



(11) **EP 2 317 207 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
18.04.2012 Bulletin 2012/16

(51) Int Cl.:
F21K 99/00 ^(2010.01) **F21Y 101/02** ^(2006.01)

(21) Application number: **09174466.4**

(22) Date of filing: **29.10.2009**

(54) **Full angle led illumination device**

360-Grad-LED-Beleuchtungsvorrichtung

Dispositif d'éclairage à DEL émettant dans toutes les directions

(84) Designated Contracting States:
**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 SE SI SK SM TR**

(43) Date of publication of application:
04.05.2011 Bulletin 2011/18

(73) Proprietor: **Chang, Chia-Cheng**
Taipei County 244 (TW)

(72) Inventors:
• **Chang, Chia-Cheng**
Taipei County 244 (TW)

• **Chang, Rong-Ming**
Taipei County 244 (TW)

(74) Representative: **Becker Kurig Straus**
Patentanwälte
Bavariastrasse 7
80336 München (DE)

(56) References cited:
DE-U1- 20 300 806 DE-U1- 20 314 298
US-A1- 2009 135 595

EP 2 317 207 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Technical Field

[0001] The present invention relates to a LED (light-emitting diode) illumination device and, more particularly, to a full angle LED illumination device capable of providing full angle illumination range and having improved thermal conductivity and heat dissipation capability in order to prolong the lifetime of the LED chips in use.

Background

[0002] Typically, a plurality of LEDs (light-emitting diodes) are arranged on the same plane of a main body to form a conventional LED illumination device in order to provide wider illumination range and better illumination intensity. By using above planar type LED illumination devices, it is able to obtain 180-degree illumination range after the LEDs are driven.

[0003] Although 180-degree illumination range can be achieved by means of above LED arrangement, the practical illumination effect provided by above LED illumination devices is not ideal. In order to widen the illumination range, two planar type LED illumination devices are combined to form a new device, the illumination of which is almost 360 degree.

[0004] However, it is also disadvantageous in several aspects to combine two planar type LED illumination devices mentioned hereinabove.

[0005] First of all, dead angles still exist even two planar type LED illumination devices are combined and it is unable to achieve 360-degree illumination range. Second, the assembling cost for combining two planar type LED illumination devices is greatly increased. Besides, assembling two planar type LED illumination devices not only requires highly complicated and difficult technical skills but also takes much longer time. Moreover, the yield of the devices produced by assembling two planar type LED illumination devices is low as well. DE 203 142984 describes a LED device comprising circuit boards which intersect and carry LEDs on their edges.

[0006] In order to overcome above shortcomings, inventor had the motive to study and develop the present invention. After hard research and development, the inventor provides a full angle LED illumination device advantageous in providing full angle illumination range, having lower manufacturing cost, and having improved thermal conductivity and heat dissipation capability in order to prolong the lifetime of the LED chips in use.

Summary of the disclosure

[0007] An object of the present invention is to provide a full angle LED (light-emitting diode) illumination device, which is made by arranging plural copper base plates in a crisscross pattern to form the backbone of a three-dimensional globe and providing LED chips on the external

surface of the three-dimensional globe at sites where any two copper base plates are crisscrossed. Thereby, LED chips are able to illuminate in different angle ranges in order to eliminate dead angles and achieve three-dimensional illumination effect.

[0008] Another object of the present invention is to provide a full angle LED illumination device, where each copper base plate is electroplated with a layer of silver thereon. Thereby, thermal conductivity and heat dissipation capability can be improved in order to prolong the lifetime of the LED chips in use while to keep the manufacturing cost low.

[0009] In order to achieve above objects, the present invention provides a full angle LED illumination device comprising at least three copper base plates, a plurality of LED chips, and a flexible circuit layer. The copper base plates are arranged in a crisscross pattern to form the backbone of a three-dimensional globe and each copper base plate is electroplated with a layer of silver thereon. Each LED chip is provided on the external surface of the three-dimensional globe at a site where any two copper base plates are crisscrossed. The flexible circuit layer is provided on the peripheries of the copper base plates and electrically connected with the LED chips for controlling the LED chips. Accordingly, it is able to provide full angle illumination range and to improve the thermal conductivity and heat dissipation capability in order to prolong the lifetime of the LED chips in use effectively.

[0010] In practice, the full angle LED illumination device preferably includes three copper base plates and six LED chips. The copper base plates are arranged to be vertical to each other to form the backbone of a three-dimensional globe while the LED chips are provided on the external surface of the three-dimensional globe at sites where any two copper base plates are crisscrossed.

[0011] The following detailed description, given by way of examples or embodiments, will best be understood in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0012] Fig. 1 shows a perspective view of a full angle LED illumination device of the present invention.

[0013] Fig. 2 shows a top view of the full angle LED illumination device of the present invention.

Detailed Description

[0014] The present invention discloses a full angle LED (light-emitting diode) illumination device comprising at least three copper base plates, a plurality of LED chips, and a flexible circuit layer. The copper base plates are arranged in a crisscross pattern to form the backbone of a three-dimensional globe. Each LED chip is provided on the external surface of the three-dimensional globe at a site where any two copper base plates are crisscrossed. The flexible circuit layer is provided on the peripheries of the copper base plates and electrically con-

nected with the LED chips for controlling the LED chips.

[0015] Please refer to Figs. 1 and 2 showing a preferred embodiment of the full angle LED illumination device of the present invention. In this embodiment, the full angle LED illumination device comprises three copper base plates 10, 12, 14, six LED chips 20, six covers 40, and a flexible circuit layer 30.

[0016] The copper base plates 10, 12, 14 are arranged to be vertical to each other to form the backbone of a three-dimensional globe. Above copper base plates can be assembled by means of using any method. Besides. Each copper base plate 10, 12, 14 is electroplated with a layer of silver thereon in order to obtain optimal thermal conductivity and heat dissipation capability.

[0017] Heat will be inevitably produced when LED chips are used. If the produced heat is unable to dissipate effectively, the temperature of the LED chips will be elevated accordingly, which may shorten the lifetime of the LED chips. In order to solve this problem and prolong the lifetime of LED chips, metal is typically used to dissipate produced heat because of good thermal conductivity and heat dissipation capability.

[0018] In this embodiment, copper and silver are used as the material to solve the problem regarding thermal conductivity and heat dissipation. The thermal conductivity coefficient of copper is 380W/m.K while the thermal conductivity coefficient of silver is 429W/m.K. Accordingly, silver has better thermal conductivity when compared with copper. However, copper is much cheaper than silver.

[0019] Therefore, in the present invention, the copper is used as a core for thermal conductivity and heat dissipation and silver is electroplated on the surface of the core made of copper. In other words, copper and silver are used to form an alloy whose thermal conductivity is between those of copper and silver. Accordingly, better thermal conductivity and heat dissipation capability can be achieved while the cost can be kept low.

[0020] In practice, the thermal conductivity coefficient of the copper base plate electroplated with a layer of silver is about 420W/m.K. That is, the thermal conductivity of the copper base plate electroplated with a layer of silver is almost the same with that of silver while the cost of the electroplated copper base plate is much cheaper than that of silver. Besides, in addition to the better thermal conductivity and heat dissipation capability, the silver electroplated on the copper base plate is also able to provide reflection effect that is beneficial to increase effective luminous flux.

[0021] Each LED chip 20 is provided on the external surface of the three-dimensional globe at a site where any two copper base plates are crisscrossed and is covered with a cover 40. Thereby, the LED chips are able to illuminate in different angle ranges. Consequently, it is able to obtain full angle illumination range and eliminate dead angles effectively.

[0022] In this embodiment, the flexible circuit layer 30 is provided on the peripheries of the copper base plates

10, 12, 14 and electrically connected with the LED chips 20 for controlling and operating the LED chips 20.

[0023] Therefore, the present invention has following advantages:

1. By arranging at least three copper base plates in a crisscross pattern to form the backbone of a three-dimensional globe and disposing each LED chip on the external surface of the three-dimensional globe at a site where any two copper base plates are crisscrossed, it is able to obtain full angle illumination range and effectively eliminate dead angles.
2. The alloy formed by electroplating a layer of silver on the surface of a copper base plate has ideal thermal conductivity and heat dissipation capability and low manufacturing cost.
3. By electroplating a layer of silver on the surface of a copper base plate, the electroplated silver can provide better reflection effect in order to increase the effective luminous flux.

