



(51) International Patent Classification:
F21V 17/00 (2006.01)

(21) International Application Number:

PCT/IB2012/052502

(22) International Filing Date:

18 May 2012 (18.05.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

11167713.4 26 May 2011 (26.05.2011) EP

(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): **CREUSEN, Mar-
tinus Petrus** [NL/NL]; c/o PHILIPS IP&S - NL, High
Tech Campus 44, NL-5656 AE Eindhoven (NL). **KESER,
Merijn** [NL/NL]; c/o PHILIPS IP&S - NL, High Tech

Campus 44, NL-5656 AE Eindhoven (NL). **OEPTS,
Wouter** [NL/NL]; c/o PHILIPS IP&S - NL, High Tech
Campus 44, NL-5656 AE Eindhoven (NL).

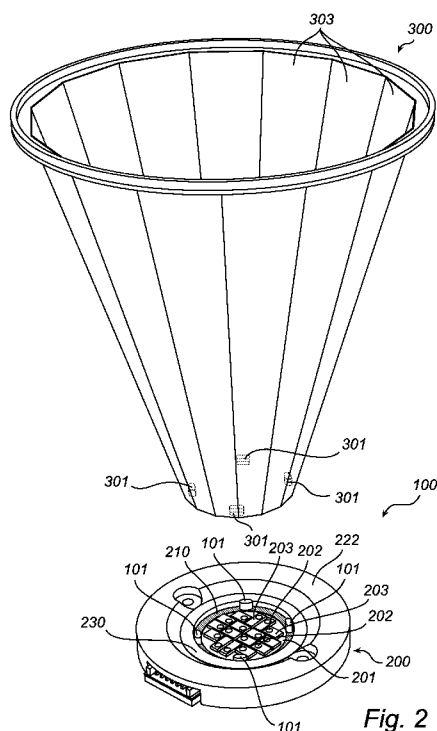
(74) Agents: **VAN EEUWIJK, Alexander** et al.; Philips Ip&s -
NL, High Tech Campus 44, NL-5656 AE Eindhoven (NL).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: AN ALIGNMENT DEVICE FOR A LIGHTING DEVICE



(57) Abstract: There is provided an alignment device(100)for aligning an ex-
ternal component(300)with a lighting module (200) comprising a light emit-
ting surface, with respect to which the aligning of the external component is
done, and a contact area (230) for engaging with the external component. The
contact area is concentric with respect to the light emitting surface, and is ar-
ranged on an upper surface of the lighting module. The alignment device is
arranged in a designated area being one of the contact area, the contact area
together with a predefined area being an area between the contact area and the
light emitting surface, and the predefined area. The alignment device com-
prises a central opening having a minimum diameter corresponding to a pre-
determined maximum diameter d_{LES} of the light emitting surface of the
lighting module. The alignment device further comprises a positioning means
(101) for positioning the external component at a predetermined location with
respect to the light emitting surface and the contact area.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, **Published:**
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

— *without international search report and to be republished
upon receipt of that report (Rule 48.2(g))*

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted
a patent (Rule 4.17(ii))*

An alignment device for a lighting device

FIELD OF THE INVENTION

The present invention relates to the field of lighting devices, and more particularly to an alignment device for aligning an external component with a lighting module.

5

BACKGROUND OF THE INVENTION

Connecting parts for connecting external components like reflectors onto lighting modules are known. Typically, the user, installer or OEM luminaire manufacturer (Original Equipment Manufacturer, OEM) can combine different external components to the same type of lighting module. As an example, Jordan Reflektoren Gmhb, provides a reflector LED_Philips Fortimo 1 x 50 with connecting part which can be combined with a lighting module, e.g. a Philips Fortimo LED SLM System. The connecting part is a metallic ring shaped part arranged to mechanically and optically fit into the interface of the lighting module. Three radially and outwards extending portions of the connection part arranged with screw holes are fitted into the mechanical interface of the lighting module, while three fixating tongues are fitted into receiving portions of the reflector which is to be fixated onto the lighting module.

10

15

20

In addition another lighting module, Osram PrevaLED, has an integrated mechanical interface which is arranged with a built in locking mechanism for the external component. Both lighting modules above have fixed interfaces for simplified developments and sustainable designs.

