

(19)



(11)

EP 2 553 332 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
23.03.2016 Bulletin 2016/12

(51) Int Cl.:
F21V 29/83 ^(2015.01) **F21V 29/506** ^(2015.01)
F21K 9/61 ^(2016.01) **F21K 9/232** ^(2016.01)
F21Y 115/10 ^(2016.01)

(21) Application number: **11760309.2**

(86) International application number:
PCT/US2011/029994

(22) Date of filing: **25.03.2011**

(87) International publication number:
WO 2011/119958 (29.09.2011 Gazette 2011/39)

(54) **INSIDE-OUT LED BULB**

UMGESTÜLPTE LED-GLÜHLAMPE
LAMPE À DEL INTERNE-EXTERNE

(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

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(30) Priority: **25.03.2011 US 201113071985**
26.03.2010 US 317871 P

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(43) Date of publication of application:
06.02.2013 Bulletin 2013/06

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Description

TECHNICAL FIELD

[0001] The invention relates to a light emitting diode (LED) based light, for example, an LED-based light bulb usable in an Edison-type fixture in place of a conventional incandescent bulb.

BACKGROUND

[0002] Incandescent light bulbs are commonly used in many environments, such as households, commercial buildings, and advertisement lighting, and in many types of fixtures, such as desk lamps and overhead fixtures. Incandescent bulbs can each have a threaded electrical connector for use in Edison-type fixtures, though incandescent bulbs can include other types of electrical connectors such as a bayonet connector or pin connector. Incandescent light bulbs generally consume large amounts of energy and have short life-spans. Indeed, many countries have begun phasing out or plan to phase out the use of incandescent light bulbs entirely.

[0003] Compact fluorescent light bulbs (CFLs) are gaining popularity as replacements for incandescent light bulbs. CFLs are typically much more energy efficient than incandescent light bulbs, and CFLs typically have much longer life-spans than incandescent light bulbs. However, CFLs contain mercury, a toxic chemical, which makes disposal of CFLs difficult. Additionally, CFLs require a momentary start-up period before producing light, and many consumers do not find CFLs to produce light of similar quality to incandescent bulbs. Further, CFLs are often larger than incandescent lights of similar luminosity, and some consumers find CFLs unsightly when not lit.

[0004] Known LED-based light bulbs have been developed as an alternative to both incandescent light bulbs and CFLs. Known LED light bulbs typically each include a base that functions as a heat sink and has an electrical connector at one end, a group of LEDs attached to the base, and a bulb. The bulb often has a semi-circular shape with its widest portion attached to the base such that the bulb protects the LEDs.

[0005] Known LED-based light bulbs suffer from multiple drawbacks. A base of a typical known LED-based light bulb is unable to dissipate a large amount of heat, which in turn limits the amount of power that can be supplied to LEDs in the typical known LED-based light bulb without a high risk of the LEDs overheating. As a result of the power supplied to the LEDs being limited, the typical known LED-based light bulb has a limited luminosity and cannot provide as much light as an incandescent light bulb that the LED-based light bulb is intended to replace.

[0006] In an effort to increase the luminosity of known LED-based light bulbs, some known LED-based light bulbs include over-sized bases having large surface areas. The large surface areas of the over-sized bases are

intended to allow the bases to dissipate sufficient amounts of heat such that the LEDs of each known LED-based light can be provided with enough power to produce in the aggregate as much luminosity as the respective incandescent bulbs that the LED-based light bulbs are intended to replace. However, the total size of one of the LED-based lights is often limited, such as due to a fixture size constraint. For example, a desk lamp may only be able to accept a bulb having a three to four inch diameter, in which case the over-sized base of an LED-based light should not exceed three to four inches in diameter. Thus, the size of the over-sized base for the known LED-based light bulb is constrained, and heat dissipation remains problematic.

[0007] Further, the use of over-sized bases in some known LED-based light bulbs detracts from the distributions of light emanating from the bulbs. That is, for a typical known LED-based light bulb having one of the over-sized bases, the over-sized base has a diameter as large as or larger than a maximum diameter of the bulb of the known LED-based light bulb. As a result of its small bulb diameter to base diameter ratio, the base blocks light that has been reflected by the bulb and would otherwise travel in a direction toward an electrical connector at an end of the base. The typical known LED-based light bulb thus does not direct much light in a direction toward the electrical connector. For example, when the typical known LED-based light bulb having an over-sized base is installed in a lamp or other fixture in which the bulb is oriented with its base below its bulb, very little light is directed downward. Thus, the use of over-sized bases can also prevent known LED-based lights from closely replicating the light distribution of incandescent bulbs.

[0008] In addition to using over-sized bases, other attempts have been made to increase the ability of known LED-based light bulbs to dissipate heat. For example, bases of some known LED-based light bulbs include motorized fans for increasing the amounts of airflow experienced by the bases. However, known LED-based light bulbs including fans often produce audible noise and are expensive to produce. As another example, bases of known LED-based lights have been provided with axially extending ribs in an attempt to increase the surface areas of the bases without too greatly increasing the diameters of the bases. However, such ribs often have the effect of acting as a barrier to air flow and, as a result, tend to stall air flow relative to the base. As a result, bases with ribs typically do not provide a sufficient amount of heat dissipation. As yet another example, fluid fill LED-based lights have been introduced, with the fluid intended to efficiently transfer heat from LEDs to outside shells of the lamps. However, these lamps are at risk for leaking or spilling their fluid, and allowance must be made for thermal expansion of the fluid, thereby reducing the heat-transferring ability of the lamps.

[0009] One known LED-based light bulb is disclosed in JP 2010 015754 A, which shows a lamp 1 with a luminous radiation machine 10 and a cap 20. The lower end

of the luminous radiation machine 10 abuts a light emitting unit 30 with a light emitting device 32. The luminous radiation machine 10 is a laminated structure including a light guide layer 11 and a light reflection layer 12 formed in the inner surface of the light guide layer 11. The lamp 1 includes a tubular radiator 40 in the internal space 10a of the luminous radiation machine 10. The light emitting unit 30 contacts or approaches the periphery of the radiator 40. The luminous radiation machine 10 is an envelope that completely surrounds the radiator 40. The heat generated by the light emitting device 32 is transmitted to the radiator 40 and emitted to the internal space 10a of the luminous radiation machine 10 for emission outside the lamp 1 via the luminous radiation machine 10. Another known LED-based light bulb is disclosed in US 2007/195527 A1, which shows an LED luminaire 10 with a screw base interface 12, including a thermal cap 14 and a lens 22 enclosing a core 24 with LEDs 26. Heat is dispersed by controlled convection airflow through the thermal cap 14. Specifically, the lens 22 creates a venturi when attached to the thermal cap 14, and the entering air passes over an impeller which creates a consistent uniform turbulence. Yet another known LED-based light bulb is disclosed in US 2009/059559 A1, which shows an LED lamp with a base 2 and a support 4 on which several LEDs 5 are mounted connected to the base 2. The support 4 is a vertically standing hollow element with an air passage opening on the top and bottom. The support 4 sits on a fan 6 that intensifies airflow through the support 4. The support 4 and the fan 6 are enclosed by a transparent cover 7 with a discharge channel 10.

SUMMARY

[0010] According to the present invention, there is provided an LED-based light as defined in Claim 1. Examples of "inside-out" LED-based bulbs described herein can have advantages over known LED-based light bulbs. For example, an example of an inside-out LED-based bulb includes a base having a first end and a second end. The base includes a physical connector fixed to the first end of the base and may include an electrical connector on one of its ends, and the base can define a compartment that can contain electronics such as a power converter and/or any other electronics in electric communication with the electrical connector. One or more LEDs can be mounted on an opposing end of the base and if more than one LED is included the LEDs can be mounted on an annular circuit board that is in electrical communication with the electronics. An annular light pipe can be positioned over the LEDs such that light produced by the LEDs enters the light pipe. High-surface area heat dissipating structures, such as fins or pins, extend from the base through a cavity defined by the annular light pipe. A thermal shroud can be positioned over distal ends of the heat dissipating structures to protect against, as an example, inadvertent contact of a hand with one or more of the heat dissipating structures. An additional group of

LEDs can optionally be mounted on a distal end of the heat dissipating structures interior of the thermal shroud. Other inside-out LED-based bulb configurations are also described herein.

