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Datasheet for the decision of 30 April 2012

Case Number: T 2316/09 - 3.4.02

Application Number: 05254407.9

Publication Number: 1617239

IPC: G02B3/00, F21Y101/02, G02F1/13357

Language of the proceedings: EN

Title of invention:
Surface light source device, illumination unit and light flux control member

Applicant:
Enplas Corporation

Relevant legal provisions:
EPC Art. 123(2)
EPC 1973 Art. 56

Keyword:
Added subject-matter (no - amended claims)
Inventive step (yes)

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T2316/09 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 30 April 2012

Appellant: (Applicant)
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 26 June 2009 refusing European patent application No. 05254407.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: F. J. Narganes-Quijano
B. Müller

Summary of Facts and Submissions

I. The appellant (applicant) has lodged an appeal against the decision of the examining division refusing European patent application No. 05254407.9 (published with the publication No. 1617239).

In its decision the examining division held that the requests then on file were not allowable. In particular, the examining division held with regard to the then valid sets of claims that some of the claims contained amendments contrary to the requirements of Article 123(2) EPC and that the subject-matter of claim 1 of the requests did not involve an inventive step (Article 56 EPC 1973) in view of the device disclosed in the application with reference to Figure 17b and the following documents:

D1: JP-A-06349305, together with the abstract published in "Patent Abstracts of Japan"
D3: JP-A-11038203, together with the abstract published in "Patent Abstracts of Japan"
D4: WO-A-03016963
D5: US-B1-6212012.

II. With the statements setting out the grounds of appeal the appellant submitted amended sets of claims and requested that the decision under appeal be set aside and a patent be granted.

III. In reply to a telephone conversation with the rapporteur of the Board, the appellant, by letter dated 27 March 2012, filed an amended set of claims 1 to 3 replacing the previous sets of claims, and amended pages of the description and of the drawings.

IV. The wording of claim 1 amended according to the appellant's request reads as follows:

"A surface light source device (2) adapted for backlighting, comprising a plurality of point-like light sources (5) and a light flux control member (4) having a back face (4a) in which is provided a plurality of recesses (7) for receiving, refracting and transmitting light from corresponding ones of said point-like light sources (5) which face respective ones of said recesses (7), the light flux control member (4) further comprising an emission face (4b) from which said light is emitted;
in which each said recess (7) has a first light-input face (7a), and a second light—input face (7b) a peripheral portion of which is smoothly connected to said back face (4a), while said first and second light-input faces (7a, 7b) are interconnected at a connection location to provide a point of inflection (P) and are configured so as to satisfy the following Conditions 1 and 2, at least for light which is emitted within an angular range within a half-intensity angular range from said point-like source:

Condition 1: the Relation θ5/θ1>1 is satisfied except for light emitted within an angular range of about 5° around the normal direction with respect to said emission face (4b);

Condition 2: the value of θ5/θ1 falls gradually according to increasing value of θ1, for θ1>0;

where θ1 is the emission angle of light, away from the optic axis, as it emerges from said point-like light source (5), and θ5 is the emission angle of that light as it emerges from said emission face (4b)."

The claim request also includes dependent claim 2 directed to a particular embodiment of the device defined in claim 1 and independent claim 3 directed to an illumination unit comprising a surface light source device as claimed in any of claims 1 and 2.

V. The arguments submitted by the appellant in support of its requests are essentially the following:

The main part of the light emitted from each point-like light source is contained in the light emitted within the half-intensity angular range. The two claimed conditions function effectively for the main part of the light emitted from the point-like light sources. As a result, the main part of the light is diverged or expanded effectively so that the ray divergence is maintained by the first of the conditions and the ray divergence action decreases with increasing angular deviation away from the frontal direction as claimed, thus preventing excessive light divergence from causing rapid illuminance reduction.

None of the documents discloses or suggests this effect. The lighting appliance for vehicles disclosed in document D1 has some resemblance to, but is quite different from the claimed arrangement. None of documents D3 to D5 discloses an optical member comparable to the light flux control member under consideration; in particular, document D3 discloses lenticular lenses without a light source arrangement, and documents D4 and D5 disclose devices for homogenizing a light beam without reference to a light source arrangement.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The Board is satisfied that the application documents as presently amended comply with the requirements of Article 123(2) EPC. In particular,

- claim 1 is based on independent claim 2 and dependent claim 4 as originally filed, together with the passages on page 1, first paragraph, page 8, penultimate paragraph, page 12, second paragraph, and page 10, second paragraph of the description and the disclosure of Figures 2, 3 and 6 as originally filed, and
- claims 2 and 3 are respectively based on Figure 5 and the sixth paragraph of page 12, and on claim 6 of the application as originally filed.

