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Case Number: T 0570/11 - 3.4.02

Application Number: 02019863.6

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Language of the proceedings: EN

Title of invention:
Sensor utilizing attenuated total reflection

Applicant:
FUJIFILM Corporation

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

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Case Number: T 0570/11 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 22 January 2015

Appellant: (Applicant)	FUJIFILM Corporation 26-30, Nishiazabu 2-chome Minato-ku Tokyo (JP)
Representative:	Klunker . Schmitt-Nilson . Hirsch Patentanwälte Destouchesstraße 68 80796 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 25 August 2010 refusing European patent application No. 02019863.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	F. J. Narganes-Quijano
Members:	A. Hornung
	B. Müller

Summary of Facts and Submissions

I. The applicant (appellant) has appealed against the decision of the examining division refusing European patent application No. 02019863.6, according to its main request, on the basis of Articles 84 and 56 EPC, and, according to its first auxiliary request, on the basis of Article 56 EPC.

II. The appellant requested that the decision of the examining division be set aside and a patent be granted on the basis of any of the main or first auxiliary requests underlying the decision of the examining division.

As a precaution, the appellant requested oral proceedings.

III. In a communication annexed to the summons to oral proceedings, the board informed the appellant about its provisional and non-binding opinion according to which, inter alia, the claimed subject-matter of both requests lacked inventive step.

Reference was made to documents D1 [EP0517930], D3 [WO00/22419], D4 ["Theoretical Analysis of Thermal Damage in Biological Tissues Caused by Laser Irradiation", J. Zhou et al., MCB, vol. 4, no. 1, 27-39, 2007 (was annexed to the grounds of appeal)] and D5 ["Simultaneous Enhancement of Fluorescence and Thermal Lensing by Reversed Micelles", C. D. Tran, Anal. Chem. 1988, 60, 182-185 (was annexed to the grounds of appeal)].

The board's opinion was worded as follows (see point 6.2 of the communication annexed to the summons):

6. "Main request

6.1 Clarity

[...]

6.2 Inventive step

The board is of the preliminary view that the claimed subject-matter does not involve an inventive step.

6.2.1 It appears to be undisputed that the features of the preamble of claim 1 are known from any of the prior art documents D1 to D3.

Starting from D1 as closest prior art, the claimed sensor differs from the sensor of D1 only in that the irradiation energy of the light beam is 100 mJ/mm^2 or less.

According to the applicant, the problem to be solved is about preventing a rise in temperature of a liquid sample, thereby enhancing accuracy in measurement of the state of attenuated total reflection. The solution consists in restricting the irradiation energy to a threshold of 100 mJ/mm^2.

The board, currently, is not convinced that the proposed solution actually solves the problem because the threshold depends on many aspects which are undefined in claim 1, such as:

- *The exact chemical composition of the liquid sample: the amount of energy absorbed and, hence, the heat generated in the liquid sample, depend on the exact chemical composition of the liquid sample. Since absorption coefficients of liquid samples may vary to a large extent, the thermal effect of the claimed*

threshold of 100 mJ/mm^2 may vary to a large extent, too.

- *The spectral distribution of the irradiating light: the absorption coefficient of each constituting molecule of the liquid sample and, hence, the generated heat depend on the wavelength of the irradiation light.*

- *The exposure time of the irradiating light: the irradiated power may vary, for instance, between megawatt/mm^2 and microwatt/mm^2 depending on whether the irradiation lasts nanoseconds or minutes. The induced thermal effect will vary correspondingly.*

- *The polarization state and the angle of incidence of the irradiating light has an effect on the efficiency of surface plasmon excitation and, hence, on the generated heat.*

- *The sensitivity of the photodetector and the signal to noise ratio acceptable by the measurement set-up influence the determination of the adequate threshold of the irradiation energy.*

Since none of these aspects are defined in claim 1, it would appear that the value of 100 mJ/mm^2 does not represent more than an arbitrary choice of a numerical value without solving a particular technical problem. No inventive step can be based on such an arbitrary value.

6.2.2 Notwithstanding the board's basic doubt about the technical significance of the claimed value of 100 mJ/mm^2, the board agrees with the argumentation of the examining division (see points 2.9 and 2.10 of the appealed decision) that the claimed value represents merely a compromise when attempting to maximise the signal to noise ratio whilst reducing the

irradiation energy as much as possible in order to reduce saturation, bleaching or heating effects. See the corresponding teaching in D1, column 5, line 52 - column 6, line 14, disclosing a variable radiation source, accurately adjusted "to provide optimum measurements whilst avoiding damage of the biomolecules". In particular, "optimum measurements", according to D1, means that "effects like temperature drift (...) are eliminated".

6.2.3 *In the view of the applicant, based on the disclosure of D4, the typical irradiation energy for the sensor of D1 would be several J/mm^2 (see the grounds of appeal, Item 2.7 to 2.9).*

*This argument is not found convincing because, first of all, it would appear that the irradiation energy referred to by the applicant equals (5 * 2.3) / (π * 2^2) ≈ 0.9 J/mm^2, which is closer to the claimed threshold than the value of 3 J/mm^2 recited by the applicant.*

Secondly, this value of 0.9 J/mm^2 corresponds to a threshold at which irreversible damage occurs to the irradiated biological tissue. However, D1 is not dealing with laser treatment or laser cutting of biological tissue but the much more gentle optical detection of the concentration of biomolecules, where irreversible damage to the tissue is necessarily avoided in order not to affect the measurement itself. In particular, D1 is concerned about not "overexciting" biomolecules in the sense of not bleaching them out (see D1, column 3, lines 38 - 46). Therefore, the skilled person, while implementing the teaching of D1, will obviously strive to remain far below any irradiation level close to the level at which irreversible damage occurs, such as 0.9 J/mm^2.

6.2.4 *The applicant further argued that "a new problem was discovered in recognizing that measurement accuracy*

deteriorates due to changes in refractive indices of liquid samples by temperature increases thereof accompanying absorption of light irradiation energy" (see the grounds of appeal, Item 2.7 to 2.9).

This argument is also not found convincing since it appears to be well known in the art that the refractive index of any optical material, including biomolecules sensed by attenuated total reflection, depends on temperature. See, for instance, D1, column 4, lines 2 to 5, mentioning angular drift due to temperature effects. Actually, D1 is well aware that too much energy alters the characteristics and physical behaviour of the biomolecules and "that this effect impairs the results of the measurement" (D1, column 3, lines 38-46). D1 further discloses that a compromise between low energy, which "would be insufficient for reliable measurements" and large energy, which "would the[n] damage the biomolecules", must be found by adjusting the emitted energy of the light source (D1, column 4, lines 24-40).

See also D3, page 5, lines 31-35 mentioning variations of the refractive index due to thermal fluctuations. See also D5, table I, listing the thermal refractive index variations for various solvents.

Based on its knowledge of the thermal dependency of the refractive index and of the influence of the refractive index on the total internal reflection and, hence, on the measurement accuracy, it is considered to be obvious to reduce the incident light energy in order to improve the measurement accuracy.

7. *Auxiliary request*

Claim 1 of the auxiliary request has been amended with respect to claim 1 of the main request so as to comprise a shutter for adjusting the amount of the irradiated light energy.

The board notes that the grounds of appeal do not contain any inventive step argument relating to the shutter. The board is also unable to find any reason why the shutter would justify an inventive step, especially in view of the explicit teaching of D1 to use an adjustable radiation source (D1, column 6, lines 10-14) and the disclosure in D3 of a shutter for irradiating the sample (D3, page 6, lines 19-27).

Therefore, the board is of the preliminary view that the claimed subject-matter does not involve an inventive step."

IV. In response to the summons to oral proceedings, the appellant informed the board with its letter dated 15 December 2014 that it would not attend the oral proceedings. The appellant filed no comments concerning the board's preliminary opinion as annexed to the summons.

V. Following the appellant's letter of 15 December 2014, the oral proceedings were cancelled.

VI. Independent claim 1 of the appellant's main request reads as follows:

"1. A sensor utilizing attenuated total reflection, comprising:

- a light source (31) for emitting a light beam;
- a measuring chip (10) comprising a dielectric block (11) transparent to said light beam, a thin film layer (12) formed on one surface of said dielectric block (11), and a liquid-sample holding mechanism (13) for holding a liquid sample on said thin film layer (12);

- an optical system (32) for making said light beam enter said dielectric block (11) at an angle of incidence so that a total internal reflection condition is satisfied at an interface between said dielectric block (11) and said thin film layer (12);
- photodetection means (40) for detecting intensity of said light beam totally reflected at said interface; and
- measurement means (61) for measuring a state of attenuated total reflection, based on the result of detection obtained by said photodetection means;

characterized in that irradiation energy of said light beam at said interface is 100 mJ/mm^2 or less."

Independent claim 1 of the appellant's auxiliary request reads as follows:

"1. A sensor utilizing attenuated total reflection, comprising:
- a light source (31) for emitting a light beam;
- a measuring chip (10) comprising a dielectric block (11) transparent to said light beam, a thin film layer (12) formed on one surface of said dielectric block (11), and a liquid-sample holding mechanism (13) for holding a liquid sample on said thin film layer (12);
- an optical system (32) for making said light beam enter said dielectric block (11) at an angle of incidence so that a total internal reflection condition is satisfied at an interface between said dielectric block (11) and said thin film layer (12);
- photodetection means (40) for detecting intensity of said light beam totally reflected at said interface; and

- measurement means (61) for measuring a state of attenuated total reflection, based on the result of detection obtained by said photodetection means;

characterized in that

- a shutter [(33)] is disposed between said light source (31) and said dielectric block (11),
- a timing control section (63) is provided that is adapted to open the shutter [(33)] for a predetermined time so that the irradiation energy of the light beam to be irradiated to said interface (12a) is a predetermined value of 100 mJ/mm^2 or less."

Reasons for the Decision

1. In the annex to the summons, the board expressed its preliminary view, along with the underlying reasons, that the subject-matter of claim 1 of both main and auxiliary request lacked an inventive step (Article 56 EPC 1973) and that the appellant's arguments in favour of inventive step, filed with the grounds of appeal, were not convincing. See point III above.

2. The appellant neither attempted to rebut the board's provisional opinion, nor submitted any new requests aiming at overcoming the objections.

The board sees no reason to deviate from its preliminary opinion, which therefore becomes final.

3. It follows that the present patent application does not meet the requirements of Article 56 EPC 1973 for the reasons set out in the board's preliminary opinion.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl

F. J. Narganes-Quijano

Decision electronically authenticated