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**Datasheet for the decision  
of 17 January 2007**

**Case Number:** T 0787/04 - 3.3.02

**Application Number:** 94302541.1

**Publication Number:** 0622067

**IPC:** A61K 6/04

**Language of the proceedings:** EN

**Title of invention:**  
Titanium orthodontic appliances

**Patentee:**  
DENTSPLY INTERNATIONAL, INC.

**Opponent:**  
DENTAURUM

**Headword:**  
Orthodontic appliances formed of a beta-titanium  
alloy/DENTSPLY

**Relevant legal provisions:**  
EPC Art. 123(2), 54, 56

**Keyword:**  
"Main request: novelty (no), the prior art specific embodiment  
is encompassed by claim 1"  
"First auxiliary request: inventive step (no), the increase in  
the Mo content is obvious in the light of the closest prior  
art"  
"Second auxiliary request: added matter (yes)"

**Decisions cited:**  
G 0004/92

**Catchword:**  
-



Case Number: T 0787/04 - 3.3.02

**DECISION**  
of the Technical Board of Appeal 3.3.02  
of 17 January 2007

**Appellant:**  
(Patent Proprietor)

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**Decision under appeal:**

Decision of the Opposition Division of the  
European Patent Office posted 17 May 2004  
revoking European patent No. 0622067 pursuant  
to Article 102(1)(3) EPC.

**Composition of the Board:**

**Chairman:** U. Oswald  
**Members:** M. C. Ortega-Plaza  
P. Mühlens

## Summary of Facts and Submissions

I. European patent No. 0 622 067, based on application No. 94 302 541.1, was granted on the basis of 17 claims, including four independent claims 1, 7, 14 and 17, which read as follows:

"1. An orthodontic appliance formed of a titanium alloy which avoids toxic or allergic reactions in patients comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum and having a  $\beta$ -monophase that is stable at body temperature."

"7. An orthodontic appliance comprising: bracket means for engaging an archwire therein, having a longitudinal slot formed in an upper surface thereof, said bracket means being formed of a titanium alloy which avoids toxic or allergic reactions in patients comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum and having a  $\beta$ -monophase that is stable at body temperature."

"14. An orthodontic bracket formed of a titanium alloy which avoids toxic or allergic reactions in patients comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum and having a  $\beta$ -monophase that is stable at body temperature,  
the yield strength of the titanium alloy being within the range 1150 to 1450 MPa,  
the tensile strength of the titanium alloy being within the range 1350 to 1950 MPa,

and the elongation of the titanium alloy being within the range 10 to 14%."

"17. An archwire formed of a titanium alloy which avoids toxic or allergic reactions in patients comprising a  $\beta$ -stabilizing, 5 wt% zirconium and 3 wt% aluminium, and having [sic] element including at least 12 wt% molybdenum a  $\beta$ -monophase that is stable at body temperature."

- II. Opposition was filed and revocation of the patent in its entirety was requested pursuant to Article 100(a) EPC on the grounds of lack of novelty and lack of inventive step and pursuant to Article 100(b) EPC for lack of sufficiency of disclosure.
  
- III. The following documents were cited *inter alia* in the proceedings:
  - (1) US-A-4 197 643
  - (3) JP-A-62 246 372
  - (3a) translation of D3 provided by the respondent
  
- IV. The appeal lies from a decision of the opposition division revoking the patent under Article 102(1) and (3) EPC. The decision was based on the main request (claims as granted), the first auxiliary request filed with the letter of 11 March 2004 and the second auxiliary request filed during the oral proceedings before the opposition division.

The opposition division considered that the requirements of Article 83 EPC were met for the claims specifying particular strength values, such as independent claim 14 of the main request, since the

skilled person had at its disposal several measures for increasing the strength properties of Ti alloys, even without precipitation of an  $\alpha$ -phase.

