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(71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WAUMANS, Lars, R., C.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **DUINE, Peter, A.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **VAN DER POEL, Lucas, L., D.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **BREEN, Remco, A., H.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agents: **ROLFES, Johannes, G., A.** et al.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

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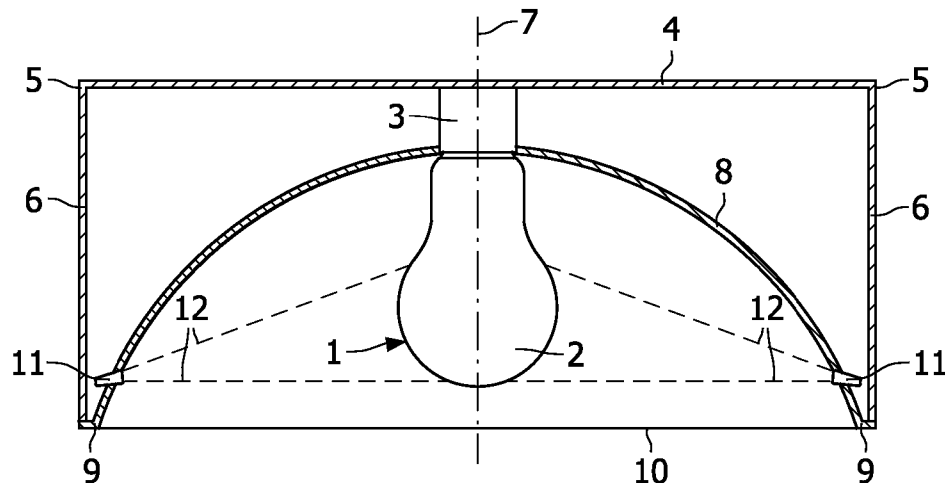
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(54) Title: LAMP SYSTEM COMPRISING A PRIMARY LIGHT SOURCE AND A SECONDARY LIGHT SOURCE



(57) Abstract: A lamp system comprising a primary light source (1) having an envelope (2) of translucent, light-diffusing material and a secondary light source provided with at least one LED (11) emitting a beam of light (12). The major portion of said beam of light (12) is directed towards said envelope (2) of light-diffusing material.

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Lamp system comprising a primary light source and a secondary light source

The invention relates to a lamp system comprising a primary light source having an envelope of translucent, light-diffusing material and a secondary light source provided with at least one LED emitting a beam of light. The primary light source may be a compact fluorescent lamp, a high-pressure or low-pressure discharge lamp, a halogen lamp, a filament lamp, or any other lamp that includes a translucent envelope of light-diffusing material, i.e. light-scattering material. The lamp system may comprise one or more of such primary light sources and one or more secondary light sources, each provided with one or more LEDs, with each LED emitting a beam of light.

Such a lamp system is disclosed in US-A-2005/0265023. This publication describes a lamp system comprising a gas-discharge lamp (the primary light source), a LED (the secondary light source), and an optical component for mixing the light from the LED with the light from the gas-discharge lamp. The gas-discharge lamp has a high efficiency in the green-blue range of light and the LED has a high efficiency in the yellow-red range of light, and it is possible to obtain a high-efficiency white-light lamp system by additively mixing these two types of light sources.

The light from the LED may be added to the light from the primary light source in order to obtain white light with a complete spectrum of wavelengths. However, the light from one or more LEDs can also be added to the light from the primary light source in order to vary the visible color of the light emitted by the lamp system. The color of the light from the lamp system can be varied by adding different light intensities of one or more LEDs having one color to the primary light source, or by adding varying light intensities of differently colored LEDs to the primary light source.

In the described lamp system, it is important to combine the light from the primary light source and the light from the LED or LEDs in such manner that the light emitted by the lamp system is completely mixed. According to US-A-2005/0265023, such mixing of the light is obtained by preventing light radiation of both light sources from leaving the lamp system without reflection on one or more reflectors.

DE-A-10011077 describes a system wherein the light from a number of LEDs is brought inside the translucent bulb of a filament lamp. The bulb of this filament lamp is

frosted, as is usual for such lamps. The base portion of the bulb, near the fitting, is not frosted or less frosted, so that the bulb is substantially transparent at that location. By positioning the LEDs near said base portion of the bulb, the light radiation of the LEDs can enter the bulb and leave it through its frosted portion, together with the light radiation of the filament of the lamp. Although an effective mixing of the light is obtained, such a lamp system is limited to lamps having a bulb provided with a transparent portion.

It is an object of the invention to provide a lamp system comprising a primary light source and a secondary light source provided with at least one LED emitting a beam of light, wherein an effective mixing of light from the primary light source and light from said LED is obtained in an efficient manner without additional optical means.

This object is achieved in that the major portion, i.e. at least 50%, of the beam or beams, of light emitted by the secondary light source, and preferably substantially the whole beam, i.e. at least 85%, or each whole beam, of light emitted by the secondary light source is directed towards said envelope of light-diffusing material, so that the light-diffusing material of the primary light source is used to diffuse the light from said LED and to mix it with the light from the primary light source. Consequently, no additional means in the lamp system are required to diffuse and mix the light from both light sources.

The visible color of the light from the secondary light source preferably differs from the visible color of the light from the primary light source, so that the color of the light from the lamp system can be varied by changing the intensity of the light from the secondary light source.

In a preferred embodiment, the secondary light source is provided with more LEDs having different colors. There are preferably three LEDs or three groups of LEDs, each LED or group of LEDs having one of the three primary colors green, blue and red. The light emitted by the lamp system can thus be varied in any desired color by changing the intensity of the light emission of one or more of the LEDs. Additionally, further LEDs with other colors, for example, the color amber may be present.

In a preferred embodiment, the lamp system comprises a reflector, so that the light from the primary light source, or a portion of this light is reflected by the reflector before it leaves the lamp system. The reflector will reflect the light from both light sources, because all light appears to originate from the same light-diffusing envelope. The light reflection by the reflector may further improve the mixing of light from both light sources.

In a preferred embodiment, at least one LED is supported by the reflector of the lamp system, which is an appropriate location for the LED, and furthermore, no

additional means for supporting the LED or LEDs are necessary. The LEDs can be fixed in small holes in the reflector and located in an appropriate position to direct the emitted light towards the primary light source, in particular towards the translucent envelope of the primary light source.

5 The reflector is preferably provided with at least one opening, with a LED being positioned at a distance from this opening, so that its beam of light passes through this opening. The LED can thus be positioned at a location where it is not visible, and the opening in the reflector (having, for example, a circular edge) can help to create an appropriate shape of the beam of light from the LED. Furthermore, hot air may pass through the opening in the
10 reflector, so that the lamp can be cooled by convection of air.

 In a preferred embodiment, the primary light source is an elongate fluorescent lamp, wherein a number of LEDs are supported by the reflector and are positioned in one or more substantially straight lines parallel to the elongate fluorescent lamp. Consequently, a high number of LEDs can be present at an appropriate location.

15 Furthermore, reflector means may be present in order to prevent direct light radiation from the primary light source into the beam leaving the lamp system. Such reflector means may be a light-reflecting coating on a portion of the envelope of the primary light source.

 The invention also relates to a method of illumination by means of a lamp
20 system, wherein the main portion of the emitted light is produced by a primary light source having an envelope of translucent light-diffusing material, and colored light is produced by at least one LED, the major portion of said colored light being directed towards said envelope of light-diffusing material.

25 The invention will now be further elucidated with reference to the drawing comprising Figures which are only schematic representations, in which:

 Fig. 1 is a sectional view of a first embodiment;

 Fig. 2 is a sectional view of a second embodiment; and

 Fig. 3 is a sectional view taken on the line III-III in Fig. 2.

30 The diagrammatic Figures do not show parts that are not relevant for understanding the invention. For example, the means for supplying electric power to the light sources are not shown in the Figures.

Fig. 1 shows a lamp system provided with a filament lamp 1 including a bulb 2 of translucent light-diffusing material, which material is generally known as material of the bulb of such a filament lamp. The lamp 1 is attached in a lamp holder 3, which is mounted on the back wall 4 of the housing of the lamp system. The back wall 4 has a circular outer edge 5, where the back wall 4 is connected to the cylindrical side wall 6 of the housing of the lamp system. The lamp system is thus substantially symmetrical about the central line 7.

The housing 4,6 of the lamp system accommodates a spherical reflector 8 around the lamp 1, which reflector 8 is connected to the lower edge 9 of the side wall 6 of the housing. A portion of the light radiation from the filament lamp 1 leaves the lamp system directly through the open lower side 10 of the housing 4,6 of the lamp system, and another portion of the light radiation is reflected by the spherical reflector 8 and then directed through the open lower side 10 of the housing 4,6 of the lamp system.

The lamp 1 is the primary light source of the lamp system. The lamp system is further provided with a number of LEDs 11, being the secondary light source. The LEDs 11 are mounted in openings in the spherical reflector 8, in a circle around the lamp 1, and near the lower edge of the reflector 8. Only two LEDs 11 are shown in Fig. 1, but there may be a much larger number, with each LED 11 being equally distributed on said circle near the lower edge of the reflector 8. The light radiation from each LED 11 is directed towards the bulb 2 of the lamp 1, as is indicated by the broken lines 12. The LEDs 11 may be provided with optical means in order to produce an appropriate light beam 12. Approximately 90% of the light of the beams from the LEDs is directed towards the bulb 2 of light-diffusing material.

