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Datasheet for the decision of 28 November 2013

Case Number: T 0544/10 - 3.4.02

Application Number: 04256351.0

Publication Number: 1524519

IPC: G01N29/26, G01S7/52, G01S15/89, G10K11/34, B06B1/06

Language of the proceedings: EN

Title of invention:
Two dimensional phased arrays for volumetric ultrasonic inspection and methods of use

Applicant:
GENERAL ELECTRIC COMPANY

Relevant legal provisions:
EPC 1973 Art. 54(1), 56

Keyword:
Novelty (main request - no)
Inventive step (auxiliary request - no)

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Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0544/10 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 28 November 2013

Appellant: (Applicant)	GENERAL ELECTRIC COMPANY 1 River Road Schenectady, NY 12345 (US)
Representative:	Bedford, Grant Richard GPO Europe GE International Inc. The Ark 201 Talgarth Road Hammersmith London W6 8BJ (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 15 October 2009 refusing European patent application No. 04256351.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: F. J. Narganes-Quijano
B. Müller

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 04256351.0 (publication No. 1524519).

In its decision the examining division held that the subject-matter of independent claim 1 of the request then on file was not new over the disclosure of document

D7: US-A-5575290.

The examining division also held in its decision that the additional features defined in dependent claim 10 were anticipated by the disclosure of document D7.

II. With the statement setting out the grounds of appeal the appellant submitted two sets of claims amended according to a main request (labelled by the appellant "primary request") and an auxiliary request, and requested that the decision under appeal be set aside and a patent be granted. Oral proceedings were also requested as a precaution.

Claim 1 amended according to the main request reads as follows:

"A method for performing an ultrasonic volumetric inspection of a test material, comprising the steps of:
providing a two-dimensional ultrasonic phased array (100), the phased array (100) includes a plurality of ultrasonic elements (102) arranged in a two-

dimensional rectilinear grid pattern extending in an azimuthal (X) and elevational (Z) direction;

applying modulation to each of the ultrasound elements to form an ultrasonic scanning beam (106); and

interrogating at least a portion of the test material with the ultrasonic scanning beam (106);

rows of the ultrasonic elements (102) are positioned symmetrically about a central axis of the ultrasonic phased array (100) extending in the azimuthal (X) direction and that symmetrical transducer pairs (102) are connected electrically in parallel to a single electronic channel by leads (112);

characterized in that:

each ultrasonic element (102) has a dimension in the azimuthal (X) direction of from 0.5 acoustic wavelengths to 7 acoustic wavelengths and a dimension in the elevational (Z) direction of from 0.5 acoustic wavelengths to 20 acoustic wavelengths, the dimensions of the ultrasonic elements (102) being larger in the elevational (Z) direction than the dimensions of the ultrasonic elements (102) in the azimuthal (X) direction."

Claim 1 amended according to the auxiliary request differs from claim 1 of the main request in that the claim further reads "and further comprising a multi-focus lens (108) that enables independent pre-focusing of the elevation of each respective row of transducers (102)."

III. Oral proceedings were appointed by the Board. In a communication annexed to the summons to attend oral proceedings the Board referred to document D7 and to the following documents:

A1: "Diffraction impulse response of rectangular transducers", J. L. San Emeterio et al.; Journal of the Acoustical Society of America (US), Vol. 92 (1992); pages 651 to 662
B1: US-A-5882309
B2: US-A-5677491
D3: US-A-6089096,

and gave a preliminary assessment of the appellant's case on appeal. In particular, as regards claim 1 of the main request the Board reasoned as follows:

"Claim 1 of the main request is based on the combination of claim 1 and dependent claim 10 of the request underlying the decision under appeal and in its decision the examining division held that this combination of features was not novel over the disclosure of document D7 (reasons of the decision, point 1.1 and last line of point 1.3). In the statement of grounds of appeal the appellant has not disputed that the features of present claim 1 corresponding to the subject-matter of the previous claim 1 are - as held by the examining division in its decision - known from the disclosure of document D7 (see Figure 4 and the corresponding description, in particular column 4, line 42 to column 5, line 62), but has contested the examining division's view that the remaining features of present claim 1 (i.e. the features of the last paragraph of the claim), corresponding to the features of the previous dependent claim 10, are also disclosed in the paragraph bridging columns 5 and 6 of document D7.

