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Datasheet for the decision of 25 September 2009

Case Number: T 1530/07 - 3.4.02

Application Number: 03721409.5

Publication Number: 1488272

IPC: G02B 26/08

Language of the proceedings: EN

Title of invention:
Laser beam directing system with rotatable diffraction gratings

Patentee:
RAYTHEON COMPANY

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1530/07 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 25 September 2009

Appellant: RAYTHEON COMPANY
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Representative: Jackson, Richard Eric
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 10 April 2007 refusing European patent application No. 03721409.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: F. Maaswinkel
C. Rennie-Smith

Summary of Facts and Submissions

I. The appellant lodged an appeal, received on 6 June 2007, against the decision of the examining division, dispatched on 10 April 2007, refusing the European patent application 03721409.5. The fee for the appeal was paid on 6 June 2007 and the statement setting out the grounds of appeal was received on 14 August 2007.

II. In the examining proceedings the following documents were cited:

D1: US-A-3 721 486
D2: US-B-6 292 278

During the examining proceedings three Communications had been issued by the examining division. In the last Communication, dated 20 December 2006, and sent as a summons for oral proceedings, objections under Art. 123(2) EPC against claim 2 and further objections under Art. 84 EPC had been raised. Furthermore, according to the division, the subject-matter of claim 1 then on file lacked an inventive step (Art. 52(1) and 56 EPC) having regard to the disclosure in document D1 and normal design capabilities of the skilled person.

With a reply letter of 21 March 2007 the applicant informed the examining division that it would not be present at the scheduled oral proceedings and requested a written decision based on the file as it stood in the sense of the Guidelines E-X, 4.4. Hence, the decision of 10 April 2007 merely consisted of a referral to the prior three official Communications.

III. With the statement containing the grounds of appeal the appellant filed a set of claims of a new main request and requested that this be considered by the board and also filed an auxiliary request for oral proceedings.

IV. In a telephone conversation on 10 September 2009 with the representative of the appellant the rapporteur pointed to minor inconsistencies in the description and invited the appellant to submit amended documents. These were filed by facsimile on the same day.

V. The documents now comprising the main request include:

Claims:	1 to 7, as received with the letter of 14 August 2007;
Description:	pages 1, 2, 5 to 11 as published; page 3 received on 7 June 2005 with the letter of 6 June 2005; pages 4 and 12 received on 10 September 2009 with the letter of 10 September 2009;
Drawings:	sheets 1/6 to 6/6 as published.

VI. The wording of independent claim 1 reads as follows:

"A system (100) for positioning a laser beam (103) comprising:

a first rotatable diffraction grating (112) disposed on a first planar transmissive substrate for deflecting the laser beam by a first predetermined angle of deviation;

a second rotatable diffraction grating (114) disposed on a second planar transmissive substrate for

receiving the deflected laser beam from the first substrate and for further deflecting the laser beam by a second predetermined angle of deviation; and

first and second electromechanical positional control elements (120, 122) to rotate respectively, the first and second substrates in response to signals from a controller (124),

characterised in that the first and second electromechanical positional control elements (120, 122) are adapted to change the relative rotational position of the first and second substrates to set the beam steering angle, and to rotate the first and second substrates together to set the beam direction around a cone".

Claims 2 to 7 are dependent claims.

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

In order to address the added-subject matter and clarity objections against claim 2 this claim has been deleted. The further clarity objection raised against former claim 3 was probably addressed to claim 4 since the phrase "angle of deviation" does not appear in claim 3. In order to address this clarity objection, claim 4 has been amended to remove the reference to the first angle of deviation. Basis for this amendment can be found on page 10, lines 3 to 4 of the description.

It is submitted that claim 1 exhibits an inventive step over the disclosure of D1 for the following reasons. D1 discloses a system for positioning a laser beam comprising: a first rotatable diffraction grating (50) disposed on a planar transmissive substrate (21) for

deflecting the laser beam by a first predetermined angle of deviation; a second rotatable diffraction grating (51) disposed on a second planar transmissive substrate (21) for receiving the deflected laser beam from the first substrate and for further deflecting the laser beam by a second predetermined angle of deviation; and first and second electromechanical positional control elements (54, 55) to rotate, respectively, the first and second substrates. The first and second electromechanical positional control elements (54, 55) are adapted to change the relative rotational position of the first and second substrates to set the beam steering angle. However, D1 does not disclose that the first and second electromechanical positional control elements (54, 55) are adapted to rotate the first and second substrates together to set the beam direction around a cone. The technical effect of this difference to the prior art is that the system of claim 1 can be used to direct a beam in any direction within a cone. Accordingly, the problem addressed by the present invention is how to adapt a system for linearly scanning a light beam in order to arrive at a system for directing a laser beam in any direction within a cone. The solution to this problem provided by the present invention is to select first and second electromechanical positional control elements which are adapted to change the relative rotational position of the first and second substrates to set the beam steering angle as well as to rotate the first and second substrates together to set the beam direction around a cone.

This solution is not obvious based on the teachings of D1 for the following reasons. Firstly, it is noted that

the entire disclosure of D1 is limited to the design and construction of a system for linearly scanning a light beam across a screen. There is no suggestion within D1 that it would be desirable to provide a system for pointing a laser beam in any direction within a cone. Consequently, it would go against the teaching of D1 to adapt the system therein to provide a system with such capability. Therefore, the skilled person would not be motivated to adapt the disclosure of D1 to provide a system capable of pointing a laser beam in any direction within a cone. Secondly, even if the skilled person had been motivated to adapt the teaching of D1 to address the problem solved by the present invention, he would not have arrived at the solution of the present invention. The two diffraction gratings 50, 51 of Dl are mounted on separate axes which are not co-linear. If the skilled person had decided to rotate both diffraction gratings together in order to change the orientation of the linear scan, he would not have been able to achieve this by using the electric motors 54 and 55. Instead, he would have had to rotate the whole arrangement of the gratings, axles and motors about a third axis in order to maintain the gratings in the same rotational position relative to one another. However, since the motors and axes are mounted on brackets 54 and 56 which are in turn connected to the screen 58, such rotation of the gratings together would also result in rotation of the screen and, consequently, the position of the beam on the screen would not change. Claim 1 specifically states that the first and second electromechanical positional control elements are adapted to change the relative rotational position of the first and second substrates to set the beam steering angle, and to

rotate the first and second substrates together to set the beam direction around a cone. That is, the same control elements are used to perform both relative and simultaneous movement of the gratings. This is not possible with the motors 54 and 56 of D1. Whichever way axes 54 and 56 are rotated, there is no way that they can be used to rotate both gratings together whilst maintaining the relative position of the first grating relative to the second grating. Consequently, it is submitted that the skilled person would not have been able to adapt the teaching of D1 to arrive at the subject matter of the claims and that, therefore, the claims define inventive subject-matter over Dl.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The board is satisfied that the amended claims meet the requirements of Art. 84 and 123(2) EPC.

3. *Patentability*

3.1 *Novelty - Claim 1*

The board concurs with the appellant that document D1 discloses a laser beam positioning system with the technical features defined in the preamble of claim 1. It is noted that in its Communication of 20.12.2006, to which explicit reference had been made in the Decision, the examining division had also expressed this view. In

point 3.4 of this Communication the examining division had stated "Claim 1 differs from D1 in the function of setting the beam in any direction around a cone". The board adds that this is one of the results of adapting the first and second positional control elements as specified by the features of the characterising portion of claim 1, the other being that simultaneously the beam steering angle can be set.

Document D2 similarly discloses a laser beam positioning system comprising two rotatable diffraction gratings. Unlike the apparatus defined in claim 1 these gratings in the apparatus of D2 (33, 34 in Figure 3) have a fixed arrangement with respect to each other and are positioned by one common positional control element (driving motor 32).

The other documents from the International Search Report are less relevant. Therefore the subject-matter of this claim is novel (Art.52(1) and 54 EPC).

