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**D E C I S I O N**  
**of 30 September 2002**

**Case Number:** T 0410/01 - 3.2.3

**Application Number:** 97946465.8

**International Publication  
Number:** WO 98/19811

**IPC:** B22F 1/00, H01G 9/042, H01G 9/052

**Language of the proceedings:** EN

**Title of invention:**  
Niobium powders and Niobium electrolytic capacitors

**Applicant:**  
Cabot Corporation

**Opponent:**  
-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step - (yes) after amendment"

**Decisions cited:**  
-

**Catchword:**  
-



**Case Number:** T 0410/01 - 3.2.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.2.3**  
**of 30 September 2002**

**Appellant:** Cabot Coporation  
2 Seaport Lane - Suite 1300  
Boston  
Massachusetts 02210-2019 (US)

**Representative:** Goldbach, Klara, Dr.  
Grünecker, Kinkeldey,  
Stockmair & Schwanhäusser  
Anwaltssozietät  
Maximilianstrasse 58  
D-80538 München (DE)

**Decision under appeal:** Decision of the Examining Division 2.3.09.015 of  
the European Patent Office dated 17 October 2000,  
posted on 3 November 2000, refusing European  
patent application No. 97 946 465.8 pursuant to  
Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** C. T. Wilson  
**Members:** F. Brösamle  
J.-P. Seitz

## Summary of Facts and Submissions

I. With decision of 3 November 2000 the examining division refused European patent application No. 97 946 465.8 in the light of

(D1) US-A-5 448 447

(D2) US-A-4 954 169

(D3) Electrocomponent Science and Technology,  
1(1974)1, pages 27 to 37, and

(D4) US-A-5 605 561 not being prepublished  
corresponding, however, to prepublished

(D4-DE) DE-A-19 536 013

for reasons of lack of inventive step.

II. Against the above decision of the examining division the applicant - appellant in the following - filed an appeal on 9 January 2001 paying the fee on the same day and filing the statement of grounds of appeal on 13 March 2001 together with new claims.

III. Following the Communication pursuant to Article 11(2) RPBA in which the board expressed its provisional opinion of the case with respect to inventive step oral proceedings were held on 16 July 2002 in which the appellant submitted new claims 1 to 33 according to his **main request**.

IV. The independent claims thereof read as follows (obvious error in claim 8 amended by replacing "current" by

"voltage"):

- "1. A capacitor anode obtainable from a niobium powder having a BET surface area of at least 0.5 m<sup>2</sup>/g, the capacitor anode having a DC leakage of less than 5.0 nA/CV."
- "2. A capacitor anode obtainable from a niobium powder having a BET surface area of at least 0.5 m<sup>2</sup>/g, the capacitor anode having a DC leakage of from 5.0 nA/CV to 0.50 nA/CV."
- "8. A method of forming a capacitor anode comprising the steps of sintering a niobium powder having a BET surface area of at least 0.5 m<sup>2</sup>/g and then anodizing the anode at a voltage of less than 60 volts."
- "31. Use of a niobium powder having a BET surface area of at least 0.5 m<sup>2</sup>/g for the production of a capacitor anode having a DC-leakage of less than 5.0 nA/CV."
- "32. Use of a niobium powder having a BET surface area of at least 0.5 m<sup>2</sup>/g for the production of a capacitor anode having a DC-leakage of 5.0 nA/CV to 0.50 nA/CV."

V. In the oral proceedings the appellant essentially argued as follows:

- (D1) is seen as the closest prior art disclosing a process for producing capacitor anodes on the basis of metal powder selected from Group VB of the Periodic Table, namely tantalum and niobium,

by sintering and anodizing the powder with 100 V or more; on the basis of tantalum powder having a BET surface area of 0,6 m<sup>2</sup>/g according to Table 2 of (D1) high values with respect to capacitance and DC leakage are achieved;

- (D2) primarily addresses tantalum, however, using voltages of 70 V according to its small table on column 7 and BET - values outside those that are claimed;
- starting from (D1) and (D2) the object to be solved by the invention is to replace tantalum by niobium for achieving capacitor anodes;
- the solution of this object is based on a niobium powder with the BET and DC leakage - values laid down in claims 1 and 2, respectively;
- as could be seen from comparative tests based on tantalum and niobium, contrary to the statement on the bottom of column 1 of (D1), tantalum is not simply to be replaced by niobium in order to achieve the subject-matter of either claim 1 or claim 2 since the known technology when applied to niobium did not produce the favourable effects according to claims 1 and 2;
- even if a skilled person considered (D3) and (D4-DE) he would not have any guidance to achieve the subject-matter of claims 1/2 since (D4-DE) is restricted to tantalum and is silent about DC leakage and (D3) is contradictory to (D1/D2), namely according to page 27, right column, thereof warning a skilled person against considering

niobium;

- with respect to the test results filed on 13 March 2001 it was observed that in remark 1 "Samples", (a) should be related to niobium and (b) to tantalum; from the test results submitted on 13 March 2001 and its graph it could clearly be seen that in the range of forming voltages of 75 V niobium and tantalum react completely different with respect to DC leakage;
- the subject-matter of claim 8 (method claim) was not rendered obvious by (D1) and (D3) which disclose forming voltages which are too high and by (D4-DE) relating to tantalum powders only and being silent about DC leakage and the application of niobium instead of tantalum;
- since the niobium powder according to either claims 1 or 2 was novel and inventive the subject-matter of claims 29, 30, 31 and 32 was likewise novel and inventive, namely incorporating this powder in a capacitor or to make use of it in combination with a capacitor or an electrolytic capacitor.

VI. The appellant requests to set aside the decision under appeal and to grant a patent on the following basis:

(a) **main request**

- claims 1 to 33 filed during the oral proceedings of 16 July 2002,
- description: pages 1 to 3, 3a, 4 to 27 submitted

on 20 September 2002,

- drawings: Figures 1 to 9 according to WO-A-98/19811;
  
- (b) claims of the first to fifth auxiliary request submitted with letter dated 14 June 2002.

### **Reasons for the Decision**

1. The appeal is admissible.

#### *Main request*

2. *Amendments*

The following observations are based on the International application published under the Patent Cooperation Treaty (PCT) i.e. WO-A-98/19811.

- 2.1 Claims 1 and 2 have been restricted in the appeal proceedings, namely by a lower BET-value and by incorporating DC leakage values. Claim 1 is based on claims 22 (capacitor obtainable from a niobium powder), 14 (BET surface area) and 34 (range for the DC leakage) and claim 2 in addition to the above features is based on page 10, lines 17 to 21 of WO-A-98/19811.
  
- 2.2 Claims 3 to 7 are based on
  - claim 54 plus page 10, line 22 to page 11, line 1,
  
  - claim 55,

- page 10, lines 5/6, and
- page 10, lines 12 to 16,

of WO-A-98/19811.

- 2.3 Claim 8 is based on claim 22 plus page 10, lines 6 to 8 and 12/13, claims 9 to 11 are based on claims 23 to 25, claim 12 on claim 33 and claim 13 on claims 15/22 of WO-A-98/19811.

Claims 14/15 are based on page 8, lines 5 and 10, claims 16 to 19 on claims 16 to 19, claim 20 on page 8, line 9, and claim 21 on claim 9; claims 22 to 24 on claims 30 to 32 and claims 25 to 28 on claims 49 to 52 of WO-A-98/19811.

- 2.4 Claim 29 is based on claim 11, page 9, line 19 to page 10, line 11, and claim 30 on page 1, line 4; claims 31 and 32 are based on claims 22, 14, 34/35 and claim 33 on page 1, lines 4 to 6.

- 2.5 Under these circumstances claims 1 to 33 of the main request are not open to an objection under Article 123(2) EPC.

### 3. *Novelty*

Novelty was not disputed by the examining division and the board so that it is not necessary to deal with it in detail. The crucial issue to be decided is therefore inventive step.

### 4. *Inventive step*



Claims 1 and 2

- 4.1 In agreement with the appellant (D1) is seen by the board as the nearest prior art document. (D1) relates to the technical field of the refused patent application and discloses *inter alia* a process for producing capacitor anodes on the basis of metal powder(s) selected from Group VB of the Periodic Table, comprising for instance niobium and tantalum and being of specific interest for the production of capacitor anodes as can be seen from (D2), (D3) and (D4-DE).

The process steps disclosed in (D1) are sintering and anodizing the sintered powder with 100 V or more starting from a tantalum powder having a BET surface area of 0,6 m<sup>2</sup>/g. The known process achieves high values with respect to capacitance and DC leakage, see Table 2 on columns 10 and 11 of (D1).

- 4.2 A similar prior art is disclosed in (D2) which is mainly based on tantalum even if in its claim 9 and column 3, lines 13 to 17, niobium is addressed either to replace tantalum or to be applied together with tantalum ("and/or"). The forming voltage cited in the small table of column 7 is 70 V.

- 4.3 Starting from (D1) as the nearest prior art to be considered, the object of the present invention is to replace tantalum by niobium for achieving capacitor anodes.

- 4.4 This object is solved by the product claims 1 and 2 basically by prescribing a BET surface area of at least 0,5 m<sup>2</sup>/g and a range for the DC leakage being less than 5,0 nA/CV or 5,0 to 0,50 nA/CV according to claims 1

and 2, respectively.

The method according to the independent method claim 8 is based on a BET surface area as in claims 1 and 2 and moreover on a formation voltage in the anodizing step of less than 60 V.

Claims 31 and 32 are based on the product defined in claims 1 and 2 and relate to its use for the production of capacitor anodes.

- 4.5 It has now to be decided whether or not the claims cited in above remark 4.4 are based on an inventive step within the meaning of Article 56 EPC.
  
- 4.6 The fact that niobium is half the weight and half the price of tantalum could be seen as an incentive to consider the replacement of tantalum by niobium. A further incentive for the application of niobium instead of tantalum is derivable from the nearest prior art document, see (D1), column 3, lines 60 to 68, in which all metals contained in Group VB of the Periodic Table are addressed, particularly, however, tantalum and niobium.
  
- 4.7 Although there existed **prima facie - incentives** to apply niobium powders for the production of capacitor anodes/capacitors/electrolytic capacitors the claimed solutions of the above object of the invention are the result of an inventive step for the following reasons:
  
- 4.8 As convincingly argued by the appellant and proven by the test results a skilled person considering whether or not, and if yes how, tantalum could be replaced by niobium had no guidance from the prior art to be

considered since the technology known in combination with tantalum was not applicable to niobium, see test results and graph filed by the appellant on 13 March 2001 in which sample (a) 8171-33-C reflects niobium and sample (b) C606-C-144577 stands for tantalum as clarified by the appellant in the oral proceedings before the board.

As can be seen from this graph headed "Niobium vs. Tantalum, Forming Voltage Range" these two powders behave similarly in a voltage range of 15 to 55 V, not, however, in the voltage range between 55 and 75 V since niobium treated with these high values of the forming/anodizing voltage leads to very high values of DC leakage - in contrast to tantalum which even then has low values of DC leakage. Even if in (D1) the replacement of tantalum by niobium was considered a skilled person had to apply inventive endeavour to make the replacement work.

4.9 From the further prior art to be considered, namely (D3) and (D4-DE) a skilled person could also not derive useful hints as to how to arrive at the subject-matter of claims 1 to 2 since (D3), see its page 27, right column, is contradictory to (D1/D2) and could be interpreted as a warning against considering the use of niobium. (D3) sets out that field crystallisation and the higher sensitivity to heat treatment have to be seen as two disadvantages of niobium with respect to tantalum so that a skilled person is not encouraged to consider (D3). Even if he did, however, he would realize that niobium could only be used in combination with liquid filled capacitors which are not specifically addressed in claims 1 and 2 and that moreover the anodizing voltages, see Tables VI, VII and

VIII of (D3) are by far too high and would lead to thick, unfavourable oxide-layers.

(D4-DE) is silent about DC leakage and moreover restricted to tantalum powders.

4.10 Summarizing, the subject-matter of claims 1 and 2 is non-obvious from the prior art so that these claims are allowable, Article 56 EPC.

#### Claim 8

4.11 It is obvious that in claim 8 the word "currency" should be replaced by "voltage", see claim 12 in this respect and the Order of the Decision. Claim 8 is based on a BET surface area of at least 0,5 m<sup>2</sup>/g as in claims 1 and 2 plus the feature of the anodizing/forming voltage of less than 60 V not derivable from (D1) which is based on 100 V or more, see Tables 1 and 2 and column 2, lines 43 to 46.

This is also true for (D3) again teaching a too high voltage of 100 V, see Tables VI to VIII.

Since (D4-DE) is restricted to tantalum it can give no guidance to achieve the subject-matter of claim 8 since moreover the parameter DC leakage is not observed. In combination with tantalum (D3) teaches in its small table on page 7 a forming voltage of 70 V being above the value according to claim 8 so that there is no direct lead from the prior art to the method of claim 8 which claim is therefore also allowable, Article 56 EPC.

#### Claims 31 and 32

- 4.12 These claims comprise the features of claims 1 and 2 respectively.

Since the niobium powder according to claims 1 and 2 is novel and inventive, its use for the production of capacitors being based on this niobium powder is novel and inventive likewise so that claims 31 and 32 are also allowable under Articles 54 and 56 EPC.

#### *Auxiliary requests*

5. The main request being allowable there is no need to consider the first to fifth auxiliary request of the appellant.

#### **Order**

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

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent with the following documents:
  - claims 1 to 33 submitted in the oral proceedings of 16 July 2002, the word "currency" in claim 8 being replaced by "voltage";
  - description: pages 1 to 3, 3a, 4 to 27 submitted on 20 September 2002; on page 3, lines 7 to 9, the words "and a capacitor anode obtainable ... of from 5.0 nA/CV to 0.50 nA/CV." are deleted;
  - drawings: Figures 1 to 9 according to

WO-A-98/19811;

The Registrar:

The Chairman:

A. Counillon

C. T. Wilson