2.2 The objections raised under Article 123(2) EPC by the examining division in the decision under appeal related to expressions introduced into the formulation of claim 1 amended according to the auxiliary request then on file. These expressions have been omitted in the formulation of the present claims and consequently the objections of added subject-matter raised by the examining division are not applicable any longer to the present set of amended claims.

2.3 The text of the description has been revised and brought into conformity with the invention as defined in the claims as presently amended, and the pertinent prior art has been acknowledged in the introductory part of the description (Article 84 EPC 1973, second sentence, together with Rules 27(1) (b) and (c) EPC

1973). The amendments to the figures concern the correction of obvious spelling errors.

3. *Inventive step*

3.1 In its decision the examining division held that the claimed invention did not involve an inventive step with regard to the closest state of the art represented by the device disclosed in the application with reference to Figure 17b or, alternatively, by the device disclosed in document D1.

3.2 The device shown in Figure 17b of the application has been disclosed for the purpose of comparison, i.e. for a better understanding of the invention (page 7, lines 5 to 9 and page 20, line 5 to page 22, line 10 of the description). The corresponding passages of the description bear the heading "prior art" (page 2, lines 17 to 23 and page 3, lines 13 to 28; see also page 7, lines 7 to 9 and page 20, lines 5 to 9), and the examining division assumed that the corresponding disclosure did indeed reflect prior art.

In the absence of corroborating evidence, however, the Board has some reservations about accepting that the disclosure of the application relating to Figure 17b reflects state of the art within the meaning of Article 54(2) EPC 1973. Nonetheless, in view of the fact that the appellant has not contested the examining division's assumption in this respect and that in any case - as will be apparent below - the device of Figure 17b, in the Board's view, does not prejudice the patentability of the claimed invention, for the purposes of the present decision it will be assumed in the following that the disclosure of the application relating to Figure 17b reflects state of the art

available to the public before the priority date of the application.

3.2.1 The backlight illumination device disclosed in the application with reference to Figure 17b (page 2, lines 17 to 23 and page 3, last two paragraphs) comprises an array of point-like light sources and a light flux control member having a back face with an array of recesses each arranged to face a respective one of the light sources and to receive, refract and transmit the light from the corresponding light source through the emission face of the member opposing the back face. According to the application, the recesses have a semi-spherical shape and are directly connected to the planar region of the back face (page 3, last paragraph), and the emission angle θ1 of the light emitted from each of the light sources and the emission angle θ5 of the corresponding light transmitted through the emission face satisfy the relation θ5/θ1 > 1 for light emitted from the light sources within a half intensity-angular-range, but excluding light emitted close to the normal direction with respect to the emission face (see Figures 16 and 17b and page 3, penultimate paragraph together with page 20, lines 18 to 20 of the application).

3.2.2 As concluded by the examining division in its decision, the device defined in claim 1 differs from the device disclosed with reference to Figure 17b in that

- each of the recesses has a first and a second face, the second face being smoothly connected at its periphery to the back face and interconnected with the first face to provide a point of inflection, and
- the first and second faces are such that, for light emitted within the angular range mentioned

above, the value of θ5/θ1 falls gradually according to increasing value of θ1.

As explained in the application (page 3, last paragraph and page 20, lines 18 to 29), in the device of Figure 17b the sharp edge between the recess and the back face causes ring-like emission of light, and as a consequence (see Figure 16 and the corresponding disclosure, in particular page 20, line 10 to page 21, line 11) the device fails to expand the emission light smoothly within the appropriate angular range of illumination, and this problem is solved in the claimed device by the two distinguishing features identified above.

3.2.3 In its decision the examining division held that the skilled person confronted with the problem mentioned above would consider the application of the teaching of document D5 to the device of Figure 17b in order to solve the problem and that this obvious procedure would lead to the claimed device.

Document D5 discloses a glass substrate comprising on one of its faces an alternate array of concave and convex cylindrical lenses (Figure 1C and abstract). The substrate is used to homogenize a beam of collimated light emitted by a laser, and the document teaches to reduce optical loss caused by unwanted light scattering and improve the homogenizing illumination capability of the substrate by smoothly shaping the boundaries between adjacent lenses (Figure 1A, abstract, and column 3, line 43 to column 4, line 36).

The problem of homogenizing a beam of collimated light, however, is different from the problem of combining a plurality of divergent light beams emitted by an array

of light sources and smoothing out the resulting combined light, and the Board has doubts as to whether the skilled person would have considered the teaching of document D5 as a possible solution to the problem considered above.

In any case, the application of the teaching of document D5 relating to smoothing out the boundaries between the faces of the substrate to the device of Figure 17b may solve, at least in part, the problem considered above but, contrary to the examining division's view, would not result in the claimed solution. Indeed, the application of the teaching of document D5 would suggest smoothly shaping the sharp edges at the boundaries between the recesses and the back face of the device of Figure 17b, thus resulting in the concave recesses being connected to the back face by surface regions having a convex shape and interconnected to the concave recesses at a point of inflection at which the curvature of the surface changes from a positive to a negative value as claimed. However, there is no conclusive technical argument or evidence that the resulting recesses would then have a shape such that the last of the claimed conditions is satisfied, i.e. such that the value of θ5/θ1 decreases gradually with θ1. In particular, the examining division concluded in its decision that this would be the case in view of the fact that in the resulting recesses the tangent to the curvature of the recess after the point of inflection would gradually approach a direction parallel to the emission face of the device, but in the Board's view neither this characteristic of the tangent to the surface of the recess nor the provision of a recess having a smoothly varying surface with a point of inflection necessarily imply that for all light beams emitted by the light

sources within the angular range of emission under consideration the function θ5/θ1 would necessarily be a gradually decreasing function of θ1 as required by the claimed subject-matter. It is noted in this respect that the claimed condition requires that the angle θ5 of emergence from the device of a light beam emitted by the corresponding light source at an angle θ1 within the angular range under consideration - in addition to being bigger than θ1 as required by the first of the claimed conditions - does not increase with θ1 or - as it is the case of the values θ5 corresponding to the specific example of the application and represented as curved 8A in Figure 4 - increases, but then at a rate sufficiently low so that the quotient θ5/θ1 decreases. In mathematical terms, since θ5 is a function of θ1, i.e. θ5(θ1), the claimed condition implies that the derivative of the function θ5(θ1)/θ1 with respect to θ1, i.e. (θ5/θ1)', satisfies for all values of θ1 within the angular range of emission under consideration the mathematical condition $(\theta5/\theta1)' < 0$ while still verifying that $\theta5 > \theta1$ as required by the first of the claimed conditions. It follows that the claimed conditions impose a non-trivial, highly restrictive constraint to the function θ5(θ1) and therefore to the refractive characteristics of the member and, more particularly, to the specific shape of the refractive recess surface including the regions at both sides of the inflection point that goes beyond the considerations made by the examining division in respect of the behaviour of the tangent to the recess surface beyond the point of inflection.

It is also noted that the second claimed condition provides not only a solution to the problem of expanding the emission light smoothly over the angular region of illumination, but also a specific solution

that, as noted above, imposes specific limitations to the shape of the recesses' surfaces and results in a specific angular distribution of the illumination field having a predetermined divergence rate as expressed by the condition that θ5/θ1 decreases for increasing values of θ1 (see appellant's submissions in point V above, penultimate paragraph, together with Figures 4 and 16 of the application and the corresponding disclosure), and that this specific illumination field is neither disclosed nor taught in the prior art under consideration.

The Board concludes that the line of argument of the examining division is insufficient to conclude that the device shown in Figure 17b of the application and the teaching of document D5 would render obvious the claimed solution to the problem considered above.

3.2.4 In its decision the examining division also held that, alternatively, the application of the teachings of each of documents D3 and D4 to the device of Figure 17b would also render the claimed subject-matter obvious.

Each of documents D3 (Figure 2) and D4 (Figures 1 and 2) discloses a lenticular lens sheet having one of its surfaces formed of an alternate array of convex and concave surfaces smoothly connected to each other (document D3, Figure 2 and last sentence of the abstract, and document D4, Figures, abstract, and paragraph bridging pages 3 and 4, together with the first paragraph of page 9). However, the lens surface arrangements are designed in each of the documents to uniformly disperse and/or homogenize a collimated light beam incident on the sheet (document D3, figures and the abstract, and document D4, Figures 1c, 3 and 4, together with page 11, first and second paragraphs)

and, for reasons similar to those given in the third paragraph of point 3.2.3 above with regard to the disclosure of document D5, the Board has doubts as to whether the skilled person would have considered the teaching of document D3 or D4 as a possible solution of the problem considered in point 3.2.2 above.

In addition, the alternate array of concave and convex lens surfaces of the sheets of documents D3 and D4 can be considered to be constituted by an array of concave recesses each interconnected to the sheet surface by convex regions forming a point of inflection with the respective recesses, but for reasons similar to those given in point 3.2.3 above with regard to the disclosure of document D5 there is no technical argument or evidence that would allow the conclusion that the application of the teaching of any of documents D3 and D4 to the device of Figure 17b would result in a device as claimed, and more particularly in a device satisfying the second of the claimed conditions.

3.2.5 In view of the above considerations, the Board concludes that the device disclosed in the application with reference to Figure 7b and the disclosure of documents D3, D4 and D5 do not render obvious the claimed subject-matter.

3.3 In its decision the examining division held that, as an alternative to the device of Figure 17b of the application, the device disclosed in document D1 can also be considered to constitute the closest state of the art and that the claimed invention would be obvious in view of this device.

Document D1 discloses a LED lighting fixture for a vehicle (Figure 1) comprising an array of light sources (21 and 22) and a transparent sheet (4) having one of its surfaces formed of an alternate array of concave and convex surfaces (41 and 42) smoothly connected to each other, each of the concave and convex surfaces facing a respective one of the light sources (Figure 1 and the abstract). In normal tail light operation, the light sources (21) facing the concave surfaces (41) are activated at a low illuminance and the emitted light is diverged by the concave surfaces and radiated at a wide angle, and during a braking operation of the vehicle also the light sources (22) facing the convex surfaces (42) are activated at a high illuminance and the emitted light is converged by the convex surfaces and radiated within a narrow illumination angle (Figure 1 and abstract, second paragraph).

However, while the claimed subject-matter is primarily directed to a light source device adapted for backlighting, the lighting device disclosed in document D1 is a lighting fixture for vehicles arranged to operate as tail light and, when braking, also as brake light, and the Board is reluctant to accept this device as closest state of the art for the objective assessment of inventive step following the problem-solution approach because only hindsight knowledge of the claimed invention would have suggested the skilled person concerned with backlighting illumination devices to consider the lighting fixture for vehicles disclosed in document D1 as the starting point, to obviate the brake light sources and the teaching according to which the convex surfaces are specifically provided for the purpose of focusing light from the brake light sources, to consider the potential use of the fixture as a backlighting illumination device, and to presuppose

that the convex surfaces would have a technical effect of some relevance on the backlighting illumination characteristics of the device for light emitted by the tail light sources facing the concave surfaces.

In addition, the line of argument of the division relies on the assumption that in the device of document D1 the fact that the surface interconnections between the adjacent convex and concave surfaces are smooth and have a point of inflection is a sufficient condition to conclude, *inter alia*, that the angle θ5 of emergence from the device of a light beam emitted by the tail light sources at an angle θ1 would, for all values of the angle θ1 within the angular range of emission under consideration, be such that the quotient θ5/θ1 decreases with increasing value of θ1. However, for reasons analogous to those given in point 3.2.3 above, there is no technical argument or evidence that would corroborate this assumption.

Accordingly, the examining division's finding of lack of inventive step on the basis of document D1 as closest state of the art is not found persuasive.

3.4 In view of the above considerations and conclusions, and since the remaining documents on file are in the Board's opinion less relevant, the Board concludes that the available prior art does not render obvious the subject-matter of claim 1 within the meaning of Article 56 EPC 1973.

The same conclusion applies to dependent claim 2 and to independent 3 by virtue of the reference in the claims to the device defined in claim 1.

4. The Board is also satisfied that the application documents as presently amended and the invention to which they relate meet the remaining requirements of the EPC within the meaning of Article 97(1) EPC.

The Board concludes that the decision under appeal is to be set aside and a patent be granted on the basis of the application documents amended according to the present request of the appellant (Article 97(1) EPC and Article 111(1) EPC 1973).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following application documents:
   - claims: claims 1 to 3 filed with the letter dated 27 March 2012,
   - description: pages 1 to 3 and 6 to 22 as originally filed, page 5 filed with the letter dated 25 April 2008, and pages 4 and 23 filed with the letter dated 27 March 2012, and
   - drawings: sheets 1/20 to 3/20, 6/20 to 13/20, 15/20 to 18/20 and 20/20 as originally filed and sheets 4/20, 5/20, 14/20 and 19/20 filed with the letter dated 27 March 2012.

The Registrar: The Chairman:

M. Kiehl A. G. Klein

Decision electronically authenticated