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Datasheet for the decision of 22 April 2020

Case Number: T 1550/17 - 3.4.02

Application Number: 08250632.0

Publication Number: 1965204

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Language of the proceedings: EN

Title of invention:
Gas sensor

Applicant:
NGK Insulators, Ltd.

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

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Catchword:

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Case Number: T 1550/17 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 22 April 2020

Appellant: (Applicant)	NGK Insulators, Ltd. 2-56, Suda-cho Mizuho-ku Nagoya-city, Aichi 467-8530 (JP)
Representative:	Mewburn Ellis LLP Aurora Building Counterslip Bristol BS1 6BX (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 15 February 2017 refusing European patent application No. 08250632.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Bekkering
Members:	A. Hornung
	B. Müller

Summary of Facts and Submissions

I. The applicant appealed against the decision of the examining division refusing European patent application No. 08250632.0 (main request and sole auxiliary request then on file) on the basis of Article 56 EPC.

II. With the statement setting out the grounds of appeal, the applicant filed sets of claims according to a main request and to first to fourth auxiliary requests. It requested that the decision of the examining division be set aside and a patent be granted on the basis of one of these sets of claims. The sets of claims of the present main request and of the present second auxiliary request are identical to the main request and to the sole auxiliary request underlying the appealed decision, respectively.

As a precaution, the applicant requested oral proceedings.

III. In a communication annexed to a summons to oral proceedings, the board informed the applicant about its provisional and non-binding opinion according to which, *inter alia*, the subject-matter of claim 1 of all requests on file lacked inventive step with respect to documents

D1: US 5,144,249,
D2: US 6,645,360 B1,
D3: US 2004/0158971 A1.

IV. The board's opinion concerning lack of inventive step of the subject-matter of claim 1 of the main request was worded as follows (see point **6.** of the communication annexed to the summons):

"**6.** Main request - Inventive step

6.1 The board, in its preliminary view, shares the opinion of the examining division that the subject-matter of claim 1 lacks an inventive step with respect to the disclosure of D1 (Article 56 EPC).

The subject-matter of claim 1 differs from the gas sensor of D1 in that the width of the chamfered portion lies within a range of 30 to 240 microns, whereas D1 is silent about the actual width of the chamfer.

According to page 23, lines 8 to 14, of the patent application, the technical effect of the differing feature consists in that "the sensor element 12 can be prevented from the breakage by contact with the housing 13 in practical use in an internal combustion engine or the like". Hence, according to the applicant's statement of grounds of appeal, page 5, last sentence, the present objective technical problem "relates to mechanical damage caused by physical impact of the sensor element against the housing".

However, such mechanical damage of the sensor seems to depend on the concrete mechanical and environmental circumstances under which the sensor is fixed to the housing, such as:

- the mechanical construction of the housing in which the sensor element is to be mounted;
- the kind of means for fixing the sensor to the housing;
- the amount of precaution taken when fixing the sensor;
- the type and the intensity of the contact with the housing (e.g. drop or hit on the edge or on a flat

surface of the sensor; sliding on the edge of the sensor);
- the thermal environment (ambient temperature versus internal combustion engine).

In addition, the concrete numerical width of the chamfer for preventing breakage seems to depend at least on the following parameters of the sensor:

- the dimensions of the sensor plate (thickness, width);
- the angle of the chamfer;
- the edge geometry (rounded; sharp edges);
- the material of the sensor plate;
- the ease of forming the chamfer;
- the fracture probability of the sensor which is considered to be acceptable (1%, 8%, 18% or 25%; see the experimental results disclosed in the last paragraph of the patent application).

None of these aspects influencing the width of the chamfer is defined in claim 1. Therefore, it would appear to the board that the alleged technical effect is not effectively obtained over the whole scope of claim 1 which is not limited by any feature related to these aspects. It follows that the technical problem has to be reformulated in less ambitious terms.

The skilled person, when putting the teaching of D1 into practice, i.e. forming chamfers at the edges of the sensor plate for reducing thermal stress at the edges, is confronted with the fact that D1 is silent about the concrete numerical value of the chamfer's width. This seems to imply that the width of the chamfer is not a critical parameter of the chamfer's capacity to reduce thermal stress. The technical problem arising from this

situation may, hence, be formulated as being the determination of a numerical value of the chamfer width.

Since there are no particular technical constraints disclosed in D1 concerning the width of the chamfer for reducing thermal stress, the skilled person would be guided essentially by conventional mechanical considerations for determining the width of a chamfer. For instance, it is well known that chamfers may reduce the risk of damaging otherwise sharp edges. In order to determine a suitable width of a chamfer, the skilled person would take into account, in a known manner, various aspects, such as those mentioned above, particularly the dimensions of the sensor plate. This task of determining a chamfer of a sensor plate represents routine work for the skilled person. As stated in the appealed decision, point 13.1, last sentence, "a width of 30 to 240 µm is merely one of several straightforward possibilities which the skilled person would select, depending on the concrete circumstances, without exercising inventive skill".

