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Datasheet for the decision of 9 July 2015

Case Number: T 1632/12 - 3.3.06

Application Number: 07856179.2

Publication Number: 2094890

IPC: D01F6/80, D02G3/04, D06M15/285

Language of the proceedings: EN

Title of invention:
METHOD FOR OBTAINING HIGH-TENACITY ARAMID YARN

Patent Proprietor:
Teijin Aramid B.V.

Opponent:
E.I. DU PONT DE NEMOURS AND COMPANY

Headword:
High-tenacity aramid yarn/TEIJIN ARAMID

Relevant legal provisions:
EPC Art. 52(1), 54, 56
RPBA Art. 13(3)

Keyword:

Opposition Division's decision to admit re-introduction of a previously withdrawn request - no reason to reverse
Auxiliary claim request filed at the oral proceedings - admitted (yes)
Novelty - (no) unambiguous disclosure in the prior art (Main request)
Inventive step - (no) obvious method (Auxiliary Request)

Decisions cited:

Catchword:

Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 1632/12 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 9 July 2015

Appellant: (Opponent)	E.I. DU PONT DE NEMOURS AND COMPANY 1007 Market Street Wilmington DE 19898 (US)
Representative:	Morf, Jan Stefan Abitz & Partner Patentanwälte mbB Postfach 86 01 09 81628 München (DE)
Respondent: (Patent Proprietor)	Teijin Aramid B.V. Westervoortsedijk 73 6827 AV Arnhem (NL)
Representative:	Heimann, Anette CPW GmbH Kasinostrasse 19-21 42103 Wuppertal (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 9 May 2012 rejecting the opposition filed against European patent No. 2094890 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	B. Czech
Members:	P. Ammendola
	P. Schmitz

Summary of Facts and Submissions

I. This appeal is against the decision of the Opposition Division rejecting the opposition filed against European patent No. 2 094 890.

II. Claims 1 and 10 of the patent as granted read:

"*1 . A method for obtaining high-tenacity aramid yarn, wherein the yarn is made of a copolymer obtained from a mixture of monomers comprising 5(6)-amino-2-(p-aminophenyl)benzimidazole, an aromatic para-diamine, and an aromatic para-diacid, wherein the yarn is heated in at least two process steps, characterized in that in a first step the yarn is heated at a temperature of 200 to 360 °C at a tension of at least 0.2 cN/dtex, followed by a second step wherein the yarn is heated at a temperature of 370 to 500 °C at a tension of less than 1 cN/dtex.*"

"*10. A multifilament aramid yarn having a tenacity of at least 2500 mN/tex wherein the yarn is made of a copolymer obtained from a mixture of monomers comprising 5-(6)-amino-2(p-aminophenyl) benzimidazole, an aromatic para-diamine, and an aromatic para-diacid wherein at least 12.5 mole% of the monomers is 5-(6)amino-2-(p-aminophenyl) benzimidazole, less than 20 mole% is 2-chloro-p-phenylenediamine, and wherein the yarn has a sulfur content of at least 0.1 wt%.*"

III. With its notice of opposition, the Opponent had requested revocation of this patent, *inter alia* on the ground of lack of inventive step (Article 100(a) EPC).

It referred *inter alia* to the following prior art documents:

D1 = V.N. Sugak *et al.*, Fibre Chemistry, Vol. 31, No. 1, 1999, pages 8 - 13, and

D2 = US 5,646,234 A.

IV. With letter of 2 March 2011 the Patentee had filed an amended set of claims (below the **claims of 2011**). It stated on page 1 of this letter (lower half):

"Patentee requests rejection of the opposition and maintenance of the patent with a new main request as submitted with this letter, and if the Opposition Division intends to decide differently oral proceedings under Art 116 EPC.

Patentee submits the following:

1. The claims as granted are withdrawn and a new set of claims is submitted to replace the claims as granted. The only difference with the claims as granted is that in claim 10 the tenacity of at least 2500 mN/tex has been amended to at least 2750 mN/tex."

V. The claims of 2011 differ from the claims as granted only in that in independent claim 10, the feature "*of at least 2500 mN/tex*" was amended to read "*of at least **2750** mN/tex*" (emphasis added by the board).

VI. With letter of 17 February 2012, the Opponent had commented, *inter alia*, on the issue of inventive step in respect of claim 10 of 2011.

VII. At the hearing before the Opposition Division the

Patentee had requested again the rejection of the opposition (as Main Request), i.e. that the patent be maintained as granted. It also requested the Opposition Division to consider the claims of 2011 as Auxiliary Request.

VIII. The Opposition Division decided to re-admit, as Main Request, the Patentee's request to reject the opposition *inter alia* because (see point 2 of the decision under appeal):
"... Whilst a 'withdrawal' of the granted claims was indicated in item 1. of the Proprietors' letter of 02.03.2011, this action does not amount to an unconditional abandonment of the subject-matter covered by the granted claims. Hence, the Opposition Division does not recognize any legal basis and/or obligation to reject the reinstatement of these claims. ln particular, the Opponents were not confronted with a total new, surprising situation which could represent a disadvantage, i.e. the Opponents should have been in the position to properly defend their case..".

The Opposition Division also found *inter alia* that claim 10 as granted was not anticipated by the yarn samples disclosed in D1, Table 2, that had been prepared from the copolyamide labelled as sample No. 1. Since this copolyamide processed into said sample had been "provided by V.B. Glazunov" (footnote in Table 1 of D1) in a not further specified form, sample No. 1, it could possibly have been synthesized by Glazunov and provided to the authors of document D1 in the form of the solution (dope) in organic solvent directly resulting from the synthesis of the copolymer. Thus, the Opposition Division concluded that Dl did not include clear information showing that the copolyamide of sample No. 1 had actually been dissolved in sulfuric

acid and then spun into fibers from this dope. Therefore, there was no direct an unambiguous disclosure in D1 of a sulfur content in the allegedly novelty-destroying fibers.

IX. In its statement of grounds of appeal the Appellant (Opponent) argued that the Opposition Division had erred in re-admitting the request of the Patentee to reject the opposition. It also disputed the findings of the Opposition Division that the subject-matter of claim 10 as granted was novel and that subject-matter of granted claim 1 involved an inventive step. In two further letters, the Appellant provided further arguments in support of its objections raised *inter alia* on the basis of documents D1 and D2.

X. In its reply to the Appellant's statement of grounds, the Respondent (Patent Proprietor) maintained that it was allowed to defend the patent as granted (Main Request) and rebutted the Appellant's novelty and inventive step objections.

XI. Oral proceedings were held before the Board on 9 July 2015.

XII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed and that the patent be maintained as granted or alternatively, on the basis of the Auxiliary Request filed with letter dated 2 March 2011 before the opposition division (claims of 2011, see V *supra*).

XIII. The arguments of the Appellant may be summarised as follows.

Admissibility of the Respondent's Main Request

As regards the re-admittance by the Opposition Division of the request of the Respondent to reject the opposition, the Appellant stressed in writing that this request had already been explicitly and unconditionally "withdrawn" with the letter of 2 March 2011 (see IV, *supra*). This was a clear procedural statement for which no interpretation was necessary. It was rather to be considered similarly to an expression stating the withdrawal of a patent application, i.e. as a final and irrevocable procedural statement. Thus, it was no longer possible for the Respondent to thereafter seek maintenance of the patent as granted, and for the Opposition Division to thereafter allow the re-introduction of a request to this end.

Admissibility of the Respondent's Auxiliary Request

The Appellant also disputed the admissibility of Respondent's Auxiliary Request, considering that it was submitted for the first time at the oral proceedings before the Board, i.e. at a very late stage. It explicitly stated, however, to be prepared to comment on the patentability of these claims as well.

Novelty - claim 10 as granted

The Appellant considered the yarn defined in claim 10 as granted to be anticipated by the prior art yarn samples Nos. 1.b, 1.c and 1.e disclosed in D2 (page 10, Table 2). All these samples were explicitly made from a copolyamide of 5(6)-amino-2-(p-aminophenyl)

benzimidazole (below **DAPBI**) as required by granted claim 10, and displayed fiber strengths (below also indicated as **tenacity**) of at least 250 cN/tex (i.e. at least 2500 mN/tex) as also required by claim 10.

Despite the lacking indication in this document of the sulfur content of these samples, the corresponding requirement in claim 10 was certainly fulfilled because these samples had certainly been spun, as all other samples referred to in Table 2, from a sulfuric acid dope. This was apparent from the whole content of D1.

The Appellant disputed the Respondent's statement that the drawing speeds used in the allegedly novelty destroying examples were too low compared to speeds conventionally used in any industrial plant for spining sulfuric acid dopes. Thus, it also disputed the Respondent's conclusion that the skilled person reading Table 2 would consider such low drawing speed as clear evidence for the use an organic solvent-based spinning dope. For the Appellant, the reference in Table 1 to viscosity values "after synthesis", measured in sulfuric acid, rather indicated that the authors of D1 must also have been in possession of the synthesized copolyamide of sample No.1 in the form of a solid but not, however, already as spun fibres (herein the copolyamide in any solid form other than fibres is indicated as **"after synthesis" solid**). They had most likely been directly provided by Glazunov with a sample in such form, but they would in any case have recovered the solid copolyamide from any dope possibly obtained from Glazunov.

Inventive step - claim 1 of the Auxiliary Request

The Appellant argued *inter alia* that the claimed method

was obvious when starting from D1 as the closest prior art, more particularly from the methods disclosed in D1 as regards the preparation of samples Nos. 3.e and 3.f reported in Table 2. Both these preparation methods resulted in yarns made of a copolyamide of DAPBI according to the definition of the copolymer in claim 1 at issue, and involved subjecting the spun fibres to a thermal drawing step at temperatures of 250 or 300°C, respectively (see Table 2 of D1), and, thereafter, to a further heat treatment. From the data in Table 2 of D1 it was apparent that this last step resulted in an increase of tenacity well above that indicated in paragraph [0013] of the patent in suit as the technical effect of the second heating step of the claimed method. Hence, the claimed method represented just an alternative to the one according to the closest prior art.

The Appellant stressed that the elongations produced during the thermal drawing reported for these samples in Table 2, were certainly indicative of the application in such step of a tension of more than "*0.2 cN/dtex*". The final treatment step applied to these sample yarns was described at the end of the second paragraph on page 10 of D1 as **treatment** "with **heat** with **n**o **t**ension when the samples were wound on spools" (below **NT heat treatment**). It was thus clearly a heating step, during which "no tension" at all had to be applied on the yarn. In particular, even in assuming *arguendo* that the above-cited passage meant that the second heat treatment had actually been carried out when the yarn was already wound on the bobbins, it was certainly possible to wound the yarn very loosely thereon and, thus, to carry out the second heat treatment with "no tension" also "on the spools", i.e.

without generating a tension of 1 cN/dtex or more due to a shrinkage of the wound-up fibres.

Accordingly, the only feature of claim 1 at issue that was not explicitly mentioned in D1 or implied by the description of the methods used according to D1 for preparing sample yarns Nos. 3.e and 3.f was the temperature used in the NT heat treatment.

The Appellant argued that identifying which temperatures in the NT heat treatment allowed to achieve an increase in tenacity comparable to that reported in D1 for samples 3.e or 3.f only required routine optimization of temperature vs. time.

Moreover, document D2 contained an explicit general teaching in column 6, lines 3 to 13, prompting the skilled person starting from D1, and also aware of the fact that the aimed-for tenacity increase was certainly also associated to an enhancement of the crystalline structure in the fibres, to also explore, for the NT heat treatment in D1, temperatures that were higher than those used in the preceding thermal drawing step. The Appellant stressed that the general character of such teaching in D2 was clearly expressed and also self-evident to the skilled person, who already knew that the annealing of fibres such as the aramid fibres at high temperatures produced an increase of the crystalline regions in the fibres and, thus, also in their tenacity. Thus, it rejected as unjustified any restrictive interpretation of the cited passage in D2 made by the Respondent in view of the features of the methods actually exemplified in D2. Hence, the method of claim 1 of the Auxiliary Request was just an alternative to the prior art methods of D1 that was

obvious in view of the combination of D1 with D2. Accordingly, this request was not allowable either.

XIV. The arguments of the Respondent may be summarised as follows.

Admissibility of the Main Request

The Opposition Division had made no error in re-admitting the request for maintenance of the patent as granted because this latter had not been unconditionally abandoned with the letter of 2 March 2011, but rather just replaced by an almost identical set of claims, only differing for a single amendment in claim 10.

Admissibility of the Auxiliary Request:

The Respondent stated to have only realized at the hearing before the Board that the Auxiliary Request finally pending before the Opposition Division had regretfully not already been re-mentioned in the written submissions filed during the appeal proceedings. This late request was, however, admissible due its very limited difference in respect of the granted claims and given that during the opposition proceedings the Appellant had already commented in writing on the relevance of this difference regarding the patentability issues at stake.

Novelty - claim 10 as granted:

The Respondent argued that the yarns defined in claim 10 were novel vis-à-vis samples Nos. 1.b, 1.c and 1.e of Table 2 of D1. As also correctly found by the Opposition Division, there was no clear and unambiguous

teaching in this document that they had been spun from a sulfuric acid dope and that, therefore, they necessarily complied with the requirement of claim 10 regarding the sulfur content.

Already in view of the indication in Table 1 that that starting copolyamide sample No. 1 had been "provided by V.B. Glazunov" it was possible that said copolyamide had not been given in dry form to the authors of D1. Hence, the relevant fibre samples Nos. 1b, 1c and 1e had possibly been spun directly from the organic solvent dope in which the copolyamide had been synthesized.

This conclusion was even more plausible considering the drawing speeds used according to the relevant examples, which were too low compared with speeds conventionally used in any industrial plant to spin sulfuric acid dopes. The reported low drawing speed was thus further evidence clearly corroborating that the relevant samples could have been spun form an organic solvent dope.

Inventive step - claim 1 of the Auxiliary Request:

The Respondent also found the methods used in document D1 for preparing the yarn samples Nos. 3.e and 3.f to represented the closest prior art.

It had initially objected that:
- these prior art methods did not mention the tension used during thermal drawing and allowed for the final heating step to be carried out when the yarn was already wound onto the bobbins and, thus, subject to "shrinking", thereby not necessarily implying a tension of "*less than 1 cN/dtex*" in the NT heat treatment,

and
- that the claimed method achieved an improvement of tenacity, described in paragraph [0013] of the patent in suit, that had not been proven by the Appellant to also be achievable according to the closest prior art.

However, during the debate at the hearing before the Board the Respondent ultimately conceded that the requirements expressed in claim 1 at issue as to the tension to be applied in each step were also implied by the relevant disclosure of the closest prior art as disclosed in D1. In particular, the Respondent did not dispute that even if the final heat treatment in this prior art had actually been conducted by heating the yarn already wound onto the bobbins, this did not necessarily imply subjecting the yarn to substantial tension, since the yarn could have been wound very loosely onto the spools before being subjected to the heating. It also conceded that the statement in paragraph [0013] referred to the effect of the second step of the claimed method (the heating at no or very low tension) and, thus, that the same effect was already achieved by the NT heat treatment in the methods of D1. This was also apparent when comparing the tenacities measured at the end of the thermal drawing and those achieved after the final NT heat treatment, as also reported for samples Nos. 3.e and 3.f in Table 2.

At the oral proceedings, the Respondent therefore also accepted that the technical problem solved vis-à-à the closest prior art was the provision of a further method for providing high-tenacity aramid yarns and that the only feature of claim 1 at issue that was not explicitly mentioned in D1 or implied by the description of the methods used for the preparations of

samples 3.e or 3.f in Table 2 of D1, was that the temperature to be used in the NT heat treatment was required in claim 1 to be "*of 370 to 500 °C*".

The skilled person seeking to solve this technical problem by completing the information provided in D1 could at most contemplate to use, in the NT heat treatment, temperatures disclosed in D1 as being useful for thermal drawing, i.e. for sample 3.e 250 °C, and for sample 3.f 300 °C. The skilled person would have no reason for setting the NT heat treatment at much higher temperatures, and in particular at temperatures even higher than the maximum temperature of 360 °C disclosed in D1 for the thermal drawing step. Thus D1 *per se* did not render obvious to even explore the range of 370 to 500 °C for the possible temperatures of the NT heat treatment of D1.

Also the proposed combination of D1 with the general statement at column 6, lines 3 to 13, of D2, would not motivate the skilled person to take into consideration such very high temperatures for the NT heat treatment, for the following two reasons:

Firstly, as evident from the examples in D2, the disclosure of this document only concerned multiple drawing treatments of fibres, under unknown tensions, at temperatures much higher than those mentioned in D1 for the thermal drawing.

Secondly, the samples in Table 2 of D1 marked by an asterisk, were explicitly indicated to have become rigid during the NT treatment due to "partial melting of the fibres". This further demotivated the skilled person from considering applying to the methods of D1

much higher temperatures, merely based on the vague indication in D2 that different kinds of heat treatments of fibres at very high temperatures could optionally be followed by a further heating step at even higher temperatures.

Hence, the Appellant's line of reasoning was incorrect because the skilled person would not combine D1 with D2 and, thus, would not arrive from such combination to the subject-matter of claim 1 of the Auxiliary Request in an obvious manner.

Reasons for the Decision

Procedural issues

1. Admissibility of the Respondent's Main Request

1.1 The Appellant requested the Board to establish that the Opposition Division had erred in deciding to admit the re-introduction, as the Patentee's Main Request, of the request to maintain the patent as granted and in subsequently considering the issues of novelty and inventive step with regard to the claims as granted.

1.2 According to the Appellant the granted claims had been withdrawn with the letter of 2 March 2011, with a clear explicit statement that was as irrevocable as, for instance, a withdrawal of a patent application (ses above section IV and XIII). Accordingly the Main Request could no longer be pursued in the procedure.

1.3 The Board confirms, however, the view taken by the Opposition Division that the indication in the letter of 2 March 2011 that the claims as granted are

"withdrawn" (see Sections IV and VIII, *supra*) is not to be understood as an unconditional abandonment, i.e. as an unconditional and irreversible decision of the Respondent to no longer pursue protection for certain subject-matter. For the Board, the quoted expression merely represents an amendment of the Respondent's requests, i.e. a replacement of a claim request by another one.

1.3.1 The Board sees also no reason for attributing similar meanings to the word "withdrawn" in, on the one hand, the context of amending the wording of claims (as in the present case) and, on the other hand, in the totally different context of the statement of an applicant that it no longer wishes to pursue a patent application as a whole which then terminates the procedure. As these are substantially different statements, the meaning of one does not have any necessary implication on the meaning of the other.

1.3.2 Thus, the subject-matter of the Main Request is still pending and can still be pursued in the proceedings.

2. Admissibility of Respondent's Auxiliary Request

2.1 At the oral proceedings before the Board the Respondent submitted for the first time in these appeal proceedings the Auxiliary Request to maintain the patent in amended form on the basis of the claims of 2011. The Appellant disputed the admissibility of this request in view of its late submission. The admissibility of this request into the proceedings is thus subject to the board's discretion (Article 13(3) RPBA).

2.2 In deciding on the admissibility of this request, the

Board considered the following specific aspects of the case:

i) The claims of 2011, i.e. according to the Auxiliary Request at issue, only differ from the granted ones in terms of the minimum tenacity value of the yarn according to claim 10 (see section V *supra*);

ii) The Appellant had already presented in its letter of 17 February 2012, during the opposition proceedings (see Section VI *supra*), its objections to the claims of 2011 and these latter were pending as the Respondent's Auxiliary Request at the hearing before the Opposition Division.

iii) The Appellant explicitly stated at the hearing before the Board that it was prepared to comment on the allowability of the claims according to this request.

2.3 Taking into account the above the Board decided to admit the Respondent's Auxiliary Request into the proceedings (Article 13(3) RPBA).

Respondent's Main Request (patent as granted)

3. Novelty - Claim 10

3.1 The Appellant argued that the subject-matter of this claim was anticipated by each of the DAPBI-based polyaramide yarn samples Nos. 1.b, 1.c and 1.e reported in D1 (in Table 2 on page 10), since these samples all displayed a "fibre strength" of at least 250 cN/tex, i.e. a yarn "*tenacity of at least 2500 mN/dtex*" as required according to claim 10).

3.2 It is common ground between the Parties that the sole

feature of claim 10 that is not explicitly disclosed by these prior art yarn samples is their sulfur content, if any. It is, however, also common ground that these yarn samples would necessarily have "*a sulfur content of at least 0.1 wt%*" if they had been spun from a sulfuric acid dope.

3.3 Therefore, the relevant explicit and implicit disclosure in D1 as to the spinning solutions actually used for spinning samples Nos. 1.b, 1.c and 1.e needs to be considered. Such disclosure is contained in the last paragraph on page 8 of D1, and in particular in the form of the statement "We used 22% LC solutions of the copolyamides in 99.8% sulfuric acid at 70°C for spinning the fibres".

3.4 The Respondent stressed at the oral proceedings that this statement can be considered as the description of what the authors of D1 had done in preparing all the other samples reported in Table 2, i.e, samples Nos. 2. a to 7.b. It argued that the same could not, however, be presumed for samples Nos. 1.b, 1.c and 1.e. This was apparent from Table 1 on page 9 of D1 listing, besides co-monomer ratios, intrinsic viscosity values determined in a solution of sulfuric acid "after synthesis" and "in fibre", respectively for copolyaramide samples Nos. 1 to 7.

3.4.1 As regards the copolyaramide sample No. 1, from which the yarn samples 1.b, 1.c and 1.e described in Table 2 had been derived, the corresponding express indication in the footnote of Table 1 reading "** The sample was provided by V.B. Glazunov" meant that it had not been prepared by the authors of D1.

3.4.2 Thus, in the Respondent's opinion, it was possible that

the copolyaramide sample No. 1 had been "provided by V.B. Glazunov" in the form of a solution in an organic solvent, rather than in the form of an "after synthesis" solid. The Respondent argued that it was indeed possible, as also found by the Opposition Division, that the copolyaramide of sample No.1 had been synthesized by V.B. Glazunov in organic solvent(s), thereby forming a dope from which the copolyaramides fibres could have been directly spun. Thus, it was at least possible that the provided copolyaramide sample No. 1 was not in an "after synthesis" solid form, but dissolved in an organic solvent and that the authors of D1 had thus directly spun all the yarn samples Nos 1.a to 1.e of Table 2 from such dope, and not from a sulfuric acid dope.

3.4.3 Moreover, Table 2 reported the use of a low drawing speed of 2.8 m/min in the preparation of yarn samples Nos. 1.b to 1.e. According to the Respondent, this speed was much lower than the speeds conventionally used in industrial plants for spinning aramid fibres from sulfuric acid dopes. It pointed to the high drawing speed of 15 m/min, allegedly comparable to said conventional drawing speeds, which is reported in Table 2 for all other yarn samples fabricated from copolyaramides prepared by the authors of D1 and definitely spun from sulfuric acid dopes. Hence, the Respondent considered that the skilled person reading Table 2 would understand that the yarns Nos. 1.a to 1.e may have been spun from an organic solvent dope.

3.5 The Board notes, however, the undisputed fact that there is no explicit indication in D1 that samples 1.a to 1.e could have been spun from an organic solvent dope.

3.5.1 Moreover, even assuming merely for the sake of argument but in favour of the Respondent, that the copolyaramide sample No. 1 had been synthesized in organic solvent and provided by V.B. Glazunov to the authors of D1 as the resulting organic solvent dope, this would not *per se* necessarily exclude that the yarns of samples Nos. 1.a to 1.e could actually have been spun from sulfuric acid dopes, for instance after recovering the "as synthesized" solid copolyaramide of sample No. 1 from the organic solvent dope.

3.5.2 Quite the contrary, weight must be given to the fact that D1 is consistently qualifying the whole content of its disclosure as a study on the fabrication of fibres from sulfuric acid solutions and on the increment of strength (in terms of yarn tenacity) that can be achieved by post-spinning heat treatments with and without tension. Reference is made, in particular, to the experimental details (reported in Tables 1 and 2 and the corresponding description from the last paragraph on page 8 to the second paragraph on page 10), the title, the abstract and the third last paragraph on page 12 of D1. All these parts of D1 coherently imply that the samples described in Table 2 are considered within the framework of a scientific study on the effects of heat treatments on fibres of different chemical composition, but being all spun from sulfuric acid solutions. Indeed, the maximum tenacity of 266 cN/tex reported in Table 2 is the one measured for sample No. 1.b and is the same mentioned in the abstract as the upper limit for the achieved increment in strength of the fibres.

3.5.3 Moreover, and even more importantly, the last but two paragraph on page 12 refers to the same maximum value of 266 cN/tex. More particularly, it is stated in said

paragraph that "[a] comparison of the indexes of the finished fibres based on copolyamides of different composition (Table 2) showed a decrease in the strength from 250-266 to 230-240 cN/tex in going from 70/30 composition to 25/75, 25/50/25, ...".

3.5.4 For the Board, the various parts of D1 quoted above indeed imply that the study has been specifically designed to determine the effect on yarn tenacity of changes in the nature of the copolyaramides used. The experimental comparisons made can only provide sound conclusions as to such effect, if the number of variables possibly influencing the final tenacity of the compared samples is kept to a minimum. This means that the experimental conditions indicated - and in particular also the initial spinning conditions - must be understood to be substantially identical for all samples, unless there are express indications to the contrary. This is the case, for instance, regarding the different drawing speeds used in the first step reported in Table 2.

3.5.5 Already for the above reason alone, the Board is convinced that yarn samples 1.b, 1.c and 1.e were also spun from sulfuric acid dope.

3.6 For the Board, the various further arguments presented by the Respondent in support of its view that D1 did not unambiguously disclose that these samples were indeed spun from sulfuric acid dope, are not convincing either for the following reasons.

3.6.1 Even assuming *arguendo* that the copolyamide sample No.1 had been provided by V.B. Glazunov as an organic solvent dope, the authors of D1 would not have carried out an experiment of rather dubious utility in the

context of the reported study, i.e. directly spinning the fibres from such organic solvent dope, without expressly mentioning this important difference over all the other sample preparations described in the study. Instead, they would rather have recovered from any such provided dope the copolyamide in the "after synthesis" solid form, and then re-dissolved it in sulfuric acid in order to spin therefrom the samples 1.a to 1.e by using the same spinning procedure as for all other samples considered in this study.

3.6.2 The Respondent's view (3.6, *supra*) would also mean that the authors of D1 omitted to indicate, in particular, an important aspect of the process used for the preparation of the yarn No. 1.b that achieves the highest reported fibre strength (266 cN/tex), i.e. of the very same best sample to which both the abstract and the last but two paragraph on page 12 of D1 draw attention.

3.6.3 In addition, considering that table 1 of D1 also reports the intrinsic viscosity measured in sulfuric acid of copolyaramide sample No. 1 "after synthesis" further corroborates the understanding that the authors of D1 had at their disposition the copolyamide of sample No.1 in the form of an "after synthesis" solid, provided as such by V.B. Glazunov or recovered from a solution provided by this person. Indeed, to have available the copolyamide in this form would be necessary in order for the authors of D1 to generate the solution of that copolyamide in sulfuric acid at the same concentration as all the other samples prepared by themselves, so as to obtain the set of comparable intrinsic viscosity values "after synthesis" reported for all samples in Table 1. This also further corroborates the understanding that it is the same

"after synthesis" solid that has been (re)dissolved in sulfuric acid to form the dope from which the yarns Nos. 1.a to 1.e have been actually been spun, using the conditions disclosed in the last paragraph on page 8 of D1.

3.6.4 The Board considers unrealistic the theoretical possibility that the authors of D1 also omitted to indicate in Table 1 that the viscosity value "after synthesis" for copolyaramide sample No.1 had either also been "provided by V.B. Glazunov" or measured by someone else, thereby also omitting to clarify whether the measurement conditions for such "provided" viscosity value were the same as those used by the authors of D1 for measuring the other reported "after synthesis" values (i.e. at the concentration indicated in the footnote of Table 1).

3.6.5 As regards the Respondent's argument that the difference in drawing speeds reported in Table 2 was a clear indication that the samples Nos. 1.a to 1.e had been spun from organic solvent dopes, which were known to only allow for lower speed than sulfuric acid dopes, the Board observes, firstly, that the Respondent provided no evidence or sound theoretical reasoning in support of this allegation which was disputed by the Appellant.

Secondly, the Board holds that even assuming *arguendo* that a skilled person would recognise the spinning speeds reported in Table 2 for the samples Nos. 1.b to 1.e as being lower than those usual for the actual industrial production of aramid fibres from sulfuric acid dopes, still such lower drawing speeds do not *per se* be reasonably understood as being in contradiction with the declared objet of the study (fibres spun from

sulfuric acid dopes).

3.7 In view of the above considerations, there is, in the Board's judgement, absolutely no room for doubting that also samples Nos. 1.b, 1.c and 1.e must have been drawn from a sulfuric acid dope, and that they thus have all the features of the yarn defined in claim 10 as granted, including "*a sulfur content of at least 0.1 wt%*".

3.8 Accordingly, the subject-matter of claim 10 as granted does not meet the novelty requirement (Articles 52(1) and 54 EPC). The ground of opposition under Article 100(a) EPC thus prejudices the maintenance of the patent in suit as granted.

3.9 Hence, the Respondent's Main Request is not allowable.

Respondent's Auxiliary Request - Inventive step - Claim 1

4. The invention

The invention (see patent in suit, paragraph [0001] *inter alia* concerns a method for obtaining high-tenacity aramid yarn, wherein the yarn is made of a copolymer of DAPBI, an aromatic para-diamine and an aromatic para-diacid, and wherein the yarn is heated in at least two process steps.

5. The closest prior art

5.1 It is common ground between the Parties that methods used for producing samples Nos. 3.e and 3.f of Table 2 of D1 represent an appropriate starting point for the assessment of inventive step.

5.2 Considering the similarity of the method of claim 1 at issue and the disclosure of document D1 in terms of the ultimate goal addressed and the features of the yarn treatments, the Board sees no reason to take a different stance.

5.3 More particularly, D1 discloses the following:

5.3.1 The methods used for for preparing sample yarns No. 3.e and 3.f disclosed in D1 achieve respective yarn tenacities ("fibre strengths") of 229 and 220 cN/tex (2290 and 2200 mN/tex), well above the tenacities of e.g. "*1990 mN/tex*" or even "*1950 mN/tex*" reported in Table 6 for some examples according to the invention. The prior art methods thus lead to "*high tenacity*" yarns within the meaning of the paten in suit.

5.3.2 According to Table 2 of D1, the increase in tenacity obtained for samples Nos. 1.e and 1.f between the thermal drawing and the NT heat treatment is in each case larger than the "*200 mN/tex*" increase indicated in [0013] of the patent in suit as being the minimum effect attributable to the second heating step of the claimed method.

5.3.3 Table 2 in conjunction with the second paragraph on page 10 discloses that in the methods according to D1 the yarn undergoes

- a first step of thermal drawing in which the yarn is heated at a temperature of 250°C (example 3.e) or 300°C (example 3.f) under an unspecified tension resulting in an elongation of 2.5% (sample 3.e) or 3.0% (sample 3.f), i.e. under the conditions falling within the terms defining the "*first step*" according to claim 1 at issue, followed by

- a "*second step*" within the meaning of claim 1 at issue, i.e. an NT heat treatment, but at unspecified temperatures.

5.3.4 It also is common ground between the Parties that the unspecified tension values applied in the prior art examples 3.e or 3.f for providing the elongations indicated in Table 2 of D1 must necessarily have been "*at least 0.2 cN/dtex*" as required in claim 1.

5.3.5 As argued by the Appellant and also no longer disputed by the Respondent at the oral proceedings, in these prior art examples the final NT heat treatment was carried out as described at the end of the second paragraph of page 10 of D1, i.e. "with no tension when the samples were wound on spools". In particular, if (as suggested by the Respondent) this heat treatment was carried out when the yarns were already wound on bobbins, still the yarns could had been wound thereon very loosely, i.e. not being subjected to any significant tension upon shrinking during said heat treatment. Hence, it is also no longer in dispute that the second heating step in the prior art methods according to D1 has indeed been carried out under no tension, i.e. at a tension of "*less than 1 cN/dtex*" as required by present claim 1.

6. The technical problem

6.1 On the basis of the considerations under 5.3.1 and 5.3.2, *supra*, the Board concludes that the methods according to the closest prior art (D1; examples 3.e and 3.f) led to high-tenacity DAPBI-comprising copolyaramide yarns, and already achieved the same increase ("improvement") in tenacity mentioned in paragraph [0013] of the patent in suit as being

provided by the method of claim 1 at issue.

6.2 Thus, the technical problem in the light of the closest prior art (D1 - examples 3.e and 3.f) can merely be seen in providing an alternative method for producing DAPBI-comprising copolyaramide yarns with the aimed-for high level of tenacity. This is also common ground among the parties.

6.3 The solution

As a solution to this technical problem, the patent in suit proposes the method for obtaining high-tenacity DABPI-comprising copolyaramide fibres according to claim 1 at issue, which is (further) characterised in particular in that in the second heating step "*the yarn is heated at a temperature of* ***370 to 500 °C***" (emphasis added by the Board).

6.4 Success of the solution

Not least in view of the examples of the patent in suit (see e.g. the process conditions and high tenacity values obtained reported in Tables 2 to 5), the Board accepts that the method according to claim 1 at issue effectively solves the posed technical problem. This was not disputed by the Appellant.

7. Obviousness

7.1 It remains to be decided whether a process according to claim 1 was obvious to the skilled person having regard to the state of the art. A key question to be answered in this respect is whether the skilled person trying to put into practice the methods of D1 would consider carrying out the second NT heat treatment at

temperatures within the range specified in claim 1.

7.2 The Board accepts the Appellant's argument that it would be obvious to the skilled person to solve the posed technical problem by completing the disclosure in D1 as regards the NT heat treatment temperature to be used in the method used for preparing samples Nos. 3.e and 3.f. The skilled person thus has to identify temperatures at which the final NT heat treatment, applied to the yarn during an almost tensionless winding-up, or to the loosely wound spools, leads to a tenacity improvement comparable to that indicated in Table 2 for the relevant samples.

7.3 In doing so, the skilled person would consider information disclosed in the prior art concerning the fabrication of copolyaramide fibres and regarding tenacity-improving heat treatment conditions. D2 is a prior art document relating to *inter alia* the preparation of copolyaramide fibres and containing such information, in particular in the following passage (column 6, lines 3 to 13): "Filaments are generally oriented/drawn to achieve a high mechanical strength and a high modulus of elasticity. The drawn ratio is usually within the range from about 1:6 to 1:20. The drawing temperature is generally between 250° and 550° C, preferably between 300° and 480° C.
The drawing can be carried out in a single step, in two steps or in more steps, in which case a hotplate or a cylindrical heater can be used for the heating. In addition, the drawn filaments can be subjected to a further heat treatment at the same or a higher temperature in order to enhance their crystalline structure" (emphasis added by the Board).

7.3.1 For the Board, the general character of the teaching provided by this passage is evident. Moreover, it is

known to the skilled person and undisputed that the tenacity (also) of aramid fibres is favoured by their crystallinity. Considering in particular the last sentence of the quoted passage, the skilled person could reasonably expect that the tenacity of an aramid fibre would be improved by a NT heat treatment similar to that disclosed in D1 carried out temperatures above those used in the preceding thermal drawing step, because such high temperature treatments are known to "enhance" the crystalline structure of the aramid fibres.

7.3.2 In other words, this indication in D2 induces the skilled person seeking to identify temperatures suitable for providing a tenacity increase in the second NT heat treatment step, to try also temperatures substantially higher than the temperatures used in the preceding thermal drawing steps. In the present case it would also consider and try temperatures substantially higher than 250 °C in the case of sample 3.e, and higher than 300 °C in the case of sample 3.f, and as high as necessary for achieving the tenacity increases reported in D1.

7.3.3 The skilled person is thus directed to also explore temperatures for the NT heat treatment which are above 370 °C (as required in claim 1) provided the desired tenacity increase is achieved, and below a reasonable upper limit, depending also on the fibre material composition (see e.g. the temperatures of up to 550 °C mentioned in D2 with respect to the drawing step). This requires nothing more than simple routine testing. Applying a temperature between 370 and 500 °C in the NT heating treatments, provided it leads to the desired tenacity increase, thereby arriving at a method falling

within the ambit of claim 1 at issue, thus requires no ingenuity.

7.4 The arguments presented by the Respondent in support of the alleged non-obviousness of the claimed process do not convince the Board for the following reasons.

7.4.1 The Board does not accept that D1 would rather deter the skilled person from using temperatures for the NT heat treatment that are higher than those used for the thermal drawing. In this respect the Respondent emphasised that "partial melting of the fibres" was mentioned in the footnote of Table 2 referring to samples Nos. 1.d and 1.e.

For the Board, this footnote says merely confirms that for different copolyaramide fibre compositions certain detrimental phenomena (such as partial melting or even chemical deterioration) may occur upon exposure to temperatures above a certain threshold for sufficient time. In the absence of any information in D1 as to the temperature an the duration of NT heat treatments for the samples referred to in the footnote of Table 2, there is no reason for the skilled person to expect that the partial melting reported for some samples should be expected in general with temperature used in the NT heat treatment being set at 370 °C or above. Hence, the cited footnote in Table 2 of D1 *per se* does not keep the skilled person from considering carrying out the NT heat treatment even at temperatures substantially higher than those disclosed for the thermal drawing steps in D1. *A fortiori*, the skilled person would not exclude the possibility of carrying out the NT heat treatment at a temperature around e.g. 370 °C, which is relatively close to the 360 °C maximum

temperature already used in D1 for thermal drawing the same copolyaramide (see sample No. 3.g).

7.4.2 The Respondent also argued that the skilled person looking for suggestions as to temperatures suitable for carrying out the NT heat treatment in the methods of D1, would disregard the above-mentioned passage in column 6 of D2, because D2 related to methods in which the fibres were subjected to repeated drawing, under unspecified tensions, at temperatures much higher than those used in the thermal drawing step in D1, and in which the further heating at temperatures equal or higher to that of the preceding drawing steps, was only mentioned as optional in the cited passage.

The Respondent considered more particularly that in the methods actually exemplified in D2 the temperatures applied in the (multiple) thermal drawing steps were 400 to
470 °C, i.e. much higher than those of 250 or 300 °C used in the thermal drawing steps in the preparation of samples Nos. 3.e and 3.f of D1.

The Board, however, holds that, as was also observed by the Appellant and not disputed by the Respondent, the skilled person reading D1 is certainly aware of the fact that the tenacity increase achieved during the NT heat treatment of samples Nos. 3.e and 3.f is (also) due to an increase of the crystallinity of the fibres taking place during such treatment. But even assuming *arguendo* that the skilled person is not aware of this known fact, he would certainly immediately appreciate the relevance, also in view of the aimed for high tenacity, of the general teaching in column 6 of D2 reported above, i.e. the general teaching that heating already drawn aramid fibres at high temperatures, even

at temperatures higher than those required for effectively drawing them, may "enhance the crystalline structure" of the fibres. This general teaching appears to be unrelated to the remainder of the conditions used in the treatments disclosed in D2. Hence,for the Board, differences between the methods of D1 and those onto which D2 focuses have no particular bearing on the above-mentioned (see 7.3.1 *supra*) reasonable expectation of the skilled person, that a tenacity-improving NT heat treatment as disclosed in D1 may be carried out at high temperatures, i.e. also above those used e.g. for the thermal drawing of the starting samples in the processes of D1.

7.5 Based on the above considerations the Board concludes that the skilled person starting from the processes for preparing samples 3.e and 3.f as disclosed in D1, and seeking to solve the technical problem posed, would be induced by the information disclosed in D2 and common general knowledge, to try, in the expectation of the sought-after tenacity increase, to carry out the NT heat treatment disclosed in D1 also at higher temperatures within the range defined in claim 1 at issue, and would thereby arrive in an obvious manner at a method falling within the ambit of claim 1 at issue.

7.6 Thus, the subject-matter of claim 1 at issue does not involve an inventive step as required by Article 52(1) in conjunction with Article 56 EPC.

7.7 The Respondent's Auxiliary Request is thus not allowable either.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

D. Magliano B. Czech

Decision electronically authenticated