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**Datasheet for the decision
of 5 June 2007**

Case Number: T 1454/05 - 3.4.02

Application Number: 99114619.2

Publication Number: 1004907

IPC: G02B 6/293

Language of the proceedings: EN

Title of invention:

Optical wavelength demultiplexer

Applicant:

Avago Technologies Fiber IP (Singapore)Pte. Ltd.

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 54, 56, 123(2)

Keyword:

"Added subject-matter (no, after amendment)"

"Novelty and inventive step (yes, after amendment)"

Decisions cited:

-

Catchword:

-



Case Number: T 1454/05 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 5 June 2007

Appellant:

Avago Technologies Fiber IP
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 8 July 2005
refusing European application No. 99114619.2
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. Klein
Members: F. Narganes-Quijano
C. Rennie-Smith

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 99114619.2 (publication No. 1004907).

II. In the decision under appeal the examining division referred to documents

D1: US-A-5835517

D2: EP-A-0196948

D3: US-A-4786133

D4: US-A-4994664

and held that claim 1 then on file did not comply with the requirements of Article 123(2) EPC and, in addition, did not define novel subject-matter over the disclosure of document D1 (Articles 52(1) and 54 EPC). The examining division also expressed its view that the features of the dependent claims then on file were also anticipated or at least rendered obvious (Article 56 EPC) by the prior art.

III. With the statement setting out the grounds of appeal the appellant submitted sets of claims amended according to different requests and requested that the decision under appeal be set aside and that a patent be granted on the basis of one of the sets of claims.

IV. In response to the preliminary opinion expressed by the Board in a communication annexed to the summons to oral proceedings, the appellant filed with its letter dated 18.04.2007 an amended set of claims 1 to 8 and, in

response to a subsequent telephone consultation with the rapporteur of the Board, the appellant filed with its letter dated 30.04.2007 amended description pages 3, 6 to 8 and 10 and drawing sheets 1/2 and 2/2 replacing, together with description pages 2 and 2a filed with the letter dated 20.05.2003, the corresponding application documents as originally filed. The appellant observed that the oral proceedings were no longer necessary in view of the amendments to the application.

After consideration of the amendments made to the application documents according to the request of the appellant, the Board cancelled the oral proceedings.

V. Claim 1 of the sole request of the appellant reads as follows:

"An optical demultiplexer comprising:

a main optical block (14) having an input for receiving a beam of multi-wavelength optical energy and a plurality of outputs for outputting a plurality of wavelength-specific optical energy beams;

a plurality of wavelength-specific filters (20, 22, 24, and 26) aligned with said plurality of outputs and connected to said main optical block such that a first of said filters is impinged by said received beam of multi-wavelength optical energy, each of said wavelength-specific filters having optical characteristics that cause transmission of optical energy at a first set of wavelengths and reflection of optical energy at a second set of wavelengths outside of said first set;

a plurality of converging reflectors (30, 32, and 36) formed at a surface of said main optical block

wherein said converging reflectors are located relative to said wavelength-specific filters such that each converging reflector receives at least a portion of said beam of optical energy from one of said wavelength-specific filters and refocuses said received optical energy toward a different one of said wavelength-specific filters; and

an input reflector (40) located relative to said input such that said beam of multi-wavelength optical energy is reflected from said input reflector to said first of said wavelength-specific filters,

wherein said input reflector (40) is an ellipsoidal reflector with a first focus point at said input and a second focus point at said first of said plurality of wavelength-specific filters."

Claims 2 to 8 all refer back to claim 1.

VI. In support of its requests the appellant submitted that the amendments to the application documents according to its latter request overcome all the objections raised during the proceedings.

Reasons for the Decision

1. The appeal is admissible
2. *Amendments*

Claim 1 amended according to the present request of the appellant is based on the combination of features defined in claim 1 and in dependent claims 2 and 4 as originally filed. Present dependent claims 2 to 8 are

based on the features of dependent claims 3 and 5 to 10 as originally filed. The amendments to the description and to the drawings relate to the acknowledgement of the state of the art (Rule 27(1)(b) EPC) and to the adaptation of the description and the drawings to the invention as defined in the claims and involving, in particular, the deletion of the embodiment disclosed with reference to Figure 3 of the application as originally filed (Article 84 and Rule 27(1)(c) EPC).

During the present appeal proceedings the appellant reverted essentially to combinations of features formulated in the claims as originally filed. Thus, the reasons alleged by the examining division for the refusal of the application on the grounds that the then amended claim 1 did not comply with the requirements of Article 123(2) EPC do not apply any longer to the present claims, i.e. they have been overcome by the amendments made to the application documents according to the present request of the appellant.

The Board is therefore satisfied that the application documents amended according to the present request of the appellant satisfy the requirements of Article 123(2) EPC.

3. *Novelty*

- 3.1 Document D1 discloses with reference to Figure 1 an optical demultiplexer (column 3, line 29 to column 4, line 20 and column 2, lines 34 to 55) comprising an optical block (substrate 10, column 3, lines 37 to 42) having an input (lens 20 and column 3, lines 57 to 65) for receiving a light beam (beam 16) and a plurality of

outputs (output of filters 22, 28), and a plurality of wavelength-specific filters (12, 22, 28 and column 4, lines 12 to 20) aligned with the plurality of outputs and connected to the optical block (column 3, lines 42 to 46) so that a first filter (filter 22) is impinged by the input light beam. Each of the filters has optical characteristics such that optical energy at a first set of wavelengths is transmitted and optical energy at a second set of wavelengths outside the first set is reflected (column 3, line 62 to column 4, line 11). The demultiplexer further comprises a plurality of converging reflectors (mirrors 14, column 3, lines 46 to 56) formed at a surface of the optical block and located so that each reflector receives a portion of the light beam from one of said filters and refocuses the light beam toward a different one of the filters (Figure 1 and column 3, line 65 to column 4, line 11).

In the demultiplexer disclosed in document D1 the light beam is input into the block of the demultiplexer and directed towards the first filter by means of a lens 20 formed on the block and the document is silent as to the provision of an ellipsoidal reflector for reflecting the input light beam towards the first of the filters and arranged as required by the claimed subject-matter.

Therefore, claim 1 amended according to the appellant's request defines novel subject-matter with regard to the disclosure of document D1 and the amended claim overcomes the reasons alleged by the examining division for the refusal of the application on the grounds of lack of novelty over the disclosure of document D1.

3.2 None of the remaining documents on file anticipates the claimed subject-matter. In particular, none of documents D2, D3 and D4 considered by the examining division during the first-instance examination proceedings discloses an optical demultiplexer comprising an ellipsoidal reflector for reflectively directing an input light beam towards a wavelength-dependent filter as claimed.

3.3 Having regard to the above, the Board concludes that the subject-matter of claim 1 amended according to the appellant's request, as well as that of dependent claims 2 to 8, is novel over the available prior art (Articles 52(1) and 54 EPC).

4. *Inventive step*

4.1 The closest state of the art is represented by the disclosure of document D1. As already concluded in point 3.1 above, the subject-matter of claim 1 differs from the disclosure of document D1 in the provision of an ellipsoidal reflector in the optical block of the demultiplexer and arranged so that the input light beam is reflected to the first of the wavelength-specific filters, the ellipsoidal reflector having a first focus point at the input of the optical block and a second focus point at the first of the plurality of filters.

According to the disclosure of the application, the distinguishing feature identified above provides a more precise imaging of the input light beam on the first of the filters (page 4, lines 23 to 27 and page 9, lines 33 to 37).

The objective problem solved by the claimed subject-matter over the closest state of the art represented by document D1 can therefore be seen in improving the optical coupling of the input light beam to the optical demultiplexer and in particular to the wavelength-specific filters.

- 4.2 Document D1 addresses the problem of re-imaging or collimating the input light beam directed towards the first of the filters (column 3, lines 62 to 65) and teaches the provision of a converging input lens having an anti-reflective coating in order to solve the problem (lens 20 in Figure 1 and column 3, lines 57 to 65). There is no suggestion in the document of the replacement of the converging lens by an ellipsoidal reflector arranged as claimed.

Document D2 discloses an optical demultiplexer constituted by an array of diffractive elements formed in an optical block for demultiplexing an input light beam (Figures 1 to 5 and abstract). The demultiplexer comprises an achromatic reflector also formed in the block for directing the input light beam towards the first of the diffractive elements (reflector 18 and 18a in Figures 1 to 3 and 5). However, the achromatic reflector is a parabolic mirror arranged to collimate the input light beam directed towards the array of diffractive elements (Figure 3 and column 2, lines 18 to 20 and 45 to 50, column 5, lines 1 to 16, and column 8, lines 20 to 28), and there is no teaching towards the use of an ellipsoidal reflector arranged as claimed.

Document D3 discloses an optical demultiplexer (Figure 1 and abstract) comprising a reflective diffraction grating constituted by reflecting elliptical facets formed in an optical block (column 2, lines 22 to 26) for demultiplexing an input light beam into light beams having different wavelengths and directing the light beams towards a respective one of an array of microguides formed in the block (column 3, lines 18 to 24). The document makes use of the optical focusing properties of ellipsoidal reflectors in the design of the reflecting grating facets for the purpose of demultiplexing and simultaneously focusing the different diffracted light beams into the corresponding microguides (Figures 2 and 3 and the corresponding description), but no suggestion or teaching can be found in the document of the ellipsoidal reflector arrangement having the structural and functional features defined in claim 1. Document D3 would at the most suggest replacing in document D1 the arrangement of wavelength-specific filters and of converging reflectors by the demultiplexing reflective diffraction grating disclosed in document D3, thus leading away from the claimed invention.

Document D4 discloses an optical device comprising an array of binary diffractive lenses optically coupled to a planar array of diffractive elements optically aligned with an array of sensor clusters (Figure 5 and column 5, line 7 to column 6, line 11), the binary diffractive lenses operating as optical splitters for light incident thereon (column 5, lines 34 to 54). The input light is directly incident on the array of binary diffractive lenses (column 5, lines 34 to 39), and there is no disclosure in the document of optical means

for directing the input light towards the optical splitting arrangement and comprising the claimed features relating to the ellipsoidal reflector.

The remaining documents on file are less relevant for the issue under consideration.

- 4.3 Having regard to the above considerations, the Board concludes that none of the available prior art documents renders obvious the subject-matter of claim 1 of the present request (Articles 52(1) and 56 EPC). The same conclusion applies to dependent claims 2 to 8 by virtue of their dependence on claim 1.

5. *Other requirements*

The Board is also satisfied that the application documents amended according to the present request of the appellant and the invention to which they relate meet the remaining requirements of the EPC within the meaning of Article 97(2) EPC.

6. In view of the above conclusions and considerations, the Board concludes that the decision under appeal is to be set aside and a patent be granted on the basis of the application documents amended according to the appellant's request (Articles 97(2) and 111(1) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent in the following version:
 - claims 1 to 8 filed with the letter dated 18.04.2007,
 - description pages 1, 4, 5, 9 and 11 as originally filed, pages 2 and 2a filed with the letter dated 20.05.2003, and pages 3, 6 to 8 and 10 filed with the letter dated 30.04.2007, and
 - drawing sheets 1/2 and 2/2 filed with the letter dated 30.04.2007.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein