Datasheet for the decision
of 7 February 2011

Case Number: T 2292/08 - 3.2.03
Application Number: 02715235.4
Publication Number: 1377790
IPC: F41H 5/04, D03D 15/00
Language of the proceedings: EN
Title of invention: Ballistic Resistant Article
Patentee: E.I. DU PONT DE NEMOURS AND COMPANY
Opponent: Teijin Twaron GmbH
Headword: -
Relevant legal provisions: EPC Art. 84, 100(b)
Relevant legal provisions (EPC 1973): -
Keyword: "Insufficiency of disclosure (no) - fixed with an unrealistic result, the skilled person would immediately recognise the deficiency in the cited method and how it should be corrected"

Decisions cited: T 0608/07

Catchword: -
Case Number: T 2292/08 - 3.2.03

DECISION
of the Technical Board of Appeal 3.2.03
of 7 February 2011

Appellant: E.I. DU PONT DE NEMOURS AND COMPANY
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Decision under appeal: Decision of the Opposition Division of the European Patent Office posted 1 October 2008 revoking European patent No. 1377790 pursuant to Article 102(1) EPC.

Composition of the Board:
Chairman: U. Krause
Members: G. Ashley
K. Garnett
Summary of Facts and Submissions

I. European patent EP-B1-1 377 790 relates to a ballistic-resistant fabric. Grant of the patent was opposed on the grounds of lack of novelty, inventive step and sufficiency of disclosure (Articles 100(a) and 100(b) EPC). The Opposition Division concluded that there was a lack of disclosure in respect of all the requests (main and three auxiliary requests) of the Patent Proprietor, and hence decided to revoke the patent. The decision was posted on 1 October 2008.

II. The Patent Proprietor (here the Appellant) filed notice of appeal on 10 December 2008, paying the appeal fee on the same day. A statement containing the grounds of appeal was filed on 10 February 2009.

III. In accordance with Article 15(1) of the Rules of Procedure of the Boards of Appeal, the Board issued a preliminary opinion of the case, together with a summons to attend oral proceedings. In response to the provisional opinion, both parties submitted further arguments and the Appellant filed amended sets of claims as its main request and first and second auxiliary requests. Oral proceedings were held on 7 February 2011.

IV. Claims

Claim 1 of the main request reads as follows (the amendments made to granted claim 1 are underlined):

"1. A flexible ballistic resistant article comprising non-woven fiber ballistic layers and a plurality of
layers of fabric having an areal density of 2 to 10 kg/m², wherein at least two of the layers of fabric are loosely woven, the loosely woven fabric layers comprising fabric woven in a plain weave with a fabric tightness factor of 0.3 to 0.6 and comprising continuous filament yarns with a linear density of at least 200 dtex having a tenacity of at least 10 grams per dtex and a tensile modulus of at least 150 grams per dtex, wherein adjacent loosely woven fabric layers are joined together by means for securing the layers to restrict the movement of the loosely woven fabric layers relative to one another."

Dependent claims 2 to 12 define preferred embodiments of the article of claim 1.

V. Relevant Documents

During the opposition proceedings, the Respondent referred to the following document:


The Appellant cited the following documents during the opposition proceedings:


D15: Table A comparing fabric tightness calculations using D9, D10 and D13 equations to calculate yarn diameter.

The Appellant submitted the following declarations together with the grounds of appeal:


D24: Declaration of Minshon J. Chiou, inventor of the disputed patent, dated 6 February 2009.

In response to the statement of the grounds of appeal, the Respondent submitted the following documents:


D26: Declaration of Prof. Dr.-Ing. Büsgen, Lehr- und
The following document was, amongst others, annexed to D26:


VI. Submissions of the Parties

(a) Article 84 EPC

The Respondent submitted that claim 1 of the main request now defines the article as comprising non-woven fiber ballistic layers. Since none of the examples set out in the description contain such a layer, the skilled person is left in the dark as to what is meant by this feature.

The Appellant referred to paragraph [0031] of the patent specification, where unidirectional and uni-weave are cited as examples of non-woven ballistic layers, and submitted that given this indication the skilled person would have no difficulty in understanding the meaning of this feature.

(b) Article 100(b) EPC

The Opposition Division held that the patent specification does not give the skilled person sufficient information for calculating the fabric tightness factor, an essential feature of the invention.
The objection under Article 100(b) EPC arose because the Opponent/Respondent had tried to reproduce the fabric of example 3 of the patent using the equations presented in the patent, but had failed to achieve the claimed fabric tightness factor.

The Appellant’s Case:

The Appellant argued that the examples given in the patent show the beneficial effects of the invention, so it is clear that these are correct.

In trying to reproduce example 3, the Respondent had obtained a fabric tightness factor of 1.3 compared with the value of 0.6 given in example 3. Such a difference should have suggested to the Respondent that something was amiss with the calculation, particularly when it is known that a factor of 1 is almost impossible to achieve (D1, page 143), and that such a high value did not correspond to the appearance of the actual fabric obtained.

