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Datasheet for the decision of 26 September 2008

Case Number: T 1117/06 - 3.4.02

Application Number: 02080073.6

Publication Number: 1306697

IPC: G02B 5/02

Language of the proceedings: EN

Title of invention:
Apparatus for uniformly illuminating a light valve

Applicant:
3M Innovative Properties Company

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
EPC Art. 84, 56, 76(1)

Keyword:
"Amendments extending beyond both the application and the earlier application as filed, lack of clarity and of support by description, lack of inventive step (all requests)"

Decisions cited:
T 0003/90

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1117/06 **-** 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 26 September 2008

Appellant: 3M Innovative Properties Company
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 17 February 2008 refusing European application No. 02080073.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division to refuse European patent application No. 02080073.6 (publication No. 1306697) filed as a divisional application of the earlier European patent application No. 95109347.5 (in the following the "parent application").

In the decision under appeal the examining division held that the subject-matter of amended claim 1 then on file did not involve an inventive step (Article 56 EPC 1973). In support of its finding, the examining division referred *inter alia* to the following documents:

D1: "Modern Optical Engineering - The design of optical systems", W. J. Smith, McGraw-Hill Inc., 2nd ed., New York, 1990; pages 263 to 265

D2: US-A-4765718.

II. With the statement setting out the grounds of appeal the appellant submitted sets of claims amended according to a main and first to fourth auxiliary requests and requested setting aside of the decision and the grant of a patent and, on an auxiliary basis, oral proceedings. The appellant also submitted the following document in support of its requests:

D6 : "Beam-shape transforming devices in high-efficiency projection systems" B.A. Jacobson *et al.*, Proceedings of SPIE Vol. 3139, 1997; pages 141 to 150.

Claims 1 to 3, 6 to 8 and 10 amended according to the main request of the appellant read as follows:

"1. An apparatus comprising:

a light source (78);

means for focusing the light from said source (78) into a light spot, the angular aperture of the focusing means with respect to an optical axis comprising an angle u;

a light tunnel, said tunnel having reflective interior walls forming a rectangular cross section of smaller inside dimension N, a length L, an entrance end (80) and an exit end (81), wherein L = kN/tan(u), k being a constant in the range from about 1.5 to 3; the tunnel receiving light from the light source from the entrance end of the tunnel with the light spot at the entrance end of the tunnel, and the tunnel uniformizing the received light by providing for multiple reflections of the received light from the walls of the tunnel and delivering the uniformized light to the exit end of the tunnel; and

a light valve (12), said valve being disposed at the exit end of said light tunnel to receive the uniformized light exiting the exit end of the light tunnel."

"2. The apparatus of claim 1, further comprising additional light transmitting tunnels (46,76) and joint members (48,64,108) for joining said light transmitting tunnels one to another, said joint members including means for filtering and directing light passing between tunnels."

"3. The apparatus of claim 1, further comprising, between said light source and the entrance end of said light tunnel or between the exit end of said tunnel and said light valve, means for filtering and directing light from said source or from the exit end of said tunnel."

"6. The apparatus of claim 1, wherein the light tunnel is tapered."

"7. The apparatus of claim 1, wherein the light tunnel has a tapered segment and a straight segment."

"8. The apparatus of claim 1, wherein the exit angular aperture of the light tunnel is less than or equal to the entrance angular aperture of the light tunnel."

"10. The apparatus of claim 1, wherein a transmission factor of the light tunnel is greater than or equal to 85%."

Claims 1 to 3 and 6 to 9 of the first auxiliary request are identical to claims 1 to 3, 6 to 8 and 10 of the main request, respectively.

Claims 2, 3 and 6 to 9 of the second auxiliary request are identical to claims 2, 3, 6 to 8 and 10 of the main request, respectively, and claim 1 of the second auxiliary request differs from claim 1 of the main request in that the penultimate paragraph of the claim includes the following feature:

", wherein the reflective interior walls of the light tunnel are silvered or else the reflective interior walls provide total internal reflection as a result of a refractive index difference between the light tunnel walls and a material filling the inside of the light tunnel".

Claims 2, 3 and 5 to 8 of the third auxiliary request are identical to claims 2, 3, 6 to 8 and 10 of the main request, respectively, and claim 1 of the third auxiliary request differs from claim 1 of the main request in that the expression "a light valve (12), said light valve being disposed" has been replaced by "an LCD panel (12), said panel being disposed".

Claims 2, 3 and 5 to 8 of the fourth auxiliary request are identical to claims 2, 3, 6 to 8 and 10 of the main request, respectively, and claim 1 of the fourth auxiliary request differs from claim 1 of the main request in that the claim incorporates the two amendments made to claim 1 of the second and the third auxiliary requests and specified in the two former paragraphs.

III. Oral proceedings before the Board were appointed for 23 September 2008 according to the auxiliary request of the appellant. In a communication pursuant to Article 15(1) of the Rules of Procedure of the Board of Appeal (RPBA), annexed to the summons to attend oral proceedings, the Board gave a preliminary assessment of the case. The Board introduced the following documents into the proceedings in order to elucidate the pertinent state of the art at the relevant date:

D7 : US-A-4111538

D8 : "Production of flat top beam profiles for high energy lasers" R. E. Grojean *et al.*, Review of Scientific Instruments (US) Vol. 51 (1980) (XP711218); pages 375 and 376

D9 : WO-A-9104829.

The passages of the communication that are pertinent to the present decision are as follows:

(a) "The application documents presently on file do not appear to satisfy the requirements of Articles 84 and 76(1) EPC 1973 and Article 123(2) EPC 2000 for the following reasons:

i) The apparatus defined in dependent claim 2 of the main request comprises a light tunnel satisfying the algebraic condition defined in claim 1 and additional joined light tunnels, the claim leaving open whether or not the resulting composite tunnel also satisfies the algebraic condition defined in claim 1. The Board has doubts as to whether such combination of features is supported by the disclosure of the parent application (Article 76(1) EPC 1973). It is noted in this respect that the parent application as filed discloses the algebraic condition of claim 1 only for an apparatus comprising one single tunnel (page 3, line 1 to page 4, line 10, page 5, lines 14 to 23, and page 10, line 18 to page 12, line 15) which tunnel may be segmented (dependent claim 9 of the parent application), but that the corresponding disclosure does not appear to support a tunnel satisfying the claimed condition and coupled to other additional tunnels.

For similar reasons, and since the description of the present application appears to be identical to that of the parent application, the subject-matter of claim 2 of the main request does not appear to be supported by the description within the meaning of Article 84 EPC 1973, second sentence; it is noted in particular that in the examples involving joined tunnel segments (see the disclosure of Figs. 8a and 8b) u = 10° and N = 21,7 mm (page 19, lines 9 to 14) and neither the lengths 50, 41 and 12 mm of the tunnel segments (page 19, lines 12 to 16) nor the length of the composite tunnel constituted by the joined tunnel segments appear to satisfy the claimed condition L = k N / tan(u) for values of k between 1.5 and 3 as required by the claimed subject-matter.

ii) There appears to be no basis in the parent application (Article 76(1) EPC 1973) for the feature of present claim 3 of the main request according to which the means for directing light from the light source or from the exit end of the tunnel and located as claimed would also constitute "means for filtering". It is noted in this respect that the passages in the parent application relating to filtering means all relate to means located not at the ends of the tunnel as claimed but between tunnel segments (page 7, line 30 to page 8, line 6, page 14, lines 1 to 9 and 19 to 22, page 15, line 16 to page 16, line 16, page 19, lines 17 to 25 and claim 14), and that the passages relating to the entrance prism of Fig. 7c (page 16, lines 16 to 18 and page 18, lines 4 to 16) only disclose the elimination of infrared and ultraviolet light and would not

appear to allow a generalization to generic "means for filtering" as claimed. Alternatively, since the description of the present application appears to be identical to the description of the parent application, the claimed features referred to above would not appear to be supported by the description within the meaning of Article 84 EPC 1973, second sentence.

iii) The "smaller inside dimension N" of the cross section of the tunnel defined in claim 1 appears to be clearly defined only when the tunnel is a non-tapered tunnel. Also the fact that the algebraic condition defined in claim 1 is independent of the taper angle of the tunnel (see in this respect document D7, column 2, line 61 to column 3, line 5) and the fact that the corresponding disclosure in the description relates to non-tapered tunnels would appear to imply that the tunnel of claim 1 is implicitly a non-tapered tunnel. Dependent claims 6 and 7, however, require that the light tunnel is tapered or at least partially tapered and are therefore inconsistent with claim 1, or at least unclear since the value of N would be indefinite (Article 84 EPC 1973). It is even doubtful whether the combination of the features of each of claims 6 and 7 with the requirement of claim 1 relating to the value of N can be derived from the application as filed (Article 123(2) EPC) because the passages of the disclosure of the original application relating to the claimed algebraic condition appear to be confined to non-tapered tunnels. [...]

iv) The alternative of dependent claim 8 according to which the exit angular aperture of the light tunnel is less than its entrance angular aperture appears to be supported by the application as filed (Article 123(2) EPC) only with respect to those embodiments requiring that the tunnel or segments thereof are tapered (see in particular page 5, lines 12 and 13, page 6, lines 14 to 20, page 12, lines 24 to 27, page 13, lines 20 to 23, and page 15, lines 16 to 18). As a consequence, it is doubtful whether dependent claim 8 referring back to claim 1 satisfies the requirements of Article 84 EPC 1973 and of Article 123(2) EPC for reasons analogous to those given in paragraph iii) above.

v) There appears to be no basis in the application as originally filed (Article 123(2) EPC) and in the parent application as filed (Article 76(1) EPC 1973) for the alternative of claim 10 of the main request according to which the transmission factor is equal to 85%. [...]"

(b) "The same objections raised in paragraphs i) to [v)] above with regard to the main request are also raised with regard to the corresponding parts of the auxiliary requests."

(c) "As regards the issue of inventive step of claim 1 of the present requests, the Board notes the following:

Among the documents considered during the first-instance proceedings, the closest state of the art would appear to be represented by the apparatus

disclosed in document D2 (Fig. 3 and abstract together with column 3, lines 38 to 49) and comprising a light valve (liquid crystal display 14) illuminated by means of a light source 10 optically coupled to a tapered light tunnel 12. Light is internally reflected within the light tunnel (column 4, lines 43 to 48) and, although not explicitly mentioned in the document, these internal reflections have intrinsically the effect of rendering more uniform the light distribution at the exit of the tunnel (see in this respect document D7 (abstract and column 2, lines 33 to 37) which discloses with reference to Figs. 1 to 4 a similar apparatus (abstract) for illuminating a light valve constituted by a Ruticon (column 1, lines 53 to 61 and column 7, line 51 ***et seq.***); see also document D1, page 264, last paragraph).

The apparatus defined in claim 1 of the main request appears to differ from the apparatus of document D1 in the following features:

a) the provision of light focusing means arranged as claimed, and

b) the light tunnel satisfies the claimed algebraic condition, the definition of the condition inherently presupposing that the light tunnel is non-tapered or at least essentially non-tapered (see paragraph [(a)-iii)] above).

Feature a) has the effect of improving the optical coupling efficiency between the light source and the illumination system. It is however a common measure well known in the field of optical illumination to improve the optical coupling of

the light source to the illumination system by means of focusing means as illustrated in document D7 (column 4, lines 29 to 41 and compare Figures 1 and 2) and document D1 (last paragraph of page 264 and the text of Figure 9.21).

As regards feature b), the Board first notes that whether the light tunnel is provided as a tapered or as a non-tapered tunnel generally depends on the particular geometrical and optical design conditions and in particular on the size of the light valve relative to that of the light source (document D7, column 3, lines 6 to 18). As an example, document D7 specifies a broad value range for the taper angle of the light tunnel and in particular a value as low as 1° (column 3, lines 11 to 14), and document D1 teaches explicitly that both tapered and non-tapered light tunnels can be used in this context (page 264, last sentence).

In addition, as acknowledged by the appellant during the proceedings (point 1.4 of the statement of grounds of appeal), the algebraic condition defined in the claim essentially expresses that the optical layout is such that the number of internal reflections of the marginal light ray from the light source is more than 1 and at most 3. According to the application (page 17, lines 10 to 12 of the description of the application), the technical effect achieved by this condition is a compromise between the gain in uniformity and the loss of transmission of the illumination light exiting the tunnel. However, as illustrated by the

disclosures of documents D8 (whole paragraph bridging the two columns on page 375) and D9 (paragraph bridging pages 1 and 2), it is well known in this art that the higher the number of internal reflections within the light tunnel, the better the illumination uniformity of the emerging light but also the lower the luminance efficiency due to the optical absorbance loss and that, consequently, a compromise should be reached for the number of internal reflections of the light rays (and in particular of the marginal light rays) within the light tunnel. In this context, the fact of selecting a maximum number of reflections of for instance 2 reflections (as it is the case in document D9 (page 4, lines 29 to 33) in a similar context) or 3 reflections and designing accordingly the optical layout (dimensions of the tunnel, input optical aperture, etc.) appears to constitute an obvious compromise that the skilled person would consider in accordance with the circumstances. In addition, no further technical effect appears to be associated with the claimed condition other than those mentioned above.

Finally, the Board notes the following:

i) Claim 1 only imposes one single condition on the three values L, N and u, so that the claimed subject-matter encompasses embodiments in which any one of the quantities L, N, L/N or u may have an arbitrarily high value (it would be enough selecting appropriately the value of the remaining quantities so that the claimed algebraic condition is satisfied); accordingly, issues such as the length or the aspect ratio of the light tunnel or

the compactness of the illumination system are irrelevant for the issue of inventive step of the claimed subject-matter because the claimed invention does not impose any restriction on a particular one of these features.

ii) The submissions of the appellant with regard to the disclosure of post-published document D6 are not considered pertinent. It is noted in particular that

- document D6 is specifically directed to aspects that have not been addressed in the present application, namely the specific analytical form of the dependence of the illuminance and of the illumination uniformity on the aspect ratio of the longitudinal section of the light tunnel (see Figures 6, 7, 11 and 12 of the document),

- the disclosure of the document (see in particular Figures 6, 7, 11 and 12) shows that no specific technical effect appears to be associated with the upper value k = 3 of the range of values specified in claim 1 and corresponding according to the submissions of the appellant in the terminology of document D6 to a value of Λ of about 1.9, so that the embodiments of the claimed invention corresponding to values close to the claimed upper value k = 3 would not appear to involve a technical effect with regard to devices of the prior art in which k is bigger than and of the same order of magnitude as 3, and

- the fact that the disclosure of the document has been made available to the public in 1997, i.e. about three years after the priority date of the application, has no impact on the

reasoning above on the issue of inventive step of the claimed invention with regard to the pertinent state of the art.

In view of the above considerations, in the preliminary opinion of the Board no inventive step would appear to be involved in the subject-matter of claim 1 of the main request (Article 56 EPC 1973). The same conclusion would be reached when starting from document D7 as representing the closest state of the art."

(d) "As regards the issue of inventive step of the subject-matter of claim 1 of the auxiliary requests, it is noted that

- claim 1 of the first auxiliary request is identical to claim 1 of the main request,

- the light valve of document D2 is a liquid crystal display (abstract), and

- it is a common procedure to provide an internally reflective light pipe as that of document D2 as operating by total internal reflection or alternatively by reflection at silvered inner walls (see document D7, column 3, lines 21 to 52; see also document D1, page 263, third paragraph).

