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Datasheet for the decision of 18 February 2011

Case Number: T 0079/09 - 3.4.02

Application Number: 99121512.0

Publication Number: 1096295

IPC: G02B 27/58

Language of the proceedings: EN

Title of invention:
Apparatus and method for providing optical sensors with improved resolution

Patentee:
ITT Manufacturing Enterprises, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 84, 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Remittal for further prosecution"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0079/09 **-** 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 18 February 2011

Appellant: ITT Manufacturing Enterprises, Inc.
1105 North Market Street
Suite 1217
Wilmington, Delaware 19801 (US)

Representative: Fischer, Uwe
Patentanwalt
Moritzstraße 22
D-13597 Berlin (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 25 July 2008 refusing European patent application No. 99121512.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division, refusing the European patent application 9911512.0. This patent application is related to an optical system having a numerical aperture and a detector array for providing a high resolution.

II. In its decision the examining division objected under Article 84 EPC that the wavelength range in which the optical system of independent claim 1 was used was indeterminate and that therefore the size of the central lobe of the diffraction pattern resulting from the aperture was not limited. Hence it was not possible to determine whether or not the detector array recited in claim 1 was such that at least five pixels would fit within the central lobe of diffraction.

A further objection was raised under Article 123(2) EPC against the expression "longest wavelength of the passing light" which did not have a basis in the original patent application.

As a consequence of the above lack of clarity, and because no source of radiation having a particular wavelength was defined as part of the claimed system, for the issue of patentability/novelty any wavelength value could be considered as the "longest wavelength of the passing light". Therefore any prior art optical system comprising a lens and a pixelated detector anticipated the subject-matter of claim 1, for instance the system disclosed in document D1 (US-A-4 549 204).

III. With the statement setting out the grounds of appeal the appellant filed a new set of claims to be considered by the board. According to the appellant the new claims were not objectionable under Art. 123(2) EPC since the objected expression relating to "longest wavelength" had been removed. Furthermore, with respect to the issue of the range of wavelengths which, according to the decision under appeal, was indeterminate, the appellant argued that in the claimed optical system the central lobe of diffraction was determined by the numerical aperture of the lens. Consequently, a designer knowing a desired cut-off frequency would use an appropriate numerical aperture for the lens. Having fixed the numerical aperture, based on the cut-off frequency, he would design the detector in order that a central lobe of diffraction pattern formed by the passing light in the lens would be covered by at least five detectors. By virtue of this arrangement the capturing of the sampled image to include all spatial frequencies up to the cut-off frequency was rendered possible. With respect to the cited prior art document D1, this document did not suggest including at least five detectors within a central lobe of diffraction.

IV. In a Communication annexed to the summons to oral proceedings the board raised formal objections against the set of claims (Article 84 EPC; Article 123(2) EPC). With respect to novelty the board observed that document D1 did not disclose an optical system with an detector array in which at least five detectors were arranged within a central lobe of diffraction and that the subject-matter of claim 1 was therefore novel by virtue of this feature. However, it appeared that

sampling of an optical image with a number of detectors greater than only two pixels within the diffraction lobe was well known in the art. In order to illustrate this the board of its own motion (Article 111(1) and 114(1) EPC) made reference in particular to the following document:

D2: SPIE Conference on Passive Millimeter-Wave Imaging Technology II, Orlando, Florida, April 1998, SPIE Vol. 3378, pages 134 - 147, W.R. Reynolds et al: "Super-resolved Imaging Sensors With Field of View Preservation".

To the board's understanding, this document disclosed oversampling of the image plane in order to recover the spatial information of bandwidth-limited images. In document D2 it was also explained on page 136, Section "Image Plane Sampling" that the need for undersampling an image was not physical, but was driven by practical and financial factors, since the cost of a focal-plane array increased with its size. It therefore appeared that the skilled person working in the field of high-resolution optical imaging (including infrared astronomical imaging and confocal microscopy) was well aware before the priority date of the patent application that frequencies up to the cut-off frequency might be recovered by using an oversampled image, and that the only trade-offs would be economical.

V. With a response of 18 January 2011 the appellant filed new sets of claims according to an amended Main Request and Auxiliary Requests 1 and 2. With respect to the disclosure in document D2 the appellant argued that this document did not disclose sampling an image with

at least five pixels across the central lobe of diffraction and capturing the image with all the spatial frequencies up to the cut-off frequency.

