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D E C I S I O N
of 19 April 2002

Case Number: T 0899/01 - 3.4.2
Application Number: 95921043.6
Publication Number: 0764288
IPC: G02B 27/22, G03B 35/00,
B41M 3/06

Language of the proceedings: EN

Title of invention:
Producing visual images

Applicant:
DE MONTFORT UNIVERSITY

Opponent:

-

Headword:

-

Relevant legal provisions:
EPC Art. 111(1)

Keyword:
"Decision re appeals - remittal (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0899/01 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 19 April 2002

Appellant: DE MONTFORT UNIVERSITY
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Representative: McNeight, David Leslie
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 19 March 2001
refusing European patent application
No. 95 921 043.6 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: A. G. M. Maaswinkel
V. Di Cerbo

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing the European patent application number 95 921 043.6 (published with the International Publication Number WO-A-95 34018).

In the decision under appeal the examining division referred *inter alia* to the following documents:

D1: WO-A-90 08343

D4: EP-A-0 520 179

and held that the subject matter of claim 1 was not new within the meaning of Articles 52(1) and 54 EPC in view of the disclosure of document D1. The examining division also held that the subject matter of product claim 10, which is appended to method claim 1 via dependent claim 2, was neither clear (Article 84 EPC) nor new (Articles 52(1) and 54 EPC).

II. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 36 as published, with the deletion of the second claim numbered 22, as a main request or on the basis of claims 1 to 35 submitted with the statement of the grounds of appeal as an auxiliary request. On an auxiliary basis, the appellant requested oral proceedings.

III. In a communication pursuant to Article 12 of the Rules of Procedure of the Boards of Appeal issued on 14 December 2001, the board referred to the following

document mentioned in document D4:

D15: US-A-4 506 296

In its communication the board also drew the attention of the appellant to the following documents cited in the Supplementary European Search Report in respect of claims 43 to 52 of the application as published and which did not appear to have been considered by the examining division:

D9: Proceedings of the 1994 International Broadcasting Convention, 16-20 September 1994, Conference Publication No.397, IEE, 1994, NL, pages 477 to 482; M McCormick *et al.*, "Examination of the requirements for autostereoscopic, full parallax, 3D TV"

D10: IEE Colloquium on "Stereoscopic Television" (Digest No. 173), 15 October 1992, London, GB, pages 3/1 to 3/4; M McCormick *et al.*, "Restricted Parallax Images for 3D T.V."

D11: "Physics World", Vol. 5, No. 6, June 1992, GB, pages 42 to 46; M McCormick *et al.*, "3-D worlds"

D14: Proceedings of the SPIE: "Miniature and Micro-Optics: Fabrication and System Applications", SPIE, Vol. 1544, 22-23 July 1991, US, pages 189 to 198; N Davies *et al.*, "Microlens arrays in integral photography and optical metrology".

The board pointed out on a preliminary basis that, provided the claims were appropriately clarified, the appellant's submissions in support of the novelty of

the claimed subject matter over the documents considered during the examination procedure would appear convincing. However, as neither the issue of inventive step nor the potential relevance of the additional documents D9 to D14 had yet been addressed by the examining division, the appellant was informed of the board's provisional intention to remit the case to the first instance for further prosecution.

IV. In response to the board's communication, the appellant agreed in a letter dated 18 February 2002 with the remittal of the case to the first instance and submitted by letter dated 11 March 2002 an amended claim 1 replacing the claim 1 of the main request and amended claims 1 to 35 replacing the claims 1 to 35 of the auxiliary request.

V. The wording of claim 1 of the main request reads as follows:

"A method for reproducing an integral image with with [sic] continuous parallax for viewing using a decoding screen as a 3-D picture, comprising representing the image as an array of image points with a density corresponding to high resolution ink printing."

The wording of claim 10 of the main request reads as follows:

"A print made by a method according to any one of claims 2 to 9."

wherein claims 3 to 9 all refer back to claim 2, this claim being appended to claim 1 and defining "a method according to claim 1, comprising printing the image

using a high resolution ink printing technique".

Claims 2 to 9 and claims 14 to 36 of the main request are appended to claim 1 and claims 11 to 13 of the main request are appended to claim 10.

