BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

D E C I S I O N
of 21 October 2005

Case Number: T 0309/04 - 3.4.03

Application Number: 96106644.6

Publication Number: 739043

IPC: H01L 33/00

Language of the proceedings: EN

Title of invention:
Light emitting diode

Patentee:
AGILENT TECHNOLOGIES, INC.

Opponent:
OSRAM Opto Semiconductors GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 100(a), 54, 56

Keyword:
"Novelty (main request, no)"
"Inventive step (auxiliary requests, no)"

Decisions cited:
G 0010/91

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0309/04 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 21 October 2005

Appellant: (Opponent)	OSRAM Opto Semiconductors GmbH Wernerwerkstrasse 2 D-93049 Regensburg (DE)
Representative:	Epping - Hermann - Fischer Ridlerstrasse 55 D-80339 München (DE)
Respondent: (Proprietor of the patent)	Agilent Technologies, Inc. (a Delaware corporation) 395 Page Mill Road Palo Alto, CA 94303 (US)
Representative:	Schoppe, Fritz Schoppe, Zimmermann, Stöckeler & Zinkler Patentanwälte Postfach 246 D-82043 Pullach bei München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 2 January 2004 rejecting the opposition filed against European patent No. 739043 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chair: R. G. O'Connell
Members: V. L. P. Frank
U. Tronser

Summary of Facts and Submissions

I. This is an appeal against the rejection of the opposition to European patent 739 043 pursuant to Article 102(2) EPC.

Grounds of opposition were *inter alia* lack of novelty and of inventive step (Article 100(a), 54 and 56 EPC).

II. Claim 1 of the granted patent, forming the basis of the respondent proprietor's main request on appeal, reads as follows (board's emphasis):

"1. A light source comprising:
a substrate (17);
a light emitting diode (10) having a light emitting junction (113; 213) perpendicular to the substrate (17) and having an electrically conductive layer (114, 151; 214, 251) at each end face of the light emitting diode (10) perpendicular to the substrate (17), each of the electrically conductive layers (114, 151; 214, 251) comprising at least one metal layer, at least one of the metal layers (151; 251) on an end face of the light emitting diode (10) covering less than the entire end face of the light emitting diode (10) for emission of light through the end face; and means (25) for mounting the light emitting diode (10) on the substrate (17) with the junction (113; 213) perpendicular to the substrate (17) and the electrically conductive layers (114, 151; 214, 251) in electrical contact with conductive areas (19, 21, 22) on the substrate (17);

wherein the metal layer comprises a metal pad (151; 251) on the end face of the light emitting diode (10), the metal pad having an edge adjacent to a side face of the light emitting diode (10) **next to** the substrate, the edge of the metal pad covering only a portion of an edge of the light emitting diode (10) between the side face and the end face of the light emitting diode (10)."

In claim 1 according to the first auxiliary request the last paragraph of claim 1 of the main request is replaced by the following:

wherein the metal layer comprises a metal pad (151; 251) on the end face of the light emitting diode (10), the metal pad having an edge adjacent to a side face of the light emitting diode (10), **wherein the side face is** next to the substrate **and faces the same**, the edge of the metal pad covering only a portion of an edge of the light emitting diode (10) between the side face and the end face of the light emitting diode (10)."

In claim 1 according to the second auxiliary request the last paragraph of claim 1 of the main request is replaced by the following:

wherein the metal layer comprises a metal pad (151; 251) on the end face of the light emitting diode (10), the metal pad having an edge adjacent to a side face of the light emitting diode (10), wherein the side face is next to the substrate and faces the same, the metal pad extending in the

direction of the edge less than the width of the end face in this direction."

III. The following prior art document was cited *inter alia* in the opposition procedure:

D1: EP 0 303 272 A

The appellant opponent filed four days before the oral proceedings the following prior art document to illustrate the general background knowledge of the person skilled in manufacturing LED devices:

D20: "Optoelektronik I", G. Winstel - C. Weyrich, Springer Verlag 1980, pp. 94 to 97

At the oral proceedings the appellant opponent and the respondent proprietor submitted respectively extracts from the Concise Oxford English Dictionary, 10th Ed and the Webster's New Encyclopedic Dictionary, 1994 Ed on the meaning of the expressions "next" and "next to".

IV. The appellant opponent argued essentially as follows:

- The side of the diode defined by the expression "a side next to the substrate", which defines in the claim the position of the metal pad, is not restricted to the side face facing the substrate, but also includes the "lateral" side faces of the diode, as the expression "next to" means "beside". Consequently, the light source according to claim 1 as granted is not new having regard to document D1.

– The amendments to claim 1 of the first auxiliary request concern the metal pad's position on the end face. However, the feature that the edge of the metal pad covers only a portion of the edge of the LED's side face has been taken out from their full context in Figures 11 and 12. This feature has no relevance at all to the purported inventive concept of the patent, since it is not related to the amount of light emitted by the diode. The patent contains therefore subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC).

– The filing of the second auxiliary request at the oral proceedings should not be admitted by the board and should be regarded as a request filed late.

– The difference between the light source claimed in claim 1 of the 1st and 2nd auxiliary requests and the light source disclosed in D1 is that the metal pad does not extend over the whole width of the LED's end face. Having regard to this difference it results that the objective technical problem addressed by the patent is to increase the amount of light emitted by the diode through said end face. It is, however, obvious that a reduction of the area occupied by the metal pad has the consequence that more light may be emitted. This is the same reason for covering only half of the end face with the metal pad in D1. The argument of the respondent proprietor that this document discloses that the whole end face is covered by an alloyed ohmic contact is contested, since in

Figure 1 the area covered by the contact is unmistakably shown.

V. The respondent proprietor argued essentially as follows:

– The expression "next to" used in claim 1 as granted is a superlative meaning nearest. The metal pad has therefore an edge adjacent to the side face which is nearest to the substrate, ie the side face facing the substrate, while the metal pad covers only a portion of the edge of the LED between this side face and the end face. This feature is not disclosed in document D1.

– The board is not empowered to consider the objection under Article 123(2) EPC raised by the appellant opponent against the 1st auxiliary request without the consent of the patent proprietor according to the decision G 10/91 of the Enlarged Board of Appeal, since the objection does not arise from the amendments made to the claim. These amendments were introduced to define unambiguously that the side face "next to" the substrate is the one facing it and has no effect on the shape of the metal pad. The objection, however, concerns the feature that the metal pad covers only a portion of the edge between this side face and the end face and is equally applicable to the claim as granted, ie does not arise from the amendments.

– The respondent proprietor requested leave to submit a 2nd auxiliary request, in the event that the board did consider itself empowered to

consider the objection under Article 123(2) EPC raised on the 1st auxiliary request. The 2nd auxiliary request has not been submitted late, since it is the reaction to the objections raised for the first time during the oral proceedings.

– The light source disclosed in document D1 is of a different nature than the one claimed in the patent, since in the prior art document the light is emitted normal to the substrate while the contested patent provides a "right angle" LED lamp in which the light is emitted in a direction parallel to the substrate. There is thus no motivation in D1 to reduce the area of the metal pad, as the LED's end face does not emit light in the perpendicular direction. Moreover, the ohmic contacts are provided in D1 on the whole end face, while the gold pads are provided only on a portion of the end face for reasons of costs. In this document the end faces are only used to provide the electrical contacts to the diode. Light emission through the LED's end face is however only considered in the contested patent.

VI. At the oral proceedings before the board the appellant opponent requested that the decision under appeal be set aside and that the patent be revoked.

The respondent proprietor requested that the appeal be dismissed or auxiliarily, that the patent be maintained in amended form on the basis of claim 1 of the first auxiliary request submitted with the letter dated 27 August 2004 or on the basis of claim 1 of the second

auxiliary request submitted during oral proceedings and claims 2 to 7 respectively as granted.

Reasons for the Decision

1. The appeal is admissible.

2. The opposed patent relates to a light source comprising a light emitting diode (LED) mounted on a substrate. Conventional LED lamps are made by mounting the LED with one of its electrodes in direct contact with a conductive portion of the substrate, such that the light emitting junction is parallel to the substrate. A very thin wire is then wire bonded to a small metallized area on the top face of the LED. The metallized area needs to cover less than the entire top surface so that light can be radiated from the LED. However, the equipment required for the bonding is expensive and requires excellent coplanarity of all the bond pads for bonding a LED matrix. A method for mounting and contacting a large numbers of LEDs simultaneously is therefore required (cf column 1, lines 15 to 35 of the patent specification).

   The light source according to the claims of all the requests comprises therefore a LED mounted so that the light emitting junction is perpendicular to the substrate. This enables the electrodes on the LED's end faces parallel to the junction to be easily contacted by soldering without the need for a wire bonding step.

3. Hereinafter the six faces of the LED brick will be designated as follows: the face in direct contact with

and facing the substrate as "bottom" and the opposite face as "top"; the faces on which the electric contacts in the form of metal pads are provided as "end faces", while the two remaining faces will be referred to as "lateral faces".

