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(54) Light emitting diode lamp device

(57) A light emitting diode (LED) lamp device (100) includes a lamp holder (200) including a power module (210), an LED module (310) and a shield (400, 402-405). The LED module (310), disposed on the lamp holder (200), is electrically connected to the power module (210). The shield (400, 402-405), disposed on the lamp holder (200), covers the LED module (310). The material of the shield (400, 402-405) is solid. The shield (400, 402-405) has a top portion (410), a lateral portion (420), an accommodating space (470), and an inner rough surface (430) and an outer surface (440) opposite to each other. The composition of the shield (400, 402-405) includes a light diffusing powder. The lateral portion (420) is connected to the lamp holder (200). The thickness of the top portion (410) is greater than that of the lateral portion (420). The thickness of the shield (400, 402-405) is substantially and gradually increased from the lateral portion (420) towards the top portion (410). The LED module (310) is located in the accommodating space (470), and the inner rough surface (430) faces the accommodating space (470).

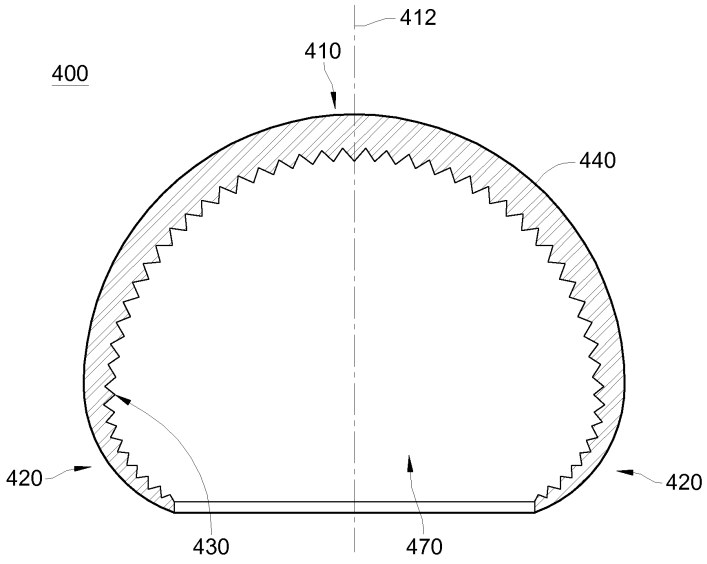

FIG. 3

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Description

BACKGROUND

Technical Field

[0001] The disclosure relates to a light emitting diode (LED) lamp device, in particularly to an LED lamp device adapted for fully illuminating.

Description of the Related Art

[0002] An LED is a semiconductor unit which is able to emit light. When current passes through the LED, electrons and holes are combined together in the LED to emit single-color light because of the Electroluminescence theory. Recently, with the rapid development of the LED technology, the LED has been widely used in general indoor lighting. For example, an LED module is disposed in a light bulb, and when the LED module is switched-on, the LED module emits light for indoor lighting. Compared to conventional incandescent bulbs, the LED light bulb has lower electricity consumption, a longer life span, smaller volume and a faster response. Therefore, the LED light bulb has replaced the conventional incandescent bulbs as the main stream of the future of illumination devices.

[0003] Generally, the greater the power the LED is, the more heat it generates. Also, when the heat may not be efficiently removed from the LED, the temperature of the LED rises rapidly, and this seriously affects the life span and the illuminating efficiency of the LED. Therefore, in prior art, the LED light bulb having greater power comprises a heat-dissipation structure. The heat-dissipation structure is in thermal contact with the LED so that the heat-dissipation structure may timely remove the heat generated by the LED.

[0004] Furthermore, compared to conventional tungsten filaments of the incandescent bulbs, the area of the illuminating source of the LED is smaller. That is, the light distribution of the LED is much more concentrated. Therefore, when the LED is used for lighting, in prior art, a lens or a diffusion shield is disposed on the LED module to diffuse the light such that the illuminating angle of the light is increased. However, when multiple lenses or diffusion shields are disposed, the light energy may be greatly lost because the light emitted by the LED needs to pass through multiple media (the multiple lenses or diffusion shields), thereby lowering the illuminating energy. Moreover, in prior art, in order to enhance the illuminating angle of the LED light bulb, the volume of the diffusion shield is increased to make the shape of the diffusion shield into a three-quarters-of-a-sphere shape to a spherical shape. However, in the above-mentioned manner, because the total length of the LED light bulb is fixed, when the volume of the diffusion shield is increased, on the contrary, the volume of the heat-dissipation structure needs to be decreased. Accordingly, when the volume of the heat-dissipation structure is reduced, the heat-dissipation efficiency of the LED light bulb is also reduced. Therefore, increasing the volume of the diffusion shield for enhancing the illuminating angle may lower the luminance (brightness) and reduce the life span of the LED light bulb.

[0005] To sum up, the conventional LED light bulb has a problem that the balance between heat dissipation and a wide illuminating angle cannot be achieved. Therefore, there is a need for a LED light bulb having a wide illuminating angle without affecting its original heat-dissipation efficiency.

SUMMARY

[0006] According to the above-mentioned problems, the disclosure provides a light emitting diode (LED) lamp device, in order to solve the problem that the balance of heat dissipation and full illumination cannot be achieved.

[0007] One embodiment of the disclosure provides an LED lamp device comprising a lamp holder, an LED module and a shield. The lamp holder comprises a power module. The LED module, disposed on the lamp holder, is electrically connected to the power module and is adapted for emitting light. The shield, disposed on the lamp holder, covers the LED module. The material of the shield is solid. The shield has a top portion, a lateral portion, an accommodating space, and an inner rough surface and an outer surface opposite to each other. The composition of the shield comprises a light diffusing powder. The lateral portion is connected to the lamp holder. The thickness of the top portion is greater than that of the lateral portion. The thickness of the shield is substantially and gradually increased from the lateral portion towards the top portion. The LED module is located in the accommodating space, and the inner rough surface faces the accommodating space.

[0008] One embodiment of the disclosure provides an LED lamp device, comprising a lamp holder, an LED module and a shield. The lamp holder comprises a power module. The LED module, disposed on the lamp holder, is electrically connected to the power module. The LED module is adapted for emitting light. The shield, disposed on the lamp holder, covers LED module. The shield, whose material is solid, includes a top portion, a lateral portion, an accommodating space, an inner surface and an outer rough surface, which are opposite to each other. The composition of the shield comprises a light diffusing powder. The lateral portion is connected to the lamp holder. The thickness of the top portion is greater than that of the lateral portion. The thickness of the shield is substantially and gradually increased from the lateral portion towards the top portion. The LED module is located in the accommodating space, and the inner surface faces the LED module.

[0009] One embodiment of the disclosure provides an LED lamp device, comprising a lamp holder, an LED module and a shield. The lamp holder comprises a power

module. The LED module, disposed on the lamp holder, is electrically connected to the power module and is adapted for emitting light. The shield, disposed on the lamp holder, covers the LED module. The shield whose material is solid includes a top portion, a lateral portion, an accommodating space, an inner rough surface and an outer rough surface, which are opposite to each other. The composition of the shield comprises a light diffusing powder. The lateral portion is connected to the lamp holder. The thickness of the top portion is greater than that of the lateral portion. The thickness of the shield is substantially and gradually increased from the lateral portion towards the top portion. The LED module is located in the accommodating space, and the inner rough surface faces the LED module.

