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D E C I S I O N
of 28 March 2003

Case Number: T 0323/01 - 3.3.5

Application Number: 88903031.8

Publication Number: 0360802

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Language of the proceedings: EN

Title of invention:
Method for making ceramic orthodontic brackets

Patentee:
3M Unitek Corporation

Opponent:
DENTAURUM J.P. Winkelstroeter KG

Headword:
-

Relevant legal provisions:
EPC Art. 56, 83, 123(2),(3)

Keyword:
"Sufficiency of disclosure (yes)"
"Inventive step (yes) - after amendments"

Decisions cited:
-

Catchword:
-

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Case Number: T 0323/01 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 28 March 2003

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 9 January 2001 rejecting the opposition filed against European patent No. 0 360 802 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: R. K. Spangenberg
Members: A.-T. Liu
P. Mühlens

Summary of Facts and Submissions

I. European patent No. 0 360 802 was granted with a set of 15 claims, with claim 1 directed to a method for making a translucent polycrystalline ceramic orthodontic bracket and claims 2 to 15 depending thereon.

II. Claim 1 read as follows:

"A method for making a translucent polycrystalline ceramic orthodontic bracket characterized by:

pressing a powder consisting essentially of aluminium oxide plus magnesium oxide in the range of from 0.05 to 0.3 percent by weight at a sufficient pressure for forming a compact having a shape corresponding to at least a portion of the shape of the completed bracket; and sintering the compact at a temperature in the range of from 1750 to 1850°C for a sufficient time for forming a bracket that is polycrystalline, has sufficient strength for withstanding the loads applied during orthodontic correction, and has sufficient translucency that visible light emitted from the front surface of the bracket comprises a portion backscattered from within the bracket and a sufficient portion transmitted from the base of the bracket to take on the color of an underlying tooth."

III. A notice of opposition was filed against the patent on the grounds of lack of inventive step and lack of disclosure (Articles 100(a) and (b) EPC). The opposition was supported inter alia by the following documents:

D1: US-A-4 219 617

D2: GB-A-1 397 974

IV. The present appeal was lodged against the decision of the opposition division to reject the opposition.

In summary, the opposition division held that the patent as granted complied with the requirements of Articles 83 and 100(b) EPC. In addition, the opposition division observed that the closest prior art document D1 was directed to the preparation of opaque, white or off-white orthodontic brackets fabricated from high alumina ceramic materials. There was no clear incentive in D1 to use a translucent alumina ceramic as a material for orthodontic brackets. The skilled person would therefore not consider combining D1 with D2.

V. With the reply to the statement of the grounds of appeal dated 5 February 2002, the respondent filed two sets of amended claims as basis for auxiliary requests 1 and 2.

VI. By letter of 28 February 2003, the appellant filed a reproduction of the single example ("Experiment") disclosed in the patent in suit and introduced new documents for the first time into the proceedings.

VII. By letter of 27 March 2002, the respondent filed a declaration by Anatoly Rosenflanz, dated 25 March 2003, commenting on the experimental data submitted by the appellant.

VIII. At the oral proceedings which took place on 27 March 2003, the appellant (opponent) submitted samples of orthodontic brackets for viewing by the Board.

IX. Also at the oral proceedings, the respondent (patentee) presented the Board with three new auxiliary requests I to III. The first auxiliary request consisted of claims 1 to 14, claim 1 being worded as follows:

"A method for making a translucent polycrystalline ceramic orthodontic bracket characterized by:

pressing a powder consisting essentially of aluminium oxide plus magnesium oxide in the range of from 0.05 to 0.3 percent by weight at a sufficient pressure for forming a compact having a shape corresponding to at least a portion of the shape of the completed bracket; and sintering the compact at a temperature in the range of from 1750 to 1850°C for a sufficient time for forming a bracket that is polycrystalline, has an average grain size in the range of 10 - 50 μm, has sufficient strength for withstanding the loads applied during orthodontic correction, and has sufficient translucency that visible light emitted from the front surface of the bracket comprises a portion backscattered from within the bracket and a sufficient portion transmitted from the base of the bracket to take on the color of an underlying tooth."

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

- Without a numerical value for the mechanical strength required, the skilled person would not know how to achieve a sufficient strength of the orthodontic bracket.

- It was questionable as to whether the control of the grain size was sufficient for obtaining sufficient strength of the bracket.

- Calculations showed that the in-line transmittance of the material according to the patent in suit would not give rise to a bracket with sufficient translucency.

- Due to lack of information from the patent in suit, the reproduction of the Experiment according to the patent in suit did not yield a translucent material.

- The closest prior art document D1 was essentially directed to the preparation of ceramic orthodontic brackets which were white or off-white. It also mentioned the pleasing aesthetic appearance of translucent brackets.

- Should the skilled person desire to obtain a translucent ceramic bracket, it was obvious for him to modify the preparation method of D1 by applying one of the various known methods for obtaining transparent alumina material. In this respect, it was observed that the term "transparent" was used in the art with the same connotation as "translucent" in the patent in suit.

XI. The respondent essentially submitted the following:

- The average grain size is a measure for controlling the strength of the ceramic bracket.

- The calculations made by the appellant with respect to transmittance and translucency were erroneous.

- The negative results obtained by the appellant were likely due to deviations from the process parameters disclosed in the patent in suit and to insufficient control of contamination encountered during the preparation process.

- D1 was not a relevant piece of prior art and the skilled practitioner would not consider combining D1 with another piece of prior art such as D2 which did not relate to the manufacturing of orthodontic brackets.

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

The respondent (patentee) requested that the appeal be dismissed or that the patent be maintained in amended form on the basis of one of the auxiliary requests 1 to 3 submitted at the oral proceedings or, as auxiliary requests 4 and 5, on the basis of the then auxiliary requests 1 or 2 filed with letter dated 5 February 2002.

Reasons for the Decision

1. *Main request*

1.1 Novelty

It is undisputed that the combination of process parameters as stipulated in claim 1 is not disclosed in any of the documents on file. This will also be clear from the following discussion on inventive step.

1.2 Inventive step

1.2.1 Claim 1 is directed to a method for making a translucent polycrystalline ceramic orthodontic bracket.

1.2.2 The Board concurs with the parties in that the closest prior art is represented by D1 which also relates to the fabrication of ceramic orthodontic brackets from high alumina ceramic materials. Preferably, these brackets are white or off-white in colour, or may be coloured to the desired shade of white, e.g. with a pigment (abstract; column 1, lines 6 to 8 and lines 58 to 59; column 6, lines 41 to 44 and claim 1).

1.2.3 The Board can accept the respondent's submission in that, with respect to D1, the problem that the patent in suit has set out to solve is to modify the process of D1 to obtain a ceramic orthodontic bracket which matches the tooth colour.

1.2.4 To solve the technical problem as stated above, a process is essentially proposed in claim 1 in which :

(i) a powder consisting essentially of aluminium oxide plus magnesium oxide in the range of from 0.05 to 0.3 percent by weight is pressed;

(ii) the compact is sintered at a temperature in the range of from 1750 to 1850°C and

(iii) the sintering time is sufficient for forming a bracket that is polycrystalline and has sufficient translucency.

1.2.5 Irrespective of the question as to whether the above proposed solution indeed solves the technical problem as stated, the Board has come to the conclusion that the stipulated process lacks an inventive step for the following reasons.

As was established at the oral proceedings, D1 not only discloses brackets formed of a high alumina ceramic material which is naturally white or off-white but it

also suggests using transparent or translucent ceramic material. In this respect, the Board wishes to observe that D1 refers to "transparent" and "translucent" alumina in equal terms (column 6, lines 41 to 46). The Board is therefore of the view that D1 clearly gives the skilled person an incentive to produce a ceramic bracket from transparent or translucent alumina. Should he choose to follow that suggestion, he is only faced with the problem of finding a method for making such transparent or translucent high alumina material.

Methods for making articles of transparent alumina are well known. For example, D2 discloses transparent polycrystalline alumina articles produced by:

(i) isostatic pressing a powder consisting of 99.9% alpha-alumina with an addition of 500 ppm magnesia;

(ii) prefiring the compact then subjecting it to sintering at a temperature of 1825°C for 5 hours at a pressure of 800 millibars.

(iii) The alumina articles produced thereby are polycrystalline and capable of permitting the passage of a large fraction of a beam of light.

(see D2, page 1, lines 43 to 65 and lines 86 to 92 and page 2, lines 57 to 65). The proportion of added magnesia and the sintering temperature as disclosed in D2 thus fall within the ranges stipulated in claim 1 for the corresponding parameters (see points II and 2.1.3 above).

Although the article produced in the example is a cylindrical tube, it is clear that the teaching generally applies to the manufacture of articles of transparent alumina (see title and page 1, lines 27 to

30). The skilled person would therefore consider D2 when looking for a method of manufacturing orthodontic brackets from transparent alumina material.

1.2.6 The respondent has alleged that the process of D2 would yield a "transparent" alumina article whereas the claimed process is to produce a "translucent" alumina bracket.

The Board notes that a clear and plausible explanation as to the meaning of the term "translucency" of polycrystalline aluminium oxide is given in the patent in suit. In summary, it is reasoned that:

"Since the material is polycrystalline, adjacent crystals have different, largely random crystallographic orientations. This results in variations in index of refraction along any straight-line path through the bracket... The grain boundaries are sites of crystallographic imperfections and these arrays of imperfections may also have different indexes of refraction which deflect light in a multiplicity of directions. Further, even though the aluminium oxide after sintering has substantially zero porosity, traces of residual porosity may remain ... Such traces of porosity would have a pronounced effect on light transmission, with resultant scattering and diffusion of light passing through the polycrystalline material. It is probable that a combination of these effects is involved in producing the desired degree of translucence in a pressed and sintered aluminium orthodontic bracket" (see column 8, lines 28 to 51).

The same explanation is essentially reiterated in the letter of 5 February 2002, stating that "in translucent materials, a multiplicity of scattering events occurs" (see page 2, second full paragraph).

The Board observes that the process of D2 also leads to a polycrystalline aluminium oxide having a density very close to theoretical (page 1, lines 82 to 85 and page 2, lines 58 to 59). The Board therefore holds that the same scattering events must occur with the polycrystalline articles according to D2 due to the manifold of unaligned crystal particles within the material in a similar way as with the polycrystalline alumina material according to claim 1. The Board therefore cannot see any distinction between the terms "transparent" used in the prior art and "translucent" as stipulated in claim 1.

1.2.7 The respondent has contended that, when desiring to solve the present technical problem which is to improve the aesthetic appearance of the orthodontic bracket, there is no incentive for the skilled person to use a transparent or translucent material. This argument is, however, contradicted by the statement in the patent in suit that "it has been proposed to use transparent single crystal aluminium oxide or sapphire for orthodontic brackets ... The idea was that the highly transparent bracket would show the tooth color" (see patent in suit, column 3, lines 23 to 24 and lines 30 to 31). The fact that single crystal alumina brackets were known at the priority date of the patent in suit was not disputed by the respondent at the oral proceedings. In the appreciation of the Board, it must also be known by then that the transparency of the orthodontic bracket was desirable for its aesthetic appearance by showing the tooth color. The skilled person would therefore follow the suggestion in D1, namely to produce ceramic brackets formed of transparent or translucent alumina, with the aim to solve the present technical problem (see points 2.1.2 and 2.1.4 above).

