

A	X	B		C	
---	---	---	--	---	--

File Number: T 187/91 - 3.4.1  
Application No.: 84 306 418.9  
Publication No.: 0 136 871  
Title of invention: Fiber optic amplifier  
  
Classification: H01S 3/06

**D E C I S I O N**  
**of 11 March 1993**

Applicant: THE BOARD OF TRUSTEES OF THE LELAND STANFORD JUNIOR UNIVERSITY

Headword: Light source/LELAND

**EPC** Articles 54, 93 and 123(2)

Keyword: "Amendments" - "Extension of protection before grant" - "Amended subject-matter within content of the application as filed" - "Added subject-matter (no)"

**Headnote**

A specific example within a generic disclosure forming part of the description of the invention in an application as filed is part of the content of the application as filed for the purpose of Article 123(2) EPC if the skilled reader would seriously contemplate such specific example as a possible practical embodiment of the described invention, having regard to its context in the remainder of the application as filed, and subject to any understanding of the skilled reader to the contrary.



Case Number : T 187/91 - 3.4.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.1**  
**of 11 March 1993**

**Appellant :** THE BOARD OF TRUSTEES OF  
THE LELAND STANFORD JUNIOR UNIVERSITY  
Encina 105  
Stanford University  
Stanford  
California 94305 (US)

**Representative :** Rushton, Ronald  
SOMMERVILLE & RUSHTON  
11 Holywell Hill  
St. Albans  
Hertfordshire AL1 1EZ (GB)

**Decision under appeal :** Decision of the Examining Division 047 of the  
European Patent Office dated 24 September 1990  
refusing European patent application  
No. 84 306 418.9 pursuant to Article 97(1) EPC.

**Composition of the Board :**

**Chairman :** G.D. Paterson  
**Members :** R.K. Shukla  
H.J. Reich



## Summary of Facts and Submissions

- I. This European patent application was filed in 1984. During the examination procedure, the first communication which was issued by the Examining Division was a communication under Rule 51(4) EPC dated 2 March 1989, informing the applicant that it intended to grant the patent with the claims as filed. In reply to this communication, the applicant approved the description and drawings of such text, but requested amendment of the claims (and corresponding amendment to the description) under Rule 86(3) EPC, first sentence. Following a further communication from the Examining Division and reply from the applicant, the application was refused in a decision of the Examining Division dated 24 September 1990, on the basis that the amended claims contained subject-matter which extended beyond the content of the application as filed, contrary to Article 123(2) EPC.
- II. The Applicant lodged an appeal against this decision, together with two sets of claims, set A and set B, (the main and auxiliary requests) which correspond respectively to the amended claims which were rejected in the impugned decision and to the claims as originally filed which were the subject of the communication under Rule 51(4) EPC.
- III. Independent Claims 1 and 10 as originally filed (set B) were worded as follows:
1. A fiber optic amplifier, characterized by:  
  
a first fiber (12) having a first refractive index;

a second fiber (14), formed of a laser material, having a second refractive index higher than said first refractive index, said fibers (12, 14) positioned in close proximity to form an interaction region (16) for transferring light from said first fiber (12) to said second fiber (14);

a cone shaped rod (50), comprising:

a first fiber sized end (54) for introducing light into one end of said first fiber (12);

a second end (52) having a diameter substantially larger than said first end (54);

a plurality of pump light sources (60), mounted to introduce pump light into said second end (52), said cone shaped rod focusing the pump light from said second end (52) to said first fiber sized end (54) for introduction into said first fiber (12) and for propagation through said first fiber (12) to the interaction region (16) to pump said second fiber (14) and cause an electronic population inversion in said laser material; and

said plurality of pump light sources (60) offset from the axis (72) of said cone shape rod (50) to excite high order modes in said first fiber (12) to enhance absorption of the pump light by said laser material of second fiber (14).

10. A method of pumping an optical fiber, formed of laser material, said method characterised by:

supplying pump light to one end (52) of a cone shaped rod (50) by mounting plural light sources (60) at respective locations removed from the central axis (72) of said cone shaped rod (50) to excite high order modes at the other end (54) of said cone shaped rod (50); and

optically coupling the other end (50) of said cone shaped rod (50) to pump the laser material of said optical fiber (14)."