[0010] To sum up, the thickness of the shield is increased from the lateral portion towards the top portion. Compared to the prior art, in the LED lamp device according to the embodiments of the disclosure, the thickness of the shield is adjusted to make the thickness of the top portion greater than that of the lateral portion. Furthermore, the material of the shield (the composition of the shield) includes a light diffusion powder. The shield includes an inner rough surface or an outer rough surface. In one embodiment, the shield includes an inner rough surface and an outer rough surface at the same time. The inner rough surface and the outer rough surface, which are unsmooth surfaces, are beneficial for spreading the light. When the LED module emits the light through the shield, the shield spreads the light, which enhances the illuminating angle of the light. Therefore, the balance between the heat dissipation and the wide illuminating angle is achieved. Moreover, Without reducing the volume of the lamp holder, the shape of the shield is between a hemispherical shape to a three-quarters-of-a-sphere shape, the LED lamp device achieves the full illuminating effect (namely, the light illuminates all round the LED lamp device).

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The disclosure will become more fully understood from the detailed description given herein below for illustration only, thus does not limit the disclosure, wherein:

FIG. 1 is a schematic perspective view of an LED lamp device according to a first embodiment of the disclosure.

FIG. 2 is a schematic exploded view of the LED lamp device according to the first embodiment of the disclosure.

FIG. 3 is a schematic cross-sectional view of a shield according to the first embodiment of the disclosure.

FIG. 4A is a schematic cross-sectional view of a shield according to a second embodiment of the disclosure.

FIG. 4B is a schematic perspective view of the shield according to the second embodiment of the disclosure.

FIG. 5 is a schematic perspective view of a shield according to a third embodiment of the disclosure.

FIG. 6A is a schematic cross-sectional view of a shield according to a fourth embodiment of the disclosure.

FIG. 6B is a schematic perspective view of the shield according to the fourth embodiment of the disclosure.

FIG. 7 is a schematic perspective view of a shield according to a fifth embodiment of the disclosure.

FIG. 8 is a schematic cross-sectional view of a shield according to a sixth embodiment of the disclosure.

FIG. 9 is a schematic cross-sectional view of a shield according to a seventh embodiment of the disclosure.

DETAILED DESCRIPTION

[0012] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[0013] An embodiment of the disclosure provides an LED lamp device, which is adapted to emit light for lighting.

[0014] Please refer to FIGs. 1 and 2, FIG. 1 is a schematic perspective view of an LED lamp device according to a first embodiment of the disclosure. FIG. 2 is a schematic exploded view of the LED lamp device according to the first embodiment of the disclosure. In this embodiment, an LED lamp device 100 comprises a lamp holder 200, a circuit board 300, a plurality of LED modules 310 and a shield 400. The circuit board 300 is disposed on the lamp holder 200. The LED module 310 is disposed on the circuit board 300, and the LED module 310 and the circuit board 300 are electrically connected to each other. The shield 400, disposed on the circuit board 300, covers the LED module 310. In this embodiment, the number of the LED modules 310 is four, but is not limited to the disclosure. In other embodiments, the number of the LED modules 310 is adjusted according to actual requirement, and the number of the LED modules 310 is

a positive integral number which is greater than one.

[0015] In this and some other embodiments, the lamp holder 200 comprises a power module 210 and a connector 220. The connector 220 is adapted for receiving electrical energy (electricity) from an outer power source (not shown). The power module 210 transforms the electrical energy from the connector 220 into the kind of electrical energy which can be used by the LED module 310. Moreover, the power module 210 transmits the electrical energy to the LED module 310.

[0016] In this and some other embodiments, the circuit board 300 is electrically connected to the power module 210. The circuit board 300 is adapted for receiving the electrical energy from the power module 210 and for transmitting the electrical energy to the LED module 310, and therefore the LED module 310 emits light towards the shield 400.

[0017] The following describes the structure of the shield 400. Please refer to FIGs. 2 and 3 together. FIG. 3 is a schematic cross-sectional view of a shield according to the first embodiment of the disclosure. The material of the shield 400 is solid, and the shape of the shield 400 is between the hemispherical shape to three-quarters-of-a-sphere shape. The shield 400 includes a top portion 410, a lateral portion 420, an inner rough surface 430, an outer surface 440 and an accommodating space 470. The lateral portion 420 is connected to the lamp holder 200. The thickness of the top portion 410 is greater than that of the lateral portion 420. That is to say, the thickness of the shield 400 is substantially and gradually increased from the lateral portion 420 towards the top portion 410. The inner rough surface 430 and the outer surface 440 is opposite to each other. The inner rough surface 430 is adapted for spreading the light emitted from the accommodating space 470 so as to enhance the illuminating angle of the light. In this embodiment, the inner rough surface 430 is an unsmooth surface. When the light passes through the inner rough surface 430, the light is refracted into different directions via the inner rough surface 430, thereby enhancing the illuminating angle of the light. Additionally, in other embodiments, the inner rough surface 430 is a plane having a microstructure which refracts the light, or the roughness of the inner rough surface 430 may be adjusted. Therefore, the light spreading is enhanced.

[0018] The accommodating space 470 is adapted for containing the LED module 310. Moreover, the composition of the shield 400 comprises a light diffusing powder. When the light emitted by the LED module 310 passes through the shield 400, the shield 400, which has the light diffusing powder, is beneficial for spreading the light, thereby enhancing the illuminating angle of the light.

[0019] In this and some other embodiments, the shield 400 has a central axis 412 located in the top portion 410. The thickness of the shield 400 is substantially and gradually decreased from the central axis 412 towards the lateral portion 420 in its entire circumferential direction.

[0020] In this disclosure, "the thickness of the shield 400 is substantially and gradually decreased from the central axis 412 towards the lateral portion 420" meaning that from the macroscopic view, the thickness of the shield 400 is gradually increased from the lateral portion 410 towards the top portion 420. The thickness of the top portion 410 is greater than that of the lateral portion 420. Then, the light, which is emitted by the LED module 310, illuminates towards outside from the accommodating space 470 of the shield 400 via the inner rough surface 430, so the light is spread by the inner rough surface 430. Meanwhile, the curvature variation of the top portion 410 of the shield 400 is larger than that of the lateral portion 420, so the refraction angle of the light is larger, too. Therefore, the light is spread towards the lateral portion 420. Compared to the top portion 410, the thickness of the lateral portion 420 is thinner. Therefore, because the curvature variation of the lateral portion 420 of the shield 400 is smaller, when the light, emitted by the LED module 310, illuminates towards the outside from the inside of the shield 400, the lateral portion 420 may enhance the luminance (brightness) of the light. Therefore, by the adjustment of the thickness of the shield 400, the shield 400 may increase the illuminating angle of the LED module 310, thereby achieving a full illumination (namely, all-around lighting) of the LED lamp device 100.

