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**Datasheet for the decision
of 23 March 2017**

Case Number: T 0592/12 - 3.4.01

Application Number: 04710048.2

Publication Number: 1599736

IPC: G01P15/08, G01P15/125, B81B7/00

Language of the proceedings: EN

Title of invention:
CAPACITIVE ACCELERATION SENSOR

Applicant:
Murata Electronics Oy

Headword:

Relevant legal provisions:
EPC 1973 Art. 54(1), 54(2), 56
RPBA Art. 13(1)
EPC Art. 123(2)

Keyword:
Inventive step - (yes)
Amendments - added subject-matter (no)
Late-filed request - admitted (yes)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 0592/12 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 23 March 2017

Appellant: Murata Electronics Oy
(Applicant) Myllynkivenkuja 6
01620 Vantaa (FI)

Representative: Boco IP Oy Ab
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 21 October 2011
refusing European patent application No.
04710048.2 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman G. Assi
Members: P. Fontenay
J. Geschwind

Summary of Facts and Submissions

I. The examining division refused European patent application No. 04 710 048.

In the "Reasons" for the decision, the examining division held that the subject-matter of claim 1 according to a main request then on file did not involve an inventive step under Art. 56 EPC 1973. Particular reference was made to document

(D1) US-A-5 367 429,

which was considered to illustrate the closest prior art.

Starting from this known item of prior art, the examining division held that the skilled person, in an attempt to provide a more durable sensor structure able to resist the wear caused by overload situations, would have considered the teaching of document

(D4) M. R. Houston et al., "*Diamond-Like Carbon Films for Silicon Passivation in Microelectromechanical Devices*", Material Research Society Symposium Proceedings, USA, Vol. 383, 1 January 1995, pages 391-402.

The skilled person would have found in this document a solution to said problem, thus arriving at the claimed invention without the exercise of any inventive skills.

The examining division further held that auxiliary requests 1 to 4 then pending defined added subject-matter contrary to Art. 123(2) EPC.

- II. The appellant (applicant) filed an appeal against the decision to refuse the application and submitted new requests.
- III. A summons to attend oral proceedings was issued.
- IV. In a communication pursuant to Art. 15(1) RPBA, the appellant was informed of objections under Art. 84 EPC 1973, Art. 123(2) EPC and Art. 56 EPC 1973.
- V. In reply, the appellant filed new requests taking due account of the Board's comments.
- VI. At the oral proceedings before the Board on 23 March 2017 the appellant's final request was that the decision under appeal be set aside and that a patent be granted with claims 1-7 and amended description pages 1-8 filed during the oral proceedings and Figures 1 and 2 of the application as published.
- VII. Claim 1 of the appellant's sole request reads:

"A capacitive acceleration sensor comprising at least one pair of electrodes, such that the pair of electrodes comprises a movable electrode (4) responsive to the acceleration, at least one stationary electrode (5), and several isolator protrusions (6) for limiting the movement of the movable electrode (4) located on one of the electrodes (4), (5) characterized

in that the isolator protrusions (6) are coated with a diamond-like DLC coating so that the isolator protrusions (6) have a two-layer composite structure, wherein the base layer consists of oxide, which base layer in turn is coated with a top layer of the diamond-like DLC coating,

in that the base layer is essentially thicker than the top layer,

in that the diamond-like DLC coating of the top layer extends also onto the sides of the isolator protrusions (6), and

in that the diamond-like DLC coating of the top layer also extends beyond the edges of the isolator protrusion (6) onto the area of electrode (4), (5) having said isolator protrusions thereon."

Claims 2 to 7 depend on claim 1.

Reasons for the Decision

1. *Applicable law*

This decision is issued after the entry into force of the EPC 2000 on 13 December 2007 whereas the application was filed before this date. Reference is thus made to the relevant transitional provisions for the amended and new provisions of the EPC, from which it can be derived which Articles and Rules of the EPC 1973 are still applicable to the present application and which Articles and Rules of the EPC 2000 are to apply. When Articles or Rules of the former version of the EPC are cited, their citations are followed by the indication "1973" (cf. EPC, Citation practice).

2. The appeal is admissible.

3. *Admissibility of the appellant's request*

The present request was filed during the oral proceedings before the Board. It differs from a second auxiliary request filed by the appellant in response to

the communication of the Board in that the last feature of claim 1 has been deleted.

The amendment made in claim 1 solves the problems of clarity and added subject-matter underlined by the Board in its communication under Art. 15 RPBA. Concretely, the amendment made during the oral proceedings permits to solve a discrepancy in claim 1 resulting from the feature of extension of the DLC coating over the edges of the protrusion, on the one hand, and the additional indication that the electrode is uncoated between the isolator protrusions, on the other hand.

The technical meaning of the amendment carried out is straightforward. It also serves the economy of the proceedings since it solves the various issues under Art. 84 EPC 1973 and Art. 123(2) EPC raised by the Board.

