BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen
(D) [ ] No distribution

Datasheet for the decision of 21 November 2006

Case Number: T 0959/04 - 3.3.09

Application Number: 98906142.9

Publication Number: 0960155

IPC: C08J 5/24

Language of the proceedings: EN

Title of invention:
Method for forming a fiber reinforced resin composite from a fiber material partially impregnated with a resin

Applicant:
CYTEC TECHNOLOGY CORP.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Obviousness - yes (main and auxiliary requests)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0959/04 - 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 21 November 2006

Appellant: CYTEC TECHNOLOGY CORP.
1105 North Market Street
Suite 1300
Wilmington, DE 19801 (US)

Representative: Bowman, Paul Alan
Lloyd Wise
Commonwealth House
1-19 New Oxford Street
London WC1A 1LW (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 February 2004 refusing European application No. 98906142.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Kitzmantel
Members: A. T. Liu
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. European patent application No. 98 906 142.9, filed as PCT/US98/02158, claiming the priority of the US application No. 08/795,632 of 6 February 1997, and published as WO 98/34979 was refused by decision of the examining division orally announced on 24 November 2003 and issued in writing on 9 February 2004.

II. Of the four prior art documents cited in the examining proceedings, reference will be made to the following:

D1: EP-A-0 583 090
D2: WO-A-92/17331
D3: US-A-4 622 091

III. The decision of the examining division was based on Claim 1 as filed by letter of 4 December 2002 (main request) and Claim 1 as filed by letter of 24 October 2003 (first auxiliary request). Essentially, it was indicated that the subject-matter of Claim 1 of the main request lacked novelty as regards the sole Example of D1 and that the subject-matter of Claim 1 of the first auxiliary request lacked an inventive step as regards the teaching of D3.

IV. A notice of appeal was lodged by the applicant on 7 April 2004. With the Statement of the grounds of appeal filed on 18 June 2004, the appellant filed two sets of 13 claims each, as bases for its main and first auxiliary requests.

V. In the annex to the summons to oral proceedings dated 23 May 2006, the board, of its own motion, made reference to two additional prior art documents cited in the patent specification US-A-6,139,942 (which issued from the application's priority document US application No. 08/795,632):

D5: B. Thorfinnson and T.F. Biermann, 31st International SAMPE Symposium, April 7-10, 1986, pages 480 to 490.

D6: B. Thorfinnson and T.F. Biermann, 32nd International SAMPE Symposium, April 6-9, 1987, pages 1500 to 1509.

In the communication, the board indicated the reasons as to why the subject-matter of Claim 1 of both the main and auxiliary requests appeared to be obvious in view of the disclosure of D3 in combination with that of D5 or D6.

VI. By letter dated 6 November 2006, the appellant submitted 3 new sets of claims as bases for a main and two auxiliary requests.

VII. Claim 1 of the main request read as follows:

"A method of forming a fiber reinforced resin composite comprising the steps of:

a. providing partially impregnated preform comprising a substrate of at least one fiber layer wherein at least one face of said fiber layer is impregnated with a resin and a portion of said fiber layer comprises dry

fibers to provide a gas escape path out of said fiber layer during curing;

b. cross-ply reinforcing said partially impregnated preform by cross-ply stitching,

c. enclosing said cross-ply reinforced partially impregnated preform in a resin content control envelope,

d. enclosing said cross-ply reinforced partially impregnated preform in said resin content control envelope in a vacuum envelope;

e. evacuating said vacuum envelope and said resin content control envelope to withdraw air and other gases from said cross-ply reinforced partially impregnated preform; and

f. heating said partially impregnated preform(s) simultaneously with the evacuation of said vacuum envelope and said resin content control envelope to cause said resin to melt, to fully infuse into said fiber layer and, then, to cure as air and other gases are withdrawn through said gas escape path from said fiber layer resulting in the formation of said fiber reinforced resin composite."