4. *Main request - Novelty (Article 54 EPC)*

4.1 Document D1 discloses (cf Figure 1) a light source comprising a substrate 1, a light emitting diode 4 having a light emitting junction 5 perpendicular to the substrate and having an electrically conductive layer 6 at each end face. Each of the electrically conductive layers 6 comprises at least one metal layer (ie a gold layer; cf column 2, lines 47 to 51). The metal layers 6 on the end faces of the LED cover less than the entire end face of the LED for emission of light through the end face (in D1 light is emitted through the top and lateral faces and through the portions of the end faces not covered by the metal pads; this point in particular will be dealt with in more detail at points 5.9 and 5.10 below). Means (ie the printed circuit board tracks 2 and 3, cf Figure 1) are provided for mounting the light emitting diode on the substrate with the junction 5 perpendicular to the substrate (cf column 1, line 55 to column 2, line 13). The electrically conductive layer 6 is in electrical contact with conductive areas 3 on the substrate, the metal layer comprising a metal pad (gold layer 6) on the end face of the light emitting diode.

4.2 According to the appellant opponent document D1 also discloses that the metal pad 6 has an edge adjacent to a side face (of the LED) next to the substrate, as the

two lateral faces of the LED are next to the substrate in the sense that they are contiguous thereto. The edge of the metal pad 6 in document D1 covers only a portion of the edge of the LED between the lateral and the end face (ie the edge of the end face extending in a direction perpendicular to the plane of the substrate). The metal pad 6 disclosed in this document has therefore all the features specified in claim 1.

4.3 The respondent proprietor has contested this interpretation and argued that the expression *next to* has the superlative meaning of *nearest*. With this interpretation the claimed light source would differ from the one disclosed in document D1, since the LED face *nearest* to the substrate is the bottom face and the edge between this face and the end face is therefore the edge of the end face extending along the plane of the substrate. This is exactly what is disclosed in Figures 11 and 12 of the opposed patent. The metal pad disclosed in D1 however extends along the whole width of the end face. The lower edge of the end face is therefore completely covered by the metal pad and, consequently the latter is not "covering only a portion" as required by the claim.

4.4 The point in dispute is therefore the exact meaning of the term *next to* in the present context. While the term *next* is defined in both dictionaries submitted by the parties as meaning *nearest* (in the sense of coming or occurring immediately after) when referring to a succession in time, space or rank, the term *next to* has also the alternative meaning of *adjacent to* (Webster's New Encyclopedic Dictionary) or *beside* (Concise Oxford English Dictionary).

4.5 Claim 1 specifies moreover "the metal pad having an edge adjacent to **a side face** of the light emitting diode **next to** the substrate" (board's emphasis). It follows, that a side face, in the sense of more than one, was seen at the time of drafting the claim as fulfilling the requirement of being next to the substrate, namely the bottom face as well as the two lateral faces. With this interpretation, the metal pad depicted in Figure 1 of D1 meets the requirement of "covering only a portion of" the edge between the LED's lateral and end faces.

4.6 For these reasons, the board judges that the light source specified in claim 1 is not new having regard to the disclosure of document D1.

5. *First auxiliary request*

5.1 According to this request, the face in dispute is defined as being next to the substrate and facing the same. There is therefore no doubt that reference is now made exclusively to the LED's bottom face. Consequently, the edge of the metal pad closest to the substrate is "covering only a portion of" the lower edge of the end face.

5.2 The appellant opponent objected that this feature had been taken out of its context in Figures 11 and 12, which merely disclose specific shapes of the metal pads (ie square and rectangular). The corresponding part of the description does not attach any significance to the edge covering ratio, but refers to the shape and area covering of the metal pad in relation to the amount of

emitted light (cf column 10, line 14 to column 11, line 27). Therefore, in his view, the amendment is prohibited by Article 123(2) EPC.

5.3 The respondent proprietor pointed out that the amendments made to claim 1 were intended to identify the LED's side face in question as being the bottom face, but that they were not modifying in any manner the shape of the metal pad. In his view, according to decision G 10/91 at point 19 the board was not empowered to examine the objection raised by the appellant opponent without the consent of the patent proprietor, because this objection had to bear on the shape of the metal pad as such and should have been raised with the grounds of opposition, as it was equally applicable to the granted claim. It did not arise from the amendments made to the claim.

5.4 These questions of alleged added subject-matter and the examinability of this issue in the light of G 10/91, although important and fundamental, need not to be answered in the present situation, since no inventive step in the sense of Article 56 EPC is involved in the claimed light source, as will be shown in the following.

