DECISION 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:
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Catchword:
-
Case Number: T 1166/03 - 3.4.02

DECISION
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
refusing European application No. 95931431.1
pursuant to Article 97(1) EPC.

Composition of the Board:
Chairman: A. G. Klein
Members: P. 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 d₀ from the fiber tip to a beam waist radius ω₀ inside the fiber according to Equations 1 to 5, wherein

θ(d₀) is the half of the numerical aperture NA of the optical fiber output,
ω₀ 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 ω₀ outside the fiber,
λ is the wavelength of the beam,
n is the refractive index of the fiber core, and

Equation 1

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

Equation 2

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

$$\omega_0 = \frac{\omega_y}{\sqrt{1 + \tan^2 \theta(\lambda)}}$$
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 \( \left( \lambda d_0 / \pi \omega_0^2 n \right) \) 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. \( \left( \lambda d_0 / \pi \omega_0^2 n \right)^2 \) 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 $\omega_0$ and $\omega_y$ 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 $\omega_0$, $\omega_y$
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 $\omega_y$ 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 $\omega_y$ 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 $\omega$ has been replaced by $\omega_c$ at line 3 of page 6 and at line 9 of page 8, and by $\omega_y$ 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 \(\frac{\lambda d_0}{\pi \omega_0^2 n}\) 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 $d_0 = 3.12 \, \mu m$ on page 6, penultimate paragraph does not appear to result from the substitution into Equation 3 of the values of $\lambda$ and $n$ specified in the paragraph. The same applies to the value of $\omega_y = 1.32 \, \mu m$ in the middle paragraph on page 7, to the value $d = 15.22 \, \mu m$ in the last paragraph on page 7, and to the value of $\omega_x = 3.4 \, \mu m$ 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