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**Datasheet for the decision
of 22 July 2008**

Case Number: T 0313/06 - 3.2.06

Application Number: 97105698.1

Publication Number: 0800781

IPC: A46D 1/00

Language of the proceedings: EN

Title of invention:

Interdental brush wire and interdental brush

Patentee:

SUNSTAR INC.

Opponent:

Althoff + Lötters Gmbh & Co. KG

Headword:

-

Relevant legal provisions (EPC 1973):

EPC Art. 56

Keyword:

"Main request - inventive step (no)"

"Auxiliary request - inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0313/06 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 22 July 2008

Appellant: Althoff + Lötters Gmbh & Co. KG
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Respondent: SUNSTAR INC.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 2 January 2006
rejecting the opposition filed against European
patent No. 0800781 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: P. Alting Van Geusau
Members: M. Harrison
K. Garnett

Summary of Facts and Submissions

I. The appellant (opponent) filed an appeal against the opposition division's decision rejecting the opposition against European patent EP-B-0 800 781.

Together with its appeal, with which it requested revocation of the patent, the appellant filed *inter alia* the following documents which had not been cited earlier:

D9: "Trends: Goodbye Ni; Welcome Co, Mn", The Orthodontic Materials Insider, 1995, Vol. 8 No. 4, pages 1-8.

D12: "High Manganese High Nitrogen Austenitic Steels", proceedings on two conferences on high manganese austenitic steels, 1987 and 1992, pages 1 to 12, R. A. Lula.

II. The respondent (proprietor) requested dismissal of the appeal.

III. Together with the summons to oral proceedings, the Board issued a communication stating its provisional opinion, in which it was noted that based on a prior art wire of SUS304 metal and the teaching of D9, doubt arose concerning inventive step in the subject matter of claim 1.

IV. With its letter of 20 June 2008, the respondent filed a series of auxiliary requests.

- V. During the oral proceedings held on 22 July 2008, the appellant confirmed its request for revocation of the patent.

The respondent likewise confirmed its (main) request as being dismissal of the appeal. All auxiliary requests previously on file were replaced by an amended first auxiliary request, according to which the respondent requested maintenance of the patent in an amended form based on an amended set of claims 1 to 5 and an adapted description.

- VI. Claim 1 of the main request (i.e. claim 1 as granted) reads as follows,

"An interdental brush wire which comprises a stainless steel wire having a diameter of 0.15 to 0.35 mm and containing at least iron, characterized by further containing chromium, manganese and nitrogen in the chemical composition, wherein a manganese content is not less than 2.50 wt% and nitrogen content is not less than 0.10 wt%."

- VII. Claim 1 of the auxiliary request reads as follows:

"An interdental brush wire which comprises a stainless steel wire having a diameter of 0.15 to 0.35 mm and containing at least iron, further containing chromium, manganese, nitrogen, molybdenum and nickel in the chemical composition, wherein a chromium content is 12 to 32 wt%, a manganese content is 10 to 38 wt%, a nickel content is not more than 6 wt%, a molybdenum content is not more than 7 wt% and nitrogen content is not less than 0.10 wt%, and the wire has tensile

properties as a proof stress of not less than 40 kgf/mm², an elongation of not less than 30% before twisting and a Young's modulus of not less than 12,000 kgf/mm² before twisting."

VII. The appellant's arguments may be summarised as follows:

Main request:

The closest prior art was SUS304 stainless steel wire as described in the patent. Its chemical composition and mechanical properties were stated in Tables 2 and 3. The only difference compared to claim 1 was the addition of manganese and nitrogen, which was however known from D9, albeit for the related field of orthodontics, to increase hardness and provide good mechanical strength, which aims were stated in the patent. The four conditions for interdental brush wires given in paragraph [0005] of the opposed patent were well known requirements and were anyway met by the wires of D9. They were also not necessarily present when considering the limitations provided by the features of claim 1. D9 disclosed that the mechanical strength of high nitrogen alloys, e.g. Noninium® and Menzanium®, was at least as good as chromium nickel alloys of which the SUS304 wire was an example. The subject matter of claim 1 thus lacked an inventive step.

