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Datasheet for the decision of 11 February 2009

Case Number: T 1508/07 - 3.2.02

Application Number: 97954229.7

Publication Number: 0969760

IPC: A61B 3/14

Language of the proceedings: EN

Title of invention:
Apparatus for improving vision and resolution of retinal images

Applicant:
UNIVERSITY OF ROCHESTER

Opponent:
-

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 52(1), 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1508/07 - 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 11 February 2009

Appellant: UNIVERSITY OF ROCHESTER
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 21 March 2007 refusing European application No. 97954229.7 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Noel
Members: S. Chowdhury
A. Pignatelli

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 21 March 2007 to refuse European patent application No. 97 954 229.7.

The application was refused on the grounds that the subject-matter of claims 1 and 9 of the main request and the subject-matter of claims 1 and 8 of the auxiliary request then on file lacked an inventive step having regard to:

D3: J. LIANG ET AL.:"Objective measurement of wave aberrations of the human eye with the use of a Hartmann-Shack wave-front sensor", JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, vol. 11, no. 7, July 1994, NEW YORK (US), pages 1949-1957 and

D7: "Computing high order wave aberration coefficients from variations of best focus for small artificial pupils", Howard C. Howland and Jan Buettner, Vision Res., Vol. 29, No. 8, pp. 979-983, 1989.

II. On 22 May 2007 the appellant lodged an appeal against the decision and paid the prescribed fee on the following day. On 30 July 2007 a statement of grounds of appeal was filed.

The appellant requests that the decision under appeal be set aside and a patent be granted on the basis of the claims 1 to 11 of the main request, filed on 20 August 2002 and refused by the examining division.

III. Independent claims 1 and 9 of the main request read as follows:

"1. An apparatus for determining higher-order wave aberrations of the living eye, said apparatus including means (102) for producing a point source of light on a retina of the eye; means (148) including a lenslet array for receiving the point source light reflected from the retina and for forming an aerial image of the retinal point source on a detector; a camera (146) located adjacent to said lenslet array for viewing said image of the retinal point source formed by said lenslet array; and a digital data processor (150) connected to receive output signals from said camera and for converting said output signals to digital signals representative of said retinal point source images, characterized in that: said lenslet array is configured to provide resolution for at least fifth order aberrations; and further, said digital data processor determines the wave aberrations of said eye so as to include at least fifth order modes, using said representative digital signals.

9. A method for determining higher-order wave aberrations of the living eye using a wavefront sensor which receives a reflected retinal point source image of the eye, comprising the steps of: producing a point source of light on the retina; providing a lenslet array (148) for receiving the point source light reflected from the retina and for forming an aerial image of the retinal point source on a detector; detecting the aerial image of the retinal point source and generating a signal representative of the aerial image converting said signal to a digital signal,

characterized by providing a lenslet array resolution for at least fifth order aberrations, and further, determining the wave aberrations of said eye so as to include at least fifth order modes, using said representative digital signal."

Claims 2 to 8, 10, and 11 are dependent claims.

Reasons for the Decision

1. The appeal is admissible.

2. *Inventive step*

2.1 The examining division and the appellant are agreed that D3 constitutes the closest prior art and the difference between the apparatus claimed in claim 1 and D3 is defined in the characterising part of claim 1, which is:

"said lenslet array is configured to provide resolution for at least fifth order aberrations; and further, said digital data processor determines the wave aberrations of said eye so as to include at least fifth order modes, using said representative digital signals".

The Board concurs with this analysis.

2.2 D3 describes the use of Zernike polynomials and indicates that these were chosen only up to the fourth degree because they contain all the primary aberrations and they are usually the compensation modes of active mirrors in adaptive optics. According to the examining

division it would be obvious to the person skilled in the art to extend the teaching of D3 in view of D7, to determine higher-order aberrations, i.e. at least fifth-order aberrations, and that the apparatus of claim 1 and the method of claim 9 lacks an inventive step, accordingly.

2.3 To the Board, however, the teaching of D7 is not so clear cut. The object of the research note D7 is to apply a measurement technique used by Van den Brink to relate a variation in focus to the wave aberrations of the eye. Tables 1 (b) and 2 (b) show a 15-term regression analysis of a polynomial fit of aberration data that were used to compare to the 6-term fit provided by Van den Brink.

It is noted that the highest order term in the 15-term analysis is a fourth-order aberration relating to spherical aberration, and both fourth-order terms in Tables 1 (b) and 2 (b) are said to be statistically insignificant. In looking at discrepancies between Van den Brink’s data and the fourth-order terms measured in the study, the authors of D7 speculated on the value of gathering more wavefront data with a method that could resolve up to seventh-order Taylor Series terms. D7 is thus narrowly directed to obtaining a better mathematical fit between the Taylor polynomial and the picture data from Van den Brink by providing more terms in the polynomial. D7 does not clearly suggest that higher- order aberrations would have an impact on vision quality.

2.4 That D7 did not suggest to the authors of D3 that higher-order aberrations would have an impact on vision

quality is supported by D3 itself, which was published some 5 years after D7. D3 bases aberration measurements on the analysis on only up to the fourth order Zernike polynomials because it was thought that all the primary aberrations of the eye were represented by fourth-order and lower-order modes (D3: page 1956, column 2, penultimate paragraph).

2.5 Therefore, it is not clear to the Board that D7 does indeed suggest to the person skilled in the art that that the measurement of higher-order aberrations would have an impact on vision quality, and therefore that the apparatus and method of D3 could be improved by the teaching of D7.

2.6 Therefore, the apparatus of claim 1 and the method of claim 9 involve an inventive step.

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 the first instance with the order to grant a patent on the basis of the following application documents:

   – claims 1 to 11 of the main request filed on 20 August 2002.

   – Description pages 2 and 4 to 12 as published.

   – Description pages 1, 3, 3a and 3b filed on 20 August 2002.

   – Figures 1 to 4 as published.

The Registrar The Chairman

D. Sauter M. Noel