1.2.8 The respondent has remarked that claim 1 stipulates that the bracket has "sufficient strength for withstanding the loads applied during orthodontic correction". He has gone on to argue that, although D2 indicates the density of the alumina material, this is not a measure of strength; it is therefore questionable whether the alumina obtained according to the process of D2 is indeed suitable for use in ceramic brackets.

The Board would first like to observe that the desired strength is not defined by any concrete value in claim 1. On the other hand, it is not plausible to the Board that a polycrystalline alumina material having a density close to theoretical value would lack mechanical strenghth. The respondent's reference to the single crystal aluminium oxide being prone to cleavage is beside the point in this respect since a polycrystalline structure, which consists of randomly oriented crystals, in contrast to single crystals does not present a natural line or surface of cleavage. The Board therefore holds that, given the lack of any evidence to the contrary, an alumina material obtained according to the process of D2 will have sufficient strength for withstanding the loads applied during orthodontic correction.

1.2.9 As a corollary to the above, the Board holds that the process of claim 1 is an obvious and straightforward combination of the technical teachings derivable from D1 and D2. Claim 1 therefore lacks an inventive step in view of these prior art documents.

2. *Auxiliary request 1*

2.1 Amendments

Claim 1 is a combination of claims 1 and 4 as originally filed and as granted. Likewise, the

dependent claims 2 to 14 are essentially based on claims 2 to 3 and 5 to 15 as originally filed and granted. It is therefore undisputed that the claims of this request meet the requirements of Articles 123(2) and (3) EPC.

2.2 Sufficiency of disclosure

The appellant has maintained his objection with respect to claim 1 of this request that the patent in suit does not contain sufficient disclosure for the skilled person to carry out the claimed method so as to make a polycrystalline ceramic orthodontic bracket that has:

(i) sufficient strength for withstanding the loads applied during orthodontic correction, and

(ii) sufficient translucency that visible light emitted from the front surface of the bracket comprises a portion backscattered from within the bracket and a sufficient portion transmitted from the base of the bracket to take on the color of an underlying tooth.

2.2.1 Re: feature "sufficient strength"

The appellant has specifically raised the objection that the patent does not give a numerical value for the mechanical strength required. The skilled person therefore would not know how to achieve a sufficient strength of the orthodontic bracket. As is pointed out in the patent in suit, however, the strength of the orthodontic bracket is in particular regulated through a control of the grain size of the material. Specifically, the average grain size should be in the range of 10 - 50 μm, as is now stipulated in claim 1 (column 6, lines 14 to 25). The Board therefore holds that the value of strength is concretely, albeit

indirectly, defined via the average grain size of the material. Furthermore, it is indicated in the patent in suit that the control of the average grain size is achieved by way of selection of the sintering composition, sintering time and temperature (column 6, lines 16 to 17). This has not been challenged by the appellant. Thus, the patent in suit also gives clear directives for achieving the stipulated aim.

The appellant has also queried that the control of the grain size alone should be sufficient for obtaining the desired strength. However, he has not provided any plausible argument, let alone convincing evidence, that the skilled person would not necessarily be able to produce a material with sufficient strength when applying the other concrete process parameters as defined in claim 1, namely by using the stipulated starting composition, applying a sintering temperature within the stipulated range and controlling the grain size of the sintered alumina particles. The Board therefore does not regard the objection of lack of disclosure, with respect to the feature of "sufficient strength", as substantiated.

2.2.2 Re: feature "sufficient translucency"

The appellant has submitted calculations to show that, with the in-line transmittance of the bracket in the range of 20% to 60% per 0.5 mm thickness as indicated in the description (column 5, lines 14 to 17) and stipulated in claim 3 as granted, the ceramic brackets of the patent in suit, which would normally have a thickness of 2 mm, would not be sufficiently translucent (see letter dated 18 May 2001, page 2, first full paragraph to page 4, paragaph 1). The Board notes that the calculations made by the appellant were strongly contested by the respondent.