[0011] In operation, the inside-out LED-based bulb can be engaged with a conventional fixture designed to receive, for example, an incandescent bulb. When powered, the electronics of the LED-based bulb can convert power received from the fixture via the electrical connector to a type of power suitable for the LEDs, and that power can be transferred to the LEDs via the circuit board. As such, the LEDs can produce light, and that light can enter the light pipe, which can in turn distribute the light in a manner closely replicating an incandescent bulb. Moreover, heat produced by the LEDs can pass to the base via the circuit board, and from the base to the heat dissipating structures. The surface area of the heat dissipating structures can be large enough to dissipate a sufficient amount of heat to allow the LEDs to use an amount of power sufficient for the LEDs to replicate an incandescent bulb. Additionally, as a result of the location of the heat dissipating structures - inside the cavity defined by the annular light pipe - the structures do not interfere with the distribution of light. Thus, inside-out LED-based lights as described herein can each produce a sufficient amount of light to replicate incandescent bulbs without overheating because of their heat dissipating ability, and the lights can produce that light in a distribution closely replicating an incandescent bulb because a large light blocking base acting as a heat sink can be avoided.

[0012] The LED based light comprises at least one LED arranged at the second end of the base and a light pipe having an inner surface and an outer surface and extending from the second end of the base along a longitudinal axis of the light to define a cavity radially inward of the inner surface and having an opposing exterior outer surface extending radially outward of the base. The light pipe has a proximal light receiving portion and is optically configured to receive a light emitted by the at least one LED and to distribute substantially all of the received light radially outward from the light pipe in a predetermined light distribution. A heat dissipating structure is in thermally conductive relation to the at least one LED and extending from the second end of the base into the cavity. The light pipe has an open-ended annular structure, with the cavity in fluid communication with an ambient environment, and a distal end, with the inner surface configured to produce substantially total internal reflection of light received by the light receiving portion. The outer surface and the distal end are configured to emit the reflected light.

[0013] Also disclosed are methods of making an LED based light. One method comprises providing a base having a first end and a second end, mounting a light structure having an inner surface and an outer surface and defining a cavity adjacent to the base so that the light structure extends along a longitudinal axis of the light,

providing a heat dissipating structure within the cavity and mounting at least one LED in thermally conductive relation to the heat dissipating structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The description herein makes reference to the accompanying drawings wherein like reference numerals refer to like parts throughout the several views, and wherein:

FIG. 1 is a cross sectional view of an example of an inside-out LED-based bulb, according to the invention, taken along a longitudinal axis of the LED-based bulb;

FIG. 2 is a blown-up view of a region of FIG. 1 including an LED and a proximal end of a light pipe, according to the invention;

FIG. 3 is a partial perspective view of the bulb of FIG. 1;

FIG. 4 is a partial perspective view of another example of an inside-out LED-based bulb, according to the invention;

FIG. 5 is a cross sectional view of an LED-based bulb taken along a longitudinal axis of the LED-based bulb, for comparison;

FIG. 6 is a cross sectional view of a another example of an inside-out LED-based bulb, according to the invention, taken along a longitudinal axis of the LED-based bulb;

FIG. 7 is a cross sectional view of a portion of a further example of an inside-out LED-based bulb, according to the invention, taken along a longitudinal axis of the LED-based bulb;

FIG. 8 is a cross sectional view of a portion of still a further example of an LED-based bulb, taken along a longitudinal axis of the LED-based bulb;

FIG. 9 is a cross sectional view of a portion of yet a further example of an inside-out LED-based bulb, according to the invention taken along a longitudinal axis of the LED-based bulb;

FIG. 10 is a cross sectional view of a portion of an additional example of an inside-out LED-based bulb, according to the invention, taken along a longitudinal axis of the LED-based bulb; and

FIG. 11 is a top plan view of the bulb of FIG. 10.

DESCRIPTION

[0015] Examples of inside-out LED-based bulbs are discussed herein with reference to FIGS. 1-11. The bulbs are referred to as being "inside-out" because the bulbs can include heat dissipating structures located radially inward of a light source, such as a light pipe, relative to longitudinal axes of the bulbs. (An example of a longitudinal axis 104 is shown in FIG. 5, and the term radial refers to a direction orthogonal to a longitudinal axis unless otherwise indicated.) A first example of an inside-

out LED-based bulb 10 in FIG. 1 is configured to replace a conventional incandescent light bulb in a conventional fixture, such as an Edison-type fixture. Alternatively, the bulb 10 can be configured to replace another type of bulb.

5 The bulb 10 can include a base 12 that houses electronics 14, a circuit board 16, a plurality of LEDs 18, a light pipe 20, heat dissipating structures 22 and thermal shrouds 24 and 25.

[0016] One end of the base 12 can include an electrical connector 26. The electrical connector 26 as illustrated is of the Edison-type, although the base can alternatively include another type of electrical connector 26 such a bi-pin or bayonet type connector. The type of connector 26 can depend on the type of fixture that the bulb 10 is designed to be engaged with. In addition to providing an electrical connection between the bulb 10 and the fixture, the connector 26 can also serve to physically connect the bulb 10 to the fixture. For example, by screwing the connector 26 into engagement with an Edison-type fixture, the bulb 10 is both physically and electrically connected to the fixture. Additionally, the connector 26 can be in electrical communication with the electronics 14. For example, electrically conductive wires can link the connector 26 and electronics 14. The connector 26 can be snap-fit, adhered, or otherwise fixed to a remainder of the base 12. The base 12 can be constructed from a highly thermally conductive material, such as aluminum, another metal, or a highly thermally conductive polymer. The base 12 can be painted, powder-coated, or anodized to improve its thermal emissivity. For example, a thermally conductive, high emissivity paint (e.g., a paint having an emissivity of greater than 0.5) can be applied to at least a portion of an exterior of the base 12.

[0017] The base 12 can be hollow so as to define a compartment 28 large enough to receive electronics 14. The electronics 14 can include, as an example, power conversion electronics (e.g., a rectifier, a filtering capacitor, and/or DC to DC conversion circuitry) for modifying power received from the connector 26 to power suitable for transmission to the circuit board 16. By forming the connector 26 separately from the remainder of the base 12 as mentioned above, the base 12 not including the connector 26 can define an opening for installation of the electronics 14. The opening in the base 12 can then be sealed when the connector 26 is fixed to the base 12.

[0018] The base 12 can define various apertures 30. The apertures 30 can be at one or more of a variety of locations, such as along the base 12 between connector 26 and the circuit board 16, adjacent and radially inward of the circuit board 16, and adjacent the heat dissipating structures 22. Each aperture 30 can provide a path of airflow between the compartment 28 and an ambient environment external the base 12. As a result, the apertures 30 can allow airflow between the compartment 28 and the ambient environment external the base 12, thereby facilitating heat transfer from the base 12 and electronics 14 to the ambient environment. Additionally, an electrical connection between the electronics 14 and circuit board

16 can pass through one or more of the apertures 30.

[0019] The base 12 can additionally define an annular platform 31. The platform 31 can be generally planar. The circuit board 16 can be annular and can be mounted on the platform 31. For example, the circuit board 16 can be attached to the platform 31 using thermally conductive tape or in another manner, such as using an adhesive or a snap-fit connection. The circuit board 16 can be electrically connected to the electronics 14, such as by way of electrically conductive wires extending through one or more of the apertures 30 and linking the circuit board 16 to the electronics 14.

[0020] The circuit board 16 can be an annular printed circuit board. Additionally, the circuit board 16 can be formed of multiple discrete circuit board sections, which can be electrically connected to one another using, for example, bridge connectors. For example, the circuit board 16 can be formed of multiple rectangular circuit boards arranged about the platform 31. Also, other types of circuit boards may be used, such as a metal core circuit board. Or, instead of a circuit board 16, other types of electrical connections (e.g., wires) can be used to electrically connect the LEDs 18 to each other and/or the electronics 14.

[0021] The LEDs 18 can be mounted on the circuit board 16 and in electrical communication therewith. As such, the LEDs 18 can be arranged in an annular configuration with the heat dissipating structures 22 extending from the base 12 radially inward of the LEDs 18. The LEDs 18 can be spaced at even intervals around the platform 31, although the LEDs 18 can alternatively be arranged in another fashion, such as in a pattern of two or more circles having different diameters. The LEDs 18 can be surface-mount devices of a type available from Nichia, though other types of LEDs can alternatively be used. For example, although surface-mounted LEDs 18 are shown, one or more organic LEDs can be used in place of or in addition thereto. Each LED 18 can include a single diode or multiple diodes, such as a package of diodes producing light that appears to an ordinary observer as coming from a single source. The LEDs 18 can be mounted on and electrically connected to the circuit board 16 using, for example, solder or another type of connection. The LEDs 18 can emit white light. However, LEDs that emit blue light, ultra-violet light or other wavelengths of light can be used in place of white light emitting LEDs 18.

