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D E C I S I O N
of 18 May 1999

Case Number: T 0510/96 - 3.4.1

Application Number: 87113344.3

Publication Number: 0259888

IPC: H01S 3/025

Language of the proceedings: EN

Title of invention:
Semiconductor laser module

Patentee:
NEC Corporation

Opponent:
Bosch Telecom GmbH
Alcatel N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 100(a), 123(2), (3), 56

Keyword:
"EPC Article 56 inventive step - no"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0510/96 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 18 May 1999

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 18 March 1996 revoking European patent No. 0 259 888 pursuant**

to Article 102(1) EPC.

Composition of the Board:

Chairman: G. Davies
Members: G. Assi
H. K. Wolfrum

Summary of Facts and Submissions

I. The appellant (proprietor of the patent) lodged an appeal, received on 28 May 1996, against the decision of the Opposition Division, dispatched on 18 March 1996, revoking the European patent No. 0 259 888 (application No. 87 113 344.3). The fee for the appeal was paid on 28 May 1996. The statement setting out the grounds of appeal was received on 19 July 1996.

Oppositions had been filed by opponent I and opponent II against the patent as a whole and was based on Article 100(a) EPC, in particular on the grounds that the subject-matter of the patent was not patentable within the terms of Articles 52(1) and 56 EPC.

The Opposition Division held that the grounds of the opposition prejudiced the maintenance of the patent, having regard *inter alia* to the following documents:

(D1) NEC Technical Report, Vol. 38, No. 2/1985, pages 84 to 89,

(D6) JP-A-57-211288 with English translation, as filed by respondent II (opponent II) with the letter of 20 November 1996, and

(D8) JP-A-57-83081.

During appeal proceedings, the Board considered the following further document, which had been submitted by respondent II with the letter of 20 November 1996:

(D11) CA-A-1 151 277.

II. Oral proceedings were held on 18 May 1999 at the request of all the parties.

III. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

main request:

claims 1 to 4 as filed with the letter of 19 July 1996,
description pages 2 to 8 of the patent specification,
Figure sheets 1/3-3/3 of the patent specification,

first auxiliary request:

claims 1 to 4 as filed at the oral proceedings on 18 May 1999,

description pages and Figure sheets according to the main request,

second auxiliary request:

claims 1 to 3 as filed at the oral proceedings on 18 May 1999,
description pages and Figure sheets according to the main request.

IV. The respondent I (opponent I) and respondent II (opponent II) requested that the appeal be dismissed.

V. The appellant's second auxiliary request was not admitted by the Board.

VI. The wording of claim 1 according to the main request reads as follows:

"A semiconductor laser DIP module comprising: a box-shaped case (9) having a window glass (10) hermetically sealed in a side wall portion thereof; a substrate (7) fixed within said case; a semiconductor laser (1) fixed on said substrate through a chip carrier (3); a first lens (6) fixed on said substrate adjacent the laser; a second lens (13) supported by a holder (12) outside the window glass for receiving light from the first lens, said holder being fixed to an outside portion of said side wall; and an optical fiber (14) fixed to said holder, which is arranged such that the endface of the fibre receives light from the second lens but is spaced from and not adhered to said second lens (13)."

The wording of claim 4 according to the main request reads as follows:

"A semiconductor laser DIP module, in which a semiconductor laser (1) and a Peltier element (8) for controlling the temperature of said semiconductor laser are mounted in a box shaped metal case (9), and which has a light-outputting fiber (14), a portion near the distal end of which is protected by a metal cylinder (15), comprising: said metal case having a window glass (10), which is hermetically sealed in a side wall portion thereof; a substrate (7) fixed on said Peltier element which is fixed in said metal case; said semiconductor laser being fixed on said substrate through a chip carrier (3); a first lens (6) fixed on the substrate adjacent the laser, a light monitoring diode (4) adjacent the laser, and a thermister (5)

fixed on said substrate; a second lens (13), an outer surface of which is supported by a holder (12) bonded to said side wall around said window glass of said case such that the second lens is situated outside the window glass and receives light from the first lens; and a slide ring (16) having an inner diameter slightly larger than an outer diameter of said metal cylinder, said slide ring being bonded to said holder, and said metal cylinder being bonded to said slide ring, wherein the fiber (14) is arranged such that the endface of the fiber receives light from the second lens but is spaced from and not adhered to said second lens (13)."

Claims 1 and 4 of the first auxiliary request are identical to claims 1 and 4 according to the main request with the deletion of the phrase "and not adhered to".

Claim 1 of the second auxiliary request is identical to claim 4 according to the first auxiliary request.

Claims 2 and 3 according to all the requests are dependent.

VII. The appellant's arguments may be summarised as follows.

As to the objection raised under Article 123(2) EPC with regard to the expression "and not adhered to" in claims 1 and 4 of the main request, a clear support therefor was found on page 7, lines 36 to 40, of the patent specification. Furthermore, it was unambiguously derivable from Figures 2B and 3B that the parts 27 and 13 were separated, which fact also followed from the requirement that these parts had to be adjustable in

the optical axis direction.

As to the objection under Article 56 EPC, the opposed patent essentially related to a semiconductor laser module in a dual-in-line (DIP) package. The DIP and coaxial configurations with advantages and deficiencies were discussed in the patent specifications. The closest prior art was considered to be disclosed in document D1 or, alternatively, in document D11, whereas D6 described the coaxial configuration. The technical problem addressed in the patent was to combine the advantages of both types of structures in an improved DIP module. Having regard to the cited documents, the disclosure in D1 was not concerned with any of the deficiencies of known DIP modules. As to D11, this document only discussed the problem of mounting the optical fibre within the DIP housing by using epoxy resin, or fusible alloys by soldering. These processes could cause contamination and possible damage of the sensitive optical and electronics parts. In D11, a solution teaching away from the present invention was offered for the discussed problems. The skilled person, reading this document, would not have any incentive to look for other solutions. As regards D6, this document disclosed the so-called "virtual fibre" coupling method based on the use of a set of lenses. However, D6 had been filed in 1981, i.e. 5 years before the priority date of the patent in suit. The same applied to D11. In the years 1981 to 1986, the technology in the technical field of the invention had developed very rapidly. Thus, the fact that nobody had arrived at the claimed solution in spite of the large interest in the field showed that neither the problem nor the solution underlying the patent was obvious.

VIII. The arguments of respondent I and respondent II may be summarised as follows.

Respondent I objected that, in the application as filed, there was no basis for the feature in claims 1 and 4 of the main request that the end face of the fibre was not adhered to the second lens, contrary to the provisions of Article 123(2) EPC.

Both respondents I and II considered document D11 as the closest state of the art. According to this document, the fact of mounting the optical fibre close to the laser within the DIP housing caused problems. Even though D11 proposed the particular solution of using the thermoelectric cooler as a heater for melting the fusible alloy used to anchor the fibre at the correct position, this would not prevent the skilled person from looking for other solutions, for instance avoiding to place the fibre end close to the laser in the DIP housing.

From documents D6 or D8, he would receive the information that this could be achieved by providing a window in the DIP housing and by coupling the light from the laser to the fibre via a set of lenses. This would improve the coupling efficiency.

Thus, the claimed invention simply consisted in applying a known solution (see D6 or D8) to a known device (see D11), the remaining differences like, for instance, the use of glass window instead of a sapphire window being mere routine measures.

Reasons for the Decision

1. The appeal is admissible.

2. *Document D11*

Document D11 has been filed by respondent II with the letter of 20 November 1996, i.e. late after expiry of the nine-month opposition period. However, considering that the appellant has filed amended claims with the grounds of appeal dated 19 July 1996 and that, according to the respondent II (see the letter of 20 November 1996, "Faits et justifications", pages 1 and 2), the disclosure of D11 shows that the manufacture of DIP modules poses problems, whereas the appellant alleged that the "recognition of the various deficiencies and advantages of DIP modules and coaxial modules does not belong to the prior art" (see the letter of 19 July 1996, page 3, penultimate sentence), the Board admits the new document into the procedure.

3. *Main Request*

3.1 Articles 123(2), (3) EPC

Claim 1 has been amended with respect to claim 1 as granted so as to include the following further features:

(i) the module is of DIP type,

(ii) the case is box-shaped, and

(iii) the optical fibre is spaced from and not adhered to the second lens.

Only the third amendment has been objected by the respondent I under Article 123(2) EPC.

The amendments (i) and (ii) are clearly disclosed in the application as filed (see the published application, page 6, lines 3 and 4, and claim 4). As to (iii), the feature that the end face of the fibre is spaced from the second lens is clearly disclosed in Figure 2 and 3 of the application as filed. The fact that a space is provided between the second lens 13 and the glass plate 27 attached on the end face of the fibre 14 entails that the fibre 14 cannot be adhered to the lens 13. Thus, the feature that the end face of the fibre is not adhered to the second lens is regarded as a tautology, i.e. a needless repetition of the claimed feature that the end face of the fibre is spaced from the second lens.

Claim 4 as granted has been amended so as to include the amendments (i) and (iii).

Thus, the amendments in claims 1 and 4 do not introduce subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC). Moreover, since the amendments clearly introduce a limitation, the protection conferred has not been extended (Article 123(3) EPC).

3.2 Novelty

The novelty of the subject-matter of the main request

is not in dispute among the parties, nor is it doubted by the Board. Thus, there is no need for a discussion of this issue.

3.3 Inventive step

3.3.1 Claim 1

3.3.1.1 Document D11, which is considered to represent the most relevant state of the art, discloses a semiconductor laser DIP module comprising a box-shaped case 14, a substrate 18, 22 fixed within said case, a semiconductor laser 12 fixed on said substrate through a pedestal 16, and an optical fibre 44 which is arranged such that its end face is disposed within the case close to the laser (see page 3, line 25, to page 4, line 25, Figures 1 and 2).

Thus, the subject-matter of claim 1 differs from the known module according to D11 by the following features:

(j) a window glass is provided hermetically sealed in a side wall of the case,

(jj) a first lens is fixed on the substrate adjacent the laser,

(jjj) a second lens is supported by a holder outside the window glass for receiving light from the first lens, said holder being fixed to an outside portion of the said side wall,

(jjjj) the optical fibre is fixed to the lens

holder,

(jjjjj) the end face of the fibre receives light from the second lens but is spaced from and not adhered to the second lens.

The same conclusion is also valid having regard to document D1, which discloses DIP type LD modules for optical telecommunications. Attention is, in particular, drawn to Figure 5 corresponding to Figures 1A and 1B of the opposed patent (see page 2, lines 12 to 17).

3.3.1.2 In the letter of 19 July 1996 (see point 4.1), the appellant points out that the description of the patent in suit explains deficiencies and advantages of the DIP modules and coaxial modules known in the state of the art. From this comparison the appellant derives the object of the invention, which should be seen in the provision of a DIP module having all the advantages of both the conventional DIP configuration and the conventional coaxial one. Such a definition indeed corresponds to the statement in the patent on page 5, lines 45 and 46. Moreover, according to the appellant, the recognition of the various deficiencies and advantages of the DIP modules and coaxial modules does not belong to the prior art, considering that DIP modules had been known and manufactured only for a relatively short time before the priority date of the patent. The appellant thus comes to the conclusion that the step of recognizing and defining the problem to be solved should be considered as a contribution over the prior art, in other words should be regarded as being part of the inventive step.

The Board does not share this view. Document D11 shows a typical DIP structure, according to which the optical fibre has an end portion anchored close to the laser by means of a mass of cured epoxy resin, so that the fibre end face receives light from the laser front facet (see page 1, lines 13 to 17). However, epoxy resin is not an ideal material for anchoring the optical fibre, because of the long room temperature curing time and the irreversibility of the curing reaction. Fusible alloys, which could be regarded as a possible alternative material, are, however, also not ideal since, in order to melt the alloy, heat must be applied, for instance by means of a soldering iron, so close to the fibre and other elements inside the package that damage, in particular breakage and contamination, may result. Moreover, it is difficult to control the temperature of miniature, heat sensitive parts, such as the laser, near the soldering iron tip (see page 1, line 18, to page 2, line 3). It is thus clear that, contrary to the appellant's statements, at the priority date of the patent in suit, deficiencies of the conventional DIP module were already known, in particular with regard to the manufacturing step of anchoring the optical fibre end portion close to the laser.

Besides the problem concerning the manufacture of the DIP module, another deficiency can be identified, which was known at the priority date of the patent in suit, as it can be inferred from document D1. Indeed, Figure 7 shows that DIP type SMF-LD modules (single mode fibre laser diode modules) have a coupling efficiency to the fibre lower than 30%, the most probable value being in the range 15-20%. This means

that the optical fibre receives light from the laser diode with considerable losses.

In view of the foregoing, the skilled person, starting from a DIP-LD module according to D11 (or D1), will try to improve, on the one hand, the manufacture of the device and/or, on the other hand, its optical coupling efficiency. The definition of such a technical problem does not contribute to a positive finding on the issue of inventiveness.

3.3.1.3 The features (j) to (jjjjj) mentioned above solve the problem as defined. In particular, they produce two effects. The end portion of the fibre has not to be anchored close to the laser diode, so that any risk of damage or contamination can be avoided. Moreover, since the fibre feedthrough is eliminated, it is easier to hermetically seal the case. Secondly, the lens system improves the optical coupling of the device. Furthermore, the advantages of the DIP structure, like hybrid packaging, standardization of pin connections and interchangeability of the module, are not lost.

3.3.1.4 Document D6 discloses a coupling device between a semiconductor laser and an optical fibre. According to the embodiment shown in Figure 6, a semiconductor laser 1 is mounted on a support 110 acting as heat sink and arranged within a box-shaped case having a sapphire window 111 hermetically sealed in a side wall portion. A first lens 21 is fixed on a holder 210 soldered with the laser support 110 within the case. A second lens 23, 24 is arranged outside the sapphire window for receiving light from the first lens. The

second lens comprises a rod element 23, which is fixed on a holder 231 disposed on the outer surface of the case side wall, and a second rod element 24 combined with the optical fibre by means of an optical binder into a single piece. The fibre is supported by a system comprising a capillary tube 301, a pipe 302 and an outer sheath 303, so that the rod element 24 is spaced from the rod element 23.

From an optical point of view, the rod element 23 of D6 performs the same function as the lens 13 of the embodiments according to Figures 2 and 3 of the patent in suit. On the other hand, the rod element 24 attached in D6 on the end face of the fibre corresponds to the glass plate 27 of the opposed patent. Moreover, the coupling efficiency of the lens system such as disclosed in D6 is higher than that achieved with the DIP arrangement, in which the end face of the fibre is simply placed close to the laser diode.

Hence, the coupling device known from D6 offers an improved coupling efficiency as compared with the DIP structure and, at the same time, allows an easier manufacture because there is no need to anchor the optical fibre close to the laser. It is thus obvious to the skilled person to apply the lens system known from D6 with corresponding effect to the DIP-LD module according to D11 (or D1). In doing this, he will arrive at a module differing from that of claim 1 only by the following features:

(k) the window is made of sapphire (not of glass),

(kk) the first lens is fixed on a holder soldered with the laser support (not on the same substrate on which the laser is arranged),

(kkk) the optical fibre is supported by a system comprising a capillary tube, a pipe and an outer sheath (it is not fixed to the second lens holder).

These differences, however, consist in constructional details which come within the scope of the customary practice followed by the skilled person or which do not provide any unexpected or surprising effect. Sapphire is a material commonly used in the field of optics. The choice between glass and sapphire is normally made according to the wavelength of the laser light.

