the assembly of the respective components.

[0009] Furthermore, the LED lamp should have shapes processed in the thermal conductive wire 20, for accommodating the lead wires 40, such as the wire penetrating holes 23 and the wire seating recesses 24. Therefore, the design freedom of the thermal conductive cover 20 forming the body of the related-art LED lamp is extremely limited, and there are many limitations in applying the LED lamp to lamp sockets of various structures.

[0010] Patent Document 0001: Korean Patent Laid-Open Publication No. 10-2012-0075012 (published on July 6, 2012, titled “LED LAMP FOR VEHICLE NUMBER PLATE)

## SUMMARY

[0011] The present disclosure has been suggested to solve the above-mentioned problems, and an object of the present disclosure is to provide an LED lamp which can reduce a manufacturing cost by simplifying a structure and an assembly process by omitting a configuration of a lead wire by applying MID technology to a related-art LED lamp, and can enhance production efficiency.

[0012] In addition, another object of the present disclosure is to provide an LED lamp which can enhance design freedom of a housing forming a main body of the LED lamp, and thus can be applied to lamp sockets of various structures.

[0013] Still another object of the present disclosure is to provide an LED lamp which can simplify a structure and a manufacturing process by directly mounting an LED package forming a light source on an electrode pad of a housing.

[0014] To achieve the above-described objects, an LED lamp of the present disclosure includes: a housing including a light source accommodation portion having a light source seating surface protruding inward, and a socket fastening portion having a fastening rib extending downward from the light source accommodation portion; a pair of light source mounting pads which are formed on a surface of the light source seating surface of the housing to have a light source mounted thereon; a pair of socket connection pads which are formed on a surface of the fastening rib of the housing to be connected to a socket electrode; a pair of traces which are formed on the housing to connect the light source mounting pads and the socket connection pads; and a light source unit which is seated on the light source mounting pads of the light source seating surface.

[0015] Herein, the light source unit may include an LED package, and the LED package may be surface mounted on the light source mounting pads, and the housing may be formed of a plastic injection molding of a high heat resistant resin.

[0016] In addition, the LED lamp may further include a reflector which is formed along an inner surface of the light source accommodation portion, and the reflector may be formed of a same material as that of the light source mounting pads.

[0017] In addition, the light source accommodation portion may have a heat radiating hole for fluidly communicating an inner space to an outside.

[0018] In addition, the LED lamp may further include: a heat radiating coating layer which is formed by coating a thermal conductive resin over the surface of the housing; and a diffusion cover which is fastened to an upper opening of the light source accommodation portion.

[0019] The LED lamp of the present disclosure has an electrode pad of a thin film directly formed on the surface of the housing using MID technology, such that there are effects that a structure and an assembly process can be simplified as a lead wire is omitted, and a manufacturing cost can be reduced and production efficiency can be enhanced.

[0020] In addition, in the LED lamp of the present disclosure, various elements including LED packages are directly mounted on the housing, and thus a substrate for mounting these is removed, such that a structure and an assembly process can be simplified.

[0021] In addition, the housing forming the main body of the LED lamp of the present disclosure can be implemented in various designs without regard to a fastening structure of a lead wire and a substrate, and a lamp applicable to various types of lamp sockets can be designed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is an exploded perspective view showing a related-art vehicle number plate LED lamp;

[0023] FIG. 2 is a cross-sectional view showing the vehicle number plate LED lamp of FIG. 1;

[0024] FIG. 3 is a perspective view showing an LED lamp according to one embodiment of the present disclosure;

- [0025] FIG. 4 is an exploded perspective view showing the LED lamp of FIG. 3;
- [0026] FIG. 5 is a top view showing a housing which is a main part of FIG. 3;
- [0027] FIG. 6 is a bottom view showing the housing which is the main part of FIG. 3; and
- [0028] FIG. 7 is a perspective view showing an LED lamp according to another embodiment of the present disclosure.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] The present disclosure and the technical objects achieved by embodiments of the present disclosure will be more apparent by preferred embodiments of the present disclosure which will be described below. Embodiments presented below are merely examples for describing the present disclosure, and are not intended to limit the scope of the present disclosure. In the description of the present disclosure, expressions “upper,” “lower,” “front,” “rear,” “left,” “right,” or the like indicate orders, positions, directions, or the like which are relative to one another, and are not limited to their dictionary definitions. In addition, an LED lamp described in the present disclosure refers to a head portion of a lighting module which is fastened to an external lamp socket and is supplied with power by the lamp socket.

[0030] FIG. 3 is a perspective view showing an LED lamp according to one embodiment of the present disclosure, FIG. 4 is an exploded perspective view showing the LED lamp of FIG. 3, and FIGS. 5 and 6 are a top view and a bottom view showing a housing which is a main part of FIG. 3, respectively.

[0031] As shown in these drawings, the LED lamp according to one embodiment of the present disclosure includes a housing 100 forming a body of the lamp, a light source module 200 seated on an upper portion of the housing, a diffusion cover 300 for sealing an upper opening of the housing, and a surface electrode 400 formed on a surface of the housing.

[0032] The housing 100 forms a main body of the LED lamp, and has an upper portion for accommodating the light source module 200 and a lower portion fastened to an external lamp socket (not shown). To achieve this, the housing 100 includes a light source accommodation

portion 110 formed on the upper portion thereof to accommodate the light source module 200, and a socket fastening portion 120 formed on the lower portion thereof to be fastened to the lamp socket.

[0033] The light source accommodation portion 110 is formed in a hollow cup shape and provides a light source seating surface 111 formed therein, and the light source seating surface 111 protrudes inward from an inner wall surface of the light source accommodation portion 110 of the cup shape. A pair of light source mounting pads 410 are formed on the light source seating surface 111 to be electrically separated from each other to supply power to the light source module 200.

[0034] The light source accommodation portion 110 has a heat radiating hole 113 having an interior divided into a plurality of spaces by a reinforcing rib 112 and having a penetrating lower end. The heat radiating hole 113 fluidly communicates the inner space of the light source accommodation portion 110 to the outside, thereby rapidly discharging heat generated in the light source module 200 to the outside. The heat radiating hole 113 may form a honeycombed structure which is divided by the plurality of reinforcing ribs 112. In addition, the light source accommodation portion 110 may further include a plurality of heat radiating ribs protruding outward so as to allow heat absorbed from the light source module 200 to be rapidly discharged to the outside through the surface of the housing.

[0035] A plurality of fastening recesses 114 may be formed on an edge of an upper end of the light source accommodation portion 110 so as to have the diffusion cover 300 fastened thereto, and a guide protrusion 115 may be formed on an inner wall of the upper end of the light source accommodation portion 110 to guide fastening of the light source module 200 and to distinguish a polarity.

[0036] The socket fastening portion 120 is provided with fastening ribs 122 extending downward from the center portion of the light source accommodation portion 110, and the fastening ribs 122 may protrude toward both sides of a center shaft 121 of a pillar shape. In addition, the socket fastening portion 120 is provided with an excess insertion prevention protrusion 123 protruding from an end of the center shaft 121, and the excess insertion prevention protrusion 123 prevents excess insertion when the LED lamp is inserted into a lamp socket. In addition, the socket fastening portion 120 is provided with a release prevention locking portion

124 recessed into or protruding from the surface of the fastening rib 122, and the release prevention locking portion 124 prevents the LED lamp from being easily released from the lamp socket due to a vibration, etc. when the LED lamp is fastened to the lamp socket, and is engaged with the lamp socket having a protruding or recessed shape, thereby enhancing reliability of electrode contact.

[0037] The housing 100 configured as described above may be manufactured by injection molding using a plastic resin. In this case, preferably, the housing 100 may be formed of a resin of a material having high thermal conductivity so as to rapidly discharge heat generated in the light source module 200. In addition, a heat radiating resin layer may be further coated over the surface of the housing 100 using a resin of high thermal conductivity so as to radiate heat. The heat radiating resin layer is coated along the surface of the housing 100 and the surface of the surface electrode 400 to have a predetermined thickness, and functions to absorb heat of the housing 100 and the surface electrode 400 and to discharge heat to the outside.