25

The connection part, both when being a freestanding part and when being integrated in the lighting module, is an important means for mounting the external component to the lighting module and may be arranged to provide mechanical fixation as well as a predetermined alignment of the external component with the lighting module. In the following the term alignment device will be used instead of connection part.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved and alternative alignment device.

This and other objects are achieved by providing an alignment device having the features defined in the independent claims. Preferred embodiments are defined in the dependent claims.

According to a first aspect of the inventive concept there is provided an alignment device for aligning an external component with a lighting module comprising a light emitting surface and a contact area for engaging with the external component. The contact area is concentric with respect to the light emitting surface and arranged on an upper surface thereof. The alignment device comprises a central opening having a minimum diameter corresponding to a predetermined maximum diameter d_{LES} of the light emitting surface of the lighting module, and positioning means for positioning the external component at a predetermined location with respect to the light emitting surface and the contact area. The positioning means is arranged in a designated area, being one of the contact area, the contact area together with a predefined area, being an area between the contact area and the light emitting surface, and the predefined area. This advantageously enables the external component to be positioned and centralized around the light emitting surface in an effective and space saving manner. Thus, placement accuracy for engaging an external component with a lighting module is achieved in an advantageous manner.

According to an embodiment of the alignment device, it further comprises alignment means for providing a predetermined azimuthal alignment of the external component with respect to a predetermined orientation of the light emitting surface.

Providing an optimized alignment of the external component with respect to the light emitting surface is important, for instance if the light sources, e.g. LEDs, being arranged in the lighting module to provide the light emitting surface, are asymmetrically arranged. When engaging an external component, being e.g. a segmented reflector, with the lighting module, the orientation of the reflector will influence the optical performance of the lighting device. An incorrect alignment may result in decreased peak intensity, projected beam non-uniformity, a wider Full width at half maximum (FWHM) etc. of the outputted light. The alignment means may optionally be comprised within the positioning means. In case of an asymmetric reflector shape, the relative orientation of the reflector with respect to the LED configuration is important for a correct optical function.

According to an embodiment of the alignment device, at least one of the positioning means and the alignment means comprises at least one guiding portion arranged

for engaging with a corresponding reference portion of the external component, which increases the rigidity of the mechanical connection between the alignment device and the external component. The guiding portion and the corresponding reference portion may be a protruding portion and a corresponding receiving portion, respectively, or a receiving portion and a corresponding protruding portion, respectively.

According to an embodiment of the alignment device, it further comprises a first retention means for securing the external component. The retention means may be any suitable retention means, like for instance a click mechanism or clamping means.

According to an embodiment of the alignment device, the positioning means comprises the first retention means, e.g. a click mechanism to engage with the external component or the lighting module.

According to an embodiment of the alignment device, it further comprises second retention means for engaging an additional external component. The second retention means may be e.g. a click mechanism or other applicable retention means.

According to an embodiment of the alignment device, the positioning means and/or the alignment means are further arranged for providing a minimum predetermined creepage distance between electrical components of the lighting module and an electrically conducting portion of the external component. This may be achieved by means of a predetermined shape of the positioning means or by means of arranging the aligning means for providing a predetermined orientation of the external component with respect to the light emitting surface, which shape or position fulfils a sufficient distance between critical components thereby fulfilling the requirement of the minimum prescribed creeping distance. This is applicable for instance when the external component is a metal reflector, and there are exposed live parts in the lighting module.

According to an embodiment of the alignment device, the predetermined creepage over surface distance for the electrical components is 3.0 mm (creepage distance value depends on actual LED string voltage, dry or damp location).

According to an embodiment of the alignment device, the positioning means and/or the alignment means are further arranged for providing a minimum predetermined clearance distance between electrical components of the lighting module and an electrically conducting portion of the external component. This may be accomplished, similar to the case with the predetermined creepage distance, by means of a predetermined shape of the positioning means or by means of arranging the alignment means to provide a predetermined orientation of the external component with respect to the light emitting surface.

According to an embodiment of the alignment device, the predetermined clearance distance for the electrical components in open air is 1.2 mm (clearance distance value depends on actual LED string voltage, dry or damp location).

According to an embodiment of the alignment device, the external component
5 is one of a reflector, a mixing chamber, a diffuser, a lens, and a remote phosphor. The latter may be applied to a lighting module e.g. when the light source thereof emits blue light, and a yellow remote phosphor is engaged to the lighting module to convert the blue light into white light.

According to an embodiment of the alignment device, the additional external
10 component is one of a reflector, a mixing chamber, a diffuser, a converting (remote) phosphor plate, a lens, and a dome element for improving spot uniformity.

According to an embodiment of the alignment device, the positioning device is a separate piece, constitutes a cover of the lighting module, or is integrated in the lighting module or the external component.

15 It is noted that the invention relates to all possible combinations of features recited in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other aspects of the present invention will now be described in more
20 detail, with reference to the appended drawings showing embodiment(s) of the invention in which:

Fig. 1 is a schematic cross sectional side view of an alignment device according to the present inventive concept applied on a lighting module.

Fig. 2 is a perspective partly exploded view of an alignment device according
25 to the present inventive concept in use for aligning a reflector on a lighting module,

Fig. 3 is a cut open perspective side view of an alignment device according to the present inventive concept in use for aligning a reflector on a lighting module

Fig. 4 is a schematic close up of an embodiment of an alignment device according to the present inventive concept in use for aligning an external component of a
30 lighting module, and

Fig. 5 is schematic close up of an embodiment of an alignment device according to the present inventive concept in use for aligning an external component of a lighting module.

DETAILED DESCRIPTION

In the following different embodiments of the alignment device are described. It should be noticed that even though it is referred to as a device, some of the described embodiments are more of alignment structures which are integrated in the lighting module (or alternatively, but not shown, alignment structures integrated in the external component).

Fig. 1 is a schematic cross-sectional side view of a lighting module 20 onto which an alignment device according to the present inventive concept is applicable. The lighting module 20 in Fig. 1 schematically illustrates relevant surfaces of the lighting module 20. A backplane 21, which here is a printed circuit board (PCB), onto which light sources and corresponding driving circuitry are arranged (not shown in Fig. 1), constitutes the back of the lighting module 20. The lighting module 20 further comprises a housing 22 for covering of the driving circuitry and interconnection to light sources, which housing 22 is provided with a contact area 23 for engaging with an external component (not shown in Fig. 1), and a central opening 24. At the same plane of the light sources (which correspond to the same height as LED sub mounts onto which the light sources are typically mounted when being light emitting diodes, LEDs), a light emitting surface LES is defined. The relative position of the light emitting surface LES with respect to the backplane 21, h_{LES} , depends on the specific lighting module, but is typically 4 mm (min. 2 mm, max. 7.2 mm). A relative position h_a of the contact area 23 with respect to the backplane 21 is here predetermined to 4 mm. A predefined area 10, between the contact area 23 and the light emitting surface LES, is the designated area for an alignment device according to an embodiment of the present invention. Further, in alternative embodiments of the invention, the predefined area 10, as illustrated in Fig. 1, and the contact area 23 together constitute the designated area for an alignment device, or alternatively only the contact area 23 constitutes the designated area for an alignment device.

Fig. 2 is a schematic perspective side view of an alignment device 100 arranged on a lighting module 200 for aligning an external component, which here is a reflector 300, with the lighting module 200. The lighting module 200 comprises a backplane 201 onto which, on an upper side of the backplane 201, light sources, which here are light emitting diodes (LEDs) 202 arranged on LED sub mounts 203. Further, the lighting module comprises electronic circuitry (not shown) for driving the LEDs 202 and a driver, which may be externally or internally arranged with respect to the lighting module 200 (not shown). Note, that other suitable light sources are applicable for the present inventive concept. The LEDs 202 are centrally arranged on the backplane 201 and arranged within a confined area

such that the light emitting surface LES is defined having an outer diameter d_{LES} , which is typically equal to the diameter of the circle around the optical domes of the LEDs, as explained with reference to Fig. 1.

