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**Datasheet for the decision  
of 24 January 2019**

**Case Number:** T 1247/14 - 3.4.02

**Application Number:** 09745690.9

**Publication Number:** 2286210

**IPC:** G01N27/404

**Language of the proceedings:** EN

**Title of invention:**

ELECTROCHEMICAL SENSOR WITH DIFFUSION LABYRINTH

**Patent Proprietor:**

MSA Deutschland GmbH

**Opponent:**

Life Safety Germany GmbH

**Headword:**

**Relevant legal provisions:**

EPC Art. 54(1), 56, 83, 84, 99(1), 123(2)  
RPBA Art. 12(4), 13(1)

**Keyword:**

Novelty - main request (no) - broad claim  
Inventive step - auxiliary request (yes)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
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Case Number: T 1247/14 - 3.4.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.02**  
**of 24 January 2019**

**Appellant:** Life Safety Germany GmbH  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
28 March 2014 concerning maintenance of the  
European Patent No. 2286210 in amended form.**

**Composition of the Board:**

**Chairman** R. Bekkering  
**Members:** A. Hornung  
T. Karamanli

## **Summary of Facts and Submissions**

- I. The opponent appealed against the interlocutory decision of the opposition division maintaining European patent No. 2286210 in amended form.

Opposition had been filed against the patent as a whole and based on the grounds for opposition under Article 100(a) EPC, together with Articles 54(1) and 56 EPC, and under Article 100(b) EPC.

The opposition division had found that the patent as amended according to a new main request then on file and the invention to which it related met the requirements of the EPC.

- II. Oral proceedings before the board were held on 24 January 2019.

During oral proceedings, the matter was discussed with the parties. In particular, the patentee withdrew all its auxiliary requests then on file and filed a new sole auxiliary request during oral proceedings. The parties confirmed their final requests as follows:

- III. The opponent (appellant) requested that the decision under appeal be set aside and that the patent be revoked.

- IV. The patentee (respondent) requested that the appeal be dismissed (main request) or, in the alternative, that the decision under appeal be set aside and that the patent be maintained as amended in the following version:

Claims: Nos. 1 to 10 according to the sole auxiliary request filed at the oral proceedings of 24 January 2019.

Description: Pages 2 to 7 filed at the oral proceedings of 24 January 2019.

Drawings: Figs. 1 to 6 as granted.

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

"An electrochemical sensor (1), comprising a housing (11) with a chamber containing an electrolyte (9), at least one measuring electrode (2a) for analyte detection, at least one counter electrode (2b) and at least one reference electrode (7), as well as an opening which controls mass flow (4) to the measuring electrode (2a),

characterised in that

the sensor (1) has a two-part diffusion barrier, wherein a first part (12) of the barrier forms a labyrinth with a second part (6) of the barrier disposed between the measuring and the counter electrode (2a, 2b), and wherein the first part of the diffusion barrier (12) carries a membrane (15) with the measuring and counter electrode (2a, 2b) on one level."

Independent claim 1 according to the auxiliary request reads as follows:

"An electrochemical oxygen sensor (1), comprising a housing (11) with a chamber containing an electrolyte (9), at least one measuring electrode (2a) for analyte detection, at least one counter electrode (2b) and at least one reference electrode (7), as well as an opening which controls mass flow (4) to the measuring electrode (2a),

the sensor (1) has a two-part diffusion barrier, wherein a first part (12) of the barrier forms a labyrinth with a second part (6) of the barrier disposed between the measuring and the counter electrode (2a, 2b), and wherein the first part of the diffusion barrier (12) carries a membrane (15) with the measuring and counter electrode (2a, 2b) on one level, the measuring and counter electrode (2a, 2b) being located on the membrane (15), the membrane (15) being gas-permeable."

VI. The following documents will be referred to in the present decision:

D3: WO 2007/115801 A1

D5: US 6,358,384 B1

D6: US 5,932,079

D7: US 5,723,036.

## **Reasons for the Decision**

1. Main request - Novelty

The subject-matter of claim 1 is anticipated by the disclosure of document D3 (Article 54 (1) and (2) EPC).

1.1 D3, with reference to figure 1, discloses an electrochemical sensor comprising all the features of the preamble of claim 1, i.e. a housing (12) with a chamber containing an electrolyte, a measuring electrode (6), a counter electrode (5), a reference electrode (9) and an opening (2) for controlling mass flow to the measuring electrode (see page 5, lines 11 to 19). This was not disputed by the patentee.

