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**Datasheet for the decision
of 21 March 2019**

Case Number: T 2024/17 - 3.4.02

Application Number: 06795769.6

Publication Number: 1927024

IPC: G02B6/42, H01L33/00, F21S8/00

Language of the proceedings: EN

Title of invention:
LIGHT SOURCE AND METHOD OF PROVIDING A BUNDLE OF LIGHT

Applicant:
Signify Holding B.V.

Headword:

Relevant legal provisions:
EPC 1973 Art. 54, 56

Keyword:
Novelty - main request (no)
Inventive step - auxiliary request (no)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2024/17 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 21 March 2019

Appellant: Signify Holding B.V.
(Applicant) High Tech Campus 48
5656 AE Eindhoven (NL)

Representative: Verweij, Petronella Daniëlle
Signify Holding B.V.
Intellectual Property
High Tech Campus 7
5656 AE Eindhoven (NL)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 6 March 2017
refusing European patent application No.
06795769.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: A. Hornung
B. Müller

Summary of Facts and Submissions

- I. The applicant appealed against the decision of the examining division refusing European patent application No. 06795769.6 on the basis of Articles 123(2) and 54(1) and (2) EPC.
- II. With the statement setting out the grounds of appeal, the appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the claims according to a new main request or a first or a second auxiliary request, all requests having been submitted with that statement.
- III. In a communication annexed to a summons to oral proceedings, the board informed the appellant about its provisional and non-binding opinion according to which, *inter alia*, the claimed subject-matter lacked an inventive step (main request and both auxiliary requests).
- IV. In response to the summons to oral proceedings, the appellant, with a letter dated 21 February 2019, filed claims according to a new main request and a new auxiliary request, replacing all previously filed requests. Moreover, the appellant withdrew its request for oral proceedings and requested that a decision be issued based on the claim requests on file.
- V. Oral proceedings were held in the absence of the appellant. The chairman noted that the appellant had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the sets of claims according to a main request and an auxiliary request, both filed with the letter of 21 February 2019.

At the end of the oral proceedings the chairman announced the board's decision.

VI. The present decision refers to the following document:

D1: WO 2004/088200 A2.

VII. Claim 1 according to the main request reads as follows:

"Light source, including

- a component (6) for emitting light, arranged to emit a major part of light generated within the component through a face (8) of the component (6), and

- at least one structure (7; 18) for coupling out light, having a base (11; 19) in contact with the face (8) of the component (6) and arranged to emit light through an aperture (12; 20) opposite the base (11; 19), wherein an interface between the component (6) and an environment surrounding the base (11; 19) is arranged to keep at least part of the light generated in the component confined to at least a layer (10) of the component (6) adjoining the base (11; 19), said interface providing total internal reflection of said part of the light,

characterized in that

the base (11; 19) is in contact with the face (8) over an area (A_2) smaller than the area (A_0) of the face (8), and in that

the component (6) for emitting light includes a layered device including

- one or more active layers (9) for converting electrical current into light,

- at least one further layer (10), transparent in a range of frequencies of light generated in the component and having a smaller absorption coefficient in that range than the active layers (9), and said at least one further layer

(10) between the face of the component and the active layers, comprising a luminescent material."

Claim 1 according to the auxiliary request differs from claim 1 of the main request in that it comprises the following additional features:

"said light source further comprising a plurality of the structures (18a-18e) for coupling out light, each having a base (20a-20e) in contact with the face (8) over an area substantially smaller than the area of the face (8), at least one arrangement (7; 22a-22f) for collimating at least the light passing through one of the structures (7; 18) for coupling out light, wherein at least one lenslet (22a-22f) is provided over the respective apertures (20a-20e) opposite the bases (19a-19e) of the structures (18) for coupling out light."

Reasons for the Decision

1. Main request - Novelty

The subject-matter of claim 1 is anticipated by the disclosure of D1 (Article 54 (1) and (2) EPC 1973).

1.1 D1 discloses, with reference to figure 1, a light source comprising:

- a component (3) for emitting light through a face (4),
- a structure (5) for coupling out light having a base (17) in contact with the face (4) of the component (3) [page 18, lines 16 and 17] and arranged to emit light through an aperture (18) opposite its base (17), wherein

- the base (17) of the structure (5) is in contact with the face (4) of the component (3) over an area smaller than the area of the face (4) of the component (3) *[page 19, lines 25 to 27]* and wherein
- the component (3) includes a layered device including
 - a stack of active layers for converting electrical current into light *[page 11, lines 17 to 33]*,
 - a further layer, transparent in a range of frequencies of light generated in the component (3) and having a smaller absorption coefficient in that range than the active layers, comprising a luminescent material and located between the light emitting face (4) of the component (3) and the active layers *[page 15, lines 20 to 29; part of the light generated by the LED chip is not converted by the luminescent material, which means that the fluorescent layer is at least partially transparent and less absorptive than the active layers]*.

Moreover, since the environment surrounding the base (17) of structure (5) is air *[cf. e.g. page 18, lines 1 and 2]* having a refractive index equal to 1 and since the component (3) has a refractive index larger than 1, part of the light generated in the component (3) is intrinsically confined in the component (3) due to total internal reflection. In other words, the interface between the component (3) and an environment surrounding the base (17) of the structure (5) is intrinsically arranged to keep part of the light generated in the component (3) confined to at least a layer of the component (3) adjoining the base (17) of the structure (5), said interface providing total internal reflection of said part of the light. It is to be noted that the expression "confined to at least a layer of the component adjoining the base of the structure" in claim 1 encompasses the

possibility that light is confined in one layer, in several layers or in the whole component (3).

It follows that D1 discloses all the features of claim 1.

1.2 The appellant presented the following counter-arguments which were found not convincing by the board:

1.2.1 The appellant, in its letter of reply dated 21 February 2019, point 6.3, first sentence, noted "that no objections are made regarding novelty, so the claims as presently on file are acknowledged to be novel".

The board, in its communication annexed to the summons to oral proceedings, page 4, third paragraph, implicitly acknowledged novelty of the subject-matter of claim 1 then on file because "D1 is silent about the thickness ratio of the stack of active layers and the further layer". Present claim 1, however, has been amended with respect to claim 1 then on file by deleting the only distinguishing feature of claim 1 over D1. Therefore, the board's preliminary opinion concerning novelty of the subject-matter of previous claim 1 is not applicable any more to the subject-matter of present claim 1.

1.2.2 The appellant, in its letter of reply, point 6.3, sixth paragraph, argued that "[T]he crux of our present invention is to position 'further layers (10)' in between the semiconductor active layers (the LED die) and the entrance aperture of the structure. This additional element (the further layers) act as light guide (...)". Moreover, "[T]his construction - the further layers acting as a light guide and adding light to the input of the structure via reflections in these further layers - is not disclosed or suggested in D1".

The board is not convinced by this argument because claim 1 is not restricted to a *plurality* of layers acting as a light guide and being positioned between the active layers and the entrance aperture of the structure, but encompasses the possibility of a *single* layer. Indeed, claim 1 refers to "an interface between the component (6) and an environment surrounding the base (11; 19) [which] is arranged to keep at least part of the light generated in the component confined to *at least a layer* (10) of the component (6) adjoining the base (11; 19), said interface providing total internal reflection of said part of the light". The expression "at least a layer" encompasses a single layer.

In addition to the "one or more active layers", claim 1 defines "*at least one further layer* (10), transparent in a range of frequencies (...) comprising a luminescent material". It is unclear from the wording of the claim whether this "*at least one further layer* (10) (...) comprising a luminescent material" is the same layer as the "*at least a layer* (10) of the component (6) adjoining the base (11; 19)" or if it defines an additional layer. In any case, it is clear from the wording of claim 1 that the "*at least one further layer* (10) (...) comprising a luminescent material" is not restricted to confine light and to act as a light guide. It cannot correspond, therefore, to one of the plurality of layers referred to by the appellant.

It follows that the light source of D1, comprising a component with a layer of luminescent material on top of a stack of active layers, thereby forming an interface with the surrounding air for confining light within the component, anticipates the light source of claim 1.

1.2.3 The appellant referred to the passage in D1, page 19, lines 25 to 29, mentioning a reduced effectiveness with regard to the emitted light strength and light intensity in case the area A_2 of the base of the out-coupling structure was smaller than the area A_0 of the face of the light-emitting component. This was an unwanted effect in the light source of D1, teaching away from the invention (cf. grounds of appeal, page 3, penultimate paragraph).

As stated in the appealed decision, point 13.3, "[T]he fact that a smaller base is not the preferred solution in D1 is not relevant for assessing novelty". As long as the feature $A_2 < A_0$ of claim 1 is disclosed in D1, it anticipates the corresponding feature in claim 1. Moreover, reduced effectiveness of the light emission also occurs in the light source of the present invention. Indeed, due to the multiple reflections within the component, light generated by the active layers will partially be absorbed in the component. Some other part of the light, perpendicularly incident on the interface between the component and the surrounding air, will escape the component outside the area A_2 of the base of the out-coupling structure.

2. Auxiliary request - inventive step

The subject-matter of claim 1 lacks an inventive step in view of the disclosure of D1 (Article 56 EPC 1973).

2.1 In addition to the features of the light source as defined in claim 1 of the main request (see point 1.1 above), D1, with reference to figures 6 and 7, discloses the following features:

- a plurality of structures (5) for coupling out light
[figure 7 of D1 shows an exemplary assembly of four

structures], each structure (5) having a base in contact with the face (4) of the component (3) over an area smaller than the area of the face (4) [page 19, lines 25 to 27; it is implicit that this passage relating to the individual structure shown in figure 6 also applies to the plurality of structures shown in figure 7],

- *an arrangement for reducing the divergence of the light emitted by the component (4) and passing through the structures (5) for coupling out light [an aspherical lens is formed at the output of the structure (5) for reducing light divergence (figure 6, page 18, line 30 to page 19, line 7); a condenser lens further reduces light divergence (page 23, lines 6 to 8)],*
- *at least one lenslet is provided over the respective apertures opposite the bases of the structures for coupling out the light [see figure 7; page 20, lines 7 to 14].*

The claimed subject-matter differs from the light source of D1 in that an arrangement for collimating light passing through one of the structures is provided, whereas the arrangement in D1 reduces the divergence angle of the emitted light without explicitly collimating it.

However, depending upon the desired brightness of the light source, it would be obvious for the skilled person, based on common general knowledge, to solve the objective technical problem of increasing brightness by modifying the shape of the lenslets, in particular, its focal length, to further reduce the divergence angle so that the emitted light beam becomes collimated.

Therefore, the subject-matter of claim 1 does not involve an inventive step.

2.2 In support of its view that the light source of claim 1 of the auxiliary request involved an inventive step, the appellant, in its letter of 21 February 2019, argued that "[c]laim 1 (auxiliary request) now seeks protection for the device with multiple element as shown by Fig.5. In the cited prior art this type of structures is not disclosed and therefore this new claim 1 is considered novel and inventive".

Contrary to the appellant's view, D1, figure 7, discloses a light source with multiple elements for coupling out light with a reduced divergence angle (see point 2.1 above).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated