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**Datasheet for the decision
of 5 February 2010**

Case Number: T 0769/08 - 3.4.02

Application Number: 98932652.5

Publication Number: 1057070

IPC: G02B 27/22

Language of the proceedings: EN

Title of invention:

A multi-layer display and a method for displaying images on such a display

Applicant:

PureDepth Limited

Headword:

-

Relevant legal provisions:

EPC Art. 123(2)

Relevant legal provisions (EPC 1973):

EPC Art. 56

Keyword:

"Added subject-matter (no-after amendment)"
"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0769/08 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 5 February 2010

Appellant: PureDepth Limited
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 8 November 2007
refusing European patent application
No. 98932652.5 pursuant to Article 97(1)
EPC 1973.

Composition of the Board:

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

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 98932652.5 filed as International Application No. PCT/NZ98/00098 (published with the International Publication No. WO 99/42889).

II. In its decision the examining division held that the claims amended according to the main request then on file did not comply with the requirements of Article 123(2) EPC 1973 and that the subject-matter of claim 1 of each of the main and the first to third auxiliary requests then on file did not involve an inventive step (Article 56 EPC 1973). In support of its view on the issue of inventive step, the examining division referred to the following documents:

D1: WO-A-9112554

D11: EP-A-0762177

D12: JP-A-3233548 and the corresponding English abstract in "Patent Abstracts of Japan"

D13: US-A-4725134

D14: WO-A-9617269

D15: US-A-3378636

D16: JP-A-8094850 and the corresponding English abstract in "Patent Abstracts of Japan"

D17: US-A-5202950.

III. With the statement setting out the grounds of appeal the appellant submitted two sets of claims amended according to a main and an auxiliary request and requested that the decision under appeal be set aside and a patent be granted.

IV. In reply to a telephone consultation with the rapporteur of the Board, the appellant submitted with its letter dated 18.12.2009 an amended page 2a of the description and a new set of claims 1 to 7 replacing the previous set of claims of the main request, and confirmed that the main request for the grant of a patent is based on these amended application documents together with description pages 1, 6 and 7 of the application as published, pages 4, 8 and 10 to 12 filed with the letter dated 14.10.2003 and pages 2, 3, 5 and 9 filed with the letter dated 03.07.2006, and drawing sheets 1/7 to 6/7 of the application as published and 7/7 filed with the letter dated 14.10.2003.

V. Independent claims 1 and 3 amended according to the appellant's main request are worded as follows:

"1. A multi-layered image display comprising:

a selectively transparent first screen (3; 16) capable of generating a first, foreground image (6) comprising pixels arranged in a pattern;

a second screen (1; 16) capable of generating a second image (5) comprising pixels arranged in a pattern, the screen arrangement being such that the second image (5) can be viewed by an observer through the first screen (3; 16); and

a slightly diffuse layer (13) positioned between the first screen (3; 16) and the second screen (1; 16) for preventing the observation of a moiré interference pattern (14) by the observer."

"3. A multi-layered image display comprising:
a selectively transparent first screen (3; 16)
capable of displaying a first image (6) comprising
pixels aligned in a first direction; and
a second screen (1; 16) capable of displaying a
second image (5) comprising pixels aligned in a second
direction;
wherein the first screen (3; 16) is in front of
the second screen (1; 16); and the second direction is
at an angle of 45 degrees with respect to the first
direction, thereby to eliminate a moiré interference
pattern observable by the observer."

The main request of the appellant also comprises
dependent claims 2 and 4 to 7 all referring back to at
least one of independent claims 1 and 3.

The wording of the claims amended according to the
auxiliary request is not relevant for the present
decision.

VI. The arguments of the appellant in support of its
requests are essentially the following:

The display device defined in claim 1 includes a
slightly diffuse layer positioned between the two
screens so as to prevent the generation of any Moiré
interference pattern while permitting the images to be
seen sufficiently clearly by a user to achieve a
perception of depth.