VI. The appellant's argumentation in support of the main request is essentially the following:

Document D1 is directed to multiview imaging and more specifically to the reproduction of stereoscopic and autostereogram images generated by the parallax barrier or barrier strip method for viewing using a barrier strip decoder. According to this imaging technique, two, and in the case of autostereograms more than two images of a scene taken from different positions along a parallax baseline are interleaved with each other. This imaging technique is to be distinguished from integral imaging in which images of the scene are taken by a very large number of lenslets spaced closely so as to virtually constitute a continuum of image taking positions distributed over an area.

Document D4 is also directed to multiview imaging. The "integral photography" technique taught in the document refers to the computer integration of a relatively low number of actual images and additional images generated by computer interpolation of the actual images and does not constitute an integral imaging technique. In fact, in document D4, see in particular column 7, lines 10 to 17, the concept of integral imaging addressed in the present patent application is rejected.

Thus, the images disclosed in documents D1 and D4 contain far less depth information than images obtained

by integral imaging. In addition, each pixel of an integral image contains information on the volumetric image of the scene rather than information on one single view of the scene, as is the case in the imaging techniques disclosed in documents D1 and D4.

Therefore, neither document D1 nor document D4 discloses or encompasses the reproduction of an integral image according to the claimed subject matter.

The print defined in claim 10 can be analysed to establish whether the printed image is an integral image and can therefore be distinguished from the prints of the prior art.

Reasons for the Decision

1. The appeal is admissible.
2. *Compliance of the main request with Article 123(2) EPC*

Claim 1 of the main request corresponds to claim 1 as published wherein the expression "an integral, panoramographic or full spatial image" has been replaced by the expression "an integral image with continuous parallax". This amendment clarifies the technical meaning of the expression "integral image" and is based on the second paragraph of page 1 and on the paragraph bridging pages 4 and 5 of the description of the application as published, where the imaging technique of the invention is described as "full spatial imaging with continuous parallax". The terms "panoramographic" and "full spatial" have been omitted in the amended claim; since these terms have no well-established

technical meaning in the art of three-dimensional imaging and in addition they have been used in the disclosure of the application as alternative and synonymous expressions for integral image, the omission of these terms in the amended claim 1 does not contravene the requirements of Article 123(2) EPC.

Claims 2 to 36 of the main request correspond to claims 2 to 21, the first of the claims numbered 22 and claims 23 to 36 as published, respectively, the second of the claims numbered 22 as published being deleted.

Therefore, the claims of the main request fulfill the requirements of Article 123(2) EPC.

3. *Clarity of the subject matter of claim 10 of the main request - Article 84 EPC*

In the decision under appeal the examining division held that claim 10 as published, which is directed to a print made by a method according to claim 2 dependent from claim 1, attempts to define the claimed print solely by the method used to produce it and is therefore contrary to the requirements of clarity of Article 84 EPC.

According to the established case law of the Boards of Appeal (see "Case Law of the Boards of Appeal", 3rd edition, 1998, chapter II, sections B.6.1 to B.6.3) and as also explained in the Guidelines, chapter C-III, paragraphs 4.7a and 4.7b, the form of the so called product-by-process claims is admissible if and only if, on the one hand, the product itself fulfills the requirements of patentability, in particular that of novelty and inventive step, and on the other hand a

formal requirement is fulfilled, namely that there is no other information available in the application for a more satisfactory definition of the product on the basis of the composition, structure or some other testable parameter.

In the present case there appears to be no information in the application as published for a satisfactory definition of the print defined in claim 10 only on the basis of structural features of the print itself. In particular, it does not appear possible, within the content of the original application, to define the features of the print without an explicit reference to the high resolution ink printing process used to represent the integral image. For these reasons, the board is of the opinion that, at least as far as the formal requirement mentioned above is concerned, the formulation of claim 10 as a product-by-process claim appears to be justified in the present case.

Therefore, the argument of the examining division that claim 10 defines a print solely by its production method is not in the present case sufficient to support the view that the claim contravenes the requirements of Article 84 EPC. The formulation of claim 10 as a product-by-process claim would be objectionable under Article 84 EPC only if the print itself does not satisfy the requirements of patentability, in particular when the claimed print itself is not new or is rendered obvious by the prior art.

4. *Novelty of the subject matter of claims 1 and 10 of the main request with respect to the documents considered in the decision under appeal*

4.1 The objection of lack of novelty raised by the examining division in the decision under appeal with respect to the then valid claims 1 and 10 is based on the ground that, as is apparent from the introductory part of document D4, the commonly accepted meaning of "integral image" is synonymous with the expressions "autostereograph" and "autostereoscopic image" as used in document D1, and that the images and the imaging techniques disclosed in document D1 are also integral within the meaning of the application in suit and anticipate all the features of claims 1 and 10.

According to the appellant's submissions, integral imaging and multiview imaging refer to two different imaging techniques, and documents D1 and D4 disclose the generation of images by multiview imaging.

4.2 The board notes that parallax stereograms or, following the terminology used by the appellant in his submissions, multiview imaging, on the one hand, and integral imaging, on the other hand, constitute conventional three-dimensional imaging techniques well known in the art, see in this respect document D9 (first and second paragraphs of section 1, first paragraph of section 2, and last paragraph on page 479); document D10 (second paragraph on page 3/1, first paragraph on page 3/2, and Figure 1); document D11 (middle paragraph in the second column of page 43, last paragraph in the first column to second paragraph in the second column on page 45, and Figures 3, 4 and 5); and document D14 (second and fourth paragraphs on page 189, third and fourth paragraphs on page 194, and Figure 1).

4.2.1 Although parallax stereograms and integral imaging both

use decoding screens for viewing the scene as a three-dimensional image, they refer nonetheless to two different three-dimensional imaging techniques. While in integral imaging the resulting image is essentially composed of an array of images of a scene each representing a unique perspective view of the whole scene as viewed from a respective one of the elements of an encoding screen and the original scene is then optically reconstructed for viewing as a three-dimensional image with continuous parallax by means of a decoding screen (see document D9, paragraph bridging pages 477 and 478; document D10, Figure 1 and first paragraph on page 3/1; document D11, last paragraph in the first column and first and second paragraphs in the second column of page 45 and Figure 5; and document D14, Figure 1 and sections 1 and 2), in a parallax stereogram two or - in the particular case of autostereograms - more than two perspective views of the scene are cut into image bands and the image bands of each perspective view are then spatially interlaced or interleaved with the image bands of the other perspective views for viewing by means of a decoding screen arranged to project the interleaved image bands of a first and a second one of the perspective views to a respective one of the eyes of the viewer (see document D9, first paragraph of section 1; document D11, Figures 3 and 4 together with the penultimate paragraph on page 43 and the paragraph bridging pages 43 and 44; and document D14, third paragraph on page 194).

It follows that the parallax information of the scene is differently encoded in these two imaging techniques. While in a parallax stereogram each of the image bands behind an element of the decoding screen represents a

perspective view of only a portion of the scene (see Figure 3 of document D11), in integral imaging each image element of the image array contains image information of the whole scene (see Figure 1 of document D9; Figure 5 of document D11; and Figure 1 of document D14). In addition, while the parallax information encoded in a parallax stereogram is confined to the relatively low number of different perspective views that have been interleaved in the stereogram, in integral imaging the parallax information encoded in the integral image and determined by the number of different perspective views present in the integral image is much higher, involving parallax information of the scene from a series of discrete positions approaching a continuum (document D9, first sentence of the abstract and the second paragraph of section 1; document D10, second paragraph on page 3/1; document D11, last paragraph in the first column and first paragraph in the second column on page 45; and document D14, third and fourth paragraphs on page 194).

- 4.2.2 The examining division argued that according to the introductory part of document D4 "a truly three-dimensional image [...] is often called an autostereoscopic image" and is a "truly spatial image" that provides a "look around" capability when the observer moves with respect to the image, and that "integral photography is a method of recording a complete spatial image" (document D4, column 1, lines 24 to 43). However, the paragraphs of document D4 considered by the examining division actually fail to identify integral photography and parallax stereoscopic or autostereoscopic imaging as the same imaging method. On the contrary, the introductory part of document D4

clearly distinguishes between, on the one hand, integral photography (column 1, line 35 to column 3, line 8) in which each of a large number of lenslets projects a view of the whole scene from a slightly different perspective than the adjacent lenslets (column 1, lines 44 to 52 and column 2, lines 11 to 17) and, on the other hand, stereoscopic images (column 1, lines 24 to 34 and column 3, lines 9 to column 6, line 52) in which each one of a plurality of lenslets projects different views of the same image portion of the scene, the image portion projected by each lenslet being different from the image portion projected by adjacent lenslets (column 4, lines 14 to 30 and lines 41 to 46).