[0022] The number and power level of the LEDs 18 can be selected such that the bulb 10 can produce a similar amount of luminosity as a conventional incandescent bulb that the bulb 10 is intended to be a substitute for. For example, if the bulb 10 is intended as a substitute for a 60 W incandescent bulb, the LEDs 18 in the aggregate can require 8-15 W of power, although this power level may change as LED technology improves. If the bulb 10 is intended to replicate another type of bulb, the LEDs 18 can output a different amount of light. The LEDs 18 can be oriented to face parallel to the longitudinal axis

of the bulb 10, although the LEDs 18 can alternatively be oriented at an angle to the illustrated position.

[0023] The light pipe 20 has a generally annular shape, and the light pipe 20 defines a cavity 32 radially inward of the light pipe 20. The light pipe 20 is positioned to receive light produced by the LEDs 18. For example, the light pipe 20 can have an annular-shaped proximal end 34 that defines an annular cutaway 36 sized to receive the LEDs 18 as shown in FIG. 2. The cutaway 36 can be continuous and annular shaped, or can have an alternative shape such as a plurality of circumferentially spaced discrete indentations spaced in accordance with spacing of the LEDs 18. The light pipe 20 can be positioned such that the LEDs 18 are received in the cutaway 36. Alternatively, the proximal end 34 can be planar and positioned against or slightly above the LEDs 18 with reference to the orientation shown in FIG. 1. As another alternative, if the light pipe 20 is hollow, the proximal end 34 can be an opening between radially spaced sidewalls of the light pipe 20. The light pipe 20 can be attached to the base 12 and/or the circuit board 14. For example, the light pipe 20 can be adhered or snap-fit to the base 12. Moreover, the light pipe 20 can be attached to the base radially outward of the circuit board 14 such that the base 12 and light pipe 20 effectively seal off the circuit board 14.

[0024] The light pipe 20 can be optically configured to direct light produced by the LEDs 16 that enters the light pipe 20 in a distribution that appears to an ordinary observer to replicate the incandescent bulb which the bulb 10 is a substitute for, although the light pipe 20 can produce an alternative distribution of light depending on its configuration. Experimentation, a computational model or other means can be used to determine the specific shape of the light pipe 20 in order to achieve a certain light distribution. While the light pipe 20 shown in FIG. 1 has a conical shape including a linear outer radial surface 38 and a linear inner radial surface 40, both of which extend radially outward as the light pipe 20 extends away from the base 12, the light pipe 20 can have other shapes. For example, FIG. 6 shows a light pipe 20' having a bulbous profile similar to a conventional incandescent bulb. The bulbous profile of the light pipe 20' can have a more familiar appearance for consumers. Additionally, the light pipe 20' can provide a different light distribution than the light pipe 20, with the light pipe 20' distributing a greater amount of light in a longitudinal direction.

[0025] The shape of the light pipe 20 is designed such that the inner radial surface 40 causes total internal reflection of most light that contacts the surface 40', thereby reducing or eliminating the amount of light that enters the cavity 32. In addition to shaping the light pipe 20 to achieve a certain light distribution, other means for achieving a certain light distribution can also be used as discussed below with reference to FIG. 9. The light pipe 20 can be hollow or solid between surfaces 38 and 40.

[0026] The heat dissipating structures 22 extend away from the base 12 within the cavity 32 defined by the light

pipe 20, and the heat dissipating structures 22 can be in thermal communication with the base 12, including the platform 31. As such, the heat dissipating structures 22 are in thermal communication with the LEDs 18 via the circuit board 16. The structures 22 can be made from highly thermally conductive material, such as aluminum, another metal, or a highly thermally conductive plastic. The shape of the structures 22 can provide a high surface area to volume ratio, or otherwise be designed to aid heat dissipation. For example, the structures 22 can be pins as shown in FIG. 3, fins, concentric conical shapes of varying diameters, a lattice-type structure, or any other heat-sink type shape. The heat dissipating structures 22 can be integrally formed with the base 12 (e.g., via machining or casting), or formed separately and attached thereto.

[0027] The shrouds 24 and 25 can protect against accidental contact with the bulb 10. For example, the shrouds 24 and 25 can be formed of thermally insulating materials (e.g., plastic) and spaced from the base 12 and heat dissipating structures 22, respectively, so as to remain at a relatively cool temperature regardless of the temperatures of the base 12 and/or the heat dissipating structures 22. The shroud 24 can extend over a distal end of the cavity 32 and can be attached to the light pipe 20. For example, the shroud 24 can be attached to the inner radial surface 40 of the light pipe 20 adjacent the distal end of the light pipe 20 opposite the platform 31 so as not to block any light passing through the distal end of the light pipe 20. The shroud 24 can be adhered to the light pipe 20 or attached in another manner (e.g., the shroud 24 can be integrally formed with the light pipe 20). The shroud 24 can include apertures to facilitate airflow between the cavity 32 and the ambient environment, or the shroud can be solid 24. The shroud 24 can protect against inadvertent contact with the heat dissipating structures 22, which may become hot during usage of the bulb 10. Similarly, the shroud 25 can cover the base 12, and can also cover a junction between the light pipe 20 and base 12. The shroud 25 can protect against inadvertent contact with the base 12.

[0028] In operation, the bulb 10 can be installed in a conventional fixture, such as an Edison-type fixture in a lamp, ceiling or other location. Electricity can be supplied to the bulb 10 via the connector 26, and the electricity can pass to the electronics 14. The electronics 14 can convert the electricity to a form acceptable for the LEDs 18, and the converted electricity can pass to the circuit board 16 and, in turn, the LEDs 18. In response, the LEDs 18 can produce light. The light can enter the light pipe 20, which can distribute the light to replicate a conventional incandescent bulb or some other predetermined pattern. Heat produced by the LEDs 18 during operation can pass through the circuit board 16 to the base 12, and from the base 12 to the ambient environment and to the heat dissipating structures 22. The heat dissipating structures 22 can dissipate heat into the cavity 32. Heat in the cavity 32 can reach the ambient environment by dissi-

pating across or through apertures in the shroud 24. As a result of the heat dissipation abilities of the base 12 and its heat dissipating structures 22, the LEDs 18 can produce a sufficient amount of light to replace an incandescent bulb or another type of light without overheating. Further, the light pipe 20 can distribute that light in a manner replicating the even distribution of the incandescent bulb, although other distributions are also possible.

[0029] In another example shown in FIG. 4, the LED-based bulb 10 can include a second circuit board 42 atop the heat dissipating structures 22 and having LEDs 18 mounted thereon. The second circuit board 42 and its LEDs 18 can supplement or act as a substitute for light passing out the distal end of the light pipe 20. The second circuit board 42 can be attached to the heat dissipating structures 22 using, as an example, thermally conductive tape or an adhesive, and the board 42 can be electrically connected to the electronics 14 or the circuit board 16 using electrically conductive wires that extend through the cavity 32. If the shroud 24 is used, the shroud 24 can be formed of a light transmitting material.

[0030] An LED-based bulb 100 shown in FIG. 5 for comparison includes organic LEDs (also known as OLEDs) 102. The bulb 100 can include a base 106 having an electrical connector 108 and housing electronics 110 in a cavity 113 similar to as described above in respect of the base 12, its connector 26 and electronics 14. The OLEDs 102 can be in electrical communication with the electronics 110 for receiving power received by the connector 108. The base 106 can have a conical flange 112, and the OLEDs 102 can be attached to an outer radial surface 112a the conical flange 112 such that the OLEDs 102 extend circumferentially about the flange 112. The OLEDs 102 can be attached to the flange 112 using, as example, adhesive or thermally conductive tape. The base 106 can additionally include heat dissipating structures 114, such as pins, fins, a lattice-type structure, a series of concentric conical extensions, or other high surface area to volume shapes, radially inward of the OLEDs 102 and the flange 112. The flange 112 and structures 114 can be in thermal communication such that the structures 114 can aid in dissipating heat transferred from the OLEDs 102 to the flange 112. A thermal shroud 116 can extend over the flange 112 to cover the flange and structures 114, and the shroud 116 can have the same configuration as the shroud 24 discussed above with respect to FIG. 1.