[0021] The following describes other structural types of the shields. However, the above-mentioned structure of the inner rough surface 430 is not limited to the disclosure. The inner rough surface 430 in this disclosure may have different shapes and structures in other embodiments, which achieves the same effects of the disclosure. Please refer to FIGs. 4A and 4B, FIG. 4A is a schematic cross-sectional view of a shield according to a second embodiment of the disclosure, and FIG. 4B is a schematic perspective view of the shield according to the second embodiment of the disclosure. The structures in this embodiment are similar to those in the above-mentioned embodiments, thus the same numerals represent similar structures. Compared to the first embodiment, in this embodiment, the inner rough surface 430 of the shield 402 further includes a plurality of circular grooves 438 adjacent to each other. When the light passes through the circular grooves 438, the light is refracted into different directions via the circular grooves 438. That is, the circular grooves 438 spread the light towards the outside of the shield 402. Therefore, in this embodiment, the shield 402 also enhances the illuminating angle of the light.

[0022] Please refer to FIG. 5, which is a schematic perspective view of a shield according to a third embodiment of the disclosure. The structures in this embodiment are similar to those in the above-mentioned embodiments, thus the same numerals represent similar structures. The inner rough surface 430 of the shield 403 includes a plurality of concave surfaces 434, and the concave surfaces 434 are formed downward from the accommodating space 470 towards the shield 403. With such a structure, when the light emits from the accommodating space 470

and passes through the concave surface 434, the light is also spread by the structure of the concave surface 434.

[0023] Please refer to FIGs. 6A and 6B together, FIG. 6A is a schematic cross-sectional view of a shield according to a fourth embodiment of the disclosure, and FIG. 6B is a schematic perspective view of the shield according to the fourth embodiment of the disclosure. The structures in this embodiment are similar to those in the above-mentioned embodiments, thus the same numerals represent similar structures. In this embodiment, the inner rough surface 430 of the shield 404 includes a plurality of circular ribs 436. The circular ribs 436 are adjacent to each other and protrude towards the accommodating space 470. Therefore, when the light is emitted from the accommodating space 470 towards the circular ribs 436, the light is refracted accordingly. That is, the circular ribs 436 adjust the travelling path of the light, which enhances the illuminating angle of the light. In other embodiments, the circular ribs 436 are an array of microstructures, and the array of microstructures also spread the light.

[0024] Please refer to FIG. 7, which is a schematic perspective view of a shield according to a fifth embodiment of the disclosure. The structures in this embodiment are similar to those in the above-mentioned embodiments, thus the same numerals represent similar structures. In this embodiment, the inner rough surface 430 of the shield 405 includes a plurality of round surfaces 432, and the round surfaces 432 protrude towards the accommodating space 470. In this embodiment, the round surfaces 432 are a hyperboloid surface, a hemispherical-shape surface or an ellipse (oval) surface, but the shape and the number of round surfaces 432 are not limited to the disclosure.

[0025] In first five above-mentioned embodiments, the shields have different shapes of the inner rough surfaces, respectively, so as to spread the light. The following describes some embodiments where the outer surface is a rough surface. Please refer to FIG. 8, which is a schematic cross-sectional view of a shield according to a sixth embodiment of the disclosure. The structures in this embodiment are similar to those in the above-mentioned embodiments, thus the same numerals represent similar structures. Compared to the first embodiment, the main difference between the first embodiment and this embodiment is that the shield 406 in this embodiment includes an inner surface 450 and an outer rough surface 460 opposite to each other. The inner surface 450 faces the accommodating space 470. The outer rough surface 460 is adapted for spreading the light emitted from the accommodating space 470. In this embodiment, the outer rough surface 460 is an unsmooth surface. When the light passes through the outer rough surface 460, the light is refracted into different directions by the outer rough surface 460, thereby enhancing the illuminating angle of the light. In other embodiments, the outer rough surface 460 is a surface having microstructures which may spread the light or the roughness of the outer rough surface 460 may be adjusted, thereby enhancing the spread of the light. For example, the microstructures of the outer rough surfaces 460 are round surfaces (i.e., bumps), concave surfaces (i.e., notches), circular ribs or circular grooves (not shown). With the light spreading of the microstructure, the shield 406 also achieves the effect of light spreading.

[0026] Please refer to FIG. 9, which is a schematic cross-sectional view of a shield according to a seventh embodiment of the disclosure. The structures in this embodiment are similar to those in the first and sixth embodiment, thus the same numerals represent similar structures. Compared to the first embodiment, the main difference between the first embodiment and this embodiment is that the shield 407 in this embodiment includes an inner rough surface 430 and an outer rough surface 460 opposite to each other. The inner rough surface 430 faces the accommodating space 470. The outer rough surface 460 is an unsmooth surface which is beneficial for spreading the light, thereby enhancing the full illuminating. In other embodiments, the inner rough surface 430 and the outer rough surface 460 are the surfaces having a plurality of microstructures, respectively. For example, the microstructures are round surfaces, concave surfaces, circular ribs or circular grooves (not shown). With the light spreading of the microstructure, the shield 407 also achieves the effect of light spreading.

[0027] In order to understand clearly, in all the figures of the disclosure, the sizes and thicknesses of the shield 400, 402-407, the inner rough surfaces 430, the round surfaces 432, the concave surfaces 434, the circular ribs 436, the circular grooves 438 and the outer rough surfaces 460 are not drawn according to actual proportions.

[0028] To sum up, the LED lamp device comprises the shield having different thickness for enhancing the illuminating angle of the light. Therefore, Compared to the prior art, in the LED lamp device according to the embodiments of the disclosure, the thickness of the shield is adjusted to make the thickness of the top portion greater than that of the lateral portion. Furthermore, the material of the shield includes a light diffusion powder. The shield includes an inner rough surface or an outer rough surface. In one embodiment, the shield includes an inner rough surface and an outer rough surface at the same time. The inner rough surface and the outer rough surface, which are unsmooth surfaces, are beneficial for spreading the light. When the LED module emits the light through the shield, the shield spreads the light, which enhances the illuminating angle of the light. Therefore, the balance between the heat dissipation and the wide illuminating angle is achieved. Moreover, Without reducing the volume of the lamp holder, the shape of the shield is between a hemispherical shape to a three-quarters-of-a-sphere shape, the LED lamp device achieves the full illuminating effect (namely, the light illuminates all round the LED lamp device).

Claims

1. A light emitting diode (LED) lamp device (100), comprising:

   a lamp holder (200) comprising a power module (210);
   an LED module (310) disposed on the lamp holder (200) and electrically connected to the power module (210), the LED module (310) being adapted for emitting light; and
   a shield (400, 402-405) disposed on the lamp holder (200) and covering the LED module (310), wherein the material of the shield (400, 402-405) is solid, the shield(400, 402-405) has a top portion (410), a lateral portion (420), an accommodating space (470), and an inner rough surface (430) and an outer surface (440) which are opposite to each other, the composition of the shield (400, 402-405) comprises a light diffusing powder, the lateral portion (420) is connected to the lamp holder (200), the thickness of the top portion (410) is greater than that of the lateral portion (420), the thickness of the shield (400, 402-405) is substantially and gradually increased from the lateral portion (420) towards the top portion (410), the LED module (310) is located in the accommodating space (470), and the inner rough surface (430) faces the accommodating space (470).