The light radiation from the LEDs 11 is scattered by the translucent light-diffusing material of the bulb 2 of the lamp 1, so that an effective mix with the light radiation from the primary light source of the lamp system (the lamp 1) is obtained. The light from the LEDs 11 is scattered through the open lower side 10 of the housing 4,6 of the lamp system as well as towards the reflector 8, similarly as the light radiation from the lamp 1.

The light from the LEDs 11 may have the same color or different colors, for example, the three primary colors red, green, and blue. Furthermore, means (not shown) are present to supply the LEDs 11 with electric power in such manner that the intensity of the light radiation from each LED 11 can be adjusted. When all LEDs 11 have the same light color, a larger or smaller quantity of light having this color can be mixed with the light from the primary light source 1 in order to vary the color of the light from the lamp system between two light colors, i.e. the light color of the primary light source 1 (for example, white

light) and the light color of the lamp system when the LEDs 11 are supplied with the maximal electric power.

When three groups of LEDs 11 are present, with each group having its own primary color of red, green, and blue, respectively, the light of the lamp system can have any
5 desired light color.

Figs. 2 and 3 show a second embodiment of the lamp system. The sectional view of Fig. 2 is taken on the line II-II in Fig. 3, and the sectional view of Fig. 3 is taken on the line III-III in Fig. 2. Similarly as in Fig. 1, the electric wires and other means for supplying the light sources with electric power are not shown.

10 The second embodiment comprises an elongate fluorescent lamp 15 as the primary light source. At each end, the fluorescent lamp 15 is mounted in a housing 16 by means of lamp holders 17. The housing 16 comprises two end walls 18 to which the lamp holders 17 are attached. The housing 16 further comprises a curved wall 19, which is provided with a light-reflecting surface at its inner side, i.e. the side being directed towards
15 the elongate lamp 15.

Light radiation can leave the housing 16 of the lamp system through its open lower side 20. The lower side of the elongate fluorescent lamp 15 is provided with a coating 21, which has a reflective inner surface (towards the light source), so that the light radiation from the primary light source 15 cannot leave the lamp system directly through the open
20 lower side 20 of the lamp system. The light radiation can only leave the lamp system after it has been reflected by the curved wall 19.

The upper side of the curved wall 19 is provided with a number of openings 22 positioned in a straight line parallel to the fluorescent lamp 15. A number of LEDs 23 are fixed to the curved wall 19 by means of support members 24 (Fig. 3) in such a way that there
25 is a LED 23 above each opening 22. A support member 24 can be welded or glued to the rear side of curved wall 19 and attached to LED 23 with any convenient means.

Similarly as the LEDs 11 in the first embodiment, the LEDs 23 may have the same or different colors. The beam of light from one of the LEDs 23 is indicated by broken lines 25. The light beam 25 of each LED 23 hits the upper side of the tube-like envelope 26,
30 which is made of translucent light-diffusing material, so that the light radiation from the LEDs 23 is scattered to the reflecting inner surface of the curved wall 19. This results in an effective mix with the light radiation from the fluorescent lamp 15, so that mixed light leaves the lamp system through the open lower side 20 of the housing 16.

In another embodiment, the LEDs 23 of the lamp system shown in Figs. 2 and 3 can be positioned in two straight lines near each of the two lower edges of curved wall 19, so that the beams of light from the LEDs are directed towards the fluorescent lamp 15, similarly as the way in which the light beams 12 in the first embodiment (Fig. 1) are directed towards the bulb 2 of lamp 1. The lamp 15 should therefore not be provided with the light-reflecting coating 21. Approximately 60% of the light of the light beams from the LEDs is directed towards the envelope 26 of translucent light-diffusing material.

The embodiments of the lamp system as described above are only examples of a lamp system according to the invention; many other embodiments are possible.

CLAIMS:

1. A lamp system comprising a primary light source having an envelope of translucent, light-diffusing material and a secondary light source provided with at least one LED emitting a beam of light, characterized in that the major portion of said beam of light is directed towards said envelope of light-diffusing material.

5

2. A lamp system as claimed in claim 1, characterized in that substantially the whole beam of light is directed towards said envelope of light-diffusing material.

10

3. A lamp system as claimed in any one of the preceding claims, characterized in that the visible color of the light from the secondary light source differs from the visible color of the light from the primary light source.

15

4. A lamp system as claimed in any one of the preceding claims, characterized in that the secondary light source is provided with more LEDs having different colors, preferably the three primary colors red, green, and blue.

20

5. A lamp system as claimed in any one of the preceding claims, characterized in that the lamp system comprises a reflector for reflecting the light radiation from the primary light source into a beam leaving the lamp system.

6. A lamp system as claimed in claim 5, characterized in that at least one LED of the secondary light source is supported by the reflector.

25

7. A lamp system as claimed in claim 5 or 6, characterized in that the reflector is provided with at least one opening, with a LED being positioned at a distance from said opening, so that its beam of light passes through said opening.

8. A lamp system as claimed in claim 6 or 7, wherein the primary light source is an elongate fluorescent lamp, characterized in that a number of LEDs are supported by the

reflector, the LEDs being positioned in one or more substantially straight lines parallel to the elongate fluorescent lamp.

9. A method of illumination by means of a lamp system, wherein the main
5 portion of the emitted light is produced by a primary light source having an envelope of translucent light-diffusing material, and a beam of colored light is emitted by at least one LED, characterized in that the major portion of said beam of colored light is directed towards said envelope of light-diffusing material.

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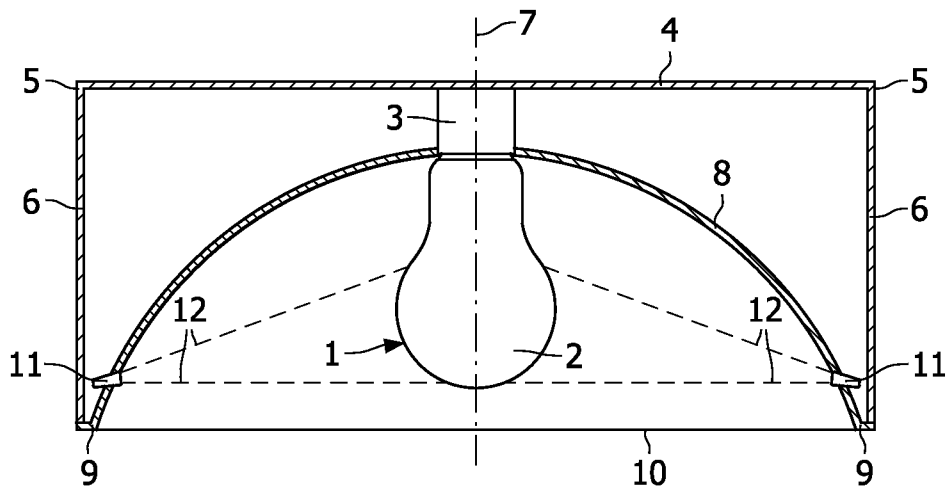


FIG. 1

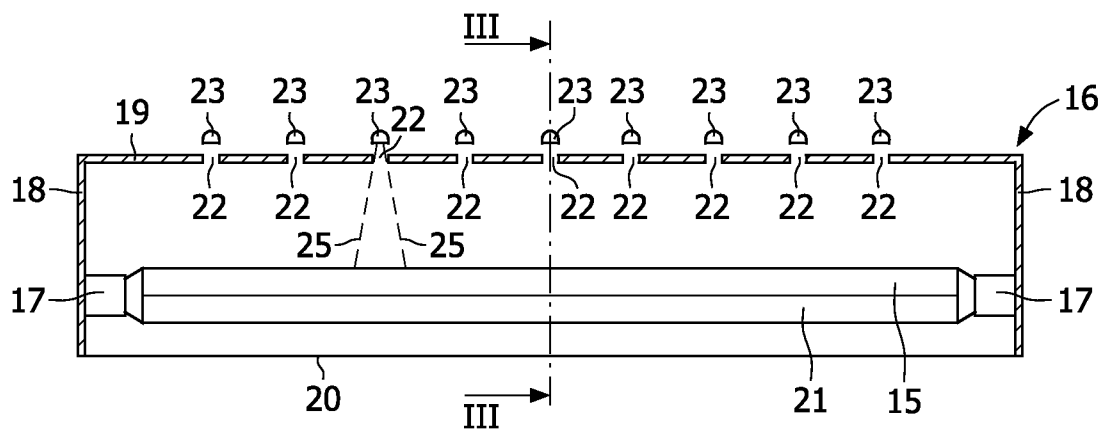


FIG. 2

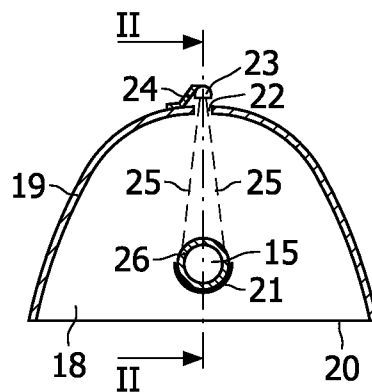


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/051118

A. CLASSIFICATION OF SUBJECT MATTER

INV. H05B35/00 F21S8/00 H01J61/72

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F21S H01J H05B G09F F21V

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hunckler, José

INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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