[0031] Note that the OLEDs 102 need not extend continuously about the entire surface of the exterior surface 112a of the flange 112, and can instead, as an example, be circumferentially or longitudinally spaced from one another. Alternatively, a single OLED 102 can be wrapped around the flange 112. Additionally, another OLED or LED can be attached to a distal end of the heat dissipating the flange 112 and/or structures 114 for producing light along the axis 104. Also, the flange 112 can be formed of multiple discrete, circumferentially spaced flange portions or can have an alternative structure for supporting

OLEDs 102 and receiving heat therefrom.

[0032] In operation, as a result of being attached to the flange 112 the OLEDs 102 are in thermal communication with the flange 112 and heat produced by the OLEDs 102 during operation can be communicated to the base 106. The OLEDs 102 can produce light radially outward from the axis 104 in a distribution replicating an incandescent bulb. Further, since heat can be effectively dissipated from the OLEDs 102 by the flange 112 and heat dissipating structures 114, the OLEDs 102 can operate at a sufficiently high power to produce a similar amount of light as an incandescent bulb without overheating.

[0033] FIG. 7 shows another example of an inside-out LED-based bulb 200. The bulb 200 includes a conical light pipe 202 having a light receiving portion 204 along a radial interior of a distal end of the light pipe 202 (relative to a base not shown in FIG. 7). Alternatively, the light receiving portion 204 can have a different location, such as spaced more toward a proximal end of the light pipe 202. The light receiving portion 204 can extend circumferentially about the entire light pipe 202 or can be comprised of a series of light receiving portions. Heat dissipating structures 210, such as pins, fins, or a lattice structure, extend from a base toward a distal end of the light pipe 202 within a cavity 203 defined by the light pipe 202. A disk 205 of thermally conductive material can be positioned atop the heat dissipating structures 210 for thermal communication therewith. LEDs 206 can be positioned on an outer radial side 208 of disk 205. For example, the LEDs 206 can be mounted on an annular circuit board attached to the disk 205 and in electrical communication with a connector of the bulb 200. The LEDs 206 can face the light receiving portion 204 such that light produced by the LEDs 206 enters the light pipe 202 and can be distributed to replicate the distribution of light provided by, for example, an incandescent bulb. Alternatively, if no disk 205 is included, the LEDs 206 can be attached to distal ends of the heat dissipating structures 210. A thermally protective shroud 207 can span the cavity 203 to protect against, for example, inadvertent contact with the disk 205 and/or LEDs 206, and the shroud 207 can include apertures for allowing air flow between the cavity 203 and ambient environment external the bulb 200.

[0034] In operation, the LEDs 206 can receive power from a fixture via any electronics included in a base of the bulb 200 and any circuit board on which the LEDs 206 are mounted. The LEDs 206 can produce light in response to receiving power, and that light can enter the light pipe 202. The light pipe 202 can distribute the light longitudinally and radially to replicate, for example, a conventional incandescent bulb. Heat produced by the LEDs 206 during operation can be communicated to the disk 205, from the disk 205 to the heat dissipating structures 210, and from the heat dissipating structures 210 to air in the cavity 203. The air in the cavity 203 can circulate with air in the ambient environment via, as an example, apertures in the shroud 207 and apertures 209 formed in the light pipe 202. Thus, the LEDs 206 can be cooled

to a sufficient extent that the LEDs 206 in the aggregate can produce enough light to replicate, as an example, an incandescent bulb.

[0035] Still another example of an LED-based bulb 300 is shown in FIG. 8. In this example, LEDs 302 are positioned on a circuit board 304 atop heat dissipating structures 306 similar to as explained with respect to FIG. 4. However, in this example, a light pipe 308 includes a domed-portion 310 spanning a distal end 312 of the light pipe 308. Additional LEDs can operationally be included to produce light that enters a proximal end of the light pipe as explained with respect to FIG. 1. The domed-portion 310 can act as a lens to distribute light produced by the LEDs 302 in a predetermined pattern, such as a pattern having the appearance of light produced by the distal end of a conventional incandescent bulb. Alternatively, the domed-portion 310 can act as light pipe allowing some light to exit a distal end of the bulb 300 and guiding some light toward a proximal end of the light pipe 308.

[0036] As shown in FIG. 9, another example of a base 12' is shown in conjunction with the circuit board 16, LEDs 18 and light pipe 20 from FIG. 1. In addition to including heat dissipating structures 22 spaced radially inward from the light pipe 20, the base 12' includes a flange 50 in thermal contact with the inner radial surface 40 of the light pipe 20. Thermal paste 52 can be applied at a junction between the inner radial surface 40 and the flange 50 to facilitate heat transfer from the light pipe 20 to the flange 50. Additionally, a reflector 54, such as reflective paint or a mirrored insert, can be applied to the inner radial surface 40 to ensure that all or nearly all light exits the outer radial surface 38 or the distal end 20a of the light pipe 20. Additionally, the light pipe 20 can be modified in other manners to obtain a predetermined light distribution. For example, a layer of diffusive material can be applied over the outer radial surface 38 and/or the distal end 20a of light pipe 20, or the light pipe 20 can include surface roughening or other light diffracting structures along one or both of the surface 38 distal end 20a of the light pipe 20. Moreover, the treatment of the light pipe 20 can vary over its longitudinal dimension. For example, light diffracting structures can become more dense nearer the distal end 20a of the light pipe 20.

[0037] In addition to facilitating heat transfer via the inclusion of the heat transferring structures, other example of an inside-out LED-based bulb can have active heat dissipating devices. For example, FIGS. 10 and 11 show an example of an LED-based bulb 400 including a base 402, an annular circuit board 404 having LEDs 406 mounted thereon, and an annular light pipe 408 that receives light produced by the LEDs 406 and defines a cavity 410 radially inward of the light pipe 408. Heat dissipating structures 412, such as pins, fins, or a lattice structure, can be disposed in the cavity 410. Additionally, a piezo-driven fan 414 can be disposed in the cavity 410. For example the heat dissipating structures 412 can define an open channel 413, and the fan 414 can be dis-

posed in the channel 413 and supported by adjacent heat dissipating structures 412. The fan 414 can be operable in response to its temperature becoming elevated to produce an airflow. Thus, the fan 414 can facilitate convective heat transfer from the heat dissipating structures 412 to an ambient environment about the bulb 400 without using any electricity. Alternatively, the piezo-driven fan 414 can be disposed at a different location, such as underlying the heat dissipating structures 412.

[0038] In one embodiment, an LED based light comprises: a base having a first end and a second end; a light structure adjacent to the base and extending along a longitudinal axis of the light; wherein the light structure includes an inner surface and an outer surface and defines a cavity; a heat dissipating structure extending into the cavity; and at least one LED mounted in thermally conductive relation to the heat dissipating structure.

[0039] The LED based light further comprises a connector fixed to the first end of the base and configured to provide a physical connection to a conventional incandescent light fixture. The light structure is a light pipe having a proximal end opposing a distal end; the inner surface is configured for substantially total internal reflection of light. The heat dissipating structure extends from the base.

[0040] In another aspect of this embodiment, the LED based light further comprises electronics wherein: the base defines a compartment; the electronics are disposed within the compartment; the connector is further configured to provide an electrical connection to the conventional incandescent light fixture; the electronics are in electrical communication with the connector and configured to receive a power from a conventional incandescent light fixture through the connector; the electronics are in electrical communication with the at least one LED; and the electronics are configured to supply a power suitable for transmission to the at least one LED.

[0041] In another aspect of this embodiment, the base includes a plurality of apertures configured to allow airflow between the compartment and an ambient environment external to the base.

[0042] In another aspect of this embodiment, the light structure is an annular flange; the at least one LED includes at least one organic LED; and the at least one organic LED is mounted to the outer surface and arranged to emit light in a predetermined light distribution.

[0043] In another aspect of this embodiment, the predetermined light distribution is the light distribution of a conventional incandescent bulb.

[0044] In another aspect of this embodiment the light pipe is configured to distribute a light produced by the at least one LED in a predetermined light distribution.

[0045] In another aspect of this embodiment, the predetermined light distribution is the light distribution of a conventional incandescent bulb.

[0046] In another aspect of this embodiment, the base is made from a thermally conductive material; and the at least one LED includes a first group of LEDs mounted in

thermally conductive relation to the base.

[0047] In another aspect of this embodiment, the second end defines an annular platform; an annular circuit board is mounted on the annular platform; the first group of LEDs is mounted on and in electrical communication with the annular circuit board; and the first group of LEDs is oriented to face substantially parallel to the longitudinal axis of the light.

[0048] In another aspect of this embodiment, the at least one LED includes a first LED disposed adjacent to the second end of the base; the proximal end of the light pipe includes a proximal light receiving portion optically configured to receive a light produced by the first LED.

[0049] In another aspect of this embodiment, the light pipe is an annular light pipe; the annular light pipe is solid between the inner surface and outer surface; and the proximal light receiving portion defines an annular cutaway sized to receive the first LED.

[0050] In another aspect of this embodiment, the at least one LED includes a second LED oriented to face the inner surface; and the inner surface includes an interior light receiving portion optically configured to receive a light produced by the second LED.

[0051] In another aspect of this embodiment, the heat dissipating structure is made from highly thermally conductive material; and the heat dissipating structure has a high surface area to volume ratio.

[0052] In another aspect of this embodiment, the heat dissipating structure is at least one of a plurality of longitudinally extending pins or a plurality of longitudinally extending fins.

[0053] In another aspect of this embodiment, the LED based light further comprises an active heat dissipating device disposed within the cavity.

[0054] In another aspect of this embodiment, the LED based light further comprises a first thermal insulating shroud disposed about the base.

[0055] In another aspect of this embodiment, the LED based light further comprises a second thermal insulating shroud, wherein: the second thermal insulating shroud extends over the distal end of the light structure to enclose the heat dissipating structure; and at least one of the light structure or the second thermal insulating shroud includes a plurality of apertures configured to allow airflow between the cavity and an ambient environment external to the light structure.

[0056] In another embodiment, a method making an LED based light comprises: providing a base having a first end and a second end; mounting a light structure having an inner surface and an outer surface and defining a cavity adjacent to the base so that the light structure extends along a longitudinal axis of the light; providing a heat dissipating structure within the cavity; and mounting at least one LED in thermally conductive relation to the heat dissipating structure.

[0057] In one aspect of this embodiment, the light structure is an annular flange, further comprising: mounting the annular flange in thermally conductive relation to

the heat dissipating structure; and mounting the at least one LED to the outer surface.

[0058] In another aspect of this embodiment, the light structure is a light pipe having a proximal end opposing a distal end; the inner surface is configured for substantially total internal reflection of light; and the light pipe is configured to distribute a light produced by the at least one LED in a predetermined light distribution.

[0059] In another embodiment, an LED based light for replacing a conventional incandescent light bulb comprises: a connector configured to provide a physical connection to a conventional incandescent light fixture; at least one LED; a light pipe having an inner surface and an outer surface and extending along a longitudinal axis of the light to define a cavity radially inward of the inner surface; wherein the light pipe is optically configured to receive a light emitted by the at least one LED and distribute substantially all of the received light radially outward from the light pipe in a predetermined light distribution; and a heat dissipating structure in thermally conductive relation to the at least one LED and extending into the cavity.

[0060] In one aspect of this embodiment, the outer surface is linear and extends radially outward along the longitudinal axis of the light to form a conical shape.

[0061] In another aspect of this embodiment, the outer surface is contoured to form a bulbous profile.

[0062] The above-described examples have been described in order to allow easy understanding of the invention and do not limit the invention. On the contrary, the invention is intended to cover various modifications and equivalent arrangements, whose scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structure as is permitted under the law.

Claims

1. An LED based light (10, 200, 400) comprising:

a base (12, 12', 402) having a first end and a second end;

a connector (26) fixed to the first end of the base (12, 12', 402) and configured to provide a physical connection to a conventional incandescent light fixture;

a light pipe (20, 202, 408) extending from the second end of the base (12, 12', 402) along a longitudinal axis (104) of the light (10, 200, 400), the light pipe (20, 202, 408) having a proximal light receiving portion (34), an inner surface (40) defining a cavity (32, 203, 410) and an opposing exterior outer surface (38) extending radially outward as the light pipe (20, 202, 408) extends away from the base (12, 12', 402);

at least one LED (18, 406) including a first LED disposed adjacent to the second end of the base

(12, 12', 402), and the proximal light receiving portion (34) is optically configured to receive a light produced by the first LED; and a heat dissipating structure (22, 210, 412) mounted in thermally conductive relation to the at least one LED (18, 406) and extending from the second end of the base (12, 12', 402) into the cavity (32, 203);

characterized by the light pipe (20, 202, 408) having an open-ended annular structure, with the cavity (32,203,410) in fluid communication with an ambient environment, and a distal end, with the inner surface (40) configured to produce substantially total internal reflection of light received by the light receiving portion (34), and the outer surface (38) and the distal end configured to emit the reflected light.

2. The LED based light (10, 200,400) of claim 1 further comprising:

electronics (14) housed in a compartment (28) defined by the base (12, 12', 402), the electronics (14) configured to receive power from a conventional incandescent light fixture and supply power to the at least one LED (18, 406), wherein the base (12, 12', 402) includes a plurality of apertures (30) configured to allow airflow between the compartment (28) and the ambient environment.

3. The LED based light (10, 200, 400) of claim 1 wherein the light pipe (20, 202, 408) is configured to distribute a light produced by the at least one LED (18, 406) in a predetermined light distribution.

4. The LED based light (10, 200, 400) of claim 1 wherein the base (12, 12', 402) is made from a thermally conductive material.

5. The LED based light (10, 200, 400) of claim 1 wherein:

the second end of the base (12, 12', 402) defines an annular platform (31) opposing the light receiving portion (34) of the light pipe (20, 202, 408);

an annular circuit board (16,404) is mounted on the annular platform (31);

the at least one LED (18, 406) is mounted on and in electrical communication with the annular circuit board (16, 404); and

the at least one LED (18, 406) is oriented to face substantially parallel to the longitudinal axis (104) of the light (10, 200, 400).

6. The LED based light (10, 200, 400) of claim 1 wherein:

the light pipe (20, 202, 408) is solid between the inner surface (40) and outer surface (38); and the proximal light receiving portion (34) defines an annular cutaway (36) sized to receive the at least one LED (18, 406).

7. The LED based light (10, 200, 400) of claim 1 wherein:

the heat dissipating structure (22, 210, 412) is made from highly thermally conductive material; and the heat dissipating structure (22, 210, 412) has a high surface area to volume ratio, wherein the heat dissipating structure (22, 210, 412) is at least one of a plurality of longitudinally extending pins or a plurality of longitudinally extending fins.

8. The LED based light (10, 200, 400) of claim 1 further comprising a thermal insulating shroud (25) disposed about the base (12, 12', 402).

9. The LED based light (200) of claim 1 further comprising a thermal insulating shroud (207) extending over the distal end of the light pipe (202) to enclose the heat dissipating structure (210), wherein at least one of the light pipe (202) or the thermal insulating shroud (207) includes a plurality of apertures (209) configured to allow airflow between the cavity (203) and the ambient environment.

10. The LED based light (10, 400) of claim 1 further comprising one additional LED (18) arranged within the cavity (32, 203) to emit light from the cavity (32, 203) in a direction of the longitudinal axis (104) of the light (10,400) to supplement light emitted from the distal end of the light pipe (20, 408).

11. The LED based light (10, 400) of claim 10 wherein the additional LED (18) is mounted on a circuit board (42) supported by the heat dissipating structure (22, 412).

12. The LED based light (200) of claim 1, wherein the inner surface (40) has an interior light receiving portion (204), further comprising one additional LED (206) arranged to illuminate the interior light receiving portion (204).

13. The LED based light (10, 200, 400) of claim 1 wherein the outer (38) surface is contoured to form a conical profile.

14. The LED based light (10) of claim 1 wherein the outer surface (38) is contoured to form a bulbous profile.

15. The LED based light (400) of claim 1 further comprising an active heat dissipating device (414) for

drawing air across the head dissipating structure (412).

5 Patentansprüche

1. LED-basiertes Licht (10, 200, 400), das Folgendes beinhaltet:

eine Basis (12, 12', 402), die ein erstes Ende und ein zweites Ende aufweist;
einen Verbinder (26), der am ersten Ende der Basis (12, 12', 402) fixiert und konfiguriert ist, um eine physische Verbindung mit einem herkömmlichen Glühlichtkörper bereitzustellen;
einen Lichtleiter (20, 202, 408), der sich vom zweiten Ende der Basis (12, 12', 402) entlang einer Längsachse (104) des Lichts (10, 200, 400) erstreckt, wobei der Lichtleiter (20, 202, 408) einen proximalen Lichtaufnahmeabschnitt (34), eine innere Oberfläche (40), die einen Hohlraum (32, 203, 410) definiert, und eine entgegengesetzte äußere Oberfläche (38), die sich radial nach außen erstreckt, während sich der Lichtleiter (20, 202, 408) von der Basis (12, 12', 402) weg erstreckt, aufweist;
mindestens eine LED (18, 406), einschließlich einer ersten LED, die sich neben dem zweiten Ende der Basis (12, 12', 402) befindet, wobei der proximale Lichtaufnahmeabschnitt (34) optisch konfiguriert ist, um ein von der ersten LED produziertes Licht aufzunehmen; und
eine Wärmeableitungsstruktur (22,210,412), die in wärmeleitfähiger Beziehung an mindestens einer LED (18, 406) montiert ist und sich vom zweiten Ende der Basis (12, 12', 402) in den Hohlraum (32, 203) erstreckt;
gekennzeichnet dadurch, dass der Lichtleiter (20, 202, 408) eine offenendige ringförmige Struktur, mit dem Hohlraum (32, 203, 410) in Fluidverbindung mit einer Umgebung, und ein distales Ende aufweist, mit der inneren Oberfläche (40) konfiguriert, um im Wesentlichen totale interne Reflexion des vom Lichtaufnahmeabschnitt (34) aufgenommen Lichts zu produzieren, und der äußeren Oberfläche (38) und dem distalen Ende konfiguriert, um das reflektierte Licht zu emittieren.

2. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, das weiter Folgendes beinhaltet:

Elektronik (14), die in einer durch die Basis (12, 12', 402) definierten Kammer (28) untergebracht ist, wobei die Elektronik (14) konfiguriert ist, um Strom von einem herkömmlichen Glühlichtkörper aufzunehmen und Strom an die mindestens eine LED (18, 406) zu liefern, wobei die

- Basis (12, 12', 402) eine Vielzahl von Öffnungen (30) einschließt, die konfiguriert sind, um Luftfluss zwischen der Kammer (28) und der Umgebung zu erlauben.
3. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei der Lichtleiter (20, 202, 408) konfiguriert ist, um ein durch die mindestens eine LED (18, 406) produziertes Licht in einer vorbestimmten Lichtverteilung zu verteilen.
4. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei die Basis (12, 12', 402) aus einem wärmeleitfähigen Material gefertigt ist.
5. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei:
- das zweite Ende der Basis (12, 12', 402) eine ringförmige Plattform (31) definiert, die dem Lichtaufnahmeabschnitt (34) des Lichtleiters (20, 202, 408) gegenüberliegt; eine ringförmige Leiterplatte (16, 404) auf der ringförmigen Plattform (31) montiert ist; die mindestens eine LED (18, 406) auf und in elektrischer Verbindung mit der ringförmigen Leiterplatte (16,404) montiert ist; und die mindestens eine LED (18,406) ausgerichtet ist, um im Wesentlichen parallel der Längsachse (104) des Lichts (10, 200, 400) zugewandt zu sein.
6. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei:
- der Lichtleiter (20, 202, 408) zwischen der inneren Oberfläche (40) und der äußeren Oberfläche (38) massiv ist; und der proximale Lichtaufnahmeabschnitt (34) einen ringförmigen Ausschnitt (36) definiert, der bemessen ist, um die mindestens eine LED (18, 406) aufzunehmen.
7. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei:
- die Wärmeableitungsstruktur (22, 210, 412) aus hochwärmeleitfähigem Material gefertigt ist; und die Wärmeableitungsstruktur (22, 210, 412) ein hohes Oberflächen-zu-Volumen-Verhältnis aufweist, wobei die Wärmeableitungsstruktur (22, 210, 412) mindestens eine von einer Vielzahl von sich längsweise erstreckenden Stiften oder einer Vielzahl von sich längsweise erstreckenden Rippen ist.
8. LED-basiertes Licht (10,200,400) gemäß Anspruch
- 1, das weiter eine wärmeisolierende Verkleidung (25) beinhaltet, die sich um die Basis (12, 12', 402) herum befindet.
9. LED-basiertes Licht (200) gemäß Anspruch 1, das weiter eine wärmeisolierende Verkleidung (207) beinhaltet, die sich über das distale Ende des Lichtleiters (202) erstreckt, um die Wärmeableitungsstruktur (210) zu umschließen, wobei mindestens eines des Lichtleiters (202) oder der wärmeisolierenden Verkleidung (207) eine Vielzahl von Öffnungen (209) einschließt, die konfiguriert sind, um Luftfluss zwischen dem Hohlraum (203) und der Umgebung zu erlauben.
10. LED-basiertes Licht (10, 400) gemäß Anspruch 1, das weiter eine zusätzliche LED (18) beinhaltet, die innerhalb des Hohlraums (32, 203) angeordnet ist, um aus dem Hohlraum (32, 203) Licht in eine Richtung der Längsachse (104) des Lichts (10, 400) zu emittieren, um das vom distalen Ende des Lichtleiters (20, 408) emittierte Licht zu ergänzen.
11. LED-basiertes Licht (10, 400) gemäß Anspruch 10, wobei die zusätzliche LED (18) auf einer Leiterplatte (42) montiert ist, gestützt durch die Wärmeableitungsstruktur (22, 412).
12. LED-basiertes Licht (200) gemäß Anspruch 1, wobei die innere Oberfläche (40) einen innenseitigen Lichtaufnahmeabschnitt (204) aufweist, das weiter eine zusätzliche LED (206) beinhaltet, die angeordnet ist, um den innenseitigen Lichtaufnahmeabschnitt (204) zu beleuchten.
13. LED-basiertes Licht (10, 200, 400) gemäß Anspruch 1, wobei die äußere Oberfläche (38) konturiert ist, um ein konisches Profil zu bilden.
14. LED-basiertes Licht (10) gemäß Anspruch 1, wobei die äußere Oberfläche (38) konturiert ist, um ein bauchiges Profil zu bilden.
15. LED-basiertes Licht (400) gemäß Anspruch 1, das weiter eine aktive Wärmeableitungsvorrichtung (414) beinhaltet, um Luft über die Wärmeableitungsstruktur (412) zu ziehen.
- Revendications**
1. Un éclairage à DEL (10, 200, 400) comprenant :
- un socle (12, 12', 402) possédant un premier bout et un deuxième bout ;
une douille (26) fixée au premier bout du socle (12, 12', 402), et configurée pour assurer une connexion physique avec une armature de lu-

- mière incandescente traditionnelle ;
 un conduit de lumière (20, 202, 408) s'étendant du deuxième bout du socle (12, 12', 402) le long de l'axe longitudinal (104) de la lampe (10, 200, 400), le conduit de lumière (20, 202, 408) comprenant une partie de réception proximale de la lampe (34), une surface interne (40) définissant une cavité (32, 203, 410) et une surface externe extérieure opposée (38) s'étendant radialement vers l'extérieur, le conduit de lumière (20, 202, 408) s'étendant dans la direction opposée au socle (12, 12', 402) ;
 au moins une diode électroluminescente DEL (18, 406), y compris une première DEL disposée dans une position adjacente au deuxième bout du socle (12, 12', 402), et la partie de réception proximale de la lampe (34) étant configurée optiquement pour recevoir un éclairage produit par la première DEL ; et
 une structure de dissipation thermique (22, 210, 412) au montage thermiquement conducteur relativement à la DEL (18, 406) au nombre d'au moins une, et s'étendant du deuxième bout du socle (12, 12', 402) jusque dans la cavité (32, 203) ;
caractérisé en ce que le conduit de lumière (20, 202, 408) possède une structure annulaire à bout ouvert, la cavité (32, 203, 410) étant en communication par le fluide avec un milieu ambiant, et une extrémité distale, la surface interne (40) étant configurée pour produire une réflexion interne substantiellement totale de la lumière reçue par la partie de réception de la lumière (34), et la surface externe (38) et l'extrémité distale étant configurée pour émettre la lumière réfléchie.
2. L'éclairage à DEL (10, 200, 400) selon la revendication 1, comprenant en outre :
- une électronique (14) placée dans un compartiment (28) défini par le socle (12, 12', 402), l'électronique (14) étant configurée pour recevoir son alimentation d'une armature de lumière incandescente traditionnelle et alimenter la DEL (18, 406) au nombre d'au moins une, le socle (12, 12', 402) comprenant une pluralité d'ouvertures (30) configurées pour permettre à l'air de s'écouler entre le compartiment (28) et le milieu ambiant.
3. L'éclairage à DEL (10, 200, 400) selon la revendication 1, le conduit de lumière (20, 202, 408) étant configuré pour distribuer une lumière produite par la DEL (18, 406) au nombre d'au moins une dans une distribution prédéterminée de la lumière.
4. L'éclairage à DEL (10, 200, 400) selon la revendication 1, le socle (12, 12', 402) étant réalisé avec une matière à conductivité thermique.
5. L'éclairage à DEL (10, 200, 400) selon la revendication 1,
 le deuxième bout du socle (12, 12', 402) définissant une plate-forme annulaire (31) opposant la partie réceptrice de la lumière (34) du conduit de lumière (20, 202, 408) ;
 une carte de circuit annulaire (16, 404) étant montée sur la plate-forme annulaire (31) ; la DEL (18, 406) au nombre d'au moins une étant montée sur la carte de circuit annulaire (16, 404), et se trouvant en communication électrique avec celle-ci ; et
 la DEL (18, 406) au nombre d'au moins une étant orientée de façon à être tournée de façon substantiellement parallèle à l'axe longitudinal (104) de l'éclairage (10, 200, 400).
6. L'éclairage à DEL (10, 200, 400) selon la revendication 1,
 le conduit de lumière (20, 202, 408) étant solide entre la surface interne (40) et la surface externe (38) ; et
 la partie réceptrice proximale de l'éclairage (34) définissant un évidement annulaire (36) dimensionné de façon à recevoir la DEL (18, 406) au nombre d'au moins une.
7. L'éclairage à DEL (10, 200, 400) selon la revendication 1,
 la structure de dissipation thermique (22, 210, 412) étant réalisée avec un matériau conducteur à conduction thermique élevée ; et
 la structure de dissipation thermique (22, 210, 412) présentant un ratio superficie / volume élevé, la structure de dissipation thermique (22, 210, 412) étant au moins une des broches longitudinales ou une série d'ailettes longitudinales.
8. L'éclairage à DEL (10, 200, 400) selon la revendication 1, comprenant en outre une enveloppe d'isolation thermique (25) disposée autour du socle (12, 12', 402).
9. L'éclairage à DEL (200) selon la revendication 1, comprenant en outre une enveloppe d'isolation thermique (207) s'étendant sur l'extrémité distale du conduit de lumière (202) pour envelopper la structure de dissipation thermique (210), au moins un des suivants : conduit de lumière (202) ou enveloppe d'isolation thermique (207) comprenant une série d'ouvertures (209) configurées pour permettre un écoulement d'air entre la cavité (203) et l'environnement ambiant.
10. L'éclairage à DEL (10, 400) selon la revendication 1, comprenant en outre une DEL supplémentaire (18) disposée autour de la cavité (32, 203) pour

émettre de la lumière depuis la cavité (32, 203) dans une direction de l'axe longitudinal (104) de la lumière (10, 400) pour compléter la lumière émise depuis l'extrémité distale du conduit de lumière (20, 408).

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11. L'éclairage à DEL (10, 400) selon la revendication 10, la DEL supplémentaire (18) étant montée sur une carte de circuit (42) supportée par la structure de dissipation thermique (22,412).

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12. L'éclairage à DEL (200) selon la revendication 1, la surface interne (40) présentant une partie réceptrice de la lumière (204), comprenant en outre une DEL supplémentaire (206) agencée de façon à éclairer la partie réceptrice de la lumière (204).

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13. L'éclairage à DEL (10, 200, 400) selon la revendication 1, la surface extérieure (38) étant profilée de façon à présenter une forme conique.

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14. L'éclairage à DEL (10) selon la revendication 1, la surface extérieure (38) étant profilée de façon à présenter une forme bulbeuse.

15. L'éclairage à DEL (400) selon la revendication 1, comprenant en outre un dispositif de dissipation thermique actif (414) aspirant de l'air dans la structure de dissipation thermique (412).

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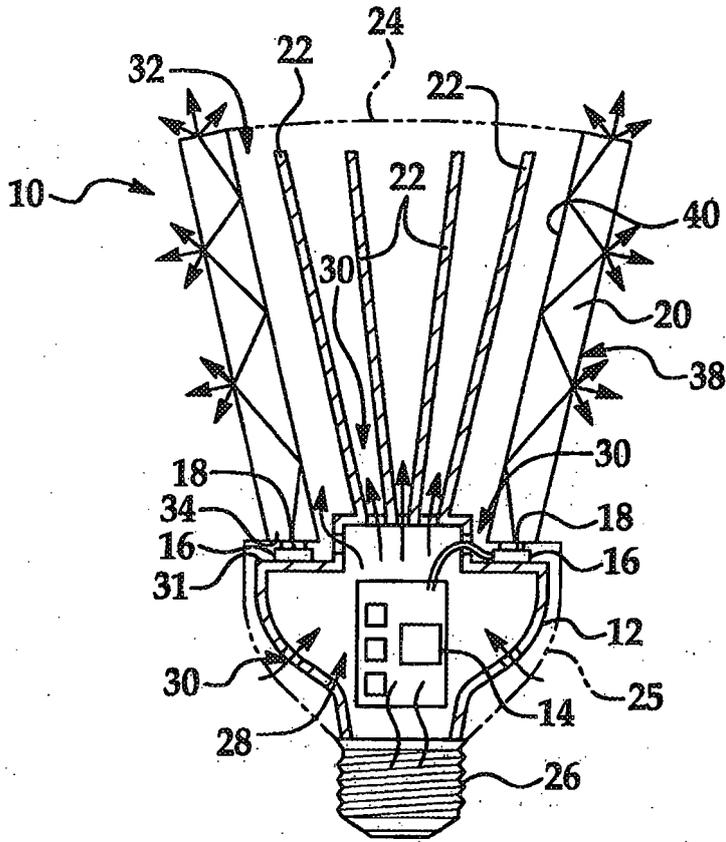


FIG. 1

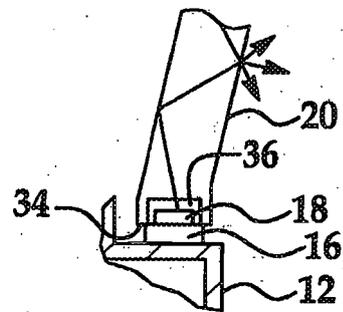


FIG. 2

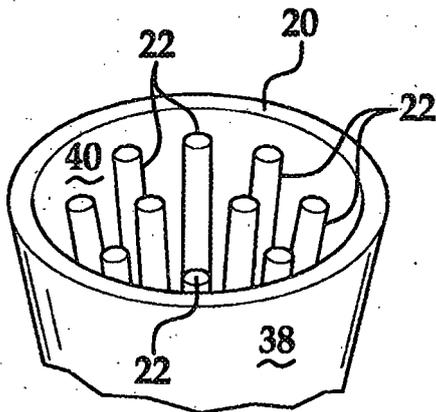


FIG. 3

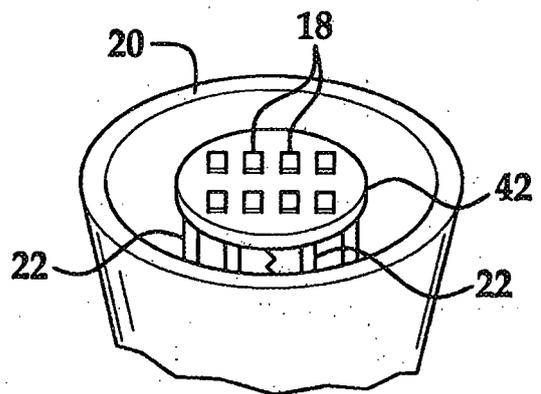


FIG. 4

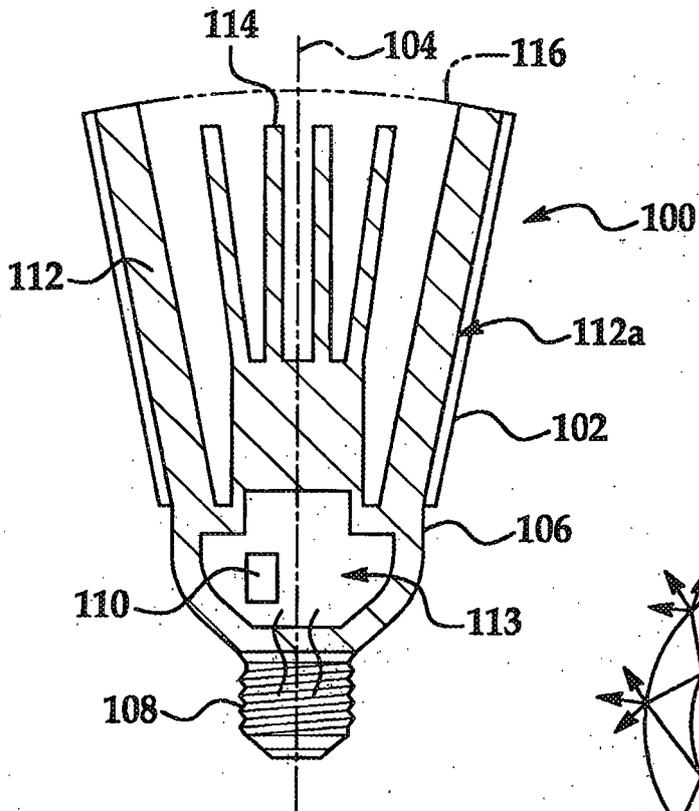


FIG. 5

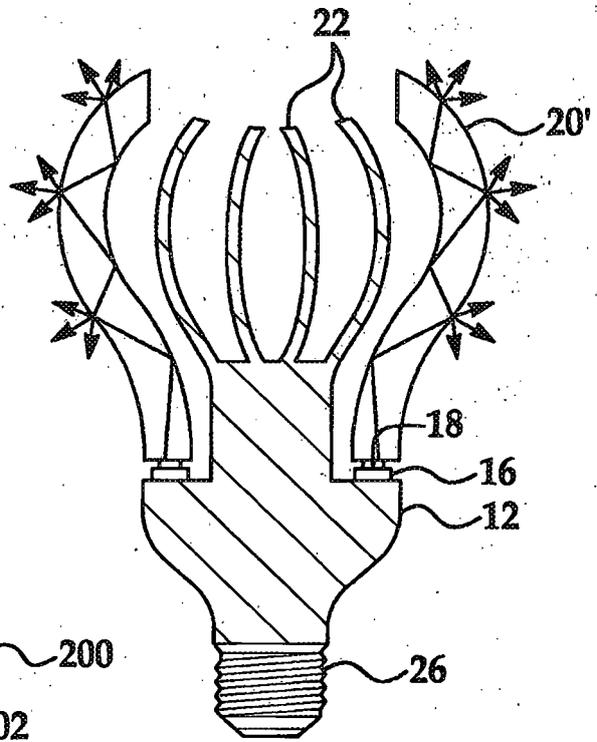


FIG. 6

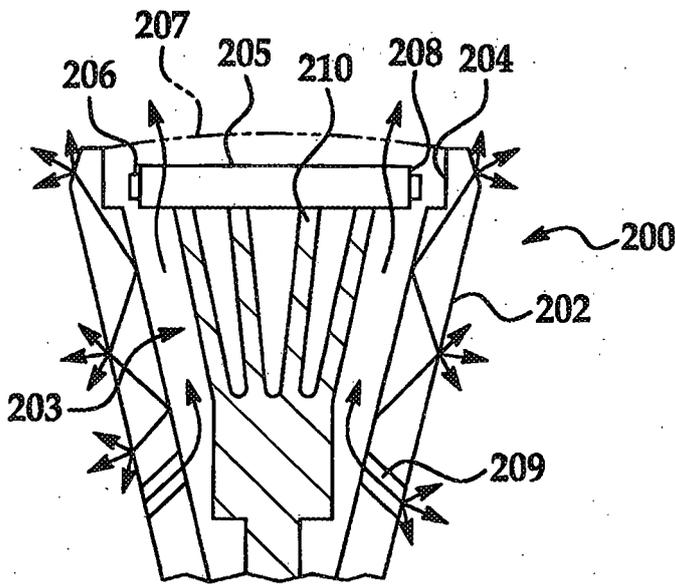


FIG. 7

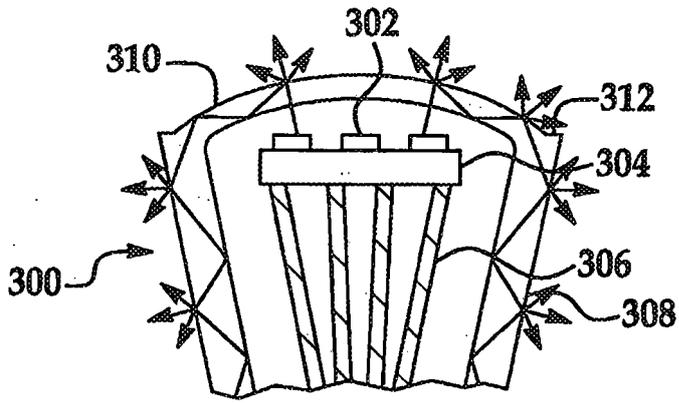


FIG. 8

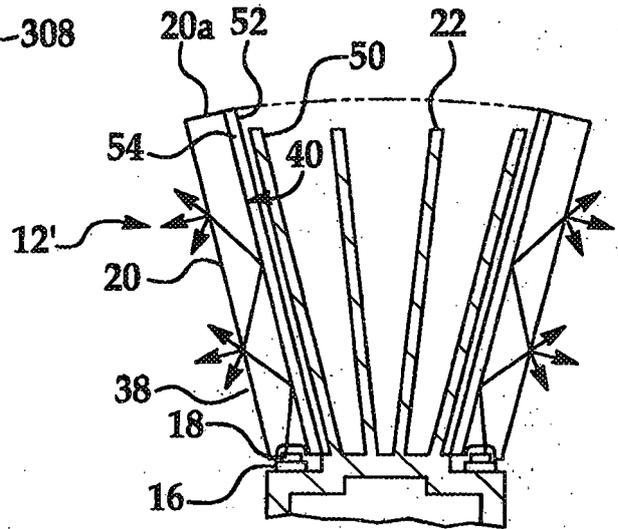


FIG. 9

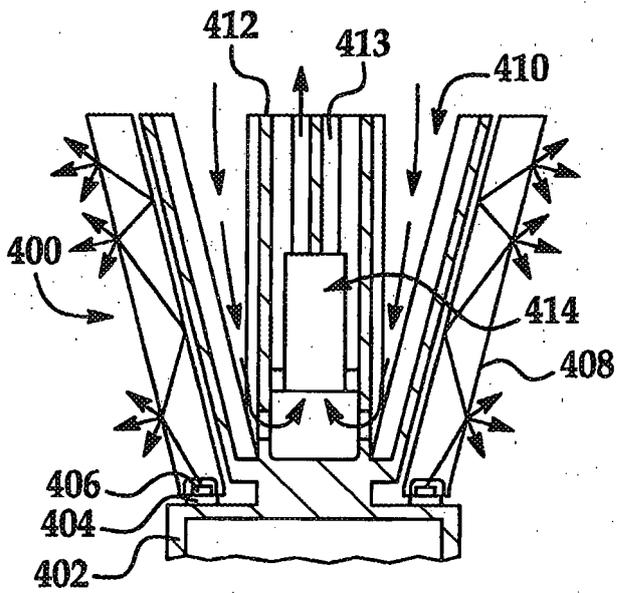


FIG. 10

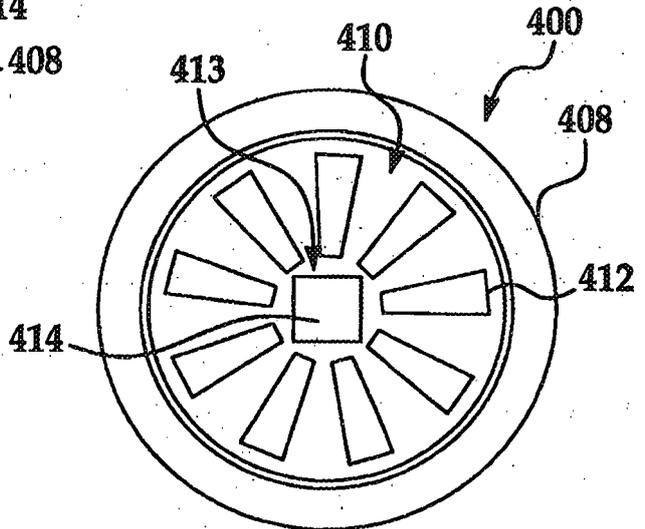


FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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