(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 857 744 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.04.2015 Bulletin 2015/15

(21) Application number: **13187514.8**

(22) Date of filing: **07.10.2013**

(51) Int Cl.:
F21V 29/00 *(2015.01)* ***F21V 31/00*** *(2006.01)*
F21V 19/04 *(2006.01)* ***F21V 3/02*** *(2006.01)*
F21Y 101/02 *(2006.01)* *F21K 99/00* *(2010.01)*

(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
Designated Extension States:
BA ME

(71) Applicant: **Hella KGaA Hueck & Co**
59552 Lippstadt (DE)

(72) Inventor: **Kerpe, Alexander**
59555 Lippstadt (DE)

(54) LED light module and lighting system

(57) The invention addresses a light module (6) comprising a carrier (2) which at least in parts consists of a heat conductive material; comprising a light emitting diode (4) which is mounted to a front side of the carrier (2) and designed for light emission into a main light exit direction (22); comprising a support structure (1) providing a carrier support (10) which support structure (1) consists of an at least partial transparent and/or translucent material and which support structure (1) is designed for light transmission; means for connecting the support structure (1) and the carrier (2); and an inner space (13) which is built between the carrier (2) and the support structure (1) with the at least one light emitting diode (4) being positioned inside the inner space (13), wherein a soft thermal interface is provided which covers at least one third of a back side of the carrier, preferred more than 50 % of the back side of the carrier and even more preferred the complete back side of the carrier.

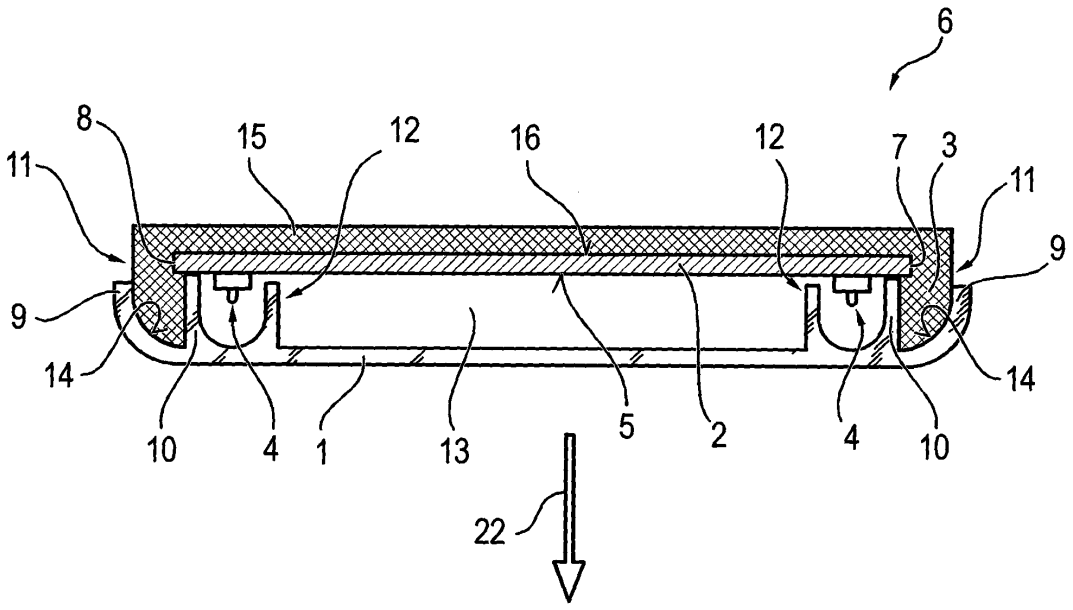

FIG. 1

EP 2 857 744 A1

Description

Field of the invention

[0001] The present patent application relates to a light module comprising a carrier which at least in parts consists of a heat conductive material, comprising a light emitting diode which is mounted to a front side of the carrier and which is designed for light emission into a main light exit direction, comprising a support structure providing a carrier support which support structure consists of an at least partial transparent and/or translucent material and which support structure is designed for light transmission, means for connecting the support structure and the carrier; and an inner space which is built between the carrier and the support structure (1) with the at least one light emitting diode being positioned inside the inner space.

[0002] Furthermore the patent application relates to a lighting system.

[0003] Light modules for lighting systems are normally mounted to a housing of the lighting system. In order to change the light module a cover needs to be removed from an opening of the housing in order to get access to the lighting module. The maintenance of these state of the art lighting systems is relatively complex and time consuming.

[0004] The European Patent Application 12 178 841.8 of the applicant discloses a lighting system with a sealed light module which allows easy assembly and maintenance. The lighting module comprises an at least partially transparent support structure and a carrier with a plurality of light emitting diodes fixed to the carrier. Additionally, a sealing is provided to seal an inner space built between the carrier and the support structure from the environment and to fix the carrier to the support structure. The design of the sealed light module allows a one-step assembly of the light module to a housing of the lighting system. The support structure is part of the light module. It acts as a carrier for the carrier and the light emitting diodes fixed to the carrier. The light module itself defines a closing mean for the opening of the housing of the lighting system.

Summary of the invention

[0005] The problem to be solved by this invention is to make assembly of the light module easier and to provide a lighting system with improved heat dissipation and electrical insolation.

[0006] To achieve the improved light module design the invention is characterized in that a soft thermal interface is provided which covers at least one third of a back side of the carrier, preferred more than 50 % of the back side of the carrier and even more preferred the complete back side of the carrier.

[0007] The particular benefit of the invention is that a thermal interface which covers a back side of the carrier provides an electric insolation and improved heat dissipation at the same time. The carrier holds at least one light emitting diode and/or further electronic components for driving and powering the at least one light emitting diode. The carrier may be a printed circuit board or comprises the same. The carrier may be made of metal, e. g. aluminum, and functions as a heat conductive plate which allows heat generated by the light emitting diodes to dissipate. The support structure gives stability to the LED light module. At the same time, the light-transmissive support structure defines a light outlet surface of the module.

[0008] The carrier is fixed to a support structure through which light is emitted from the at least one light emitting diode to the outside of the light module. The support structure may have at least one lens or other refractive element for guiding the light emitted by the light emitting diode. E. g, the support structure is partially or completely made of a clear, transparent or translucent material. Preferably, the support structure is made of a plastic material which is electrically non-conductive.

[0009] The inventive design of the light module provide excellent thermal properties as only the carrier and the thermal interface define a thermal path from the heat generating devices (light emitting diode and/or electric components located on the carrier) to an external heat sink. Additional components, e. g. an electrically non-conductive pad or a gel coating are unnecessary.

[0010] According to a preferred embodiment of the invention a sealing is provided which seals the inner space of the LED light module against environment. The support structure may have at least one carrier support which holds the carrier in a defined position with respect to the support structure and any optical elements of the support structure. Moreover, the support structure may provide a side wall which defines a trench together with the carrier support. The trench may hold a sealing which is used as a connecting mean and fixes the carrier to the support structure. The sealing may provide the soft thermal interface.

[0011] Preferably, the sealing and/or the soft thermal interface provide a dielectric strength of at least 5 kV/mm. A dielectric strength of 10 kV/mm or more is preferred as it allows a thin sealing design especially with respect to the thermal interface covering the back side of the carrier. E. g., to provide an insolation of 500 V, the sealing thickness needs to be 0.1 mm at a dielectric strength of 5 KV. However, due to production, 0.1 mm to 3 mm seem to be reasonable.

[0012] According to a further embodiment of the invention the sealing and/or the soft thermal interface have a heat connectivity which is greater than or equal to a heat connectivity of air. Due to its heat conductive properties the sealing and/or the soft thermal interface may dissipate heat generated by the light emitting diodes. Therefore, the sealing defines a both isolating and heat conductive coating for the carrier.

[0013] To fix the carrier to the support structure at least

one edge of the carrier and/or one edge of the support structure may be held within the sealing. Preferably, all edges of the carrier are held within the sealing. The sealing surrounds the support structure as well as the carrier at least partially. It is preferably the only connecting mean between the carrier and the support structure. No screw, clip or the other connecting means are used for connecting the carrier and the seal. Depending on the material properties of the sealing the connection can be permanent or detachable.

[0014] The sealing may be made of an at least semi-elastic plastic material, silicone or the like. Preferably, the sealing and/or the soft thermal interface are mold or cast or glue. The trench defined by the at least one carrier support and the side wall of the support structure is preferably designed as a surrounding trench which contains the sealing.

[0015] Preferably, the sealing and/or the soft thermal interface are processed by low pressure injection molding. It may be a hot melt made only on a polyamide base. The sealing and/or the soft thermal interface preferably consist of a soft material with a hardness of 20 to 100 durometer shore A. Applicants research shows good properties at a hardness of 60 durometer shore A.

[0016] In practice the thermal interface covering the back side of the carrier has a thickness of 0.1 to 3 mm. Within this range the thermal interface allows electrical isolation as well as good heat conductivity and sufficient elasticity to allow a smooth arrangement of the sealed light module to the heat sink.

[0017] According to a preferred embodiment of the invention the thermal interface is an integral part of the sealing. The same material is used for the thermal interface and the sealing, E. g. sealing and thermal interface are made of silicone.

[0018] According to a further embodiment of the invention a plug or connection harness is fed through the sealing. E.g. the sealing in this case both seals the inner space and the plug or connection harness. The sealing and pull-force protection of the connection harness is injection molded and the carrier and the support structure are connected within the same production step.

[0019] The inventive light system comprises the LED light module and a heat sink for dissipating heat generated within the light module. The heat sink is in smooth contact to the thermal interface which covers the back side of the carrier. The heat sink may be fixed to a housing, or the heat sink is an integral part of the housing. Preferably, the LED light module is detachable connected to the heat sink.

[0020] The specific hardness of the sealing and/or the soft thermal interface allow a smooth arrangement and plain contact area between the sealing and a heat sink. Preferably, the heat sink may be in close contact to the thermal interface covering the back side of the carrier. It is a special benefit of the invention that the contact surface of the heat sink as well as a corresponding contact surface defined by the back side of the carrier can provide a reduced surface quality. The surface roughness of the contact surfaces may increase as the soft thermal interface which is arranged between the contact surfaces adapts itself and achieves a good heat conductivity even at low surface qualities. Therefore, low cost production of the sealed light module, the heat sink, and the lighting system becomes available.

[0021] The lighting system provides excellent thermal properties as the thermal path solely consists of the carrier and the electronic components fixed to the carrier (e.g. printed circuit board assembly PCBA) and the thermal interface. No additional base plate or other rigid component is required. Moreover, no additional insulation or heat conducting material is necessary (e. g. glued silicone film or interlayer).

[0022] Even if the carrier deforms due to thermal effects the soft thermal interface still ensures the smooth contact between the carrier and the heat sink. Due to its softness position and form tolerances of the carrier can be compensated by the soft thermal interface and good heat dissipating properties can be reached.

[0023] The design of the lighting systems allows an easy maintenance and exchange of the LED light module. As the heat sink is fixed to the housing and is not part of the LED light module the assembly is easy. Moreover, the LED light module can be built at low costs.

[0024] As the LED light module contains the at least partially transparent or translucent support structure the assembly of the lighting system becomes very easy. While assembly of a light module typically requires the removal of a cover from an opening of a housing in a first step and the exchange of the light module held in the housing thereafter the invention allows a one-step assembly as the support structure is an integral part of the light module.

[0025] Further advantages and embodiments of the invention are disclosed in the dependent claims.

Brief description of the drawings

[0026] The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by a way of illustration only, and thus, are not limitive to the present invention.

[0027] In the drawings:

Fig. 1 shows a sectional view of a sealed LED light module in a first embodiment;

Fig. 2 shows the assembly of an inventive lighting system comprising the sealed LED light module shown in fig. 1, a housing, and a heat sink;

Fig. 3 shows the sealed LED light module of fig. 1 mounted in the housing of the lighting system;

Fig. 4 shows a sectional view of the sealed LED light

module in a second embodiment;

Fig. 5 shows a sectional view of a sealed LED light module in a third embodiment;

Fig. 6 shows a sectional view of a sealed LED light module in a forth embodiment; and

Fig. 7 shows a sectional view of a sealed LED light module in a fifth embodiment.