2. The LED lamp device (100) according to the claim 1, wherein the inner rough surface (430) includes a plurality of round surfaces (432) and the round surfaces (432) face the accommodating space (470).

3. The LED lamp device (100) according to the claim 1, wherein the inner rough surface (430) includes a plurality of concave surfaces (434).

4. The LED lamp device (100) according to the claim 1, wherein the inner rough surface (430) includes a plurality of circular ribs (436) adjacent to each other.

5. The LED lamp device (100) according to the claim 1, wherein the inner rough surface (430) includes a plurality of circular grooves (438) adjacent to each other.

6. The LED lamp device (100) according to the claim 1, wherein the shape of the shield (400, 402-407) is between a hemispherical shape to a three-quarters-of-a-sphere shape.

7. The LED lamp device (100) according to the claim 1, wherein the shield (400, 402-407) includes a central axis (412) located at the top portion (410), and the thickness of the shield (400, 402-407) is substantially and gradually decreased from the central axis (412) towards the lateral portion (420).

8. An LED lamp device (100), comprising:

   a lamp holder (200) comprising a power module (210);
   an LED module (310) disposed on the lamp holder (200) and electrically connected to the power module (210), and the LED module (310) being adapted for emitting light; and
   a shield (406) disposed on the lamp holder (200) and covering the LED module (310), wherein the material of the shield (406) is solid, the shield (406) includes a top portion (410), a lateral portion (420), an accommodating space (470), and an inner surface (450) and an outer rough surface (460) which are opposite to each other, the composition of the shield (406) comprises a light diffusing powder, the lateral portion (420) is connected to the lamp holder (200), the thickness of the top portion (410) is greater than that of the lateral portion (420), the thickness of the shield (406) is substantially and gradually increased from the lateral portion (420) towards the top portion (410), the LED module (310) is located in the accommodating space (470), and the inner surface (450) faces the LED module (310).

9. The LED lamp device (100) according to the claim 8, wherein the outer rough surface (460) includes a plurality of round surfaces and the plurality of the round surfaces face the accommodating space (470).

10. An LED lamp device (100), comprising:

    a lamp holder (200) comprising a power module (210);
    an LED module (310) disposed on the lamp holder (200) and electrically connected to the power module (210), and the LED module (310) being adapted for emitting light; and
    a shield (407) disposed on the lamp holder (200) and covering the LED module (310), wherein the material of the shield (407) is solid, the shield (407) includes a top portion (410), a lateral portion (420), an accommodating space (470), and an inner rough surface (430) and an outer rough surface (460) which are opposite to each other, the composition of the shield (407) comprises a light diffusing powder, the lateral portion (420) is connected to the lamp holder (200), the thickness of the top portion (410) is greater than that of the lateral portion (420), the thickness of the shield (407) is substantially and gradually increased from the lateral portion (420) towards

the top portion (410), the LED module (310) is located in the accommodating space (470), and the inner rough surface (430) faces the LED module (310).