In the device of document D1 the pixels are not
bordered by a black matrix and therefore the
arrangement would not give rise to the appearance of a

Moiré pattern, and even if the arrangement would in practice give rise to a slight Moiré pattern, none of documents D11 to D17 provides the necessary teaching as to how the problem could be solved. In particular, in documents D13 to D17 a single image is displayed and, in addition, the diffuser is either positioned behind the image display screen or in such a way that the entire image is diffused, and in the devices of documents D11 and D12 the diffusing element serves to diffuse each of the displayed image components by the same amount. There is no teaching in these documents as to how the use of a diffuser can overcome the problem of the Moiré pattern resulting from the interaction of the pixel boundaries of two overlapping display screens as claimed, and in any case any direct solution suggested by any of these documents would not result in the claimed arrangement.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request - Amendments*

The objection raised under Article 123(2) EPC 1973 by the examining division in its decision with regard to the main request then on file (point II above) related to features defined in dependent claims which have been omitted in the set of claims amended according to the present main request. Consequently, the objection no longer applies to the sets of claims amended according to the present main request.

In addition, the Board is satisfied that the application documents amended according to the present main request comply with the requirements of Article 123(2) EPC. In particular,

- the subject-matter of claim 1 is based on claim 13 of the application as published and the disclosure of the embodiment represented in Figures 3 and 4 of the application as published, and in particular the passages on page 3, lines 6 and 7, page 5, lines 24 to 27, page 7, lines 21 to 26 and page 9, lines 16 to 21 of the application as published,

- the subject-matter of independent claim 3 is based on claim 7 and the passage on page 9, lines 22 to 24 of the application as published, and

- the features of dependent claim 2 are based on page 8, lines 23 to 28, those of dependent claim 4 on page 1, lines 4 to 7 and page 6, lines 13 to 19, and those of dependent claims 5 to 6 on claims 18 to 20 and page 6, lines 13 to 19 of the application as published.

3. *Main request - Inventive step*

3.1 Claim 1

3.1.1 The Board concurs with the examining division that the image display device disclosed in document D1 with reference to Figures 4 and 5 represents the closest state of the art. This image display device comprises two image display screens each generating an image in the form of an image pattern of pixels, the arrangement being such that a first one of the image display screens is selectively transparent and is superposed on and spaced from the second one of the screens and the image of the second screen can be viewed by an observer

as a background image through the foreground image displayed by the first screen (see disclosure relating to Figures 4 and 5, and in particular page 3, last paragraph, page 6, second paragraph, page 7, line 31 to page 8, line 21, and paragraph bridging pages 8 and 9).

- 3.1.2 The multilayered image display device defined in claim 1 differs from the image display device disclosed in document D1 in the provision of a slightly diffuse layer between the two image display screens and according to the claimed invention the slightly diffuse layer is sufficient by itself alone to prevent the observation of a Moiré interference pattern by the observer.

As submitted by the appellant and also disclosed in the application by reference to Figures 4 and 5 of the application (page 9, lines 16 to 24), the claimed diffuse layer slightly diffuses the image pixel pattern of the second screen so as to eliminate by itself alone the Moiré interference pattern generated in the observer's field of view by the superposition of the patterns of image pixels of the two image display screens. The problem of the appearance of unwanted Moiré patterns would also arise inherently in the device of document D1; indeed, although - as submitted by the appellant - document D1 does not disclose a black matrix surrounding the pixels of the image screens, contrary to the appellant's submissions (point VI above) the pixelated patterns of the image screens of document D1 would also give rise to a Moiré interference pattern observable in the observer's field of view, although possibly a weaker Moiré pattern than

that generated by pixelated image display screens having a black matrix.

- 3.1.3 The objective technical problem solved by the claimed subject-matter over the image display device disclosed in document D1 can therefore be seen in improving the quality of the observable final image displayed by the image display device, and in particular reducing unwanted image artefacts such as Moiré interference patterns.
- 3.1.4 In its decision the examining division referred to documents D11 to D17 and held with reference to claim 1 of the main and the first to third auxiliary requests then on file that it was obvious to solve the objective problem formulated in point 3.1.3 above by means of a slightly diffuse layer interposed between the image display screens as specified in present claim 1.

Documents D13, D14, D16 and D17 all disclose illumination devices comprising optical structures (Fresnel lenses or sheets, lenticular or prism screens, etc.) that generate illumination patterns in the illumination field. Unwanted Moiré interference patterns are generated by the illumination patterns themselves (D13, column 1, lines 53 to 58, and D5, page 37, lines 3 and 4 and Figure 17) or by the interaction of the illumination patterns with image patterns (D16, lines 8 to 11 of the abstract, and D17, column 4, lines 63 to 68), and each of these documents discloses the use of a diffuse layer or plate arranged to diffuse the illumination patterns in order to suppress the generation of Moiré patterns (D13, abstract and column 1, lines 53 to 58; D14, Figure 17

and the corresponding disclosure, and in particular page 35, lines 29 to 31 and page 37, first paragraph; D16, abstract; and D17, abstract together with column 4, last paragraph). However, in the device disclosed in document D1 there is no illumination pattern giving rise to the formation of Moiré interference patterns, the latter being generated in the device by the image display screens themselves. In addition, while any solution to the objective problem formulated above presupposes the preservation of the pixelated image patterns generated by the image display screens of document D1, documents D13, D14, D16 and D17 all aim at the opposite, i.e. at homogenizing by diffusion the illumination field and more particularly at eliminating any pattern in the illumination field; consequently, the skilled person would refrain from applying the teaching of these documents to solve the objective problem formulated above because such a procedure would involve diffusing and therefore homogenizing the image patterns displayed by the screens in detriment of the image quality. As a matter of fact, documents D13, D14, D16 and D17 all teach the use of diffuse layers or plates having high light-diffusing characteristics and the application of the teaching of these documents to the disclosure of document D1 would not result in the claimed subject-matter requiring the use of a slightly diffuse layer, but in the provision of a light diffusing layer or plate that would inevitably blur out the image generated by the image display screens.

Only documents D11, D12 and D15 disclose the use of diffusing elements to eliminate Moiré interference patterns generated by image display structures.

More precisely, document D11 discloses a stereoscopic image display device comprising a lenticular lens sheet and teaches the use of a diffuser to eliminate the generation of Moiré patterns (abstract and Figures 1 to 5 together with the corresponding description). In this device, however, the Moiré patterns are not formed by interference of two image patterns as in document D1, but by the interference of the structured pattern of the stereoscopic image generated in a display screen and the lenticular structure of the lenticular lens sheet used to decompose and project the two stereoscopic image components towards the viewer and, in addition, the diffuser is arranged so as to diffuse all the image components (column 1, lines 26 to 32, and Figure 8 together with the corresponding disclosure). Thus, document D11 would at the most suggest diffusing by the same amount the two images generated by the image display screens of document D1, and there is no hint in document D11 towards the claimed solution involving the use of a slightly diffuse layer between the two image display screens so as to slightly diffuse only the background image, the diffuse layer being sufficient by itself alone to prevent the formation of Moiré patterns by interference between the foreground image and the slightly diffused background image.

Similar comments apply to document D15 which discloses the provision of a light diffusing surface on the screen of a television tube for compensating the formation of a Moiré pattern (abstract). The Moiré pattern is not that resulting from the interference of two image patterns, but from the interference between the grid structure of a filter of the tube screen and

the image pattern of raster lines and/or colour phosphor dots of the television tube (column 2, lines 27 to 56). In addition, the diffusing surface is applied in document D15 on the outer surface of the screen including the filter (Figures 2 and 3 and the corresponding disclosure, in particular column 3, lines 29 to 33) and the document would therefore suggest at the most a diffuse layer located in front of the first screen of the device of document D1 so as to diffuse both the background and the foreground images of the display screens.