5.5 The light source according to claim 1 differs from the one disclosed in document D1 in that the metal pad provided on the LED's end face closest to the light emitting junction does not extend over the whole width of this face.

5.6 It is common ground that the objective technical problem having regard to this difference is to increase the light emitted by the LED, either in the direction

parallel to the substrate or, by refraction of the emitted light at the LED's surface, in the other directions also.

5.7 Document D20 is a textbook on optoelectronics which documents the common general knowledge in the art. In Figure 3.6.a on page 97 a conventional LED is shown having electrodes on its two end faces. The electrode on the end face closest to the light emitting junction is split into two smaller electrodes covering only a small fraction of the whole surface so that light emission is not impeded by them. This document discloses also that the light emitted at the junction is absorbed within the volume of semiconductor material and by the metal electrodes (cf page 95, last paragraph). The main face employed in these LEDs for light emission is the end face closest to the junction (cf Figures 3.5 and 3.6), since in this case the light traverses only a short distance within the semiconductor material before leaving the LED (this common general knowledge in the art is, incidentally, confirmed by the introduction to the opposed patent, cf point 2 above). As typical dimensions of an LED the opposed patent discloses an end face of about 125 micrometers square and about 40 micrometer thickness between the end face and the light emitting junction (cf column 3, lines 37 to 58).

5.8 There are no reasons suggesting that the common general knowledge in the art has to be adapted when modifying the way of mounting the LED so that its junction is perpendicular to the substrate. The change in the mounting manner makes contacting the end faces easier, as pointed out in the opposed patent, but has no

influence at all on the light emission properties of the LED. The skilled person is still confronted with the problem of maximizing the light emitted. He would be tempted to dispense completely with the electrodes, since they absorb the light emitted by the junction, but this is impossible since they are required for injecting electric carriers into the device. This is a typical situation in which a trade-off between two conflicting requirements needs to be made. Sufficient surface of the electrode is required to allow a significant portion of the junction to be active and for homogeneous emission of light. However, the larger the electrode's area the more light is absorbed by it. Faced with this situation the skilled person would reduce the area of the metal pad as far as possible until the amount and homogeneity of the light emitted by the junction is on the point of falling below an acceptable level. The board is unable to discern that anything more is done in the patent.

5.9 The respondent proprietor has argued that the end faces of the LED disclosed in document D1 are opaque to the emitted light, as their whole surface is covered by the alloyed ohmic contact (cf column 2, lines 47 to 51). In his view, the electrode 6 depicted in Figure 1 corresponds only to the gold layer, which for cost reasons only covers the lower portion of the end face. Consequently, a skilled person would not consider the light source disclosed in this document as a starting point for a right angle LED lamp.

5.10 The board, however, is not persuaded by this argument. Firstly since it is not plausible that the skilled person would cover the LED's end face which, according

to the common general knowledge in the art, is the main light-emitting face, without any strong reason to do so (no reason is mentioned in D1) and, secondly because document D1 explicitly states that the gold layer is provided over the alloyed ohmic contact, ie the area 6 shown in Figure 1 corresponds to both the ohmic contact and the gold layer while the rest of the end face is kept uncovered to emit light.

5.11 The board, for these reasons, judges that the light source according to claim 1 does not involve an inventive step in the sense of Article 56 EPC.

6. *Second auxiliary request*

6.1 Claim 1 of this request has been amended in order to overcome the Article 123(2) EPC objection raised by the appellant opponent having regard to the disclosure of the metal pad's edge covering ratio. Essentially it is specified that the metal pad has a width which is always smaller than the width of the end face.

6.2 The appellant opponent has objected to this request being admitted into the proceedings, as in his view it had not been submitted in due time. The respondent proprietor on the contrary has argued that it was responsive to objections raised for the first time at the oral proceedings. The board however considers that under the present circumstances it is far more expedient to deal with the substance of the request than to enter into an extensive analysis on whether it should be admitted or not. This approach avoids, in the board's view, an undue delay to the proceedings.

6.3 The respondent proprietor has not argued and the board cannot recognize that the amendments made to the claim influence the reasoning on inventive step presented on the 1st auxiliary request, which therefore applies with equal force to claim 1 of the 2nd auxiliary request, since the shape of the metal pad is still nothing more than a trade-off between the conflicting requirements mentioned above.

7. For the reasons set out above, it is the board's judgement that the light source according to claim 1 of all the requests of the respondent proprietor is not patentable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

Registrar: Chair:

D. Meyfarth R. G. O'Connell