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Datasheet for the decision of 11 December 2012

Case Number: T 1407/11 - 3.4.02

Application Number: 06717483.9

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Language of the proceedings: EN

Title of invention:
TWO-DIMENSIONAL SMALL ANGLE X-RAY SCATTERING CAMERA

Applicant:
Osmic, Inc

Headword:

Relevant legal provisions:
EPC Art. 123(2), 54, 56

Keyword:

Catchword:

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Case Number: T 1407/11 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 11 December 2012

Appellant: (Applicant)	Osmic, Inc. 1900 Taylor Road Auburn Hills, MI 48326 (US)
Representative:	Solf, Alexander Patentanwälte Dr. Solf & Zapf Candidplatz 15 81543 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted 22 December 2010 refusing European patent application No. 06717483.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. Klein
Members: F. Maaswinkel
D. Rogers

Summary of Facts and Submissions

I. The appellant lodged an appeal against the decision of the examining division, refusing the European patent application 06 717 483.9. This patent application relates to a two-dimensional x-ray scattering camera and a method of analyzing a sample with a two-dimensional x-ray beam.

According to the decision, the main request then on file did not fulfil the requirements of Art. 123(2) EPC, since in claim 1 the feature relative to the use of a pivot had been deleted which introduced added subject-matter. In addition, the subject-matter of claim 1 lacked novelty over the disclosure in document D5 and, furthermore, did not involve an inventive step over the combined teachings of documents D5 and D8:

D5: J. Appl. Cryst. vol. 33, no.2, pages 869 - 875: Bergmann A. et al: "Improvement of SAXS measurements on Kratky slit systems by Göbel mirrors and imaging-plate detectors";

D8: Powder Diffraction, vol. 17 no. 2 pages 81 - 93: Jiang L. et al: "Basic principle and performance characteristics of multilayer beam conditioning optics".

II. With the letter containing the notice of appeal the appellant requested to set aside the decision and to grant a patent and, furthermore, filed an auxiliary request for oral proceedings. With the subsequent letter containing the grounds of appeal the appellant filed sets of claims according to a main and first to third auxiliary requests.

III. In a communication pursuant to Article 15(1) RPBA accompanying the summons to oral proceedings the board raised objection under Article 84 EPC against the sets of claims of all requests, since it appeared that the independent claims did not include the features that the x-ray source is a microfocusing source and that the two-dimensional optic produces a well-collimated or focused beam, which were regarded as essential features of the invention. It was indicated that a set of claims in which these objections were overcome could possibly form an allowable basis for a patentable invention.

IV. With a letter dated 8 November 2012 and a subsequent letter dated 9 November 2012, both letters received on 9 November 2012, the appellant filed a replacement set of claims and amended description pages for consideration by the board.

V. Thereupon the board cancelled the oral proceedings.

VI. The appellant's request of 8 and 9 November 2012 includes the following application documents:

Claims: 1 to 26, under cover of a letter dated 8 November 2012;
Description: pages 1, 2 and 2a filed under cover of a letter dated 8 November 2012;
page 5, filed under cover of a letter dated 9 November 2012;
pages 3, 4 and 6 to 9 as published under the PCT;
Drawings: sheets 1/5 to 5/5 as published under the PCT.

VII. The wording of independent claim 1 reads as follows:

" A two-dimensional x-ray scattering camera for analyzing a sample comprising:

a microfocusing source which emits x-rays;

a two-dimensional optic which reflects the x-rays in two dimensions to form a beam of X-rays which are converging to a focal point or are parallel and directs the beam to interact with the sample;

a detector which detects x-ray radiation that is scattered by the sample in a parasitic-scattering free zone; and

a pair of collimating blocks positioned between the optic and the detector to collimate the beam, a first surface of one block being aligned with a second surface of the other block to form the parasitic-scattering-free zone ".

The wording of independent claim 19 reads as follows:

" A method of analyzing a sample with a two-dimensional x-ray beam comprising:

emitting x-rays from a microfocusing source;

reflecting the x-rays from the source to the sample in two-dimensions to form a beam of X-rays which are converging to a focal point or are parallel and directs the beam to interact with the sample;

collimating the beam with a pair of collimating blocks positioned between the source and the detector, a first surface of one block being aligned with a second surface of the other block to form a parasitic-scattering free zone; and

detecting x-ray radiation scattered by the sample with a detector in the parasitic-scattering free zone".

Claims 2 to 18 and claims 20 to 26 are dependent claims.

VIII. The appellant's arguments may be summarised as follows:

In the decision it was argued that claim 1 was inadmissibly amended because of the omission of the last feature of the originally filed claim "the blocks being rotatable relative to the beam about a pivot". The criterion whether a feature may be left out of the claim is that the expert immediately can conclude from the original disclosure as a whole that the left-out feature is not necessarily required for solving the problem addressed. In the present case, the object of the invention is to avoid the disadvantages of the prior art Kratky camera by offering a camera having a high resolution and a low Qmin. This is discussed in paragraphs [0003] and [0004]) disclosing that the disadvantage of the known Kratky camera is the smearing effect and that, on the other hand, pinhole cameras have low flux, low resolution and a far too limited Qmin. According to the invention the beam intensity distribution at the detector position can be made independent of the block collimation (which by nature is asymmetric, see [0006]), which is achieved through the combination of block collimation with the use of a two-dimensional multilayer optic and a microfocusing x-ray source. The combination of these elements results in a camera having a low Qmin and a high resolution without smearing effects. According to the original disclosure, the pivotability of the block collimation is not required, rather the invention essentially depends only on the claimed combination, see, for instance, paragraph [0018] describing with respect to the pivotability of the collimation blocks that: "The Qmin range can be easily and continuously changed by

rotating the collimating blocks 22 and 24…". From this passage the expert recognizes that the rotation only serves to *vary* or *adjust* the Qmin, for example in order to change the diameter of the beam so that the camera can be adjusted for analyzing different sample materials. However, for analyzing the same samples, pivoting is not needed. The variation for Qmin is consequently not basically causal for the function of the new camera. Rather the collimating blocks provide themselves for a parasitic-scattering-free zone above the a-b line identified in figures 2 and 3 (paragraph [0019]). The parasitic-scattering-free zone which is of importance for the invention is thus not produced through the rotation of the collimating blocks. The rotation only causes a variability of Qmin, see also paragraph [0021]. Thus the invention does not disclose the imperative use of pivotable collimating blocks, but rather discloses that the collimating blocks *may* be pivotable. The omission of this feature in claim 1 is therefore not objectionable under Art. 123(2) EPC.

With respect to the issue of novelty, the examining division argued that document D5 anticipated the subject-matter of claim 1. The appellant disagrees with this conclusion for claim 1 of the main request then under consideration. In any case present claim 1 is further distinguished over the prior claim in that it defines that the x-ray source is a microfocusing source and that the two-dimensional optic reflects the x-rays in two dimensions to form a beam of x-rays which are converging to a focal point or are parallel. These features are, in combination with an arrangement of collimating blocks, not disclosed in D5 nor in any other prior art document. Therefore the subject-matter of claim 1 on file is novel.

With respect to inventive step, the examining division referred to document D8, Figure 14, arguing that the person skilled in the art would replace the pair of pinholes in this embodiment by a Kratky block collimation system. Document D8, however, is not concerned with improvement of this system at all, but only reports on certain multilayer 1D and 2D x-ray optic systems. The arrangement in Figure 14 relies on the use of two pinholes in the camera. It is not clear how or why these pinholes could be substituted by a single Kratky block collimator, as suggested by the examining division, because it is general knowledge that anisotropic samples can be analyzed by a pinhole camera, but that this only works if a third pinhole is used. Therefore, for analyzing anisotropic samples, one would try to install a further block collimating system or another equivalent collimating system corresponding to a third pinhole in the pinhole camera. This would not lead to the present invention. Also the hint on page 92, left column, 2nd paragraph of D8 "Theoretically, the combination of a microfocusing source and a CMF optic is an ideal system for both flux and resolution" refers to a choice of an x-ray source and a choice of an optic for guaranteeing flux and resolution. This statement in D8 which is not associated with the object of the present invention cannot result in a meaningful combination with the descriptions of other elements of multilayer beam conditioning optics which are dealt with in D8 in another place.