The opposition division considered that claim 1 of the main request lacked novelty over document (1). In the opinion of the opposition division, the concentration of at least 12 wt% Mo as defined in this claim in its broadest meaning referred to the  $\beta$ -stabilising element. Therefore, the Mo content as defined in claim 1 was found not distinctive over the alloy Ti-11.5Mo-6Zr-4.5Sn disclosed in document (1). According to the opposition division's findings, this titanium alloy fulfilled all the requirements specified for the alloy in claim 1 of the main request.

As regards the first and second auxiliary requests, the opposition division did not conclude on its assessment of Articles 123(2) and (3) EPC since, in the opposition division's opinion, the subject-matter of both requests lacked an inventive step. The opposition division considered document (1) to be the closest prior art. The opposition division came to the conclusion that the disclosure of document (3) rendered it credible that the problem of providing alloys of increased corrosion resistance had been solved, but that as a corollary this improvement was also rendered obvious by document (3).

- V. The appellant (patentee) lodged an appeal against the decision and filed two auxiliary requests with the grounds of appeal.

In the first auxiliary request the four independent claims (claims 1, 7, 14 and 17) were amended so as to specify that the content of alloying components is measured as a wt% of the titanium alloy. Claim 1 of this request reads as follows:

"1. An orthodontic appliance formed of a titanium alloy which avoids toxic or allergic reactions in patients and which alloy comprises molybdenum as a  $\beta$ -stabilizing element, wherein the molybdenum is present in an amount of at least 12 wt% of the alloy, and wherein the alloy has a  $\beta$ -monophase that is stable at body temperature."

In the four independent claims 1, 6, 12 and 14 of the second auxiliary request, the alloying elements and/or the content thereof were further specified. Claims 1 and 14 of this request read as follows:

"1. An orthodontic appliance formed of a titanium alloy which avoids toxic or allergic reactions in patients and which alloy comprises molybdenum and zirconium as  $\beta$ -stabilizing elements, wherein the molybdenum is present in an amount of 15 wt% of the alloy, the zirconium is present in an amount of 5 wt% of the alloy, and wherein the alloy has a  $\beta$ -monophase that is stable at body temperature."

"14. An archwire formed of a titanium alloy which avoids toxic or allergic reactions in patients and which alloy comprises molybdenum and zirconium as  $\beta$ -stabilizing elements, and aluminium, wherein the molybdenum is present in an amount of at least 15 wt% of the alloy, the zirconium is present in an amount of 5 wt% of the alloy, and the aluminium is present in an

amount of 3 wt% of the alloy, and wherein the alloy has a  $\beta$ -monophase that is stable at body temperature."

- VI. The respondent (opponent) filed counterarguments.
- VII. The board sent a communication as annex to the invitation to oral proceedings in which it was noted that the amount of molybdenum as defined in the independent claims of the second auxiliary request was not disclosed in generalised form in the application as originally filed, and that it would have to be assessed to what extent the specific examples could be used as a basis for said amendments (Article 123(2) EPC).

In addition, the board's preliminary opinion concerning the wording of claim 1 was expressed, in particular with respect to how the expressions "a titanium alloy ... comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum" and "a titanium alloy ... having a  $\beta$ -monophase" were to be construed.

- VIII. In response to the communication accompanying the summons to oral proceedings, the respondent filed further arguments and two supporting documents.
- IX. In a letter dated 15 January 2007 the appellant announced the following: "Please be advised that the Proprietor/Appellant will not be attending the Oral Proceedings scheduled to take place on 17 January 2007".

However, the appellant did not file any substantive comments in reply to the board's communication accompanying the summons to oral proceedings.

- X. Oral proceedings were held before the board on 17 January 2007 in the absence of the appellant.
- XI. The appellant's arguments were filed in writing with the grounds of appeal. They may be summarised as follows:

As regards the objection of lack of novelty of claim 1 of the main request, the appellant submitted that, from the wording of said claim particularly when interpreted in the light of the description, it was clear that the expression "including at least 12 wt% molybdenum" referred back to the titanium alloy. Claim 1 of the main request was therefore novel over document (1), since this document did not disclose a titanium alloy containing at least 12% molybdenum.

In addition, the appellant identified the term " $\beta$ -monophase that is stable at body temperature" as a limiting feature, which further distinguished the claims from document (1). In the appellant's view document (1) did not disclose a  $\beta$ -monophase material that is stable at body temperature but a mixed  $\alpha/\beta$  microstructure. The appellant submitted that in example 1 of document (1) the material is heated to 482°C for a period of 2-8 hours, which is below the temperature of about 885°C required to obtain a  $\beta$ -monophase.

The appellant further submitted that the claims of the main request and the claims of the first and second auxiliary requests involved an inventive step. In the appellant's view, document (1) represented the closest prior art, and the problem to be solved was to be seen



as lying in the identification of a titanium orthodontic appliance alloy that avoids toxic and allergic reactions in patients. According to the appellant, this problem had been solved by using a titanium alloy with at least 12% molybdenum allowing a  $\beta$ -phase to be produced that is stable at body temperature. The appellant further submitted that document (1) did not disclose an alloy in which the  $\beta$ -phase is stable at body temperature or which avoids toxicity and allergic reaction. Moreover, in the appellant's opinion document (1) did not teach or suggest that a titanium alloy with at least 12% molybdenum would provide a solution to the above-mentioned problem.

In addition, the appellant referred to further advantages over the disclosure of document (1), namely, improved mechanical properties and superior corrosion resistance. The appellant noted that the opposition division had acknowledged the superior corrosion resistance of the alloys defined in claim 1, but argued that the opposition division was wrong to conclude that this effect was obvious in view of document (3).

The claims of the second auxiliary request were directed to orthodontic appliance formed of a titanium alloy comprising 15 wt% molybdenum and 5 wt% zirconium as  $\beta$ -stabilizing elements, and were therefore still further removed from the prior art disclosures.

XII. The respondent stated at oral proceedings that it would concentrate on the essentials of its arguments, which may be summarised as follows:

Concerning the novelty analysis of claim 1 of the main request, the respondent shared the conclusions reached by the opposition division in its decision. All the features appearing in claim 1 were anticipated by document (1).

With respect to the first auxiliary request, the respondent argued that the subject-matter claimed in claim 1 lacked an inventive step over document (1), which the respondent identified as constituting the closest prior art.

The respondent argued that none of the advantages alleged by the appellant had been made plausible by pertinent comparative tests. In particular no evidence had been provided to demonstrate an advantage linked to the increase in molybdenum content of 0.5 wt% over the disclosure of prior art document (1). In the absence of such evidence, the problem to be solved was to be seen in the provision of further orthodontic appliances comprising titanium alloy with molybdenum as an alloying constituent. Increasing the molybdenum content from 11.5 to 12 wt% was a trivial modification, which could not be viewed as being inventive.

With respect to the second auxiliary request, the respondent considered that the subject-matter of claim 14 did not meet the requirements of Article 123(2) EPC, since no basis could be found in the application as originally filed for a molybdenum content of "at least 15 wt%". In addition some formal objections were raised with respect to independent claim 12 and other dependent claims in which corresponding mechanical properties were specified.

XIII. The appellant (patentee) requested that the decision under appeal be set aside and that the patent be maintained as granted (main request), or on the basis of one of the first or second auxiliary requests filed with the grounds of appeal.

The respondent (opponent) requested that the appeal be dismissed.

### **Reasons for the Decision**

1. The appeal is admissible.
2. The oral proceedings before the board took place in the absence of the appellant who was duly summoned but decided not to attend, as announced with its letter of 15 January 2007. The present decision is based on facts and evidence put forward during the written proceedings. Therefore, the conditions set forth in decision G 004/92 (OJ EPO 1994, 149) are met in the present case.
3. *Main request*
  - 3.1 Document (1) discloses orthodontic appliances formed of titanium alloy. In particular, document (1) states in example 2: "The same materials as in Example 1, but of different wire diameter size, were tested for yield strength and modulus of elasticity. Additionally, the wires were formed into an orthodontic rectangular loop spring ..." (column 8, lines 48-51).

The materials which are disclosed in example 1 are as follows: "Mill-processed beta-titanium wire, having a specification composition by weight of 11.5% molybdenum, 6% zirconium and 4.5% tin with the balance being titanium was obtained ... in both a solution heat-treated condition and an as-drawn condition. The solution heat-treated material was almost completely beta phase material developed by heating the alloy to 1300-1350°F. and water quenching. The solution heat-treated material was subsequently heated to a temperature of 482°C. (900°F.) for a period of from two to eight hours..." (column 7, lines 58-68).

Thus, document (1) discloses orthodontic rectangular loop springs formed of Ti-11.5Mo-6Zr-4.5Sn  $\beta$ -titanium alloy wires. This has been acknowledged in the patent in suit (see paragraphs [0006] and [0007]).

- 3.1.1 As expressed in the board's communication annexed to the invitation to oral proceedings, the value of "at least 12 wt%" in the expression "a titanium alloy ... comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum" as used in claim 1 of the main request is to be construed as referring to the relative amount of molybdenum in the  $\beta$ -stabilizing element. Thus, it is only required that the  $\beta$ -stabilizing element includes at least 12 wt% molybdenum, and the amount of  $\beta$ -stabilizing element with respect to the amount of titanium alloy is not defined.

In the alloy Ti-11.5Mo-6Zr-4.5Sn disclosed in document (1), the amount of molybdenum relative to the amount of  $\beta$ -stabilizing element is clearly greater than 12 wt%.

3.1.2 Document (1) discloses an alloy in the form of the solution heat-treated material, which may be subsequently heat aged, whereby the solution heat-treated material is almost completely  $\beta$ -phase material and  $\alpha$ -phase precipitation occurs on heat aging (see passages of document (1) quoted above and column 8, lines 28-30).

Since the process used in example 1 of document (1) is an analogous process to that used in the examples of the patent in suit (see paragraphs [0023] and [0024]), it must be concluded that the said materials obtained in example 1 of document (1) fulfil the requirement of being "a titanium alloy ... having a  $\beta$ -monophase" as defined in claim 1 of the main request.

3.1.3 Moreover, the board is convinced that the alloys and the orthodontic appliances disclosed in document (1) have a  $\beta$ -phase that is stable at body temperature, in view of the field of application in orthodontic appliances in conjunction with the disclosure in document (1) that the  $\beta$ -titanium alloys used are "room temperature stabilized" (see e.g. column 3, lines 5-8) and of good environmental stability and biocompatibility with oral tissues (column 6, lines 18-20).

3.1.4 As regards the feature "which avoids toxic or allergic reactions in patients" appearing in claim 1, it is further noted that document (1) discloses: "The alloy of the present invention also provides good environmental stability and biocompatibility with oral tissues" (column 6, lines 18-20). Indeed, the patent in

suit confirms that an alloy of the composition as exemplified in document (1) does not contain elements believed harmful to the human body (column 2, lines 14 and 15).

- 3.1.5 Accordingly, the orthodontic appliances as disclosed in example 2 of document (1) are encompassed by claim 1 of the main request since they fulfil all the requirements as defined therein.

Therefore, claim 1 of the main request lacks novelty vis-à-vis document (1) (Articles 52 and 54(2) EPC).

- 3.2 The board cannot agree with the appellant's argument that in claim 1 of the patent in suit the specified weight percent of molybdenum clearly refers back to the titanium alloy. A claim should be read in its broadest technically meaningful sense. The description cannot be construed to restrict the subject-matter of a claim which is in itself technically meaningful. Hence, the broadest meaningful reading of the expression "a titanium alloy ... comprising a  $\beta$ -stabilizing element including at least 12 wt% molybdenum" is that "including at least 12 wt% molybdenum" refers back to the immediately preceding feature, namely, the  $\beta$ -stabilizing element. The syntax and punctuation used, specifically the lack of comma before "including", supports this reading. Moreover, this reading is consistent with the fact that other elements may be included as  $\beta$ -stabilizing elements.

As regards the appellant's arguments that document (1) did not disclose a  $\beta$ -monophase material that is stable at body temperature but a mixed  $\alpha/\beta$  microstructure, the

following has to be said: Contrary to the appellant's submission, the temperature of 482°C refers in example 1 of document (1) to the heat aging process subsequent to the solution heat treatment which is performed at 1300-1350°F (704-732°C) (see document (1), column 7 lines 63-68).

Moreover, the appellant derives the minimum temperature of about 885°C required to obtain a  $\beta$ -phase from the phase diagram in Figure 2 of the patent in suit which relates to a Ti-Mo binary phase diagram, rather than the phase diagram of the alloy exemplified in document (1).

Hence, the appellant's allegation that the minimum temperature required for producing a  $\beta$ -phase was not achieved in example 1 of document (1) does not hold.

- 3.3 Consequently, the appellant's main request for maintenance of the patent as granted fails for lack of novelty of claim 1 (Articles 52 and 54(2) EPC).

In view of the above conclusion it is not necessary to comment on the remaining independent claims.

4. *First auxiliary request*

- 4.1 It has not been contested by the respondent that this request meets the requirements of Articles 123(2) and (3) EPC and the board sees no reason to differ.

- 4.2 In the first auxiliary request, claim 1 has been amended such that the titanium alloy must contain at least 12 wt% of molybdenum. Since none of the cited

prior art disclose orthodontic appliances made of alloys fulfilling this requirement, the novelty of the subject-matter of claim 1 of the first auxiliary request can be acknowledged (Articles 52 and 54(2) EPC).

The respondent did no longer dispute the novelty of the subject-matter of claim 1.

#### 4.3 Inventive step

##### 4.3.1 Document (1) represents the closest prior art. This has not been disputed by the parties.

As already mentioned, this document relates to orthodontic appliances that utilize room temperature stabilized  $\beta$ -titanium alloys (see e.g. column 3, lines 5-8).

In the light of this prior art, the problem to be solved lies in the provision of further orthodontic appliances formed of a  $\beta$ -titanium alloy.

The solution as defined in claim 1 relates to an orthodontic appliance characterised by the fact that molybdenum is present in an amount of at least 12 wt% of the alloy.

Having regard to the embodiments described in particular in paragraphs [0024] to [0026] of the description of the contested patent, the board is satisfied that the problem has been plausibly solved.



It remains to be investigated whether the proposed solution is obvious to the skilled person in the light of the prior art.

As becomes evident from the analysis of document (1) made under point 3.1 above, document (1) discloses orthodontic appliances formed of Ti-11.5Mo-6Zr-4.5Sn  $\beta$ -titanium alloy wires.

Document (1) teaches in a section explaining the nature of the  $\beta$ -titanium alloy materials (see document (1), column 6, line 21 - column 7, line 26) that the alloying constituents molybdenum, columbium, tantalum and vanadium stabilise the  $\beta$ -titanium phase, whereby the  $\beta$ -stabilized titanium alloy may contain up to about 25% by weight and more of the alloying constituents, and that additional stabilizing alloying elements can include manganese, iron, chromium, cobalt, nickel, and copper as well as aluminium, tin and zirconium.

Thus, an amount of alloying constituents, in particular  $\beta$ -stabilizing elements, of up to 25% is taught by document (1). Accordingly, the skilled person faced with the problem defined above is led by the teaching of document (1) to modify the proportion of alloying constituents disclosed in the alloy Ti-11.5Mo-6Zr-4.5Sn exemplified in document (1). Hence, the increase of the molybdenum content in the alloy to a value of at least 12 wt% must be viewed as being an obvious modification within the teaching of document (1).

Consequently, the subject-matter of claim 1 of the first auxiliary request lacks an inventive step (Articles 52 and 56 EPC).

- 4.3.2 The board cannot accept the appellant's definition of the problem to be solved as lying in the identification of a titanium orthodontic appliance alloy that avoids toxic and allergic reactions in patients.

No evidence has been provided to make it plausible that an avoidance of toxic and allergic reactions is actually achieved beyond that to be expected from the teaching of document (1) and that this can be attributed to the distinguishing feature of the invention, i.e., the increase in content of molybdenum from 11.5 wt%, as disclosed in the structurally closest prior art alloy Ti-11.5Mo-6Zr-4.5Sn, to at least 12 wt% as claimed.

As is well established in the case law of the boards of appeal, alleged but unsupported advantages cannot be taken into consideration in respect of the determination of the problem to be solved.

Similarly, neither the description nor the submissions of the appellant contain any evidence to make it plausible that the additional alleged improvements with respect to the prior art are actually achieved over the whole scope claimed in claim 1. The sole mention of advantageous properties in general terms cannot be regarded as evidence for that purpose.

With regard to the question of whether the disclosure of document (3) renders any improvement credible for the subject-matter as claimed, the board does not share the opinion of the opposition division. Document (3) discloses that with increasing amounts of molybdenum in

a  $\beta$ -phase titanium-molybdenum binary alloy, the mechanical strength and corrosion resistance are raised, whereby said improvement is particularly marked in the range above 15 wt% molybdenum (see document (3a), pages 6-9 and Figure 2).

The term binary alloys is defined in document (3) to include alloys containing "an amount of other elements which substantially does not affect this binary alloy, specifically up to 6 wt% of palladium, aluminium, iron, chromium, manganese, cobalt, nickel or the like as an alloy-improving element, or trace amounts of element impurities" (see document (3a), page 6, paragraph 2).

From this passage, it becomes clear that any expectation of improvement only holds for binary alloys optionally containing small amounts of additional elements. Thus, the data disclosed in document (3) does not render it credible that such improvements would be valid across the full scope of claim 1 of the first auxiliary request, which encompasses much greater variations.

Therefore, the board concludes that the achievement of an advantage cannot be included in the formulation of the technical problem.

4.4 Thus, the first auxiliary request is rejected for lack of inventive step of claim 1 (Articles 52 and 56 EPC).

In view of the above conclusion it is not necessary to comment on the remaining independent claims.

5. *Second auxiliary request: added matter*

5.1 In claim 14 of the second auxiliary request the composition of the titanium alloy is defined as comprising molybdenum, zirconium and aluminium such that "the molybdenum is present in an amount of at least 15 wt% of the alloy, the zirconium is present in an amount of 5 wt% of the alloy, and the aluminium is present in an amount of 3 wt% of the alloy".

In the description as originally filed, the molybdenum component of the titanium alloy is specified to be at least 12 wt%, whereby the alloy may also comprise zirconium and aluminium. Preferably 5 wt% of zirconium is added to the alloy and about 3 wt% of aluminium (see page 4, lines 5-20 in combination with page 6, line 33 - page 7, line 26).

The amount of molybdenum of at least 15 wt% as defined in independent claim 14 of the second auxiliary request is not disclosed in generalised form in the application as originally filed. The only example in the application as originally filed of an alloy falling within the scope of claim 14, i.e. comprising at least four elements, is Ti-15Mo-5Zr-3Al (see page 7, lines 25-26).

The skilled person examining said example would derive the information that the quaternary alloy consisting of 15 wt% molybdenum, 5 wt% zirconium and 3 wt% aluminium, with the balance being titanium, is a preferred embodiment of the invention. Based on this information, the skilled person would not directly and unambiguously recognise the value of 15 wt% molybdenum as

constituting the lower limit of a range in a subgroup of alloys as defined in claim 14.

Therefore, in the board's opinion claim 14 constitutes an unallowable generalisation of a single example, which is not unambiguously disclosed in the application as filed.

5.2 Although the appellant was aware that the board considered that the question of added matter would have to be assessed (see Facts and Submissions, point VII), it chose not to file any arguments in support of the conformity of the claimed subject-matter with the requirements of Articles 123(2) EPC.

5.3 Consequently, the second auxiliary request fails since the subject-matter of claim 14 does not meet the requirements of Article 123(2) EPC.

In view of the above conclusion it is not necessary to comment on the remaining independent claims.

**Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

A. Townend

U. Oswald