Moreover, D3 discloses a sensor which has a two-part diffusion barrier (8, 11), wherein a first part (11) of the barrier forms a labyrinth with a second part (8) of the barrier disposed between the measuring and the counter electrode (6, 5),

*[see figure 1 of D3 showing an isolating device (11), interposed between the measuring electrode (6) and the counter electrode (5) and having a shape which, in combination with the electrolyte-soaked separator (8), forms a two-part diffusion barrier with turnarounds, i.e. a labyrinth as claimed, wherein the isolating device (11) and the electrolyte-soaked separator (8) correspond to the first and second part of the diffusion barrier, respectively].*

Furthermore, the first part (11) of the diffusion barrier carries a membrane (13)

*[see D3, claims 3 and 4, page 7, lines 8 to 11 and 31 to 33, figure 1, disclosing an oxygen permeable membrane (13) disposed on the isolating device (11) for sealing an aperture (2, 3)]*

with the measuring and counter electrode on one level

*[see D3, page 10, lines 20 to 22, disclosing that the two electrodes are on the same plane].*

For the assessment of novelty of the claimed subject-matter, it is irrelevant on which concrete part of the sensor the electrodes are disposed, since the wording of claim 1 leaves open this aspect.

It follows that document D3 discloses all the features of claim 1.

## 1.2 Counter-arguments of the patentee

1.2.1 The patentee expressed the opinion that claim 1 defined a membrane (15) on which both the measuring and counter electrode were disposed.

It acknowledged, as suggested by the opponent, that the corresponding feature of claim 1 "the first part of the diffusion barrier (12) carries a membrane (15) with the measuring and counter electrode (2a, 2b) on one level" might be considered to be ambiguous as to whether both electrodes were carried by a membrane or not. In such a case, the skilled person would look in the description of the patent for clarification.

In paragraphs [0005] and [0006] of the patent, the disadvantages of the conventional electro-chemical sensor of D3 were described: since the two electrodes could not be combined in a single component, a large number of components was required; the need for several components increased the probability of manufacturing errors and complicated the structure. As explained in [0007] of the patent, the present invention overcame these disadvantages since less components were required, making the design simpler, the operation more reliable and robust, while maintaining a small and compact sensor.

Furthermore, the patentee referred to paragraphs [0010], [0013] and [0019] disclosing, respectively, the wordings "carries a membrane (15) with the measuring electrode (2a) and counter electrode (2b) on one level", "the ME [*measuring electrode*] and CE [*counter electrode*] being formed on one membrane" and "the membrane (15) on which the measuring and counter electrode (2a, 2b) are located".

From these passages of the patent description, the skilled person learned that the measuring electrode and the counter electrode were effectively carried by one



membrane, thereby forming a unit. A broader interpretation of the wording of claim 1, allowing for the electrodes being disposed on two distinct membranes or anywhere else, was not compatible with the actual claim wording.

Contrary thereto, in D3, it was not possible that the electrodes be carried by one membrane forming a unit because in D3 the isolating device (11) separated the electrodes (see D3, page 9, lines 6 to 12). Nowhere in D3 was disclosed a membrane carrying an electrode.

- 1.2.2 Nothing in the patent contradicted the interpretation of the claim wording according to which both electrodes were carried on one membrane. In particular, contrary to what the opponent argued, figure 1 of the patent was only a schematic drawing and did not exclude that the membrane (15), shown in figure 1, was a single membrane.
- 1.2.3 D3, page 10, lines 20 to 23, did not unambiguously disclose that the two electrodes were necessarily on the same plane because D3 disclosed that the measuring electrode and the counter electrode "may be slightly offset with regard to one another".
- 1.2.4 Even if it might be considered that D3 disclosed a labyrinth in general, D3 did not disclose a second part of a diffusion barrier contributing to the formation of the labyrinth. Indeed, the electrolyte-soaked separator (8) fulfilled a completely different function in the electrochemical sensor of D3. Identifying the electrolyte-soaked separator (8) of D3 as being the second part of the labyrinth was based on hindsight.
- 1.2.5 In conclusion, even under the assumption that the wording of claim 1 was ambiguous as to whether both electrodes were carried by a single membrane or not, the skilled

person would clearly deduce from the patent as a whole that both the measuring and counter electrodes were disposed on a single membrane, as opposed to the electrodes of D3.

1.3 The board is not convinced by the patentee's counter-arguments.

1.3.1 The subject-matter of the invention is defined by the actual features of claim 1, *inter alia* by the feature "... carries a membrane with the measuring and counter electrode on one level". This feature of claim 1 is not unclear as such. It has to be interpreted, namely, as broadly as reasonable. According to a reasonable interpretation of the claim wording, the feature under debate defines a membrane and two electrodes on one level. That, in addition, both electrodes are necessarily disposed on the same, single membrane cannot be deduced from the wording of claim 1.

The patentee's referral to various paragraphs of the patent description, which allegedly disclosed that the two electrodes were disposed on the same, single membrane, is not relevant in the present case. In particular, the statements in the description of the patent in paragraph [0013], i.e. "the ME and CE being formed on one membrane", and in paragraph [0019], i.e. "the membrane (15) on which the measuring and counter electrode (2a, 2b) are located", cannot limit the scope of claim 1. A limitation of the claimed subject-matter going beyond the actual wording of the claim, e.g. on the basis of explanations in the description of the patent, the claim wording being clear as such, is not allowable.

1.3.2 The fact that a narrower interpretation of the feature under debate is not excluded by the patent description is

not relevant as long as a broader interpretation is reasonable.

1.3.3 D3, page 10, lines 20 to 22, discloses unambiguously a preferred embodiment wherein "the measuring electrode and the counter electrode are disposed on the same plane". It does not matter whether D3 discloses a further embodiment wherein the two electrodes "may be slightly offset with regard to one another".

1.3.4 The board shares the view of the opponent that it does not matter whether the electrolyte-soaked separator (8) of D3 is explicitly identified in D3 as a second part of a diffusion barrier forming a labyrinth. A labyrinth in an electro-chemical sensor is a path with turnarounds where gas diffuses or flows. Such a path is effectively provided in D3 due to the electrolyte-soaked separator (8).

1.3.5 The scope of a claim, the wording of which is broad but clear as such, is not limited by features which are only disclosed in the description.

## 2. Auxiliary request

2.1 The auxiliary request was filed towards the end of the oral proceedings before the board. It replaced all auxiliary requests then on file.

2.2 Claim 1 of the auxiliary request differs from claim 1 of the main request in that the electrochemical sensor is an electrochemical oxygen sensor and in that the following feature has been added at the end of the claim: "the measuring and counter electrode being located on the membrane, the membrane being gas-permeable".

## 2.3 Admissibility

The Board, exercising its discretion under Article 13(1) RPBA, decided to admit the auxiliary request into the appeal proceedings for the following reasons:

- 2.3.1 The amendment of claim 1 concerning the membrane overcomes the novelty objection at issue. Indeed, D3 does not disclose a membrane on which the measuring and counter electrode are located.
- 2.3.2 One of the well-established criteria for assessing the admittance of late-filed claims during appeal proceedings is whether the amendments are *prima facie* clearly allowable (see, for instance, the decisions cited in the Case Law of the Boards of Appeal, 8th edition 2016, IV.E.4.4.2). The present amendment fulfils this criterion since it appears that amended claim 1 fulfils the requirements of Article 123(2) EPC (see page 8, third paragraph of the application as originally filed), Article 84 EPC (the opponent raised no clarity objection) and Article 54(1) EPC. Moreover, it constitutes a promising attempt to define subject-matter involving an inventive step (Article 56 EPC).
- 2.3.3 While the amended feature of claim 1 is taken from the description and not from the granted claims, the board, nevertheless, considers that the amendment concerning the membrane is neither complex nor surprising. The amended wording of claim 1 merely clarifies that the meaning of the feature concerning the membrane is the one which the patentee and the opposition division (see point 4 of the appealed decision) considered to be inherent to the wording of claim 1 of the main request underlying the appealed decision.
- 2.3.4 The opponent argued that the issue about the ambiguity of the feature relating to the membrane was not new, but was

discussed already during the first-instance proceedings, and that the patentee should not have waited for the board of appeal to confirm the ambiguity of the feature before filing an amendment for overcoming the ambiguity.

Moreover, by taking the amendment from the description, and not from dependent claims, and by filing the amended claim only during the oral proceedings, the opponent had no possibility to search for prior art relating to the amended feature.

The opponent further raised doubts concerning the compliance of the amendment with the requirements of Article 123(2) EPC. In particular, it was not apparent from the application as originally filed that the preferred embodiment described on page 8, third paragraph, and whose features have been added to claim 1, was compatible with the dependent claims of the patent, whose features were described as belonging to other preferred embodiments.

Finally, with the membrane being gas-permeable, a completely new aspect had been introduced into claim 1 which needed discussion. Remittal to the first-instance should, therefore, be considered.

2.3.5 The board is not convinced by the opponent's counter-arguments presented during the oral proceedings.

The amendment of claim 1 merely clarifies what the patentee already asserted during the first-instance proceedings, i.e. that the same membrane carried both the measuring and the counter electrodes. Therefore, such a clarification in claim 1 cannot come as a surprise to the opponent. In particular, this aspect appears to have been searched by the opponent, since it filed documents D5 to

D7 during the first-instance proceedings for showing that membranes carrying a plurality of electrodes were known in the art.

The board sees *prima facie* no reason why the features of the preferred embodiment described on page 8, third paragraph, of the application as originally filed, should not be compatible with the features of the dependent claims of the patent. Except from showing that the features of certain dependent claims of the patent corresponded to certain preferred embodiments in the description of the patent, the opponent did not present further arguments why the requirement of Article 123(2) EPC was infringed. This fact alone, however, does not represent evidence that the features of the various embodiments could not be combined.

The board sees no reason why the feature of the membrane being gas-permeable should justify a remittal to the first-instance. The opponent did also not present concrete reasons for remitting the case.

While the board acknowledges that the patentee should preferably have filed amendments for dealing with the opponent's objections at the beginning of the appeal proceedings, the board, nevertheless, in view of the fact that there is no substantial extension of the discussion as compared to the discussion already held in connection with the main request about whether electrodes provided on a membrane were disclosed in D3, that the amendments overcome the novelty objection and that *prima facie* the requirements of Articles 84 and 123(2) EPC seem to be fulfilled, decided to admit the auxiliary request into the proceedings.

#### 2.4 Amendments

2.4.1 The patent as amended according to the auxiliary request fulfils the requirements of Article 123(2) EPC. In particular, the amendments of present claim 1 are based on page 6, second paragraph, first sentence, and on page 8, third paragraph, of the application as originally filed.

2.4.2 The opponent acknowledged that present claim 1 contained no subject-matter which extended beyond the content of the application as filed. However, it contended that the dependent claims were infringing the requirements of Article 123(2) EPC because a membrane being gas-permeable, as now defined in claim 1, was not disclosed in combination with the features of the dependent claims. In particular, dependent claims 6 to 10 of the auxiliary request corresponded to various embodiments of the sensor, described on page 7, second to fifth paragraph, of the application as filed. There was no unambiguous disclosure in the application as originally filed of an embodiment comprising both the feature of a membrane being gas-permeable and one of the features of dependent claims 6 to 10. Such an embodiment, however, was now defined by the combination of the features of claim 1 and one of claims 6 to 10, contrary to the requirements of Article 123(2) EPC.

In view of the general character of gas-permeability for a membrane in an electrochemical oxygen sensor as disclosed in the present patent application, the board, however, shares the patentee's view that the skilled person would understand that gas-permeability is a trait common to all embodiments of the patent.

2.5 Clarity

The opponent raised no objection of lack of clarity. The board does also not see any reason for objecting to the clarity of the amendments of the claims (Article 84 EPC).

## 2.6 Sufficiency of disclosure

The opponent raised no objection of lack of sufficiency of disclosure. The board does also not see any reason for objecting to the sufficiency of disclosure of the invention (Article 83 EPC).

## 2.7 Novelty

The opponent raised no objection of lack of novelty. The board does also not see any reason for objecting to the novelty of the subject-matter of claim 1 (Article 54(1) EPC). Indeed, D3 does not disclose an electrochemical oxygen sensor comprising a membrane, the measuring and the counter electrodes being located on the membrane.

## 2.8 Inventive step

The subject-matter of claim 1 involves an inventive step in view of the disclosure of the available prior art, in particular, document D3 and any of documents D5 to D7 (Article 56 EPC).

### 2.8.1 Documents D5 to D7

In its statement of grounds of appeal, the opponent raised an objection of lack of an inventive step in view of document D3 and any of documents D5 to D7.

Documents D5 to D7 were filed by the opponent during the first-instance opposition proceedings, after the nine-month period stipulated in Article 99(1) EPC. The



opposition decided not to admit documents D5 to D7 into the opposition proceedings.

The board, however, exercising its discretion under Article 12(4) RPBA, decided to admit documents D5 to D7 into the appeal proceedings, since the subject of the proceedings had changed.

In particular, present claim 1 has been amended during oral proceedings before the board so as to specify that the measuring and counter electrode are located on a membrane. The amended feature has been taken from the description and not from the granted claims, which justifies the fact that D5 to D7 have not been filed during the nine-month opposition period. Moreover, the patentee, in the absence of D5 to D7, denied that printing electrodes on a membrane was widely practiced in the art before the priority date of the patent.

2.8.2 The opponent submitted that the subject-matter of claim 1 lacked an inventive step (Article 56 EPC) essentially for the following reasons:

- The subject-matter of claim 1 differed from the sensor of D3 only in that the measuring and counter electrodes were located on the membrane.
- The technical effect of the distinguishing feature was that the number of parts of the electrochemical oxygen sensor was reduced with respect to the situation where the electrodes were located on two distinct carriers.
- Starting from D3 as closest prior art, it would be obvious for the skilled person, either on the basis of common general knowledge or on the basis of the disclosure of any of the documents D5 to D7, to solve

the objective technical problem of reducing the number of parts of the sensor of D3 by printing the two electrodes on a single membrane. Printing electrodes on a membrane was widely practiced in the art, as evidenced by D5 to D7.

- No other technical effect than reducing the number of parts of the sensor was linked to the distinguishing feature of claim 1. This technical effect was not surprising and provided no special technical advantage which justified an inventive step of the claimed sensor.
  
- The patentee contended that disposing the measuring and counter electrode on a single membrane, thereby forming an integral unit, provided the additional technical effect of simplifying the mounting of the two electrodes into the sensor, as compared to the situation of D3 where the two electrodes and the membrane were mounted separately. The opponent denied the presence of this additional technical effect. In view of the membrane of claim 1 being disposed on a barrier forming a labyrinth and of the fact that claim 1 did not comprise any feature which guaranteed that the assembling would be easier with a membrane carrying both electrodes, no ease of manufacturing was related to the distinguishing feature.
  
- The patentee's counter-argument that the skilled person, starting from the sensor of D3, would refrain from providing a single membrane on which the measuring and counter electrode were disposed due to the complex shape of the isolating device (11) separating the two electrodes, was not valid. For instance, the skilled person would obviously consider

providing a non-flat membrane in D3 which followed the shape of the isolating device (11).

- The opponent specifically referred to D5 and submitted that the distinguishing feature of claim 1 did not involve an inventive step in view of D3, in combination with D5, figure 1, column 3, lines 14 to 21, disclosing three electrodes (26, 28, 30) disposed on a single gas-permeable substrate (24).

2.8.3 The board shares the view of the patentee that the opponent's arguments concerning lack of inventive step are not convincing for the following reasons:

- Many options exist to solve the problem identified by the opponent of reducing the number of parts of the sensor of D3. There is no obvious reason for the skilled person to reduce primarily the number of membranes used in the sensor of D3. For instance, looking at figure 1 of D3, the skilled person could rather reduce the number of electrolyte-soaked separators.
- In D3, the existing membranes (13) are used as seals for sealing apertures (2, 3) and not as carriers for electrodes. Disposing the measuring and counter electrodes on a single membrane would imply the provision of an additional membrane, which does not solve the objective technical problem, as proposed by the opponent, of reducing the number of parts, on the contrary. Therefore, the skilled person would have no reason to provide an additional membrane carrying the two electrodes.
- Providing, in the sensor of D3, a single membrane with the two electrodes disposed on it, might admittedly be

technically feasible but is complex due to the tortuous mechanical structure of the isolating device interposed between the two electrodes. Therefore, the skilled person would be reluctant to foresee such a complex membrane without a strong incentive based e.g. on a significant technical improvement arising from a single membrane carrying both electrodes. The opponent did not present convincingly such technical improvements related to the single membrane carrying the electrodes.

- The overall technical configuration of the sensor of D3, on the one hand, and of the sensors of D5 to D7, on the other hand, is substantially different. Therefore, there is no obvious reason for applying the teaching of any of the documents D5 to D7 to D3.

In conclusion, the board cannot see any obvious reason, even in the light of the common general knowledge or of documents D5 to D7, to modify the sensor of D3 so as to arrive at the subject-matter of claim 1.

2.8.4 In view of the above considerations, the board comes to the conclusion that the sensor of claim 1 involves an inventive step over the available prior art.

3. For the above reasons the board is satisfied that the patent as amended according to the present auxiliary request and the invention to which it relates, meets the requirements of the EPC.

## **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 maintain the patent as amended in the following version:

Claims: Nos. 1 to 10 according to the sole auxiliary request

filed at the oral proceedings of 24 January 2019.

Description: Pages 2 to 7 filed at the oral proceedings of 24 January 2019.

Drawings: Figs. 1 to 6 as granted.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated