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Datasheet for the decision of 29 September 2022

Case Number: T 2967/19 - 3.4.02

Application Number: 16181375.3

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Language of the proceedings: EN

Title of invention:
SENSING MODULE AND SENSING METHOD

Applicant:
Personal Genomics, Inc.

Relevant legal provisions:
EPC Art. 56, 84, 123(2)
RPBA 2020 Art. 12(8)

Keyword:
Decision in written proceedings -(yes) - no oral proceedings necessary or appropriate
Clarity (yes, amended claims)
Inventive step (yes, amended claims)

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Case Number: T 2967/19 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 29 September 2022

Appellant: (Applicant)	Personal Genomics, Inc. PO Box 309, Ugland House, Grand Cayman KY1-1104 (KY)
Representative:	Becker Kurig & Partner Patentanwälte mbB Bavariastraße 7 80336 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 17 June 2019 refusing European patent application No. 16181375.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairwoman	T. Karamanli
Members:	F. J. Narganes-Quijano
	H. von Gronau

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 16 181 375.3.

II. Among the documents considered during the first-instance proceedings, the following documents were *inter alia* cited in the present appeal proceedings:

D2: US 2011 306143 A1
D3: US 2008 219615 A1
D5: US 2006 273245 A1
D7: US 2005 110989 A1
D8: US 5738825 A
D9: US 2006 040376 A1.

III. In the decision under appeal the examining division held in respect of the requests then on file as follows:

- main request: claim 1 was not clear (Article 84 EPC) and the subject-matter of claim 1 did not involve an inventive step over document D2 as closest state of the art (Article 56 EPC);

- first auxiliary request: the subject-matter of claim 1 did not involve an inventive step over a combination of document D2 as closest state of the art with the disclosure of any of documents D7, D8 and D9 (Article 56 EPC); and

- second auxiliary request: the claims were not admitted into the proceedings for being late filed and because the subject-matter of claim 1 did not *prima facie* overcome the objection of lack of inventive step

raised in respect of claim 1 of the first auxiliary request.

IV. In reply to a communication issued by the board under Article 15(1) of the revised Rules of Procedure of the Boards of Appeal (RPBA 2020, OJ EPO 2019, A63) and annexed to a summons to oral proceedings, the appellant filed by letter dated 13 April 2022, among other application documents, pages 1 to 3, 5 to 14 and 16 of the description.

V. In reply to a further communication of the board, the appellant filed by letter dated 15 July 2022 pages 4 and 15 of the description. In reply to a subsequent telephone call from the rapporteur, the appellant filed by letter dated 26 September 2022, received on the same day at 14:18, claims 1 to 10 according to a main request, with a minor amendment in claim 7.

VI. According to a further letter dated 26 September 2022, received on the same day at 15:56, the appellant requested as main and sole request that the decision under appeal be set aside and that a patent be granted on the basis of the following application documents:

- claims 1 to 10 filed with the letter dated 26 September 2022,
- pages 1 to 3, 5 to 14 and 16 of the description filed with the letter dated 13 April 2022, and pages 4 and 15 of the description filed with the letter dated 15 July 2022, and
- figures 1, 2A, 2B and 3 of the application as originally filed.

The appellant requested oral proceedings on an auxiliary basis.

VII. Subsequently, the appointed oral proceedings were cancelled.

VIII. Independent claims 1 and 7 of the main request read as follows:

"1. A sensing module (100, 100B), comprising:

a sample loading layer (130) comprising at least a sample loading aperture into which a sample (50, 50B) may be loaded;

a sensing layer (110) being configured to receive light and turn it into electrical signals;

an optical resonance layer (120, 120B) located between the sample loading layer (130) and the sensing layer (110), wherein the sample loading aperture exposes a part of the optical resonance layer (120, 120B) and is configured to load samples (50, 50B), wherein the optical resonance of the optical resonance layer (120, 120B) is provided by an optically resonant structure (122, 122B) on the surface of the optical resonance layer (120, 120B) and the optically resonant structure (122, I22B) is located at the bottom of the sample loading aperture; and

a light source, configured to provide an excitation light (L1, L6) to the optical resonance layer (120, 120B) through the sample loading layer (130), wherein the light source illuminates the sample loading aperture and the optically resonant structure (122, 122B), and wherein the sensing module (100, 100B) satisfies:

$\lambda/n_{wg} \leq \Lambda \leq \lambda$, wherein λ is the wavelength of the excitation light (L1, L6), n_{wg} is the refractive index of the optical resonance layer (120, 120B), and Λ is the period of the optically resonant structure (122, 122B), wherein the light source is a laser and the excitation light (L1, L6) strikes the optically

resonant structure (122, 122B) at a resonance angle (α), and the excitation light (L1, L6) excites waveguide-mode resonance in the optically resonant structure (122, 122B)."

"7. A sensing method, comprising:

providing a sensing module (100, 100B), wherein the sensing module (100, 100B) comprises a sample loading layer (130) comprising at least a sample loading aperture into which a sample (50, 50B) may be loaded, a sensing layer (110) being configured to receive light and turn the light into electrical signals, and an optical resonance layer (120, 120B) located between the sample loading layer (130) and the sensing layer (110), wherein the sample loading aperture exposes a part of the optical resonance layer (120, 120B) and is configured to load samples (50, 50B), wherein the optical resonance of the optical resonance layer (120, 120B) is provided by an optically resonant structure (122, 122B) on the surface of the optical resonance layer (120, 120B), and the optically resonant structure (122, 122B) is located at the bottom of the sample loading aperture, wherein the sensing module (100, 100B) further comprises a light source configured to provide an excitation light (L1, L6) to the optical resonance layer (120, 120B) through the sample loading layer (130);

loading a sample (50, 50B) into the sample loading aperture of the sample loading layer (130) of the sensing module (100, 100B); and

illuminating the optically resonant structure (122, 122B) with the excitation light (L1, L6) by the light source, wherein the excitation light (L1, L6) is provided by a pulse laser, wherein the sensing module (100, 100B) satisfies:

$\lambda/n_{wg} \leq \Lambda \leq \lambda$, wherein λ is the wavelength of the excitation light (L1, L6), n_{wg} is the refractive index of the optical resonance layer (120, 120B), and Λ is the period of the optically resonant structure (122, 122B), wherein the excitation light (L1, L6) strikes the optically resonant structure (122, 122B) at a resonance angle (α) and the excitation light (L1, L6) excites a waveguide-mode resonance in the optically resonant structure (122, 122B)."

The main request also includes dependent claims 2 to 6 and 8 to 10 referring back to independent claims 1 and 7, respectively.

Reasons for the Decision

1. The appeal is admissible.

2. Since the board decides the case in favour of the appellant, the appointed oral proceedings were cancelled. Therefore, the decision is taken in written proceedings in accordance with Article 12(8) RPBA 2020, which applies in the present case under Article 25(1) RPBA 2020. The case is ready for decision on the basis of the appellant's written submissions. For this reason, the issuing of the decision in written procedure without oral proceedings is in compliance with the requirements of Articles 113(1) and 116(1) EPC.

3. *Amendments - Article 123(2) EPC*

3.1 The board is satisfied that the claims of the present main request meet the requirements of Article 123(2) EPC. In particular,

- claim 1 is in substance based on the alternative of claim 1 as originally filed relating to the optically resonant structure being located at the bottom of the sample loading aperture, together with the features of dependent claims 6 to 8 as originally filed,

- independent claim 7 is in substance based on the alternative of independent claim 11 as originally filed relating to the optically resonant structure being located at the bottom of the sample loading aperture, together with the features of dependent claim 12 and part of dependent claim 13 as originally filed, and

- dependent claims 2 to 6 and 8 to 10 are respectively based on dependent claims 2, 4, 5, 9, 10, part of dependent claim 13, and dependent claims 14 and 15 as originally filed.

3.2 The amendments made to the description relate to the adaptation of its content to the invention as defined in the present claims (Rule 42(1)(c) EPC), and to the acknowledgement of the pertinent state of the art (in particular, of document D2) in the introductory part of the description (Rule 42(1)(b) EPC).

4. *Clarity - Article 84 EPC*

The claims of the present main request consist essentially of the claims of the first auxiliary request underlying the decision under appeal, after incorporation of the features of dependent claims 7 and 12 as originally filed into the present independent claims 1 and 7, respectively, and after deletion of the dependent claim corresponding to dependent claim 3 as

originally filed. These amendments, together with other minor amendments were carried out in order to overcome objections of lack of clarity raised during the appeal proceedings. The board is satisfied that the present claims are clear and - after appropriate amendment of the description, see point 3.2 above - also supported by the description within the meaning of Article 84 EPC.

5. *Novelty*

No objection of lack of novelty was raised by the examining division in its decision in respect of the requests then on file, and the board is of the opinion that the same applies to the subject-matter of the present claims. More particularly:

5.1 Document D2 discloses a sensing module (Fig. 8; see also the variants of Fig. 9 to 14) comprising a laser light source configured to provide an excitation light (paragraph [0041]), and a planar waveguide structure (paragraph [0051]) constituted by

- an upper cladding layer (layer 114) operating as a sample loading layer including a sample loading aperture (aperture 120) for receiving the sample loaded therein (paragraph [0053]),
- a core layer (layer 112) having a grating (grating 402) on a portion of its upper surface (paragraphs [0071] and [0072]), and
- a lower cladding layer (layer 116) operating as a sensing layer configured to receive light emitted by the sample (paragraphs [0040] and [0054]), and including means arranged to turn the received light into electrical signals (claim 58 and paragraph [0045]).

In addition, the wavelength of the excitation light λ, the period Λ of the grating, and the refractive index n of the core layer of document D2 satisfy the relationship $\lambda/n \leq \Lambda \leq \lambda$ (see paragraph [0165]), and the waveguide and the laser light source of document D2 are arranged so that the excitation light emitted by the light source is transmitted through the sample loading layer (Fig. 8), strikes the grating at a predetermined angle (Fig. 8), is guided along the core layer towards the aperture (see the arrow in Fig. 8, and paragraph [0069] together with paragraphs [0071] and [0072]), induces light emission - in particular, by fluorescence or phosphorescence, see paragraphs [0040], [0086], and [0087] - in the sample loaded in the aperture (paragraph [0040]), and the light emitted by the sample is detected by the sensing layer. Therefore, the grating of the sensing module of document D2 operates as an optically resonant structure, the excitation light excites waveguide-mode resonance in the optically resonant structure, and the section of the core layer comprising the grating constitutes an optical resonance layer.

5.2 As already held by the examining division in the decision under appeal in respect of claim 1 of the first auxiliary request then on file, the sensing module of claim 1 of the present main request differs from the sensing module of document D2 in that, while in document D2 the optically resonant structure is located on a section of the core layer laterally shifted with respect to the sample loading aperture and the light source illuminates this section of the core layer (Fig. 8), in the claimed sensing module the optically resonant structure is located at the bottom of the sample loading aperture and the light source illuminates the sample loading aperture.

In addition, the board is of the opinion that the claimed sensing module further differs from the sensing module of document D2 in that, while in document D2 the sample loading aperture exposes a section of the core layer not constituted by the optical resonance section of the core layer, in the claimed sensing module the sample loading aperture exposes a part of the optical resonance layer.

5.3 Independent claim 7 of the present request is directed to a sensing method comprising the provision of a sensing module essentially having the features of the sensing module of claim 1, and including the steps of loading a sample into the sample loading aperture and illuminating the optical resonant structure with the excitation light from the light source of the sensing module. Therefore, the method of independent claim 7 differs from the sensing method disclosed in document D2 in the same features identified in point 5.2 above.

5.4 The remaining documents on file are less pertinent for the issue of novelty.

5.5 Therefore, the subject-matter of independent claims 1 and 7 of the main request, and therefore also that of dependent claims 2 to 6 and 8 to 10 of the main request, is new over the documents of the prior art on file (Article 54(1) EPC).

6. *Inventive step*

6.1 The board concurs with the examining division that document D2 represents the closest state of the art.

In the decision under appeal the examining division held in respect of claim 1 of the then first auxiliary request that the distinguishing features mentioned in point 5.2 above, first paragraph, had the same technical effect already achieved by the grating arrangement of document D2, i.e. the technical effect of providing a means of excitation of the sample loaded into the aperture with excitation light from the source, and that for this reason the objective technical problem solved by the mentioned distinguishing feature was only the provision of an alternative way of using the grating of document D2 to provide the same technical effect.

The board, however, cannot follow the examining division's view in this respect because the mentioned distinguishing features - under consideration of the further distinguishing feature referred to in point 5.2 above, second paragraph - result, as submitted by the appellant, in technical effects not considered by the examining division. While in document D2 the grating merely operates as a light coupler for coupling the excitation light emitted by the light source into the planar light waveguide and directing the excitation light along the core layer towards the excitation zone of the sample aperture for the purpose of exciting the sample (document D2, Fig. 8, together with paragraphs [0050] and [0069] to [0071]), the distinguishing features identified in point 5.2 above have a double technical effect, namely

- directing the light from the light source into the aperture, so that the excitation light from the light source is directly projected onto the sample and also coupled by the optically resonant structure into the optical resonance layer and distributed within the bottom of the aperture in the presence of the sample,

thus improving the degree of excitation of the sample loaded into the aperture and also the intensity of the light emitted by the sample (paragraphs [0036], [0043], [0045] and [0063] of the description of the application as originally filed), and

- preventing excitation light from being directed towards the sensor layer, while the light emitted by the sample is transmitted through the optically resonant structure and the optical resonance layer towards the sensor layer (paragraphs [0036], [0043], [0045] and [0063] of the description of the application as originally filed).

In addition, as a result of these technical effects, the signal-to-noise ratio of the sensing module is improved (paragraphs [0002], [0005], [0025], [0043], [0045] and [0063] of the description of the application as originally filed).

Therefore, in the board's opinion the claimed sensing module solves the objective technical problem of improving the light emission detection sensibility, and in particular the signal-to-noise ratio, of the sensing module of document D2.

6.1.1 In its decision the examining division found that the subject-matter of claim 1 of the first auxiliary request then on file was obvious in view of the combination of document D2 with any of documents D7, D8 and D9. However, although the devices of documents D7, D8 and D9 share some structural similarities with the distinguishing features of claim 1, and in particular the provision of a diffraction grating structure below an aperture in which a sample is loaded, in the board's opinion none of these documents renders obvious the claimed solution for the following reasons:

- Document D7 is not related to the detection of light emitted by a sample excited by an incident light beam, but to the measurement of the optical properties, and in particular of the refraction index, of a sample (paragraphs [0002], [0003] and [0026]) by waveguide interferometry using a diffraction grating structure or by prism-like refractometry in which the prism is replaced by a diffraction grating structure (see Figs. 1 and 6, and paragraphs [0004] to [0006], [0027], [0028], [0036], [0047], [0054], [0055], [0058] to [0061], and [0084] to [0088]). In addition, in document D7 the grating structure is disposed at the bottom of an aperture holding the sample (Fig. 6) and light is projected on the grating structure from below the aperture at a large incidence angle (paragraph [0092]), reflectively diffracted by the grating structure, and detected and processed (Fig. 6 and the corresponding description) to obtain information on the critical angle and therefore on the refraction index of the sample with high sensitivity (paragraph [0099]). Therefore, document D7 pertains to a different technical filed and is silent as to the objective technical problem formulated in the technical context of document D2. In particular, the technical nature of the light to be detected, the physical principle underlying the detection, and the optical arrangement - in particular, the structure and the technical function of the grating structure - of the device of document D7 are different from those of the sensing module of document D2. In these circumstances, the board is of the opinion that, even assuming that - as maintained by the examining division in its decision - the skilled person would consult document D7 in order to solve the objective technical problem, document D7 contains no hint that would suggest the skilled person to modify the position of the grating of document D2, to locate

it at the bottom of the sample loading aperture so that the sample loading aperture exposes a part of the optical resonance portion of the core layer, and to illuminate the sample loading aperture directly with the light from the light source as claimed.

- Document D8 is directed to the measurement of changes in the effective refractive index of a waveguide film (Fig. 3, film 12) in contact with a sample loaded within a cavity the bottom of which is constituted by the waveguide film (Fig. 3). The waveguide film comprises a diffraction grating structure (grating 10) and the measurement is carried out by means of light projected from below the waveguide film into the grating structure and reflectively diffracted by the grating structure (abstract, Figs. 3 to 6, and column 4, line 14, to column 5, line 40). Therefore, analogous considerations to those put forward above in respect of the combination of document D2 with document D7 also apply to the combination of document D2 with document D8.

- Document D9 discloses a chamber for receiving a sample and comprising a grating structure at the bottom of the chambre (Figs. 33 and 55). Light is projected from the bottom or from the top of the chamber into the chamber and the light reflected or transmitted by the grating structure is analysed for detecting bio-molecular interactions in the sample (Figs. 33 and 55, together with paragraphs [0053], [0223] and [0224], and paragraphs [0075] and [0298], respectively). However, the detected light is not light emitted by the sample after being excited (see paragraph [0083] together with paragraphs [0004] and [0005]), but white light that has been filtered by the optical resonant characteristics of the grating structure within a narrow band of

wavelengths which depends on the dielectric characteristics of the sample (paragraph [0095] together with paragraphs [0083] to [0086]). Therefore, also in this case the technical nature of the light to be detected, the physical principle underlying the detection, and the optical arrangement of the device of document D9 - in particular, the structure and the technical function of the grating structure and, more particularly, its optical resonance characteristics - are different from those of document D2. Therefore, for considerations similar to those put forward above in respect of the combination of document D2 with document D7, the skilled person would not find in document D9 any incentive to modify the sensing module of document D2 so as to result in the claimed sensing module.

The remaining documents on file are less relevant. In particular, documents D3 and D5 also cited by the examining division in its decision only concern respectively a photonic crystal sensor for detecting biomolecules and comprising a grating structure designed and arranged to reflect a narrow band of wavelengths when illuminated with white light (document D3, abstract and Fig. 1A together with paragraphs [0009] and [0049] to [0053]), and an optical analyte detection device (document D5, abstract and Fig. 5B) comprising a first grating structure (filter 506) between a source of excitation light and the sample to be detected and operating as a polarization filter, and a second grating structure (Fig. 5B, wavelength separation device 401) between the sample and a detector and operating as a monochromator filter (paragraph [0081]). Therefore, similar considerations to those set forth above in respect of documents D7, D8 and D9 also apply to these documents.

6.1.2 The board is therefore of the opinion that the sensing module of claim 1 of the main request involves an inventive step over the documents on file.

6.2 The distinguishing features of the method of independent claim 7 over the method disclosed in document D2 are the same as those of the sensing module of claim 1 (see point 5.3 above) and the claimed method also involves an inventive step for the same reason given in point 6.1 above in respect of the sensing module of claim 1.

6.3 The board concludes that the subject-matter of independent claims 1 and 7 of the main request and therefore also that of dependent claims 2 to 6 and 8 to 10 of the main request involves an inventive step over the documents of the state of the art on file (Article 56 EPC).

7. In view of the above considerations, the board concludes that the application documents of the present main request meet the requirements of the EPC.

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 with the order to grant a patent in the following version:

- claims: Nos. 1 to 10 filed with the letter dated 26 September 2022;

- description: pages 1 to 3, 5 to 14 and 16 of the description filed with the letter dated 13 April 2022, and pages 4 and 15 of the description filed with the letter dated 15 July 2022; and

- drawings: figures 1, 2A, 2B and 3 of the application as originally filed.

The Registrar: The Chairwoman:

L. Gabor T. Karamanli

Decision electronically authenticated