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**D E C I S I O N**  
**of 17 September 2003**

**Case Number:** T 1023/00 - 3.4.3

**Application Number:** 96925244.4

**Publication Number:** 0914668

**IPC:** H01J 37/00

**Language of the proceedings:** EN

**Title of invention:**

Method and apparatus for producing and using plasma

**Applicant:**

Jouanneau, André

**Opponent:**

-

**Headword:**

Stable plasma/JOUANNEAU

**Relevant legal provisions:**

EPC Art. 83, 84, 54

**Keyword:**

"Clarity (no) - functional feature directed to the creation of a state of matter whose very existence is in doubt and for which there is no established technique of detection"  
"Sufficiency of disclosure (no)"

**Decisions cited:**

T 0541/96, T 0068/85, T 0418/89, T 0107/00

**Catchword:**

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Case Number: T 1023/00 - 3.4.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.3  
of 17 September 2003

**Appellant:** Jouanneau, André  
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**Representative:** Findlay, Alice Rosemary  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 18 May 2000  
refusing European application No. 96925244.4  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** R. K. Shukla  
**Members:** G. L. Eliasson  
J. P. B. Seitz

## Summary of Facts and Submissions

- I. European patent application No. 96 925 244.4 was refused in a decision of the examining division dated 18 May 2000. The ground for the refusal was that the application did not meet the requirements of Articles 83 and 84 EPC.
- II. The appellant (applicant) lodged an appeal on 19 July 2000, paying the appeal fee the same day. A statement of the grounds of appeal was filed on 27 September 2000 together with claims according to a main request and an auxiliary request, respectively.
- III. In a communication under Article 11(2) of the RPBA accompanying summons for oral proceedings, the Board informed the appellant of its provisional opinion that the application did not appear to meet the requirements of Articles 83, 84, 52(1) and 54 EPC. The Board referred to the following documents:
- D1: Zeitschrift für Elektrochemie, Vol. 57, No. 6, 1953, pages 399 to 405;
- D2: Journal of the Electrochemical Society, Vol. 102, No. 8, 1955, pages 485 to 489;
- D3: Nature, Vol. 342, 23 November 1989, pages 375 to 384; and
- D4: Nature, Vol. 340, 17 August 1989, pages 525 to 530.

Documents D1 and D2 are cited in the application in suit and documents D3 and D4 were cited in the International Search Report.

- IV. With a letter dated 16 September 2003, the appellant informed the Board that he would not attend the oral proceedings scheduled for 17 September 2003.
- V. Oral proceedings were held on 17 September 2003 in the absence of the appellant.

The appellant requested in writing that the decision under appeal be set aside and a patent be granted on the basis of one of the following requests:

**Main request:**

Claims 1 to 38 according to the main request filed on 27 September 2000 with the statement of the grounds of appeal;

**Auxiliary request:**

Claims 1 to 16 according to the auxiliary request filed on 27 September 2000 with the statement of the grounds of appeal.

- VI. The independent claims 1 and 2 according to the main request have the same wording as claims 1 and 2 which formed the basis of the decision under appeal and read as follows:

"1. The method of creating and using a stable plasma inside a solid, comprising: providing a solid with a lattice of such nature that it will allow the creation of stable plasma inside, causing

particles to enter the lattice and become a stable plasma inside, and using the plasma."

- "2. Apparatus for creating and using a stable plasma inside a solid, including: providing a solid material with a lattice of such nature that it will allow the creation of stable plasma inside, means for moving particles into said lattice and causing said particles to become a stable plasma inside, and means to use the plasma."

VII. The independent claims 1 and 9 according to the auxiliary request read as follows:

- "1. A method of creating and using stable plasma inside a solid, comprising: providing cathode of a solid material with a lattice of such nature that it will allow the creation of stable plasma inside, the solid material being or including at least one metal with an affinity for hydrogen and the lattice including elementary cells with a free available volume of between  $3.75 \text{ \AA}^3$  and  $4.5 \text{ \AA}^3$ , providing a source of particles with a pH of less than 0.4, causing the particles to enter the lattice and become a stable plasma inside by energising the cathode at a voltage such that the current density is greater than  $0.1 \text{ A/cm}^3$ , and using the plasma."

- "9. Apparatus for creating and using a stable plasma inside a solid, including a cathode of solid material with a lattice of such nature that it will allow the creation of stable plasma inside, the solid material being or including at least one

metal with an affinity for hydrogen and the lattice including elementary cells with a free available volume of between  $3.75 \text{ \AA}^3$  and  $4.5 \text{ \AA}^3$ , a source of the particles with a pH of less than 0.4, means for moving particles into said lattice and causing said particles to become a stable plasma inside comprising means for energising the cathode at a voltage such that the current density is greater than  $0.1 \text{ A/cm}^3$ , and means for using the plasma."

VIII. In the decision under appeal, the examining division reasoned essentially as follows:

- (a) Claims 1 and 2 do not define the essential features of the invention in clear terms, since they indicate the result to be achieved instead of defining the structural features and/or actions which are essential for obtaining the result. In particular, a solid is provided whose only stated feature is that it has a lattice "of such a nature that it will allow the creation of a stable plasma inside." In the claims it is furthermore not stated which kind of plasma should be obtained in the lattice, so that the exact result to be achieved is left ambiguous. Therefore, the requirement of clarity according to Article 84 EPC is not met.

It is furthermore not clear which kind of method step or device means is referred to by the function of "causing particles to enter the lattice and become a stable plasma inside". The above feature "formation of a stable plasma" is

the feature, which according to the applicant forms the main difference between the invention and the prior art. Consequently, the skilled person does not know how to obtain this feature.

- (b) Regarding Article 83 EPC, there is no experimental evidence showing that the postulated stable plasma in the lattice of a solid is obtainable at all, and the disclosure appears to lack a description of a specific embodiment which would enable the skilled person to create and verify such a stable plasma. The applicant seems to base the existence of a plasma solely on theoretical speculations relating to the  $V$  vs.  $\log(I)$  curves shown in Figures 5a and 5b, and not on any experimental evidence relating to the plasma itself.

IX. In support of his requests, the appellant presented essentially the following arguments:

- (a) Regarding the objections under Article 84 EPC, the application in suit discloses the conditions required on the solid in order that a stable plasma may form inside the lattice. There are also several methods disclosed in the application for introducing the charged particles into the solid (electrolytes, plasma injection). Finally, several types of particles to be introduced in the lattice are disclosed. Therefore, the requirements of Article 84 EPC are met, since the claims are kept concise and the scope of the independent claims is well-defined.

- (b) The application meets the requirements of Article 83 EPC as well, since the description provides detailed information as to which solid materials would have a lattice allowing the creation of stable plasma inside, as well as disclosing several means for moving particles into the solid material and causing the particles to become a stable plasma inside. The application also discloses which types of particles would be suitable for forming stable plasma, and it discloses different means for using the plasma.
- (c) The claimed method and apparatus are new with respect to the documents cited in the search report, since in all these cases, *atomic* hydrogen is stored in palladium, whereas in the claimed invention, hydrogen in *plasma* form is stored.

### **Reasons for the Decision**

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. *Article 83 EPC:*
  - 2.1 The examining division objected to that the application in suit failed to disclose any experimental evidence showing that the postulated stable plasma in the lattice of a solid was obtainable at all, and that the disclosure appeared to lack a description of a specific embodiment which would enable the skilled person to create and verify such a stable plasma. In particular, the applicant seemed to base the existence of a plasma



solely on theoretical calculations relating to the  $V$  vs.  $\log(I)$  curves shown in Figures 5a and 5b, and not on any experimental evidence relating to the plasma itself (cf. item VIII(b) above).

The appellant referred to the detailed description giving ample examples of metals which would be suitable for formation of a stable plasma, and the different manners how particles can be made to enter the metals and form a stable plasma within the metals (cf. IX(b) above).

- 2.2 As already mentioned in the communication accompanying the summons for oral proceedings, the Board agrees with the examining division that the alleged formation of a plasma inside the palladium electrode is based on the conjecture that such a plasma is formed when the coefficient  $b$  is equal to zero in the Tafel equation

$$V = a - b \log(I)$$

(in the following referred to as 'the "b=0" state'). This condition is shown to take place when a palladium electrode is placed in an electrolyte having pH of about 0.40 or less (cf. application, page 6, lines 33 to 35; page 10, lines 1 to 34; Figure 5a). The embodiments of Figures 8 and 9, on the other hand, use techniques of immersing a palladium electrode in hydrogen plasma or hydrogen gas, for which the application does not offer any theory predicting the formation of a plasma inside the electrode.

- 2.3 It is acknowledged in the application in suit that the "b = 0" state for a palladium electrode in an electrolyte was also disclosed in documents D1 and D2 (cf. application in suit, page 9, line 22 to page 10, line 6; D1, Section "Grenzwert der Diffusionsüberspannung" on pages 403 to 404; D2, page 486 "Results", Figures 2a and 2b, page 488, right hand column, last paragraph to page 489). In contrast to the theory of plasma formation developed in the application in suit, both the documents D1 and D2 attribute this phenomenon to the formation of a super-saturated state of hydrogen in palladium, i.e. an explanation which does not entail the formation of a plasma inside the palladium electrode (cf. D1, page 404, right hand column; D2, page 48, right hand column to page 489).
- 2.4 The alleged formation of a plasma inside a palladium electrode remains a highly controversial topic in the scientific community, as exemplified by the documents D3 and D4, which both are published in Nature, a peer-reviewed scientific journal. Both the documents D3 and D4 present negative results on the search for nuclear fusion in palladium, a phenomenon which presupposes the existence of a hydrogen (deuterium) plasma inside palladium.
- 2.5 Thus, in the present case, the theory of plasma formation inside a palladium electrode forming the basis of the claimed invention is not only in contradiction with the theories presented in documents D1 and D2 for explaining the same phenomenon, but is also in contradiction with the findings in numerous other scientific publications, such as documents D3 and

D4, which all report the failure to observe any indication that a high-density hydrogen (deuterium) plasma could be formed inside a palladium electrode.

- 2.6 In the decision T 541/96 it was held that if an invention seems, at least at first, to offend against the generally accepted laws of physics and established theories, the disclosure should be detailed enough to provide to a skilled person conversant with mainstream science and technology that the invention is indeed feasible (cf. reasons, items 6.1 and 6.2).
- 2.7 Thus, under the present circumstances where the present invention is in apparent contradiction with established theories, it is not sufficient for meeting the requirements of Article 83 EPC merely to present a theory which shows the possibility of forming a plasma inside a solid without providing experimental evidence that (i) such a plasma is actually produced; and (ii) the plasma can be produced using the means disclosed in the application in suit.
- 2.8 Furthermore, the Board also notes that the application in suit fails to provide any experimental evidence that the plasma allegedly produced in the solid could be put successfully into the different uses envisaged in the application in suit, such as rocket propellant, source of very high current, nuclear fusion, or transmutation of elements. As mentioned above, a large number of scientific articles, such as documents D3 and D4, show that until to date, nuclear fusion in the manner envisaged in the application in suit has not been observed despite considerable effort spent on these

endeavours. The same applies to the alleged transmutation of elements inside palladium.

Therefore, the onus is also here on the appellant to show that the different uses disclosed in the application in suit are not merely speculative but feasible. The appellant has however failed to provide any evidence supporting the alleged feasibility.

2.9 Therefore, in the Board's judgement, the application in suit does not meet the requirements of Article 83 EPC.

3. *Article 84 EPC:*

3.1 In the decision under appeal, the examining division held that the independent claims fail to define the essential features of the invention in clear terms, since they indicate the result to be achieved instead of defining the structural features and/or actions which are essential for obtaining the result (cf. item VIII(a) above).

The appellant argued that the independent claims 1 and 2 according to the main request are drafted in functional terms while still providing a clear definition of the invention over the prior art (cf. item IX(a) above).

3.1.1 The Board agrees with the appellant that it is permissible to define technical features in a claim in functional terms, i.e. in terms of a technical result to be achieved, if such features provide sufficient clear instructions to reduce them to practice (see, e.g. T 68/85, OJ EPO 1987, 228; T 418/89, OJ EPO 1993, 20;

T 107/00 unpublished). In the present case, in the method of claim 1 according to the main request the lattice is of such nature that "it will allow the creation of stable plasma inside" and a process step is provided for "causing said particles to become a stable plasma inside" the lattice. In the apparatus according to claim 2 according to the main request, also the lattice is defined as in claim 1 and the apparatus includes means for "causing said particles to become a stable plasma".

3.1.2 As mentioned above when discussing the requirements of Article 83 EPC, the concept of a "stable plasma" inside a solid does not have a well-recognized meaning; in fact it is highly questionable whether such a plasma exists at all, taking into account that the appellant's theory predicting the formation of a "stable plasma" inside a solid is in disagreement with other scientific findings as exemplified by documents D1 to D4 (cf. in particular items 2.2 and 2.3 above). Furthermore, the application in suit does not provide any teaching as regards the detection of the "stable plasma", nor is such a technique common general knowledge in the art. Consequently, it is not possible to establish whether or not a given process or apparatus has created a "stable plasma" in a solid.

3.1.3 Therefore, any functional feature directed to the creation of a "stable plasma", such as the above-mentioned features in claims 1 and 2 according to the main request, cannot be clear, since it not only refers to the creation of a state of matter whose very existence is in doubt, but also there does not exist any established technique for detecting the state of

matter to be created. Consequently such functional features must fail to meet the above-stated criterion established in the case law of the boards of appeal of providing sufficient clear instructions to reduce them to practice (cf. item 3.1.1 above).

Thus, independent claims 1 and 2 according to the main request are not clear, contrary to the requirements of Article 84 EPC.

- 3.2 Independent claims 1 and 9 according to the auxiliary request specify the conditions for attaining the "b = 0" state, referred to under item 2.2 above, for an electrode in an electrolyte as means for causing particles to enter the lattice and become a stable plasma inside the lattice. The "b = 0" state is, according to application in suit, an indication of the creation of a stable plasma inside the electrode.

As discussed above, the appellant's theory explaining the "b = 0" state in terms of the formation of a stable plasma inside the electrode is in contradiction with other scientific works, as exemplified by documents D1 to D4 (cf. item 2.5 above). Therefore, it is not clear that a "stable plasma" inside a solid is indeed created, even if one has succeeded in obtaining the "b = 0" state, and since there is no known technique for detecting the alleged "stable plasma", there is no known way to establish whether the "stable plasma" was successfully formed or not.

The independent claims 1 and 9 according to the auxiliary request are therefore not clear, contrary to the requirements of Article 84 EPC.

- 3.3 The terms "using said plasma" and "means to use said plasma" in claims 1 and 2 according to the main request and in claims 1 and 9 according to the auxiliary request are so vague that they do not have any limiting effect at all on the scope of the claims. The claims are therefore not clear, contrary to the requirements of Article 84 EPC.
- 3.4 Therefore, in the Board's judgement, claims 1 and 2 according to the main request and claims 1 and 9 according to the auxiliary request do not meet the requirements of Article 84 EPC.
4. The Board also draws attention to the fact that *if* the applicant were successful in showing that a plasma could indeed be produced inside the palladium electrode when the overvoltage  $V$  is independent of the current in Figure 5a (the "b=0" state), *then* such a plasma must also have been produced in the experiments disclosed in documents D1 and D2, since the experimental conditions disclosed in the application in suit are the same as those disclosed in documents D1 and D2 (cf. D1, Section "Grenzwert der Diffusionsüberspannung" on pages 403 to 404; D2, page 486 "Results", Figures 2a and 2b, page 488, right hand column, last paragraph to page 489). In such a case, the subject matter of claim 1 according to both requests would not be new within the meaning of Article 54(1) and (2) EPC having regard to any of documents D1 and D2.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

P. Martorana

R. K. Shukla