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Datasheet for the decision of 6 February 2007

Case Number: T 0904/04 - 3.4.02

Application Number: 00310306.6

Publication Number: 1113302

IPC: G02B 26/08

Language of the proceedings: EN

Title of invention:
Folded optical cross connect with a curved mirror

Applicant:
LUCENT TECHNOLOGIES INC.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 84, 54, 56

Keyword:
"Claim 1, clarity, novelty and inventive step - yes (after amendments"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0904/04 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 6 February 2007

Appellant: LUCENT TECHNOLOGIES INC.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 7 April 2004 refusing European application No. 00310306.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. Klein
Members: M. Rayner
M. Vogel

Summary of Facts and Submissions

I. The applicant has appealed against the decision of the examining division refusing European patent application number 00 310 306.6 relating to an optical switch. In its decision, the examining division was of the opinion that the subject matter of the independent claim 1 presented to it was neither clear nor new. Even if interpreted so as to be new, no inventive step would be involved in the subject matter concerned. The division referred to the following document

D1 Patent Abstracts of Japan, vol. 013, no. 342 (P-908), 2 August 1989 (&JP-A-1 102515).

The independent claim presented to the division was considered not to be clear in view of use of the term Rayleigh range, which range cannot be determined from the device itself. While, despite some doubtful numerical values in the description, the term may have a clear meaning to the skilled person, it is applied for Gaussian beam profiles and depends on wavelength and beam waist, neither of which were specified in the claim submitted. It is therefore possible to find an input signal having a beam profile, wavelength and beam waist for a given optical switch so that the distance between the mirror array and the curved component is larger than the Rayleigh range of that particular optical signal. Thus, any given switch may or may not fall within the claim. Therefore, consequent to properties of the beam of light being undefined, the distances recited in the claim are also undefined, which renders the claim unclear. A further obscurity arises because the distances between any mirror of the

array and any component comprised in the optical switch are encompassed in the claim, neither the function of an optical component having a curved surface, nor its position along the path through the optical switch being defined. Thus claim 1 is not clear within the meaning of Article 84 EPC.

Insofar as clear, the subject matter of claim 1 lacked novelty in the sense of Article 54 EPC over document D1. A typical beam of light in telecommunication applications as used in document D1 would have a waist radius w_0=3μm and a wavelength λ=1550nm and thus has a Rayleigh range of about 18 μm. Since the device of document D1 is a macroscopic switch with moving parts, it is plausible that the distance between any mirror and any lens in the device is larger than the Rayleigh range.

Moreover, it appears trivial to arrange two optical components at a certain distance, it not being apparent from the wording of the claim which particular problem is solved by the specified features. Even were it novel, it would not therefore seem that the subject matter of the claim could be considered to involve an inventive step.

II. The appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of independent claim 1, which is worded as follows:

"An optical switch (7;300), comprising at least one mirror array (75;320,340) optically couplable to an optical signal; and an optical component (80,330) characterized in that:

said optical component is deployed to receive a portion of said optical signal (72',315',325') reflected from said at least one mirror array, said optical component having a curved surface and being spaced from said at least one mirror array by a distance (Z) greater than a Rayleigh range (Z_R) of at least the reflected portion of said optical signal (72',315',325') from said at least one mirror array, the curved surface having a radius of curvature selected based upon a curvature of the reflected portion of said optical signal such that scattering of said optical signal between said at least one mirror array and said optical signal is averted."

Pursuant to the amendments made on appeal, claim 1 defines an invention which is novel and inventive over document Dl. In particular, document Dl fails to teach or suggest an optical component deployed to receive a portion of an optical signal reflected from at least one mirror array. The claimed optical component has a curved surface and is spaced from the at least one mirror array by a distance (Z) greater than a Rayleigh range (Z_R) of at least the reflected portion of the optical signal. In contrast, document Dl teaches reflecting a signal from flat mirrors, e.g. the mirrors M_{1-5} and m_{1-5}, and not mirror arrays. Moreover, document D1 is silent with regard to a Rayleigh range. Document Dl also fails to teach or suggest that the curved surface has a radius of curvature that is selected based upon a curvature of a portion of a reflected optical signal. Consequently, the optical fibre connector shown in document Dl does not achieve the advantages of the present invention.

III. The board issued a communication, in which it indicated that it could accept that the term Rayleigh range is understood by the person skilled in the art. The invention addresses problems of drive voltage of array mirrors by reducing the mirror steering range by increasing the spacing from the mirror array to the curved component. This is possible without scattering because the curvature of the component corresponds to the increase in spacing over the Rayleigh range. The board, nevertheless, had some residual doubts about the application papers presented, but offered the appellant an opportunity to comment further.

IV. In reply to the communication of the board, the appellant submitted amended application papers. As a result, the papers upon which grant of a patent is requested are as listed in the order below.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments (Article 123(2) EPC)*

2.1 No objection on the basis of Article 123(2) was made in the decision under appeal, nor does the board have any objection on this ground. The amendments made on appeal concern the features (1) "said optical component is deployed to receive a portion of said optical signal (72',315',325') reflected from said at least one mirror array," and (2) "the curved surface having a radius of curvature selected based upon a curvature of the reflected portion of said optical signal such that

scattering of said optical signal between said at least one mirror array and said optical signal is averted." Support for feature (1) can be found, for example, in Figures 3 and 7 and for feature (2), in column 4, line 21 taken with column 6, lines 14-18 and the sentence bridging columns 8 and 9. Amendments made to the description comply with the Rules.

3. *Clarity (Article 84 EPC)*

3.1 In the proceedings before the examining division it was common ground that the term Raleigh range is clear to the skilled person, despite some numerical values not being correct in the view of the division. The board concurs that the term is clear to the skilled person and observes that a recitation of its definition is not therefore necessary in the claim.

3.2 In the amended claim, function of the optical component having a curved surface and its position receiving an optical signal from the mirror array are now defined. The consequence is that the Raleigh range is no longer open ended upwardly because a counterweight to the increased range is now specified in the claim, i.e. the characterising feature of the device involving curvature of the curved surface based upon curvature of the reflected portion of the signal to avert scattering. The approach of the examining division of finding an input signal so that the distance between the mirror array and the curved component is larger than the Rayleigh range of that particular optical signal amounts to dealing with just one side of the scales. In a balanced approach meeting both the distance and curvature constraints, the distances in the claim are

defined sufficiently for clarity in the sense of Article 84 EPC, rendering as a consequence reference to beam waist, wavelength or profile unnecessary for defining the invention. Since, moreover, the claim defines the features of the invention, other undefined components in the optical switch about which the examining division speculated do not affect the clarity of the present claim. Therefore, the objections as to lack of clarity made by the examining division do not therefore convince the board in relation to the claim as amended.

3.3 The board is therefore satisfied that claim 1 upon which the appeal is based does not give rise to objection under Article 84 EPC.

4. *Substantive Patentability (Articles 54, 56 EPC)*

4.1 Document D1 relates to an optical fibre connector and the figure shows two sets of parallel fibres pointing toward each other with a lateral offset giving interleaves between the individual fibres occupied by a respective rotatable, seemingly flat mirror opposite each fibre. The idea is that an incoming optical signal is deflected by a rotated mirror opposite the fibre concerned and, depending upon which one of the other mirrors is rotated, back out at the fibre opposite that other mirror. The signal is thus daisy chained through the non rotated mirrors until it reaches the desired output. There is a condensing lens at the end of each fibre, consequent to which the emitted light beam, to use the wording of the document, "goes to parallel rays", so that it is "not influenced so much" by a single intensity drop caused by broadening of the light

beam. In the Figure, the flat mirrors are shown, albeit schematically, further from each other in the optical path than is a flat mirror from a lens.

4.2 In the system of document D1, in the case where the beam "goes to parallel rays", the condensing lens is upstream of the rotatable mirror, which means that the condensing lens, if the term "optical component" used in the claim is taken to read onto this, is not deployed to receive a signal from the rotatable mirror. Moreover, issues relating to the Rayleigh range are not addressed in document D1, the drawing even shows there is always flat mirror to flat mirror transmission in the daisy chain. From this point of view, there is a situation not unlike the background situation discussed in the patent application (see, for example Figure 2, which also uses a flat mirror). Therefore, quite apart from upstream disposition, in the absence of any underlying recognition in document D1 of issues relating to the Raleigh range, the board does not attach any significance, in the context of novelty and the claim as amended, to the speculation of the examining division concerning whether or not the spacing between a condensing lens and a mirror, has a value greater than the value of 18 μm. Moreover, there is no disclosure of the curved surface of the optical component having a radius of curvature selected based upon a curvature of the reflected portion the optical signal such that scattering of said optical signal between said at least one mirror array and said optical signal is averted. The board is therefore satisfied as to the novelty in the sense of Article 54 EPC of the subject matter of claim 1.

4.3 As indicated in the communication of the board, the novel features address problems of high drive voltage of array mirrors. Reduction of mirror steering range and thus lower driving voltage results from increasing the spacing between the mirror array and optical component. An increase in spacing over the Rayleigh range is not, however, possible while averting scattering in the case of a flat component, but is possible by compensating with a curved component, providing the curvature is selected based upon a curvature of the reflected portion of the optical signal. The board can find no teaching addressing the problem in document D1, in fact there is just the opposite situation because the flat mirrors are shown, even though schematically, further from each other in the optical path than they are from the lenses. Accordingly, there is no reason for the skilled person to think the subject matter claimed obvious. This conclusion also applies in the light of the remaining prior art in the file as this adds no more to the prior art of relevance to subject matter claimed than has already been discussed. The board thus considers the subject matter of claim 1 to involve an inventive step within the meaning of Article 56 EPC.

4.4 The appeal therefore succeeds.

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 based on the following application documents:

Description

Pages 1-19 as originally filed with page 3, line 1 (the heading) deleted according to the request in the letter of 09.07.2003
Page 2a filed with the letter of 09.07.2003
Page 20 filed with the letter of 17.10.2006

Claims

1-14 filed with the letter of 17.10.2006

Drawings

Sheets 1/4 to 4/4 as originally filed.

The Registrar The Chairman

M. Kiehl A. G. Klein