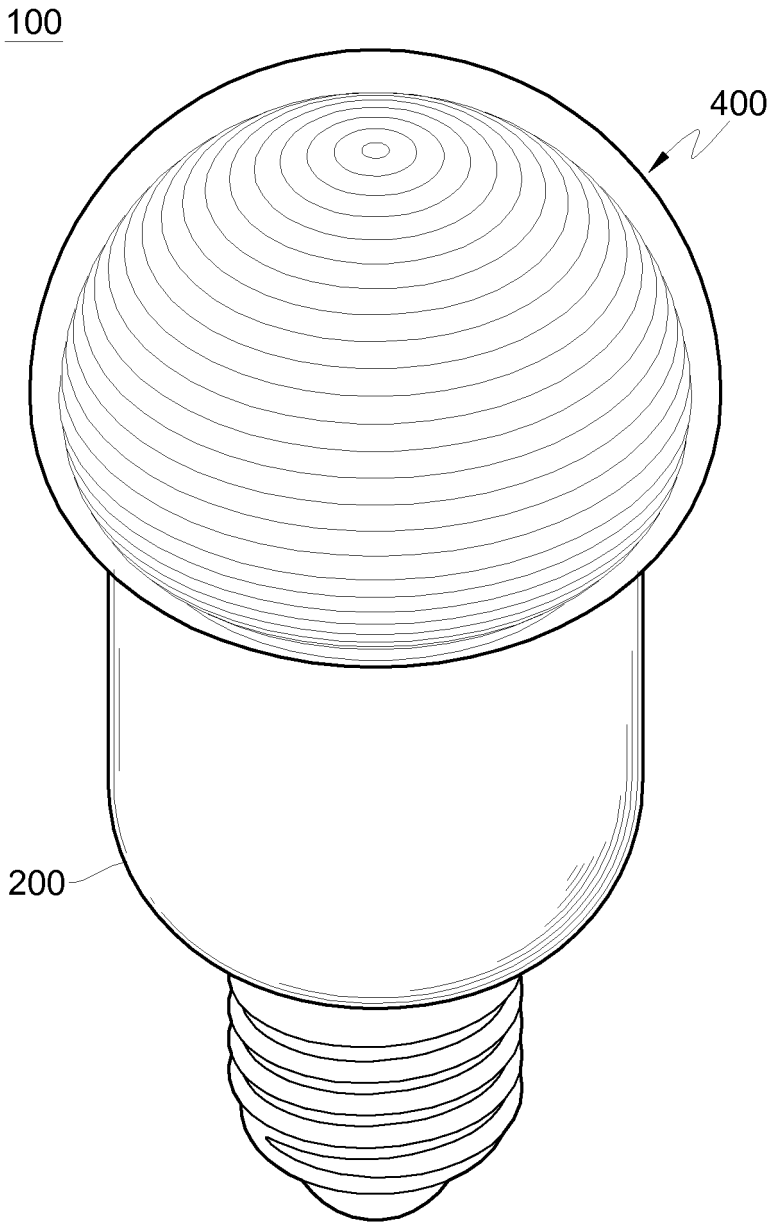

FIG. 1

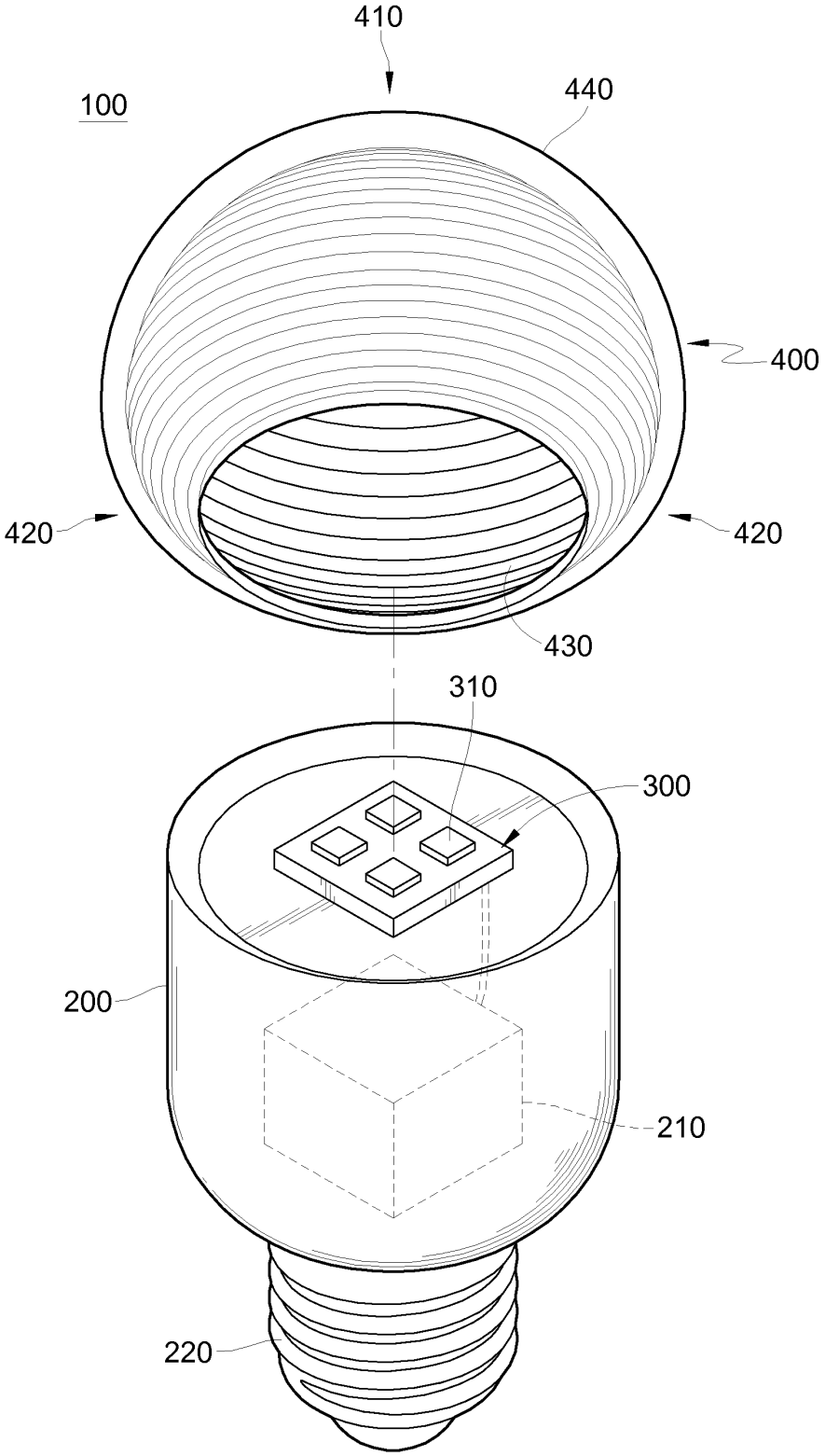

FIG. 2

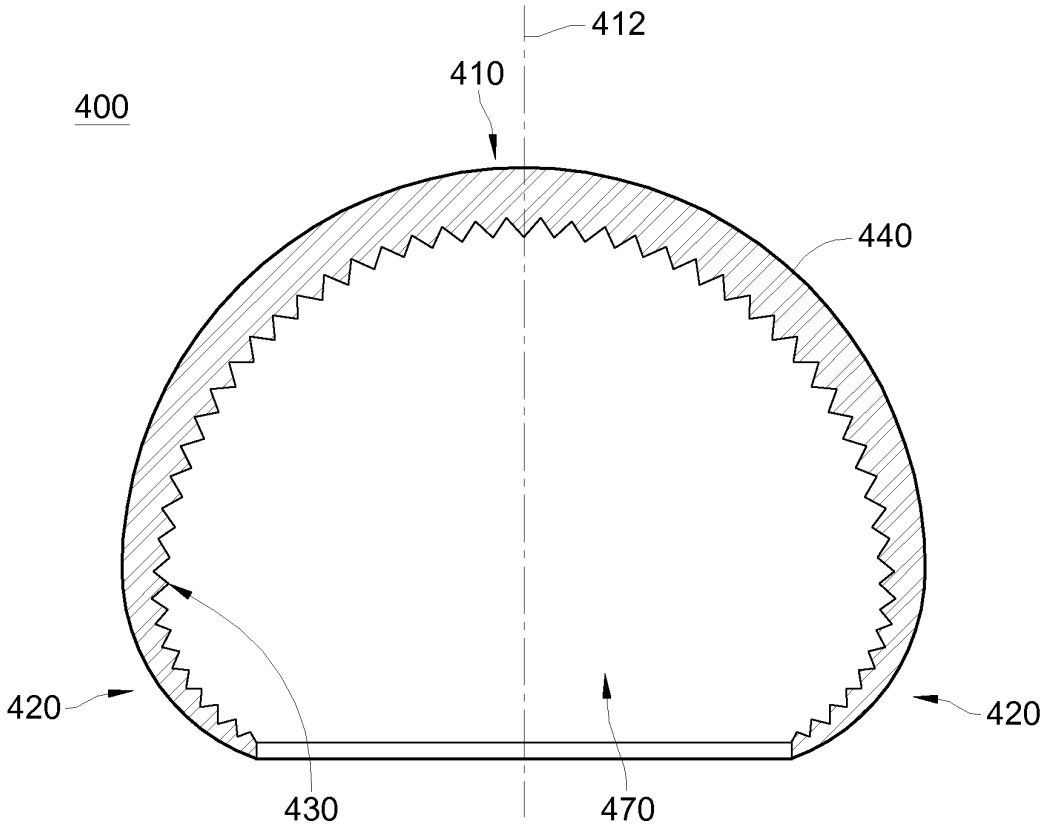

FIG. 3

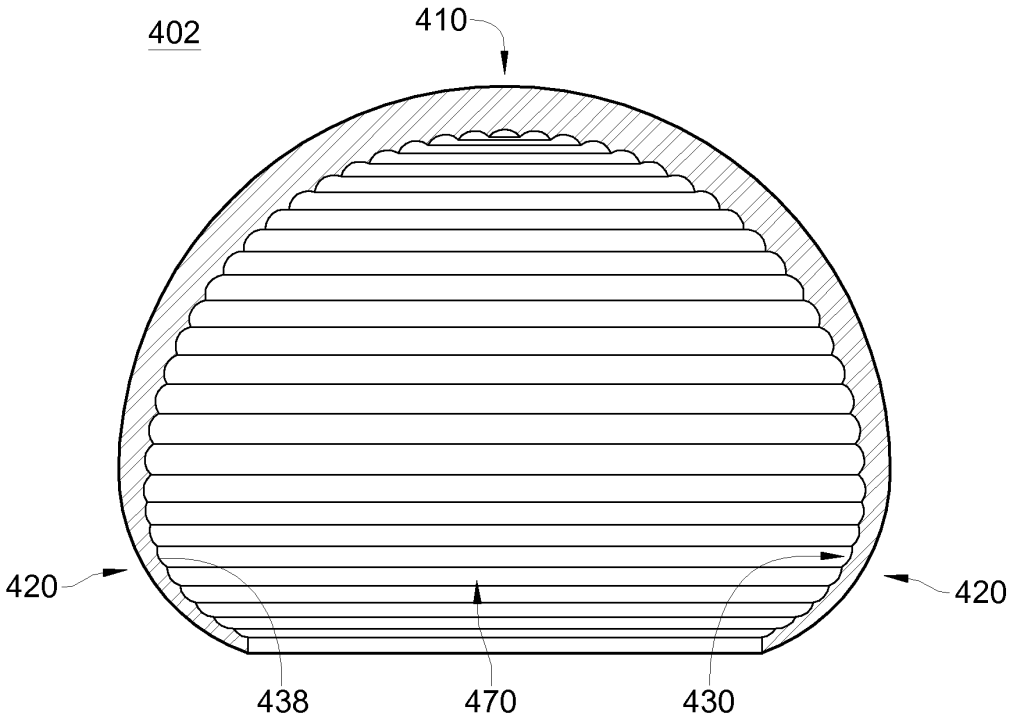

FIG. 4A

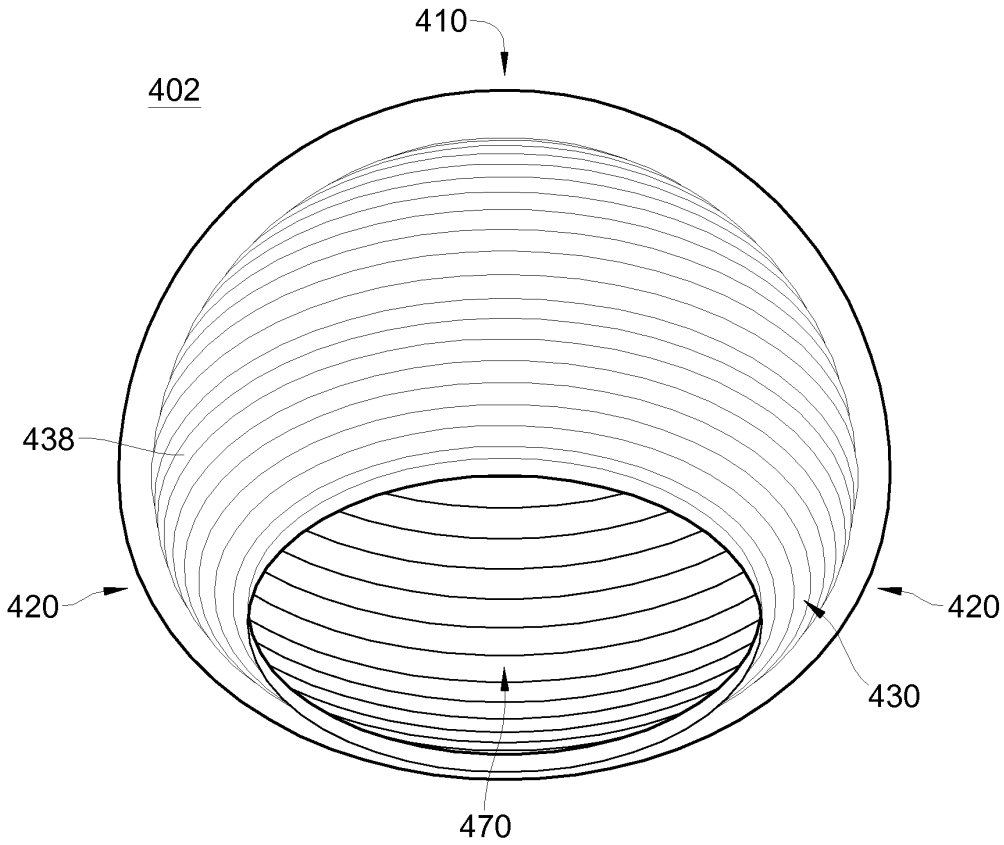

FIG. 4B

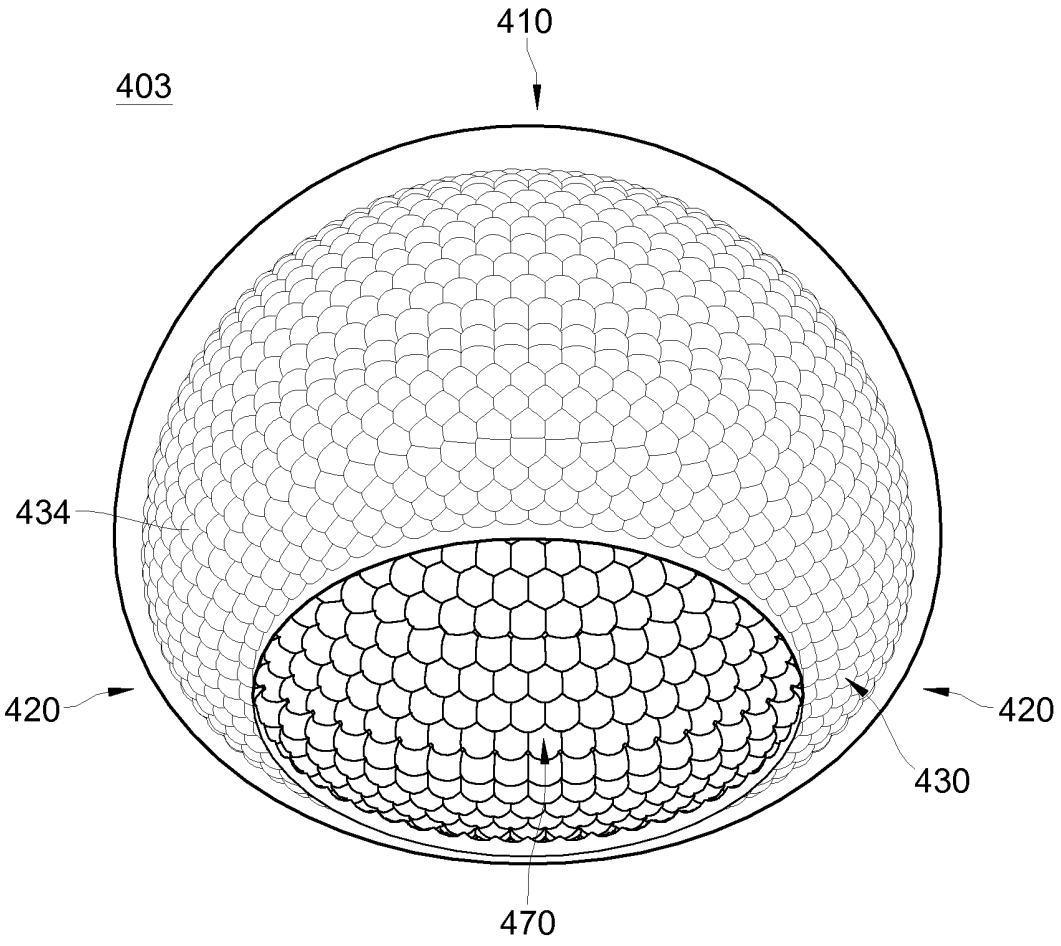