[0038] The light source module 200, which is a light source of the LED lamp, forms a module which has a plurality of LED packages 220 mounted on a substrate 210. The LED packages 220 may be formed of a plurality of LED elements emitting light of different colors, and the substrate 210 may be formed of a flat type printed circuit board (PCB) or flexible PCB (FPCB). A circuit pattern is printed on the substrate 210, and the LED packages 220 and various elements for controlling driving of the LED packages 220 are mounted on the circuit pattern. In addition, the substrate 210 has a guide recess 215 formed therein to correspond to the guide protrusion 115 of the light source accommodation portion 110.

[0039] The light source module 200 is assembled by being seated on the light source seating surface 111 through the upper opening of the light source accommodation portion 110, and in this case, the light source module 200 is electrically connected to the light source mounting pad 410 formed on the light source seating surface 111. In this case, preferably, the housing 100 may be formed of a high heat resistant material which can sufficiently withstands a reflow process for seating the substrate.

[0040] The diffusion cover 300 is formed in a hemispherical or cylindrical shape, and has a hollow formed therein and a lower portion opened, and is assembled with the light source accommodation portion 100 so as to seal the opening of the light source accommodation portion

110. Fastening protrusions 304 are formed at an edge of a lower end of the diffusion cover 300 to correspond to the fastening recesses 114 of the light source accommodation portion 110, such that the diffusion cover 300 is removably assembled with the light source accommodation portion 110. Such diffusion cover 300 provides a light mixing space inside to allow light emitted from the LED package 220 to be sufficiently mixed in the space, such that a spot phenomenon of light emitted through the diffusion cover 300 can be minimized. The diffusion cover 300 may be formed of a resin of a transparent or translucent material to which a light diffusing agent is added.

[0041] The surface electrode 400 is a lead electrode for supplying power to the light source module 300 through the surface of the housing 100, and, in the present disclosure, the surface electrode 400 may be formed of an electrode having a conductive metal of a thin film directly formed on the surface of the housing 100, and may be formed by using MID technology.

[0042] In general, the MID technology is technology for implementing a circuit by forming a pattern on a surface or an inside of a plastic injection molding, and makes it possible to fabricate a three-dimensional (3D) electric component. In recent years, plastic molding products for diverse purposes which have a circuit directly formed on a 3D injection molding using the MID technology are introduced, and a pattern which can be metallized may be formed on a surface of an injection molding through laser direct structuring (LDS), laser masking (LDAT/Modat), physical vapor deposition (PVD), or the like, as a method for giving a conductive pattern to a plastic injection molding, and then a conductive circuit of a thin film may be formed using electroless plating or electro plating. As a method for giving a conductive pattern applied to the present disclosure, various kinds of MID technology can be applied in addition to the above-described methods.

[0043] The surface electrode 400 may include the pair of light source mounting pads 410 formed on the surface of the light source seating surface 111 of the light source accommodation portion 100, a pair of socket connection pads 420 formed on the surfaces of the fastening ribs 122 of the socket fastening portion 120, and a pair of traces 430 formed along the surface of the housing 100 to connect the light source mounting pads 410 and the socket connection pads 420.

[0044] The pair of light source mounting pads 410 may supply power to the light source module 400 mounted on the light source seating surface 111, and the pair of socket connection pads 420 is in contact with an electrode of the lamp socket to receive power from the lamp socket.

The surface electrode 400 may transmit power supplied from the socket connection pads 420 to the light source mounting pads 410 through the traces 430, thereby lighting the light source module 400. In this case, the traces 430 are formed along an outer surface of the housing or a surface of a via hole penetrating through the housing, and connect the light source mounting pads 410 and the socket connection pads 420.

[0045] Accordingly, in the LED lamp of the present disclosure, the lead electrode for supplying power is directly formed on the surface of the housing using the MID process, such that the housing 100 can have various 3D shapes and thus there is an advantage of enhanced design freedom of the shape of the LED lamp. In addition, the present disclosure does not require a separate lead wire for supplying power to the light source module 200, and thus can simplify a structure and an assembly process.

[0046] FIG. 7 is a perspective view showing an LED lamp according to another embodiment of the present disclosure. In the LED lamp according to another embodiment, the LED package is directly mounted in the housing.

[0047] Specifically, referring to the drawing, the light source accommodation portion 110 provides the light source seating surface 111 in an inner space thereof, and the pair of light source mounting pads 410 are formed on the light source seating surface 111. The LED package 220 is directly seated on the light source mounting pads 410 on the light source seating surface 111 by surface mounting. In this case, various control elements for driving the LED package 220 may be surface mounted on a separate circuit portion formed on the other side surface of the housing 100 by the trace 430.

[0048] The housing 100 should be formed by a high heat resistant material which can sufficiently withstand a reflow process, such that the LED package 220 can be directly surface mounted on the housing 100. For example, the housing 100 may be formed by using a resin based on polyetherimide (PET), polyphthalamide (PPA), liquid crystal polymer (LCP), or polyamide (PA), and preferably, may be formed of a resin which is resistant to high temperature greater than or equal to about 280°C. Since the LED package 220 is directly mounted on the surface of the housing 100 described above, there is an advantage that a separate substrate such as a PCB or an FPCB having a circuit printed thereon is not required.

[0049] The LED package 220 may be mounted on the housing 111 by using a conductive

adhesive, in addition to the surface mounting process, and in this case, the housing 100 may be formed of a normal plastic injection molding rather than a high heat resistant material.

[0050] In addition, the LED lamp may further include a reflector 440 formed along an inner surface of the light source accommodation portion 110. The reflector 440 prevents light emitted from the LED package 220 from being absorbed into the light source accommodation portion 110, and may reflect light inside the light source accommodation portion 110, thereby enhancing brightness of the LED lamp.

[0051] Such reflector 440 may be formed by coating a resin mixed with a light reflector over an inner surface of the light source accommodation portion 110, and may be formed of the same material as that of the light source mounting pads 410. Since conductive metal forming the light source mounting pads 410 normally shows excellent light reflectivity, when the reflector 440 is formed of the same material as that of the light source mounting pads 410, the light reflector 440 may be formed with the light source mounting pads 410 through a plating process, and thus there is an advantage that a separate process for forming the reflector 440 is not added. In this case, preferably, the reflector 440 may be divided into a pair of reflectors and may be formed on as wide a region of the inner surface of the light source accommodation portion 440 as possible.

[0052] Although the present disclosure has been described with reference to one embodiment illustrated in the drawings, it will be understood by an ordinary person skilled in the related art that various changes can be made therefrom and other equivalent embodiments are possible.

**What is claimed is:**

1. An LED lamp comprising:
  - a housing comprising a light source accommodation portion having a light source seating surface protruding inward, and a socket fastening portion having a fastening rib extending downward from the light source accommodation portion;
  - a pair of light source mounting pads which are formed on a surface of the light source seating surface of the housing to have a light source mounted thereon;
  - a pair of socket connection pads which are formed on a surface of the fastening rib of the housing to be connected to a socket electrode;
  - a pair of traces which are formed on the housing to connect the light source mounting pads and the socket connection pads; and
  - a light source unit which is seated on the light source mounting pads of the light source seating surface.
2. The LED lamp of claim 1, wherein the light source unit comprises an LED package, and the LED package is surface mounted on the light source mounting pads.
3. The LED lamp of claim 1, wherein the housing is formed of a plastic injection molding of a high heat resistant resin.
4. The LED lamp of claim 1, further comprising a reflector which is formed along an inner surface of the light source accommodation portion.
5. The LED lamp of claim 4, wherein the reflector is formed of a same material as that of the light source mounting pads.
6. The LED lamp of claim 1, wherein the light source accommodation portion has a heat radiating hole for fluidly communicating an inner space to an outside.
7. The LED lamp of claim 1, further comprising a heat radiating coating layer which is formed by coating a thermal conductive resin over the surface of the housing.

8. The LED lamp of claim 1, further comprising a diffusion cover which is fastened to an upper opening of the light source accommodation portion.

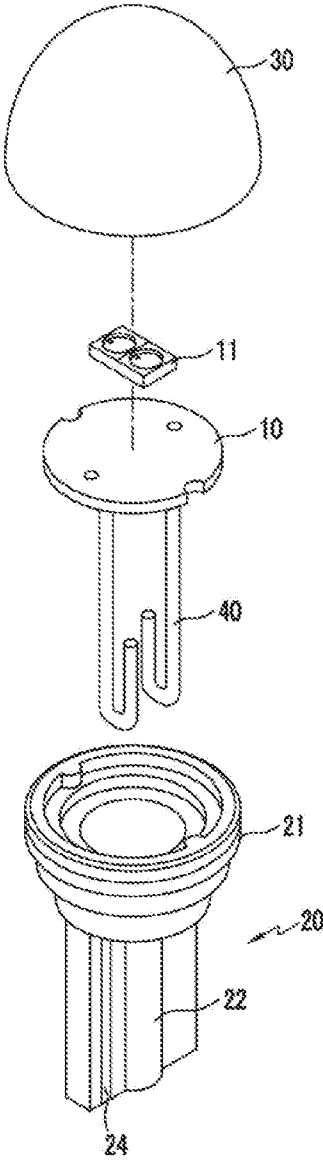


FIG. 1

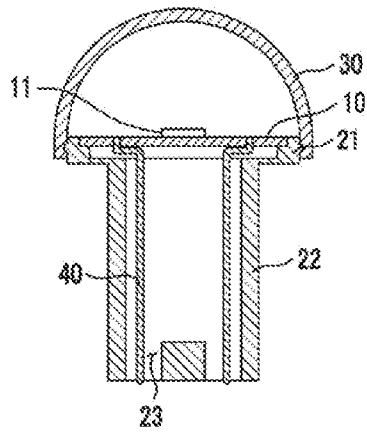


FIG. 2

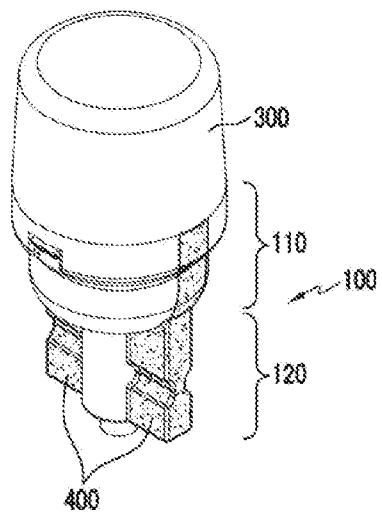


FIG. 3

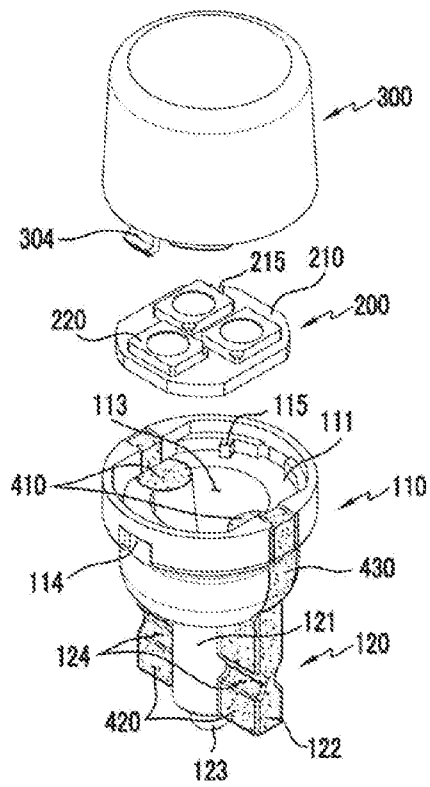


FIG. 4

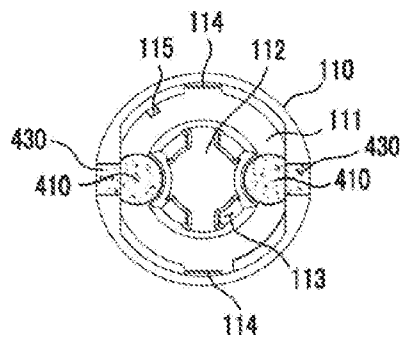


FIG. 5

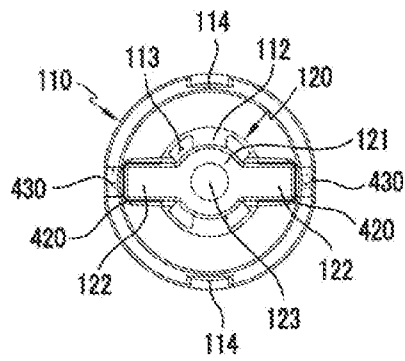


FIG. 6

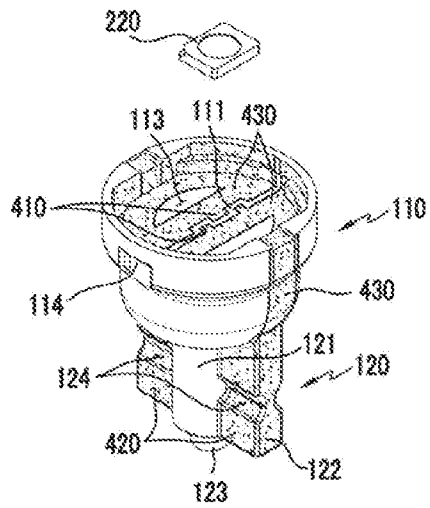


FIG. 7

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2017/066350****A. CLASSIFICATION OF SUBJECT MATTER****F21V 15/01(2006.01)i, F21K 9/68(2016.01)i, F21V 29/87(2014.01)i, F21Y 115/10(2016.01)i**

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 15/01; F21V 29/83; F21S 2/00; F21V 29/00; F21V 7/22; F21Y 101/02; F21K 99/00; F21K 9/68; F21V 29/87; F21Y 115/10

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; Keywords: lamp, reflect, heat, mount, MID

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                         | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | JP 2012-234628 A (SHARP CORP.) 29 November 2012<br>See paragraphs 32-50, claim 1 and figures 1-8.          | 1-4, 6-8              |
| A         |                                                                                                            | 5                     |
| Y         | KR 10-0904211 B1 (KIM SUNG WAN) 25 June 2009<br>See paragraphs 20-44 and figures 2-7.                      | 1-4, 6-8              |
| Y         | JP 2016-518013 A (TECHNICAL CONSUMER PRODUCTS INC.) 20 June 2016<br>See paragraphs 8-18 and figures 1A-3B. | 4                     |
| Y         | KR 20-2011-0011435 U (CHYN, WEN-LONG) 12 December 2011<br>See paragraphs 36-48 and figures 1-6.            | 6                     |
| Y         | US 2015-0131300 A1 (MOLEX INCORPORATED) 14 May 2015<br>See paragraphs 26-32 and figures 1-6.               | 7                     |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

09 April 2018 (09.04.2018)

Date of mailing of the international search report

**09 April 2018 (09.04.2018)**

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

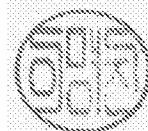


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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2017/066350**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                     | Publication<br>date                                                                            |
|-------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| JP 2012-234628 A                          | 29/11/2012          | None                                                                                                                           |                                                                                                |
| KR 10-0904211 B1                          | 25/06/2009          | None                                                                                                                           |                                                                                                |
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| KR 20-2011-0011435 U                      | 12/12/2011          | None                                                                                                                           |                                                                                                |
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