BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

A		B		C	X

File Number: T 292/91 - 3.2.3

Application No.: 86 907 068.0

Publication No.: WO 87/03674

Title of invention: Multi-layered, flexible, fiber-containing articles

Classification: F41H 5/04, B32B 7/00, 27/00

D E C I S I O N
of 16 October 1992

Applicant: Allied Corporation

Headword:

EPC Articles 56, 84, 123(2)

Keyword: "Inventive step (yes)"

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 292/91 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 16 October 1992

Appellant : Allied Corporation
Columbia Road
PO BOX 2245R
Morristown
New Jersey 07960 (US)

Representative : Brock, Peter William
Urquhart-Dykes & Lord
91 Wimpole Street
London W1M 8AH (GB)

Decision under appeal : Decision of Examining Division of the European Patent Office dated 9 November 1990 refusing European patent application No. 86 907 068.0 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : C.T. Wilson
Members : K.W. Stamm
L.C. Mancini

Summary of Facts and Submissions

I. European patent application No. 86 907 068.0, filed on 28 October 1986 and published under international publication No. WO 87/03674 with 47 claims was refused by decision of the Examining Division on 9 November 1990.

II. The decision was based on the following amended independent Claims 1 and 14:

"1. An article of manufacture comprising a plurality of flexible layers formed from fibers, characterized by comprising a plurality of first flexible layers arranged in a first portion of said article, each of said first flexible layers consisting essentially of uncoated fibers comprising fiber selected from polyolefin fibers, polyvinyl alcohol fibers, polyacrylonitrile fibers and mixtures thereof having a tensile modulus of at least 300 g/denier (2.65×10^7 Nm/kg) and a tenacity of at least 15 g/denier (1.32×10^6 Nm/kg), and a plurality of second flexible layers arranged in a second portion of said article, the resistance to displacement of fibers in each of said second second flexible layers being greater than the resistance to displacement of fibers in each of said first flexible layers."

"14. An article of manufacture resistant to ballistic threat and comprising a plurality of fiber-containing layers, characterised in that the layers are arranged such that the resistance to fiber displacement F_i for each layer increases from the first layer exposed to ballistic threat,

$$F_i = \frac{\sum_{i=1}^{i=n} b_i}{nx}$$

wherein b_i = the number of broken fibers in the i^{th} layer resulting from the impact of a ballistic threat having an impact velocity of at least 90 percent of the V_{50} value of an article constructed essentially form 3n i^{th} layers, where n = the number of layers removed and individually inspected to determine the number of broken fibers in each layer i = 1 to i = n, and x = the number of fibers within the area layer i = 1 to i = n, the impact area being defined as that area of the layer substantially equal to the initial cross sectional area of the ballistic threat (measured in a plane normal to the direction of travel of the ballistic threat)."

III. In its decision the Examining Division referred to the following documents

D1: GB-A-0 883 529
D2: US-A-4 457 985
D3: US-A-4 522 871

and based the refusal on the following reasons:

(a) "Considering that the extension of the fabrics described in Document (1) is caused by displacement of fibres (cf. Figures 5 and 6), it can be concluded that the terms "extensibility" (Document (1)) and "displacement of fibers" (application) are synonymous."

(b) "Therefore, starting from Document (1) it would be fair to construe this document in the light of the

subsequent knowledge from Document (2) to have regard to the knowledge available at the priority date of the application (Guidelines C-IV, 9.3)."

"No inventive step can be seen in the fact that different fibers are mentioned in present Claim 1 since the suitability of polyolefin fibers for the same purpose is known from Document (2)."

(c) "The objection raised in the communication of 29.11.89 against Claims 1, 10 and maintained against present Claims 1, 10 due to lack of inventive step applies to present Claim 14 as well."

(d) The question whether amended Claim 1 complied with Article 123(2) EPC "can be left aside ... since the broadest claim is not allowable" due to lack of inventive step.

IV. On 15 January 1991 the Appellant (Applicant) filed a Notice of Appeal against the decision of the Examining Division per telecopy and paid the appeal fee on the same day. The appeal was confirmed by letter received on 23 January 1991; the Statement of Grounds was filed per telecopy on 15 March 1991 and confirmed on 18 March 1991.

Together with the Statement of Grounds amended Claims 1 to 14 were submitted. Claim 1 reads:

"1. An article of manufacture comprising a plurality of flexible layers of high strength fibers, at least some of which are polyethylene fibers having a tensile modulus of at least 300 g/denier (2.65 x 10^7 Nm/kg) and a tenacity of at least 15 g/denier (1.32 x 10^6 Nm/kg), characterised in that the layers are arranged such that there are polyethylene layers on the side of the ballistic threat, and the resistance to lateral fiber displacement for

subsequent layers increases from the first layer exposed to ballistic threat, and in that said article has an RIR (Resistance Index Ratio) value of at least 1.25, wherein the RIR value is the value of RI_1 divided by RI_2 where RI_1 is equal to the higher resistance index, RI, value and RI_2 is the lower resistance index, RI, value, the resistance index RI being defined as

$$RI = \sum_{i=1}^{i=n} F_i AD_i$$

where n = number of consecutive impact effective layers (beginning with the first impact effective layer nearest a face of the article) constituting substantially one half of the areal density of all of the impact-effective layers of the article, an impact-effective layer being defined as any fiber-containing layer of said article wherein said fibers have a tenacity of at least 15 g/denier (1.32×10^6 Nm/kg), and any fiber-containing layer of said article having a specific energy absorption value of at least one third of the highest specific energy absorption value calculated for any layer of the article; AD_i is equal to the areal density of the i^{it} layer, and F_i is equal to the resistance to fiber displacement value of the i^{th} layer; F_i being determined by the following equation;

$$F_i = \frac{\sum_{i=1}^{i=n} b_i}{nx}$$

wherein b_i = the number of broken fibers in the i^{th} layer resulting from the impact of a ballistic threat having an

impact velocity of at least 90 percent of the V_{50} value of an article constructed from 3n i^{th} layers, where n = the number of layers removed and individually inspected to determine the number of broken fibers in each layer i = 1 to i = n, and x = the number of fibers within the impact area of each layer i = 1 to i = n, the impact area being defined as that area of the layer substantially equal to the initial cross sectional area of the ballistic threat (measured in a plane normal to the direction of travel of the ballistic threat)."
(correction in bold letters added).

V. The Appellant is of the following opinion:

(a) The argument set out in paragraph 3.2 of the contested decision (see above under III., b) and c)) is based upon ex post facto reasoning.

(b) The Examining Division has erred in concluding that extensibility and resistance to displacement are synonymous.

(c) The decision has chosen the wrong starting point for considering the nature of the invention.

VI. The Appellant requests to set the contested decision aside and that a European patent be granted on the basis of Claims 1 to 14 filed together with the Statement of Grounds.

He also auxiliarily requests oral proceedings.

Reasons for the Decision

1. The Appeal is admissible.

2. Amendments

2.1 Present Claim 1 is based on Claims 1 and 36 as filed with the application including the following amendments: The features (a) "high strength", (b) "polyethylene" and (c) "lateral" are inserted, the feature (d) "uncoated" is omitted. Features (a) to (c) correspond to the disclosure on pages 1, line 4; page 6, second paragraph and page 10, line 3, respectively. The omission of feature (d) is supported by page 2, lines 18 to 23, where the fibres are described without mentioning this feature, and by the original Claims 31 and 46 which refer to coated fibres.

2.2 The words: "impact area of each" added in Claim 1 (see under IV) are a necessary and obvious correction of an error as follows from original Claim 36. On the other hand the words "where RI_1 divided by RI_2" on line 12 of amended Claim 1 in its version of 18 March 1991 have been removed as a second necessary and obvious correction of an error.

2.3 Amended Claims 2 to 14 correspond to the original ones in the following order:

amended claims: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
original claims: 37, 1, 2, 3, 6, 7, 8, 10, 11, 12, 15, 25, 31.

The amended Claims 1 to 14 comply, therefore, with the requirements of Article 123(2) EPC.

3. Interpretation

3.1 The term "resistance to lateral displacement of fibers" is generally defined on page 10, first paragraph, of the description: It is "the force required to displace fiber in a given direction in the plane defined by the major face of the layer relative to an adjacent fiber in the same layer". Five specific factors influencing that parameter are mentioned and later on specified in detail (fibre geometry, fibre properties, matrix properties, fibre network structure, layer interaction). Quantifying definitions are given using equations for F (ratio of broken fibres to the number of fibres in the impact area), for RI (resistance index for a given multilayered article) and for F_i (value F for layer i).

3.2 Document D1 was interpreted by the Examining Division as disclosing by the term "extensibility" a synonym of the term "resistance to displacement of fibers".

Document D1, however, uses the term "extensibility" without giving a specific definition, notwithstanding the fact that the theory on which the solutions presented in D1 are fully based on that term. No reason, however, is perceivable, which might attribute any other meaning to "extensibility" than the normal one: Extensibility means the capacity of elongation under stress. Figures 5 and 6 show and page 5, lines 100 to 112, accordingly describe a rather particular effect related to slipping fibres in weaves in order to obtain "extensibilities of varying degree". It could be correct to state that under specific conditions, viz. the geometrical arrangement of stuffer threads and warps, the final extensibility is also a function of lateral movement. This very special cause-effect relation is, therefore, - even the reversed proportion being neglected - no reason for the synonymous

equation "extensiblity = resistance to lateral displacement", since this means at least confusing the cause with the effect.

4. Novelty

The features of Claim 1 are not to be found in any one of the available prior art documents; thus, the subject-matter of Claim 1 is new.

5. Prior art, technical problem and solution

5.1 The prior art part of Claim 1 is based on Document D2 which is regarded as closest to the invention among the available prior art documents. Document D2 shows that polyolefine can provide a very useful material for ballistic armour. The problem can be considered, therefore, as being to find a manner in which the effective material can more advantageously be used.

5.2 The solution is evidently found by the subject-matter of Claim 1, defining constructional properties of the article in terms of qualitatively and quantitatively specified criteria in direct cause-effect relationship to the problem to be solved, viz. the resistance to lateral displacement upon impact, using a particularly defined "resistance index."

6. Inventive step

6.1 The solution found in document D2 was based on the idea that high tenacity polyethylene and polypropylene materials of ultra high molecular weight perform surprisingly well as ballistic-resistant materials, in spite of their relatively low melting points. The solution in D2 referred mainly to defining appropriate substance-related and mechanical values such as average molecular

weight, tensile modulus, tenacity and the use of heat and pressure during production. No teaching is, however, deducible from the disclosure of D2 as regards the sequence of the layers in relation to a specified criterion allowing to distinguish the relevant quality of assembled layers according to Claim 1.

6.2 Document D1 bases a theory on the extensibility of layers and suggests to use "an assembly of a plurality of units of woven fabric in face contact with one another each unit having at least one layer of a homogeneous material the extensiblity of each unit being different from that of any other unit, and the units being positioned one behind the other in decreasing order of extensibility from the impact face rearwardly." The extensibility was found to be decisive for the form of reaction upon impact: a small base area was observed together with a relatively great depth of the impact cone resulting in considerable attenuation and ultimately causing failure - related to high extensibility. On the other hand, a large base area with little depth of the impact cone ended in early failure - related to low extensibility. Resistance to lateral displacement was not mentioned in this context and the skilled person had accordingly no reason to consider this parameter.

6.3 However on page 4, lines 77 to 86 and 94 to 100 of D1 the phenomenon of displacement in analogy to the application under appeal appears to be mentioned, though in respect of the behaviour of fabrics and structures which allow fibre slippage. The following is said:

"... the threads tend to slip away from the impact point and so allow the projectile to penetrate the fabrics with a minimum of energy-absorbing damage by just displacing them." "The extent to which such yarn slippage becomes a major factor in reducing the capacity of the armour to

absorb energy, depends, however, not only on the fabric structure and the resistance of its yarn components to displacement but also on the velocity of the projectile." (emphasis added).

It is clear that the skilled person is taught here that low resistance to such (lateral) displacement generally may result in bad energy absorption. It appears, therefore, that the idea for using this displacement of fibres might arise as an interesting parameter. But it is also clear that - based on the teaching of document D1 - no idea is to be associated to the very means for making use of such resistance as defined in Claim 1, viz. the specific "resistance index" in the given context. The subject-matter of Claim 1 is, therefore, not obvious to the skilled person having regard to documents D1 and D2.

6.4 The remaining documents mentioned in the International Search Report, viz.

D3: US-A-4 522 871
D4: FR-A-2 292 946
D5: US-A-4 403 012
D6: EP-A-0 122 857

do not suggest any teaching in respect of the resistance index as defined in Claim 1.

6.5 The subject-matter of Claim 1 involves, therefore, an inventive step. Claims 2 to 14, appendant to Claim 1, are also valid.

7. Since the description is not yet amended, it is to be modified in order to correspond to the amended claims.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division for further prosecution with the order to grant a patent based on corrected Claim 1 as presented above under paragraph IV and Claims 2 to 14 received with the Statement of Grounds on 18 March 1991, provided an appropriately amended and allowable description is filed.

The Registrar: The Chairman:

N. Maslin C.T. Wilson

27.10.92
28

04107