FIG. 5

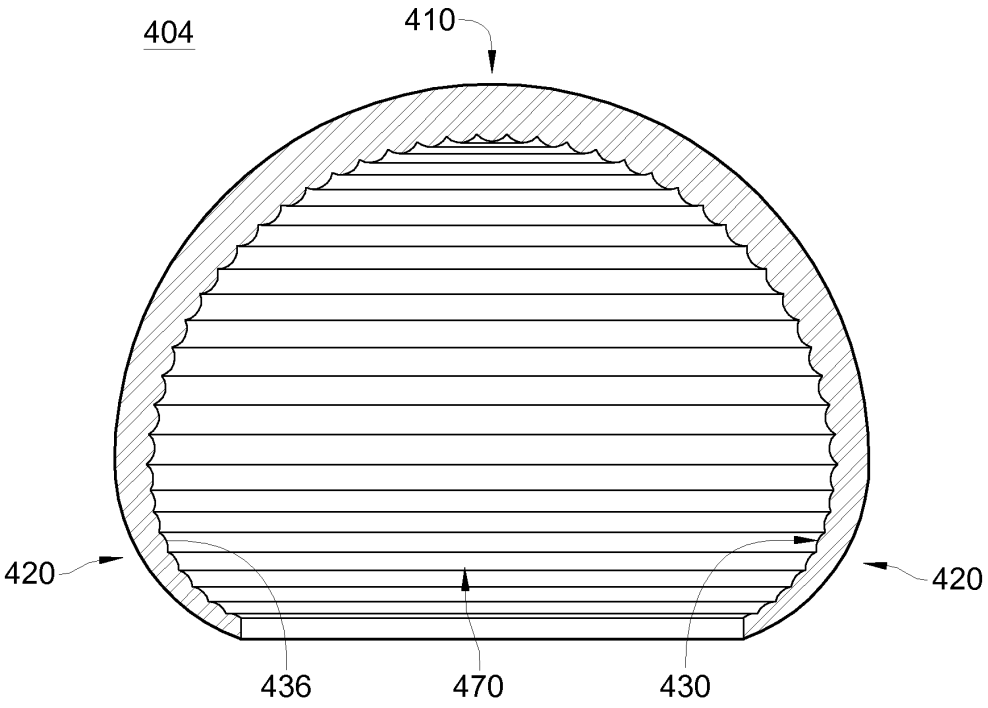

FIG. 6A

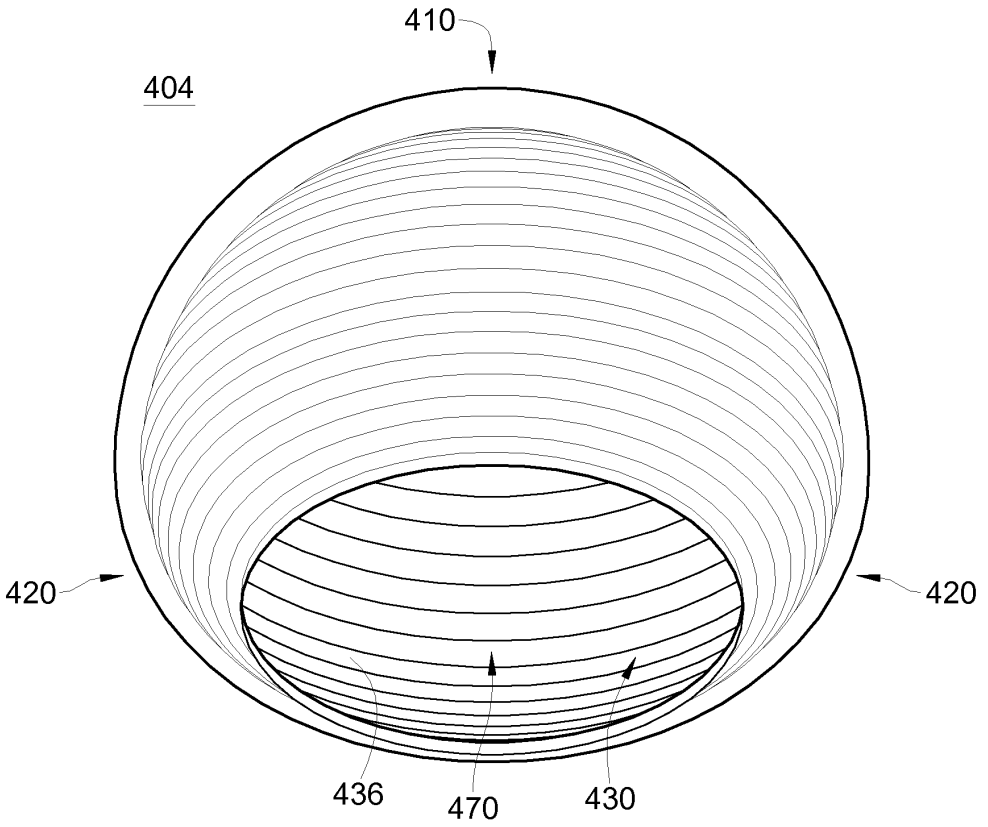

FIG. 6B

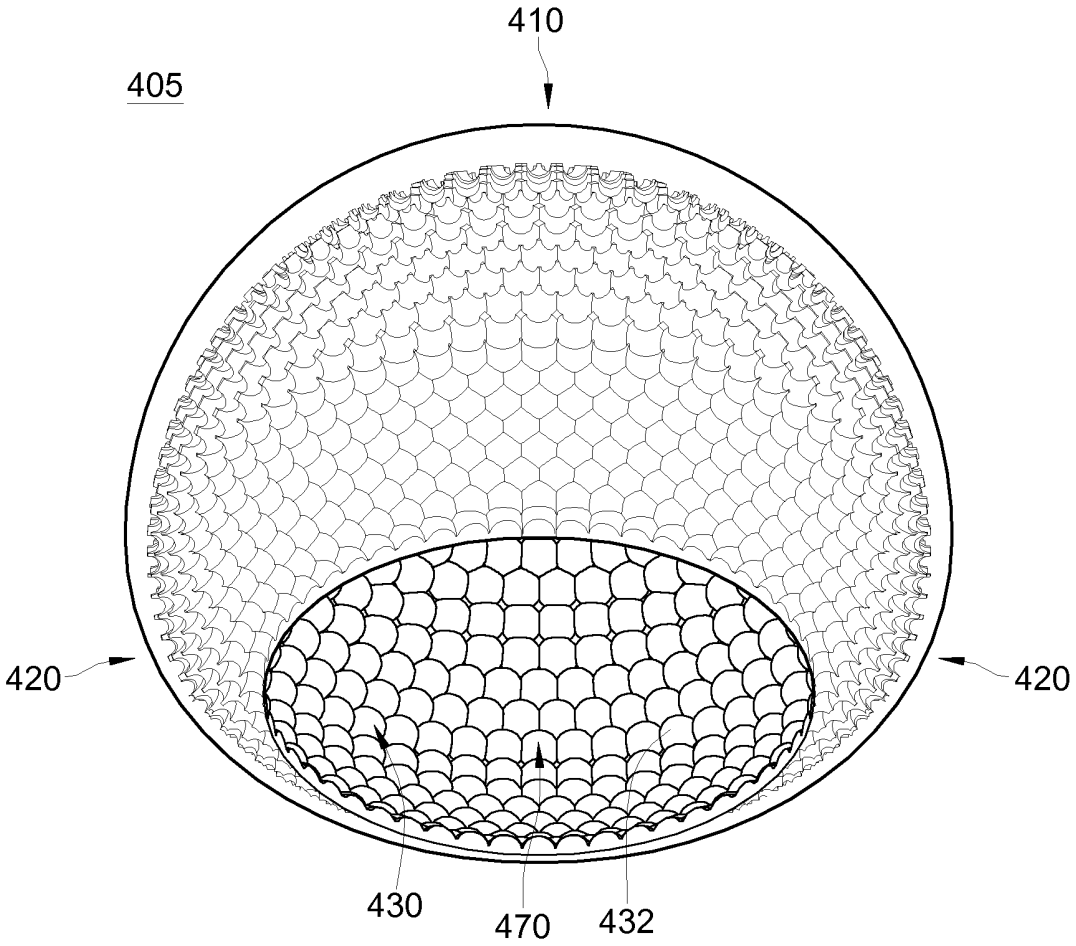

FIG. 7

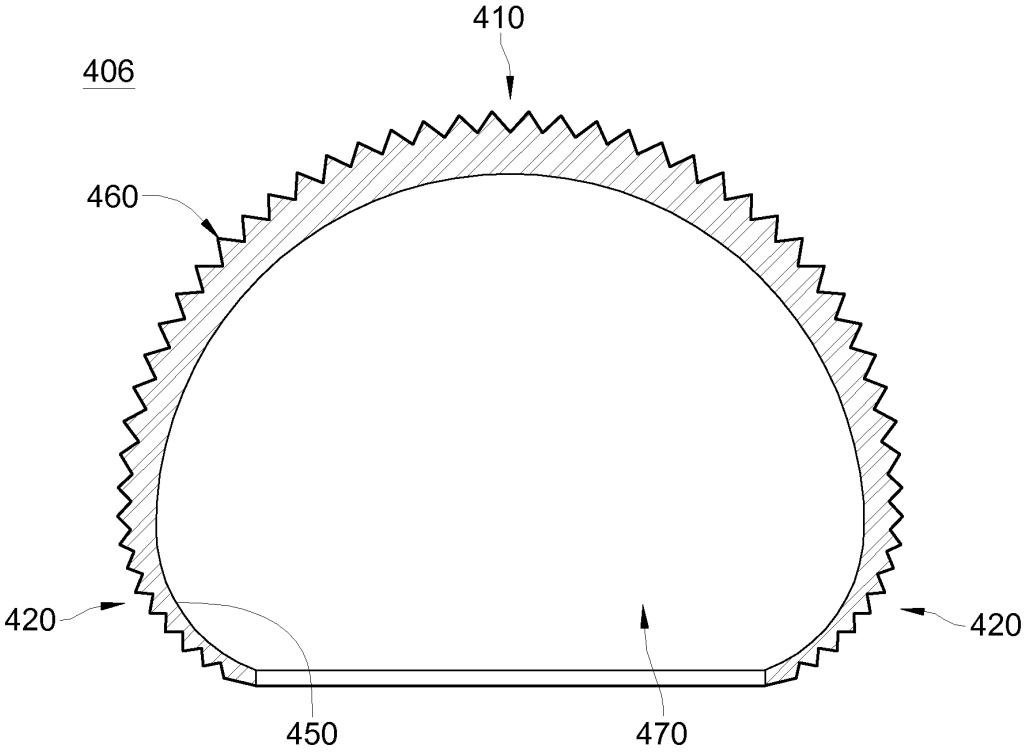

FIG. 8

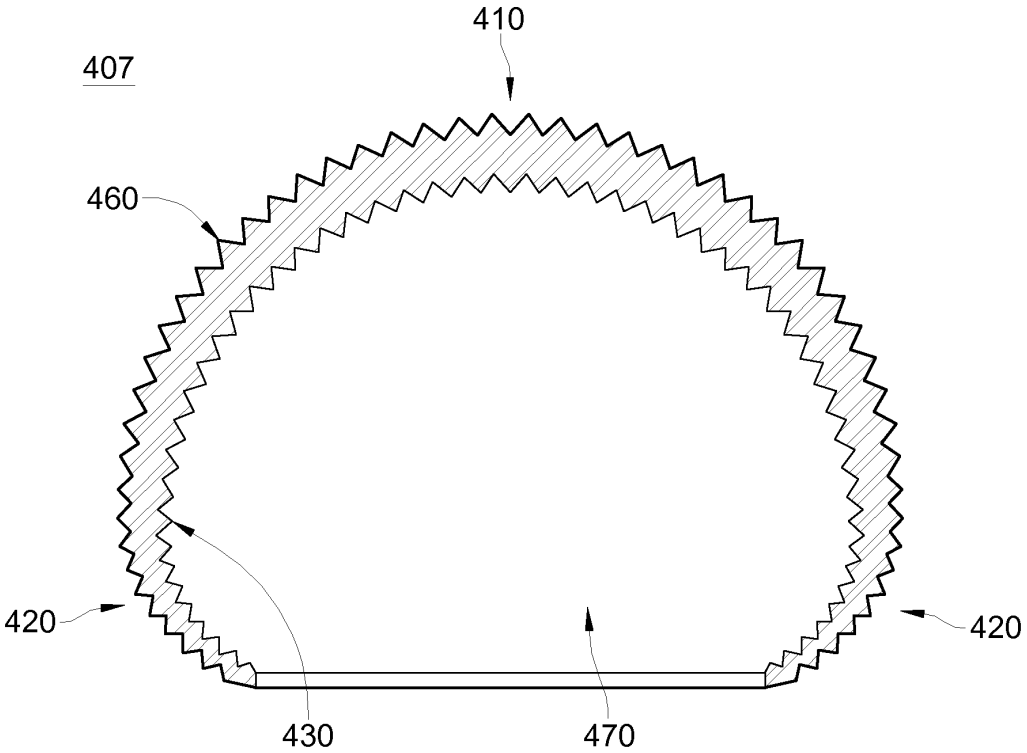

FIG. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 17 2678

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2012/134161 A1 (KAWAMURA NOBUO [JP] ET AL) 31 May 2012 (2012-05-31) * paragraph [0036] - paragraph [0040] * * paragraph [0043] - paragraph [0044] * * paragraph [0051] * * paragraph [0058] - paragraph [0059] * * figures 5,6,12,18 *	1-10	INV. F21K99/00 F21V3/04 ADD. F21V5/00 F21Y101/02
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 August 2013	Soto Salvador, Jesús

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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