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**Datasheet for the decision
of 7 February 2011**

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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

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 7 February 2011

Appellant: (Patent Proprietor)	E.I. DU PONT DE NEMOURS AND COMPANY 1007 Market Street Wilmington DE 19898 (US)
Representative:	Beacham, Annabel Rose Dehns St Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Respondent: (Opponent)	Teijin Twaron GmbH Kasinostrasse 19-21 D-42103 Wuppertal (DE)
Representative:	Helmann, Anette CPW GmbH Patentabteilung Kasinostrasse 19-21 D-42103 Wuppertal (DE)
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

C5307.D

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
        <u>non-woven fiber ballistic layers and</u> a plurality of

layers of fabric having an areal density of 2 to
10 kg/m^2, wherein at least two of the layers of fabric
are loosely woven, the loosely woven fabric layers
comprising fabric woven <u>in a plain weave</u> 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:

D1:   Lord and Mohamed, "Weaving: Conversion of Yarns to
      Fabric", pages 140 to 143, Merrow, 1982.

The Appellant cited the following documents during the
opposition proceedings:

D8:   "Man-Made Fiber and Textile Dictionary", Celanese
      Fibers Inc., 4th edition 1978, page 36.

D9:   J.B. Dickson, "All-Fiber System Meets Needs of
      Fabric Engineering", pages 113 to 115, 242 to 246,
      246, 248 and 250, Textile World, October 1952.

D10: J.W.S. Hearle et al. "Structural Mechanics of
     Fibers, Yarns, and Fabrics", Volume 1, pages 330
     to 335, Wiley Interscience, 1969.

D13: JP-A-9 72697 with English translation.

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:

D22: Declaration of Mark Anderson,
     employee of JPS Composite Materials Corporation,
     dated 29 January 2009.

D23: Declaration of Mahmoud Salama,
     employee of JPS Composite Materials Corporation,
     dated 26 January 2009.

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:

D25: Declaration of Mr. Schwung, Consultant at
     Weberei C. Cramer, dated 2 August 2009.

D26: Declaration of Prof.Dr.-Ing. Büsgen, Lehr- und

Forschungsgebiet Textiltechnik, Hochschule
Niederrhein, dated 12 August 2009.

The following document was, amongst others, annexed to
D26:

D26[3]:   Z. Grosicki, "Watson's Textile Design and
            Colour", Newnes-Butterworths, Appendix III,
            pages 368 to 377, London 1975.

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 a 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 so 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.

4.7   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.

4.8   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 a
        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