Auxiliary request:

The features included in the amendments to claim 1 regarding the composition of the wire were already known from SUS304 wire. The Young's modulus, as quoted in Table 2 was also above 12,900 kgf/mm² and the

elongation was 53%, being well above 30% as claimed, and whilst a proof stress of 34.9 kgf/mm² was quoted for SUS304, it could be seen that it was well known to have proof stresses well above 40 kgf/mm² in other known interdental wires and that this was only a small increase. Menzanium® in D9 had all the defined chemical properties of claim 1 and as it was a high nitrogen steel alloy it also had the required mechanical properties, even if these were not explicitly stated. The same held for Noninium®. D12 confirmed for example that the addition of nitrogen even in small quantities such as 0.2 to 0.4% greatly increased strength and hardness; the 0.7-1 wt% presence of nitrogen in Menzanium® or the 1% wt% of nitrogen in Noninium® proved that these were high nitrogen steel alloys according to the description in D9 having very good mechanical properties. Also, it might be noted that a 304 steel was also present in Table I in D9 as an example of a chromium-nickel alloy to which the high nitrogen alloys of D9 were being compared. The presence of both types of wire in Table I showed the close overlap of the technical fields. It could thus only be expected that better mechanical properties would be present in a wire of Menzanium® or Noninium® compared to a wire of SUS304, whilst the extra strength in D9 due to the presence of manganese and nitrogen gave the improved value of proof stress. The subject matter of claim 1 thus lacked an inventive step.

VIII. The respondent's arguments may be summarised as follows:

Main request:

The problem to be solved starting from the known SUS304 wire, was to provide an improved interdental brush and wire therefor. The requirements on interdental brushes formed of wire such as SUS304 and the requirements on orthodontic wires as known from D9 were very different. A skilled person wishing to produce a better interdental brush would therefore not look to D9 for a solution. If D9 were considered, this led away from the invention, since nitrogen caused increased hardness and a skilled person would find this contrary to the requirement for an interdental brush being bent repeatedly. Also it could not be expected from D9 that using a wire made from Noninium® or Menzanium® would give any advantage in an interdental brush wire of a different diameter. The conditions laid down in paragraph [0005] of the patent were important when considering the improvements now made to the claimed wire in its use in an interdental brush. Table 1 in D9 showed many different steels for use in orthodontics; the presence of a 304 steel alloy gave no indication towards using other alloys on the list as a wire for an interdental brush which had a wire diameter between 0.15 and 0.35 mm.

Auxiliary request

The amendments made to claim 1 gave very specific mechanical properties to the wire which were specific for providing an improved interdental brush, as disclosed in paragraph [0025] of the patent. The composition of the wire alone did not result in the mechanical properties, but the processing of the wire

during manufacture was equally important. The proof stress of the SUS304 wire was below that claimed and of course it contained no manganese or nitrogen. When considering the use of Menzanium® or Noninium® wires of D9 to provide improvement, it could not simply be assumed that these would give the desired properties already present in the SUS304 wire. The Young's modulus, proof stress and elongation would all vary and nothing in D9 indicated that these wires should be processed in some way during manufacture to provide these qualities. The appellant had provided no evidence that the mechanical properties now defined in claim 1 and originally in granted claims 8 and 9 would be present in the steel alloys of D9; this was pure speculation.

Reasons for the Decision

1. *Main request*
- 1.1 In agreement with the parties, the Board concludes that the closest prior art is represented by the SUS304 stainless steel wire, which is disclosed in the patent as having been known for use as a wire in interdental brushes. The standard values of the chemical composition of SUS304 wire are stated in Table 1 of the patent, while the chemical composition of a specific SUS304 wire and test results relating to this wire are disclosed in Tables 2 and 3 respectively.
- 1.2 In accordance with paragraph [0004] of the patent, the known interdental brush wire made from SUS304 suffers from the problem of a buckling phenomenon which is attributed to it not being "sufficiently hard". In the

same paragraph it is stated that repeated bending of the base may result in breakage due to "insufficient durability". In paragraph [0010] it is confirmed that the brush wire and brush should not be "buckled or broken", together with further characteristics.

- 1.3 A skilled person faced with these particular problems would thus look for prior art where such problems are addressed. D9 addresses these problems in that it explains (see page 2, right hand column last three paragraphs and page 3, left hand column first three paragraphs) that nickel (which is present in SUS304 steel), can be replaced, albeit for other reasons, by the use of manganese which allows the inclusion of nitrogen thereby hardening the metal and whereby the mechanical strength is equally good, in fact quoting values of 30-40 ksi for chromium-nickel alloys (e.g. SUS304) and a higher yield strength of 70 ksi for high-nitrogen alloys.

Based on this information, the skilled person wishing to solve the problems of buckling due to inadequate hardness and breaking due to insufficient durability, is taught by D9 that this can be solved by the addition of manganese and nitrogen. Specific examples of materials used are given on page 2 as being Menzanium® and Noninium® and these are also quoted in Table 1 of D9. For Menzanium®, the quantity of manganese added is 18 wt%, while the nitrogen is 0.7-1 wt%, whilst nickel has been reduced to only 0.16% wt%; for Noninium®, the quantity of manganese and nitrogen added is 18% wt% and 1 wt% respectively, with a maximum of 0.2 wt% nickel. The characteristic of austenite is also maintained in such steels by this quantity of manganese, allowing

homogeneity to be maintained despite the absence of nickel. Based on this information, and in light of the technical problem to be solved, the Board concludes that a skilled person would consider it obvious to use the metal compositions of either Menzanium® or Noninium® which include manganese and nitrogen in the amounts defined in claim 1, as taught by D9, for producing wires of the diameter defined in claim 1 and known from SUS304.

1.4 The respondent argued that D9 was only concerned with orthodontic wires and that these were very different to those of interdental brush wires. However, the Board is not persuaded by this argument since the technical teaching of D9 is very general in explaining the way in which manganese and nitrogen act together to change the hardness and improve mechanical strength. Indeed, on page 3, left hand column, second to last paragraph it is noted that the use of manganese steels is continuously expanding. The further fact that D9 is in a closely related field, also makes the skilled person aware that use of such materials in the mouth is not a limiting factor which might otherwise perhaps deter a skilled person. The fact that orthodontic wires might be subject to differing requirements for their particular use would not therefore cause the skilled person to ignore the general teaching of D9.

1.5 The Board also finds the respondent's arguments concerning the different requirements put on wires for interdental brushes compared to those on orthodontic wires unconvincing. The conditions mentioned in paragraph [0005] of the patent are:

- "(1) The wire must be chemically nontoxic to [the] human body.
(2)The wire must not be sprung back and can be twisted.
(3) The wire must not be broken even when it is bent repeatedly.
(4) The wire must not be buckled by a brushing operation along the axial direction of the wire."

These conditions do not put any defined limits on the wire, but instead are all relative criteria. The wire in claim 1 is moreover so broadly claimed that the respondent cannot rely on these conditions as providing any difference over D9. For example, the term "nontoxic" in item (1) is dependent on what criteria are chosen to measure toxicity. Claim 1 also does not prevent the use of elements which might be regarded as toxic in some situations and non-toxic in others. The condition in item (1) is anyway already met by the manganese steels of D9, which by their long term use in the mouth must be, at least relatively, non-toxic. Items (2), (3) and (4) are also relative factors having no defined limits and no corresponding limitation in claim 1, nor any indication in D9 teaching away from same. The fact that 304 steels as used for interdental brushes are also listed amongst the orthodontic wire and fixture materials together with Menzanium® and Noninium® is an additional indication that such properties would also, albeit in an undefined relative manner, be present anyway in steels used for orthodontic purposes.

- 1.6 The respondent's argument that the teaching of D9 to increase hardness by the use of manganese and nitrogen would dissuade the skilled person from using

manganese/nitrogen as this would be contrary to the requirement for repeated bending, is unconvincing. One underlying problem given in the patent in paragraph [0004], namely a lack of hardness causing the SUS304 wire to buckle, is precisely what the respondent now alleges should dissuade the skilled person from the use of this property. The respondent's argument thus contradicts the disclosure in the patent. Additionally, the Board concludes that a skilled person is anyway capable within the bounds of his general knowledge and based on the teaching of D9 to include sufficient manganese and nitrogen to meet the requisite hardness requirements without including excessive amounts to prevent bending or which would lead to breakage.

- 1.7 The respondent's argument that no advantage could be expected from D9 when using the steels therein in an interdental brush wire of a different diameter, is not persuasive. The underlying general teaching of D9 relates to the use of manganese and nitrogen for hardening and improving mechanical properties in steel alloys when replacing nickel. There is no reason to suspect that the production of a wire in a different diameter for use as an interdental brush wire would result in a removal of the advantages of hardness and mechanical strength. On the contrary, precisely these properties would be expected to remain.

- 1.8 The argument of the respondent that the presence of a 304 steel alloy in Table 1 in D9 gave no indication towards using other alloys on the list as a wire for an interdental brush which had a wire diameter between 0.15 and 0.35 mm, also would not dissuade the skilled person against using the general teaching of D9 when

solving a problem related to the SUS304 wire of a specific composition.

- 1.9 The subject matter of claim 1 therefore lacks an inventive step. Consequently the requirement of Article 56 EPC 1973 is not fulfilled.

2. *Auxiliary request*

- 2.1 Claim 1 of the auxiliary request results from a combination of granted claims 1, 4, 8 and 9. Apart from an objection to lack of inventive step, no further objections were raised by the appellant.

- 2.2 Concerning the matter of inventive step, the amendments brought into claim 1 concern on the one hand a limitation on the chemical composition of the stainless steel used for the wire and, on the other hand a limitation concerning the mechanical properties of the wire. This latter factor is only partly a result of the chemical composition; it is however also related to the manufacturing process of the wire in question, where the varying treatment processes applied can change these properties.

First, the Board has already found with regard to the main request that, to solve the technical problem underlying the invention, it would be obvious to use a wire having a diameter of 0.15 to 0.35 mm having the properties of Menzanium® or Noninium® as disclosed in D9. Further, it is noted that these wires already possess the chemical composition now defined in claim 1 of the auxiliary request (see D9, Table 1 and page 2, right hand column). However, due to the differences in

mechanical properties which can arise due to the wire manufacturing process resulting in the wire of claim 1, it still remains to be considered whether the mechanical properties defined in claim 1 are present or not in such a wire or whether it would be obvious to provide such properties. The three properties defined in claim 1 are:

- (a) a proof stress of not less than 40 kgf/mm²
- (b) an elongation of not less than 30% before twisting
- (c) a Young's modulus of not less than 12,000 kgf/mm² before twisting.

D9 does not state exact values for these properties. However, taking the properties of the SUS304 wire into account when considering the teaching of D9 with regard to its mechanical properties, it is first noted that Table 3 of the patent discloses that the proof stress of SUS304 wire is 12,900 kgf/mm², i.e. already above the claimed minimum Young's modulus of 12,000 kgf/mm². As noted with regard to the main request, D9 discloses that the manganese-nitrogen stainless steel wires therein are hardened by the addition of nitrogen with manganese and that the strength of high nitrogen alloys is higher than the chromium nickel alloys (the value of 70 ksi in D9 is disclosed for such alloys, approximating to about 49 kgf/mm² compared to 30 to 40 ksi for nickel chromium alloys). Due to the amount of nitrogen present (0.7 to 1 wt%) in Menzanium® or 1 wt% in Noninium®, the Board concludes that these are high nitrogen alloys. This is also in line with D12 (see page 1, left hand column second paragraph and page 6, left hand column last paragraph and Figure 15) which discloses that nitrogen is not only a very potent

hardener but that tensile and yield strengths are directly related to the nitrogen content, and that these strengths increase sharply even with the addition of only very small quantities of nitrogen which are less than those for Menzanium® or Noninium® given in D9. Thus, there is a clear indication that the Young's modulus in a wire made of Menzanium® or Noninium® compared to that in the SUS304 wire in the patent will be even higher. Likewise, the proof stress which is 34.9 kgf/mm² for SUS304 is only marginally below the proof stress defined in claim 1, and with the alteration in properties caused by the replacement of nickel by manganese and nitrogen, there is a clear indication that the proof stress would again be higher. However, these values do not stand alone but are combined with property "(b)" regarding the elongation percentage. Whilst the elongation in an SUS304 wire is well above 30%, the replacement of nickel by large amounts of manganese and nitrogen as in the materials of D9 does not allow the conclusion to be drawn that, even if the properties (a) and (c) are present, that property (b) would also be present.

The appellant has provided no convincing evidence which allows the conclusion to be drawn that wires made from Menzanium® or Noninium® in D9 would have all these three properties intrinsically or that wires of these materials made for orthodontic use would as a result of their manufacture definitely possess these properties.

In regard to the above, these three properties are stated in paragraph [0025] of the patent to be chosen in accordance with the invention such that a good balance of the hardness, spring properties and

workability required for an interdental brush wire are achieved. In D9 on the other hand, the only specific uses to which the Menzanium® or Noninium® should be put are for orthodontic brackets and archwires, which are subject to different criteria. For the wire of claim 1, a specific balance of the three properties (a), (b) and (c) must purposefully be provided in the manufacture thereof. Based on the information presented by the appellant, the Board is thus unable to draw the conclusion, without doubt, that these properties would necessarily be present in Menzanium® or Noninium® wires of D9. To conclude so, based on the prior art presented, would amount to speculation. Likewise, it cannot be concluded from the properties present in the wire of SUS304 that wires made from Menzanium® or Noninium® should be altered in their manufacture to have the specific balance of properties defined in claim 1, as such would be a hindsight analysis based on the balance of characteristics of the wire stated to have been achieved by the invention.

For the foregoing reasons, the subject matter of claim 1 involves an inventive step with respect to the cited prior art and consequently the requirement of Article 56 EPC 1973 is fulfilled.

- 2.2 As regards the appellant's argument that it would be expected that the properties of Menzanium® or Noninium® would be better than those of the SUS304 wire and thus the claimed values would be present, the Board finds this argument, at least in respect of the elongation value in claim 1, to be unconvincing, since the increased hardness and additional strength by the addition of significant amounts of manganese and

nitrogen when replacing nickel would have unknown effects on the elongation values. Further, as stated above, the processing of the wire during its manufacture could also provide significant variation on all three properties. Thus, the appellant's arguments do not alter the conclusions made in item 2.1 above.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of:
 - (a) claims 1 to 5 of the amended first auxiliary request as filed during the oral proceedings;
 - (b) the description consisting of pages 2, 2a, 3, 4, 5, 7, 9, 14 as filed during the oral proceedings and pages 6, 8, 10, 11, 12, 13 and 15 as granted;
 - (c) Figures 1 to 8 as granted

The Registrar:

The Chairman:

D. Sauter

P. Alting van Geusau