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Datasheet for the decision of 28 February 2008

Case Number: T 1400/04 - 3.5.04

Application Number: 00936285.6

Publication Number: 1181812

IPC: H04N 1/60

Language of the proceedings: EN

Title of invention:
Constrained multi-dimensional color transformation

Applicant:
Eastman Kodak Company

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)
RPBA Art. 13

Relevant legal provisions (EPC 1973):
EPC Art. 54, 56, 84, 111(1)

Keyword:
"Added subject-matter (no - after amendment)"
"Clarity (yes - after amendment)"
"Remittal (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1400/04 **-** 3.5.04

D E C I S I O N
of the Technical Board of Appeal 3.5.04
of 28 February 2008

Appellant: Eastman Kodak Company
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Representative: Hilleringmann, Jochen
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 19 July 2004 refusing European application No. 00936285.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: F. Edlinger
Members: M. Paci
C. Vallet

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing European patent application No. 00 936 285.6.

II. The following documents were cited as prior art in the decision under appeal:

D1: EP-0 611 231 A1
D2: EP-0 779 736 A2
D3: EP-0 534 871 A2
D4: US-4 831 409 A
D5: US-5 764 795 A
D6: WO-93/20648 A1
D7: DE-43 35 143 A1
D8: US-5 359 436 A
D9: GB-2 213 674 A.

III. The application was refused by the examining division on the grounds that:

- claim 1 was unclear (Article 84 EPC 1973);
- the subject-matter of claim 1 was not new in view of the disclosure of D1 (Articles 54(1) and (2) EPC 1973); and
- the subject-matter of claims 13 and 14 did not involve an inventive step in view of the disclosure of D3 (Article 56 EPC 1973).

Documents D2 and D4 to D9 were cited but not used in the reasons for the decision.

IV. With the statement of grounds of appeal the appellant filed a set of amended claims replacing the claims on which the appealed decision had been based.

V. In an annex to the summons to oral proceedings the board expressed doubts that the amended claims complied with Articles 84 and 123(2) EPC 1973. The board also indicated that if these objections, as well as those relating to novelty and inventive step based on D1 and D3 in the appealed decision, were overcome the board intended to remit the case to the examining division for further prosecution so that the patentability of the claimed subject-matter could be examined in the light of documents D2 and D4 to D9.

VI. Amended claims were filed by the appellant around two weeks before the oral proceedings.

VII. Oral proceedings were held before the board on 28 February 2008 during which the appellant filed amended claims replacing all previous claims.

VIII. The appellant's final request is that the decision under appeal be set aside and that a patent be granted in the following version:

Description:
pages 1, 3 and 4 as filed with letter dated 16 July 2002,
page 1a as filed with the statement of grounds of appeal and
pages 2 and 5 to 12 as published

Claims:
No. 1 to 11 as filed in the oral proceedings on 28 February 2008.

Drawings:
sheets 1/3 and 2/3 as published and
sheet 3/3 as filed with letter dated 16 July 2002.

IX. Independent claim 1 reads as follows:

"A method for multi-dimensional color transformation comprising:
applying a multi-dimensional color transformation for transformation of source device-dependent coordinates (20) to destination device-dependent coordinates (24), comprising the steps of
(a) converting source device-dependent coordinates (20) to source device-independent coordinates,
(b) constraining the destination device-dependent coordinates (24) to a range of destination device-dependent coordinates (24) within which colorimetrically matching destination device-dependent coordinates (24) are searched for by the multi-dimensional color transformation, said range being a function of the source device-dependent coordinates (20),
wherein step (b) includes constraining the destination device-dependent coordinates (24) to prevent (i) addition of selected colorants not specified by the source device-dependent coordinates (20) and/or (ii) removal of selected colorants specified by the source device-dependent coordinates (20).

(c) selecting destination device-dependent coordinates (24) from the range of destination-device dependent coordinates (24) obtained in step (b),
(d) converting the selected destination device-dependent coordinates (24) to destination device-independent coordinates,
(e) monitoring the resulting error calculated between the source device-independent coordinates and the destination device-independent coordinates,
(f) using the selected destination device-dependent coordinates (24) as the result of the transformation of the source device-dependent coordinates (20) to the destination device-dependent coordinates (24) if the error calculation results in an error equal to or below a pre-determined value,
(g) otherwise selecting other destination device-dependent coordinates (24) from the range of the destination device-dependent coordinates (24) obtained in step (b), and
(h) repeating steps (d) to (g) until the error calculation results in an error equal to or below said predetermined value."

Claims 2 to 9 are dependent on claim 1.

Claim 10 reads as follows:

"A system for executing a method for multi-dimensional color transformation as in any of claims 1 to 9, the system comprising:

- a processor (12) that applies the multi-dimensional color transformation for transformation of source device-dependent coordinates (20) to destination device-dependent coordinates (24), and

– a memory (16) that stores constraints (32),

– wherein the processor (12) is programmed to apply the following steps:

(a) converting source device-dependent coordinates (20) to source device-independent coordinates,

(b) constraining the destination device-dependent coordinates (24) to a range of destination device-dependent coordinates (24) within which colorimetrically matching destination device-dependent coordinates (24) are searched for by the multi-dimensional color transformation, said range being a function of the source device-dependent coordinates (20),

wherein step (b) includes constraining the destination device-dependent coordinates (24) to prevent (i) addition of selected colorants not specified by the source device-dependent coordinates (20) and/or (ii) removal of selected colorants specified by the source device-dependent coordinates (20).

(c) selecting destination device-dependent coordinates (24) from the range of destination-device dependent coordinates (24) obtained in step (b),

(d) converting the selected destination device-dependent coordinates (24) to destination device-independent coordinates,

(e) monitoring the resulting error calculated between the source device-independent coordinates and the destination device-independent coordinates,

(f) using the selected destination device-dependent coordinates (24) as the result of the transformation of the source device-dependent coordinates (20) to the destination device-dependent coordinates (24) if the error calculation results in an error equal to or below a pre-determined value,

(g) otherwise selecting other destination device-dependent coordinates (24) from the range of the destination device-dependent coordinates (24) obtained in step (b),
(h) repeating steps (d) to (g) until the error calculation results in an error equal to or below said predetermined value."

Claim 11 reads as follows:

"A computer-readable medium containing program code that, when executed by a processor (12), performs a method for multi-dimensional color transformation as in any of claims 1 to 9."

X. The reasoning of the examining division in the decision under appeal regarding the claims 1, 13 and 14 then on file can be summarised as follows:

Clarity

The term "constraining" used in claim 1 is vague and indefinite (Article 84 EPC 1973) because it does not provide a tangible technical teaching as to the manner in which the destination device-dependent coordinates are constrained. There is no indication in the claim of objective criteria on the basis of which the constraining occurs. It is thus not clear whether or not the constraining step (b) restricts the claim and goes beyond what is already required according to step (a). The meaning of the term "constraining" is further obscured by the passage in the description on page 6, lines 21 to 25, in which a colour transformation that uses only box constraints (corresponding to the

physical limits of the destination device) is referred to as "unconstrained".

Novelty

In so far as it can be understood, the subject-matter of claim 1 is not novel (Article 54(1) and (2) EPC 1973) in view of the disclosure of D1.

D1 discloses (see page 4, line 26, to page 5, line 38; figures 3, 4 and 5) applying constraints to points in the input colour space which specify the mapping into the output colour space by a multi-dimensional colour transform. As a consequence the points in the output colour space are constrained to a range of matching points in the output colour space searched by the multi-dimensional colour transformation as a function of the points in the input colour space. Whether the transformation is constrained *a priori* on the basis of the source or destination device-dependent coordinates or, as alleged by the applicants to be a distinction between the claimed subject-matter and D1, the device-independent coordinates, this results in device-dependent coordinates being constrained, as is clear from the cited passage in D1 (page 5, lines 4 to 13), according to which colour reproduction of, for example, a single colour such as a skin tone is constrained.

Inventive step

It is generally known to use a system comprising a suitably programmed processor and a memory for executing colour transformation, as disclosed, for instance, in D3 (see in particular figures 3C, 5 and 6

and the corresponding text in the description). The subject-matter of claims 13 and 14 therefore merely concerns a matter of obvious design and is thus not based on an inventive step in the sense of Article 56 EPC 1973.