VIII. Claim 1 of the first auxiliary request read as follows:

"A method of forming a fiber reinforced resin composite comprising the steps of:

a. forming a preform comprising a substrate of at least one fiber layer wherein at least one fiber layer

is partially impregnated with a resin by applying a resin to at least one face of said at least one fiber layer and applying heat and/or pressure thereon to form a partial resin matrix in the interstices of said at least one fiber layer such that resin is intimately associated with said layer and a portion of said at least one fiber layer comprises dry fibers to provide a gas escape path out of said fiber layer during curing;

b. cross-ply reinforcing said partially impregnated preform by cross-ply stitching;

c. enclosing said cross-ply reinforced partially impregnated preform in a resin content control envelope,

d. enclosing said cross-ply reinforced partially impregnated preform in said resin content control envelope in a vacuum envelope;

e. evacuating said vacuum envelope and said resin content control envelope to withdraw air and other gases from said cross-ply reinforced partially impregnated preform; and

f. heating said cross-ply reinforced partially impregnated preform(s) simultaneously with the evacuation of said vacuum envelope and said resin content control envelope to cause said resin to melt, to fully infuse into each of said at least one fiber layer and, then, to cure as air and other gases are withdrawn through said gas escape path from said fiber layer resulting in the formation of said fiber reinforced resin composite."

IX. Claim 1 of the second auxiliary request read as follows:

"The use of a partially impregnated preform to facilitate cross-ply reinforcement by cross-ply stitching of said partially impregnated preform in a method of forming a fiber reinforced resin composite comprising the steps of:

a. providing partially impregnated preform comprising a substrate of at least one fiber layer wherein at least one face of said fiber layer is impregnated with a resin and a portion of said fiber layer comprises dry fibers to provide a gas escape path out of said fiber layer during curing;

b. cross-ply reinforcing said partially impregnated preform by cross-ply stitching,

c. enclosing said cross-ply reinforced partially impregnated preform in a resin content control envelope,

d. enclosing said cross-ply reinforced partially impregnated preform in said resin content control envelope in a vacuum envelope;

e. evacuating said vacuum envelope and said resin content control envelope to withdraw air and other gases from said partially impregnated preform; and

f. heating said partially impregnated preform(s) simultaneously with the evacuation of said vacuum envelope and said resin content control envelope to cause said resin to melt, to fully infuse into said fiber layer and, then, to cure as air and other gases

are withdrawn through said gas escape path from said fiber layer resulting in the formation of said fiber reinforced resin composite."

X. At the oral proceedings of 21 November 2006, the appellant essentially argued as follows:

– D3 should be considered to comprise the closest prior art teaching.

– To avoid various problems encountered in the use of fully impregnated preforms, D3 placed an emphasis on the use of dry fibres which facilitate cross-stitching of the plies. The resin layer was kept separate and subsequently added to the dry preform.

– The technical problem to be solved with respect to D3 could be seen in the provision of a process for making fibre-reinforced composites, without the need for positioning the resin layer separately.

– *Prima facie*, the use of partially impregnated prepregs for achieving void-free composites could be considered obvious in view of D5 or D6. However, both these prior art documents were silent about cross-stitching the preforms.

– D3 mentioned that the sticky resin would make it difficult to cross-ply stitch the fibre layers together. Thus, it was not obvious to stitch the partially impregnated preforms.

XI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of Claims 1 to 10 of the main request, or alternatively, on the basis of Claims 1 to 11 of the first auxiliary request, or Claim 1 to 10 of the second auxiliary request, all filed with the letter of 6 November 2006.

Reasons for the Decision

Main request

1. Inventive step

1.1 Closest prior art

The board can agree with the appellant in that D3, also directed to a process for forming a fibre-reinforced resin composite, should be considered to comprise the closest prior art teaching. According to the appellant, D3 essentially tackles various disadvantages encountered hitherto with the use of pre-impregnated plies ("prepregs") for making such composites (D3, column 1, line 29 to column 2, line 11). To overcome these disadvantages, D3 proposes the use of dry preforms instead of prepregs. The dry plies may be stitched together in the cross-ply direction. At least one layer of resin is then added to the dry preform. The dry preform and a resin layer are enclosed by a resin content control envelope through which a conduit, such as breather tape, passes. The resin content control envelope is, in turn, enclosed by a vacuum envelope. After air and other gases are withdrawn via the envelopes, the composite is heated. As the resin

enters the preform, air and other gases remaining in the preform are withdrawn via the conduit created by the fibers that form the preform and the breather tape. As the heating takes place, the resin infuses into the dry preform (column 2, lines 29 to 60).

1.2 Problem - Solution

The appellant submitted that the process of D3 was complicated by the fact that the dry preforms and the resin layer had to be kept separate. The technical problem to be solved with respect to D3 therefore could be seen in the provision of an alternative process which would not require the separate manipulation of these parts and still allow cross-stitching of the preforms.

In order to solve the indicated technical problem, it is proposed in Claim 1 to use a **preform partially impregnated with a resin** in lieu of a dry preform and a separate layer of resin (see item VII above; Claim 1, step a): "providing partially impregnated preform comprising a substrate of at least one fiber layer wherein at least one face of said fiber layer is impregnated with a resin and a portion of said fiber layer comprises dry fibers to provide a gas escape path out of said fiber layer during curing ...").

1.3 Obviousness

1.3.1 D3 has recognised that the disadvantage of using fully impregnated preforms is the difficulty of removing gases, either trapped between the plies when a layup is formed or produced in the layup when the resin is being

cured (column 1, lines 45 to 53). The problems related to curing completely impregnated preforms and that of creating monolithic structures from such pre-impregnated preforms are avoided in D3 by the use of dry preforms.

1.3.2 However, it is already known in the art that the same problems relating to the use of a fully impregnated prepeg can be avoided by the use of a partially impregnated prepeg (see D5, Introduction, page 480, right hand column, first full paragraph and D6, Abstract). Thus, when seeking to solve the technical problems relating to the use of fully impregnated prepegs, it is obvious for the skilled person to consider the alternative of using such partially impregnated prepegs, instead of using dry prepegs as in D3.

1.3.3 The Appellant's argument that the skilled person was predisposed against the use of partially impregnated prepregs because of the difficulties encountered in the cross-ply stitching of fully impregnated prepregs (D3 column 1, lines 40 to 44) is not convincing. While it is accepted that the stickiness of the resin impregnation is an aspect of concern because too sticky a resin may lead to needle fouling, it is evident that the practical importance of this problem depends on the degree of the partial impregnation as well as on the tack properties of the resin. If these two parameters are chosen in a way to reasonably address the needle fouling problem, the concern expressed in D3 would be overcome. Since there are, however, no features in Claim 1 addressing these parameters, it can only be concluded that in that respect the claimed invention

fully relies on the knowledge of the expert who is apparently considered capable of determining them without the exercise of inventive skill. As an aside it is noted that Claim 8 of the main request requires the resin to be "substantially tack-free".

1.3.4 The subject-matter of Claim 1 of the main request does not therefore involve an inventive step.

First auxiliary request

2. Claim 1 of this request differs from Claim 1 of the main request only in that it includes the additional step of forming a preform (see item XIII; Claim 1, step a: "forming a preform comprising a substrate of at least one fiber layer wherein at least one fiber layer is partially impregnated with a resin by applying a resin to at least one face of said at least one fiber layer and applying heat and/or pressure thereon to form a partial resin matrix in the interstices of said at least one fiber layer such that resin is intimately associated with said layer and a portion of said at least one fiber layer comprises dry fibers to provide a gas escape path out of said fiber layer during curing..."). The recitation of this process step has been included with the sole aim of clarifying the expression "partially impregnated preform" (see also page 8 of the Appellant's letter dated 6 November 2006). Therefore, the argument in respect of the obviousness of the claimed process is not affected by the inclusion of this additional process step. In consequence, the finding of lack of an inventive step for Claim 1 of the main request applies *mutatis mutandis* to Claim 1 of the first auxiliary request.

Second auxiliary request

3. Claim 1 of this request essentially corresponds to Claim 1 of the main request, with the only difference that it is drafted in the form of a use claim (see item IX above; Claim 1: "The use of a partially impregnated preform to facilitate cross-ply reinforcement by cross-ply stitching of said partially impregnated preform in a method of forming a fiber reinforced resin composite ...".

3.1 The board wishes to remark that "to facilitate" is a relative term. Without a standard for comparison, it is unclear as to the meaning of this term in the context of Claim 1. However, this aspect needs not be expanded since the subject-matter of this claim also lacks an inventive step with respect to the teaching of D3 in combination with that of D5 or D6 for the same reasons as indicated above.

4. It follows that none of the requests pertains to allowable subject-matter.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar | The Chairman

G. Röhn | P. Kitzmantel