Detailed description of the drawings

[0028] In fig. 1 a sectional view of an inventive sealed light module 6 is shown. A support structure 1 holds a carrier 2 by means of a sealing 3. A plurality of light emitting diodes 4 is fixed to a front side 5 of the carrier 2. The light emitting diodes 4 emit light through the at least partially transparent and/or translucent support structure 1 into a main light-exit direction 22 of the light module 6.

[0029] The carrier 2 carrying the light emitting diodes 4 on its front side 5 may also support further electronic components not shown which may be used for driving and/or powering the light emitting diodes 4. In this embodiment of the invention the carrier 2 is made of metal and provides means for electrical connecting light emitting diodes 4 and/or the further electronic components to an energy source. The carrier 2 is a rectangular carrier 2 with four edges 7, 8 which are enclosed by the sealing 3.

[0030] The support structure 1 has a surrounding side wall 9 as well as a surrounding carrier support 10 which carries the carrier 2 and defines a mounting position of support structure 1 and carrier 2. The side wall 9 and the carrier support 10 define a trench 11 which holds the sealing 3.

[0031] Moreover, refracting optical structures 12 allocated to the light emitting diodes 4 are part of the support structure 1. The refracting optical structures 12 are designed in such a way that a desired light distribution is provided by the sealed light module 6. E. g., the refracting light structures 12 are built as lenses 12.

[0032] The support structure 1 and the carrier 2 located to the support structure 1 define an inner space 13. The sealing 3 interacts with a surface 14 of the trench 11 and the edges 7, 8 of the carrier 2 to fix the carrier 2 to the support structure 1 and to seal the inner space 13 against the environment. The light emitting diode 4 which may be light emitting diodes are arranged inside the sealed inner space 13.

[0033] The sealing 3 provides a thermal interface 15 which covers a back side 16 of the carrier 2. The back side 16 of the carrier 2 is a plane back side 16 and completely covered by the sealing 3 and/or the thermal interface 15. In this embodiment of the invention the sealing 3 is made of a silicone material. The sealing 3 may also consist of any other suitable semi-elastic plastic material. It provides a hardness of 20 to 100 durometer shore A and a dielectric strength of 5 kV/mm or more. Moreover, the sealing 3 is built of a heat conductive material which allows heat generated by driving the light emitting diodes 4 to be dissipated. According to a preferred embodiment the heat connectivity of the sealing 3 is equal to or greater than the heat connectivity of air.

[0034] With respect to the lighting system 17 shown in fig. 2 and 3 the heat sink 18 is fixed to a housing 19 of the lighting system 17. The housing 19 provides an opening 20 designed for assembly of the sealed light module 6. When mounting the sealed light module 6 to the opening 20 of the housing 19 the thermal interface 15 which covers the back side 16 of the carrier 2 adapts itself to a flat contact surface 21 of the heat sink 18. With the light module 6 being mounted to the opening 20 the flat surface 21 of the heat sink 18 is in smooth contact to the thermal interface 15.

[0035] As the thermal interface 15 covers the back side 16 of the carrier 2 completely or to a large extent the lighting system 17 provides electrical isolation as well as heat conductivity by means of the sealing 3. Moreover, the soft sealing material allows easy assembly of the lighting system 17 even if the back side 16 of the carrier 2 or the contact surface 21 of the heat sink 18 provides reduced surface qualities. Accordingly, the housing 19, the heat sink 18 and/or the light module 6 can be produced at low costs while achieving a low thermal resistance between these components.

[0036] According to Fig 4 the sealed LED light module 6 may provide a sealing 3 and a separate thermal interface 15 covering the back side 16 of the carrier 2. Different materials can be used for the sealing 3 and the thermal interface 15. For example, the sealing 3 is built at first to connect the carrier 2 to the support structure 1. Thereafter, the thermal interface 15 is built by casting with the sealing 3 being used as a mold and defining the boundary of the thermal interface 15.

[0037] According to a further embodiment of the invention shown in Fig. 5 the sealing 3 may define an edge 25 with respect to the thermal interface 15. The edge 25 formed by the sealing 3 simplifies the assembly of the lighting system 17 as the sealing 3 serves as a guide when fixing the heat sink 18 to the thermal interface 15.

[0038] Fig. 6 shows a further embodiment of the invention. According to this embodiment the heat sink 18 is an integral part of the housing of the lighting system 17.

[0039] According to a further embodiment of the invention shown in Fig. 7 a connection harness 26 is provided. The connection harness 26 is fed through the sealing 3 of the light module 6 and connected to the carrier 2. In this embodiment of the invention the sealing 3 seals both the inner space 13 and the connection harness 26. It also connects the support structure 1 and the carrier 2 as it coats the edges 7, 8 of the carrier 2 and corresponding edges 27, 28 of the carrier support 10.

List of reference numbers

[0040]

1 support structure
2 carrier
3 sealing
4 light emitting diode
5 front side
6 sealed LED light module
7 edge
8 edge
9 side wall
10 carrier support
11 trench
12 optical structure
13 inner space
14 surface
15 thermal interface
16 back side
17 lighting system
18 heat sink
19 housing
20 opening
21 surface
22 main light-exit direction
25 edge
26 connection harness
27 edge
28 edge

Claims

1. LED light module (6) comprising

- a carrier (2) which at least in parts consists of a heat conductive material;
- a light emitting diode (4) which light emitting diode (4) is mounted to a front side of the carrier (2) and/or which light emitting diode (4) is designed for light emission into a main light exit direction (22);
- a support structure (1) providing a carrier support (10) which support structure (1) consists of an at least partial transparent and/or translucent material and which support structure (1) is designed for light transmission;
- means for connecting the support structure (1) and the carrier (2);
- an inner space (13) which is built between the carrier (2) and the support structure (1) with the at least one light emitting diode (4) being positioned inside the inner space (13);

characterized in that a soft thermal interface (15) is provided which covers at least one third of a back side (16) of the carrier (2), preferred more than 50 % of the back side (16) of the carrier (2) and even more preferred the complete back side (16) of the carrier (2).

2. LED light module (6) comprising

- a carrier (2) which is made of a heat conductive material;
- at least one light emitting diode (4) which is fixed to a front side (5) of the carrier (2);
- a soft thermal interface (15) which covers a back side (16) of the carrier (2) at least partially wherein a thermal path from the light emitting diode (4) to an external heat sink (18) consists solely of the carrier (2) and the soft thermal interface (15).

3. LED light module (6) according to claim 1or 2 **characterized in that** a sealing (3) is provided which seals the inner space (13) against an environment, and/or that the support structure (1) has at least one side wall (9) which defines a trench (11) together with the at least one carrier support (10) and wherein the trench (11) holds the sealing (3) which interacts with at least one edge (7, 8) of the carrier (2) and a surface (14) of the trench (11) to fix the carrier (2) to the support structure (1), and/or that the sealing (3) provides the soft thermal interface (15).

4. LED light module (6) according to one of the claims 1 to 3 **characterized in that** the sealing (3) and/or the soft thermal interface (15) consist of an electrically non-conductive material and/or that the sealing (3) and/or the soft thermal interface (15) provide a dielectric strength of at least 5 kV/mm, preferred 10 kV/mm or more.

5. LED light module (6) according to one of the claims 1 to 4 **characterized in that** the sealing (3) and/or the soft thermal interface (15) consist of a adaptable material and/or that the sealing (3) and/or the soft thermal interface (15) have a hardness of 20 to 100 durometer shore A.

6. LED light module (6) according to one of the claims 1 to 5 **characterized in that** a heat conductivity of the sealing (3) and/or the soft thermal interface (15) are greater than or equal to a heat conductivity of air.

7. LED light module (6) according to one of the claims 1 to 6 **characterized in that** the sealing (3) and/or the soft thermal interface (15) consist of a silicone material or a glue or an adhesive material.

8. LED light module (6) according to one of the claims 1 to 7 **characterized in that** the thermal interface (15) which covers the back side (16) of the carrier (2) has a thickness of 0.1 to 3.0 mm.

9. LED light module (6) according to one of the claims 1 to 8 **characterized in that** the soft thermal interface (15) is an integral part of the sealing (3) and/or that the same material is used for the sealing (3) and the soft thermal interface (15).

10. LED light module (6) according to one of the claims 1 to 9 **characterized in that** the sealing (3) seals a plug and/or a connection harness (26).

11. A lighting system (17) comprising

- a LED light module (6) according to one of the claims 1 to 10;
- a heat sink (18) for dissipating heat from the LED light module (6); wherein the heat sink (18) is in close contact to the thermal interface (15) which covers the back side (16) of the carrier (2) and/or the thermal interface (15) is adapted to a flat contact surface (21) of the heat sink (18) by means of the heat sink (18).

12. Lighting system (17) according to claim 11 **characterized in that** the heat sink (18) and/or the housing (19) is detachable connected to the sealed light module (6).

13. Lighting system (17) according to claim 11 or 12 **characterized in that** the flat contact surface (21) of the heat sink (18) is in a parallel orientation to the back side (16) of the carrier (2).

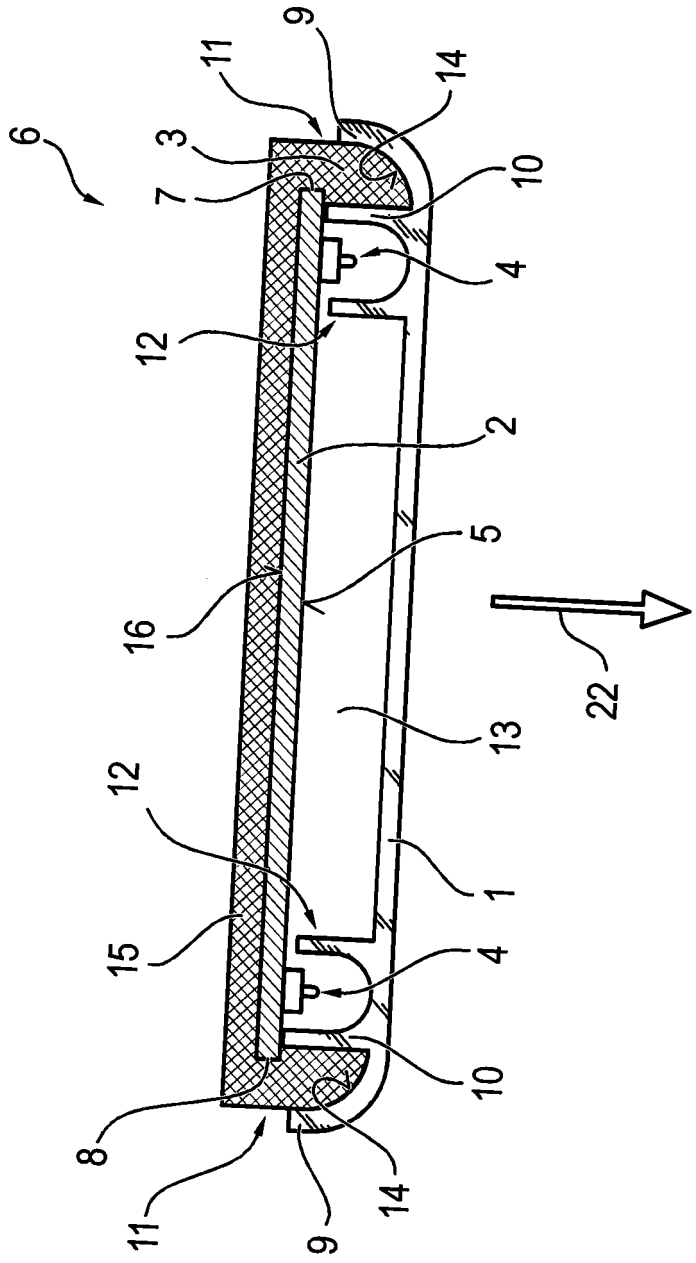

FIG. 1

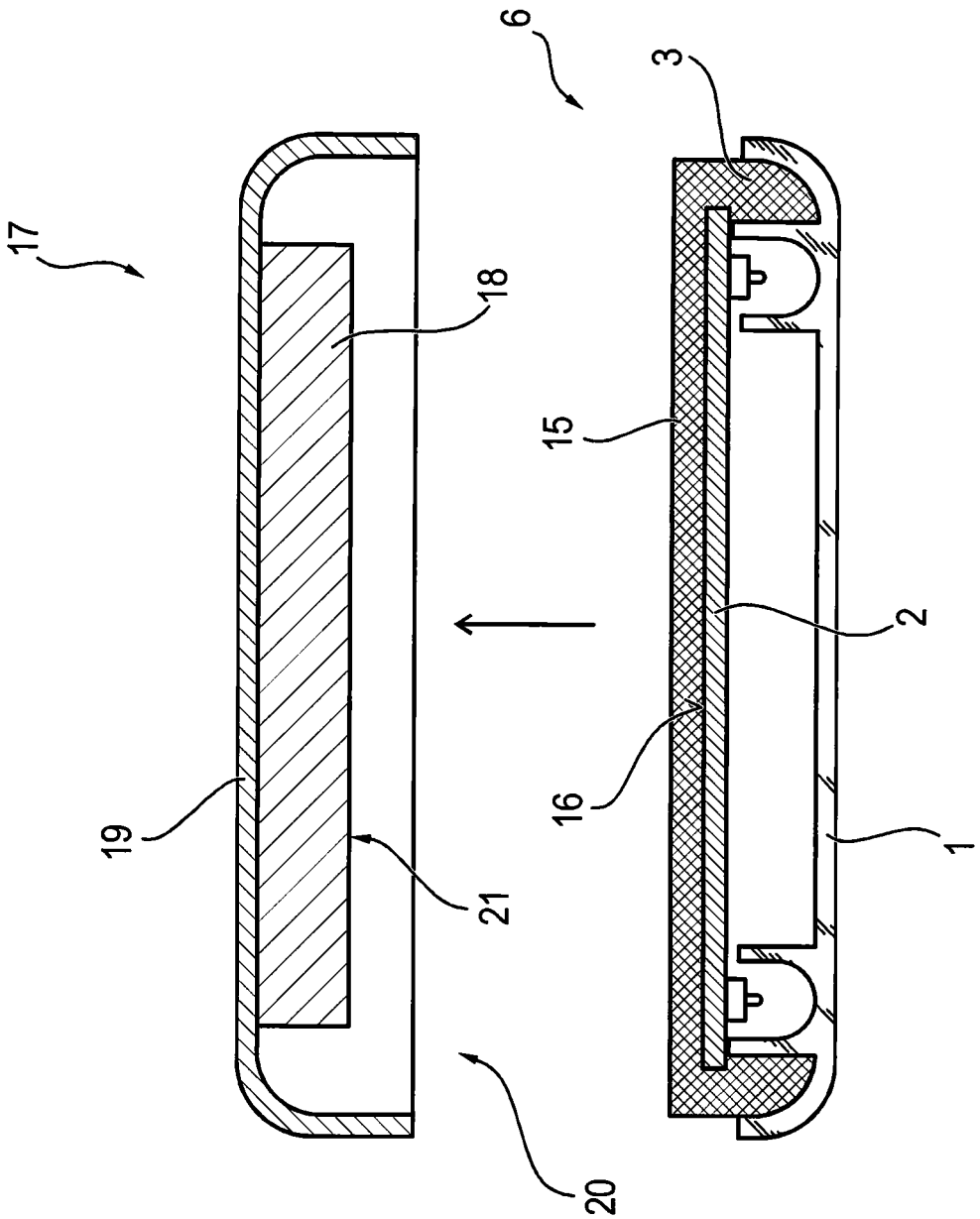

FIG. 2

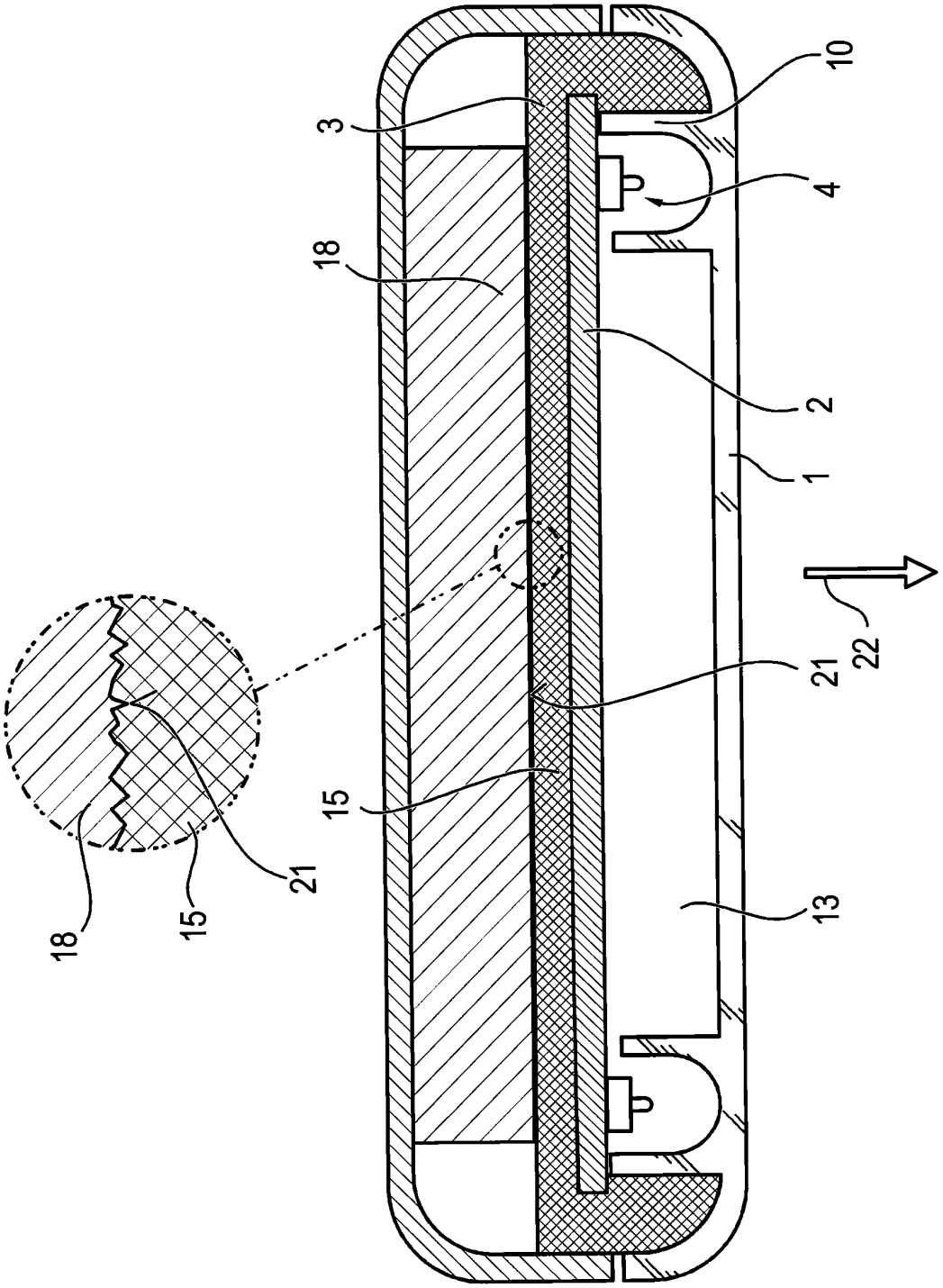

FIG. 3

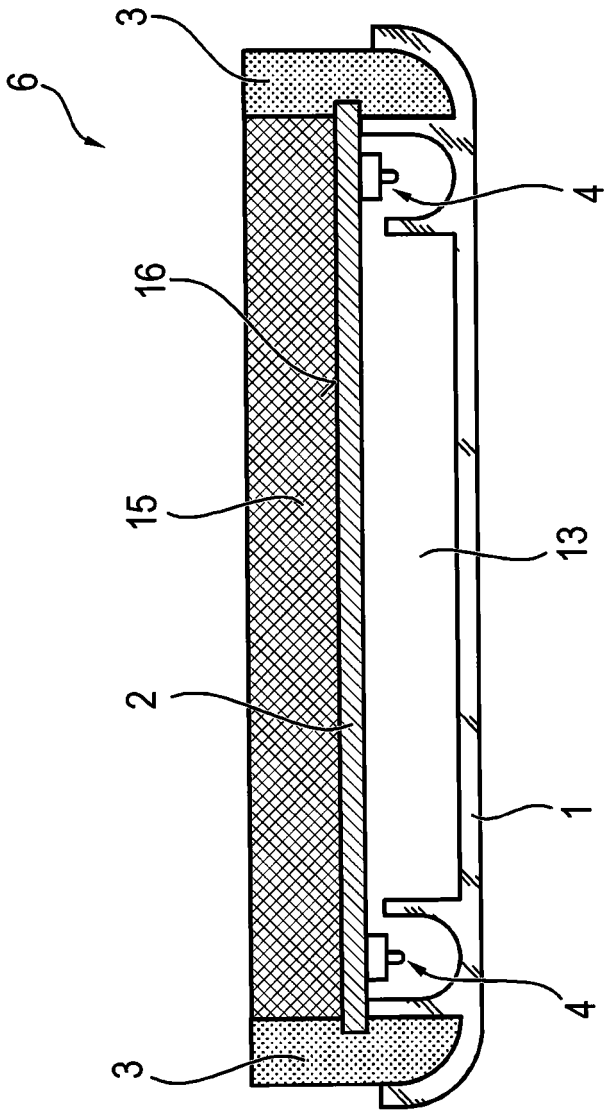

FIG. 4

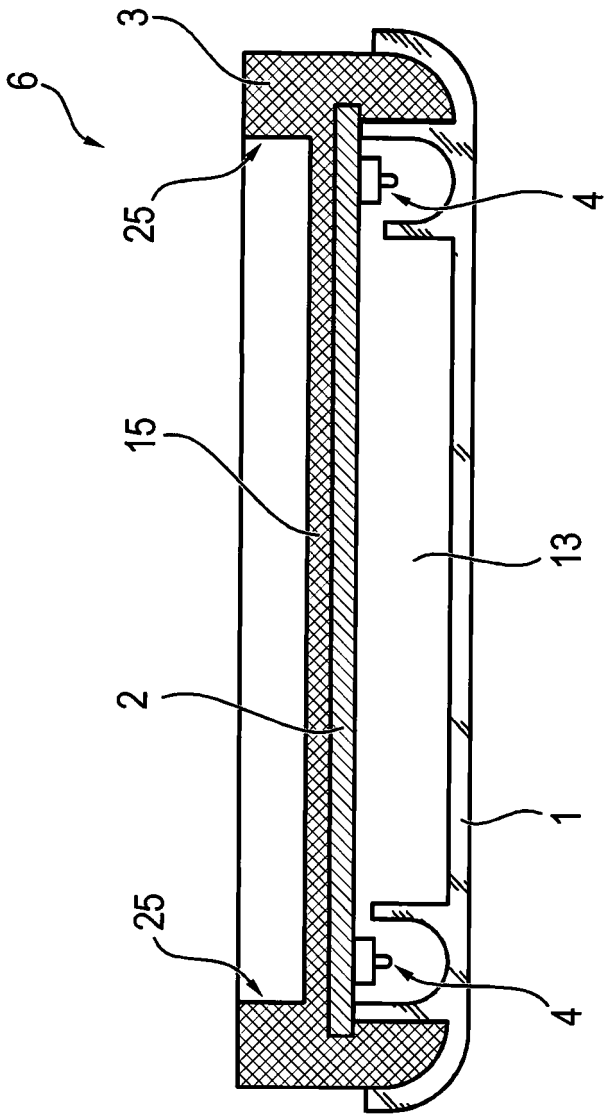

FIG. 5

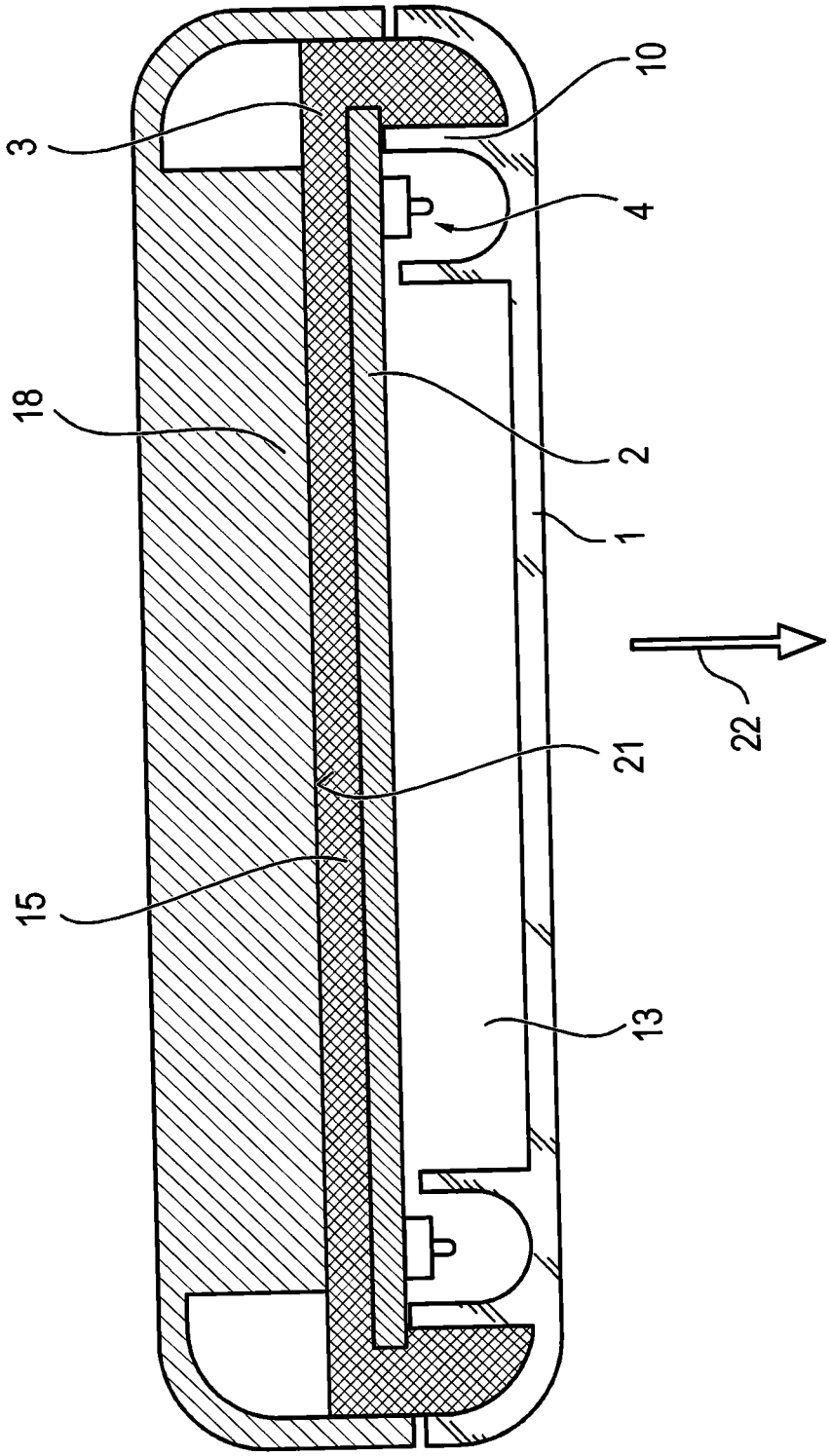

FIG. 6

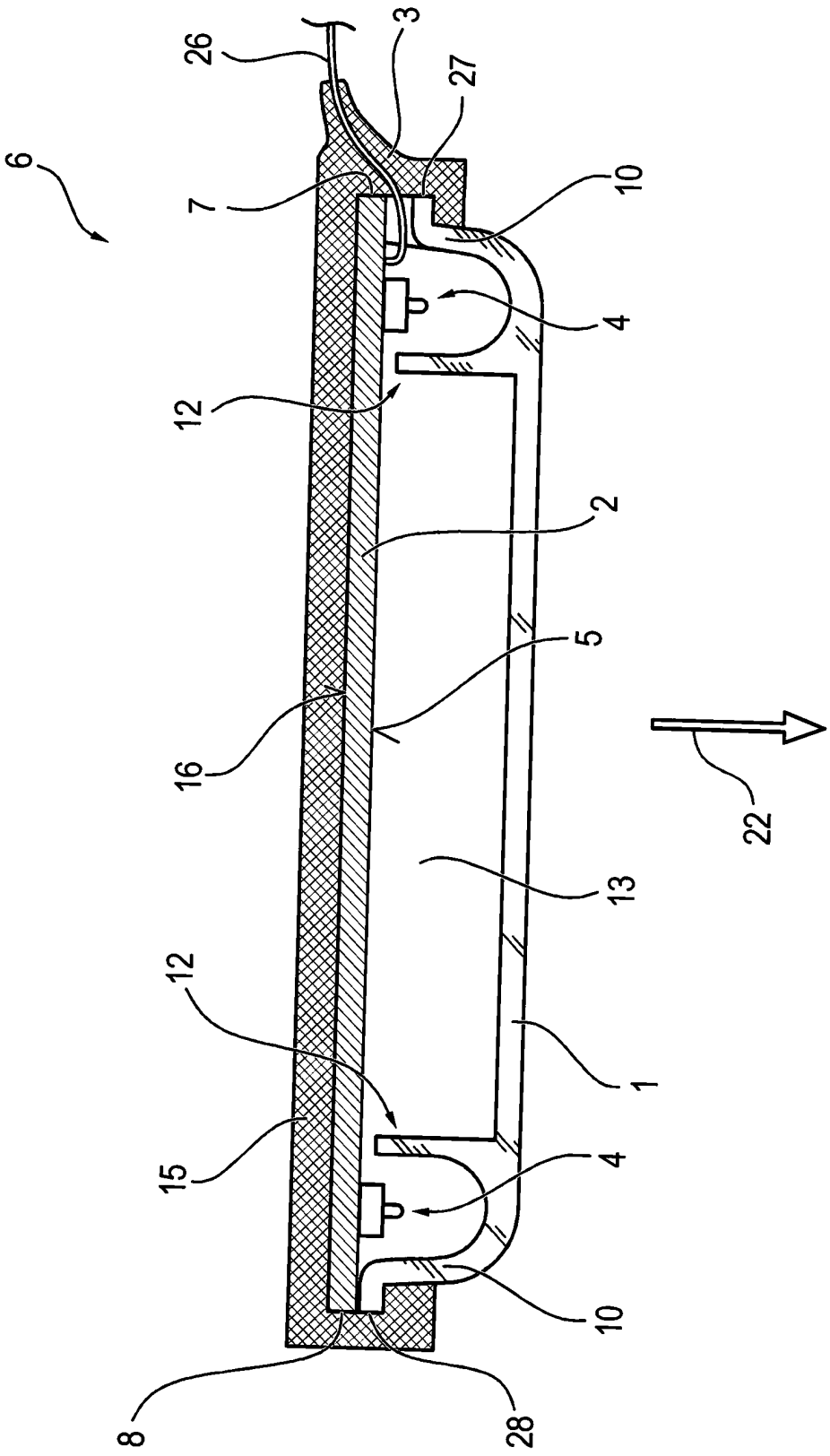

FIG. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 18 7514

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2013/043781 A1 (WANG ROBERT [TW]) 21 February 2013 (2013-02-21) * figures 4-7 * * paragraph [0016] - paragraph [0027] *	1,3-6,8, 11-13	INV. F21V29/00 F21V31/00 F21V19/04 F21V3/02
X	EP 2 535 642 A2 (TRILUX GMBH & CO KG [DE]) 19 December 2012 (2012-12-19) * paragraph [0007] - paragraph [0024]; figures 1a-1b *	1-13	ADD. F21Y101/02 F21K99/00
X	EP 2 287 640 A2 (LG INNOTEK CO LTD [KR]) 23 February 2011 (2011-02-23) * figures 1,30,37 * * paragraph [0035] - paragraph [0058] * * paragraph [0112] * * paragraph [0150] - paragraph [0172] * * paragraph [0160] - paragraph [0161] *	1-9, 11-13	
X	EP 2 481 973 A2 (TOSHIBA LIGHTING & TECHNOLOGY [JP]) 1 August 2012 (2012-08-01) * figures 1, 9, 10 * * paragraph [0014] - paragraph [0025] * * paragraph [0098] - paragraph [0101] *	1,3-9, 11-13	TECHNICAL FIELDS SEARCHED (IPC) F21V F21Y F21K
X	EP 2 320 134 A2 (LG INNOTEK CO LTD [KR]) 11 May 2011 (2011-05-11) * abstract; figures 4, 13 * * paragraph [0060] - paragraph [0061] *	1-9, 11-13	
A	US 2010/328960 A1 (WANG PEI-CHOA [TW]) 30 December 2010 (2010-12-30) * paragraph [0020] - paragraph [0023]; figure 2 *	1,3	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 April 2014	Thibaut, Arthur

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 18 7514

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 320 138 A2 (LG INNOTEK CO LTD [KR]) 11 May 2011 (2011-05-11) * figures 4, 8, 9 * * paragraph [0007] - paragraph [0017] * * paragraph [0039] - paragraph [0068] *	1-13	
X	WO 2013/072805 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]) 23 May 2013 (2013-05-23) * page 7, line 17 - page 9, line 32; figures 1-3b *	1,2,5,6, 8,11,12	
X	US 2012/002419 A1 (ZADEREJ VICTOR [US] ET AL) 5 January 2012 (2012-01-05) * paragraph [0123] - paragraph [0135]; figures 27-30 *	2,4-6,8, 11,12	
X	EP 2 600 055 A1 (MARSHALLS MONO LTD [GB]) 5 June 2013 (2013-06-05) * paragraph [0022] - paragraph [0023]; figures 5, 9-12 *	2,6,7, 11-13	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 April 2014	Thibaut, Arthur

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 13 18 7514

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 13 18 7514

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1(completely); 3-13(partially)

LED light module comprising a carrier, a LED mounted to a front side of the carrier, a support structure designed for light transmission and a soft thermal interface which covers at least one third of a back side of the carrier.

---

2. claims: 2(completely); 3-13(partially)

LED light module comprising a carrier, a LED mounted to a front side of the carrier, a soft thermal interface which covers at least partially a back side of the carrier wherein a thermal path from the LED to an external heat sink consists solely of the carrier and the thermal interface.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 18 7514

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-04-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013043781 A1	21-02-2013	NONE	
EP 2535642 A2	19-12-2012	DE 102011077668 A1	20-12-2012
		EP 2535642 A2	19-12-2012
EP 2287640 A2	23-02-2011	CN 101929651 A	29-12-2010
		EP 2287640 A2	23-02-2011
		EP 2672299 A1	11-12-2013
		JP 2010272527 A	02-12-2010
EP 2481973 A2	01-08-2012	CN 202561467 U	28-11-2012
		EP 2481973 A2	01-08-2012
		US 2012262928 A1	18-10-2012
EP 2320134 A2	11-05-2011	CN 102182939 A	14-09-2011
		EP 2320134 A2	11-05-2011
		JP 2011100735 A	19-05-2011
		TW 201118311 A	01-06-2011
		US 2011109215 A1	12-05-2011
US 2010328960 A1	30-12-2010	NONE	
EP 2320138 A2	11-05-2011	CN 102095098 A	15-06-2011
		EP 2320138 A2	11-05-2011
		JP 2011100736 A	19-05-2011
		TW 201124671 A	16-07-2011
		US 2011109216 A1	12-05-2011
WO 2013072805 A1	23-05-2013	NONE	
US 2012002419 A1	05-01-2012	NONE	
EP 2600055 A1	05-06-2013	EP 2600055 A1	05-06-2013
		GB 2497282 A	12-06-2013

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 12178841 A **[0004]**