As regards feature (kk), once the first lens holder is soldered, according to D6, to the laser support, a common base is formed which corresponds to the substrate of claim 1. On such a common base the adjustment of the first lens with respect to the laser can take place in the same way as in the patent in suit.

As to feature (kkk), in D6 the system used for fixing the optical fibre to the module case is such that the fibre end portion and the second lens both are fixed on the same outer surface of the case. As far as the mutual adjustment between the optical fibre and the second lens is concerned, the known system is equivalent to the claimed one.

3.3.1.5 The module according to claim 1 essentially comprises two independent aspects. The mechanical and electrical structure of the DIP modules providing the advantages of hybrid packaging, standardization of pin connections and interchangeability of the module is combined with a lens system optically coupling the external fibre and the laser diode within the case in an efficient way. The claimed module thus results in the mere aggregation of two systems known *per se*, i.e. from documents D11 (or D1) and D6, each of which functions in the conventional manner without together achieving an unexpected effect.

3.3.1.6 The appellant has argued that, since D11 discloses the use of the thermoelectric device provided within the module case both as a cooler (during operation of the module) and as a heater (in the manufacturing phase) in order to solve the problem of anchoring the fibre end portion close to the laser diode without causing any damage or contamination, this document would prevent the skilled person from looking for other solutions.

The Board disagrees with this argument. The fact that a document of the state of the art shows a solution to a given problem does not mean that the skilled person does not seek alternatives to the known device or process providing the same or similar effects or which offer other advantages. With regard to D11, the problem arises because of the location of the fibre end portion close to the laser diode. An alternative to the disclosed solution would then be providing the fibre end portion far away from the laser.

3.3.1.7 The appellant has also argued that D6 and D11 had been filed in 1981, i.e. 5 years before the priority date (12 September 1986) of the patent in suit, so that the skilled person would regard the fact that nobody had arrived at the claimed solution in this relatively long period of time in spite of the rapid technological development in the technical field of the invention as an indication of the presence of inventive step.

The Board disagrees with this line of argument considering that the publication dates of D6 (25 December 1982) and D11 (2 August 1983) rather than the priority dates should be looked at. It follows that the relevant time period considered between the priority date of the patent in suit and the publication dates of the prior art documents is not particularly long.

3.3.1.8 For these reasons, the subject-matter of claim 1 of the main request does not involve an inventive step (Article 56 EPC), having regard to the combination of documents D11 (or D1) and D6.

3.3.2 Claims 2 to 4

Claim 4 refers to a semiconductor laser DIP module, as is the case for claim 1. All the features of claim 1 are literally mentioned in claim 4 except for the wording that the optical fibre 14 is fixed to the holder 12. However, also this feature is included in claim 4, having regard to the fact that the metal cylinder 15 protecting the optical fibre is bonded to the slide ring 16 which is bonded to the holder 12.

Therefore, claim 4 is regarded as a dependent claim (Rule 29(4) EPC), as well as claims 2 and 3. The additional features defined in claims 2 to 4 concern routine design options which, in the Board's judgement, do not involve an inventive step.

3.3.3 For these reasons, the appellant's main request is not allowable.

4. *First auxiliary request*

Claims 1 and 4 of the first auxiliary request are identical to claims 1 and 4 of the main request, apart from the deletion of the phrase "and not adhered to", which is regarded as a tautology (see point 3.1 above). Thus, the subject-matter of the claims does not involve an inventive step for the same reasons mentioned above in point 3.3.

The appellant's first auxiliary request is not allowable.

5. *Second auxiliary request*

The appellant's second auxiliary request was not admitted into the procedure by the Board because it was filed late at the end of the oral proceedings without any clear justification either for the amendment or its late submission.

6. The grounds for opposition mentioned in Article 100(a) EPC prejudice the maintenance of the patent as amended by the appellant.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer G. Davies