In the main request, the amendments in Claim 1 of Claims set A consist in the replacement of "a plurality of pump light sources" and "said plurality of pump light sources" with "a pump light source" and "said pump light source", respectively. Claims 5 to 7 and 11 and the description on pages 4 and 5 have been amended for consistency with Claim 1. A new dependent Claim 2 has been added.

IV. The arguments of the Appellant in support of his main request can be summarised as follows:

Applying the criteria laid down in Decision T 331/87 (OJ EPO 1991, 22) for the allowability of the replacement or removal of a feature from a claim under Article 123(2) EPC of the present case, the proposed amendments are permissible because

- (i) the feature regarding the number of light sources was not explained as essential in the disclosure;
- (ii) that feature is not, as such indispensable for the function of the invention in the

light of the technical problem it serves to solve; and

- (iii) an embodiment of the present invention with only one light source requires no real modification of other features to compensate for the change.

In particular, in the description of the invention there is nowhere any emphasis placed on the exact number of light sources to be mounted on the cone-shaped rod of the invention. Three light sources which are disclosed in the embodiment of Figures 6 and 7 serve as an example only and this is made evident by the description on page 16, lines lines 14 to 17 referring to "more or less (than three) sources may be utilized". The exact number of light sources is thus not presented as an essential feature of the invention.

The technical problem addressed by the present invention is to provide a compact, efficient, high power fibre optic amplifier that can be used in applications such as high accuracy gyroscopes or communication networks. Although the solution to one aspect of the above problem entails increased absorption of the input pump power and excitation of higher order modes, the number of light sources increases the input pump power into the cone, and has no relationship to the excitation of higher order modes. From the description of the invention, and in particular having regard to the embodiment of Figure 8 showing a single beam, it would be evident to a skilled person that for each light source acting independently of the other sources, the excitation of higher order

modes depends strictly on the extent to which the light source is offset from the centre of the cone shaped rod, so that even a single source will function to excite higher order modes and thereby increase the absorption of the input pump power. A skilled person reading the original disclosure would therefore realise that the number of light sources is not an indispensable feature for the function of the invention.

Finally, an embodiment of the invention with only one source requires no modification of other features to compensate for the change, since it is evident from the description that adding or removing light sources from the cone shaped rod does not affect the operation of the invention. Also there are no well founded reasons for believing that the invention would perform with two light sources and not one light source.

The proposed amendment is also an obvious clarification in the sense of the Guidelines C-VI, 5.6, and therefore allowable.

- V. At the conclusion of the oral proceedings held on 11 March 1993, the decision was announced that the appeal is allowed and that the case is remitted to the first instance with an order to grant a patent on the basis of claim set A filed as the main request.

### **Reasons for the Decision**

- 1. The effect of the requested amendments is that the claims of the application after amendment seek

protection for a fibre optic amplifier (and a method of pumping an optical fibre) including **one** or more light sources, whereas in the application as filed the claims sought protection for a fibre optic amplifier (and a method of pumping an optical fibre) including **two** or more light sources ("a plurality of pump light sources").

Such amendments clearly extend the protection which is sought by the application, which is permissible in itself provided that there is no contravention of Article 123(2) EPC. The only question in issue in the appeal is whether the amended application "contains subject-matter which extends beyond the content of the application as filed".

2. One consideration which underlies Article 123(2) EPC stems from the fact that, pursuant to Article 93(1) EPC, a European patent application has to be published as soon as possible after the expiry of a period of 18 months from the date of filing (or date of priority if applicable), which is well before the examination of the application under Article 96 EPC in the light of the European search report is completed. Thus the reader of such a published application will be informed of the maximum extent of its subject-matter and therefore its maximum content, some time before the text of the application (including the claims) is finalised having regard to the drawing up of the European search report and the subsequent examination of the application. The content of the application as filed and as published determines the matter for which protection may be sought in the claims of that

application and accordingly gives an indication to the public of the protection which may be granted.