Incidentally, reference is made to D2, column 4, lines 24 to 26, figure 5, and to D3, paragraphs [0045], [0046], [0088] and [0122], disclosing numerical values of the dimension of typical chamfers of gas sensors. Several of these values disclosed in D2 and D3 lie in the range of 30 to 240 microns and confirm that a chamfer width as claimed is typical and the values are well-known in the art.

See also the reasons provided in the appealed decision, points 12 and 13.

6.2 The applicant, in its statement of ground[s] of appeal, pages 4 to 9, submitted extensive reasoning about why the appealed decision was flawed.

6.2.1 According to the applicant, "the considerations in D1 are entirely different from those of the present invention", in the sense that D1 related to the problem of decreasing thermal stress, whereas the present invention solved the technical problem related to mechanical damage caused by physical impact of the sensor element against the housing. Moreover, in the applicant's view, "there is no teaching in D1 that could lead the skilled reader to the present chamfering width" and "[i]t is far from clear [...] why 'thermal stress release' and 'breakage caused by contact' should have the **same** chamfering width requirements". Finally, the applicant submitted that "no reason why the reader of D1 **would** reach the claimed invention" was set out.

These arguments do not appear to be convincing. According to the overall disclosure of D1, the skilled person is taught that thermal stress at the edges of a gas sensor plate may be reduced by forming a chamfer at the plate's edges. No further guidance is provided in D1 about how to form the chamfer. It is to be assumed that no specific precautions other than those ordinarily taken by the skilled person when designing a chamfer are to be taken and that a large variety of chamfer types and widths are suitable. None of these large variety of chamfer types and widths comprises an inventive step since they emanate from routine considerations of the skilled person. Self-evidently, circumstances exist for which the adequate chamfer width, selected from this large variety of chamfer types by the skilled person, is a chamfer width lying in the range of 30 to 240 microns. Hence, under these specific circumstances, the gas sensor falls under the scope of claim 1.

6.2.2 Furthermore, under the designation "second reason for denying inventive step", the applicant, in its statement

of grounds of appeal, sought to refute the objection of the examining division "that the technical effect of the invention could not be expected to be achieved over the whole scope claimed".

For the reasons explained above, the board is of the preliminary view that the alleged technical effect of improved prevention of mechanical breakage, supported by the comparative examples disclosed in figure 7 of the patent application, is only achieved under specific circumstances but not over the whole scope of the claim."

V. In the annex to the summons to oral proceedings, the board raised doubts about the admissibility of the auxiliary requests 1, 3 and 4. Irrespective of the question of admissibility, the board provided its preliminary view *inter alia* on inventive step of the subject-matter of claim 1 of the auxiliary requests. The board's opinion concerning lack of inventive step of claim 1 of the auxiliary requests 1 to 4 was worded as follows (see points **7.3**, **8.2**, **9.3** and **10.2** of the communication annexed to the summons, respectively):

"**7.** First auxiliary request

(...)

7.3 For a certain soft type of contact, it would appear that the chamfer of the gas sensor of D1 would prevent breakage of the sensor. Anyway, it appears to be obvious that the skilled person, putting the disclosure of D1 into practice would design a chamfer such as to prevent breakage. Therefore, the additional feature of claim 1 does not seem to involve an inventive step (Article 56 EPC).

8. Second auxiliary request

(...)

8.2 According to D1, column 3, lines 24 to 29, the sensor of D1 is fixed by compressing talc powder through supporting members, implying a certain space for talc powder surrounding the sensor of D1. See also figure 1(a) of D1 showing a space around portions of the sensor plate (12) corresponding to the supporting members (28a to 28c) and to the connector (rear part of the housing).

In the preliminary view of the board, the actual size of the surrounding space, in particular its cross-sectional area, is obtained via standard technical considerations by the skilled person. No surprising technical effect over the whole scope of the claim appears to be related to the selection of an area of 1.5 to 3.0 mm^2 for reasons corresponding to those given for the main request.

The arguments of the applicant in the statement of grounds of appeal, pages 10 to 12, are not convincing for reasons corresponding to those given by the board for the main request.

9. Third auxiliary request

(...)

9.3 It would appear that the subject-matter of claim 1 lacks an inventive step. While the definition of the chamfer angle refines the technical circumstances under which the alleged technical effect occurs, the board is of the preliminary opinion that many further aspects (see point 6.1 above) are still undefined in claim 1.

Therefore, the objective technical problem consists in determining an adequate width of the chamfer in general.

10. Fourth auxiliary request

(...)

10.2 The new amended feature defines that beveled edges are present only at the portions corresponding to the supporting members and to the connector. It is not clear to the board which surprising technical effect is related to this feature. The description of the patent application, page 21, lines 9 to 21, is silent about any special technical effect. On the contrary, it seems that the alternative embodiment, described on page 23, line 24 to page 24, line 13 of the patent application, in which the edges are chamfered over the entire length of the sensor plate, is an obvious alternative. The applicant, in its statement of grounds of appeal does also not mention any special technical effect.

Therefore, in view of the multiple embodiments of D1, column 4, lines 3 to 24, figures 3(a) to 3(d), comprising a chamfer of various lengths and shapes, it would appear to the board that the configuration of the beveled portions as defined in claim 1 merely corresponds to an obvious possibility of forming a chamfer without involving any inventive step."

VI. In response to the summons to oral proceedings, the applicant informed the board with its letter dated 14 April 2020 that it intended not to attend or be represented at the oral proceedings. The applicant did not file any comments concerning the board's preliminary opinion as annexed to the summons.

VII. Following the applicant's letter of 14 April 2020, the oral proceedings were cancelled.

VIII. Independent claim 1 according to the main request reads as follows:

"A gas sensor comprising a sensor element (12) for detecting a concentration of a specific gas component in a measurement gas and a housing (13) for supporting said sensor element (12) therein,
wherein said sensor element (12) has a rectangular solid structure of a solid electrolyte body (11) containing a ceramic material, and comprises a gas inlet (26) for introducing said measurement gas formed at a distal end, an electrode for detecting said gas component formed inside, and a lead wire extending rearward from said electrode,
said housing (13) comprises a plurality of supporting members (86a, 86b, 86c) for supporting said sensor element (12) and a connector (88) for supporting a rear portion of said sensor element (12) and for being electrically connected to said lead wire,
a space between the supporting members (86a, 86b, 86c) is filled with talc (94a, 94b)
in said solid electrolyte body (11), at least an edge portion corresponding to said supporting members (86a, 86b, 86c) and an edge portion in a portion corresponding to said connector (88) are beveled to form chamfered portions, and
said chamfered portions have a width of 30 to 240 µm".

- Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the following feature is added at the end of the claim:

"the chamfering being sufficient to prevent breakage caused by contact between the sensor element and the housing".

- Claim 1 of the second auxiliary request differs from claim 1 of the main request in that the following feature is added at the end of the claim:

"wherein a space is formed between said supporting members (86a, 86b, 86c) and said portions of said solid electrolyte body (11) corresponding to said supporting members (86a, 86b, 86c), and has a cross-sectional area of 1.5 to 3.0 mm^2 ; and
wherein a space is formed between said connector (88) and a portion of said solid electrolyte body (11) corresponding to said connector (88), and has a cross-sectional area of 1.5 to 3.0 mm^2".

- Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request in that the feature "at an angle of 45°" is added as follows:

"in said solid electrolyte body (11), at least an edge portion corresponding to said supporting members (86a, 86b, 86c) and an edge portion in a portion corresponding to said connector (88) are beveled at an angle of 45° to form chamfered portions".

- Claim 1 of the fourth auxiliary request differs from claim 1 of the third auxiliary request in that the feature "at least an edge portion" is replaced by the feature "only edge portions in portions" as follows:

"in said solid electrolyte body (11), only edge portions in portions corresponding to said supporting members (86a, 86b, 86c) and an edge portion in a portion corresponding

to said connector (88) are beveled at an angle of 45° to form chamfered portions".

Reasons for the Decision

1. In its letter dated 14 April 2020 the applicant stated: "... *the applicant does not intend to attend, nor to be represented at, the oral proceedings scheduled for 15 December 2020*". This statement is considered equivalent to a withdrawal of the request for oral proceedings (see Case Law of the Boards of Appeal, 9th edition 2019, section III.C.4.3.2 and further references cited there). Consequently, the oral proceedings were cancelled and an immediate decision on the file as it stood was taken.

2. The board admits the auxiliary requests 1, 3 and 4, which were filed for the first time together with the statement of grounds of appeal, into the proceedings under Article 12(4) RPBA 2007.

3. In the communication annexed to the summons (see points IV. and V. above), the board expressed its preliminary opinion, along with the underlying reasons, that the subject-matter of claim 1 of the main request and of auxiliary requests 1 to 4 lacked an inventive step and that the applicant's arguments in favour of inventive step, filed with the grounds of appeal, were not convincing. The applicant did not rebut the board's provisional opinion. The board sees no reason to deviate from its preliminary opinion, which therefore becomes final.

4. It follows that the subject-matter of claim 1 of the main request and the auxiliary requests 1 to 4 lacks an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl R. Bekkering

Decision electronically authenticated