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D E C I S I O N
of 16 July 1997

Case Number: T 0749/95 - 3.4.2

Application Number: 89107257.1

Publication Number: 0338586

IPC: G02C 5/00

Language of the proceedings: EN

Title of invention:

Eyeglass frame having Ti-N-V alloy element with improved wear comfortability

Patentee:

TOKIN CORPORATION, et al

Opponent:

Nitinol Development Corporation

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 83, 84, 123
EPC R. 57a

Keyword:

"Inventive step - (yes) after amendment"
"Additional method claim - allowed"
"Claims - product-by-process"

Decisions cited:

T 0762/90, T 0150/82

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0749/95 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 16 July 1997

Appellant:
(Proprietor of the patent)

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Respondent:
(Opponent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 12 July 1995
revoking European patent No. 0 338 586 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
L. C. Mancini

Summary of Facts and Submissions

- I. The appellant (proprietor of the patent) lodged an appeal against the decision of the Opposition Division to revoke European patent No. 0 338 586.

An opposition based on Article 100(a) EPC had been filed against the patent as a whole since the subject matter of the patent in suit allegedly lacked an inventive step.

The Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC prejudiced the maintenance of the patent having regard to the following documents:

- D1: WO-A-87/07961
- D2: JP-A-63 14834 (combined with an English translation), and
- D3: JP-A-56 99317 (also combined with an English translation).

During the appeal proceedings, the Board of its own motion referred to the following further document:

- D4: Kirk-Othmer: "Encyclopaedia of Chemical Technology", third edition, vol. 15, John Wiley, New York 1981, pages 332, 334 and 335.

- II. In the communication of 9 May 1997 pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board pointed out that the subject matter of the claims in accordance with the appellant's

main request, i.e. claims 1 to 5 as granted, seemed to lack an inventive step with respect to documents D1 and D2, and that it was doubtful whether the claims according to the appellant's various auxiliary requests complied with Articles 123(2) and 84 EPC, respectively.

- III. Oral proceedings took place on 16 July 1997 in the respondent's absence which had informed the Board by letter of 30 April 1997 that it would not attend the oral proceedings.
- IV. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of claims 1 to 6, filed at the oral proceedings.
- V. The respondent did not submit any request.
- VI. The wording of independent claims 1 and 6 on file at the time of the present decision reads as follows:

"1. An eyeglass frame comprising bridge means (14) connecting a pair of lens fixing rims (11) and temples (15) connected to the rims, respectively, wherein at least one element of said bridge means (14) and said temples (15) is made of an alloy having an elasticity defined by a stress-strain curve having a generally rectangular hysteresis loop wherein strain gradually increases with increase of stress and rapidly and suddenly increases at an elevated stress, and strain gradually reduces with reduction of stress and rapidly and suddenly reduces at a reduced stress,

characterised in that said alloy is made of Ti-Ni-V comprising V at 0.25 to 2.0 at.% and the balance of Ni and Ti with an atomic ratio Ni/Ti of 1.02 to 1.06, said elasticity existing over a temperature range of 0 to 20°C, and

in that each of said temples (15) of the eyeglass frame is formed of said alloy by the following steps:

an alloy ingot is prepared by use of high frequency induction melting in vacuum, the ingot is solution treated at 900°C for two hours and is worked to a wire having a diameter of 1.4 mm by hot hammering, hot rolling and cold drawing, thereafter it is cold worked to have a diameter of 1.2 mm without annealing and a portion of it is annealed at 750°C for 10 minutes and thereafter is rolled to have a thickness of 1.0 mm to obtain a temple piece (15'), which temple piece is treated at 425°C for 15 minutes."

"6. Method of producing an eyeglass frame, the eyeglass frame comprising bridge means (14) connecting a pair of lens fixing rims (11) and temples (15) connected to the rims, respectively, wherein at least one element of said bridge means (14) and said temples (15) is made of an alloy having an elasticity defined by a stress-strain curve having a generally rectangular hysteresis loop wherein strain gradually increases with increase of stress and rapidly and suddenly increases at an elevated stress, and strain gradually reduces with reduction of stress and rapidly and suddenly reduces at a reduced stress,

and wherein said alloy is made of Ti-Ni-V comprising V at 0.25 to 2.0 at.% and the balance of Ni and Ti with an atomic ratio Ni/Ti of 1.02 to 1.06, said elasticity existing over a temperature range of 0 to 20°C,

wherein said method comprises forming a temple (15) of the eyeglass frame from said alloy with the following steps:

preparing an ingot of said alloy by use of high frequency induction melting in vacuum,

solution treating said ingot at 900°C for 2 hours, working said ingot into a wire having a diameter of 1.4 mm by hot hammering, hot rolling and cold drawing, thereafter cold working said wire to have a diameter of 1.2 mm without annealing, annealing a portion of said wire at 750°C for 10 minutes, thereafter rolling said portion to have a thickness of 1.0 mm to obtain a temple piece (15'), and heat-treating said temple piece at 425°C for 15 minutes."

Claims 2 to 5 are appended to claim 1.

VII. The appellant's argumentation in support of its request may be summarised as follows:

The subject matter of claim 1 has now been restricted by literally including all the method steps for forming a temple as disclosed at page 7, line 21 to page 8, line 4 of the original application documents. In consequence, admissibility problems under Article 123(2) EPC should no longer exist.

Although this method is not described very precisely in the original application documents, a skilled person would nevertheless be capable of understanding it in detail so that the requirements of Articles 83 and 84 EPC should also be met. In particular, from Figure 5 in combination with page 8, lines 1 to 5 it must be assumed that the expression "temple piece 15'" relates to the whole precursor form of the temple only lacking the final annealing and polishing steps.

Furthermore, a skilled person would not be misled by the wording of page 7, lines 23 to 27 since this passage does not definitely rule out the continued existence of a wire portion having the initial diameter

of 1.4 mm. A skilled person would rather understand the wording to include a thicker end portion as an option, such thicker portions being conventionally used for connecting the temple to a hinge. Therefore, when considering the temple piece 15' shown in Figure 5, a skilled person would readily identify the distinct temple sections with wire diameters of 1.4, 1.2 and 1.0 mm, respectively.

This interpretation is clearly consistent with the respective functions of the temple sections as apparent from the different process steps. Whereas the optional thickest section serves for connecting purposes, the medium section consists of pseudoelastic material, and the other end section having the smallest diameter is provided for permanently fitting the eyeglass frame to the anatomy of the wearer. Of course, pseudoelastic properties are not desirable for this latter section which therefore is recrystallised by a separate annealing step at relatively high temperature to become normal shape memory material at room temperature. The pseudoelastic properties of the middle section are set by the final heat treatment at 425°C.

A product-by-process definition is justified in the present case since the claimed temple properties as exemplified in Figure 6 of the application for the pseudoelastic section can be obtained by the specific process treatment. Apart from the change of category, the additional method claim 6 corresponds to claim 1 and complies with Articles 123(2) and (3) EPC. This claim should therefore also be admissible.

Having regard to inventive step, the claimed treatment is not disclosed in document D2. From document D4, it can be seen that any annealing treatment is delicate and may strongly influence the material properties. In the cited documents, there is no incitation to

integrally form a temple end portion suitable for head adjustment. Such an adjustment could be achieved in various ways, e.g. by joining a plastic earpiece to a pseudoelastic temple. The claimed solution has the advantage of forming an adjustable end section from the same material by modifying the material properties in a simple way. An integral temple piece consisting of shape memory alloy and having different material properties in its distinct sections cannot be considered obvious from the available prior art.

VIII. The respondent did not file any counterarguments.

Reasons for the Decision

1. Article 123 EPC

1.1 Claim 1 now under consideration corresponds to claim 1 as granted, additionally including all the method steps for temple formation disclosed at page 7, line 22 to page 8, line 4 of the original application documents. Omission of the final polishing step at page 8, lines 4/5 is considered justified since it is not essential for achieving the desired material properties. Therefore, claim 1 meets the requirements of Articles 123(2) and (3) EPC.

1.2 Additional method claim 6, in its present version basically submitted before the oral proceedings as a further auxiliary request annexed to the appellant's letter of 16 June 1997, is the process equivalent to product-by-process claim 1 and therefore also admissible under Article 123(2) EPC. The change of

category does not offend against Article 123(3) EPC since the scope of protection has been restricted to a specific fabrication process and its direct product (see, e.g., decision T 762/90 of the present Board). In consequence, claim 6 also complies with Article 123 EPC.

Moreover, in the present case the Board considers the addition of a process claim as admissible under Rule 57a EPC since it arises in relation to the restriction of claim 1 to a corresponding product-by-process definition.

1.3 Dependent claims 2 to 5 correspond to claims 2 to 5 as granted and are as well admissible.

2. *Articles 83 and 84 EPC*

2.1 The additional process features of independent claims 1 and 6 are in substance literally derived from said passage of the description disclosed at page 7, line 21 to page 8, line 4 of the original application documents. The Board agrees with the appellant that the overall disclosure is sufficiently clear and complete for the process to be carried out by a skilled person. In particular, the appellant's interpretation of the different temple sections shown in Figure 5 and their respective functions plausibly corresponds to what an expert would deduce from said passage despite some ambiguities.

In consequence, claims 1 and 6 are considered clear as well.

2.2 In the present case, the Board considers the product-by-process form of claim 1 admissible since there is no other information available in the application which could be directly used for a different, structure-based definition (see T 150/82, OJ EPO 1984, 309).

3. *Articles 54 and 56 EPC*

3.1 In document D1 coming closest to the subject-matter of claim 1, there is described an eyeglass frame comprising all the features of the precharacterising portion of claim 1 (see D1, Figures 1 and 2C and associated text: eyeglass frame 12; bridge means 18; pair of lens fixing rims 14, 16; temples 20, 22; temples made of an alloy having an elasticity defined by the claimed stress-strain curve, see page 9, last paragraph and Figure 2C).

The subject matter of claim 1 differs from this prior art by the features of the characterising portion, i.e. in particular by the use of a specific Ti-Ni-V alloy having pseudoelastic properties between 0 and 20°C, and by the process features leading to a specific temple piece. Document D1 generally refers to Ni-Ti alloys in this context and mentions an effective useful temperature range of as little as 20°C for those materials, without however indicating the upper and lower temperature limits (see D1, page 2, line 6 to page 3, line 19).

Furthermore, a pseudoelastic temple piece having an integrally formed end portion processed to have shape memory properties and thus good adjustability is not disclosed in D1. According to D1 (see page 17, lines 1 to 13), shape memory alloys either having "optimised elasticity" (i.e. a combination of pseudoelasticity and superelasticity achieved by work-hardening; see D1,

page 12, second paragraph and Figure 2H) or "elastic & memory" properties (i.e. a combination of springy elastic behaviour and shape-memory characteristics below M_s , achieved by work-hardening and partial annealing; see D1, page 4, second paragraph and Figure 2G) are provided for temples, said alloys of the temples, however, having uniform properties. The formation and properties of the temple earpieces shown in Figures 1 and 15 of D1 are not specifically described in this prior art.

3.2 The remaining documents being more remote from the claimed subject matter (in particular, documents D2 and D4 do not relate to eyeglass frames and document D3 does not disclose pseudoelastic temples consisting of Ti-Ni-V alloy), the eyeglass frame according to claim 1 is novel with respect to the available prior art (Article 54 EPC).

3.3 From document D1, it is apparent that pseudoelasticity only exists in a limited temperature range in the austenitic state (see D1, Figures 2A and 2C: $M_s < T < M_d$), i.e. pseudoelastic alloys have to be selected with regard to the desired service temperature range which according to D1 should be from about 10° to 40°C (see D1, page 12, lines 14 to 20). Furthermore, the mechanical properties of shape-memory alloys are very dependent upon processing and temperature (see D1, page 9, lines 18 to 22).

The technical problems to be solved by the claimed subject matter with respect to the closest prior art can therefore be seen in

- (i) selecting and working a specific alloy for temples so that the pseudoelastic temperature range is adjusted to include the service temperature range of 0 to 20°C (see also the original application

documents, page 2, lines 21 to 26); and

- (ii) providing simple and good adjustability of pseudoelastic temples to the wearer's anatomy (for the effect of the specific temple formation steps see also item 3.5 below).

Both of these problems must be considered conventional in the field of eyeglass frames consisting of pseudoelastic material.

- 3.4 In the Board's opinion, the solution to problem (i) would be obvious to a skilled person taking account of document D2.

In view of the "high tech" character of the present eyeglass frames based on sophisticated solid-state material properties as apparent from document D1, the Board is convinced that a correct assessment of a skilled person's abilities must go beyond a simple optician's comprehension and necessarily include the knowledge of a solid-state specialist, i.e. physicist or metallurgist, forming, e.g., a small team with the normal frame designer. Knowing the desired temperature range for the temple elasticity, such a specialist would employ the teaching of document D2 disclosing an alloy made of Ti-Ni-V comprising V at 0.25 to 2.0 at.% and the balance of Ni and Ti with an atomic ratio Ni/Ti of 1.02 to 1.06, said elasticity existing over a temperature range of 0 to 20 °C (see D2, page 2, last paragraph to page 3, second paragraph and page 5, second paragraph of the English translation).

Moreover, in document D2 (see page 3, last paragraph above Table 1 to page 4, first paragraph) there is described a method of forming a wire of said alloy comprising the steps of

- (a) preparing an ingot of said alloy by use of high frequency vacuum decomposition;
- (b) heat treating said ingot at 900°C for two hours;
- (c) working said ingot into a wire having a diameter of 1.3 mm by hot hammering, hot rolling and cold drawing;
- (d) thereafter cold working said wire to have a diameter of 1.0 mm **without** annealing (as the appellant has correctly pointed out during the opposition proceedings (see the minutes of the oral proceedings dated 20 June 1995), the English translation of D2 is erroneous in this respect); and
- (e) heat treating said wire at 400, 450 and 500°C, respectively, for 30 minutes.

These method steps correspond in substance to those set out in claim 1 only differing from the prior art by somewhat larger wire diameters of 1.4 mm and 1.2 mm in steps (c) and (d), and slightly different annealing conditions in step (e) (425°C for 15 minutes).

Hence, when employing the teaching of D2 for an obvious solution to problem (i), the solid-state specialist would also make use of method steps (a) to (e) which therefore cannot contribute to patentability.

3.5 However, the subject matter of claim 1 differs substantially from the prior art as disclosed in D2 by the additional method steps of

- (d₁) annealing a portion of the cold worked wire at 750°C for 10 minutes; and

(d₂) thereafter rolling said portion to achieve a further thickness reduction (from 1.2 to 1.0 mm) between steps (d) and (e).

As the appellant plausibly and uncontestedly pointed out in the respective oral proceedings before the Opposition Division and the present Board, these additional steps lead to the formation of a recrystallised temple end portion having no longer pseudoelastic properties but showing the shape memory effect which as such is already described in document D1 (see Figures 2B and 2G). By exploiting the shape memory effect for the temple end portions, the eyeglass frame can be fitted to the head of the person wearing it. In particular, the end portions can be permanently deformed and remain so deformed until they are heated to recover the original undeformed shape which - after cooling - can be deformed again. Thus, steps (d₁) and (d₂) provide a solution to the above-mentioned problem (ii).

3.6 In the available prior art, there is no indication of such a temple design. Document D1 does not give any details about the temple earpiece shown in the Figures nor is this the case in document D3. Documents D2 and D4 do not relate to temple formation but to general alloy technology, and therefore cannot give any hint with respect to temple adjustability.

Moreover, the Board does not consider the claimed solution to be of the type of workshop modifications falling within a skilled person's competence. Since various possibilities of designing the temple end piece exist in the field of pseudo- or superelastic eyeglass frames (see, e.g., Figure 1 of document D3 apparently showing a separate temple end portion of completely different deformed material), the claimed solution would not readily occur to a skilled person. This

solution is specific in that the temple end portion has to be treated separately without affecting the pseudoelastic properties of the adjoining temple section, and meets the requirements of adjustability in a simple and effective way.

Since starting from another one of the above-cited documents would manifestly not lead to a different result in an assessment of inventive step, the subject matter of claim 1 is not obvious from the available prior art (Article 56 EPC).

- 3.7 Device claim 1 being patentable, patentability of corresponding method claim 6 need not be separately examined.

Dependent claims 2 to 5 concerning specific embodiments of claim 1 are also allowable.

However, the description of the patent specification needs adaptation to the amended version of claims, which shall be carried out before the first instance.

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 in amended form on the basis of claims 1 to 6 filed at the oral proceedings, with the description to be adapted and the drawings as granted.

The Registrar:

E. Görgmaier

The Chairman:

E. Turrini