Equations for calculating the fabric tightness factor are set out in paragraphs [0026] and [0027] of the patent. Although paragraph [0026] refers to the widths of the yarns in the fabric, there is no indication in the patent specification as to how these should be derived. However, the skilled person would be aware that a yarn width is usually based on a theoretical calculation rather than actual measurement, particularly as the diameter of the yarn is used as a design criterion for fabrics, and hence is calculated in advance of actually making the fabric. It is also well known that calculated values for yarn diameter
differ from actual measured values (see D9, page 115, left-hand column and D26[3], page 368).

In determining the widths of the yarns by using a microscope to measure actual yarns in the fabric, rather than by the conventional method of calculating theoretical widths, the Respondent had failed to apply the equations in paragraph [0026] correctly. On obtaining such an abnormally high tightness factor, it would have been immediately apparent to the skilled person that the determination of the yarn width was wrong, and it should have been carried out on the basis of a theoretic calculation.

There are several calculation methods known from textbooks, such as that of Grosberg (D10, page 332, first paragraph) and Watson (D26[3], page 369). These both start from the assumption that yarns are cylindrical and, since the yarn is made up of a number of monofilaments, a degree of porosity (0.65 for Grosberg, 0.60 for Watson) is taken into consideration in the calculations. The Appellant suggested that the Respondent had failed to take into account the porosity of the yarn.

By applying one of these methods, such as Grosberg, a value for the fabric tightness factor is obtained which falls within the claimed range, and which corresponds to that given in the patent for example 3 (see D15).

The Appellant submitted that there was no undue burden in choosing a suitable calculation. In the event that a calculated result is outside of the claimed range, another method can be chosen and the same values put
into the new equation. It is not necessary to carry out new experiments and trials.

The Respondent's Case:

The patent specification contains a clear definition in paragraph [0026] of parameters $d_w$ and $d_f$, which correspond to the width of the warp yarn and the fill yarn in the fabric respectively. In addition, the claim itself is directed to a finished product, namely the fabric. The skilled person is thus directed by the patent specification to measuring the width of the yarns in situ in the fabric, and not at a some moment prior to manufacture of the fabric. Given that optical measurement of fiber diameters is not an unusual approach, the method used by the Respondent is reasonable and in line with the teaching of the patent.

The theoretical calculation techniques based on yarn having a circular cross section were developed many years ago for cotton and wool fabrics, and it is not apparent that they are also applicable to advanced fibers as used in ballistic resistant articles. According to the declaration D25, faced with the problem of determining the fabric tightness factor for such a material, the skilled person must measure the yarn diameter in the fabric and then make corrections based on factors such as the number of filaments in the yarn, the cross-sectional shape of the filaments and the construction of the yarn. There is no information concerning these latter variables in the patent specification, meaning that it is not possible to carry out the invention solely on the basis of the information provided in the specification.
Notwithstanding the above, should a skilled person wish to calculate a fiber tightness factor based on theoretical values for the yarn diameter, there are numerous calculation methods at his disposal and no indication in the patent of a suitable one; hence the skilled person faces an onerous task. The values cited in D24 (a declaration cited by the patentee) and those presented in tables 1 and 2 of declaration D26 show that there are considerable differences, up to 20%, between diameters obtained by the various methods of calculation, so that the different methods cannot be seen to be equivalent.

The fact that the different methods of calculation do not lead to the same results means that there is ambiguity at the edges of the claimed range - whether a woven material lies within the scope of the claim merely depends on the method chosen for calculating the yarn diameter. Given that the skilled person is left to select an appropriate calculation, it is not possible to carry out the invention with any degree of certainty.

VII. Requests

The Appellant requested that the decision under appeal be set aside and the case be remitted to the Opposition Division on the basis of the main request, alternatively the first or second auxiliary requests, all filed with the letter dated 2 September 2009.

The Respondent requested that the appeal be dismissed.
Reasons for the Decision

1. The appeal is admissible.

2. Article 123 EPC

Granted claim 1 has been restricted to loosely woven fabric layers in a plain weave, which are mentioned at page 9, lines 10 to 15 and in examples 1, 3 and 6 of the application as originally filed (WO-A-02/084202). Granted claim 1 was also amended to contain the feature that the article comprises non-woven fiber ballistic layers, which is referred to at page 10, lines 15 to 18 of the patent application. The amendments therefore meet the requirement of Article 123(2) EPC, and since they do not extend the scope of the claim, the requirement of Article 123(3) is also satisfied.

3. Article 84 EPC

The Respondent alleges that the meaning of the expression "non-woven fiber ballistic layers" is not clear. However, the term "non-woven" is common in the field of fabric manufacture and the skilled person, making use of his general knowledge and assisted by the examples given in paragraph [0031] of the patent, would know what fabric is meant, such that no objection arises under Article 84 EPC.

4. Article 100(b) EPC

4.1 The invention defined in claim 1 of the main request relates to an article having loosely woven fabric layers that have a defined fabric tightness factor. The
ground of opposition under Article 100(b) EPC raises the question as whether the patent discloses the invention in a manner sufficiently clear and complete for it to be carried out by the skilled person.

4.2 A method for determining the fabric tightness factor is given in paragraphs [0026] and [0027] of the disputed patent. The equations given in paragraph [0026] include the parameters $d_w$ (width of warp yarn in the fabric) and $d_f$ (width of fill yarn in the fabric). The Respondent made a fabric in accordance with Example 3 and measured the widths of the yarns in the fabric using an electron microscope. Calculating the fabric tightness factor on the basis of these measurements gave values above 1.3, which is in excess of the 0.6 indicated in example 3 and the range (0.3 to 0.6) defined in claim 1.

4.3 It is thus apparent that either the examples given in the patent are not examples of the claimed invention, or there is something wrong with the method set out in paragraphs [0026] and [0027]. The examples are, however, quite clear in showing that, with the given material parameters, the alleged effect can be achieved; this tends to indicate that there is a deficiency regarding the disclosed method. The question is therefore whether the skilled person would readily notice the deficiency and how it would be corrected.

4.4 The fabric tightness factor calculated by the Respondent was above 1.3. A fabric tightness factor of 1.0 means that the measured cover factor was greater than the theoretical maximum, indicating that the fabric is jammed with yarns being compressed together. This result is clearly not in agreement with the basic
teaching of the patent, whose purpose is to produce layers of loosely woven fabric (see paragraph [0009] of the patent specification), and also does not correspond to the appearance of the fabric actually produced by the Respondent. Faced with such a curious result, the skilled person would immediately recognise that there was a problem concerning the way the fabric had been made.

4.5 The Appellant has submitted extracts from textbooks (D8, D9 and D10) and declarations (D22 to D24), which show that it is well known in the art to use the theoretical diameter of the yarn when designing fabrics. This is because yarn woven into a fabric is distorted to such an extent that meaningful results based on actual measurements are difficult to obtain. Being well aware of the use of a theoretical diameter for the yarn, it would occur to the skilled person that by using this approach, rather than by measuring values, a more appropriate result in line with the teaching of the patent might be obtained.

4.6 There is more than one way to calculate the diameter of the yarn. Although the results provided by the Respondent in Table 3 of declaration D26 differ greatly, it was accepted by the Respondent that these had been based on an incorrect calculation (see letter of 23 September 2010). The results calculated for example 3 (see Tables 1 and 2 of D26), although different, still fall within the claimed range. Unlike the results based on measured values for the diameter of the yarn, they are in line with the claimed invention.
It would not amount to an undue burden for the skilled person to calculate the diameter of the yarn according any one of the equations put forward by the parties, as this means simply evaluating the data by a different equation, and does not involve the repetition of experiments to obtain more data, as was argued by the Appellant.

It is also clear that the degree of porosity of the yarn has a bearing on the estimation of the yarn diameter, and is determined largely by the factors referred to by the Respondent (number of filaments in the yarn, cross-sectional shape of the filaments and construction of the yarn). The porosities of the fibers of the examples in the patent are not given, but a nominal value of 0.60 or 0.65 is commonly taken in practice for the purpose of calculating the yarn diameter. Since example 3 defines the linear density of the yarn (dtex), the only other variable that could have a significant influence on the diameter of the yarn is porosity.

Should use of the typical values for porosity not lead to a fabric tightness factor within the claimed range, it would be a simple matter for the skilled person to calculate on the basis of yarns having a different porosity. So, on obtaining the unusual experimental values a skilled person would realise that the extremely high cover factor (and therefore the unrealistic tightness factor) could be corrected by choosing a yarn having an appropriate porosity value.
4.9 The Respondent has suggested that the different results of the various calculations lead to ambiguity at the limits of the claimed range, meaning that it is not possible to determine with certainty whether a particular woven fabric falls within the scope of the claim.

Regarding this point, the Appellant referred to T 608/07, which considered that ambiguity at the edges of a claim is a matter for Article 84 EPC, an article that specifically concerns the scope of the claims. Articles 83 and 100(b) EPC concern sufficiency of disclosure and, in the words of T 608/07, whether an ambiguity deprives the skilled person of the promise of invention. Given that it is possible for the skilled person to obtain the claimed ballistic resistant article, the alleged ambiguity does not give rise to an objection under Article 100(b) EPC.

4.10 Summary

In summary, faced with an unrealistic result, the skilled person would be alerted to an error in the method by which the fabric tightness factor is calculated using measured values for the yarn diameter, and would be aware that this can be corrected by using theoretical values instead, as is commonly done in the art. The Board therefore considers that the patent specification contains sufficient information for the skilled person to carry out the invention.
5. Auxiliary Requests

Given that there is no objection under Article 100(b) EPC to the claimed subject-matter of the main request, there is no need to consider the claims submitted as auxiliary requests.

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 for further prosecution.

The Registrar: The Chairman:

A. Counillon U. Kause