On the other hand, the appellant provided the Board with an orthodontic bracket as sample for viewing at the oral proceedings, with the observation that the sample is a commercial product made according to the patent in suit. The appellant has, however, not submitted that the sample provided is not translucent, nor has he argued that the in-line transmittance of that sample is different from that indicated in the patent in suit. The Board therefore does not have any reason to accept the appellant's calculations and to doubt that the claimed method indeed leads to a translucent ceramic bracket (see also point 2.1.5 above).

2.2.3 The appellant has also filed an alleged reproduction of the Experiment disclosed in the patent in suit in column 7, line 54 to column 8, line 15. The appellant has put forward the argument that, due to the incomplete information, the polycrystalline mouldings obtained in the reproduction, instead of the desired translucency, have an anthracite grey colour for which any kind of in-line transmission measurement is futile (see the appellant's letter dated 28 February 2003, point 1c) from page 6; in particular page 7, paragaph 2).

The Board cannot, however, accept the appellant's submission as a fair reproduction of the teaching according to the patent in suit for two reasons. First, as is pointed out by the respondent and not refuted by the appellant, the Experiment of the patent in suit is not reworked exactly in all details but deviations are made from that procedure. For example, the starting composition is changed and contains 0.06 % by weight of magnesium oxide powder instead of 0.2 % as in the Experiment. Secondly, more decisively, however, the appellant has not given a plausible explanation for the grey-colouring of the polycrystalline material. In

particular, he has not provided analytical data which could tentatively trace the source of that colouration. As any chemist knows, sintered alumina as such is not coloured. And the Board concurs with the respondent in that the occurrence of a chromatic effect like that observed by the appellant must be due to the presence of contaminations, in particular, carbonic contaminations in the finished polycrystalline aluminium oxide bracket (see declaration by Anatoly Rosenflanz, page 4, point 4). Since the colouring of the polycrystalline alumina is neither mentioned in the patent in suit nor in any of the prior documents directed to the fabrication of transparent alumina, the Board must conclude that this problem as such does not exist when due care is taken as can be expected from a skilled person.

Thus, the alleged reproduction of the Experiment of the patent in suit cannot be accepted as evidence in support of the objection of lack of disclosure.

2.3 Inventive step

The subject-matter of present claim 1 differs from that of the main request in that it further stipulates that the claimed method is for forming a bracket that "has an average grain size in the range of 10 - 50 μm".

2.3.1 As is stated in the patent in suit, the grain size of the sintered alumina product is responsible inter alia for the strength and translucency of the orthodontic bracket (column 6, lines 14 to 19). In the absence of proof to the contrary, the Board therefore accepts that the stipulated grain size effectively contributes to solving the technical problem, namely the provision of a method for obtaining a ceramic orthodontic bracket which matches the tooth colour (see also point 3.2 above).

2.3.2 As the respondent has correctly pointed out, neither D1, the only document on file pertaining to methods for producing ceramic orthodontic brackets, nor any of the other prior art documents on file, in particular D2, indicates the grain size of the sintered ceramic product. The Board therefore accepts that the skilled person cannot foresee the effect of that parameter on the strength and translucency of the polycrystalline alumina material. On the basis of the available evidence, it cannot be denied that the solution to the stated technical problem as proposed in claim 1 involves an inventive step.

2.3.3 Claims 2 to 14 are dependent claims relating to specific embodiments of the process according to claim 1. Their subject-matter is therefore also novel and involves an inventive step. The patent can thus be maintained with the claims of the present request.

As was established at the oral proceedings, the average grain size of the polycrystalline bracket is referred to in the description as part of the invention and not as a preferred embodiment (see patent in suit, column 4, lines 14 to 16). The Board therefore concurs with the parties that no further adaptation of the description is necessary in the present case.

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 maintain the patent in amended form in the following version:

   - claims 1 to 14 of the first auxiliary request submitted at the oral proceedings;

   - description, drawing as granted.

The Registrar: The Chairman:

U. Bultmann R. Spangenberg