[0024] As disclosed in the above description and attached drawings, the present invention can provide a full angle LED illumination device capable of providing full angle illumination range and advantageous in having improved the thermal conductivity and heat dissipation capability in order to prolong the lifetime of the LED chips in use while keeping the manufacturing cost low. It is new and can be put into industrial use.

[0025] Although the embodiments of the present invention have been described in detail, many modifications and variations may be made by those skilled in the art from the teachings disclosed hereinabove.

Claims

1. A full angle LED (light-emitting diode) illumination device, comprising:

at least three copper base plates (10, 12, 14), where each copper base plate is electroplated with a layer of silver thereon, and the copper base plates (10, 12, 14) are arranged in a crisscross pattern to form the backbone of a three-dimensional globe;
a plurality of LED chips (20), each of which is provided on the external surface of the three-dimensional globe at a site where any two copper base plates are crisscrossed; and
a flexible circuit layer (30), provided on the peripheries of the copper base plates (10, 12, 14) and electrically connected with the LED chips (20) for controlling the LED chips (20).

2. The full angle LED illumination device as claimed in claim 1, wherein each LED chip (20) is further covered by a cover.

3. The full angle LED illumination device as claimed in claim 1, comprising three copper base plates (10, 12, 14) and six LED chips (20), wherein the copper base plates (10, 12, 14) are arranged to be vertical to each other to form the backbone of a three-dimensional globe; the LED chips (20) are provided on the external surface of the three-dimensional globe at sites where any two copper base plates are criss-crossed.
4. The full angle LED illumination device as claimed in claim 3, wherein each LED chip (20) is further covered by a cover (40).

Patentansprüche

1. Vollwinkel-LED-Beleuchtungseinheit (LED = Leuchtdiode), umfassend:
- mindestens drei Kupfergrundplatten (10, 12, 14), wobei jede Kupfergrundplatte galvanisch mit einer Silberschicht beschichtet ist, und die Kupfergrundplatten (10, 12, 14) kreuzweise zu einander angeordnet sind und so das Rückgrat einer dreidimensionalen Kugel bilden;
- eine Mehrzahl von LED-Chips (20), von denen jeder auf der Außenfläche der dreidimensionalen Kugel an einem Ort angeordnet ist, an dem jeweils zwei Kupfergrundplatten kreuzartig aufeinander treffen; und
- eine flexible Schaltungsschicht (30), die an den Peripherien der Kupfergrundplatten (10, 12, 14) vorgesehen und elektrisch mit den LED-Chips (20) zur Steuerung derselben verbunden ist.
2. Vollwinkel-LED-Beleuchtungseinheit nach Anspruch 1, wobei jeder LED-Chip (20) ferner mit einer Abdeckung abgedeckt ist.
3. Vollwinkel-LED-Beleuchtungseinheit nach Anspruch 1, umfassend drei Kupfergrundplatten (10, 12, 14) und sechs LED-Chips (20), wobei die Kupfergrundplatten (10, 12, 14) senkrecht zu einander angeordnet sind und so das Rückgrat einer dreidimensionalen Kugel bilden; die LED-Chips (20) auf der Außenfläche der dreidimensionalen Kugel an Orten angeordnet sind, an denen jeweils zwei Kupfergrundplatten kreuzartig aufeinander treffen.
4. Vollwinkel-LED-Beleuchtungseinheit nach Anspruch 3, wobei jeder LED-Chip (20) durch eine Abdeckung (40) abgedeckt ist.

Revendications

1. Dispositif d'éclairage à DEL (diodes électrolumines-

centes) émettant dans toutes les directions, comprenant :

au moins trois plaques de base en cuivre (10, 12, 14), dans lequel une couche d'argent est plaquée par dépôt électrolytique sur chaque plaque de base en cuivre, et les plaques de base en cuivre (10, 12, 14) sont agencées en quinconce pour former la dorsale d'un globe tridimensionnel ;

une pluralité de puces de DEL (20), chacune d'elles étant disposée sur la surface externe du globe tridimensionnel à un emplacement où deux plaques de base en cuivre quelconques s'entrecroisent ; et

une couche de circuit flexible (30), disposée sur les périphéries des plaques de base en cuivre (10, 12, 14) et reliée électriquement aux puces de DEL (20) pour commander les puces de DEL (20).