XI. The appellant essentially argued as follows.

Clarity and support for the amendments

Claim 1 (as filed during the oral proceedings before the board) defines in detail all the steps of the multi-dimensional colour transformation, including the iterative search process within a constrained range of destination device-dependent coordinates. The method of claim 1 is supported by figure 2 of the application as originally filed and the corresponding description. The constraining step (b) of claim 1 is further defined by specific constraints (i) and/or (ii). These features find support, for instance, on page 5, lines 9 to 13, of the application as filed. Thus the amendments made to claim 1 overcome the examining division's objections relating to the alleged vagueness of the constraining step (b).

Novelty

The method of claim 1 differs from the disclosure of D1 in at least the following features:

– the destination **device-dependent** coordinates (24) are constrained by preventing (i) addition of selected colorants not specified by the source device-dependent coordinates and/or (ii) removal of selected colorants specified by the source device-

dependent coordinates, whereas in D1 only the intermediate **device-independent** coordinates are constrained (see page 4, line 52, to page 5, line 20 of D1);

- a search is performed within the range defined by the constraints, whereas there is no search within a constrained range in D1;
- the search is an iterative process, whereas there is no iterative process in D1.

Hence the method of claim 1 is novel with respect to the disclosure of D1.

Inventive step

D3 was only cited by the examining division as evidence that it was known to execute a colour transformation in a system comprising a suitably programmed processor and a memory. Otherwise the colour transformations of D3 are not relevant to the present invention. Since the system of claim 10 comprises a processor programmed to apply the method steps of claim 1, the system is not rendered obvious by D3 even in combination with D1. The same conclusion applies to the computer-readable medium of claim 11 containing program code that, when executed by a processor, performs the method of claim 1.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of the late-filed request*

Both the claims filed around two weeks before the oral proceedings and the present claims filed in the oral proceedings constitute amendments to the appellant's case under Article 13(1) and (3) RPBA (see OJ EPO 2007, 536). In exercising its discretion the board took into account that these amendments constitute reactions to objections made by the board and that they are convergent clarifications of the claims which had been filed with the statement of grounds of appeal. Since in *ex parte* proceedings only the board has to deal with the amended case and adjournment of the oral proceedings was not necessary in view of appropriate amendments which rather reduced the complexity of the case, the board decided to admit the late filed amendments.

3. *Amendments (Article 123(2) EPC)*

Claim 1 has been amended by introducing additional method steps (a) and (c) to (h) in order to match more closely the embodiment of the method disclosed in figure 2 and in the corresponding description in the application as filed (see, in particular, page 4, line 13, to page 5, line 13).

Step (b) of the method of claim 1 has been amended in order to specify that the constraining of the destination device-dependent coordinates includes "*constraining the destination device-dependent coordinates (24) to prevent (i) addition of selected colorants not specified by the source device-dependent coordinates (20) and/or (ii) removal of selected*

colorants specified by the source device-dependent coordinates (20)". These limitations are disclosed in the application as filed, in particular on page 5, lines 9 to 12, on page 7, lines 1 to 4, on page 8, lines 1 to 16, in claims 4 and 8 and in figure 3.

Accordingly the board sees no objection under Article 123(2) EPC to the amendments made to claim 1 and corresponding amendments made to claims 13 (system) and 14 (computer-readable medium) which have now become claim 10 and claim 11, respectively.

4. *Clarity (Article 84 EPC 1973*)

Unlike claim 1 considered in the decision under appeal, present claim 1 specifies that the step of "constraining" the destination device-dependent coordinates includes preventing "*(i) addition of selected colorants not specified by the source device-dependent coordinates (20) and/or (ii) removal of selected colorants specified by the source device-dependent coordinates (20)*". These features provide a tangible technical indication of how the destination device-dependent coordinates are constrained. They impose a minimum constraint on the destination device coordinates which depends on the source device-dependent coordinates and goes beyond the mere physical constraint imposed by the destination device itself (i.e. the fact that a printer cannot use less than 0% or more than 100% of any ink). The board is thus satisfied that the objections of vagueness and indefiniteness concerning the constraining step raised in the decision under appeal have been overcome by the more detailed and specific formulation of claim 1.

Moreover claim 1 now explicitly defines the various steps of the iterative search process colorimetrically matching destination device-dependent coordinates within the constrained range, thereby contributing to the overall clarity of the claim in that, for the iterative search, device-dependent coordinates are selected from a range which is restricted as a function of the source device-dependent coordinates.

For the above reasons the board considers that claim 1 meets the requirements of Article 84 EPC 1973.

The above conclusion applies *mutatis mutandis* to claims 10 and 11.

5. *Novelty (Article 54(1) and (2) EPC 1973)*

5.1 D1 discloses a method for multi-dimensional colour transformation of source device-dependent coordinates to destination device-dependent coordinates. Like the method of claim 1 the method of D1 may use a device-independent colour space (such as the CIELAB colour space) as an intermediate stage in the transformation from the source device-dependent colour space to the destination device-dependent colour space (see figure 3 of D1 and page 4, lines 26 to 35). Models of the input and output colour spaces are formed to relate input and output colour values to colour values in the intermediate device-independent colour space (see page 4, lines 40 to 42). Subsets of input colour values are then formed by grouping them based on a common property, such as flesh tones, or purpose, such as a single object in a scene (see page 4, lines 42 to 44).

Each of the subsets is then assigned a colour transform from the input colour space to the output colour space according to a selected strategy such as colorimetric reproduction (see page 4, lines 44 to 47). For certain subsets the colour transforms are constrained (see page 4, line 52, to page 5, line 3). The constraints are applied in the intermediate device-independent colour space (see L*a*b* axes in figures 5(A) to 5(D)) and may be a point constraint, a line constraint, a surface constraint or a volume constraint (see page 5, lines 4 to 10). The point constraint might, for instance, be used for constraining the colour reproduction of a single colour such as a skin tone or a corporate trademark colour (see page 5, lines 5 to 7). Even in the case of a point constraint in the device-independent CIELAB colour space (see figure 5(A)), the most constraining case of all in D1, there is still an infinite number of ways of matching this single colour in the destination device-dependent colour space. For instance, the black component of the constrained colour in the CIELAB colour space could be reproduced in the destination colour space with black ink or, instead, with a combination of cyan, magenta and yellow. Thus, even a point constraint in the CIELAB does not constrain the destination device-dependent colour space in such a way as to prevent the addition of selected colorants not specified by the source device-dependent coordinates and/or removal of selected colorants specified by the source device-dependent coordinates.

There is no disclosure in D1 of a search process within a range defined by the constraints, let alone an iterative one.

5.2 Therefore, at least the following features of the method of claim 1 are not disclosed in D1:

(a) the destination **device-dependent** coordinates (24) are constrained by preventing addition of selected colorants not specified by the source device-dependent coordinates and/or removal of selected colorants specified by the source device-dependent coordinates;

(b) a search is performed within the range defined by the constraints; and

(c) the search is an iterative process.

5.3 For the above reasons the subject-matter of claim 1 is novel with respect to the disclosure of D1. The same conclusion applies for similar reasons to claims 10 and 11.

6. *Relevance of D3*

D3 discloses a colour transformation which is of little relevance to the present invention because no constraints (other than the physical limits of the destination device) are involved. D3 was apparently only cited by the examining division as evidence that it was known to use a system comprising a processor and a memory for executing a transformation from one colour space to another colour space.

Since, as already explained, the disclosure of D1 does not jeopardise the novelty of the method of claim 1, the execution of the method of D1 by a system comprising a processor and a memory, as suggested by D3, would not lead to the subject-matter of either claim 10 or claim 11.

7. For the above reasons the board regards the subject-matter of claims 1, 10 and 11 as novel in view of D1 and inventive with respect to the disclosure of D3.

8. *Remittal*

In the decision under appeal prior art documents D2 and D4 to D9 were cited but not used in any kind of reasoning. The board thus considers it appropriate to exercise the power conferred upon it by Article 111(1) EPC 1973 and to remit the case to the department of first instance for further prosecution.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance for further prosecution.

The Registrar: The Chairman:

D. Sauter F. Edlinger