In view of the above, the same conclusion reached in [section (c)] above would also appear to apply to claim 1 of each of the first to fourth auxiliary requests (Article 56 EPC 1973)."

IV. In reply to the summons to attend oral proceedings, the appellant's representatives informed the Board by letter dated 22 August 2008 that they would not attend

the oral proceedings and looked forward to receiving a decision. The Board subsequently cancelled the oral proceedings with a communication dated 5 September 2008.

V. In the letter dated 22 August 2008 the appellant did not make any substantive submission in reply to the preliminary opinion of the Board given in the communication annexed to the summons. The sole substantive arguments advanced by the appellant were developed in the statement setting out the grounds of appeal and concerned the issue of lack of inventive step raised by the examining division. These arguments, however, pre-date, and thus have no bearing on, the issues subsequently raised by the Board in the aforementioned communication.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters*

With the statement of the appellant in its letter dated 22 August 2008 that it would not attend the oral proceedings before the Board and that it awaited a decision of the Board, the appellant unequivocally expressed that it was interested in a decision but did not wish to make oral submissions in the oral proceedings previously requested on an auxiliary basis. According to the established case law of the Boards (cf. in particular decision T 3/90 (OJ EPO 1992, 737), point 1 of the reasons), these statements amount to a withdrawal of the auxiliary request for oral

proceedings. In the circumstances of the case, the Board found it appropriate to cancel the oral proceedings.

3. In the communication pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings the Board explained in detail why in its preliminary opinion

(a) neither the subject-matter of claim 1 of the main request nor the subject-matter of claim 1 of each of the first to fourth auxiliary requests would appear to involve an inventive step within the meaning of Article 56 EPC 1973 (see sections (c) and (d) of point III above),

(b) the subject-matter of dependent claims 2, 3 and 10 of the main request as well as that of dependent claims 2, 3 and 9 of the first and the second auxiliary requests and dependent claims 2, 3 and 8 of the third and the fourth auxiliary requests would appear to contravene the requirements of Article 76(1) EPC 1973 (see paragraphs i), ii) and v) of section (a) together with section (b) of point III above),

(c) the subject-matter of dependent claims 6 to 8 and 10 of the main request as well as that of dependent claims 6 to 9 of the first and the second auxiliary requests and dependent claims 5 to 8 of the third and the fourth auxiliary requests would appear to contravene the requirements of Article 123(2) EPC (see paragraphs iii) to v) of section (a) together with section (b) of point III above), and

(d) the subject-matter of dependent claims 2, 3 and 6 to 8 of the main, the first and the second

auxiliary requests as well as that of dependent claims 2, 3 and 5 to 7 of the third and the fourth auxiliary requests would not appear to be clear or be supported by the description within the meaning of Article 84 EPC 1973 (see paragraphs i) to iv) of section (a) together with section (b) of point III above).

In the course of the appeal proceedings, the appellant made no substantive submissions in reply to the detailed objections raised by the Board in the communication under Article 15(1) RPBA. In particular, the appellant chose neither to attend the oral proceedings nor to take a written position on the matters raised by the Board. The appellant has therefore not availed itself of the opportunity to reply to the preliminary view of the Board expressed in the aforementioned communication.

After consideration of the reasons advanced in the communication under Article 15(1) RPBA, and in the absence of any attempt by the appellant to refute or to overcome the objections raised by the Board with regard to the application documents on file (point V above), the Board sees no reason to depart from the preliminary opinion expressed in the aforementioned communication. Accordingly, noting that the appellant has had, and has failed to use, the opportunity to present comments on the objections raised by the Board in the aforementioned communication (Article 113(1) EPC 1973), the Board concludes that none of the requests of the appellant complies with the requirements of Article 123(2) EPC and of Articles 84, 76(1) and 56 EPC

1973 mentioned in paragraphs (a) to (d) of point 2 above.

The appeal must therefore be dismissed for the reasons already communicated to the appellant and reproduced in points (a) to (d) of point III above (Rule 66(2) (g) EPC 1973).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl A. G. Klein