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**Datasheet for the decision  
of 22 January 2021**

**Case Number:** T 1545/17 - 3.4.03

**Application Number:** 11173957.9

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**IPC:** H01L41/08, G01B17/02,  
G01N29/11, G01N29/22,  
H01L41/113, G01N29/24

**Language of the proceedings:** EN

**Title of invention:**

Device and system for measuring material thickness

**Applicant:**

General Electric Company

**Headword:**

**Relevant legal provisions:**

EPC Art. 54, 56

**Keyword:**

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

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
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Case Number: T 1545/17 - 3.4.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.03**  
**of 22 January 2021**

**Appellant:** General Electric Company  
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Schenectady, NY 12345 (US)

**Representative:** Illingworth-Law, William Illingworth  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 10 February  
2017 refusing European patent application No.  
11173957.9 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** M. Papastefanou  
**Members:** M. Stenger  
C. Almberg

## **Summary of Facts and Submissions**

- I. The appeal concerns the decision of the Examining Division to refuse European patent application No. 11173957. This decision according to the state of the file refers to communications dated 13 July 2016, 16 January 2017 and 20 January 2017. In these communications, the Examining Division objects that the subject-matter of the independent claims of the requests then on file lacks an inventive step compared to a combination of documents D4 and D5 as listed below.
- II. The appellant requests that the decision be set aside and that a patent be granted on the basis of a main request or one of auxiliary requests 1 and 2, all filed with the grounds of appeal and corresponding to the requests on which the contested decision is based.

Oral proceedings were requested as a precaution in the event the Board was minded to issue any adverse decision in respect of the application (grounds of appeal, last sentence).

With letter dated 17 December 2020, the appellant withdrew their request for oral proceedings following a communication of the Board in preparation of such oral proceedings. The appellant requested further the partial reimbursement of the appeal fee ("reimbursement of any portion of the appeal fee for which we are eligible").

Following the appellant's letter, the board cancelled the scheduled oral proceedings, and issues its decision in writing.

III. The following documents are referred to:

D2: US 2004/0224482 A1

D4: WO 2009/029158 A1

D5: JP 02-140991 A

D8: US 2008/0289426 A1

D9: US 7302866 B1

D8 and D9 were used during patent proceedings concerning family members of the present application; copies of these two documents were annexed to the Board's communication preparing oral proceedings.

IV. Claim 1 of the main request has the following wording (labelling a), b), c), ... added by the Board):

a) *A piezoelectric sensing device (100) for use on a target (484) comprising:*

b) *a substrate (102);*

c) *a solder layer (136) disposed on the substrate (102);*

d) *a piezoelectric element (104) coupled to the substrate (102) via the solder layer (136),*

e) *the piezoelectric element (104) comprising a ceramic body (106) having a first electrode (108) on a first surface thereof of and a second electrode (110)*

*on a second surface opposite the first surface thereof;  
and*

*f) a wrap tab (112) comprising conductive material disposed around at least a portion of the piezoelectric element (104), the wrap tab (112) disposed on the first and second surfaces of the ceramic body (106) and a third surface of the ceramic body (106) connecting the first and second surfaces;*

*g) wherein the substrate (102), the solder layer (136), and the piezoelectric element (104) are arranged as a layered structure (138) that has a profile height that does not exceed 3 mm;*

*h) wherein the substrate (102) comprises a circuit material (114, 414) that is compatible with operating temperatures in excess of 120°C; and*

*i) wherein the circuit material (114, 414) comprises a polyamide-based film or a material or film that comprises one or more of: polyester PET, polyimide PI, polyethylene naphthalate PEN, and polyetherimide PEI.*

V. Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that it comprises the additional feature j) as follows (labelling j) added by the Board):

*j) wherein the piezoelectric element is comprised in a transducer array, the transducer array having a plurality of piezoelectric elements coupled to the substrate, the transducer array comprising a first row of piezoelectric elements and a second row of piezoelectric elements, wherein the second row is positioned in perpendicular relation to the first row.*

VI. Claim 1 of auxiliary request 2 differs from claim 1 of the main request in that it comprises the additional feature k) as follows (labelling k) added by the Board):

k) *wherein a ground plane (256) is incorporated into the flexible circuit material (214) of the substrate.*

VII. The relevant arguments of the appellant may be summarized as follows:

The aim of the present application was to provide a sensing device on a flexible circuit with a low profile height enabling it to be used where access is limited for contacting non-planar targets and being compatible with harsh operating conditions and temperatures (grounds of appeal, page 2, second paragraph). D4, however, was directed to a different purpose and did not mention any need for flexibility or to withstand harsh conditions (grounds of appeal, page 2, third paragraph, last sentence).

## **Reasons for the Decision**

1. Main request - independent claim 1

The submission of the appellant with respect to D4 (see section VII. above) is interpreted by the Board such that D4 is considered by the appellant as not being suitable to represent the closest prior art (see the Board's communication preparing the oral proceedings, point 4.3).

Document D4 is directed at "a bond pad for use with piezoelectric substrates that has good adhesion to ceramic substrates, is low in cost, has good solderability and allows the piezoelectric substrate to mechanically vibrate without any noticeable damping effect from the bond pad" (page 1, lines 29 to 32). The Board therefore accepts that D4 is directed to a different purpose than the present application. Thus, although this document has many technical features in common with the claimed invention and might therefore be used as closest prior art in the problem solution approach, it is not considered to represent an ideal starting point (see Case Law of the Boards of Appeal of the EPO, 9th edition 2019, section I.D.3.1.).

Sensing devices with the same aim as the present application and having the most relevant technical features in common with the claimed invention were however known at the priority date of the present application. It is the Board's view that such a device constitutes a more suitable starting point than D4.

Examples of such devices are disclosed in D8 and D9 as follows.

The sensors disclosed in these two documents are designed to withstand harsh conditions (the sensors of D8 and D9 are to be attached to airplanes; D8, see paragraphs [2] and [28]: "...provides additional protection against harsh environmental conditions such as moisture, freeze/thaw cycles, and chemical spillage."; D9, see column 1, lines 13 to 39). Further, according to each of these documents, ceramic piezoelectric sensors are arranged on or in a flexible substrate (D8 see paragraphs [13] to [20] and figure



1A, D9 see column 3, line 40 to column 5, line 27 and figures 1 and 2).

Thus, each of documents D8 and D9 discloses features a) and b).

More particularly, according to both D8 and D9, the piezoelectric elements are coupled to the substrate via a solder layer, i.e contact pads 108, 308 in D8 and wire traces 150 in D9. Alternatively, the bonds 116a and 116b in D8 and the conductive contacts 140 in D9 could be seen as a layer coupling the piezoelectric elements to the substrate.

Therefore, each of these two documents discloses features c) and d).

It is commonly known that piezoelectric elements have to be provided with electrodes on two opposite surfaces to be operational.

Feature e) is thus inherent to any functioning piezoelectric element and thereby at least implicitly disclosed in both D8 and D9.

Further, both documents D8 and D9 explicitly disclose that the piezoelectric elements are contacted from only one/a first surface and not from two opposite surfaces (D8: figure 1A; D9: figure 1 and column 1, lines 45 to 61). This implies that the second surface and the first surface of these piezoelectric elements are provided with a wrap-around electrode corresponding to the *wrap tab* defined in claim 1 of the main request, otherwise they would not function. Both documents D8 and D9 thus disclose at least implicitly feature f).

Moreover, in both D8 and D9, the layered structure comprising the substrate, the solder layer and the

piezoelectric element has a profile height that does not exceed 3 mm (according to D8, the sum of the thicknesses of the corresponding layers amounts to a maximum of 25,5 mils / 0,62 mm, see paragraphs [13] and [17] to [18]; D9: 0,36 mm, see column 4, lines 55 to 58). Feature g) is thus disclosed in each of D8 and D9.

Finally, in both these documents, the substrate comprises a circuit material made of polyimide (D8: films 102, 306, see paragraph [13]; D9: polyimide layer 170, see column 5, lines 16 to 17). Polyimide is one of the materials listed in feature i). The normal long-term operating temperatures of polyimide largely exceed 160°C. The circuit material disclosed in both D8 and D9 is thus compatible with operating temperatures in excess of 120°C according to feature h). Both D8 and D9 therefore disclose features i) and h) as well.

The Board concludes from the above that the subject-matter of claim 1 of the main request lacks novelty under Article 54 EPC, since all of its features are disclosed in each of D8 and D9.

2. Auxiliary request 1 - independent claim 1

Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that it comprises the additional feature j) as defined above (see point V).

D8 discloses an array of transducer assemblies (see paragraph [5], claims 27 and 29). D9 discloses transducers arranged in a row (see figure 4), that is in a one-dimensional array.

The number of transducers or transducer assemblies in an array and their particular geometric arrangement (e.g. in parallel or in perpendicular rows) will be

chosen as a matter of routine by the skilled person depending on the particular needs and circumstances. They would thereby arrange the arrays of any of D8 or D9 as required by feature j) without the exercise of an inventive skill.

Consequently, the subject-matter of claim 1 of auxiliary request 1 is not inventive under Article 56 EPC in view of any of D8 or D9 combined with the common general knowledge of the skilled person.

3. Auxiliary request 2 - independent claim 1

Claim 1 of auxiliary request 2 differs from claim 1 of the main request in that it comprises the additional feature k) relating to a ground plane as defined above (see point VI).

The Board notes that the application does not explicitly mention any technical effect achieved by the provision of a ground plane according to feature k) (see paragraph [25]). However, providing a ground contact in an electric circuit for sensing purposes on a target is a generally known necessity. In addition, the Board considers that it was common general knowledge at the priority date of the present application that a larger ground *area* or *plane* as opposed to a ground *point contact* will provide improved ground contact and shielding properties.

Starting from any of D8 or D9, the skilled person wishing to provide an improved ground contact would thus readily implement feature k) into the sensing devices disclosed in these documents without the exercise of an inventive step.

Therefore, the subject-matter of claim 1 of auxiliary request 2 is not inventive under Article 56 EPC in view of any of D8 or D9 combined with the common general knowledge of the skilled person.

4. None of the independent claims of the main request and of auxiliary requests 1 and 2 fulfills the requirements of the EPC. Thus, the appeal must fail.
5. Regarding the appellant's request for the partial reimbursement of the appeal fee, the board notes that the requirements of Rule 103(4)(c) are fulfilled. Thus, 25% of the appeal fee is to be reimbursed.

## Order

### For these reasons it is decided that:

1. The appeal is dismissed.
2. The appeal fee is reimbursed at 25%.

The Registrar:

The Chairman:



S. Sánchez Chiquero

M. Papastefanou

Decision electronically authenticated