VI. In a subsequent phone conversation on 20 January 2011 between the rapporteur and the appellant's representative the rapporteur made reference in particular to the further document:

D4: SPIE Vol. 1946 Infrared Detectors and Instrumentation (1993), pp. 238 – 248, G.J. Stacey et al: "KWIC: A Widefield Mid-Infrared Array Camera/ Spectrometer for the KAO".

Recalling the reference to infrared astronomical imaging in the prior Communication the rapporteur explained that this document D4 disclosed an optical system designed for use at a wavelength λ of 44 µm. The diffraction limit of the system at this wavelength was $1.22\lambda/D = 12.11"$. According to page 245, Section 3.5.2, the pixel size of the array was 3". Hence the sampling was carried out with >4 pixels for the central diffraction lobe. Therefore, since it was known to design an optical system with >4 pixels covering the diffraction lobe, it would be discussed at the oral proceedings what the technical problem and the contribution to inventive step of the claimed subject-matter was, in particular since it was known from D2 that the only reason for undersampling was merely economical trade-offs.

VII. Oral proceedings took place on 18 February 2011. In the course of the discussions in the oral proceedings the

appellant filed a new main request. The board gave its decision at the end of the oral proceedings.

VIII. Independent claim 1 of the main request filed at the oral proceedings reads as follows:

" An optical system (10) having a numerical aperture and a detector array (28, 30) for capturing a single image of a scene wherein:
the optical system passes light from the scene to the detector array, the light including all spatial frequencies up to a cut-off frequency, the cut-off frequency determined by the numerical aperture

$$f_c = \frac{2.NA}{\lambda}$$

where,
fc is the cut-off frequency,
NA is the numerical aperture,
λ = is the wavelength of the passing light,
wherein said detector array (28, 30) has individual detectors (14) sized to fit at least five detectors within a central lobe of diffraction (18) formed by the cut-off frequency and the detector array (28, 30) capturing the single image of a scene, the single image being sampled, wherein said detector array has from six to nine detectors spread across the central lobe of diffraction
wherein the sampled image captures all the spatial frequencies up to the cut-off frequency,
wherein the optical system is diffraction limited,
wherein said detectors are arranged in a configuration which is a multi-linear array, and

wherein said multi-linear array includes a different colour filter disposed over each individual linear array ".

Claims 2 to 17 are dependent claims.

IX. The arguments of the appellant can be summarised as follows:

Claim 1 has been amended to include the further feature that the detector array has from six to nine detectors spread across the central lobe of diffraction. This ensures sampling to recover all the spatial frequencies, up to the cut-off frequency. In addition the claim includes the features of original claims 10 – 12 which, according to the examiner in the Communications of 15 July 2004 (point 3.4) and 12 August 2005 (point 4) appeared admissible. Accordingly, since the board has indicated that the present set of claims fulfils the formal requirements of the EPC, the claims of the Main Request should also be patentable.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The appellant has deleted the objected expression relating to the "longest wavelength". Therefore the former objection under Article 123(2) EPC no longer applies.

2.2 Furthermore, the board does not have any objections under Article 84 EPC. In particular the board considers that the optical system defined in claim 1 is designed for a dedicated range of wavelengths: this follows from the concept of numerical aperture, which for any particular wavelength provides a corresponding central lobe of diffraction; and from the selection of the detector array, which as a matter of course must be responsive to this wavelength and which, according to the claim, is designed to capture the central lobe of diffraction with six to nine detectors across this spot. The board thus has no doubt that the skilled person would readily recognise whether a given optical system would meet the limitations of claim 1 or not. Therefore the set of claims is formally allowable.

3. *Further prosecution*

3.1 In the decision under appeal the main grounds for refusing the patent application were formal objections under Article 84 and 123(2) EPC, the objection to lack of novelty against document D1 mainly being based on the assessment by the examining division that the wavelength of the optical system was indeterminate or arbitrary. As set out above, it is the board's view that this is not the case. Thus, the grounds for the refusal under Articles 84 and 123(2) EPC have been overcome by the claims of the Main Request and the decision under appeal must be set aside.

3.2 During the first instance proceedings, the further documents D2 and D4 mentioned by the board had not been before the examining division. Remittal of the case to the department of first instance for further

prosecution is required in order for the compliance of the claims of the Main Request with the provisions of the EPC, other than Articles 123(2) and 84 EPC, to be examined in the light of these documents, and, if necessary, to adapt the description to these claims.

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 upon the basis of claims 1 - 17 of the Main Request submitted during the oral proceedings.

The Registrar: The Chairman:

M. Kiehl A. G. Klein