The request filed during the oral proceedings was therefore admitted into the appeal proceedings (Art. 13(1) RPBA).

4. *Added subject-matter*

Claim 1 results, in essence, from a combination of original claims 1 to 7. The feature of the protrusions being located on one of the electrodes results from the explicit reference to the two alternatives in original dependent claims 9 and 10.

Dependent claims 2 to 7 correspond, respectively, to original claims 8 to 13.

The claims and description pages according to the appellant's request therefore meet the requirements of Art. 123(2) EPC.

5. *Novelty and inventive step*

5.1 Document D1 discloses a capacitive acceleration sensor comprising a pair of electrodes such that the pair of electrodes comprises a movable electrode responsive to acceleration (cf. column 2, lines 55-62; column 6, lines 10-23). The pair of electrodes comprises, in particular, a movable electrode, two stationary electrodes and a plurality of isolator protrusions (cf. Figure 1, 17; column 14, lines 25-35). According to various embodiments of the known acceleration sensor, the isolator protrusions are positioned on both sides of one of the electrodes, namely the movable electrode.

Document D1 does not disclose the two-layer composite structure of isolator protrusions as recited in claim 1.

None of the other available items of prior art discloses an acceleration sensor as defined in claim 1.

For these reasons, the claimed subject-matter is considered to be new in the sense of Art. 54 EPC 1973.

5.2 D1 belongs to the same field as the claimed invention. It further shares many structural features with the claimed configuration as shown above and addresses a problem similar to the one addressed by the present invention, namely the risk of sticking of the movable electrode onto the stationary electrode when both electrodes contact each other.

Therefore, document D1 constitutes a valid starting item of prior art in order to decide on the inventive merits of the claimed invention. D1 is thus considered to illustrate the closest prior art.

The claimed accelerometer differs from the accelerometer of D1 in that:

- (i) the isolator protrusions are coated with a DLC coating;
- (ii) the DLC coating extends onto the sides of the protrusions;
- (iii) the DLC coating extends beyond the edges of the protrusions onto the area of the electrode having said isolator protrusions located thereon.

Feature (i) permits to limit the wear of the structure resulting from repeated contacts between the two electrodes.

Feature (ii) permits to improve the bounds between the base oxide layer and the DLC coating.

Feature (iii) allows an electric discharge of the interface between the DLC coating and the base layer in case of impacts between the protrusions and the stationary electrode. The electrostatic attraction resulting from the presence of charges on this interface could namely be large enough to cause stiction between both electrodes. With the slightly conductive DLC coating, a leak of said charges toward the supporting electrode takes place.

Document D4 relates to micromechanical devices and addresses the general problem of stiction between movable parts in such devices (cf. abstract). More specifically, the micromechanical devices may include accelerometers (cf. section "*Stiction in Micromachining*", first paragraph). In addition, document D4 also addresses the problem of the invention, as acknowledged by the appellant, regarding the wear of the protrusions incurred in such devices due to repeated contacts between movable and stationary electrodes (cf. section "*Stiction in Micromachining*", first paragraph, lines 13 and 14).

Consequently, the skilled person would have considered D4 when seeking a solution to the general problem of wear resulting from repeated stiction (cf. page 392, Section "*Stiction in Micromachining*").

In particular, D4 teaches to provide the surface of the electrode with a protective film of Diamond-Like-Carbon (DLC coating), the DLC coating being applied directly to the electrode. There is accordingly no information regarding the elaboration of composite protrusions.

The skilled person, considering the teaching of D4, would have nevertheless amended the accelerometer of D1 accordingly, that is, by providing the top surfaces of the protrusions of D1 with an additional layer of DLC coating. No inventive activity can thus be recognised in the presence of feature (i) in the claimed subject-matter.

There is, however, no indication to be found in D4, or in other documents of the prior art, suggesting to extend the DLC coating onto the sides of the protrusions (feature ii) and beyond the edges of said

protrusions onto the area of the electrode (feature (iii)).

As a matter of fact, in the absence of prior art structures with protrusions consisting of different layers, there is no suggestion to be found in the available prior art that the bounding between the DLC coating and oxide layer may need to be reinforced under the circumstances. There is also no suggestion in the prior art to solve the problem of stiction due to electrostatic forces by providing a slightly conductive path extending to the electrode.

Consequently, the subject-matter of claim 1 does not result in an obvious manner from the prior art. It is therefore inventive in the sense of Art. 56 EPC 1973.

6. In conclusion, the appellant's request is allowable.

Order

For these reasons it is decided that:

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

claims 1 to 7, filed as main request at 10:40 during the oral proceedings before the Board;

description pages 1 to 8 filed at 10:55 during the oral proceedings before the Board;

Figures 1 and 2 of the application as published.

The Registrar:

The Chairman:



R. Schumacher

G. Assi

Decision electronically authenticated