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Datasheet for the decision of 11 August 2015

Case Number: T 0578/11 - 3.2.05

Application Number: 07075883.4

Publication Number: 1880819

IPC: B29B11/16

Language of the proceedings: EN

Title of invention:
Preform moulding material

Patent Proprietor:
Gurit (UK) Limited

Opponents:
Vestas Wind Systems A/S
Hexcel Corporation

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

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Case Number: T 0578/11 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 11 August 2015

Appellant: (Opponent 01)	Vestas Wind Systems A/S Alsvej 9 8900 Randers (DK)
Representative:	Peter Hertling Inspicos A/S Kogle Allé 2 P.O. Box 45 2970 Hørsholm (DK)
Respondent: (Patent Proprietor)	Gurit (UK) Limited St. Cross Business Park, Newport, Isle of Wight PO30 5WU (GB)
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Party as of right: (Opponent 02)	Hexcel Corporation 11711 Dublin Blvd. Dublin, CA 94568 (US)
Representative:	Peter Franck Uexküll & Stolberg Patentanwälte Beselerstrasse 4 22607 Hamburg (DE)
Decision under appeal:	**Interlocutory decision of the opposition division of the European Patent Office posted on 12 January 2011 concerning maintenance of the European Patent No. 1880819 in amended form.**

Composition of the Board:

Chairman	M. Poock
Members:	H. M. Schram
	C. Vallet

Summary of Facts and Submissions

I. On 15 March 2011 the appellant (opponent 01) lodged an appeal against the interlocutory decision of the opposition division posted 12 January concerning the maintenance of European patent No. 1 880 819 in amended form. The statement setting out the grounds of appeal was received on Monday 23 May 2011.

The opposition division held that claim 1 of the amended main request filed during the oral proceedings held on 23 June and 4 October 2010 contained subject-matter which extended beyond the content of the application as filed, cf Article 123(2) EPC in combination with Article 100(c) EPC 1973, that the subject-matter of claim 1 of the amended first auxiliary request filed during said oral proceedings did not involve an inventive step, but that the grounds of opposition under Article 100(a) EPC 1973 (lack of novelty, Article 54 EPC 1973, and lack of inventive step, Article 56 EPC 1973), and Article 100(c) EPC 1973 (inadmissible extension, Article 123(2) EPC) did not prejudice the maintenance of the patent on the basis of claims 1 to 4 filed by the respondent (patent proprietor) during the oral proceedings before the opposition division as amended second auxiliary request.

The opposition division further held that the subject-matter of claim 1 of the amended second auxiliary request did not extend beyond the earlier application as filed (grounds of opposition under Article 100(c) EPC 1973 in combination with Article 76 EPC), that said claim was clear, Article 84 EPC, and that the priority of claim 1 of the amended second auxiliary request was

validly claimed, Article 87 EPC 1973, see points 6.1, 6.3 and 6.4 of the decision under appeal.

It may be noticed that the European patent application No. 07 075 883.4 that matured into the patent in suit is a divisional application of European patent application No. 03 251 394.7 (publication No. EP-A 1 342 544), hereinafter referred to as the earlier application.

II. Opponent 02 lodged an appeal against said interlocutory decision, but withdrew both its appeal and opposition with letter of 30 April 2013.

III. Claim 1 of the request on the basis of which the opposition division intended to maintain the patent reads as follows (henceforth referred to as main request):

"A preform moulding material (12) consisting of two individual unidirectional reinforcement layers (14, 16) of fibrous reinforcement material and a resin material between adjacent fibrous reinforcement layers (14, 16), characterised in that

the resin material is a matrix resin material whereby the preform moulding material (12) forms a prepreg,

wherein the matrix resin material between the fibrous reinforcement layers (14, 16) partially impregnates and conjoins the fibrous reinforcement layers (14, 16) thereby obviating the need in the prepreg for an additional bonding means to join the individual fibrous reinforcement layers (14, 16),

wherein one of the fibrous reinforcement layers (14, 16) comprises a fabric skewed relative to a lengthwise direction of the preform moulding material

and comprising a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction, and the other of the fibrous reinforcement layers (14, 16) comprises a fabric skewed relative to a lengthwise direction of the preform moulding material and comprising a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction,

wherein the orientation of the unidirectional fibrous reinforcement material of one of the reinforcement layers (14, 16) differs from the orientation of the unidirectional fibrous reinforcement material of the other reinforcement layer (14, 16)

whereby said preform moulding material (12) is a bi-axial prepreg."