A further consideration underlying the relationship between the claims and the content of a European patent application is that, after appropriate amendment if necessary, the granted claims should give a fair protection for the inventive subject-matter which is contained in the application as filed.

In some cases Boards of Appeal have found it useful to relate and even to equate the necessary considerations under Article 123(2) EPC with a "novelty test", ("i.e. no new subject-matter must be generated by the amendment" - Decision T 201/83 (OJ EPO 1984, 401); see also Decision T 194/84 (OJ EPO 1990, 59). There is clearly a close conceptual correlation between the assessment of novelty and the assessment of what is an allowable amendment under Article 123(2) EPC. However, as stated in Decision T 133/85 (OJ EPO 1988, 441), "care is necessary when applying the law relating to novelty to questions which arise in relation to "Article 123(2) EPC, since it is the wording of Article 123(2) EPC "which must ultimately be considered in each particular case". Furthermore, the considerations set out above which underlie Article 123(2) EPC are different from those that underlie Article 54 EPC.

3. In the present case, the content of the application as filed (i.e. the description, drawings and claims) may be summarised as follows:-

3.1 "Background of the Invention" - page 1 to page 4, line 7. This section refers to the problems, such as relatively large size, and high power and cooling requirements of the prior art Nd: YAG optical amplifiers (see, in particular, page 3, lines 5 to 14; page 4, lines 1 to 7).

3.2 "Summary of the Invention" - page 4, line 9 to page 5

Page 4, lines 9 to 36 describes the "present invention" as a fibre optic amplifier having various components. Reference is made to "Plural light sources", mounted to introduce light into the larger second end of a cone shaped rod, which focusses the light into the smaller fibre sized first end of the rod, for introduction into the pump fibre.

It is also stated that "In order to increase the absorption of light per unit of length of the amplifier fibre, the light sources are mounted at a location which is offset from the rod axis to cause excitation of high order modes".

Preferred features are described from page 4, line 37 to page 5, line 24. At page 5, lines 25 to 36 the "present invention" is further described as a method of pumping an optical amplifier, including a further reference to "plural light sources".

3.3 "Detailed Description of the Preferred Embodiment" - page 6, line 33 to page 20 (this follows a "Brief Description of the Drawings" at page 6, lines 1 to 31).

A preferred embodiment of the structure of a fibre amplifier is described with reference to Figure 1. A

preferred pump source for the amplifier structure of Figure 1 is described with reference to Figure 6, at page 14, line 35 to page 16, line 17. The description refers to "plural light sources 60" being mounted on the planar end face of a cone shaped rod 50. In fact, three light sources are shown in Figure 6. The structure of each light source is described in detail with reference to Figure 7, from page 15 line 26 to page 16, line 14. At page 16, lines 14 to 17, it is then stated that "Further, while the drawings show three such light sources 60 mounted on the cone shaped rod 50, it will be understood that more or less sources 60 may be utilized".

Figure 8 is a schematic drawing showing the path of an exemplary ray input to the cone shaped rod. The description with reference to Figure 8 on page 16, line 18 to page 17, line 17 and at page 18, lines 17 to 28 makes it plain that substantially all of the light entering the large end of the cone shaped rod 50 is efficiently coupled to the fibre 12 at the small end of the cone shaped rod 50, provided that the incident light is offset from the axis of the cone. Furthermore, such offset location results in the incident ray having higher angles of incidence by the time it reaches the fibre sized end 54 of the cone, which in turn is advantageous for the excitation of the signal fibre 14 since the incident radiation makes an increased number of reflections, and thus, an increased number of passes over a relatively short length of the signal fibre 14. According to the description on page 18, line 29 to page 19, line 18, the optimum location of each light source on the face of the cone is found independently of the locations of other sources.

An alternative embodiment of an amplifier structure is described at page 19, line 19 to page 20 with reference to Figures 9 and 10. Figure 10 is a diagram showing a cone shaped rod 50, and two light sources 60.

- 3.4 Claims 1 to 15 set out on pages 21 to 23 all refer to "a plurality of light sources", or "plural light sources".
4. It is clear from the above summary of the content of the application as filed that, with the exception of the sentence at page 16, lines 14 to 17, the invention and its preferred embodiment has been described throughout the application as filed as having more than one light source, and that, in the absence of such sentence at page 16, lines 14 to 17, there would be nothing in such content to indicate expressly the possibility of using only one light source when carrying out the invention. However, the sentence at page 16, lines 14 to 17 states that although the preferred embodiment of the invention is shown as having three light sources 60, "it will be understood that more or less sources 60 may be utilized". Prima facie, therefore, this sentence is a generic statement that the preferred embodiment of the invention may include any number of light sources either more or less than three, including only one light source. In the Board's view, this sentence indicates that the writer of the application as filed was aware of the fact that the invention can be carried out with only one light source.

Such a specific example (one light source) within a generic disclosure (more or less than three light

sources) forming part of the description of the invention in an application as filed is part of the content of the application as filed if the skilled reader would seriously contemplate such specific example as a possible practical embodiment of the described invention, having regard to its context in the remainder of the application as filed, and subject to any understanding of the skilled reader to the contrary.

- 4.1 In the Board's view, a skilled person would understand from the application as filed that in contrast to the prior art discussed in the application, the invention as described aims to provide a compact, efficient, high power fibre optic amplifier that can be used in applications such as high accuracy gyroscope or communication networks (see, in particular, page 4, lines 32 to 36; page 9, lines 2 to 10, lines 15 to 26; page 12, lines 10 to 15; page 14, lines 23 to 33; page 17, lines 13 to 17).

As discussed in paragraph 3.3 above, the description with reference to Figure 8 makes it clear to the skilled person that substantially all of the light entering the large end of the cone shaped rod 50 is efficiently coupled to the fibre 12 at the other end of such rod by ensuring that the light input is offset from the axis of the cone shaped rod. Such efficient coupling is not related to the number of the light sources.

In the Board's view a skilled reader of the application as filed would seriously contemplate the use of only one light source when carrying out the described

invention in accordance with his practical output intensity requirements, and there is nothing in the application as filed or in his common general knowledge which would cause the skilled person to understand that the reference at page 16, lines 14 to 17 to less than three light sources is intended to exclude the possibility of using only one light source.

- 4.2 The Examining Division in its Decision appears to have regarded the sentence at page 16, lines 14 to 17 as being necessarily subsidiary to the passages in the "Summary of the Invention" and in the detailed description with reference to Figures 6 and 10, as well as in the claims, which refer to "a plurality of light sources" or the equivalent. The reference to more or less sources 60" was therefore interpreted as having still to be consistent with "a plurality of sources". In the Board's view, this is too narrow a view of the effect of this sentence. Such sentence, with its indication of the possibility of using one light source in an embodiment of the invention, is just as much a part of the technical content of the application as the rest of the application with its references to a plurality of light sources. On a careful and analytical reading of the whole content of the application as filed, including this sentence, there is no reason to regard the use of a plurality of light sources as essential to the invention in order to achieve its stated aims.

On the contrary in the Board's judgment, the proper interpretation of the content of the application as filed is that it includes as one possible practical variation of the preferred embodiment of the invention

a fibre optic amplifier having only one light source. There being no reason why a skilled reader would not seriously contemplate the use of only one light source, a reader of the application as filed would therefore be sufficiently informed of the possibility that the granted application would protect such an amplifier by means of claims covering the use of one or more light sources as set out in claims set A. Furthermore, such claims are supported by and provide a fair protection for what was included in the content of the application as filed.

5. For the foregoing reasons, in the Board's judgment the amended claims of set A forming the basis of the main request do not contain subject-matter which extends beyond the content of the application as filed, and do not therefore contravene the requirements of Article 123(2) EPC. The patent should therefore be granted including the amendments as set out in paragraph III above.

## **Order**

### **For the above reasons, it is decided that:**

1. The decision of the Examining Division is set aside.
2. The appeal is allowed.

3. The case is remitted to the first instance with an order to grant a patent on the basis of claim set A filed as the main request with the Statement of Grounds of Appeal filed on 24 January 1991.

The Registrar:

The Chairman:

M. Beer

G. Paterson