Document D12 is the sole available prior art document addressing the generation of Moiré patterns by interference between image patterns. Each of the image patterns are generated in document E12 by a respective image liquid crystal display panel and the images are then combined and superposed on each other by means of a dichroic prism before being projected on a screen (Figures and abstract), and the document proposes the provision of a light diffusion plate in front of each of the image liquid crystal display panels in order to diffuse extremely weakly each of the images before being combined so that the cooperative diffusing effect of the diffusion plates inhibits the formation of Moiré patterns by superposition of the pixelated structures of the images (abstract, first and last paragraphs). This document provides a solution to the objective problem formulated above, but not the claimed solution because, while the latter involves a slightly diffuse layer that slightly diffuses only the background image and is sufficient by itself alone to prevent the formation of a Moiré pattern, the application of the teaching of document D12 to the image display device

disclosed in document D1 would require weakly diffusing each of the images to an amount sufficient to cooperatively prevent the formation of Moiré patterns and the document fails to suggest that in an image display device as that disclosed in document D1 it would be sufficient to slightly diffuse the background image to prevent the generation of Moiré patterns. In addition, diffusing each of the images according to the teaching of document D12 would require the provision in the device of document D1 of a diffuser in front of each of the two image screens, with the disadvantage that the background image would then be diffused twice in detriment of the image quality; this disadvantage could be overcome by adopting an arrangement as that disclosed in document D12 involving the use of an image prism combiner in order to combine the two images after each having been diffused only once, but this approach would result in a bulky arrangement different from the compact claimed arrangement comprising two image display screens with a slightly diffuse layer between the screens.

Therefore, none of the documents considered by the examining division suggests the claimed solution to the objective problem formulated above.

- 3.1.5 In its decision the examining division also held that the use of diffusers to suppress the formation of Moiré patterns, at the priority date of the application, constituted common general knowledge in this art as illustrated by the disclosure of documents D11 to D17 taken as a whole. However, as shown in the analysis above, the common general knowledge alleged by the examining division only generally involves the use of

diffusing screens or layers and is in itself insufficient to render obvious the specific claimed arrangement involving slightly diffusing a background image viewable through the selectively transparent screen generating a foreground image to an amount sufficient to prevent the formation of a Moiré pattern.

The remaining documents on file are less pertinent than those considered above.

3.1.6 In view of the above considerations, the Board concludes that the subject-matter of claim 1 of the present main request involves an inventive step within the meaning of Article 56 EPC 1973 with regard to the prior art presently on file. In these circumstances, the secondary indications of inventive step submitted by the appellant during the first-instance proceedings and concerning in particular the alleged commercial success of an image display as claimed need not be addressed in the present decision.

3.2 *Independent claim 3 and dependent claims 2 and 4 to 7*

Independent claim 3 provides an alternative solution to the objective technical problem formulated in point 3.1.3 above and consisting in arranging the two image display screens so that the respective directions of alignment of the pixels of the two images are at an angle of 45 degrees with respect to each other, thereby eliminating the Moiré interference pattern. This claim corresponds in substance with an independent claim already present in the claim requests underlying the decision under appeal and during the first-instance oral proceedings the examining division considered that

this claim defined patentable subject-matter (minutes of the oral proceedings dated 08.11.2007, page 8, second paragraph). In view of the prior art on file, the Board sees no reason to depart from the finding of the examining division in this respect.

Dependent claims 2 and 4 to 7 all refer back to at least one of independent claims 1 and 3 and consequently the subject-matter defined in these claims also involves an inventive step.

4. The Board is also satisfied that the application documents amended according to the main request and the invention to which they relate meet the remaining requirements of the EPC within the meaning of Article 97(1) EPC. The Board therefore 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 main request of the appellant (Article 97(1) EPC together with 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 in the following version:
 - claims 1 to 7 filed with the letter dated 18.12.2009,
 - description pages 1, 6 and 7 of the application as published, pages 4, 8 and 10 to 12 filed with the letter dated 14.10.2003, pages 2, 3, 5 and 9 filed with the letter dated 03.07.2006, and page 2a filed with the letter dated 18.12.2009, and
 - drawing sheets 1/7 to 6/7 of the application as published and drawing sheet 7/7 filed with the letter dated 14.10.2003.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein