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D E C I S I O N
of 17 November 1999

Case Number: T 0279/95 - 3.2.3

Application Number: 86102454.5

Publication Number: 0199019

IPC: F41H 1/02

Language of the proceedings: EN

Title of invention:
Ballistic-resistant fabric article

Patentee:
AlliedSignal Inc.

Opponent:
Acordis AG

Headword:
-

Relevant legal provisions:
EPC Art. 52, 54, 56

Keyword:
"Interpretation of a parameter ("Tensile modulus")"
"Novelty (no, main request)"
"Inventive step (no, auxiliary requests)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0279/95 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 17 November 1999

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 30 January 1995 rejecting the opposition filed against European patent No. 0 199 019 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: C. D. Wilson
Members: J. du Pouget de Nadaillac
M. K. S. Aúz Castro

Summary of Facts and Submissions

I. The appeal is directed against the decision dated 30 January 1995 of an Opposition Division of the EPO, which rejected the opposition filed against European patent EP-B1-0 199 019 having the priority dates of 25 February and 9 December 1985. The subject-matter of this patent is an anti-ballistic article, which includes a network of polymeric fibres and which is particularly characterised in that the network is coated with an elastomeric material having a tensile modulus not greater than about 41.500 kPa (6000 psi). According to the above decision, the grounds put forward by the Opponent, namely lack of novelty and inventive step of the subject-matter of the claims, could not be acknowledged, i.a. regarding the evidence relating to an alleged prior use, which provides no hint to use an elastomeric elastomer having a low tensile modulus as claimed in the patent in suit.

II. The Opponent (hereinafter the Appellant) lodged the appeal on 30 March 1995 and paid the appeal fee at the same time. Together with the statement of grounds of appeal filed on 3 June 1995, he submitted new evidence as to the alleged prior use.

The Patentee (Respondent) contested the admissibility and content of the newly filed evidence. He also submitted in the course of the proceedings new sets of claims as auxiliary requests.

III. First oral proceedings took place on 24 September 1997. During these proceedings, the Respondent filed new claims as main and auxiliary requests. During the

discussion, the measurement of the tensile modulus of the coating elastomeric material according to the alleged prior use was challenged by the Respondent and then, the questions whether the expression "tensile modulus" as used in the patent was clear and how this modulus was to be measured were raised for the first time. The parties were not in a position to discuss these new issues, so that the oral proceedings had to be adjourned and it was decided to continue the proceedings in writing.

IV. During the two following years, several written submissions accompanied by numerous documents were filed by both parties.

New oral proceedings were held on 17 November 1999. During these proceedings, the following issues were examined:

- Interpretation of the expression "tensile modulus";

- Patentability of the subject-matter of Claim 1 according to the main request of the Respondent filed on 24 September 1997 having regard to the alleged prior use;

- Patentability of the subject-matter of Claim 1 according to all auxiliary requests filed on the same date.

V. Claim 1 according to each of these requests reads as follows:

Main request:

"A ballistic resistant article comprising a multiplicity of layers of networks of polymeric fibers wherein the fibers comprising each network have a modulus of at least about 200g denier and a tenacity of at least about 10g denier wherein each network of fibers is coated with an elastomeric material having a tensile modulus (measured at about 23°C) not greater than about 41,300 kPa (6,000 psi)."

First auxiliary request:

"A ballistic resistant article comprising a multiplicity of layers of networks of polymeric fibers wherein the fibers comprising each network have a modulus of at least about 200g denier and a tenacity of at least about 10g denier wherein each of the individual fibers of each network are coated with an elastomeric material having a tensile modulus (measured at about 23°C) not greater than about 41,300 kPa (6,000 psi)."

Second auxiliary request:

"A flexible ballistic resistant soft armour comprising a multiplicity of layers of networks of polymeric fibers wherein the fibers comprising each network have a modulus of at least about 200g denier and a tenacity of at least about 10g denier wherein each network of fibers is coated with an elastomeric material having a tensile modulus (measured at about 23°C) not greater than about 41,300 kPa (6,000 psi)."

Third auxiliary request:

"A ballistic resistant article comprising a multiplicity of layers of networks of polymeric fibers wherein the fibers comprising each network have a modulus of at least about 200g denier and a tenacity of at least about 10g denier wherein each of the individual fibers of each network are coated with an elastomeric material having a tensile modulus (measured at about 23°C) not greater than about 41,300 kPa (6,000 psi),
wherein said fibers are not woven and wherein said fibers are arranged in unidirectional layers having an arrangement in which the fiber alignment directions in selected layers are rotated with respect to the fibre alignment direction of another layer."

Fourth auxiliary request:

"A flexible ballistic resistant soft armour comprising a multiplicity of layers of networks of polymeric fibers wherein the fibers comprising each network have a modulus of at least about 200g denier and a tenacity of at least about 10g denier wherein each of the individual fibers of each network are coated with an elastomeric material having a tensile modulus (measured at about 23°C) not greater than about 41,300 kPa (6,000 psi), wherein said fibers are not woven and wherein said fibers are arranged in unidirectional layers having an arrangement in which the fiber alignment directions in selected layers are rotated with respect to the fibre alignment direction of another layer."

VI. Of the numerous documents filed during the Opposition and opposistion appeal proceedings, the following remain relevant to the present decision(the documents referenced with a letter were submitted by the Appellant, whereas those mentioned as "attachments" were filed by the Respondent):

(a) As far as the interpretation of the expression "tensile modulus" of the patent in suit is concerned:

Attachment 11: Measurements and curves of the tensile modulus of Kraton® D1107 and Kraton® G1650, made by the technical departments of the Appellant in 1997.

Attachment 12: Brochure "Kraton® Typical Property Guide", SC: 68-82, from the manufacturer SHELL Oil C°.

Attachment 14 comprising:

a- Detailed initial part of the curve according to Attachment 10, this last evidence concerning the whole curve of the tensile modulus of Neoprène®.

b- Encyclopaedia of Physical Science and Technology, Robert A. Meyers, Editor TRW, Inc, vol. 11, "Polymers, mechanical behaviour", pages 61 to 69.

Attachment 15: Plastics Engineering Handbook of the Society of the Plastics Industry, Inc., fourth edition, 1976, published by Van Nostrand Reinhold C°(US), Chapter 30 "Performance Testing of plastics product", pages 872 to 875.

Attachment 16 with the following enclosures:

a- Plastics Edition 6, a desk-top data bank® , Book B, 1983, The International Plastics Selector, Inc., San Diego, pages B-998, -999, -1000, -1001, -1008.

b- Elastomers, edition 2, a desk-top data bank®, 1980, the International Plastics Selector, Inc., San Diego, pages xi, xiii and 75.

c- Modern Plastics Encyclopaedia, 1984-1985, McGraw-Hill Inc., New York, vol. 3, Data bank, pages 478 and 479.

Attachment 17: comprising the standard test methods ASTM D 412 (for Rubber properties in tension), D 638 and D 638-M (for tensile properties of plastics; M for metric units) and, further, the D 1566 (Standard definitions of terms relating to Rubber), all published 1983 and 1984 (the Board has not considered the ASTM procedures enclosed in Attachment 14, which were mentioned by the Appellant in the oral proceedings, since they were published in 1994, thus long after the priority dates of the patent in suit; they show substantial differences compared to the 1984 edition.).

Attachment 19: US-A-4 482 690 (1984).

Attachment 20: Declaration of Edward S. Clark, Professor Emeritus, Department of Materials Science and Engineering, the University of Tennessee, Knoxville, who mentions:

- "Whittington'd Dictionary of Plastics", Lloyd R. Whittington, Technomic publishing Co., Inc. 1978.

- Modern Plastics Encyclopaedia, 1971-1972, vol. 48, No. 10A.

Attachment 21: Declaration of Garth L. Wilkes, Director, University Materials Council, Director, Materials Science and Engineering Science Ph.D.program and Chair Professor of Chemical Engineering at the Virginia Polytechnic University.

D'12: Statements of Mr H. Jackson Knight, Jr.

(b) As to the alleged prior use:

D4 to D10: invoices and confirmations of orders dated from June 1983 to February 1984 of the firm VERSEIDAG INDUTEXT GmbH to the firm SITEK GmbH, Germany.

B14: Unsworn solemn declaration (Eidesstattliche Versicherung) dated 24 May 1995 of Dr Bernd Meffert of VERSEIDAG INDUTEX GmbH.

B15/B16: Leaflets "UltraX® -Aramidgewebe" of VERSEIDAG INDUTEX, June 1984;

B17: Laboratory test report concerning a Neoprene® sample, from Professor Dr H. Daug of the Bergische University, Gesamthochschule Wuppertal.

B18: Invoice dated in March 1983 and delivery note of

the Verseidag INDUTEXT GmbH to the Bavarian firm BMW in Munich.

B20: (first) Unsworn solemn declaration dated 18 August 1997 of Mr H. Veith from the firm VERSEIDAG INDUTEX GmbH with as enclosure:

- Copy of a fax of Du Pont Dow Elastomers GmbH, 12 August 1997.

B21: Kraton® D-1107CS from Shell Chemicals

B22: Laboratory test report of the Institute for the processing of plastics, Rhein.-Westf. Technische Hochschule in Aachen (Germany), concerning a Neoprene GRT® sample.

B23: (second) Unsworn solemn declaration dated 6 August 1999 of Mr H. Veith.

(c) As to the issue of patentability:

D1: "Characteristics and uses of KEVLAR® 29 Aramid", from DU PONT, September 1976.

D3: "Lightweight Composite Hard Armour Non Apparel Systems with T-963 3300 dtex Du Pont Kevlar 29 Fibre", Du Pont de Nemours International S.A., Geneva, 1984.

D'9: US-A-4 457 955.

B19: DE-A-2 916745

Attachment 5: Ballistic tests with coating elastomeric materials having tensile modulus in or outside the claimed range, August 1997, from the Respondent.

VII. The Appellant has argued as follows:

The main distinguishing feature of the claimed solution is the low tensile modulus of an elastomeric coating. As soon as elastomers are concerned, the person skilled in the art knows that the measurements are to be made in accordance with ASTM procedure D 412. The brochure KRATON® of the manufacturer of this elastomer confirms this. In Attachment 17, the standard procedure ASTM D 412 clearly relates to elastomers, whereas D 638 concerns plastics in general. Of course, the skilled person could have had the KRATON® materials, which are mentioned in the patent description, and have measured them. However the patentee himself by doing so has shown that, at least with KRATON® G1650, he obtained quite different results for the initial tensile modulus measured according to ASTM D 638, namely 13.788 kPa (2000 psi) given in the patent and 22592 kPa (3279 psi) according to his 1977 measurement. On the basis of the curve of this elastomer (Attach. 11), a measurement at 300% extension gives a modulus of about 2756 kPa (400 psi), whereas the corresponding manufacturer's value is twice (800 psi). A difference also appears when considering the tensile modulus curve of Kraton® D1107 (Attach. 11), which shows a rather identical slope at 100% and at 300% elongation, so that it would have been expected to obtain similar moduli for these two elongations: The patentee, however, found a modulus of about 35 psi at 100%, whereas the manufacturer in his brochure gives a value of 100 psi at 300%.

Therefore, having regard to all these inaccuracies, the skilled person, who looks for the correct measurement method, cannot find an answer.

The Patentee's statement that the expression "tensile modulus" always means the initial or Young's modulus is not correct, as is seen for example from the ASTM D 1566 in Attachment 17, which determines the standard terminology and defines the tensile modulus as the tensile stress at a given elongation. Just after, the Young's modulus is defined, but differently. The patent literature (see for example Attachment 19, as well as technical books, such as Attachment 16 with its enclosures (a), (b) and (c)) shows that this expression is unclear and can be used for the Young's modulus as well as for the moduli with 100%, 200%, or 300% elongation. Because of this lack of disclosure in the patent in suit concerning the main feature of the invention, said unclear expression has to be interpreted as including all the known methods.

All the documents, which usually constitute the evidence of a prior art use, that is to say invoices, confirmations of orders and unsworn solemn declarations as well as a declaration coming from the manufacturer of the elastomeric material Neoprene GRT®, have been filed. Therefore, this prior use is to be recognised. Of particular importance are the items 05 and 06 of evidence B18, since they concern a ballistic resistant fabric having - in the absence of any mention of several layers or plies, as is the case for the other products in this invoice, - only one ply and being coated with an elastomeric material, more precisely with a mixture of Neoprene GRT® as specified in the

declarations B14 and B20. This Neoprene® is not a family of products as shown by B20 or even by Attachment 1, and what has been measured is the mixture always used by the firm VERSEIDAG, and this without modifications as attested in evidence B20, so that it is not necessary to know the exact composition of this mixture. A firm, moreover, would not change the composition of a given product without informing its customers, since otherwise this would make them unsure. B22 shows that this mixture, even when it is vulcanised, has a tensile modulus substantially under the claimed limit of the patent in suit. Finally, no difference can be seen between the expressions "coated" in English and "beschichtet" in German. Thus, the product defined in Claim 1 according to the main request was anticipated.

The feature added in Claim 1 of the first auxiliary request is unclear, since anyone reading the description, page 2, line 46 ff. of the patent in suit does not see what the exact meaning of "fiber" is. The advantage brought by this feature is not proven, since the comparative tests described in the patent as well as in Attachment 5 do not relate to the product as claimed. Moreover, this feature is well known in the art, see B19 (DE-A-2 916 745). The expressions "flexible" and "soft" in the second auxiliary request add nothing new, since it is clear that the product according to the prior use being a fabric has these properties. The feature "unidirectional" applied for the fibres of a layer in the third auxiliary request was not disclosed in the patent application as originally filed, thus infringing Article 123(2) EPC. Moreover, US-A-4 457 955 enclosed in Attachment 16 and

B19 (page 6, second paragraph) show that the added feature of this auxiliary request in its entirety was known. The fourth auxiliary request is a mere compilation of the second and third auxiliary requests. In conclusion, the product of Claim 1 of each of these auxiliary requests either is not new or does not involve an inventive step.

VIII. The Respondent defended his patent by arguing as follows:

In ASTM D 412, there is no mention or definition of the "tensile modulus" and the method disclosed in this document only concerns measurements at a given elongation of the rubber to be measured. In contrast thereto, the declarations of two renowned experts and several documents among those filed clearly show that, unless a given elongation is reported, the expression "tensile modulus" means the Young's modulus, which equals the "initial modulus", also synonymous with the "modulus of elasticity", which is measured according to ASTM D 638, that is to say at zero strain. When the measurement method according to ASTM D 412 is used, then the expression "tensile modulus" may be used, however always accompanied by a given elongation, as shown by the patent literature or many technical books.

As far as the alleged prior use is concerned, it has not been proven which products were really sold or put on the market. Mixtures of the coating material according to the alleged prior use have indeed been measured by the Appellant. However, he has not proven that these mixtures, once applied on the fabric as a coating, still had a tensile modulus under the limit

claimed in our patent. No information has been provided by the Appellant, showing how the Neoprene® mixture was coated on the fabric, whether a vulcanisation step occurred or not and, if yes, under which conditions. The technical literature teaches that the addition of carbon black, for example, can significantly modify the tensile modulus. In their declarations, Mr Meffert and Veith did not indicate whether the products were vulcanised or not, and, as far as evidence B22 is concerned, only the attorney of the Appellant says that the mixture measured in the mentioned laboratory was vulcanised. Thus, the Appellant has failed to prove that the products effectively on the markets before the priority date of the patent in suit had the required tensile modulus.

The word "fiber" in the claims, as disclosed in the description, is to be understood as being the basic unit of the fabric, whether it is made of a bundle of filaments or not. When each fibre is coated, it substantially increases the antiballistic effects (see in this respect Attachment 5, Table 2). Although the fibres as such of the present invention already show high ballistic resistant properties, they can be pushed away by the bullets. The coating of each fibre by joining the fibres together solves this problem, whereas simultaneously the low modulus elastomeric material brings high friction and, absorbing the kinetic energy of a projectile, prevents the bullet energy from being transmitted to the fibre. It is irrelevant to indicate that this feature was known as such, since what is important is the cooperation between the low modulus and the individual coating of each fibre. There is no suggestion in the prior art of

this combination. Also, no disclosure of a soft and flexible armour made of a multiplicity of layers as claimed in the second auxiliary request can be found in the prior art. The unidirectional direction of the fibres in a layer avoids the disadvantage of the cross-linked fibres of a woven fabric, which are under strain at their junction points. The effect of the bullet can consequently be transmitted to the whole length of each fibre. There is no disclosure of this effect in the prior art, so that the person skilled in the art has no reason to apply this technical measure, even if it is known per se, in the ballistic resistant article comprising the claimed fibres coated with an elastomeric material of low tensile modulus. The same applies for the soft and flexible armour according to the fourth auxiliary request.

IX. The Appellant requested that the decision under appeal be set aside and that the European patent No. 199 019 be revoked.

The Respondent requested that the appeal be dismissed, with the proviso that the patent be maintained on the basis of Claims 1 and 9 filed as main request on 24 September 1997 or one of the auxiliary requests 1 to 4 all filed also on the 24 September 1997.

Reasons for the Decision

1. The appeal is admissible.

2. Admissibility of the new claims (Articles 84 and 123(2) and (3) EPC).

The Appellant questioned the admissibility of Claim 1 both according to the first auxiliary request because of the term "fiber", which in her opinion is unclear, and according to the third auxiliary request, since the term "unidirectional" was not disclosed in the patent, as originally filed.

According to the description of the patent in suit, page 2, lines 48 and 49, the term "fiber" includes single filament, ribbon, strip and the like. During the oral proccedings, the Respondent explained that the term "fiber" is to be seen in connection with the feature "network" of the claim, the fibre being the basic unit of said network, even if one possibility is to have each fiber being a yarn, that is to say made of a bundle of filaments. Interpreted as such and as far as the patent in suit is concerned, the term is clear (Article 84 EPC).

It is true that the term "unidirectional" does not appear in the original documents of the patent in suit. However, original Claim 6 relates to an article having an arrangement in which the fibre alignment directions in selected layers are rotated with respect to **the fibre alignment direction** of another layer. Thus, the term "unidirectional" is implicitly disclosed (Article 123(2) EPC).

Main request

3. *Novelty (Article 52 and 54 EPC)*

3.1 Interpretation of the expression "tensile modulus".

No decision can be taken on the question of novelty without having a clear definition of the article, subject-matter of Claim 1 according to the main request as well as to the auxiliary requests, and hence of the expression "tensile modulus" used in the claims.

Neither ASTM D 638 (corresponding to DIN 53457) nor D 412 uses the term "tensile modulus", so that they are of no help in this respect.

However, several handbooks and technical encyclopaedias indicate that the expression **tensile modulus** used alone means Young's modulus and is also synonymous with modulus at zero strain (or zero elongation, zero extension), with modulus of elasticity, and with initial modulus, all being given the symbol E. Reference is made to:

- Encyclopaedia of Physical Science and Technology, vol. 11, page 67 (Attachment 14), which defines this modulus as the initial slope of the stress-strain curve, that is to say the tangent of the curve at the zero point of the curve. It further discloses that this parameter is an indication of the stiffness of the material since it represents the stress generated in the limit of small deformation and has to be distinguished from another parameter, namely the secant modulus, which is the secant drawn from the origin of the curve to the stress at any point on the stress-strain curve, for example at zero elongation. In this last case, it is further specified (see page 68) that the degree of elongation must be correlated to the calculated slopes, i.e. the

elongation must be given.

- Plastics Engineering Handbook (Attachment 15), page 874, which indicates that it is the most useful tensile data and refers to ASTM D 618.

- Plastics, edition six (Attachment 16, a), which correlates tensile modulus with ASTM D 638 and specifies the given elongation, when it is not the initial one.

- Elastomers, Ed. 2 (enclosure b of Attachment 16), page xiii, D 638 Tensile properties, third paragraphs. On page xi, only a tensile stress at given elongation is mentioned in relation with ASTM D 412.

Found by the Board:

- Handbook of Plastics Test Methods, second edition, edited by R. P. Brown, 1980, in association with the Plastics and Rubber Institute in Great Britain, page 138, which indicates:

  "It is worth noting that the rubber technologist often refers to 100 per cent modulus, 200 per cent modulus, etc., when talking about tensile data on elastomers. These are not, however, modulus values but the values of the tensile stress at given elongation."

- Properties of Polymers, by D. W. Van Krevelen (Netherlands), Elsevier Scientific publishing Company, 1976, page 261.

Two acknowledged experts, Professors Clark and Wilkes (Attachments 20 and 21), have also found that the expression "tensile modulus" was clear and unambiguous at the time of the present invention, even when applied to elastomeric materials; they refer to some of the above citations or to the following:

- Whittington's Dictionary of Plastics, 1978, Technomic publishing Co., Inc, (USA), pages 109, 204, 309 and 343.

- Modern Plastics Encyclopaedia, 1971-1972, pages 566 and 567.

They also stated that methods other than Young's modulus are accompanied by measurement parameters and that, in references, listings such as "modulus 300%" refer either to a secant modulus (stress divided by strain at a given elongation) or to a tangent modulus (slope of the stress-strain curve at a given elongation).

In contrast thereto, the Appellant did not provide any evidence of a mere mention of a tensile modulus, which nevertheless having regard to the context could only have the meaning of a tensile stress at a given elongation. The only reference, which seems at first sight to confirm this view, is the Standard D 1566 (Attachment 17), which nevertheless for this expression does not give a definition, but only sends back to the tensile stress **at a given elongation**. It consequently implies a "tensile modulus" **with** an elongation, for example "tensile modulus 100% elongation " and thus, confirms the Respondent's statement that, unless a

strain value is reported, the tensile modulus is always to be understood to be at zero strain, thus to be the Young's modulus measured according to ASTM D 638 or E 111.

In conclusion, for the person skilled in the art, this expression "tensile modulus" as used in the patent in suit, that is to say without any mention of elongation, could only mean the Young's modulus.

A consequence is that the skilled person would have seen no need to examine whether the data given in the patent for the KRATON® materials are in accordance with the method measurement of ASTM D 638. Should he nevertheless have conducted such an examination, he would have seen that even with approximative measurements, the method of measurement could only be that according to the standard D 638, since, it is clear - simply by regarding the curves in Attachment 11 - that tensile moduli, or correctly speaking the tensile stresses, at 100% or 300% elongations are significantly lower. The moduli at these specific elongations are those which are most usually given in all technical books, see also in this respect the Kraton® guide (Attachment 12). For KRATON D1107, when the tensile modulus is about 1378 kPa (200 psi), the tensile stresses at 100% and 300% elongation are 241 kPa (35 psi) and 689 kPa (100 psi) respectively. For KRATON G1650, the corresponding values are 13788 kPa (2000 psi) (or 22592 kPa, namely 3279 psi, according to the measurement made in 1997), 1426 kPa (207 psi) and 5512 kPa (800 psi). The differences are too great to allow any confusion as to the methods of measurement.

3.2 The alleged prior use

3.2.1 The facts and declarations: The Respondent did not contest the fact that the firm VERSEIDAG-INDUTEX GmbH has sold between April 1983 up to February 1984, thus before both priority dates of the patent in suit, antiballistic articles ULTRAX® to the firms SITEK GmbH and BMW AG, as attested by the evidence items D4 to D10 and B18. According to the invoice B18, the items 05 and 06 having respectively the article numbers W7630000 and W7640000 concern coated fabrics. The price list and prospect ULTRAX®-Aramid fabric (evidence items B15 and B16) indicate that both articles, which have a thickness of about 0.43 mm and weigh about 270 or 330 g/m^2, are made of Kevlar® 29 or Kevlar® 49, which are kinds of fibres also mentioned in the patent in suit, and that the articles are coated on both sides with rubber. Messrs Meffert and Veith from the VERSEIDAG-INDUTEX GmbH (evidence items B14, B20 and B23) have declared:

- that this rubber was a mixture based on the elastomeric material NEOPRENE GRT® of the firm Du Pont,

- that the composition and the preparation of said mixture had never been modified,

- that it was this material which was sent to the Rhein.-Westf. Technische Hochschule in AACHEN, and

- that the articles coated with this mixture and listed in B15 and B16 are still being manufactured today in the same way as in the years 1983/84.

Mr Veith has further filed a fax from the company Du Pont Elastomer GmbH (B20), which attested that it has always been the same product which was manufactured under the name NEOPRENE GRT® and that modifications in the tensile modulus of this product in the vulcanisate are not to be expected.

According to the report of the Institute of Plastics Processing, part of the Technische Hochschule in AACHEN (B 22), the tensile modulus of five samples cut from the coating material provided as a band was measured according to DIN 53457 and had a mean value of about 10.140 kPa, thus far under the limit required by Claim 1 of the patent in suit.

3.2.2 The Respondent pointed out:

- neither Messrs Meffert and Veith in their declarations nor the Institute, which made the measurements, mentioned or suggested that the material provided to said Institute was vulcanised. Only the agent of the Appellant said so.

- What had been measured is the coating material itself, alone, and not the material as coating the fabric, whereas Claim 1 of the patent in suit, which concerns a product, requires a low modulus of the elastomeric material when it is coating the fabric. The Appellant has provided no evidence as to how the coating material had been applied onto the fabric. The coating process may have modified the properties of the coating material. Therefore, there is no evidence that the products sold on the

market had the required tensile modulus.

3.2.3 The Board cannot follow the Respondent for the following reasons:

The statement of the Appellant's agent that the product provided for measurement to the Institute was vulcanised is to be considered in the context of the proceedings: During these the Respondent, criticizing the evidence items filed at the first stage, argued that Dr Daug's report (B17) was irrelevant since it was made on the basis of a different measurement method, which can lead to tensile moduli reduced by a factor 7.3, and that Dr Meffert's declaration (B14) was unclear, since he did not indicate whether the "product" was a raw polymeric rubber or a vulcanised compound rubber, although "variation in final physical properties of the compounding vulcanised NEOPRENE GRT® arise by virtue of the compounding ingredients and by virtue of vulcanisation procedures" (bottom of page 2 and middle of page 3 of the submission dated 11 September 1997), so that a number of different compounds and vulcanisates could have been prepared either in the Du Pont factories or in the Verseidag factory. In view of these objections, the Appellant then tried to react, and evidence items B22 and B23 are the result of this attempt. In the written submission received on 1 September 1999, the Appellant expressly stated that, in view of **these** particular arguments of the Respondent, a vulcanised sample having the same composition (as attested by B23) was sent to the Institute, which further measured its tensile modulus **according to** the method set out in D638. It would have been a nonsense to try to refute the Respondent's

objections by sending a material, which was not vulcanised. It is also not surprising under these circumstances that it was not felt necessary to confirm the vulcanisation in the report. The second objection of the Respondent is then not understood, since vulcanization, when it takes place, is conducted at the last stage of the manufacturing of an article, so that in the present case, the fibres were first coated and the product eventually vulcanized. Then, the tensile modulus of the elastomeric material coating the fibres is that of the elastomeric material as vulcanized. As far as the coating processes are concerned, they are necessarily chosen so as to not adversely affect the ballistic properties of the fibres as it is the case with the present invention, and thus the properties of the coating material also are not altered.

3.2.4 Moreover, regarding the first objection of the Respondent, attention is drawn to the fact that the article in question is a single-ply fabric. It is not clear for which reason such a fabric would have been vulcanised, especially as its main object is to be assembled with other identical fabrics, so as to form multilayer fabric articles, which usually implies a moulding process under heat and pressure. The vulcanization step occurred at the last stage, after the moulding step. A previous heating for vulcanizing each fabric would have been superfluous. Moreover, it may affect the properties of the fibres.

Important is also to notice that the mean value of the tensile modulus given by the report of the Institute (B22) is 10.700 kPa, that is to say one quarter of the limit value of 41.300 kPa of Claim 1. The Respondent

has stated that, depending on the components used in the mixture or on their amounts, the modulus could change three folds. Therefore, even supposing this to be correct for the sample sent to the Institute, the tensile modulus of the coating material applied on the fibres of the manufactured article would still not reach the claimed limit value.

3.2.5 According to the invoices, items comprising **several** layers were also sold. The Board concludes, therefore, that products corresponding to the subject-matter of claim 1 were sold before the priority dates of the Patent in suit, so that this subject-matter is not new. As a consequence, the main request is to be rejected.

First auxiliary request

4. Claim 1 of this request contains the additional feature that each of the individual fibres is coated.

4.1 As pointed out by the Appellant, no difference can be seen between a network of fibres which is coated and a fabric in which each of the individual fibres are coated. In the description of the patent in suit, no difference is made between a coated fibre network and coated fibres or even "the coated fiber" (see page 2 of said description, lines 26 to 33), and in all examples C-1 to C-11 of said description it is each fabric and not each fibre which is coated by immersion in a bath of elastomeric material. It is also remembered that, according to this description, a fibre can be a yarn and that moreover the fibres are not necessarily completely coated (see in this respect the description which mentions only a substantial coating - page 5,

line 46- and indicates further that, before being coated, the fibres can be wound or connected together - page 4, line 35). Moreover, if the method for assembling the layers together is the usual most used moulding process (see above point 3.2.5.) which favours the flow of the elastomer as confirmed by Attachment 5 and by the Respondent's written submission received on 25 August 1997 (top of page 4), each individual fibre of each network would be coated.

Items 05 and 06 according to the prior use are given as being "coated fabrics", which seems barely distinguishable, so that already the novelty of the article according to Claim 1 of this request is doubtful.

4.2 Moreover, it is known in the prior art to coat each of the individual fibres of a fabric: B19, which concerns a composite armour consisting of a hard panel and a laminate reinforced with fibres, teaches that the network of fibres is to be kept loose during the coating step, so that the elastomeric material, the object of which is to bind the fibres together, can better impregnate the network or fabric, which implies a coating of each fibre. See also D1, page 5, Paragraph A, and the last line of page 7, just before Table IX. The additional feature of Claim 1 of the request under consideration is therefore a well-known and common coating measure, so that the person skilled in the art would contemplate applying it on the fabric according to the prior use. Even if Neoprene as such, as argued by the Respondent, is not a suitable elastomer for moulding processes, then the person skilled in the art would select another appropriate

elastomeric material of the same kind or preferably apply another method, which reaches a complete impregnation of the fibres, for example an immersion or bathing process as suggested by the term "Trankbarkeit" used in document B19. Since moreover he knows that he must avoid an assembling method which alters the properties of the fibres, he is pushed to do so.

The increasing antiballistic effect, which according to the Respondent results from the combination of this technical measure with the low modulus elastomeric material, is not clearly demonstrated by the tests presented in Attachment 5, since this document shows that the moulding or curing conditions play an important role and that composites **with** a matrix were tested. However, Claim 1 is quite silent about the volume of the low modulus elastomer, so that the tests according to Attachment 5 **only** concern a **particular** embodiment of the present invention as claimed.

4.3 Claim 1 does not therefore comply with Articles 52(1) and 56 EPC and, consequently, the patent cannot be maintained on the basis of the first auxiliary request.

Second auxiliary request

5. Claim 1 of this request relates to **a flexible and soft armour** having all the features of Claim 1 according to the main request. No definition of the terms "flexible" and "soft" is given in the patent in suit. Document D1, page 5, shows that, for ballistic resistant armours made of fabrics of KEVLAR® fibres, possibly impregnated with elastomeric material, it is common practice to mould them into flexible or hard armours, and document

D3, page 7, which concerns the same fabrics, teaches that soft fabric armours are those, which comprise a multitude of plies without any resins and are used for bullet-resistant vests, jackets, blankets or curtains. It would consequently have been a normal consideration for the person skilled in the art to use the fabrics according to the prior use for applications which require a soft and flexible article. Thus, no inventive step can be seen in the subject-matter of Claim 1 of this request.

Third auxiliary request

6. The subject-matter of Claim 1 according to this request is the same as that of Claim 1 according to the main request, however restricted to fibres being not woven and arranged in unidirectional layers, which, when considering the respective fibre alignment directions, are rotated with respect to each other. According to the Respondent, the single direction of the fibres and the fact that they are not connected together, that is to say that they are free, permit the whole length of each fibre to sustain the action of the low modulus elastomer. No tests were provided, showing that an improvement was in fact obtained due to the combination of these features with the required low modulus material.

6.1 It is first noticed that, even if the description of the patent in suit indicates that no matrix material may occupy the region **between the fabric layers,** the wording of Claim 1 does not exclude the presence of a matrix, which may fill the voids between the fibres in a layer or even the spaces between the layers. The term

"coated" as such does not exclude a matrix, and the Respondent himself in his written submissions has used the expression "matrix material of the present invention" and admitted that the elastomer coat according to the present invention can be considered as a matrix material, see for example Attachment 5. This is, on the one hand, consistent with the mention of a possible amount of low modulus material, on the one hand, up to 50 volume per cent as given in the description of the patent in suit, whereas on the other hand, the fibre network can occupy from 50 up to 90 volume per cent of the fabric layer. It can only be concluded that, according to the description of the patent, a matrix can be present or not. No tests were provided, showing that an improvement was in fact obtained due to the combination of the additional features of Claim 1 with the claimed low modulus material, and, as soon as a substantial matrix is present, the fibres are not free, so that the alleged above-mentioned effect is not understood.

6.2 In this technical field, the provision of unidirectional layers and of their rotating arrangement having regard to the fibre directions was known, as shown by document D'9. In this prior art, column 5, it is disclosed that composite materials for antiballistic vests can comprise fibres coated with a matrix material, for example with an elastomer matrix, and can be suitably arranged, so that each layer consists of fibres arranged in parallel fashion and that successive layers are rotated with respect to the previous layer. Different angles of rotation are given. Thus, the person skilled in the art receives a clear suggestion to apply such an arrangement in all similar composite

articles, and, consequently, also in the articles according to the prior use.

6.3 Therefore, the subject-matter of Claim 1 according to this request does not involve an inventive step.

Fourth auxiliary request

7. Claim 1 of this request is a combination of all Claims 1 according to the previous requests. The Respondent has not provided any evidence as to the presence of a surprising effect, which could be the result of the combination of all the above mentioned distinguishing features. Under these circumstances, each of theses features is to be considered alone and the arguments given for each of the auxiliary requests still apply. As a consequence, the subject-matter of Claim 1 according to this request also lacks inventive step.

8. None of the requests of the Respondent are therefore acceptable, so that the patent cannot be maintained.

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:

N. Maslin C. T. Wilson