The Board, in this respect, notes the following:

Document D7 discloses that each of the transducer elements of the two-dimensional ultrasonic phased array "extends over an area of approximately 0.3 mm along the azimuth and 7 mm along the elevation" (column 6, lines 3 to 6). Therefore, in document D7 the dimensions of the transducer elements are "larger in the elevational direction than [...] in the azimuthal direction" as required by the last of the features of the last paragraph of present claim 1. The last paragraph of claim 1 further requires that the ultrasonic elements have "a dimension in the azimuthal direction of from 0.5 acoustic wavelengths to 7 acoustic wavelengths and a dimension in the elevational direction of from 0.5 acoustic wavelengths to 20 acoustic wavelengths". According to the appellant the corresponding dimensions specified in document D7 do not fall within the claimed ranges because, taking into account that the transducers are operated in document D7 at 2.5 MHz (column 8, line 47) and assuming that document D7 uses the common ultrasonic transducer material PZT in which the velocity of sound is of 3200 m/s, then the dimensions of the transducer elements disclosed in document D7 (i.e., 0.3 and 7 mm in the azimuthal and the elevational directions, respectively) would be of 0.234 λ and 5.469 λ in the azimuthal and the elevational directions, respectively, and therefore outside the claimed ranges. The Board, however, cannot follow the appellant's assumption that the transducer material used in document D7 has a sound velocity of 3200 m/s because this value is at variance with the disclosure of document D7. Indeed, in the same paragraph bridging columns 5 and 6 of document D7 and referred to above it is stated that the "azimuthal spacing [between the transducers] is typically 0.25 or 0.5 wavelengths up to approximately 2.0 wavelengths" and that "an exemplary azimuthal spacing is 0.3 mm"; in

the event that the velocity of sound in the material is taken according to the appellant's assumption as 3200 m/s, then the wavelength ($\lambda = v/f$) would be of 1.28 mm, and the exemplary azimuthal spacing of 0.3 mm would amount to 0.234 wavelengths, i.e. to a value outside the disclosed range of "typically 0.25 or 0.5 wavelengths up to approximately 2.0 wavelengths". Therefore, the appellant's argumentation is based on an alleged value of the speed of sound in the material of 3200 m/s that is inconsistent with the disclosure of document D7.

In addition, according to the paragraph of document D7 referred to by the appellant and disclosing the frequency of operation of 2.5 MHz (column 8, lines 42 to 50; see also column 9, lines 11 to 19 and paragraph bridging columns 9 and 10) the approach followed in the document is based on the same approach followed in document A1 which relies on a value of the speed of sound of the material of 1500 m/s (document A1, page 658, first column, first paragraph). This value of the speed of sound is, unlike the value assumed by the appellant, consistent with the values disclosed in the paragraph bridging columns 5 and 6 of document D7 and, in addition, implies together with the frequency 2.5 MHz specified in the document a value of the wavelength ($\lambda = v/f$) of 0.6 mm. Accordingly, the exemplary transducer elements disclosed in document D7 and extending "over an area of approximately 0.3 mm along the azimuth and 7 mm along the elevation" (column 6, lines 3 to 6) would extend over an area of approximately 0.50 and 11.67 wavelengths along the azimuthal and the elevational directions, respectively, and would therefore fall within the claimed range.

In view of the above considerations, the method of claim 1 [...] would not appear to be new over the disclosure of document D7 (Article 54(1) EPC 1973).

In addition, even assuming that the claimed range of the dimensions of the ultrasonic elements was novel over the disclosure of document D7, this feature would not appear to involve an inventive step (Article 56 EPC 1973) in view of the disclosure of document D7 relating to the spacings and the dimensions of the rectangularly shaped transducer elements (column 5, line 63 to column 6, line 6) and the teaching of document A1 relating to the aspect ratio of the transducer elements and the effect of the same on the characteristics of the transducer array (abstract, and Figure 1, together with page 651, second column, second paragraph; see also Figures 4, 6, 8, 9, 11 and 13 and the corresponding disclosure). In particular, it would be obvious for the skilled person to select the appropriate aspect ratio and dimensions of the ultrasonic elements in order to adjust, in accordance with the circumstances (for instance, when inspecting irregularly shaped parts as submitted by the appellant in the grounds of appeal), the characteristics of the resulting ultrasonic beam, and more particularly the divergence of the beam (see description of the application, page 8, last two paragraphs); see in this respect document D3, column 2, line 36 *et seq*."

As regards claim 1 of the auxiliary request, the Board reasoned in its communication as follows:

"Claim 1 amended according to the auxiliary request requires, in addition to the features of claim 1 of the main request, a multi-focus lens enabling independent pre-focusing of the elevation of each respective row of

transducers. This feature has been taken from the description (page 9, second column, paragraph bridging pages 10 and 11, and page 12, second paragraph) and has not been previously defined in the sets of claims submitted by the appellant during the first-instance proceedings. In addition, the examining division has not considered this feature during the examination procedure. In view of these considerations, the admissibility of the auxiliary request under Article 12(4) RPBA (Rules of Procedure of the Boards of Appeal, OJ EPO 2007, 536) will have to be addressed during the oral proceedings.

Assuming that the auxiliary request is admitted by the Board into the proceedings, the issue of inventive step of the claimed subject-matter will be addressed during the oral proceedings. The Board notes on a preliminary basis that the use of multi-focus lenses for independently pre-focusing the elevation of the rows of transducers of a two-dimensional ultrasonic phased array as claimed was already known at the priority date of the application (see for instance document B1, Figures 4 to 7 and the corresponding description together with column 4, lines 56 to 63 and column 6, lines 1 to 18, and document B2, Figures 4 to 7 and the corresponding description together with column 4, last paragraph) and that, for this reason, no inventive step (Article 56 EPC 1973) appears to be involved in the subject-matter of independent claim 1 [...] of the auxiliary request."

IV. In reply to the summons to oral proceedings, with a letter dated 13 November 2013, the appellant withdrew the request for oral proceedings and requested a written decision in accordance with the state of the file.

The letter dated 13 November 2013 included no substantive submission in reply to the preliminary opinion of the Board given in the communication annexed to the summons.

V. Oral proceedings were held on 28 November 2013. The appellant was not represented at the oral proceedings. At the end of the oral proceedings the Board announced its decision reported in the order below.

Reasons for the Decision

1. The appeal is admissible.

2. With its letter dated 13 November 2013 the appellant withdrew the request for oral proceedings previously made in the statement of grounds of appeal. In the circumstances of the case the Board found it appropriate to maintain the oral proceedings as scheduled. The absence of the appellant and of its representative at the oral proceedings did not prevent the Board from coming to a final decision at the end of the oral proceedings (Article 15(3) RPBA), especially in view of the fact that the appellant requested in its letter dated 13 November 2013 a decision in accordance with the state of the file.

3. In the communication annexed to the summons to oral proceedings the Board explained in detail (see point III above) why in its preliminary opinion

- the subject-matter of claim 1 of the main request was not new (Article 54(1) EPC 1973) and in any case would not involve an inventive step (Article 56 EPC 1973), and

- assuming that the auxiliary request was admitted into the proceedings, the subject-matter of claim 1 of the auxiliary request would not involve an inventive step (Article 56 EPC 1973).

The appellant has made no substantive submissions in reply to the detailed objections raised by the Board in the aforementioned communication. In particular, the appellant chose neither to attend the oral proceedings nor to take a written position on the substantive matters raised by the Board. The sole substantive arguments given by the appellant were developed in the statement of grounds of appeal; these arguments, however, pre-date and have no bearing on the issues subsequently raised by the Board in the aforementioned communication. The appellant has therefore not availed itself of the opportunity to reply to the preliminary assessment of the case given by the Board in the aforementioned communication.

During the oral proceedings the Board decided to admit the auxiliary request into the proceedings and, after consideration of the assessment advanced in the communication, and in the absence of any attempt by the appellant to refute or overcome the objections raised by the Board with regard to the claim requests on file, the Board saw no reason to depart from the preliminary opinion expressed in the communication, which therefore became final.

Accordingly, noting that the appellant has had, and has failed to use, the opportunity to present comments on

the objections raised by the Board in its communication (Article 113(1) EPC 1973), the Board concluded during the oral proceedings that the main and the auxiliary requests did not comply with the requirements of Article 52(1) EPC in view of the prior art under consideration and that, consequently, the requests were not allowable.

The appeal must therefore be dismissed for the reasons already communicated to the appellant and reproduced in point III above (Rule 66(2)(g) EPC 1973).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Rodríguez Rodríguez A. G. Klein

Decision electronically authenticated