IV. The documents referred to in the appeal proceedings include the following:

D2 WO 00/27632;

D35 WO 89/01405;

D56 US 4,567,738.

V. In a communication dated 1 June 2014, the board expressed its provisional opinion that it would appear that claim 1 of the main request did not contain subject-matter extending beyond the contents of the application as filed, Article 123(2) EPC or beyond the contents of the earlier application as filed, Article 76(1) EPC (cf points 6.4 and 8.3) and that the subject-matter of claim 1 of the main request seemed to be new with respect to document D35 (cf point 9.3).

VI. Oral proceedings were held before the board of appeal on 11 August 2015.

VII. The appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent requested that the appeal be dismissed.

VIII. The arguments of the appellant, in writing and during the oral proceedings, can be summarized as follows:

Document D2 was regarded as the closest prior art. This document disclosed a preform moulding material consisting of two individual unidirectional reinforcement layers of fibrous reinforcement material and a resin material between adjacent fibrous reinforcement layers (page 7, lines 27 to 32), wherein the resin material was a matrix resin material whereby the preform moulding material formed a prepreg (page 3, line 26), wherein the matrix resin material between the fibrous reinforcement layers partially impregnated and conjoined the fibrous reinforcement layers thereby obviating the need in the prepreg for an additional bonding means to join the individual fibrous reinforcement layers (page 3, lines 21 to 24, and page 8, lines 1 and 2), wherein one of the fibrous reinforcement layers comprised a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction and wherein the other of the fibrous reinforcement layers comprised a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction (page 7, lines

26 to 32; warp and weft being implicitly provided in a woven fabric as explicitly recited on page 7, lines 19 to 21), wherein the orientation of the unidirectional fibrous reinforcement material of one of the reinforcement layers differed from the orientation of the unidirectional fibrous reinforcement material of the other reinforcement layer, and whereby said preform moulding material was a bi-axial prepreg (page 7, lines 26 to 32, notably line 30: "or in different directions").

The sole difference between the claimed subject-matter according to the main request and the disclosure of document D2 was the presence of a fabric skewed relative to the lengthwise direction of the preform moulding material in each of the fibrous reinforcement layers. The only technical effect achieved by skewing a fabric with respect to the intermediate product was that the weft in the finished product became located at an angle relative to the warp in the lengthwise direction. The objective technical problem was (cf the associated technical effect arising from the above difference) to tailor or improve the strength properties of the preform moulding material. It was incorrect to formulate a technical problem which was directed to the activity of orientating a direction of the fibres, ie a problem related to the manufacturing of the intermediate product of the fibre layers rather than a problem solved by the moulding material itself.

In the art of composite engineering, skewed fabrics were commonly used to obtain the desired strength properties of laminated structures, see eg document D56, column 1, line 67, to column 2, line 2, reading "*Hence, a need has developed for a reinforcing material which can provide variable or multiple directional*

strength characteristics. The present invention addresses these problems". The fact that claim 1 of document D56 mentioned stitching as an additional manufacturing step did not render its teaching incompatible with the disclosure of document D2, cf in particular the statement on page 8, lines 1 and 2, of document D2, from which the skilled person directly derived that the adhesive properties of the resin constituted a suitable and equivalent alternative to stitching, since the adhesive properties of the resin layer were "sufficient to retain the fibrous layer howsoever formed in position". Moreover, document D2 taught the skilled person that the arrangement of the structure of the fibres in the fibrous layer or of the fibrous layer itself could be altered depending on the properties required to be exhibited in the finished end product (page 9, lines 5 to 8).

For these reasons, the skilled person starting from document D2 would arrive at the claimed invention in an obvious manner in view of his common general knowledge and/or in view of document D56.

IX. The arguments of the respondent, in writing and during the oral proceedings, can be summarized as follows:

Document D2 disclosed the following features in claim 1 of the main request: a preform moulding material comprising at least two individual layers of fibrous reinforcement material and a resin material between adjacent fibrous reinforcement layers, wherein the resin material was a matrix resin material, whereby the preform moulding material formed a prepreg, wherein the matrix resin material partially impregnated and conjoined the fibrous reinforcement layers thereby obviating the need in the prepreg for an additional

bonding means to join the individual fibrous reinforcement layers, said preform moulding material being a multi-axial prepreg. Document D2 did not disclose the combination of partial impregnation with (1) each of the adjacent fibrous reinforcement layers comprising a skewed fabric, (2) the skewing being relative to a lengthwise direction of the prepreg, (3) the fabric comprising a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and (4) a warp of fibres in the lengthwise direction and (5) the orientation of the adjacent wefts of unidirectional fibrous reinforcement material differing to form (6) a bi-axial prepreg. There was a synergy between the features by which the claimed invention differed from document D2. The combination of features for the first time recognised that a biaxial prepreg could be formed using partial resin impregnation and specific skewing of weft UD fabrics without requiring additional bonding means. The weft UD fabrics were skewed and immediately formed into the biaxial prepreg with the partial impregnation carried out during prepreg manufacture providing a secure holding of the fibre orientations.

It could not be inferred from the passage on page 7, lines 27 and 28 of document D2, which stated that fibres were arranged such that they were unidirectional, that said fibres formed a fabric, since according to the previous paragraph fibres could be used “in the form of tissue, chopped strand mat, continuous mat, woven fabrics, stitched fabrics, or simple rovings”.

The objective technical problem present in document D2 was, in view of the distinguishing features recited above,to provide a multi-axial prepreg which could be

manufactured in a prepreg machine at high speed using a versatile manufacturing process and which had enhanced structural properties and air transport properties. This problem corresponded with the technical problem mentioned in paragraph [0016] (paragraph numbers in this section refer to the patent in suit) in combination with what was explained in the preamble of the specification as follows: Multi-axial fabrics were known per se in the art and could be produced on eg multi-axial weft insertion machines, see paragraph [0007]. Document D56, cited in paragraph [0008], disclosed a structural multi-axial fabric comprising a plurality of substantially parallel uniaxial structural yarns, which were orientated at an angle skewed from the fabric's centerline. A bi-axial fabric was made by sewing or stitching two skewed fabrics together. For a period of at least 20 years, in the production of multi-axial prepregs, it had been common practice to prepare multi-axial fabrics by stitching of individual layers of reinforcement material or by using multi-axial weft insertion machines, followed by impregnation of the stitched fabric in a prepreg machine, see paragraphs [0009] and [0010]. The impregnation speeds of fabrics produced on multi-axial weft insertion machines was low, partly due to the stitching, see paragraphs [0011] and [0015]. The solution to the objective technical problem in document D2 (and in the invention) was solved in accordance with the present invention by providing, in combination with partial impregnation of the fibrous reinforcement layers by the matrix resin material, by the combination of features (1) to (6) mentioned above. This combination of features, together with the remaining features recited in claim 1, was not remotely disclosed in or hinted at in the state of the art.

The present invention as defined in claim 1 of the main request was predicated on the surprising finding by the present inventors that if each of the adjacent fibrous reinforcement layers comprised a fabric comprising a weft of unidirectional fibrous reinforcement material and a warp of a support web of fibres, the fabric layers could be skewed readily and fed in a common longitudinal direction through a prepreg machine, as illustrated in Figure 1 and described in paragraphs [0049] and [0058] to [0061], with the structural weft fibres of the respective layers readily orientated at the required respective angles. There was no need to join layers before impregnation, and the merging of the fibre layers could take place concurrently with the impregnation within the prepreg machine, allowing high impregnation speeds, see paragraphs [0051] and [0053]. The resultant prepregs exhibited superior properties with respect to conformability within complex tooling curvatures, see paragraph [0056]. The partial impregnation provided the technical effect of venting of inter- and intra-laminar gases out of the moulding material during processing of the material, see paragraph [0034].

Document D56 did not relate to prepegs, it was directed to a structural fabric having substantially parallel, longitudinal edges with a centerline therebetween comprised of a plurality of substantially parallel, uniaxial structural yarn and means for holding each of the structural yarns in place with a secondary yarn, whereby said structural yarns were oriented at an angle skewed from both the centerline and a line perpendicular to said centerline. Document D56 taught that two of such biased fabrics, each skewed in different directions as shown in Figure 3, were stitched together to provide a single structural

fabric. The two layers were not "individual layers" in the sense of the invention, since according to paragraph [0027] of the patent in suit the term "individual layers" referred to the property of the layers that the layers were separate and that before impregnation of the layers, the layers were not interconnected or joined in any way and remain separate. Document D56 did not mention that two biases fabrics could be conjoined by using resin. The person skilled in the art would not omit the stitching step as required by all the claims of document D56, since that would be tantamount to deconstructing the teaching of said document.

When taking document D2 as the closest prior art, the skilled person would not consider document D56, and if he did, he would not have been led to the technical solution claimed.

Reasons for the Decision

1. The appeal is admissible.

2. *Grounds for opposition under Article 100(c) EPC 1973 (Articles 123(2) and 76(1) EPC) and Article 100(a) EPC 1973 (Article 54 EPC 1973)*

During the oral proceedings the board came to conclusion that claim 1 of the main request met the requirements of Articles 123(2) and 76(1) EPC and Article 54 EPC 1973, confirming its provisional opinion expressed in the communication dated 1 June 2014, see point V above. Since the patent must be revoked for lack of inventive step (see point 3 below), there is no need for further substantiation of this matter.

3. *Ground for opposition under Article 100(a) EPC 1973 in combination with Article 56 EPC 1973*

3.1 Document D2 represents the closest prior art.

This document relates to composite moulding materials which include fibres in their structure which in the moulded product will provide reinforcement (page 1, lines 4 to 6), and more particularly to a multilayered moulding material comprising a layer of resin material and conjoined to at least one surface thereof a fibrous layer (page 3, lines 17 to 19). The fibrous layer may be attached to the resin layer by any suitable means, for example it may be held in place by the inherent tack of the surface of the resin layer (page 3, lines 21 and 22). The fibrous layer may be partially impregnated by the resin of the resin layer (page 3, lines 23 and 24). The moulding material may itself be a prepreg (page 3, line 26). It is preferred that the adhesive properties of the resin layer are sufficient to retain the fibrous layer in position (page 8, lines 1 and 2). In view of said retaining capability and the reference to "prepreg" in Example 1, the board has no doubt that the person skilled in the art will construe the term "resin", in the light of the document read as a whole, as a "matrix resin". The moulding material shown in Figure 1 comprises a central resin film having two fibrous layers located on opposing faces thereof (page 14, lines 28 and 29).

This document further mentions that the fibre layer or layers may be formed from any suitable fibres and that the fibres may be used in the form of inter alia woven fabrics (page 7, line 8 and lines 19 to 21). After having read about "woven fabrics", the person skilled

in the art will interpret the statement in the next paragraph, namely that "[In] a particularly preferred arrangement, the fibres are arranged such that they are unidirectional" (cf. page 7, lines 27 and 28) that unidirectional woven fabrics may be used in the multilayered moulding material. The rest of said paragraph reads: "*Where the moulding material of the present invention comprises two fibrous layers conjoined to opposing faces of the resin layer, the fibrous layers may be orientated in the same direction or in different directions. In particular, the fibre orientation of the skins of the sandwich material may be 0°, 90°, 0°/90°, +/-45° or quasi isotropic or 0°/ +45°/-45°.*" The person skilled in the art will readily recognise that the skins having a fibre orientation of 0° or 90° correspond to a warp UD and a weft UD, respectively. Since the two fibrous layers may be orientated in different directions, one skin may be a warp UD and the other skin a weft UD. In this case the warp UD has unidirectional reinforcement fibres at an angle of 0° relative to the lengthwise direction and a weft of fibres in the cross-direction, and the weft UD has unidirectional reinforcement fibres at an angle of 90° relative to the lengthwise direction and a warp of fibres in the cross-direction. The two skins combined form a square or rectangular pattern of unidirectional reinforcement fibres.

Document D2 therefore discloses the preamble of claim 1 of the main request (viz "A preform moulding material (12) consisting of two individual unidirectional reinforcement layers (14, 16) of fibrous reinforcement material and a resin material between adjacent fibrous reinforcement layers (14, 16)"), the first characterising feature (viz "the resin material is a matrix resin material whereby the preform moulding

material (12) forms a prepreg"), the second characterising feature (viz "wherein the matrix resin material between the fibrous reinforcement layers (14, 16) partially impregnates and conjoins the fibrous reinforcement layers (14, 16) thereby obviating the need in the prepreg for an additional bonding means to join the individual fibrous reinforcement layers (14, 16)", the fourth characterising feature (viz "wherein the orientation of the unidirectional fibrous reinforcement material of one of the reinforcement layers (14, 16) differs from the orientation of the unidirectional fibrous reinforcement material of the other reinforcement layer (14, 16)", and the fifth (and last) characterising feature (viz "whereby said preform moulding material (12) is a bi-axial prepreg".

3.2 Document D2 does not disclose directly and unambiguously the third characterising feature of claim 1 of the main request, namely that each of the fibrous reinforcement layers (14, 16) "comprises a fabric skewed relative to a lengthwise direction of the preform moulding material and comprising a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction" (wherein the orientation of the unidirectional fibrous reinforcement material in one layer differs from the orientation of the unidirectional fibrous reinforcement material in the other layer, cf the fourth feature of claim 1 of the main request).

3.3 As compared to the square or rectangular pattern of unidirectional reinforcement fibres in a moulding material according to document D2 comprising a layer of resin material and conjoined to a warp UD and a weft UD, the distinguishing feature mentioned in point 3.2

above leads to a diamond pattern of unidirectional reinforcement fibres.

The objective technical problem to be solved for the person skilled in the art, starting from document D2, is therefore to tailor or improve the strength properties of the preform moulding material. It may be noticed that this problem is addressed on page 9, lines 5 to 7, of document D2 itself.

The claimed diamond pattern of unidirectional reinforcement fibres are known in the art per se, see for example document D56. This document addresses the problem cited above (column 1, line 67, to column 2, line 2) and is directed to a structural fabric having substantially parallel, longitudinal edges with a centerline therebetween comprised of a plurality of substantially parallel, uniaxial structural yarn and means for holding each of the structural yarns in place with a secondary yarn, whereby said structural yarns were oriented at an angle skewed from both the centerline and a line perpendicular to said centerline (page 2, lines 5 to 13). Two of such single biased fabrics, each skewed in different directions as shown in Figure 3, are stitched together to provide a single double bias fabric.

The claimed diamond pattern of unidirectional reinforcement fibres per se is also known from document D2 itself, since the double bias fabric known from document D56 corresponds to the skin having a fibre orientation +/-45° as mentioned on page 7, line 31, of document D2.

The person skilled in the art starting from document D2 will realize that the two single biased fabrics having

a fibre orientation of + 45° and -45°, respectively, can be conjoined to the top and bottom surface of the resin layer and (cf page 8, lines 1 and 2) will be held in place by said resin layer, thereby obviating the need for stitching the layers together.

3.4 In the judgement of the board, it was therefore obvious to the person skilled in the art to provide two individual unidirectional reinforcement layers of fibrous reinforcement material, each comprising a fabric skewed relative to a lengthwise direction of the preform moulding material and comprising a weft of unidirectional fibrous reinforcement material at an angle relative to the lengthwise direction and a warp of fibres in the lengthwise direction, wherein the orientation of the unidirectional fibrous reinforcement material in one layer differs from the orientation of the unidirectional fibrous reinforcement material in the other layer.

The subject-matter of claim 1 of the main request does therefore not involve an inventive step, Article 56 EPC 1973.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

D. Meyfarth M. Poock

Decision electronically authenticated