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Case Number: T 1473/11 - 3.4.02

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Title of invention:
SPECTRAL IMAGING CAMERA AND APPLICATIONS

Applicants:
Arieli, Yoel
Weitzman, Yosef

Headword:

Relevant legal provisions:
EPC R. 137(5)
EPC Art. 123(2)

Keyword:

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Catchword:

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Case Number: T 1473/11 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 11 May 2016

Appellants: (Applicants)	Arieli, Yoel 14b Rabbi Meir Street 93185 Jerusalem (IL) Weitzman, Yosef 42 Tvuot Haaretz Street 69546 Tel-Aviv (IL)
Representative:	Appleyard Lees IP LLP 15 Clare Road Halifax HX1 2HY (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 8 February 2011 refusing European patent application No. 06728193.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairwoman	T. Karamanli
Members:	F. Maaswinkel
	F. J. Narganes-Quijano

Summary of Facts and Submissions

I. European patent application No. 06728193.1 relating to a spectral domain imaging camera was refused in the decision of the examining division posted on 8 February 2011. In this decision, reference was made to prior examining division communications dated 8 April 2010 and 10 November 2010 and to the applicants' letter dated and received on 21 January 2011 in which a decision according to the state of the file had been requested.

By the communication of 10 November 2010, the examining division introduced document D6 (WO 02/27285) and raised objections of lack of novelty and inventive step against claim 1 of the set of claims 1 to 18 filed with the letter of 17 August 2010.

II. The applicants (appellants) lodged an appeal against this decision on 7 April 2011. The fee for appeal was paid on the same day. In a letter of 17 June 2011 setting out the grounds of appeal, the appellants requested that a patent be granted on the basis of the set of claims 1 to 18 filed with the letter of 17 August 2010. Alternatively, oral proceedings were requested.

The documents of this request are:

Claims:
1 to 18, filed with the letter of 17 August 2010;
Description:
pages 4 - 14 as originally filed;
pages 1 - 3, and 16 filed with the letter of 28 September 2009;

page 15 filed with the letter of 23 March 2010;
Drawings:
Sheets 1/7 - 7/7 as originally filed.

Claim 1 of this request reads as follows:

"An apparatus (10) for analyzing optical properties of an object (2), the apparatus comprising:
an optical system (8, 20)for collecting a light beam emanating from each point of the object (2) wherein each light beam is composed of multiple spectral bands, and wherein each spectral band has a respective amplitude, phase and polarization;

a spectral imaging camera comprising an array of detectors (4, 22, 34, 42), each detector corresponding to each point of the object, wherein the spectral imaging camera is arranged to receive the collected light;

a modulator for applying a modification to change a physical property of the optical system or spectral imaging camera; and

a processing unit for obtaining an output indicating said object's optical properties at each point;

characterised in that:

the spectral imaging camera measures the overall intensity of each light beam as the sum of the specific intensities of the spectral bands contained in the beam at the same time and the processing unit calculates the intensity of each spectral band using a set of matrices and a detected change in overall intensity after the modification has been applied."

In the grounds of appeal the appellants presented arguments in support of the patentability of the claimed subject-matter with respect to the documents

referred to by the examining division in its communications of 8 April 2010 and 10 November 2010. Inter alia, they submitted that the claims on file reflected the disclosure at pages 11 to 14 of the published patent application and they referred to the "page 11 aspect" and to the passage on page 14, lines 20 and 21, according to which "higher optical throughput can be obtained by using most of the optical signal while changing only some specific bands each time".

III. In a communication pursuant to Article 15(1) RPBA, accompanying the summons to oral proceedings dispatched on 28 January 2016, the board gave a preliminary assessment of the appellant's case on appeal. In this communication the issue of the patentability of all of claims 1 to 18 of the sole request then on file was addressed.
With respect to independent claim 1, the board expressed doubts as to whether the effect the appellants said occurred was unambiguously defined in claim 1 in terms of technical features, or necessarily implied by the claimed subject-matter. In the board's view, even without making explicit reference to a particular prior-art publication, it appeared that conventional astronomical spectrographs including a slit, collimating optics, a grating, camera optics, and a 2d-CCD-detector with the corresponding processing unit comprised all the features of claim 1.

In addition, the board introduced the following document into the proceedings:

D7 : N. Douglas and H. Butcher "Heterodyned Holographic Spectroscopy and the ESO VLT", Very Large Telescopes and their Instrumentation, ESO Conference and Workshop

Proceedings, Garching, March 21-24, 1988, edited by Marie-Helen Ulrich, pages 1223-1233,

and objected that the subject-matter of claim 1 lacked novelty over the disclosure in document D7.

IV. With a letter dated 13 April 2016 and filed on 14 April 2016 the appellants submitted a set of claims 1 to 18 according to a new Main Request and a further set of claims 1 to 18 according to a new First Auxiliary Request. The appellants requested that the decision under appeal be set aside and that the patent application be considered on the merits of the new requests. In this letter the appellants discussed the patentability of the subject-matter of the claims according to the new Main and First Auxiliary Requests vis-a-vis the disclosure of document D7.

V. In this letter the appellants referred to the following passages in the description as filed for the basis of claim 1 of the new Main Request (emphasis by the board):

"New claim 1 has been amended to define "an optical system (8, 20) for collecting a plurality of wavefronts, the plurality of wavefronts emanating from respective points of the object (2), wherein each of the plurality of wavefronts is composed of multiple spectral bands". Basis for this amendment is found in the description as filed, particularly in the final paragraph of page 5. We note that according to the indicated passage, a "wavefront originated from each point of the object" and that, thus, a plurality of wavefronts originate from the object 2.

New claim 1 has been amended further to define that "the modulator is disposed along an optical path that passes between the object and the spectral imaging camera". Basis for this amendment is found in the final paragraph of page 5 of the description as filed, where a modulator 6 is described that is disposed along the optical path passing between the object 2 and the camera 4.

New claim 1 has been amended further to define that "the modulator is configured to individually modulate each of the wavefronts emanating from the respective points". Basis for this amendment is found in the final paragraph of page 5 of the description as filed, where the modulation of an individual wavefront is described.

New claim 1 has been amended further to define that the modulator is "causing one or more spectral bands within a first portion of the wavefront that travels along the optical path to interfere with one or more spectral bands within a second portion of the wavefront that travels along the optical path". Basis for this amendment is found in the final paragraph of page 5, and the second paragraph of page 6 of the description as filed, where the interference of a first portion of a wavefront with a second portion of the wavefront is described. We note particularly that there the special case of destructive interference (wavefront delayed by half its wavelength) is discussed, and that also the general case of non-destructive interference (wavefront delayed by other than half its wavelength) is discussed. Further basis is found in the third paragraph of page 6 of the description as filed, where it is stated that the considered optical scheme maintains a single optical path.

New claim 1 has been amended further to define the modulator to be "applying an optical path difference to the first portion of the wavefront relative to the second portion of the wavefront that is equal for all of the spectral bands of the first portion of the wavefront". Basis for this amendment is found in page 5, final paragraph, to page 6, first paragraph, of the description as filed. There, "delaying part of the wavefront [...] relative to the other part" is described. We note particularly that while the Relative Phase Delay $\delta\Phi$ depends on the particular optical properties of the spectral bands of a wavefront, the Optical Path Difference Δ is independent of the optical properties and therefore equal for all spectral bands."

Claim 1 of the new Main Request reads as follows:

"An apparatus (10) for analyzing optical properties of an object (2), the apparatus comprising:

an optical system (8, 20) for collecting a plurality of wavefronts, the plurality of wavefronts emanating from respective points of the object (2), wherein each of the plurality of wavefronts is composed of multiple spectral bands, and wherein each spectral band has a respective amplitude, phase and polarization;

a spectral imaging camera comprising an array of detectors (4, 22, 34, 42), each detector corresponding to the respective points of the object, wherein the spectral imaging camera is arranged to receive the plurality of wavefronts;

a modulator for applying a modification to change a physical property of the optical system or spectral imaging camera, wherein the modulator is disposed along an optical path that passes between the object and the spectral imaging camera; and

a processing unit for obtaining an output indicating said object's optical properties at each point;

characterised in that:

the modulator is configured to individually modulate each of the wavefronts emanating from the respective points by, individually, for each of the wavefronts:

causing one or more spectral bands within a first portion of the wavefront that travels along the optical path to interfere with one or more spectral bands within a second portion of the wavefront that travels along the optical path,

by applying an optical path difference to the first portion of the wavefront relative to the second portion of the wavefront that is equal for all of the spectral bands of the first portion of the wavefront; and

the spectral imaging camera measures the overall intensity of each wavefront as the sum of the specific intensities of the spectral bands contained in the beam at the same time and the processing unit calculates the intensity of each spectral band using a set of matrices and a detected change in overall intensity after the modification has been applied".

VI. With respect to claim 1 of the First Auxiliary Request the following passages in the description as filed were indicated as the basis for disclosure (emphasis by the board):

"The First Auxiliary Request is based on the Main Request, and the amendments have been indicated with respect to the Main Request.

New claim 1 has been amended to define "an apparatus (10) for use with a light source (12) configured to

direct spatially incoherent light having a plurality of wavelengths toward an object (2) through a lens (26) with high chromatic aberration and analyzing the optical properties of the object". Basis for this amendment is found in the second paragraph of page 8 of the description as filed. There, the technical effect of having several focuses 30 for each wavelength is discussed. The particular example discussed there relates to an array of white (point) light sources 12 which is imaged through a lens 26 with high chromatic aberration. We submit, however, that the skilled person will understand that the described technical effect of having several focuses 30 for each wavelength can be achieved through many alternatives which are immediately obvious to the skilled person. Instead of a source of white light, any light source producing light with a plurality of wavelengths will be suitable. Further, instead of an array of light sources, several focuses 30 can be achieved, for example, using a single light source and a grating. A further alternative is using an extended light source. In general, multiple focuses may be achieved using spatially incoherent illumination. Depending on the particular laboratory set-up, any one or all of these immediately obvious alternatives may be suitable. It is therefore submitted that the skilled person will understand that the described technical effect is achieved by any light source producing light a) having several wavelengths and b) which is spatially incoherent.

New claim 1 has been amended further to include that "the plurality of wavefronts emanating from respective points (2), as a result of the spatially incoherent light being directed toward the object". Basis for this amendment is found in the second paragraph of page 8, where it is stated that the light from the light source

12 is imaged onto the object 28, and the reflected light passed to a detector."

Claim 1 of the First Auxiliary Request reads as follows:

"An apparatus (10) for use with a light source (12) configured to direct spatially incoherent light having a plurality of wavelengths toward an object (2) through a lens (26) with high chromatic aberration and analyzing optical properties of the object (2), the apparatus comprising:

an optical system (8, 20) for collecting a plurality of wavefronts, the plurality of wavefronts emanating from respective points of the object (2), as a result of the spatially incoherent light being directed toward the object, wherein each of the plurality of wavefronts is composed of multiple spectral bands, and wherein each spectral band has a respective amplitude, phase and polarization;

a spectral imaging camera comprising an array of detectors (4, 22, 34, 42), each detector corresponding to the respective points of the object, wherein the spectral imaging camera is arranged to receive the plurality of wavefronts;

a modulator for applying a modification to change a physical property of the optical system or spectral imaging camera, wherein the modulator is disposed along an optical path that passes between the object and the spectral imaging camera; and

a processing unit for obtaining an output indicating said object's optical properties at each point;

characterised in that:

the modulator is configured to individually modulate each of the wavefronts emanating from the respective points by, individually, for each of the wavefronts:

causing one or more spectral bands within a first portion of the wavefront that travels along the optical path to interfere with one or more spectral bands within a second portion of the wavefront that travels along the optical path,

by applying an optical path difference to the first portion of the wavefront relative to the second portion of the wavefront that is equal for all of the spectral bands of the first portion of the wavefront;

and

the spectral imaging camera measures the overall intensity of each wavefront as the sum of the specific intensities of the spectral bands contained in the beam at the same time and the processing unit calculates the intensity of each spectral band using a set of matrices and a detected change in overall intensity after the modification has been applied".

VII. In a further communication pursuant to Article 15(1) RPBA, sent by fax on 27 April 2016 in preparation for the scheduled oral proceedings, the board noted that, according to the appellants in their letter of 13 April 2016 (see point V *supra*), the basis for claim 1 of the new Main Request was to be found in the final paragraph of page 5 and the first and second paragraphs of page 6. The board observed that this part of the description related to the embodiment in Figure 1 which had not been the subject of the international search or addressed during the first-instance examination proceedings. Reference was made to the provisions of Rule 137(5) EPC.

With respect to claim 1 of the First Auxiliary Request, which apparently addressed combined features of the unrelated embodiments in Figure 1 and Figure 3, the board doubted that the patent application as originally filed provided a proper basis for such a combination (Article 123(2) EPC). Furthermore, since the embodiment in Figure 1 related to unsearched subject-matter within the meaning of Rule 137(5) EPC the admissibility of these claims was in doubt.

VIII. The appellants did not make any submissions in reply to the board's communication of 27 April 2016.

IX. The board held oral proceedings on 11 May 2016 in the absence of the duly summoned appellants, in accordance with Article 15(3) RPBA. The chairwoman noted that the appellants had implicitly requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the claims according to the Main Request or the First Auxiliary Request, both requests filed with the letter dated 13 April 2016. At the end of the oral proceedings, the chairwoman announced the board's decision.

Reasons for the Decision

1. The appeal is admissible.

2. Main Request

2.1 In its communication of 27 April 2016 the board objected that it doubted that the sets of claims according to the Main and First Auxiliary Requests filed with the letter of 13 April 2016 complied with Rule 137(5) EPC.

2.2 This provision reads:

"Amended claims may not relate to unsearched subject-matter which does not combine with the originally claimed invention or group of inventions to form a single general inventive concept. Nor may they relate to subject-matter not searched in accordance with Rule 62a or Rule 63."

2.3 The "single general inventive concept" requirement is defined in Article 82 EPC and elaborated on in Rule 44(1) EPC (unity of invention) which reads:

"Where a group of inventions is claimed in a European patent application, the requirement of unity of invention under Article 82 shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. The expression "special technical features" shall mean those features which define a contribution which each of the claimed inventions considered as a whole makes over the prior art."

2.4 Concerning the subject-matter on which the search had been based for the present patent application, an international preliminary report on patentability had been issued. In its Box III "Non-establishment of opinion with regard to novelty, inventive step and industrial applicability" of this report, the box "no

international search report has been established for the whole application or for said claims Nos. 1-162" had been ticked.

In the accompanying international search report, the following objection was made under Box II, with reference to sheet PCT/ISA/210:

"Continuation of Box II.2
Claims Nos.:

The present independent claims 1 and 82 are unclear and, additionally, relate to an extremely large number of possible methods/devices. Support and disclosure in the sense of Article 6 and 5 PCT is to be found however for only a small proportion of the apparatus/methods claimed; see Figures 3-5 and corresponding pages 7-10 of the application. The non-compliance with the substantive provisions is to such an extent, that the search was performed taking into consideration the non-compliance in determining the extent of the search of claims 1 and 82 (PCT Guidelines 9.19, 9.23 and 9.25).

The search of claims 1 and 82 was restricted to those claimed apparatus/methods how they are understood and which appear to be supported. The extent of the search was consequently limited to the clearly defined examples in the description; see above-mentioned figures" (emphasis by the board).

2.5 It therefore appears that the search had been restricted to the apparatuses and/or methods disclosed in the context of Figures 3 to 5 and addressed on pages 7 to 10 of the published patent application. This is confirmed by paragraph 2 of section "Re Item V." of the

written opinion of the international searching authority, which reads:

"2. The subject-matter of Claims 1 and 82, as far as the claims are understood, is anticipated from D1, or D2 or D3; see citations in the international search report. Also the embodiments corresponding to Figures 3 to 5 are known from these documents ...."

2.6 The citations in the international search report refer, inter alia, to document D3 (US2004/179202) citing paragraphs [0019] to [0034] and Figure 1. Indeed, Figure 1 of this document discloses an apparatus for analyzing optical properties of an object as defined in claims 1 and 82 of the original patent application in the context of Figure 5, i.e. comprising a Linnik interferometer, see in particular Figure 1 and paragraph [0021] of document D3. Therefore original claims 1 and 82 examined in the context of the embodiments of Figures 3 to 5 did not include any "special technical features" within the meaning of Rule 44(1) EPC, since their features were anticipated by prior-art document D3.

2.7 Amended claim 1 of the Main Request filed with the letter dated 13 April 2016 addresses the embodiment disclosed in the context of Figure 1 and page 5, final paragraph to page 6, second paragraph. Unlike the apparatus for analyzing optical properties defined in original independent claim 82 and searched in the context of Figures 3 to 5, present claim 1 is related to an apparatus for analyzing optical properties defined according to the embodiment of Figure 1 which includes a particular modulator as defined in the characterising portion of claim 1.

The embodiment of Figure 1 and the corresponding part of the description were not part of the original search. Furthermore it appears that the particular modulator defined in the characterising portion of claim 1 does not have a "same or corresponding feature" as regards the embodiments that were the subject of the international search (i.e. the embodiments of Figures 3 to 5), since these embodiments do not include such a modulator. Furthermore, as pointed out by the board in point 1.4 of its communication of 27 April 2016, the feature "modulator" was not defined in any of the original claims. Therefore, irrespective of whether the particular modulator defined in claim 1 of the Main Request defines a "special technical feature" over the prior art (which cannot be established, since such a claim was not part of the international search), the amended claim does not combine with the originally claimed invention "to form a single inventive concept" as prescribed by Rule 137(5) EPC, because the new feature does not have a corresponding feature in either the original claims or in the embodiments of Figures 3 to 5.

3. First Auxiliary Request

3.1 In its communication of 27 April 2016 the board observed that claim 1 of the First Auxiliary Request defined an apparatus comprising the features of claim 1 of the Main Request (addressing the embodiment in Figure 1) and comprising additional features of the embodiment in Figure 3 (page 8, second paragraph), namely a lens having high chromatic aberration. However, the original patent application did not provide a basis for combining the features of the embodiments in Figure 1 (disclosing an apparatus with an SLM effecting different optical path differences to

portions of a wavefront) and Figure 3 (employing a high chromatic aberration lens and an array of small holes).

Therefore claim 1 of this request, and similarly claim 10, appeared to infringe Article 123(2) EPC.

Furthermore, in addition to the claimed subject-matter apparently not being disclosed in the application as originally filed, it also appeared doubtful that this embodiment had been part of the international search, because the embodiment in Figure 1 related to unsearched subject-matter within the meaning of Rule 137(5) EPC (see also point 2 supra).

3.2 With its communication of 27 April 2016 the board informed the appellant that it doubted that the appellants' two requests were admissible in view of Rule 137(5) EPC. The appellant did not provide any counter-arguments against the position of the board, nor did it file any further requests. The board sees also no reason to depart from the preliminary opinion expressed in its communication.

4. In view of the above, the board considers that neither the Main Request nor the First Auxiliary Request is admissible in view of Rule 137(5) EPC.

5. In the absence of any allowable request, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairwoman:

M. Kiehl T. Karamanli

Decision electronically authenticated