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**Datasheet for the decision
of 10 January 2025**

Case Number: T 0728/22 - 3.5.04

Application Number: 19209113.0

Publication Number: 3654289

IPC: G06T11/00

Language of the proceedings: EN

Title of invention:

METHODS FOR METAL ARTIFACT REDUCTION IN CONE BEAM
RECONSTRUCTION

Applicant:

Carestream Dental LLC

Headword:

Relevant legal provisions:

EPC Art. 83, 111(1)

EPC R. 42(1)(e)

RPBA 2020 Art. 11

Keyword:

Main request - sufficiency of disclosure (yes)

Appeal decision - remittal to the department of first instance
(yes)

Decisions cited:

T 0990/07

Catchword:



Beschwerdekammern
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Case Number: T 0728/22 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 10 January 2025

Appellant: Carestream Dental LLC
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 12 October 2021
refusing European patent application
No. 19209113.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair B. Willems
Members: F. Sanahuja
W. Ungler

Summary of Facts and Submissions

I. The appeal is against the examining division's decision to refuse European patent application No. 19 209 113.0.

II. The application was refused on the following grounds:

(a) The application did not describe in detail at least one way of carrying out the invention defined in claim 1 of the main request (Article 83 EPC together with Rule 42(1)(e) EPC).

(b) The first to third auxiliary requests were not admitted into the proceedings (Rule 137(3) EPC).

III. The applicant ("appellant") filed notice of appeal. With its statement of grounds of appeal, the appellant filed four requests corresponding to the main request and the first to third auxiliary requests which had formed the basis for the decision under appeal.

The appellant provided arguments to support its opinion that the invention defined in claim 1 of all the requests was disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art and that the subject-matter of claim 1 of all the requests was new and involved an inventive step.

IV. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request or, alternatively, on the basis of the claims of one of the first to third auxiliary requests, all the requests having formed the basis for the decision under appeal. It further

requested that the board "*exert[ed] its power to decide that the present application was ready to grant*", "*without the need to refer the application back to the Examining Division*". As a precautionary measure, the appellant requested that oral proceedings in accordance with Article 116 EPC be held.

- V. In a communication under Article 15(1) RPBA, the board expressed the preliminary view that the invention disclosed in claim 1 met the requirements of Article 83 EPC and Rule 42(1)(e) EPC. The board was minded to exercise its discretion under Article 111(1) EPC by remitting the case to the department of first instance for further prosecution.
- VI. With a letter dated 18 November 2024, the appellant withdrew its request for oral proceedings, this withdrawal being subject to the board upholding its preliminary opinion.
- VII. By a communication from the Registry dated 22 November 2024, the appellant was informed that the oral proceedings had been cancelled.
- VIII. Claim 1 of the main request reads as follows:

"A method for reconstruction of a volume radiographic image, the method executed at least in part on a computer and comprising:

a) acquiring a plurality of 2-D projection images of a subject at a plurality of acquisition angles;

b) generating (700) an initial 3-D volume image formed of image voxels according to the acquired 2-D

projection images;

c) forming (702) an initial 3-D reconstruction metal mask from voxels that have attenuation to x-rays that is indicative of metal;

d) removing (706, 707, 800, 802, 806, 808, 810, 814, 816, 818) at least one voxel from the initial 3-D reconstruction metal mask to form a refined 3-D reconstruction metal mask according to a distribution of pixel values that contribute to the corresponding data value for the at least one voxel;

e) modifying (708) one or more 2-D projection images according to the distribution of pixel values; and

f) generating (712, 714) a refined 3-D volume image according to the modified 2-D projection images."

Reasons for the Decision

1. *The invention*

The invention relates to medical and dental imaging and, in particular, to a method for improving image reconstruction by reducing the presence of metal artefacts.

To achieve this aim, the application discloses generating an initial reconstructed three-dimensional (3-D) image from a number of two-dimensional (2-D) projection images captured at different angles (see paragraphs [0031] and [0049] of the description).

A 3-D reconstruction metal mask is generated from voxels of the initial reconstructed 3-D image that appear to be metal by, e.g., applying a threshold to voxel values. These values represent a measure of the X-ray attenuation coefficient of the material at the voxel's position (see paragraphs [0050] and [0051] of the description).

A metal mask for each 2-D projection image is formed using forward projection on the initial reconstructed 3-D image (see paragraph [0053] of the description). For each voxel of the metal mask, contributing pixels are taken into account when classifying the voxel as a metal voxel or an artefact voxel (see paragraphs [0033], [0052], and [0056] to [0062] of the description). Corrected 2-D projection images are generated by modifying pixel values within the 2-D metal mask corresponding to artefact voxels (see paragraph [0053] of the description). The corrected 2-D images are used to generate a second reconstructed 3-D image which retains the metal content but has reduced metal artefacts (see paragraph [0054] of the description).

2. *Main request - sufficiency of disclosure
(Article 83 EPC)*

2.1 Under Article 83 EPC, the European patent application must disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

Rule 42(1)(e) EPC stipulates that the description "*shall describe in detail at least one way of carrying out the invention claimed, using examples where appropriate and referring to the drawings, if any*".

2.2 Under the case law of the boards of appeal, where the application discloses the claimed invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, that application then necessarily discloses at least one way of carrying out the invention claimed in accordance with Rule 42(1)(e) EPC (see Case Law of the Boards of Appeal of the European Patent Office, "Case Law", 10th edition, 2022, II.C.5.3).

Rule 42(1)(e) EPC requires examples of the invention only "where appropriate". This would be the case, for example, when examples are needed to complete an otherwise incomplete teaching or to provide sufficient information for reproducing the invention (see Case Law, II.C.5.3 and T 990/07, point 3 of the Reasons, regarding Rule 27(1)(e) EPC 1973, corresponding to Rule 42(1)(e) EPC).

2.3 The examining division found that, although the application disclosed "the basic principle behind the invention", it did not fulfil the requirements of Article 83 EPC together with Rule 42(1)(e) EPC, because it failed to describe in detail at least one way of carrying out the invention, in particular step d) of claim 1 (see points 6.1, 6.4 and 6.15 of the decision under appeal).

According to the examining division, the person skilled in the art learned from the disclosure of Figure 6 and paragraphs [0046] and [0047] that variations of projection pixel values could help to distinguish metal from artefact voxels. Paragraph [0047] further "hinted" at applying thresholding, averaging or using the dynamic range of projection pixel values (see

points 6.3 and 6.4 of the decision under appeal). However, to assess the issue of compliance with Article 83 EPC, this disclosure could not be considered in isolation, separately from Figure 8 and paragraphs [0057] to [0061], which disclosed the only way for carrying out the invention within the meaning of Rule 42(1)(e) EPC (see point 6.9 of the decision under appeal). To carry out the invention disclosed in Figure 8 and paragraphs [0057] to [0061] of the description, the person skilled in the art would have to rely "either on inventive skill or on try-and-error", contrary to the requirements of Article 83 EPC together with Rule 42(1)(e) (see point 6.15 of the decision under appeal).

2.4 In view of point 2.2 above, it is sufficient for the board to assess whether the application discloses the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC). In such a case, the application would necessarily meet the requirements of Rule 42(1)(e) EPC.

2.5 The board agrees with the appellant that the requirements of Article 83 EPC concern the invention as defined by the claims.

Thus, under Article 83 EPC it needs to be assessed whether the application discloses method step d) of claim 1, i.e. how to remove at least one voxel from the initial 3-D reconstruction metal mask according to a distribution of pixel values that contribute to the corresponding data value for the at least one voxel, in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art.

2.5.1 Paragraph [0042] of the description discloses that *"2-D pixels that are related to image artifacts can be difficult to detect in projection images acquired at some angles (for example, FIG. 4), but clearly visible in projection images acquired at other angles (for example, FIG. 5)"*. It proposes to *"analyze the pattern of data for suspected or 'candidate' metal pixels over a range of successive projection images in order to determine whether or not the data acquired at each angle consistently indicates metal"* and states that *"[w]here there is significant deviation from a pattern that indicates metal, the corresponding pixel can then be flagged as contributing to a metal artifact"*.

The board considers that the person skilled in the art would learn from this passage that significant deviations from a metal pattern of pixel values contributing to a particular voxel are indicative of a metal artefact. A metal artefact is characterised by a high attenuation coefficient (see paragraph [0027] of the description). Determining a metal pattern, e.g. the expected range of pixel values, is straightforward to the person skilled in the art using conventional techniques (see paragraph [0027] of the description and the first paragraph following the citation from the description on page 8 of the statement of grounds of appeal).

2.5.2 Paragraph [0047] of the description proposes analysing the variation of the pixel values of 2-D projection images which correspond to a voxel to distinguish artefact voxels. More specifically, it teaches the reader to *"apply threshold values, averaging or use the dynamic range of pixel values in order to distinguish artifact pixel content from metal pixel content"*.

The board concurs with the appellant that, knowing the expected range of pixel values for a metal pixel and that a deviation from that range is indicative of an artefact, the use of any of the methods disclosed in paragraph [0047] to determine whether a pixel value contributes to an artefact voxel will not present difficulties to the person skilled in the art (see page 8 of the statement of grounds of appeal). Thus, the application discloses, in a manner that is sufficiently clear and complete, how to use the distribution of pixel values contributing to a voxel value to identify and remove artefact voxels from a metal mask.

2.6 In view of the above, the invention defined in claim 1 meets the requirements of Article 83 EPC. It follows that the invention necessarily meets the requirements of Rule 42(1)(e) EPC (see point 2.2 above). Whether the person skilled in the art would have to rely either on inventive skill or on "try-and-error" to implement the example of paragraphs [0056] to [0061] of the description as filed is therefore inconsequential to the discussion of Article 83 EPC.

3. *Remittal (Article 111(1) EPC, Article 11 RPBA)*

3.1 In view of section 2. above, claim 1 of the main request meets the requirements of Article 83 EPC. Consequently, the contested decision cannot be upheld.

3.2 Under Article 111(1) EPC, the board, in deciding upon the appeal, may exercise any power within the competence of the department which was responsible for the decision appealed or remit the case to that department for further prosecution.

According to Article 11 RPBA, a remittal should be the exception, requiring special reasons for it to be ordered.

3.3 The primary object of the appeal proceedings is a judicial review of the appealed decision (Article 12(2) RPBA).

3.3.1 In the present case, the decision of the examining division for the main request was limited to the issue of sufficiency of disclosure (Article 83 EPC).

3.3.2 The appellant stated that the board could decide on the issues of novelty and inventive step without remitting the case to the examining division because the prior art cited in the first instance did not disclose the invention (see sections 5 and 6 of the statement of grounds of appeal).

However, there is no assessment of novelty or inventive step for the subject-matter of the claims of the present main request by the examining division.

If the board were not to remit the case, it would have to assess for the first time whether the subject-matter of claim 1 of the main request was new and involved an inventive step (Articles 54(1) and 56 EPC), which would be contrary to the primary object of appeal proceedings (Article 12(2) RPBA).

3.4 In the board's view, these circumstances represent special reasons within the meaning of Article 11 RPBA for remittal of the case.

Consequently, the board decides to exercise its discretion under Article 111(1) EPC by remitting 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 examining division for further prosecution.

The Registrar:

The Chair:



K. Boelicke

B. Willems

Decision electronically authenticated