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D E C I S I O N
of 6 October 1997

Case Number: T 0194/94 - 3.4.2

Application Number: 89308702.3

Publication Number: 0365125

IPC: G02B 5/18

Language of the proceedings: EN

Title of invention:
Diffraction grating

Applicant:
Northern Telecom Limited

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes, after amendment)"

Decisions cited:
-

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 0194/94 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 6 October 1997

Appellant:

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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 26 October 1993
refusing European patent application
No. 89 308 702.3 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: A. G. Klein
B. J. Schachenmann

Summary of Facts and Submissions

- I. European patent application No. 89 308 702.3 (publication No. EP-A-0 365 125) was refused by the Examining Division.
- II. The reason for the refusal was that the subject-matter of claim 1 lacked novelty in the sense of Article 54 EPC in view of the disclosure in document EP-A-0 196 948 (D3).
- III. The appellant filed an appeal against the decision of refusal.

His main request is to the effect that a patent be granted on the basis of an amended set of claims, of which claim 1, the only independent claim, reads as follows:

"A reflective type diffraction grating formed in a slab waveguide, the diffracting elements of which diffraction grating are formed by totally internally reflecting facets (24) extending substantially perpendicularly with respect to the plane of the slab waveguide, characterised in that said facets are provided by walls of a line of discrete apertures or wells (23) formed in the slab waveguide, each aperture or well providing a single one of said reflecting facets when the grating is illuminated by a collimated or divergent beam of light."

Claims 2 to 8 are appended to claim 1.

The appellant further requests refund of the appeal fee.

IV. In support of the patentability of the subject-matter of claim 1, the appellant submitted that a significant difference concerned the reflectivity provided on the one hand by the individual light-intercepting facets 24 (Figure 2) of the apertures 23 of the present invention, and on the other hand by the individual light-intercepting facets of the grooves (Figure 4a or 4b) of document D3. The individual facets 24 of the invention extended through the full depth of the guided mode of the slab waveguide, and were totally internally reflecting because the angle of incidence was made greater than the critical angle. If this was not the case, the operation of the device would be impaired both because of loss occasioned by less than 100% reflection, and because that reflection would be polarisation dependent. The individual facets of the Figures 4a, 4b grooves of document D3 terminated within the core layer 12 of the slab waveguide, and hence did not extend through the full depth of its guided mode. Accordingly they were not totally internally reflecting. Indeed they could not be totally internally reflecting because, if the facet upon which the light was first incident were to be totally internally reflecting, it would, by definition, reflect all of that incident light, and thus there would be no light left to be reflected by the second and subsequent facets. This would mean that the facets would be incapable of co-operating to provide the wavelength selective Bragg law reflection that was an essential feature of the device disclosed in document D3.

With regard to his request for refund of the appeal fee the appellant submitted that, in the reply to the Examining Division's assertion that document D3

described a diffraction grating, he gave a fully reasoned explanation as to why he thought that this was not so, and the refusal was issued without affording him due opportunity to respond to a full presentation of the Examining Division's position.

Reasons for the Decision

1. The appeal is admissible.
2. *Compliance of the amendments brought to the claims and description with the requirements of Article 123(2) EPC*

Present claim 1 is distinguished from claim 1 as originally filed in that it specifies that the reflecting facets are "totally internally" reflecting facets, which is supported by the passage at the top of page 7 of the description as originally filed stating that the angle of incidence of the light upon the individual facets of the grating should exceed the critical angle.

Present claim 1 also specifies that the substantial perpendicular extension of the facets is meant "with respect to the plane of the slab waveguide" which is self evident and shown for instance in any of Figures 2 to 4 as originally filed. So is the indication added at the end of claim 1 that each aperture or well is "providing a single one of said reflecting facets when the grating is illuminated by a collimated or divergent beam of light" (see Figures 2 and 3 for the operation of the diffraction grating under illumination by a collimated beam of light and Figure 4 for a diffraction grating illuminated by a divergent beam of light).

Dependent claim 6, which has no counterpart in the set of claims as originally filed, defines the arrangement of the line of discrete apertures or wells along a straight line, the normals of the diffracting facets being aligned with the direction of linear extension of the grating. This linear arrangement is shown in any of Figures 2 to 4.

Besides a number of amendments of merely editorial nature, the description has only been adapted to the amended wording of claim 1, and supplemented with a short summary of the relevant content of document D3, as is required by Rule 27(1)(b) and (c) EPC.

For these reasons the amendments brought to the European patent application do not offend against the provisions of Article 123(2) EPC.

3. *Patentability of the claimed subject-matter*

In the course of the examination procedure, the Examining Division expressed its view that the subject-matter of claim 1 as originally filed would appear to define patentable subject-matter in view of the prior art on file, with the proviso that the claim be clarified so as to specify in particular that the reflecting facets provided total internal reflection, which constituted one of the essential features of the invention (see the communication dated 8 February 1993, point 2.1). Later on, the Examining Division raised an objection of lack of novelty in view of document D3, stressing that the reason why claim 1 could be read on document D3 was that it did not specify in which sense the grating facets were reflective (see the communication dated 29 April 1993, point 2.2).

Claim 1 now clearly specifies that each aperture or well provides a single totally internally reflecting facet when the grating is illuminated by a collimated or divergent beam of light, and the board is satisfied that the patentability of its subject-matter is no longer prejudiced by the prior art brought to light by the Search Report, in agreement with both the appellant's and the Examining Division's opinions.

In short, the device disclosed in document D3 comprises a series of networks R_1, R_2, \dots, R_n disposed in succession (see Figure 1). Each network comprises a number of parallel grooves and forms a structure operating under the Bragg condition, so as to diffract the portion of an incident beam of light having a specific wavelength and to transmit the remainder of the beam. Neither the operation of the networks under the Bragg condition, which actually involves diffraction of light by successive layers of the networks, nor the transmission of the remainder of the beam could possibly be achieved if the reflecting facets were totally internally reflecting in the sense of claim 1. The subject-matter of claim 1 is not anticipated by the device of document D3, accordingly.

Neither does any of the other prior art documents on file disclose diffracting elements of a diffraction grating which are formed by totally internally reflecting facets provided by walls of a line of discrete apertures or wells, each aperture or well providing a single one of said reflecting facets. For these reasons the subject-matter of claim 1 is considered to be novel in the sense of Article 54 EPC.

In view of the fundamentally different mode of operation of the device of document D3, the nearest prior art is considered to be disclosed in the paper entitled "New Integrated Optical Multiplexer

Demultiplexer Realised on a Silicon Substrate" by S. Valette, 85X, 38041 Grenoble Cédex, Proceedings of the Fourth European Conference on Integrated Optics EC1087, SETG Ltd, Glasgow, Scotland, as acknowledged in the introductory portion of the present description and illustrated in Figure 1. In this known device, which is defined in the preamble of claim 1, the totally internally reflecting facets are all provided by a wall of a single aperture formed in a slab waveguide, instead of being provided by walls of a line of discrete apertures or wells, each aperture or well providing a single reflecting facet.

The claimed arrangement affords improved efficiency insofar as it overcomes the problem of a proportion of the incident light being lost in the nearest prior art device as a result of the presence of additional facets connecting the actual diffracting facets when these are formed in the wall of a single aperture (see the paragraph bridging pages 3 and 4 of the description).

The prior art on file does not provide any hint at overcoming the above problem by providing the diffracting elements each in a single respective aperture. In particular, the only document to disclose an aperture provided with a single totally internally reflecting facet is the document "Proceedings of the Fourth European Conference on Integrated Optics ECIO 87", 11 to 13 May 1987, pages 90 to 93, SETG Ltd., Glasgow, Scotland, which is dedicated to a totally reflecting waveguide mirror. There is no reference whatsoever in the document to the provision of a plurality of such apertures in a diffraction grating, the only application contemplated being the achievement of 90° directional change in radiation path.

For these reasons, the subject-matter of claim 1 is considered to involve an inventive step in the sense of Article 56 EPC, and so is the subject-matter of remaining claims 2 to 8, by virtue of their appendence to claim 1.

4. *Refund of appeal fees*

According to Rule 67 EPC, reimbursement of appeal fees can only be ordered if such reimbursement is equitable by reason of a substantial procedural violation.

In the present case the ground for rejecting the application, namely lack of novelty of the subject-matter of claim 1 in view of the disclosure of D3, was communicated to the appellant in the Examining Division's communication of 29 April 1993. This communication also included a detailed explanation of the reasons why the various features of claim 1 were considered to be disclosed in document D3; see point 2.2 of the communication. The appellant thus had an adequate opportunity to present his comments before the decision of 26 October 1993 was taken, which he actually did; see the second paragraph on page 3 of appellant's response dated 11 May 1993.

Accordingly, the requirement of Article 113(1) EPC that decisions may only be based on grounds or evidence on which the parties concerned have had an opportunity to present their comments was met and the Board cannot identify any procedural violation which could justify reimbursement of the appeal fee.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent with the following version:

Description: Pages 1 to 10 as filed with letter dated 2 September 1997.

Claims: 1 to 8 as filed with letter dated 2 September 1997.

Drawings: sheets 1/4 to 4/4 as originally filed.

The Registrar:

The Chairman:

P. Martorana

E. Turrini