3.2 *Inventive step*

3.2.1 *Closest prior art*

As is apparent from the discussion in point 3.1, document D1 may be identified as disclosing the closest prior art.

3.2.2 The subject-matter of claim 1 differs from the laser beam positioning system disclosed in document D1 in the features of the characterising portion: the first and second electromechanical positional control elements are adapted so that the relative rotational position of

the first and second substrates can be changed to simultaneously set the laser beam steering angle and to rotate both substrates together to steer the beam direction around a cone.

3.2.3 For the definition of the objective technical problem care should be taken that the elements of the solution are not included, which in the present case include the setting of the steering angle and moving the beam around a cone. Therefore the problem may be formulated in a general sense as discussed in the Section "Background" on page 2 of the published application, where it is explained that "In many applications, it is desirable to direct a laser beam over a very large field of regard, and once having reached some designated angle within the field of regard, to generate a small scan or raster pattern for the purpose of finding a target of interest". Therefore the objective technical problem may be seen as modifying the prior art scanning system of document D1 for direction over a large field of interest.

3.2.4 The board concurs with the appellant that the disclosure in document D1 is related to a system for producing a time sequential linear scan, see the Abstract of D1 and, for instance, its independent claims 1, 2 and 10. It is noted that the examining division in Section 3.4 of the letter of 20 December 2006, while acknowledging that claim 1 differs from D1 in the function of setting the beam in any direction around a cone, continued its argument in stating that it was "…a matter of normal design procedure to adapt the system of D1 if a beam deflecting pattern different from a line is desired".

Therefore, according to the examining division, it would be obvious for the skilled person to modify the control mechanism of the system of D1 to obtain deflection directions around a cone thus arriving at the claimed subject-matter without inventive activity.

3.2.5 The board does not share this position: as correctly put by the appellant, in document D1 there is no disclosure or suggestion whatsoever that this system may be used for scanning the beam in a cone, rather the entire system, including the rotation of the gratings which must be moved in opposite directions (see again: Abstract and independent claims), is designed for obtaining a linear scan. In contrast, as is illustrated by the flow chart in Fig. 6 of the present patent application, in the positioning of the present invention the gratings are rotated with respect to each other to change the beam steering angle (step 608) and, subsequently, the gratings are rotated together to change the beam direction in a cone (step 610). Furthermore the argument of the appellant, that in the system of D1, Fig. 3, the diffraction gratings 51 and 52 are mounted on separate and not collinear axes which arrangement prohibits the rotation of the gratings while maintaining their relative position, appears credible. It is concluded that, even if the skilled person would wish to design a laser beam positioning system with the properties of the claimed system, i.e. having the ability to select the steering angle and set the beam direction around a cone, this would not be possible with the system disclosed in document D1, at least not without major technical modifications, for which neither this document nor any available other prior art gives any teaching or hint.

3.2.6 As discussed in point 3.1, the remaining citations referred to in the examining proceedings are not more relevant. The only prior art from the International Search Report disclosing a large beam scanning system for obstacle avoidance is document US-A-5,471,326, which discloses a system including two concentric holographic transmission gratings. The reason for including two holographic gratings in that system is to obtain a small off-axis angle (see col. 2, lines 15-26) and to this end the gratings are bonded to form a composite holographic element. Hence, this system is not capable of providing a conical beam with selectable steering angle.

3.2.7 Therefore, in the opinion of the board, the subject-matter of claim 1 involves an inventive step (Art. 52(1) EPC and 56 EPC).

3.3 The further claims 2 to 7 are dependent claims and are therefore equally allowable.

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 on the basis of the following documents:

Claims:	1 to 7, as received with the letter of 14 August 2007;
Description:	pages 1, 2, 5 to 11 as published; page 3 received on 7 June 2005 with the letter of 6 June 2005; pages 4 and 12 received on 10 September 2009 with the letter of 10 September 2009;
Drawings:	sheets 1/6 to 6/6 as published.

The Registrar: The Chairman:

M. Kiehl A. G. Klein