Document D5 deals with the use of a parabolic bent multilayer x-ray mirror in a Kratky slit collimating system which enables the use of an image-plate detector. This camera system is normally used for

isotropic samples (page 869, left hand column, 2nd para) and is not suitable for analyzing anisotropic samples. Since this document addresses the issue of small-angle x-ray scattering and improving the system by a Kratky block collimation system, document D5 may be considered as the closest prior art. Starting from D5, the object of the invention can be recognized as making the Kratky camera capable of analyzing anisotropic samples. For the solution of this object one cannot find any starting points in document D5. The same hold true for document D8, which is not concerned with improvement possibilities at all, but reports only on certain optic systems.

The solution presented in the present invention is to combine a 2D x-ray optic system with a x-ray microfocusing source and only one block collimator. Experts who obtained knowledge of the invention could not believe after publication of the invention that only one block collimating system is present. They assumed that the collimating system in the Kratky camera was very probably exchanged or altered. It was surprising to them that only the use of a 2D optic made it possible to analyze anisotropic samples, because the pinhole camera with which anisotropic samples can be analyzed, functions with a 2D optic as well as with a point source. Thus it was not recognizable that the 2D optic in the Kratky camera leads to the capability of analyzing anisotropic samples. Consequently the applicant is credited with the solution to the problem of making a Kratky camera, which is designed much more compact than a pinhole camera, capable of analyzing anisotropic samples. An indication for an inventive achievement is that the pinhole camera, the Kratky camera and the 2D optic systems existed many years before the priority date of the present patent

application. The inventive combination however was up to now not considered by experts, because success was not recognizable. Thus it can be ascertained that the subject-matter of the patent application involves an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Article 123(2) EPC provides that a European patent application or European Patent may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed. Conversely, an amended version of the application or patent documents can only offend against Article 123(2) EPC if it comprises subject-matter - in the sense of technical information - which was not present in the version as originally filed.

A valid objection under Article 123(2) should therefore be based on the identification of relevant technical information in the amended documents which is lacking in the originally filed version.

2.2 In the decision under appeal an objection under Article 123(2) EPC had been raised because the feature from the independent claims as originally filed "…the blocks being rotatable relative to the beam" had been deleted from these claims.

2.3 According to a first argument of the examining division, such deletion introduced added subject-matter into the application, since new embodiments were thus covered by these independent claims.

This argument is clearly incorrect. Extension of the scope of protection is prohibited only under Article 123(3) EPC, in respect of amendments of granted claims of a European patent.

2.4 The examining division also ruled that the original patent application did not provide a basis for elimination of the feature at issue from the claim, because the sentence in paragraph [0018] of the published patent application "The Qmin-range can be easily and continuously changed by rotating the collimating blocks 22 and 24 about, for example, a pivot 38…" did not imply that, "for example", other embodiments for changing the Qmin-range were possible, but only that a rotation could be carried out about a pivot other than pivot 38 (shown in Figures 2 and 3). In support of this argument the examining division also referred to paragraph [0021].

2.5 In the grounds of appeal the appellant has argued that the object addressed in the patent application is to overcome the disadvantages of prior art Kratky cameras by offering a camera having a high resolution and low Qmin, and that this object is achieved by combining block collimation with a two-dimensional optic and a microfocusing x-ray source. According to the appellant, the pivoting of the collimation block allows for adjustment of Qmin but this is not essential for the function of the camera.

2.6 The board in this respect notes that paragraph [0018] of the present application, as originally filed, states: "The combination of the microfocusing source 30 and the optic 32 produces a well defined two-dimensional beam 36." and "The two-dimensional beam 36 with the collimating blocks 22 and 24 provides a camera with high resolution and low Qmin. The camera 20 has exceptional resolution (i.e. good $\Delta d/d$) and angular range (Qmin from 0.0003 $Å^{-1}$ to wide angles)". Combining high resolution and low Qmin is precisely the aim of the invention as explicitly set out in paragraph [0004] as filed. The pivoting of the collimator blocks is not required for obtaining the desired performance. Rather this pivoting is only carried out for adjustment of the Qmin-range, as is also explained in the subsequent passage of paragraph [0018] "The Qmin-range can be easily and continuously changed by rotating the collimating blocks 22 and 24 about, for example, a pivot 38…". Incidentally, adjustment of the camera resolution by changing the tilt of the collimator block is - per se -a feature known in the art, see document D5, page 872, right hand column, 2nd paragraph and Table 1.

2.7 Thus the feature relating to the pivotability of the collimation block is objectively inessential to the operation of the disclosed invention, and was not been presented as being essential in the originally filed description. Therefore, the board cannot see which additional technical information the skilled person is confronted with by the removal of this feature from the original independent claims.

2.8 Therefore the board is satisfied that the set of claims of appellant's request does not contain subject-matter which extends beyond the patent application as

originally filed. Thus these claims satisfy the requirements of Article 123(2) EPC

2.9 By inclusion of the features in the independent claims that the x-ray source is a microfocusing source and that the two-dimensional optic produces a well-collimated or focused beam, these claims also adequately define the essential features of the disclosed invention and thus meet the requirements of clarity, conciseness and support by the description of Article 84 EPC.

3. *Patentability*

3.1 *Novelty*

3.1.1 In the decision an objection of lack of novelty with respect to the embodiment in Figure 3 of document D5 against claim 1 then on file had been raised. With reference to this Figure a two-dimensional x-ray scattering camera is disclosed comprising:
- an x-ray source (not shown in Figure, however, from page 869, left hand column, last paragraph; page 870, left hand column, line 16 and line 26; page 870, right hand column, line 5; and page 871, left hand column, see footnote "1", it follows that the light source for SAXS-Kratky arrangements is a line-shaped x-ray source);
- a two-dimensional optic (parabolically bent Göbel mirror, collimating along one axis, see Figure 1 and section 2);
- a detector; and
- a pair of collimating blocks (Figure 3, block collimation system B_1 and B_2).

3.1.2 Claim 1 (*and similarly method claim 19*) furthermore defines:
- the x-ray source is a microfocusing source (i.e. a small-size source);
- a two-dimensional optic which reflects the x-rays in two dimensions to form a beam of X-rays which are converging to a focal point or are parallel and directs the beam to interact with the sample.

3.1.3 These features distinguish the subject-matter of the independent claims from the arrangement shown in document D5. Furthermore, the features of these claims are also not shown in combination in the other available documents. Therefore the subject-matter of these claims is novel.

3.2 *Inventive step*

3.2.1 In its analysis of the issue of inventive step the examining division choose the arrangement in Figure 14 of document D8 as a starting point. Although the division recognised that this arrangement shows a diffractometer it argued that the term "x-ray scattering camera" is so broad that it also encompassed the diffractometer shown in this Figure.

3.2.2 The board does not question that the arrangement in D8, Figure 14, including an x-ray source in point projection, a multilayer imaging mirror and a detector, may, in a general sense, be considered as an "x-ray scattering camera". However, as correctly identified by the examining division with reference to page 89, right hand column, lines 4 to 7, the arrangement in Figure 14 relates to a "diffractometer", and more in particular to a Laue transmission diffractometer. To the board's understanding a typical application area of such

devices is the investigation of crystal materials (see page 89, right hand column, line 14) in which case coherent scattering under larger angles occurs. The board notices that in the subsequent line on page 89 also "small angle scattering" is referred to, but document D8 does not provide any further details in this respect. Rather, as pointed out by the appellant, the emphasis of the disclosure in document D8 is on x-ray multilayer 1D and 2D optics.

3.2.3 On the other hand document D5 relates to small angle x-ray scattering and an arrangement comprising a block collimation system of the type referred to in paragraph [0003] of the published patent application. For this reason the board considers the disclosure in this document as the more appropriate prior art for a starting point for the discussion of inventive step.

3.2.4 As noted in point 3.1.2 supra, the subject-matter of the independent claims differs from the known prior art arrangement of document D5 in the choice of the type of x-ray source, which in the patent application is a microfocusing device, whereas the prior art discloses a line source; and by the optics system, which according to the independent claims collimates or focuses the x-ray beam in two dimensions, whereas the prior art system only collimates along a single axis (i.e. in one dimension).

3.2.5 According to the appellant, the claimed arrangement and method allow the investigation of anisotropic samples, whereas the prior art one-dimensional system (x-ray line source; optics only collimating along one axis) only allow investigation of isotropic samples (see D5, page 869, left hand column, 2nd paragraph of the Section "Introduction"). Furthermore the problem of

"smearing" is reduced (see paragraph [0016] of the published patent application; see also document D5, page 871, left hand column, last para).

3.2.6 In the opinion of the board, document D5 itself does not give any hints to modify the arrangement addressed in Figure 3 along the lines proposed in the patent application and defined in the independent claims, since the gist of Kratky cameras resides in the use of a line-shaped x-ray source, to be combined with appropriate slits (see Figure 2 of D5) or 1D-collimating optics (Figure 3 of D5) and in particular with the block collimation system, which is characteristic for the Kratky arrangement.

3.2.7 In the final paragraph of the discussion of inventive step (page 8, 3d paragraph of the decision), it was suggested that the skilled person, starting from document D5 and wishing to improve flux and resolution of the camera described herein would find a solution in document D8, which discloses on page 92, left hand column, 2nd paragraph "Theoretically, the combination of a microfocusing source and a CMF optic is an ideal system for both flux and resolution". Here the CMF optic is shown in Figure 15 of document D8 ("Confocal Max-Flux^{TM} "). However, such a drastic modification of the 1-dimensional x-ray source and the optics employed in the arrangement of document D5 by the 2-dimensional components referred to in the above passage of document D8 presupposes that the skilled person would have readily understood that such a substitution would be advantageous. For such a teaching neither document D5, nor D8 gives any clue: rather, since the block collimation system of the Kratky camera only collimates along one axis and is, by its very nature, one-dimensional and also the further components (line-

shaped x-ray source; beam shaping elements) work along one axis, it is not obvious why a skilled person, without hindsight knowledge of the invention, would have modified the 1-dimensional arrangement shown in document D5 in the manner as defined in the independent claims.

3.2.8 As set out before the board does not consider document D8, in particular the arrangement in Figure 14, as a proper starting point for the discussion of inventive step. The examining division had argued that the skilled person, working with this arrangement, would have noticed the problem of parasitic scattering caused by the pinhole slits and that for overcoming this problem, he would have considered replacing the pair of pinholes by a Kratky block collimation system, for instance as shown in Figure 3 of document D5. However, in contrast to the arrangement in Figure 14 of document D8, which is a two-dimensional resolving system, the block collimation system shown in document D5 has only a one-dimensional function. Therefore, a replacement of the pinholes in the system in Figure 14 of document D8 would imply using two consecutive pairs of collimation blocks. To the board the implications of such a system are not evident at all, because it is not clear whether such consecutive pairs might again introduce parasitic scattering. In any case such a system would not have the technical features of the independent claims which define a (single) pair of collimating blocks "…to form the parasitic scattering-free zone".

3.2.9 Therefore documents D5 and D8 do not reveal, nor hint at, the steps defined in the independent claims, nor do the further documents cited in the International Search Report. It is concluded that the subject-matter of

claims 1 and 19 involves an inventive step and defines patentable subject-matter

3.2.10 Claims 2 to 18 and claims 20 to 26 are dependent claims and are equally allowable.

4. For the above reasons, the board finds that the application in accordance with appellant's Request meets the requirements of the EPC and that a patent can be granted on the basis thereof.

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 with the order to grant a patent based on the following documents:

Claims: 1 to 26, under cover of a letter dated 8 November 2012;
Description: pages 1, 2 and 2a filed under cover of a letter dated 8 November 2012;
page 5, filed under cover of a letter dated 9 November 2012;
pages 3, 4 and 6 to 9 as published under the PCT;
Drawings: sheets 1/5 to 5/5 as published under the PCT.

The Registrar: The Chairman:

M. Kiehl A. Klein

Decision electronically authenticated