A contact area 230 for engaging with the external component is concentrically arranged with respect to the light emitting surface LES and parallel to the backplane 201 of the lighting module 200. The contact area 230 is arranged at a predetermined vertical height with respect to the backplane 201. A preferred range of the predetermined vertical height is between 3.5 and 4.0 mm. As described above, the alignment device 100 is arranged in a predefined area 210, which is arranged between the contact area 230 and the light emitting surface LES, which predefined area 210 is designated for the alignment device 100. The alignment device 100 must thus comply with a central opening having a minimum diameter d_{c_min} corresponding to a predetermined maximum diameter d_{LES_max} of the light emitting surface LES of the lighting module 200. The maximum LES can be typically 23 mm.

Further, the alignment device 100 comprises positioning means, which here are four protruding portions 101, protruding upwardly and perpendicularly with respect to the backplane 201 for positioning of the external component 300 at a predetermined location with respect to the light emitting surface LES. The positioning means 101 is each arranged between the contact area 230 and the light emitting surface LES. Receiving portions 301 arranged on the external component 300 allow positioning and aligning of the external component 300 with respect to light emitting surface LES. The receiving portions 301 here are loops arranged along an inner rim of the reflector 300, but may take other forms, like for example cavities arranged in the wall of the external component. The position, vertical alignment along the vertical axis, and the azimuthal alignment with respect to the light emitting surface LES of the external component 300 are governed by the protruding portions 101, which act as guiding portions when being received by the corresponding reference portions 301 of the external component 300. To achieve a predetermined azimuthal alignment of the reflector is advantageous for example when the reflector 300, as in this case, is segmented by vertically arranged facets 303. Optionally, the protruding portions are arranged on the external component and the corresponding receiving portions are arranged on the alignment/positioning means (not shown).

Fig. 3, is a schematic cut open side view illustration of an embodiment of a lighting device 400 according to the present inventive concept. The lighting device 400 comprises a lighting module 200 onto which a reflector 600 is arranged such that it engages with the lighting module 200 at contact area 230. An alignment device 500 here comprises a

ring shaped protrusion 501 which is integrated in the housing 222 of the lighting module 200, and is thus arranged along the inner diameter of the contact area 230. The ring shaped protrusion 501 outer diameter d_c is equal to the inner diameter of the contact area 230 of the lighting module, while the ring shaped protrusion 501 inner diameter is at least equal to the light emitting surface LES diameter d_{LES} . In this embodiment of the alignment device 500, the position of the external component, i.e. the reflector 600, in the plane of the backplane 201, and the vertical alignment along a vertical axis of the external component are governed by the positioning means (the ring shaped protrusion 501).

According to an embodiment of the alignment device, the positioning means and/or alignment means, further comprises retention means, e.g. click mechanisms, for locking the external component into position (not shown).

Fig. 4 is a close-up illustration of an alignment device 700, which is arranged to, in addition to the features of the embodiments above with reference to Figs. 2 and 3, further comprise retention means 750 for engaging an additional external component 751, which here is a diffuser, arranged above the light sources 202 of the lighting module. The retention means 750 may any suitable fixation means, e.g. a click mechanism. The additional external component 751 may optionally be a reflector, a mixing chamber, a diffuser, a lens, or a dome element for improving spot uniformity.

In the above the external component is mainly referred to a reflector element, however the external component may further be for instance a mixing chamber, a diffuser, a lens, or a remote phosphor.

As mentioned before, the alignment device according to inventive concept may be implemented as a separate piece, to constitute a cover of the lighting module, or to be integrated in the lighting module or the external component.

In a schematic illustration of an alignment device 800 as shown in Fig. 5, the design of the positioning means or alignment means, which here is represented by a protruding portion 801, is selected for ensuring that an electrically conducting part of the external component 300, e.g. the reflector metallization, is separated at least a minimum predetermined creepage distance from any live parts, being parts which carry an electrical voltage or a current, of the electrical components 203 of the lighting module 200. As previously mentioned, this may be achieved by means of a predetermined shape of the positioning/alignment means, e.g. by providing a step with sufficient height and/or thickness such that the distance Δ along the surface, including the step, between the reflector 300 and the closest circuitry 203, is long enough to prevent creepage. Further, arranging the aligning

means for providing a predetermined orientation of the external component with respect to the light emitting surface may also provide a sufficient distance between critical components thereby fulfilling the requirements for the creeping distance. Preferably, the alignment device is arranged to provide a predetermined minimum creepage distance of 3.0 mm.

5 In the same manner the alignment device may further be arranged for providing a minimum predetermined clearance distance between electrical components of the lighting module and an electrically conducting portion of the external component. Preferably, the device is arranged for providing a predetermined clearance distance of 1.2 mm for the electrical components in open air.

10 According to an embodiment of the alignment device, the external component is positioned and aligned using indents in the designated area (not shown). By providing the external component with to the indents corresponding protrusions, like for instance pin-like extensions, these are received in the indents thereby providing azimuthal alignment and positioning of the external component.

15 The person skilled in the art realises that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

CLAIMS

1. An alignment device (100, 500) for aligning an external component (300, 600) with a lighting module (200) comprising a light emitting surface and a contact area (230) for engaging with said external component, and wherein said contact area is concentric with respect to said light emitting surface and arranged on an upper surface of said lighting

5 module,

wherein said alignment device comprises a central opening having a minimum diameter corresponding to a predetermined maximum diameter d_{LES} of said light emitting surface of said lighting module; and

positioning means (101, 501) for positioning said external component at a predetermined location with respect to said light emitting surface and said contact area;

wherein said positioning means is arranged in a designated area, being one of said contact area, said contact area together with a predefined area being an area between said contact area and said light emitting surface, and said predefined area.

2. An alignment device (100) according to claim 1, further comprising alignment means (101) for providing a predetermined azimuthal alignment of said external component (300) with respect to a predetermined orientation of said light emitting surface.

3. An alignment device (100) according to claim 2, wherein at least one of said positioning means and said alignment means comprises at least one guiding portion (101) arranged for engaging with a corresponding reference portion (301) of said external component.

4. An alignment device (100) according to claim 3, wherein said guiding portion and said corresponding reference portion is a protruding portion (101) and a corresponding receiving portion (301), respectively, or a receiving portion and a corresponding protruding portion, respectively.

5. An alignment device according to any preceding claim, further comprising a first retention means for securing said external component.

6. An alignment device according to claim 5, wherein said positioning means comprises said first retention means.

7. An alignment device (700) according to any preceding claim, further comprising second retention means (750) for engaging an additional external component (751).

8. An alignment device (800) according to any of claims 2 -7, wherein said positioning means and/or said alignment means (801) are further arranged for providing a minimum predetermined creepage distance Δ between electrical components (203) of said lighting module (200) and an electrically conducting portion of said external component (300).

9. An alignment device according to claim 8, wherein said predetermined creepage distance for said electrical components is 3.0 mm.

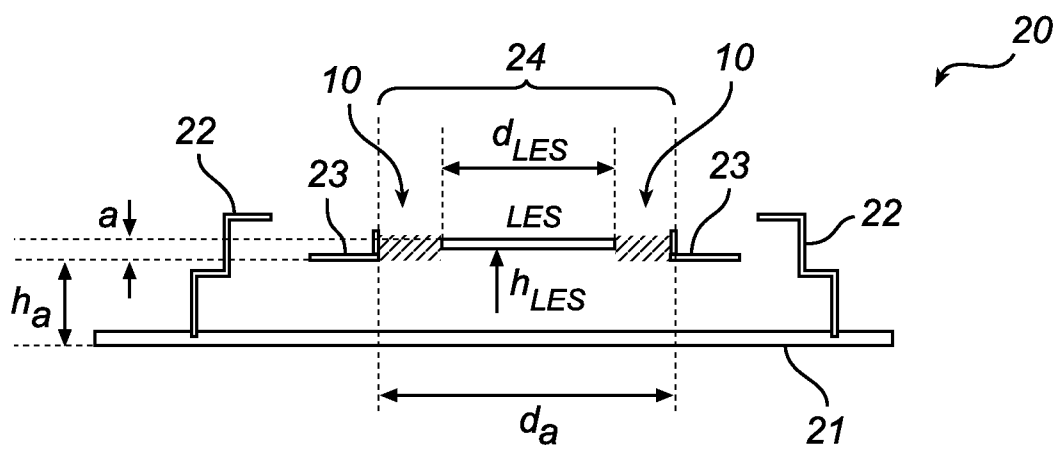
10. An alignment device according to any preceding claim, wherein said positioning means and/or said alignment means are further arranged for providing a minimum predetermined clearance distance between electrical components of said lighting module and an electrically conducting portion of said external component.

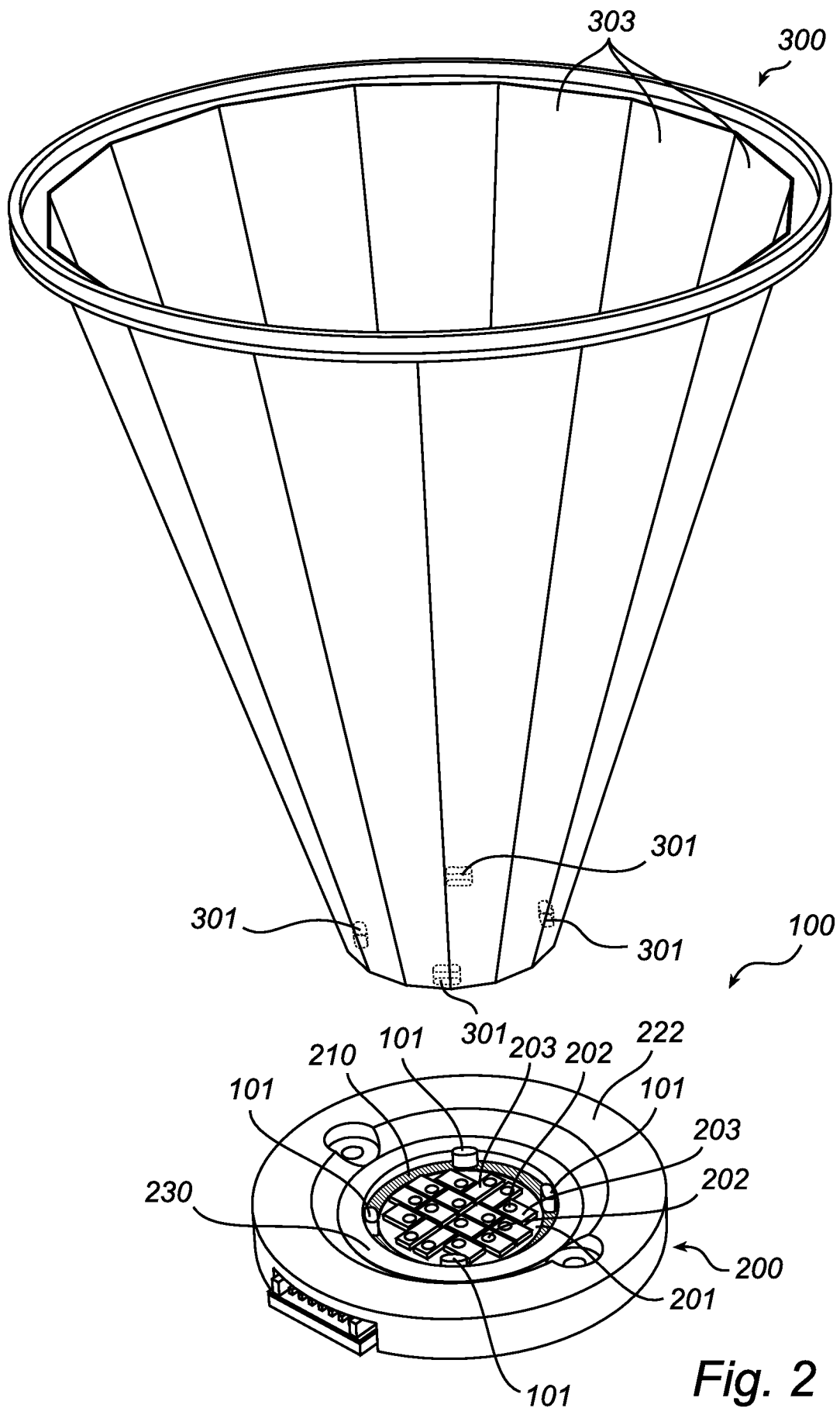
11. An alignment device according to claim 10, wherein said predetermined clearance distance for said electrical components is 1.2 mm.

12. An alignment device according to any preceding claim, wherein said first external component is one of a reflector, a mixing chamber, a diffuser, a lens, and a remote phosphor.