2. Dispositif d'éclairage à DEL émettant dans toutes les directions selon la revendication 1, dans lequel chaque puce de DEL (20) est en outre recouverte d'un cuivre.

3. Dispositif d'éclairage à DEL émettant dans toutes les directions selon la revendication 1, comprenant trois plaques de base en cuivre (10, 12, 14) et six puces de DEL (20), dans lequel les plaques de base en cuivre (10, 12, 14) sont agencées pour être verticales l'une par rapport à l'autre afin de former la dorsale d'un globe tridimensionnel ; les puces de DEL (20) sont disposées sur la surface externe du globe tridimensionnel à des emplacements où deux plaques de base en cuivre quelconque s'entrecroisent.

4. Dispositif d'éclairage à DEL émettant dans toutes les directions selon la revendication 3, dans lequel chaque puce de DEL (20) est en outre recouverte d'un cuivre (40).

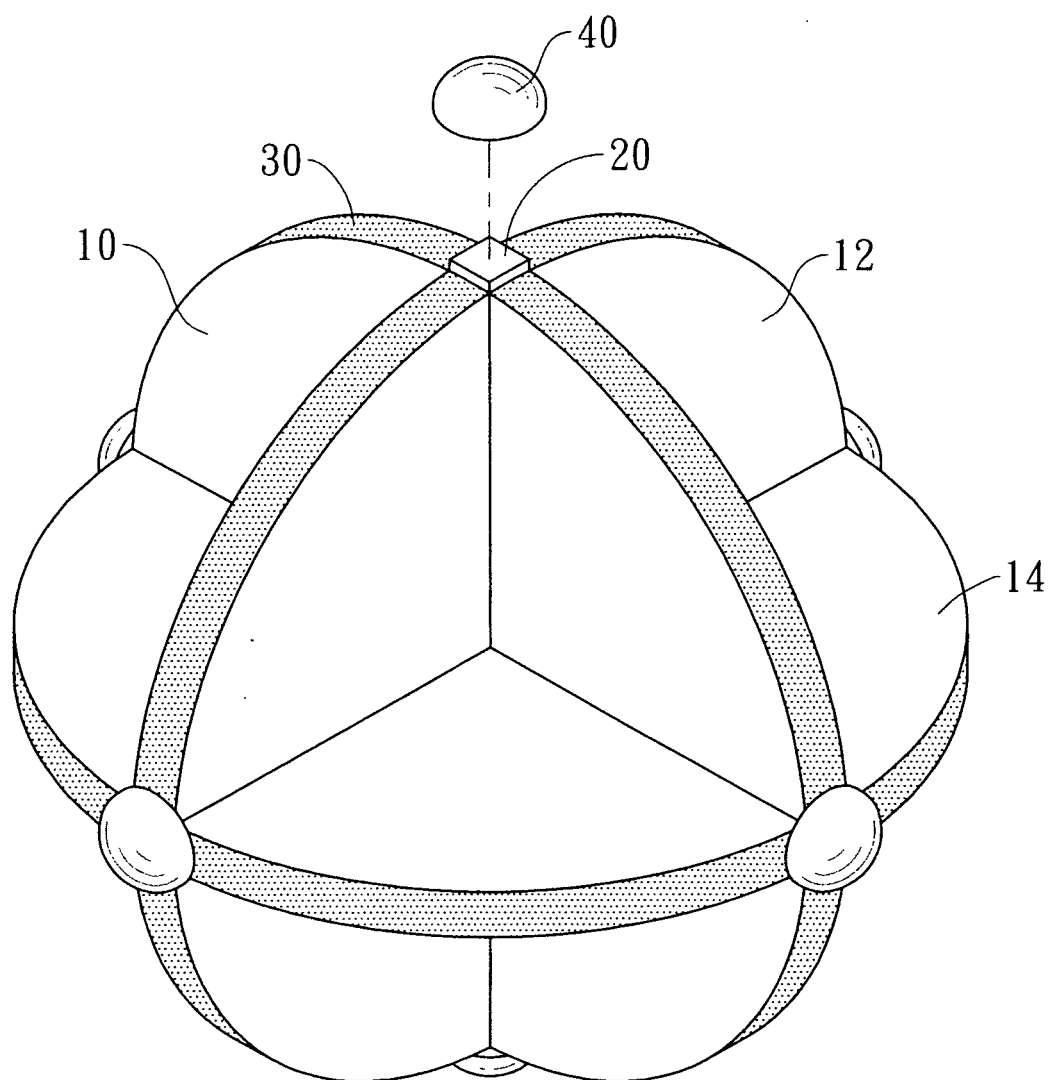


Fig. 1

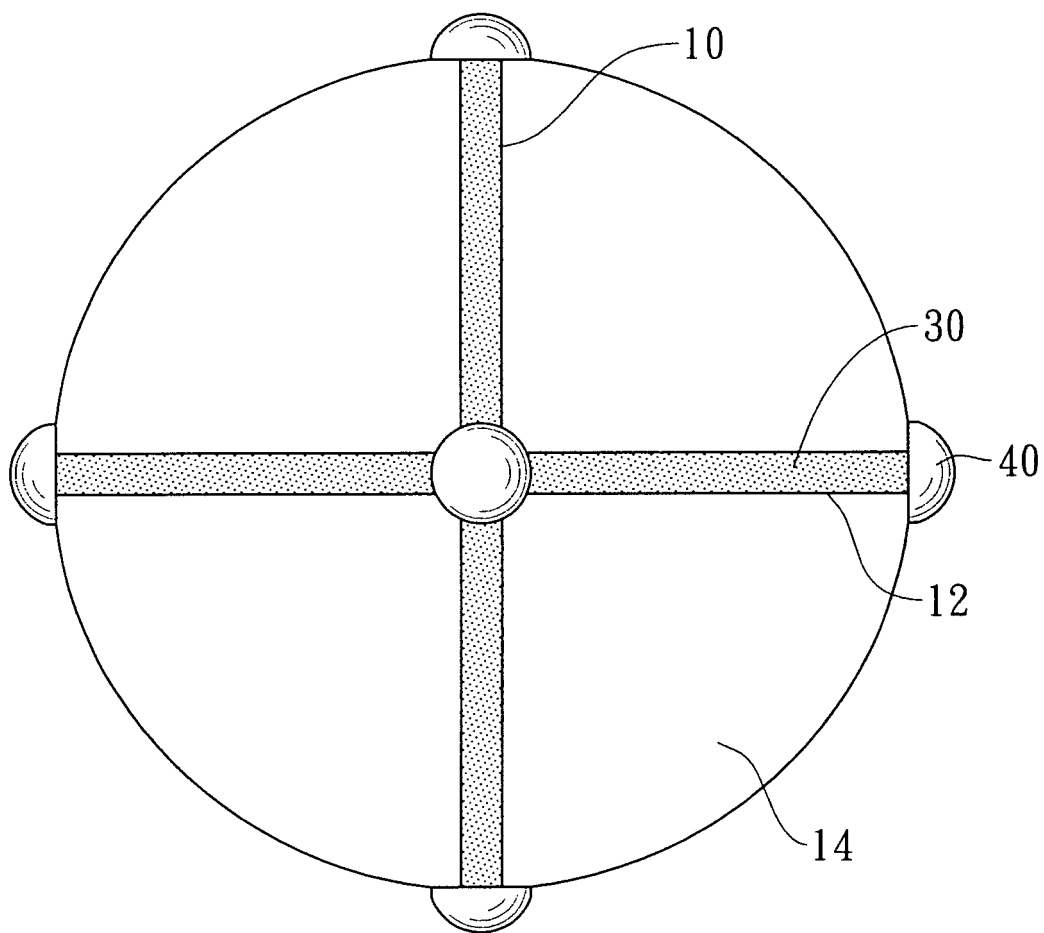


Fig. 2

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

- DE 203142984 [0005]