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D E C I S I O N
of 16 October 2001

Case Number: T 0173/97 - 3.4.1

Application Number: 89300926.6

Publication Number: 0327310

IPC: H01S 3/06

Language of the proceedings: EN

Title of invention:
Solid state microlaser

Patentee:
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Opponent:
EADS Deutschland GmbH Patenabteilung

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
"Added subject-matter (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0173/97 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 16 October 2001

Appellant: (Proprietor of the patent)
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Respondent: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 20 December 1996 revoking European patent No. 0 327 310 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: G. Davies
Members: M. G. L. Rognoni
G. Assi

Summary of Facts and Submissions

I. The appellant (patentee) lodged an appeal, received on 13 February 1997, against the decision of the opposition division, despatched on 20 December 1996, revoking European patent No. 327 310. The appeal fee was paid on 14 February 1997 and the statement setting out the grounds of appeal was received on 21 April 1997.

II. The opposition had been filed against the patent as a whole, based on Article 100(a) EPC.

III. In a communication dated 9 March 2001, accompanying a summons to attend oral proceedings, the Board expressed, *inter alia*, the preliminary opinion that the main and auxiliary requests did not appear to be admissible under Article 123(2) EPC.

IV. By letter dated 2 April 2001 the representative of the appellant (patentee) informed the Board that they had been instructed by their client not to attend the oral proceedings, and asked that the Board issue its decision "on the basis of the papers currently on file".

V. Oral proceedings were held on 16 October 2001 in the absence of the appellant.

VI. The appellant requested in writing that the decision of the opposition division be set aside and the patent be maintained on the basis of:

Main request: claims 1 to 12 filed with a letter dated 21 April 1997, Description and Figures of the patent as granted with lines 7 and 8 of page 2 changed to "features set out in the characterising portions of Claims 1 and 2";

Auxiliary requests: claims 1 to 11 filed with the letter dated 21 April 1997, Description and Figures as for the main request.

The respondent (opponent) requested that the appeal be dismissed.

VII. The wording of claims 1 and 2 according to the **main request** reads as follows;

"1. An optically pumped microlaser (30) comprising a gain medium (32) disposed between two mirrors (34, 36), characterised in that the distance between the mirrors is such that the gain bandwidth of the gain medium (32) is less than the frequency separation of the cavity modes, in that the microlaser is pumped to operate in a single transverse mode, in that the gain medium (32) is a solid state non-stoichiometric material, and in that the separation between the mirrors (34, 36) is in the range of several hundred micrometers."

"2. An optically pumped microlaser (30) comprising a gain medium (32) disposed between two mirrors (34, 36), characterised in that the distance between the mirrors is such that the gain bandwidth of the gain medium (32) is less than the frequency separation of the cavity modes, in that the microlaser is pumped to operate in a

single transverse mode, in that the gain medium is a solid state stoichiometric material, and in that the separation between the mirrors (34, 36) is in the range of 10-100 micrometers."

The wording of claim 1 according to the **auxiliary request** reads as follows:

"1. An optically pumped microlaser (30) comprising a gain medium (32) disposed between two mirrors (34, 36), characterised in that the distance between the mirrors is such that the gain bandwidth of the gain medium (32) is less than the frequency separation of the cavity modes, in that the microlaser is pumped to operate in a single transverse mode, in that the gain medium (32) is Nd:YAG and in that separation between the mirrors (34, 36) is in the range of several hundred micrometers."

Claim 2 according to the **auxiliary request** is the same as claim 2 according to the main request.

VIII. The appellant did not comment on the objections under Article 123(2) EPC raised in the Board's communication.

The respondent argued essentially that the independent claims 1 and 2 according to the main request and claim 2 of the auxiliary request were not allowable under Article 123(2) EPC because their respective subject-matters constituted a generalisation of a teaching of the application as originally filed.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Claim 1 differs from the corresponding claim of the patent as granted essentially in that:

- the gain medium is a solid state non-stoichiometric material,

- the separation between the mirrors (34, 36) is in the range of several hundred micrometres.

2.2 Claim 2 differs from claim 1 of the patent as granted essentiallyin that:

- the gain medium is a solid state stoichiometric material, and

- the separation between the mirrors (34, 36) is in the range of 10-100 micrometres.

3.1 The application as originally filed specifies that:

(a) *"The separation between adjacent ones of the cavity modes 16 - 24 is given by the equation* ν_c = *c/ 2nl , where c is the speed of light, n is the refractive index of a gain medium and l is the length of the resonant cavity. As will be appreciated by those skilled in the art, if the spacing* ν_c *of cavity modes is greater than the gain bandwidth* ν_g, *then only a single longitudinal mode will oscillate when the oscillator operates in a single transverse mode."* (page 2, lines 20 to 28)

(b) *"For a laser gain medium such as Nd:YAG, the cavity length would be approximately several hundred* μm, *while for a stoichiometric compound*

laser material such as Nd pentaphosphate, cavity lengths will be typically in the range of 10-100 μm. " (page 3, lines 7 to 12)

3.2 According to *(a)*, the spacing between the resonant modes of a particular resonant cavity defined by two opposite facing mirrors depends both on the spacing between the mirrors and on the **refractive index** of the medium located in the cavity. When the separation between cavity modes is greater than the gain bandwidth of the laser material, only one longitudinal mode can be sustained in the cavity.

In view of *(a)*, the statement *(b)* should be interpreted as meaning that a medium such as Nd:YAG has a **refractive index** and a **gain band width** which require a cavity spacing of "several hundred *μm*" to satisfy the condition defined in (*a*). Similarly, a stoichiometric medium such as Nd pentaphosphate has a refractive index and a gain bandwidth requiring a cavity length in the range of 10 - 100 *μm*.

Hence, in the opinion of the Board, the application does not disclose that the two claimed ranges of cavity lengths ensure single longitudinal mode operation for **unspecified** stoichiometric and non-stoichiometric laser materials, respectively.

Indeed, it is doubtful whether all the laser materials covered by the term stoichiometric and non-stoichiometric have **refractive indexes** which, together with the claimed ranges, would satisfy the condition indicated in *(a)*. In this respect, it should be noted that claims 1 and 2 are based on a combination of

claims 1 and 6, and of claims 1 and 7 of the contested patent, respectively. However, in the contested patent claims 6 and 7 are dependent on claims (4 and 5, respectively) which define the laser medium.

3.5 Hence, the subject-matters of claims 1 and 2 according to **main request** are a generalization of a teaching (ie ranges for the cavity spacing) which in the application as originally filed is disclosed only in connection with specific materials (Nd:YAG and Nd pentaphosphate).

4. *Auxiliary request*

4.1 Claim 2 corresponds to claim 2 of the *main request*, and, for the same reasons, its subject-matter has no support in the application as originally filed.

5. In summary, the Board finds that the main and the auxiliary requests contain subject-matter which extends beyond the content of the application as originally filed.

Since none of the appellant's requests is admissible under Article 123(2) EPC, there is no basis for the maintenance of the patent.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher G. Davies