13. An alignment device according to any preceding claim, wherein said additional external component is one of a reflector, a mixing chamber, a diffuser, a lens, and a dome element for improving spot uniformity.

14. An alignment device according to any preceding claim, wherein said positioning device is a separate piece, constitutes a cover of the lighting module, or is integrated in said lighting module or said external component.

*Fig. 1*



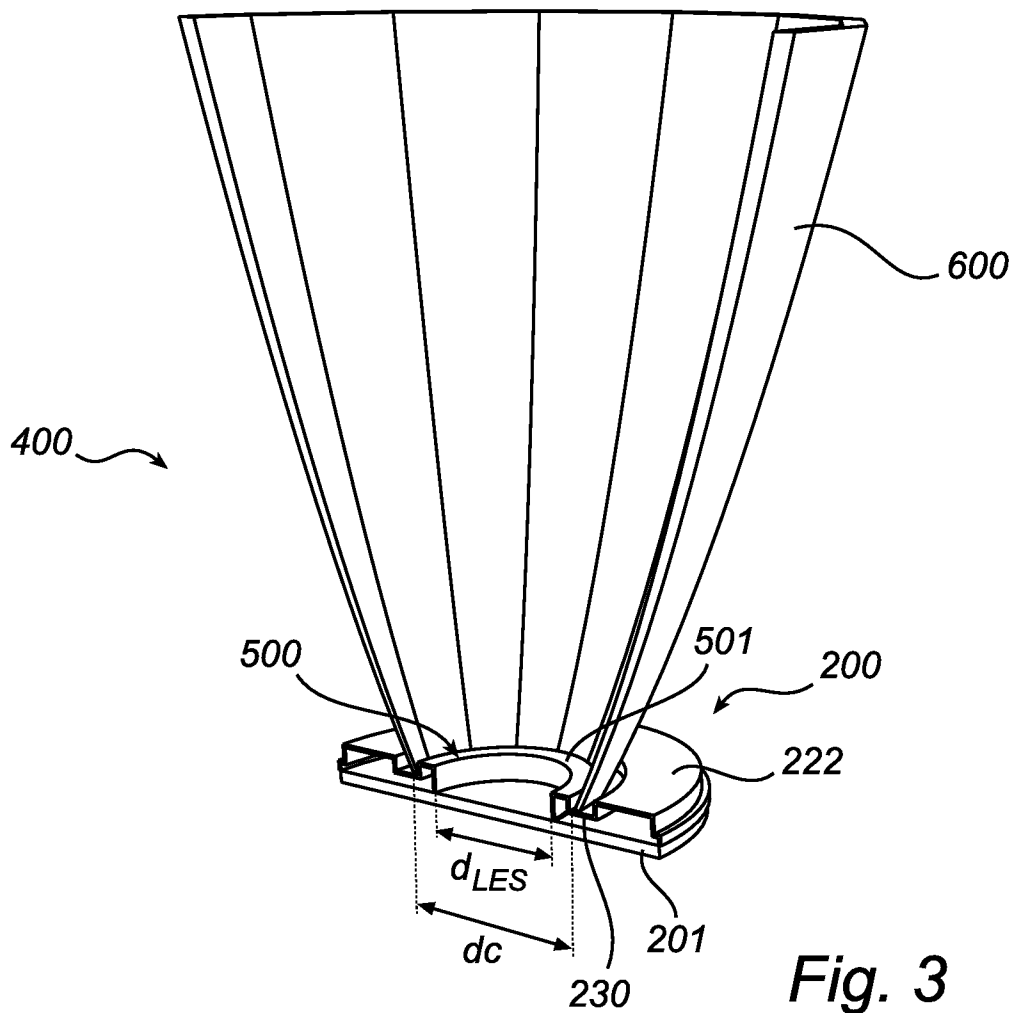


Fig. 3

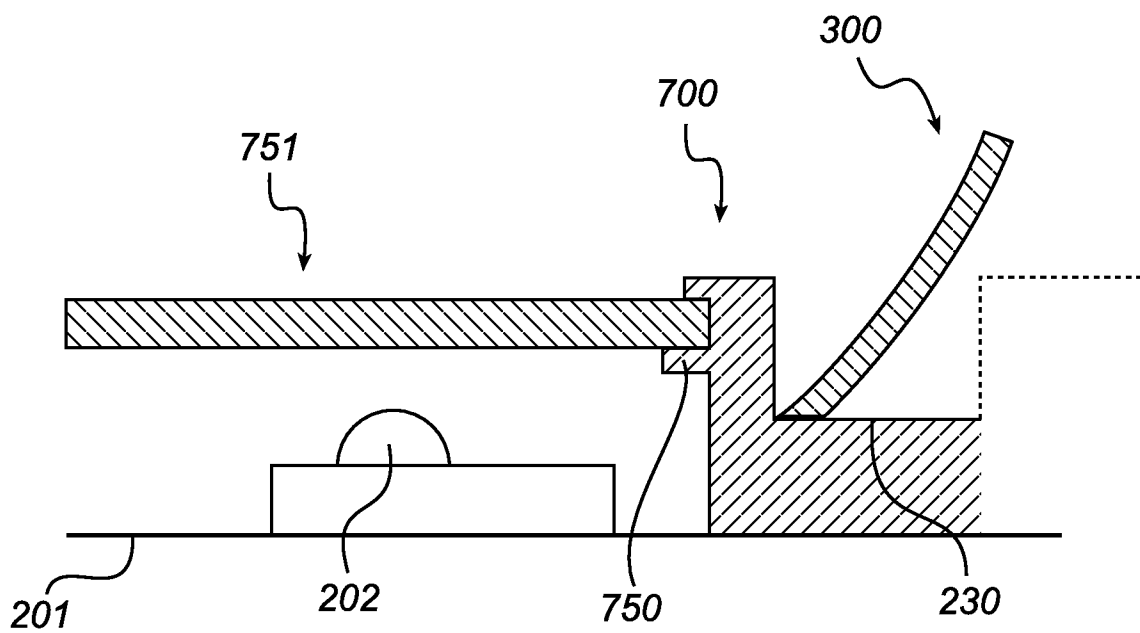
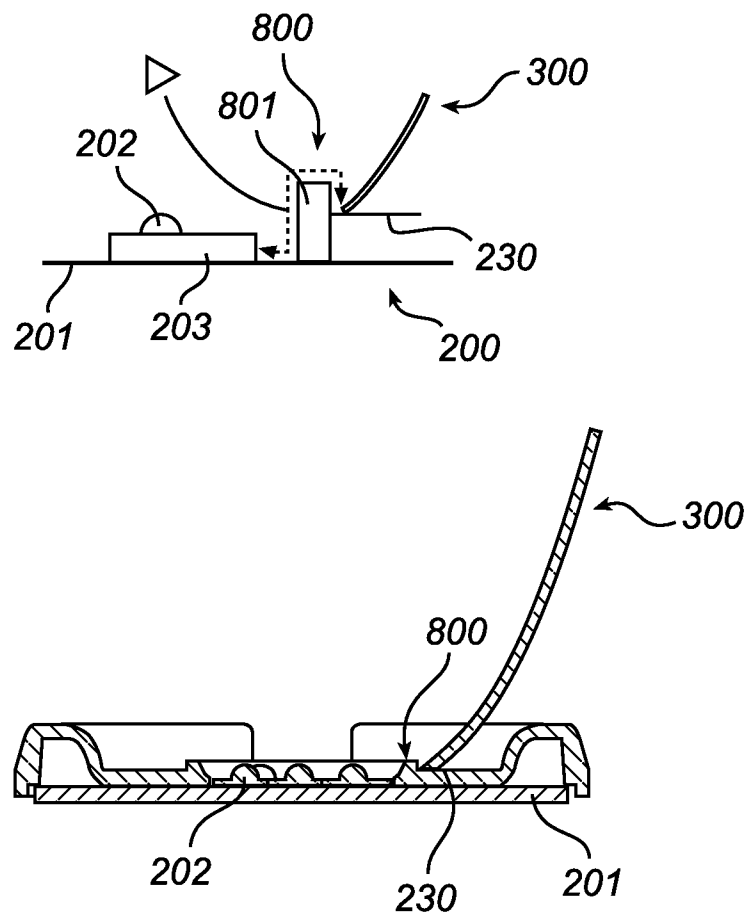


Fig. 4

*Fig. 5*