The examining division also argued that the disclosure of document D4, and in particular claim 1 of the document, refers to the autostereoscopic image generated by the method disclosed in the document as an "integral three-dimensional image". However, when referring to the autostereoscopic images, the term "integral" is not used in the document in the sense of designating images obtained according to the integral imaging technique. As submitted by the appellant, this is apparent from the statement in column 7, lines 11 to 17 that "the inventors have departed from conventional integral lenticular photography".

That the images resulting from the imaging technique disclosed in document D4 constitute parallax autostereograms and not images obtained by an integral imaging technique is further confirmed by the manner the different perspective views are assembled with one another. According to column 9, lines 6 to 16 of document D4, the resulting image is said to contain

"strips of photographic elements from the different perspectives that make the ultimate integral photograph". In addition, according to section D "Composite Print File" of document D4, the generation of the composite images for viewing is as described in document D15, in which respective parallel portions of the images corresponding to different perspective views of the scene are selected and interlaced with each other and positioned behind a lens of a lens array (document D15, Figures 1 and 2 together with column 2, lines 56 to 62, column 4, lines 28 to 37 and column 5, lines 5 to 30).

The examining division's contention that, as is apparent from document D4, the meaning of "integral image" is synonymous with autostereograph or autostereoscopic images is therefore not convincing.

- 4.2.3 Hence, the board concurs with the appellant's submission that integral imaging and parallax stereograms refer to two different three-dimensional imaging techniques.

- 4.3 The appellant's submission that the integral image of the claimed subject matter is of the integral imaging type and not a parallax stereogram is supported by the description of the patent application. In particular, the imaging techniques disclosed with reference to Figures 7 to 17 of the patent application correspond with integral imaging techniques. Furthermore, the paragraph bridging pages 4 and 5 of the description clearly distinguishes between the images of the invention that are obtained by means of "a synthesised aperture - a wide aperture lens simulated by an assembly of smaller lenses" and multiview imaging in

which "multiple separate images taken from spaced apart lenses for eventual assembly into a composite image [...] but which is by no means full spatial imaging with continuous parallax", thus clearly identifying the images of the invention with images generated by integral imaging techniques as opposed to parallax stereograms.

In addition, the formulation of claim 1 of the main request has been amended during appeal proceedings so as to refer to the reproduction of "an integral image with continuous parallax", thus clearly and unambiguously distinguishing the integral images of the invention from parallax stereograms, i.e. from images obtained by multiview imaging techniques the parallax information of which is determined by, and confined to the discrete number of views of the scene that have been interleaved with each other (see point 4.2.1 above).

- 4.4 The further submission of the appellant that document D1 is directed to parallax stereograms and not to integral imaging appears to be supported by the corresponding disclosure.

Document D1 discloses the computer-assisted generation of barrier strip autostereographic images of an object. A predetermined number of images of the object are interleaved by means of a computer and then printed on a spacer, each of the images representing a view of the object from one of a predetermined number of different viewpoints (page 4, first to third paragraph and page 5, last paragraph). The interleaved views are then positioned behind the slits of a barrier strip as shown in Figure 1 (page 7, lines 11 to 15 and last

paragraph). The board understands that the reference in document D1 to a discrete number of different views of an object that are first interleaved with each other and then positioned behind a barrier strip operating as decoding screen clearly means that the resulting images constitute parallax stereograms, and more specifically parallax autostereograms. This conclusion is confirmed by Figure 1 of document D1 which shows a typical representation of the viewing method of a parallax stereogram and further confirmed by the statements in the introductory part of the document (page 2, second paragraph) that the parallax barrier or barrier strip method consists in cutting the views of the object into columns that are first interleaved and then arranged behind a barrier strip so that each eye of a viewer only sees a respective one of the interleaved views.

Therefore, the images disclosed in document D1 are not integral images within the meaning of the claimed subject matter.

4.5 During the examination procedure the examining division also objected lack of novelty of the then valid claim 1 with regard to document D4. However, as submitted by the appellant, the images obtained according to the imaging techniques disclosed in document D4 are parallax autostereograms, integral imaging being explicitly rejected in the document, see point 4.2.2 above.

4.6 The board therefore cannot endorse the examining division's opinion that document D1 or D4 disclose the reproduction of an integral image according to the claimed subject matter. The subject matter of claim 1 of the main request is therefore considered to be novel

with regard to the documents considered by the examining division.

- 4.7 Claim 10 is directed to a print made by the method of any of claims 2 to 9, claims 3 to 9 referring back to claim 2 and claim 2 being directed to the method of claim 1 further comprising printing the image by means of a high resolution ink printing technique. Thus, the subject matter of claim 10 is to be construed as being directed to a print obtainable by first reproducing an integral image as defined in claim 1 and then printing the image using a high resolution ink printing technique. Such a print would therefore contain an integral image printed thereon.

The assessment of the novelty of the print defined in claim 10 over document D1 depends on the question of whether, and to what extent the print defined in the claim is also obtainable by, i.e. can be produced according to the method disclosed in document D1.

As already put forward in point 4.4 above, the method disclosed in document D1 generates a parallax stereogram, i.e. an image arrangement constituted by image bands of a plurality of different perspective views of the same scene, the image bands representing a respective portion of the scene and been interlaced or interleaved with each other, see point 4.2.1 above. This image arrangement, however, cannot give rise to an integral image, i.e. an image arrangement of a plurality of different perspective views of a same scene arrayed adjacent to one another. It follows that the image arrangement defined by an integral image cannot be obtained, i.e. is not obtainable as the image arrangement of a parallax stereogram.

It follows that a print according to claim 10 cannot be produced according to the imaging and printing techniques disclosed in document D1 and therefore the print defined in claim 10 of the main request is new over document D1.

As the images disclosed in document D4 are also of the parallax stereogram type (see point 4.5 above), the same conclusion applies with regard to document D4.

5. *The decision under appeal*

The examining division's arguments in support of the refusal of the application on the grounds of lack of novelty and lack of clarity are therefore not found convincing by the board with regard to the claims of the appellant's main request. For this reason the decision under appeal must be set aside.

6. *Further prosecution of the application*

6.1 The board notes, however, that the issue of the inventive step of the claimed subject matter with regard to the documents considered during examination has not yet been addressed by the examining division.

6.2 In addition, the board notes that, among the documents cited in the International Search Report and in the Supplementary European Search Report, at least documents D9, D10, D11 and D14 would appear to disclose integral imaging for viewing using a decoding screen as a three-dimensional image (see the citations in point 4.2.1 above), and that at least in documents D9 (Figures 3 and 5 together with sections 3 to 6, see in particular page 479, second column, first sentence of

the third paragraph) and D10 (Figures 1 and 2 and the corresponding description) the resulting images appear to be represented as an array of pixels. These documents appear therefore to come much closer to the claimed subject matter than any of the prior art documents considered during the examination procedure and deserve due consideration when assessing the patentability of the subject matter of claim 1 of the main request.

The board observes that according to the stamp on the first page of document D9, the document appears to have been published on 16 September 1994, i.e. after the filing date 4 June 1994 of the first of the priority documents GB 9411226.5 from which priority is claimed in the present application. However, since the priority document GB 9411226.5 appears to only refer to printing techniques and printed images and present claim 1 is directed to images represented as an array of image points "with a density corresponding to" high resolution ink printing, i.e. also including images displayed, but not actually printed, in a pixel screen such as a LCD having the pixel density specified in the claim (see claim 14 of the main request together with the last paragraph on page 2, the second paragraph on page 4 and the paragraph bridging pages 10 and 11 of the description), it would have to be assessed whether the right to priority from the first of the priority documents can be considered valid in respect of the subject matter of claim 1 of both the main and the auxiliary requests, in which case document D9 would constitute prior art within the meaning of Article 54(2) EPC.

The board also notes that there is no indication in the file that the examining division has already considered any of these issues.

- 6.3 The main duty of the Boards of Appeal is to review decisions under appeal and not to examine for the first time issues not yet considered by the first instance.

Accordingly, since the issues mentioned in points 6.1 and 6.2 above have not yet been considered by the first instance, and in order not to deprive the appellant of the possibility of having its case considered by two instances, the board considers appropriate in the present circumstances to exercise its power under Article 111(1) EPC to remit the case to the first instance for further prosecution.

7. *Appellant's request for oral proceedings*

Since the decision under appeal is set aside and the appellant has agreed with the remittal of the case to the first instance before which the examination procedure would be continued, there is no need to appoint oral proceedings before the present board.

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 for further prosecution on the basis of the appellant's main request consisting of claim 1 filed with the letter dated 11 March 2002 and claims 2 to 36 as published, with the second of the claims numbered 22 as published being deleted.

The Registrar:

The Chairman:

P. Martorana

E. Turrini