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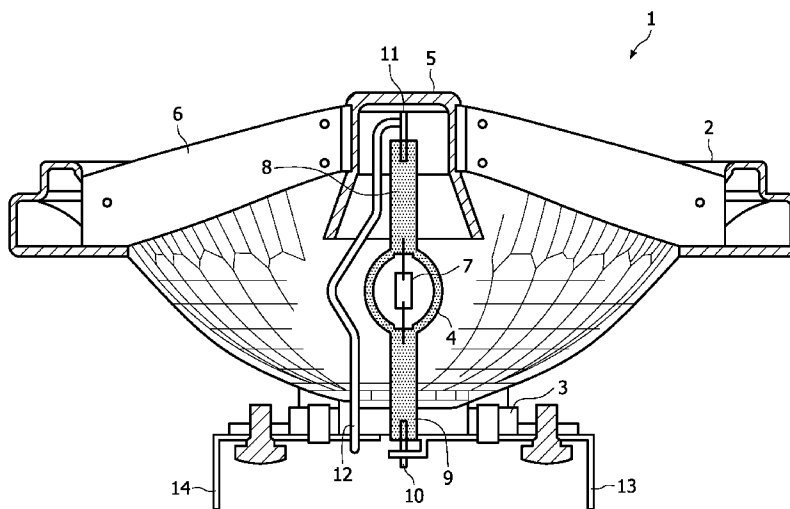


FIG. 1

(57) Abstract: The invention relates to an illumination assembly (1) comprising an electric lamp (4), a reflector (2) associated with the electric lamp and an antiglare cap (5), provided as a separate structural element and disposed in front of said electric lamp, wherein the antiglare cap is at least partially composed of a composite material comprising a light transmissive matrix and a light absorptive pigment dispersed therein. According to preferred embodiments, the matrix material and/or the pigment material is an infrared transmissive material. The antiglare cap may comprise a distinctive marking.

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ILLUMINATION ASSEMBLY COMPRISING REFLECTOR LAMP AND ANTI-GLARE CAP

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TECHNICAL FIELD OF THE INVENTION

The present invention relates to an illumination assembly for general and professional illumination applications, comprising an electric lamp, a reflector associated with said electric lamp and an antiglare cap positioned in front of said electric lamp to control the light output thereof.

BACKGROUND OF THE INVENTION

15 Illumination assemblies of this particular kind are useful for illumination of various areas of interest in shops, offices, public and private areas, particularly for spotlight, floodlight or wallwasher illumination applications.

The electric lamps used for the invention are *inter alia* incandescent halogen lamps. These lamps provide small but very intense light sources as needed for the intended applications. As compared to non-halogen incandescent lamps, halogen lamps have the advantage of a considerably higher luminous efficiency at a given absorbed power and a given lifetime. However, because of the higher luminous efficiency of incandescent halogen lamps, it becomes important that their light should not be blinding.

Several prior art methods have been used to control the light emitted from lamps in a reflector lamp that may cause glare or shine into the eyes of an on-looking person. One common method is to cover the front portion of the lamp envelope with an opaque, low-reflectivity material that prevents transmission of a direct light beam from this portion of the lamp envelope.

Another method of controlling light in illumination assemblies involves mounting a refractory metal shield inside the lamp bulb near the filament.

30 Yet another method involves placing an antiglare cap as a separate structural element inside the reflector cavity in front of the electric lamp. Such an antiglare cap is commonly designed as a non-reflective black metal shield, which can

withstand the high temperature generated by the lamp bulb. The cap effectively blocks all direct light emitted by the lamp bulb. For example, US 4,623,815 discloses a reflector-lamp combination for illumination of display windows, special windows, passageways and the like, that comprises a lamp cap surrounding the end portion of a halogen
5 incandescent lamp, held by a flat metal strip.

However, using a metal shield for blocking the direct light emitted by the lamp bulb results in inefficiencies in the illumination assembly, because it prevents a large percentage of the light emitted by the lamp from exiting from the assembly.

Another problem with the antiglare caps known in the prior art is that
10 while they may absorb some of the excess heat generated by the lamp, they do not remove the absorbed heat or dissipate it to the outside, away from the lamp. As a result, the heat released internally by the antiglare cap of the prior art may cause damage to the lamp housing and reduce the life span of the lamp.

15 SUMMARY OF THE INVENTION

Therefore, it would be desirable to have an illumination assembly comprising an antiglare cap that overcomes the problems associated with the prior art assembly.

According to the invention the object is achieved by an illumination
20 assembly comprising an electric lamp, a reflector associated with the electric lamp and an antiglare-cap, provided as a separate structural element and disposed in front of said electric lamp, wherein the antiglare cap is at least partially composed of a composite material comprising a light transmissive matrix and a light absorptive pigment dispersed therein.

25 An antiglare cap using light absorptive pigments as an effective light shielding component in a light transmissive matrix prevents transmission of a direct light beam by absorbing, and partially scattering, the beam radiation. This structure is favorable because the direct light beam path within the reflector of the lamp is not totally blocked as is the case when use is made of a black coating or a metallic cap.

30 The selective absorption of visible light is achieved without any lowering of the heat transit. Heat may thus escape from the lamp and in the illumination assembly, whereby heat accumulation is avoided. This results in assemblies with much lower

temperatures underneath the antiglare cap, compared to the conventional metallic antiglare-caps, which absorb visible light and heat radiation. This allows also miniaturization in size and maximization of wattage of the electric lamp. Due to the better heat management, the lamp bulb can be fixed in a more backward position in reflectors, which results in additional freedom of lamp design.

The lower temperature underneath the antiglare cap is also particularly favorable with regard to maintenance of the lamp filament and possible lamp coatings.

The cap may advantageously be used as a decorative fixture positioned in the reflector in front of the lamp. The assembly looks aesthetic and appealing and may possess a better optical efficiency.

According to a preferred embodiment, the electric lamp is an incandescent halogen lamp, a high pressure ceramic discharge lamp or a LED lamp.

Preferably, the light transmissive matrix is formed by a material selected from the group of clear, transparent or translucent glasses, glass-ceramics, ceramics and polymers.

According to a preferred embodiment of the invention, the matrix of the composite material is composed of a light and infrared transmissive glass ceramic or polymer.

An anti-glare cap, wherein the matrix is composed of an infrared transmissive glass ceramic or polymer, reduces further the thermal impact of the adjacent lamp such as an incandescent halogen lamp, as it dissipates the absorbed heat to the outside, away from the lamp.

Particularly preferred is an embodiment, wherein the pigment is a light absorptive, infrared transmissive pigment. The use of a pigment as described leads to a further improved transmission of infrared radiation besides substantial absorption of visible light.

Very little pigmentation may be needed to provide an antiglare effect while maintaining transparency in the infrared region. 0.5 to 20 vol% of pigment in the matrix may be all that is needed.

According to one embodiment of the invention, the cap body is composed of the composite material. Alternatively, the cap body may be composed of a light transmissive material coated with a coating layer comprising the composite material.

According to one aspect of the present invention, the antiglare cap comprises a distinctive marking. Antiglare caps comprising a distinctive marking allow an aesthetic and cost efficient way of conveying information e.g. on brand names, which can be identified even during operation. Such antiglare caps can be used as
5 differentiators.

Illumination assemblies comprising an antiglare cap as a separate structural element are typically designed to be of the open-beam type, which is advantageously used for all types of display and general illumination systems.

These and other aspects of the invention will be apparent from and
10 elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 shows a cross-sectional view of an illumination assembly according to the invention.
15 Fig. 2 shows a perspective view of an illumination assembly according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention relates to an illumination assembly comprising an electric
20 lamp, a reflector associated with the electric lamp and an antiglare cap that is disposed in front of said electric lamp and encloses the lamp at least partially.

While the reflector functions to reflect the light from the lamp bulb forward, thus forming a light beam, the antiglare cap functions to eliminate a "hot spot" which would otherwise be visible when looking into the lamp beam.

25 The lamp can be any electric lamp and the lamp bulb can be of any conventional form. Such electric lamps include incandescent lamps, high pressure and low pressure discharge ceramic gas discharge lamps and LED lamps. Embodiments wherein the electric lamp is an incandescent halogen lamp, a high pressure ceramic discharge lamp or a LED lamp are particularly preferred.

30 According to an embodiment of the invention the lamp is a double-ended tungsten halogen incandescent lamp.

Fig. 1 illustrates an illumination assembly comprising a double-ended tungsten halogen incandescent lamp bulb 4 mounted within the cavity of a reflector 2.

The lamp bulb 4 includes a hermetically sealed, light-transmissive lamp envelope and a filament 7 sealed within the envelope. The bulbous portion of the lamp envelope surrounding filament 7 has an ellipsoidal shape. Filament 7 is mounted on the central axis of said envelope and is supported by lead-in wires. The lead-in wires extend through two mutually opposed pinched ends 8 and 9 formed in the envelope and are electrically connected to external contact pins 10 and 11, respectively, at opposed ends of the lamp envelope.

Contact pin 10 extends to an electrical contact 13 of which one part is arranged below the lamp base 3. Contact pin 11 extends to an electrical return lead 12, which leads to an electrical contact 14.

In the example of Fig. 1 the lamp bulb 4 is supported by a ceramic lamp base 3 and a mounting strap. The lamp base 3 accommodates electrical conductors 13, 14 for connecting them to a source of electrical energy in a conventional fashion.

It will be understood that the envelope and filament structure of the tungsten halogen incandescent lamp bulb may have configurations other than that shown in Fig. 1.

Reflector 2 comprises a shaped, reflecting interior surface that is usually parabolic in shape, but that may alternatively have an ellipsoidal or other shape. The reflecting surface has a central axis and a focal point. The reflector further includes a heel portion for mounting the lamp bulb 4. The lamp bulb 4 can be mounted in reflector 2 by any suitable mounting structure, as known in the art.

In the embodiment shown in Fig.1 the reflector 2 is mounted directly on lamp base 3. The lamp bulb 4 is preferably mounted in reflector 2 such that the longitudinal axis of filament 7 coincides with the central axis of the parabolic or ellipsoidal reflecting surface of the reflector and such that the center of filament 7 is located at or near the focal point of the parabolic or ellipsoidal reflecting surface. This ensures that light emitted by filament 7 and incident on the parabolic or ellipsoidal reflecting surface is reflected through the reflector opening as an approximately parallel light beam.

According to a preferred embodiment, the construction of the illumination assembly is of the open-beam type. It utilizes a reflector with an accessible reflector cavity. The front side of the reflector provides an opening through which the lamp bulb can be releasably mounted in the lamp base. In case of damage to the bulb, for instance if
5 the filament burns out, the lamp bulb is simply removed through the opening and replaced by a new one.

Otherwise, the construction may be of the "sealed-beam" type, wherein the reflector rim is closed with a front lens. Sealed beam lamps typically use glass for the lens as well as for the reflector and the two pieces are hermetically bonded in the
10 manufacturing process.

The antiglare cap of the illumination assembly according to the invention is formed as a separate structural component in the reflector cavity.

The antiglare cap typically includes a cap body 5, which is disposed generally in front of the lamp bulb, and a separate clamping element 6, which extends
15 from the cap body and engages the reflector or some other proximate structure.

For the clamping element holding the cap body in the applied position, use is preferably made of brackets that support the cap body and are connected to either the reflector rim or the lamp base.

In one preferred arrangement, the cap body is supported by a bracket
20 composed of a ring portion and side supports, which are secured to the cap body on one side and to the reflector rim on the other side. The ring portion is slideable onto the antiglare cap such that the clamping element can fit tightly in slits in the reflector shroud. Ring portion and side supports are provided as flat strips of metal as shown in Fig.1. The strips are placed on the edge so that the shadow effect is minimal. They extend in bent-
25 up bridging form diametrically across the reflector, as best seen in Fig. 2

Alternatively, the clamping element may be coupled to the reflector in a rigid connection or may be welded to a lamp housing, screwed to a housing or fitted to the housing.

The antiglare cap embodying the invention comprises a cap body 5, which
30 may have any conventional design that covers the forward end of the lamp bulb at least partially. The cap body is preferably hollow in order to collect light rays emitted by the lamp bulb.

Figs. 1 and 2 illustrate an embodiment wherein the antiglare cap body has a truncated cone section and a hollow cylindrical section joined thereto, extending to the opening of the reflector. It comprises a shoulder serving as a means for limiting the sliding movement of the ring portion of the clamping element or as a stop at which the clamping element can abut.

In another embodiment, the outer shape of the cap may be a hollow circular tube with a closed front end.

Other designs are possible as well. Such designs may be a function of preferred styling features. For example, other shapes that may be used for the cap body include decorative shapes with e.g. a hexagonal, octagonal or square cross-section.

When the antiglare cap is mounted, the cup portion is generally horizontally aligned with the lamp bulb assembly. To eliminate the "hot spot" which would otherwise be visible when looking into the lamp beam, the antiglare cap is mounted such as to ensure that the light which is emitted from the lamp bulb, but which is not directed toward the parabolic or ellipsoidal portion of the reflector, is prevented from exiting the reflector opening. The light that is reflected from the parabolic or ellipsoidal portion of the reflector is more controlled and is less likely to cause glare. Thus, the antiglare cap is typically designed and mounted such that light which is emitted laterally at 10° to 90° up from the axis of the lamp bulb is blocked from exiting the front opening of the reflector, because this light forms what is known as veiling glare. As the antiglare cap of the invention does not reflect radiation back to the light source, it is not necessary to take the beam path into consideration.

The antiglare cap is at least partially composed of a composite material comprising a light transmissive matrix and a light absorptive pigment.

In one embodiment, the entire antiglare cap may be a compact component composed of the composite material. Alternatively, only the front portions or the side portions of the cap body may be composed of the composite material. According to a further embodiment a transparent or translucent cap body is covered with a coating comprising the composite material.

The composite material has a minimum of two components; it comprises a light transmissive matrix phase and at least one light absorptive pigment dispersed therein.

The light transmissive matrix material may be opaque, translucent or clear. It is preferably selected from the group of clear, transparent or translucent glasses, glass-ceramics, ceramics and polymers. Most often, the matrix is substantially transparent to visible light and the absorption of visible light is accomplished by the
5 pigment.

Preferably, the material constituting the matrix is a light transmissive material having high transparency to infrared radiation, too. Thus, the material from which the antiglare cap is preferably formed is a high silica material such as quartz or Vycor ®. Other high temperature glasses such as aluminosilicate, borosilicate or Pyrex
10 ® may be used but are less preferable since they are less efficient transmitters of infrared radiation.

Where matrix materials other than high silica glass are to be used to form the composite, the matrix material may be preferably selected from among essentially any of the transparent or translucent glass, glass ceramic or ceramic materials known in the
15 art.

Alternatively, known infrared transmissive polymers, such as polyamides, fluoropolymers and silicones, may be used as the matrix material.

Light absorptive pigments are added to the composite material to produce an opaque or semi-transparent structural element. The term "pigment" as used in this
20 specification means a water-insoluble, colored, material that exists in solid particulate form rather than solution form.

A wide variety of pigments may be employed in the present invention. Examples of particular useful pigments are light absorptive pigments, particularly light absorptive and infrared transmissive pigments.

25 Suitable light absorptive pigments include organic and inorganic colored pigments. Suitable inorganic colored pigments include metals, oxides, sulfides and mixtures thereof. Particularly, metal pigments of metals such as aluminum, copper, iron, cobalt, nickel and alloys thereof provide a high absorptive power. As metal oxides, in particular, iron oxides such as goethite and magnetite, haematite, chromium oxide and
30 chromium hydroxide, chromium/iron mixed oxides, and spinels, such as, for example, cobalt aluminate pigments are preferred. Useful metal sulfide pigments include molybdenum and iron sulfides. Carbon black may be used as well.

Of the suitable organic colored pigments, particular mentioned should be quinacridones, benzimidazolones, phthalocyanines, such as copper phthalocyanine, azo pigments, indanthrenes, 1,4-diketopyrrolopyrroles, perinones, anthanthrones, anthraquinones, and derivatives thereof.

5 Particularly preferred as pigments are infrared transmissive, visible-light absorptive pigments. Such pigments are known, for example, for use in retro-reflective structures of signals and labels for unobtrusive reading and detection of such signals and labels.

For example, praseodymium-doped zircon ((Zr, Pr)SiO₄) and Fe₂O₃ or
 10 NiO in combination with TiO₂ may be added to matrix material to provide a yellow colored, infrared transmissive cap body. Cobalt zinc silicate ((Co,Zn)₂ SiO₄) may be added to provide a blue colored, infrared transmissive cap body.

Table 1 lists some further visible light absorptive, infrared transmissive pigments and their infrared transmissive wavelength range.

15

Table 1

Pigment Family	IR Transmissive Wavelength ranges
C.I. Pigment Black 12	(1140-2500 nm)
C.I. Pigment Black 27	(1860-2130 nm)
C.I. Pigment Black 30	(1600-2350 nm)
C.I. Pigment Blue 36	(720-1140, 1710-2500 nm)
C.I. Pigment Brown 24	(790-2500 nm)
C.I. Pigment Brown 33	(1110-2500 nm)
C.I. Pigment Green 17	(760-2240 nm)
C.I. Pigment Green 26	(750-1150, 1760-2260 nm)
C.I. Pigment Green 50	(850-1050, 1880-2430 nm)
C.I. Pigment Yellow 119	(850-2500 nm)
C.I. Pigment Yellow 164	(1080-2500 nm)

The abbreviation "C.I." refers to the "Colour Index", edited by the Society of Dyers and Colourists and the American Society of Textile Chemists and Colorists.

5 A particularly suitable pigment/matrix composite material is that which is produced by subjecting quartz containing copper oxide to a diffusion process in an atmosphere of hydrogen where the copper oxide is reduced to metallic copper. This is a standard product available from glass manufacturers, which provides a red or ruby color i.e. a "warm" effect. The density of the ruby coloring is a function of the firing time used by the glass manufacturer and can be chosen as required.

10 The pigment composition may comprise one light absorptive pigment, but may also comprise two or more pigments that each absorb a particular range of the visible spectrum of light. When two or more pigments are included, their proportions are chosen so that together they absorb a maximum amount of visible light while transmitting a maximum amount of infrared radiation.

15 The pigment composition may additionally comprise an opacifying pigment. The opacity of opacifying pigments is a result of diffuse reflection, refraction and scattering of the greater part of incident visible light. Opacifying pigments are in particular white pigments, which impart white scattering power across all visible wavelengths without a high degree of absorption.

20 Suitable opacifying pigments include titanium dioxide or a combination of titanium dioxide and auxiliary pigments such as zinc oxide, lead oxide, a synthetic polymer pigment, and mixtures thereof.

25 A variable that is important for maximum utilization of the inherent hiding power of pigments is the effect of pigment concentration, by volume, in the cap body or coating.

The total proportion of pigment in the matrix film is chosen by balancing the facts that, on the one hand, the lower the number of pigment particles the greater the infrared transmission, and, on the other hand, the greater the number of pigment particles the lower the visible transmission. For this reason, the pigment volume concentration, that is the volume-percent of pigment relative to the combined total of pigment and
30 matrix film, is seldom above 25%/ by volume and has a higher efficiency in the range of 10-15%.

The shapes of the pigment particles are not subject to particular limitations and may include shapes such as granules, flakes (e.g. aluminum flakes) and fibers.

Further, the pigments typically have a relatively narrow size distribution for effective coating and optical efficiency. The particles are generally of standard pigment sizes, usually less than 2 or 3 microns in diameter. While pigment particles of completely uniform crystalline size cannot be obtained, their size distribution and average particle size can be controlled. Average particle size diameters of 0.2 to 0.35 microns are reasonably efficient for visible light.

According to a preferred embodiment the cap body is composed of the composite material comprising a matrix material and pigment particles dispersed therein.

According to another embodiment of the invention, the composite material is provided in a separate coating layer on a light transmissive cap body. The coating layer comprises a matrix film in which pigment particles of a pigment are dispersed. The layer is preferably applied on a transparent cap body formed of glass, glass-ceramic or ceramic.

The layer is prepared from a liquid composition that comprises a vehicle, which includes a binder material that will become the matrix film and usually a volatile thinner to dissolve or disperse the binder material, and the described pigment particles dispersed in the vehicle. The visible-light absorptive layer may be formed by directly coating the cap body, or the layer may be preformed and then applied to the base structure.

The binder material may be chosen from a wide variety of materials. Typical suitable organic binder materials include alkyds, acrylics, polyurethanes, epoxies, polystyrenes, and fluorinated polymers.

The efficiency of the infrared transmission is affected by the thickness of the infrared-transmissive, visible-light absorptive layer. The thickness of this layer is preferably from 20 to 500 nm to provide a semi-transparent coating. To maximize infrared transmission, the layer is generally less than 200 nm thick; but it usually is at least 100 nm thick.

According to another aspect of the invention, the antiglare cap is provided with a distinctive marking. In Fig. 2, there is shown a perspective view of an illumination assembly comprising an antiglare cap bearing such a distinctive marking.

Distinctive markings may take a variety of forms to convey specific information. Preferably, the distinctive marking represents letters and/or numerals and/or symbols. Typically, the distinctive marking may comprise advertising markings, such as brand names, trademarks or symbols.

While these distinctive markings may also enhance the appearance and thus the marketability of the illumination assembly, the main reason for adding these distinctive markings relates to informational and identification purposes.

The distinctive marking may consist of grooves, ribs, striations, dimples, blind bores, recesses, one or more roughened areas or prints. The markings preferably are in the shape of raised ribs arranged substantially across the front plate of the antiglare cap.

Alternatively, it may sometimes be useful to create a marking effect by means of grooves. It is considered however that grooves might tend to collect debris, and it is proposed to fill said grooves with an optically different material to make them clearly visible.

Other improvements, modifications and embodiments will become apparent to one of ordinary skill in the art upon review of this disclosure. Such improvements, modifications and embodiments are considered to be within the scope of this invention as defined by the following claims. In the claims, the word "comprising" does not exclude other elements and the indefinite article "a" and "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference sign in the claims should not be construed as limiting the scope.

CLAIMS:

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1. Illumination assembly (1) comprising an electric lamp (4), a reflector (2) associated with the electric lamp and an antiglare-cap (5,6), provided as a separate structural element and disposed in front of said electric lamp, wherein the antiglare cap is at least partially composed of a composite material comprising a light transmissive
10 matrix and a light absorptive pigment dispersed therein.
2. An illumination assembly according to claim 1, wherein the electric lamp is an incandescent halogen lamp, a high pressure ceramic discharge lamp or a LED lamp.
- 15 3. An illumination assembly according to claim 1, wherein the light transmissive matrix is formed by a matrix material selected from the group of clear, transparent or translucent glasses, glass ceramics, ceramics and polymers.
4. An illumination assembly according to claim 3, wherein the matrix
20 material is selected from the group of light and infrared transmissive glass ceramics and polymers.
5. Illumination assembly according to claim 1, wherein the pigment is a light absorptive and infrared-transmissive pigment.
- 25 6. An illumination assembly according to claim 1, wherein the matrix comprises 0.5 to 20 vol% of pigment.
7. An illumination assembly according to claim 1, wherein the antiglare cap
30 comprises a cap body (5) and a clamping element (6).

8. An illumination assembly according to claim 7, wherein the cap body is composed of the composite material.

9. An illumination assembly according to claim 7, wherein the cap body is
5 composed of a light transmissive material coated with a coating layer comprising the composite material.

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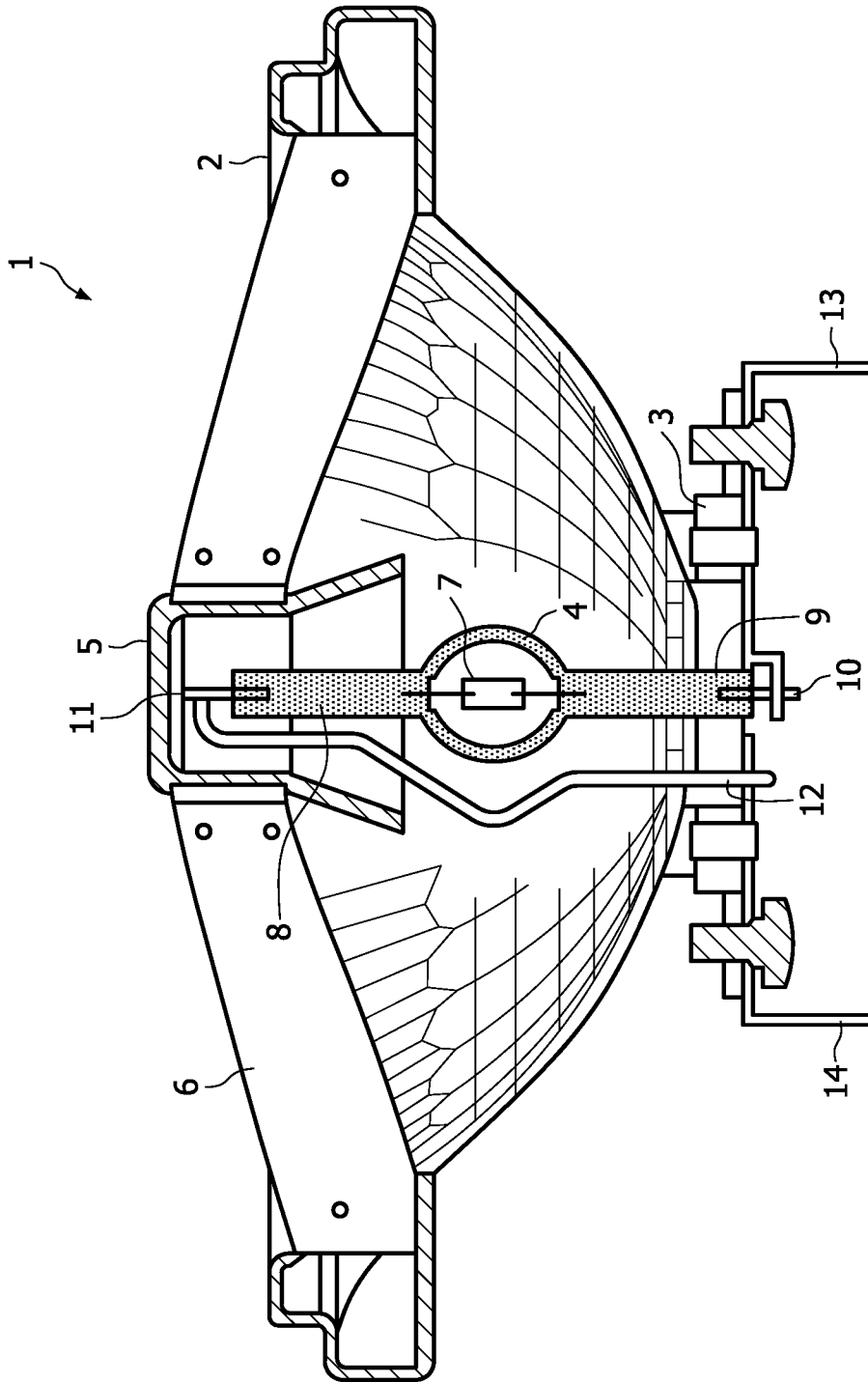


FIG. 1

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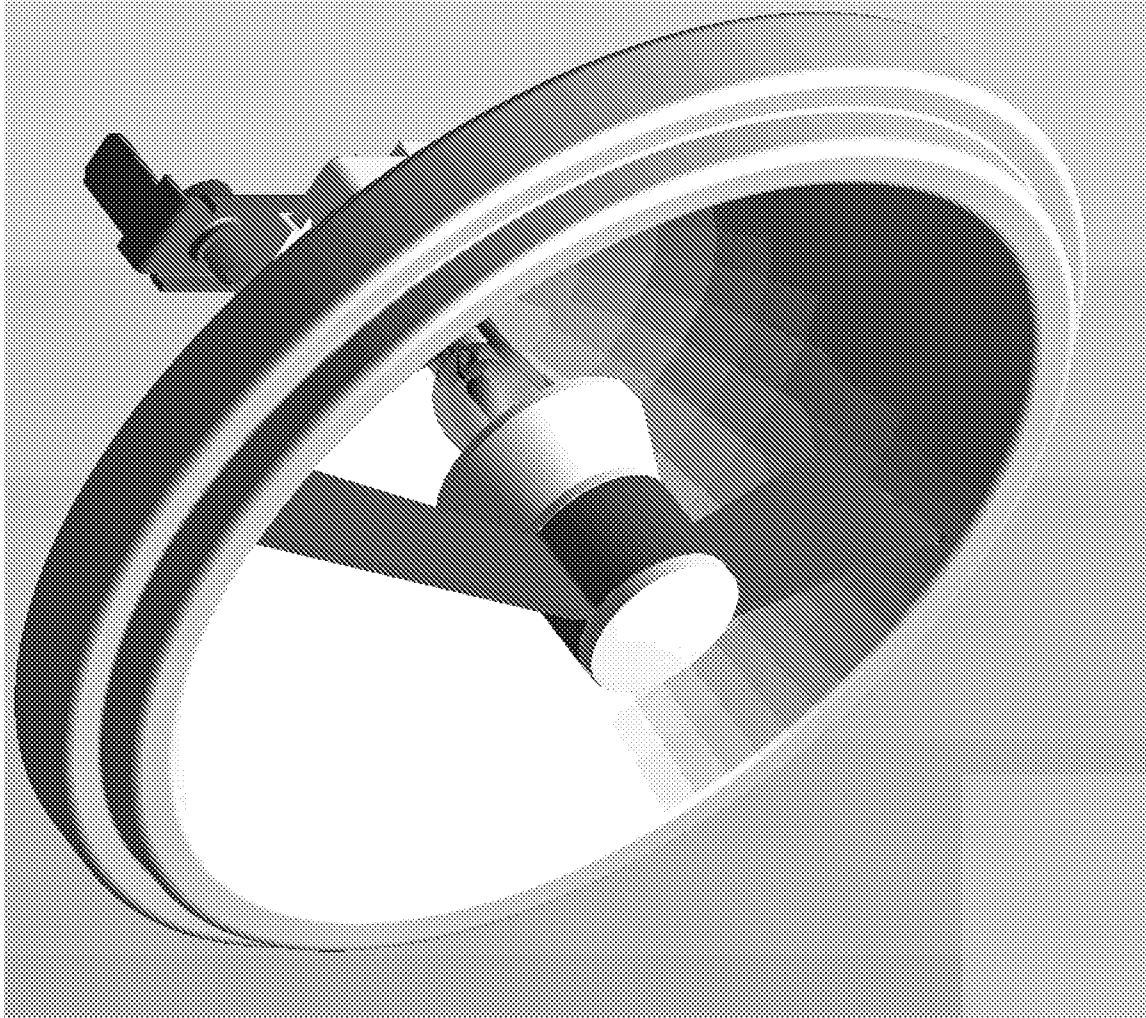


FIG. 2