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D E C I S I O N
of 18 October 2005

Case Number: T 1166/03 - 3.4.02

Application Number: 95931431.1

Publication Number: 0802433

IPC: G02B 6/10

Language of the proceedings: EN

Title of invention:
Optical fiber with lens and method of manufacturing the same

Applicant:
Namiki Seimitsu Houseki Kabushiki Kaisha

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 83, 84, 52(1), 123(2)
EPC R. 88

Keyword:
"Series of objections, inconsistencies and other deficiencies in the amended application documents - unchallenged provisional opinion of the Board"
"Decision on the state of the file - dismissal of appeal on the grounds communicated to the appellant"

Decisions cited:
-

Catchword:
-

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Case Number: T 1166/03 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 18 October 2005

Appellant: Namiki Seimitsu Houseki Kabushiki Kaisha
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 July 2003 refusing European application No. 95931431.1 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: F. J. Narganes-Quijano
J. H. P. Willems

Summary of Facts and Submissions

I. The appellants (applicants) lodged an appeal against the decision of the examining division refusing European patent application No. 95931431.1 based on International application No. PCT/JP95/01853 published under the PCT as WO96/08738. The English translation of the International application was published pursuant to Article 158(3) EPC with the publication No. 0802433.

In the decision under appeal the examining division held that the subject-matter of the claims according to the requests then on file was not novel or did not involve an inventive step over the prior art (Articles 52(1), 54 and 56 EPC).

II. With the statement setting out the grounds of appeal the appellants requested that the decision under appeal be set aside and that a patent be granted on the basis of the following application documents:

- set of amended claims 1 to 4 submitted with the statement of grounds of appeal,

- description pages 1, 2 and 4 as filed with the letter dated 14 March 1997, pages 3 and 8a filed with the letter dated 25 August 1999, pages 5 to 8 filed with the letter dated 26 November 2001, and page 3a filed with the statement of grounds of appeal, and

- drawing sheets 1/5 to 5/5 as filed with the letter dated 14 March 1997.

Claim 1 according to the appellants' request reads as follows:

"An optical coupling system comprising a light source and an optical fiber, the optical fiber having a semi-cylindrical lens at its end for coupling a beam of light emitted by the light source to the optical fiber; the lens having a diagonal cut surface forming a wedge and having a desired curvature at the tip of the wedge; characterized in that the radius R of curvature is calculated by a distance d_0 from the fiber tip to a beam waist radius ω_0 inside the fiber according to Equations 1 to 5, wherein

$\theta(d_0)$ is the half of the numerical aperture NA of the optical fiber output,
ω_Y is a beam waist radius at the light source in a direction perpendicular to the ridge line of the wedge and to the optical axis of the fiber:
d is a distance from the fiber tip to the beam waist radius ω_Y outside the fiber,
λ is the wavelenght of the beam,
n is the refractive index of the fiber core, and

Equation 1

$$\theta_{(d_0)} = \tan^{-1}\left(\frac{\lambda \cdot d_0}{\pi \cdot \omega_0^2 \cdot n}\right)$$

Equation 2

$$\omega_y = \omega_0\sqrt{1+\left(\frac{\lambda \cdot d_0}{\pi \cdot \omega_0^2 \cdot n}\right)^2} = \omega_0\sqrt{1+\tan^2\theta(d_0)}$$

$$\omega_0 = \frac{\omega_y}{\sqrt{1+\tan^2\theta(d_0)}}$$

Equation 3

$$d_0 = \frac{\tan\theta(d_0)\cdot\pi\cdot\omega_0^2\cdot n}{\lambda}$$

Equation 4

$$(M_1) = \begin{pmatrix} 1 & d \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \frac{1-n}{R} & n \end{pmatrix}\begin{pmatrix} 1 & d_0 \\ 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1+\frac{1-n}{R}\cdot d & d_0+\frac{1-n}{R}\cdot d\cdot d_0+n\cdot d \\ \frac{1-n}{R} & \frac{1-n}{R}\cdot d_0+n \end{pmatrix} = \begin{pmatrix} A & B \\ C & D \end{pmatrix}$$

Equation 5

$$\left(\frac{\omega_y}{\omega_0}\right)^2 = \frac{1}{\left(\frac{\pi\cdot\omega_0^2}{\lambda}\right)^2\cdot C^2 + D^2}$$

."

Claim 2 also defines an optical coupling system essentially as that defined in claim 1, where the lens at the end of the optical fibre is elliptic instead of semi-cylindrical. Claims 3 and 4 are directed to the manufacture of an optical fibre essentially of the type defined in claims 1 and 2, respectively.

III. Oral proceedings were appointed, as requested by the appellants on an auxiliary basis. In a communication pursuant to Article 11(1) of the Rules Procedure of the Boards of Appeal accompanying the summons to attend oral proceedings, the Board gave a preliminary assessment of the case and indicated its provisional, non-binding opinion that the amended application documents did not appear to be allowable. The passages

of the communication that are pertinent to the present decision are as follows:

1. "The subject-matter of each of independent claims 1 to 4 presently on file is defined in terms of Equations 1 to 5 to be satisfied by a series of physical quantities defined in the claims. After consideration of the mathematical expressions defined by the claimed subject-matter, the Board notes the following:

(a) The algebraic terms $(\lambda d_0/\pi\omega_0^2 n)$ and $\tan\theta(d_0)$ in Equation 2 according to the original application (see Equation 2 in the description of the English translation of the original application and Equation 2 on page 6 of the publication WO-A-9608738 of the application as originally filed) have been replaced in present claims 1 to 4 by the square of the terms, i.e. $(\lambda d_0/\pi\omega_0^2 n)^2$ and $\tan^2\theta(d_0)$. It is however unclear from the file whether this replacement

(i) is due to a mistake or

(ii) on the contrary, constitutes a deliberate amendment and in particular an attempt to rectify some previous error present in the application as originally filed, possibly with the intention to bring the corresponding mathematical expressions into line with the expressions known from the Gaussian beam approach, see for instance the following documents cited from the Board's own knowledge:

D4: US-A-5293438,

D5: "Microlenses on the end of single-mode optical fibers for laser applications" by K S Lee *et al.*, Applied Optics Vol. 24, No. 19 (1985) US, pages 3134 to 3139 [XP2022524],

D6: "Semiconductor laser to single-mode fiber coupler" by M Saruwatari *et al.*, Applied Optics Vol. 18, No. 11 (1979) US, pages 1847 to 1856 [XP2279202],

D7: EP-A-0430532, and

D8: "Matching of single-mode fibre to laser diode by microlenses at 1.5 µm wavelength" by J John *et al.*, IEE Proceedings: Optoelectronics (GB) Vol. 141, No. 3 (June 1994), pages 178 to 184 [XP6002014]

and in particular the paragraph bridging columns 8 and 9 and Figure 1b of document D4, section II and equations (5) to (7) of document D5, section IV.A together with Appendix II of document D6, Figures 7 and 8 and the corresponding description (see in particular equation (4)) of document D7, and section 2 (in particular equations (8) and (9)) of document D8.

In the alternative (i), the amended mathematical expressions should be brought into line with the expressions shown in the application as originally filed (Article 123(2) EPC). In the alternative (ii), the question arises whether the amended mathematical expressions comply with the

requirements of Article 123(2) and/or constitute admissible corrections under Rule 88 EPC.

(b) The definition of the quantity $\theta(d_0)$ as representing "half of the numerical aperture NA of the optical fiber output" in claims 1 to 4 does not appear to have an explicit basis in the application as originally filed (Article 123(2) EPC). In any case, this quantity is used in claims 1 to 4 exclusively as an intermediate parameter in Equations 1 to 3 and the claims impose no restriction on this quantity so that the aforementioned definition of $\theta(d_0)$ in the claims would appear to be superfluous (Article 84 EPC). It is also noted in this respect that

- Equation 3 in claims 1 to 4 is identical to Equation 1 and is therefore redundant;
- the second of the equations labelled "Equation 2" of claims 1 to 4 expresses the same mathematical condition as the second equality of the first of the equations labelled "Equation 2" and is therefore also redundant;
- the third member in the first of the equations labelled "Equation 2" of claims 1 to 4 is by definition (see Equation 1) the same as the second member and consequently the second equality of the first of the equations "Equation 2" imposes no additional limitation to that imposed by the first equality; thus, the third member of the first of the equations "Equation 2" appears to be redundant and the definition of the

intermediate quantity $\theta(d_0)$ in "Equation 1" superfluous; and

- of the four matrix elements "A" to "D" defined in Equation 4 and the parameter "d" defined in claims 1 to 4, only the quantities "C" and "D" are then used in Equation 5 of the claims and therefore the matrix definition of the quantities "A" and "B" in Equation 4 and the definition of the quantity "d" in the claims would also appear to be superfluous.

Thus, among all of the mathematical expressions in the equations defined in claims 1 to 4, only Equation 5 and the first equality of the first of the equations labelled "Equation 2" contribute to the definition of the claimed subject-matter, the remaining expressions - with the exception of the definition of the quantities "C" and "D" in Equation 4 - being either redundant or superfluous.

(c) According to each of claims 1 to 4 the beam waist radii ω_0 and ω_y and the radius of curvature R of the wedge tip of the fibre have to meet the conditions expressed by Equation 5 and by the first of the equalities of the first of the equations labelled "Equation 2". The Board has doubts as to both the mathematical and the technical consistency of the double condition imposed by these two equations on the values ω_0, ω_y and R. In particular, assuming that the invention relies on the Gaussian beam approach (see paragraph [1.(a)(ii)] above), it would then appear that the second member in the first of the

equations labelled "Equation 2" expresses the waist radius of the beam at a position adjacent to the fibre tip, i.e. at position "A" in Figure 4 of the application (see for instance document D4, column 8, line 56 to column 9, line 15 together with Figure 1b), and not the beam waist radius ω_y at the light source as required by present claims 1 to 4; consequently, claims 1 to 4 as they presently stand would appear to require that the beam waist at the fibre tip has the same value as the beam waist ω_y at the light source, in clear contradiction to the disclosure of the invention and the problem that the invention intends to solve, see in particular Figures 4 to 6 and the corresponding description."

2. "As regards the description, the Board notes the following:

(a) In the description as amended according to the application documents at present on file the quantity ω has been replaced by ω_c at line 3 of page 6 and at line 9 of page 8, and by ω_y in Equation 6 on page 7. The question arises whether these amendments comply with the requirements of Article 123(2) EPC and/or are allowable as corrections within the meaning of Rule 88 EPC.

(b) The algebraic terms $(\lambda d_0/\pi\omega_0^2 n)$ and $\tan \theta(d_0)$ in Equation 2 on page 6 of the description are, unlike the corresponding ones in present claims 1 to 4 (see paragraph [1.(a)] above), not raised to the second power and therefore Equation 2 on page 6 is inconsistent with Equation 2 of present

claims 1 to 4 (Article 84 EPC). In addition, Equation 2 on page 6 also appears to be inconsistent with Equation 5 on page 7 and possibly also with Equation 6 for reasons analogous to those put forward in paragraph [1.(c)] above.

(c) The value d_0 = 3.12 μm on page 6, penultimate paragraph does not appear to result from the substitution into Equation 3 of the values of λ and n specified in the paragraph. The same applies to the value of ω_y = 1.32 μm in the middle paragraph on page 7, to the value d = 15.22 μm in the last paragraph on page 7, and to the value of ω_x = 3.4 μm in the first paragraph on page 8, which do not appear to result from the substitution in Equations 5, 6 and 7, respectively, of the remaining quantities specified in the description.

(d) There are also doubts as to the correctness of Equation 6 on page 7, and in particular as to the power of the quantity "B" (see for instance document D6, equation (A11) in Appendix II)."

3. "It follows from the deficiencies and irregularities noted above that, apart from the lack of conciseness (Article 84 EPC) of the claimed subject-matter (see paragraph [1.(b)] above), the subject-matter for which protection is sought would not appear to be clear and supported by the description as required by Article 84 EPC (paragraphs [1.(c)] and [2.(b)] above), and there are doubts as to whether the amended application documents at present on file comply with the

requirements of Article 123(2) and Rule 88 EPC (paragraphs [1.(a)], [1.(b)] and [2.(a)] above). In addition, the question arises whether the deficiencies and irregularities in the application documents identified above (see in particular paragraphs [1.(c)], [2.(b)], [2.(c)] and [2.(d)] above) can be overcome or clarified without offending against the provisions of Article 123(2) EPC - and possibly corrected under Rule 88 EPC - and, in the negative, whether they would affect the sufficiency of disclosure of the invention within the meaning of Article 83 EPC."

4. "Due to the nature of the issues raised above, and in particular those raised in paragraphs [1.(a)] and [1.(c)] above, the Board considers that no meaningful assessment of the patentability of the claimed invention under Articles 52(1), 54 and 56 EPC can be carried out on the basis of the present application documents unless and until the deficiencies and irregularities noted above are appropriately overcome or clarified. In addition, assuming that all the deficiencies and irregularities noted above are appropriately overcome and/or clarified, it appears that the disclosure of documents D4, D5, D7 and D8 may be prejudicial to the novelty, or at least to the issue of the inventive step of the claimed subject-matter (Articles 52(1), 54 and 56 EPC), see in particular:

- document D4, abstract together with Figures 1b and 1d and the corresponding description in columns 8 and 9 and the examples,
- document D5, abstract and sections I and II,

- document D6, abstract together with sections II-A, II-B, III-C and III-D,
- document D7, Figures 7 and 8 and the corresponding description, and
- document D8, abstract and Figures 6 and 9 together with the corresponding description."

IV. In reply to the summons to oral proceedings, the appellants - without submitting any substantive argument in reply to the objections and deficiencies noted by the Board - requested that the oral proceedings be cancelled and that the proceedings be continued in writing. The appellants were then informed that the oral proceedings would be held on the date fixed by the summons, and, in reply thereto, the appellants informed the Board that they would not attend the oral proceedings and requested a decision according to the state of the file.

V. Oral proceedings were held before the Board in the absence of the appellants. At the end of the oral proceedings the Board gave its decision.

VI. The sole substantive arguments advanced by the appellants were developed in the statement setting out the grounds of appeal. These arguments, however, pre-date and have no bearing on the issues subsequently raised in the Board's communication, and are therefore omitted.

Reasons for the Decision

1. The appeal is admissible.

2. In the communication pursuant to Article 11(1) RPBA annexed to the summons to oral proceedings, the Board explained in detail why in its preliminary opinion:

   (a) the claims according to the request of the appellants do not comply with the requirements of clarity, support in the description and conciseness set forth in Article 84 EPC (point III.3 together points III.1.(b), III.1.(c) and III.2.(b) above);

   (b) there are doubts as to whether the amendments to the application documents satisfy the requirements of Article 123(2) EPC and/or constitute admissible corrections under Rule 88 EPC, and as to whether these objections and other deficiencies in the application documents can be overcome and/or corrected without offending against the provisions of Article 123(2) and Rule 88 EPC and, in the negative, whether they would affect the sufficiency of disclosure of the invention within the meaning of Article 83 EPC (point III.3 together with points III.1.(a), III.1.(b), III.1.(c), III.2.(a) III.2.(b), III.2.(c) and III.2.(d) above); and

   (c) the disclosure of documents D4, D5, D7 and D8 would appear to be prejudicial, if not to the novelty, at least to the issue of the inventive

step of the claimed subject-matter (Articles 52(1), 54 and 56 EPC) (point III.4 above).

In reply to the aforementioned communication, the appellants requested the cancellation of the oral proceedings. The appellants, however, gave no reasons in support of their request and, in addition, made no substantive submissions in reply to the detailed objections raised by the Board. In the absence of any reason or special circumstance for doing otherwise, the Board maintained the oral proceedings which were held in the absence of the appellants pursuant to Rule 71(2) EPC.

3. After consideration of the issues raised by the Board in its communication, and in the absence of any attempt by the appellants to refute or to overcome the objections and deficiencies raised by the Board, the Board sees no reason to depart from the preliminary opinion expressed in the aforementioned communication.

Having regard to the above, and in view of the appellants' request for a decision based on the state of the file, during the oral proceedings the Board concluded that the application documents according to the appellants' request do not comply with the requirements of the EPC (see point 2 above) and that the appeal must be dismissed for the reasons already communicated to the appellants and reproduced in points III.1 to III.4 above.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana A. G. Klein