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Datasheet for the decision of 1 October 2009

Case Number: T 0140/07 - 3.3.09

Application Number: 97200021.0

Publication Number: 0783959

IPC: B32B 1/10

Language of the proceedings: EN

Title of invention:
Method of fabricating hybrid composite structures

Patentee:
The Boeing Company

Opponent:
Airbus SAS

Headword:
-

Relevant legal provisions:
EPC Art. 56
EPC R. 139

Relevant legal provisions (EPC 1973):
-

Keyword:
"Main request: Inventive step (no)"
"Auxiliary request 1: Admissibility (yes); Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0140/07 - 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 1 October 2009

Appellant: (Patent Proprietor)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 21 November 2006 concerning maintenance of European patent No. 0783959 in amended form.

Composition of the Board:

Chairman: P. Kitzmantel
Members: W. Ehrenreich
M-B. Tardo-Dino

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 0 783 959 in respect of European patent application No. 97 200 021.0 filed on 6 January 1997 in the name of *The Boeing Company* was announced on 2 January 2004 (Bulletin 2004/01).

The patent was granted with thirteen claims. Claim 1 read as follows:

"1. A method for forming a hybrid composite structure on a lay-up mandrel (10), comprising the steps of:

(a) forming a plurality of metallic gore strips (12);
(b) applying a first plurality of the metallic gore strips in a first direction on the lay-up mandrel to form a list layer of gore strips having seams therebetween;
(c) applying strips of a polymeric matrix composite material (71) over the first layer of metallic gore strips to form a first layer of composite material on said mandrel, and applying a second quantity of the metallic gore strips (12) in the first direction over the first layer of composite material, opposite the first layer of metallic gore strips to form at least a second layer of metallic gore strips to create a skin structure having metallic gore strips as the first and last layers,

characterized by the further step of applying a layer of honeycomb material (72) over the last layer of the first skin structure."

Claims 2 to 13 were, either directly or indirectly, dependent on Claim 1.

II. An opposition against the patent was filed by

Airbus SAS

on 1 October 2004.

The Opponent based its opposition on Article 100(a) EPC, namely that the subject-matter of the patent did not involve an inventive step.

Inter alia the following documents were cited:

D5 US-A 3 189 054
D9 US-A 3 490 983.

III. With its decision orally announced on 12 October 2006 and issued in writing on 21 November 2006 the Opposition Division rejected the Patent Proprietor's main request (dismissal of the opposition, ie, maintenance of the patent as granted), as well as its auxiliary requests I, IA and II, and ordered that the patent be maintained in amended form on the basis of a set of claims according to auxiliary request III filed in the oral proceedings.
As to the subject-matter of the requests which were rejected, the Opposition Division held that it was not inventive over a combination of D5 with D9.
It reasoned in particular that the application of a honeycomb layer as a further layer onto the hybrid composite structure did not contribute to the solution

of the problem posed, namely to minimise manual material handling, especially of the gore strips. For that reason the application of a honeycomb layer disclosed in D9 over the composite structures described in D5 was considered to be an obvious and routine measure for a skilled person.

Concerning the issue of inventive step of the subject-matter of auxiliary request III, the Opposition Division held that the closest prior art was represented not by D5, but by the information contained in paragraph [0003] of the patent specification. As compared thereto, feature (d) of Claim 1 relating to the provision of gore strips of varying width applied on a mandrel in an edge-to-edge relationship, enabling thereby the formation of aircraft fuselage sections with varying diameters, involved an inventive step.

IV. Notice of appeal against the decision was filed by the Patent Proprietor (hereinafter: the Appellant) on 16 January 2007. The Statement of the Grounds of Appeal was submitted on 30 March 2007. The Appellant upheld its main request to maintain the patent as granted and submitted with the appeal grounds new sets of claims as bases for auxiliary request 1 to 4. Furthermore the Appellant requested, as auxiliary requests 5 to 7, that the patent be maintained on the basis of one of auxiliary requests I, IA and II filed in the opposition proceedings.

In the oral proceedings before the Board, held on 1 October 2009, the Appellant submitted an amended first auxiliary request replacing auxiliary request 1 on file, and withdrew auxiliary requests 2 and 5 to 7.

Claim 1 of this amended first auxiliary request reads as follows:

"1. A method of forming a hybrid composite structure of an airplane fuselage section on a lay-up mandrel (10), comprising the steps of:

(a) forming a plurality of metallic gore strips (12);
(b) applying a first plurality of the metallic gore strips in a first direction on the lay-up mandrel to form a first layer of gore strips having seams therebetween, the first direction being substantially parallel to a longitudinal axis of the fuselage section;
(c) applying strips of a polymeric matrix composite material (71) over the first layer of metallic gore strips to form a first layer of composite material on said mandrel, and applying a second quantity of the metallic gore strips (12) in the first direction over the first layer of composite material, opposite the first layer of metallic gore strips to form at least a second layer of metallic gore strips to create a skin structure having metallic gore strips as the first and last layers; and
(d) applying a layer of honeycomb material (72) over the last layer of the first skin structure,

wherein the strips of polymeric matrix composite material (71) are applied in the direction transverse to the first direction."

V. Arguments of the Appellant

In the oral proceedings a discussion arose concerning the relevance of D5 as well as of the information (without citation of a document) given in paragraphs [0002], [0003] and [0005] of the patent specification as prior art for the assessment of inventive step. The Appellant agreed that the information in the patent specification formed part of the general knowledge of a skilled person, and therefore belonged to the state of the art, and as such represented the prior art closest to the subject-matter of the invention.

According to this information, it was known to use hybrid composite structures, including layers of metal, polymeric matrix composite and honeycomb material bonded to one another in a sandwich arrangement for aircraft fuselage sections (paragraphs [0002] and [0003]). It is further indicated in paragraph [0005] that the various layers in the above structure were hitherto laid up with one another on a lay-up mandrel in a process which required a number of manual steps.

With reference to this prior art the Appellant argued that the problem to be solved by the invention was the provision of a method for forming a hybrid composite structure which minimized this laborious manual lay-up technique. In its view the key difference over this prior art was the application of a plurality of metallic gore strips which solved the above problem by their longitudinal arrangement relative to the axis of the mandrel, a measure which implicitly emerged from the wording "gore strips".

A skilled person starting from this prior art would not be induced by D5 to apply metallic gore strips longitudinally to a mandrel in a multi-ply arrangement consisting of alternate layers of metal and polymeric matrix composite material. In the multi-ply tubular member of the first embodiment according to figure 1 of D5, consisting of alternate metal/polymeric matrix layers, metal tapes were helically wound around the axis of the mandrel, thereby excluding the use of gore strips.
A skilled person would also not combine this first multi-ply embodiment with the prolate spheroid structure according to the second embodiment of D5, with a longitudinal arrangement of the metal segments as a first layer and a glass fibre layer as a second layer, because the maximum number of layers for this embodiment was two. A skilled person would therefore not be induced to arrange the metal segments in the multi-ply structure of the first embodiment longitudinally.

A combination of the prior art mentioned in the patent specification with D5 would therefore not lead to the subject-matter of Claim 1 of the main request.

Because the structures according to Claim 1 of the first auxiliary request were limited to airplane fuselage sections D5 no longer constituted relevant prior art for this subject-matter.

In comparison with the dimensions of aircraft fuselage sections, the structures of D5 concerned casings for rocket motors or submerged or fluid pressure-containing vessels and were therefore considerably smaller in size

and diameter. Apart from this, the requirements as to strength and load were different. The structures disclosed in D5 were designed to withstand high stresses mainly in the hoop direction, whereas the load in the hoop direction to which aircraft fuselage sections are exposed was low. Rather, these structures had to withstand high bending forces, in particular when used for the construction of passenger cabins.

It was not obvious from the prior art mentioned in paragraphs [0002], [0003] and [0005] of the patent specification that the problem of minimizing material handling could be solved by the application of metallic gore strips parallel to a longitudinal axis of the fuselage section and to apply transversely thereto the strips of the polymeric matrix composite material, as claimed in Claim 1 of the first auxiliary request.

VI. Arguments of the Respondent

In the oral proceedings, the Respondent accepted that the information given in paragraphs [0002], [0003] and [0005] of the patent specification could be considered as the closest prior art, in combination with which it considered D5 highly relevant.

In its opinion, the term "gore" did not imply a specific arrangement of the strips and thus the application of the gore strips according to Claim 1 of the main request was not limited to an arrangement of the metal strips longitudinally to the axis of the mandrel. Moreover, Claim 1 was not confined to any shape of the hybrid composite structures. Therefore, no conceptual difference existed between the structures

resulting from the method according to Claim 1 of the main request and the prolate spheroid structure according to the second embodiment of D5 having metal segments arranged in the longitudinal direction.

Furthermore, in the light of the general disclosure in D5, Claim 1 and column 1, lines 53 et seq., that the laminates have alternating layers of thin metal and glass fibres, and column 2, lines 12 et seq., that the metal tape is arranged on a mandrel, the option for the prolate spheroid to arrange the metal strips in a multi-ply structure longitudinally on a mandrel was also implicitly taught in D5.

Therefore, bearing in mind that the second embodiment in D5 was just a variant of the first embodiment, a combination of the prior art information mentioned in paragraphs [0002] and [0003] of the patent specification with the specific teaching of D5 rendered the subject-matter of Claim 1 of the main request obvious.

As regards the limitation to composite structures of an airplane fuselage section in Claim 1 of the first auxiliary request, the Respondent referred to the problem solution approach as set out in decisions T 967/97 and T 558/00. It submitted that to deny inventive step, it was sufficient when one path can be found starting from a point in the prior art leading to the solution of a technical problem in the light of which the skilled person would regard the invention as obvious. In accordance with this approach D5, which related to pressure-resistant vessels, remained relevant prior art because airplane fuselage sections

were also exposed to conditions requiring high pressure stability. Furthermore, the applicant of D5 was Aerojet Corporation, i.e. an aeronautic company, which fact established a conceptual relation of D5 to airplane fuselage sections.

The further limitation in Claim 1, namely that the gore strips were applied on a lay-up mandrel parallel to a longitudinal axis of the fuselage section and that the fibres of the composite material were applied transversely thereto, did not specify the lay-up operations on the mandrel in any way different from the known prior art. Therefore, the claimed mode of realisation was already disclosed in, or at least derivable from, D5.

Consequently, the subject-matter of the first auxiliary request was also obvious from a combination of the above prior art with D5.

VII. The Appellant requested that the decision under appeal be set aside and the patent maintained as granted or, alternatively, on the basis of Claims 1 to 11 of the first auxiliary request filed during the oral proceedings, or on the basis of the claims of auxiliary requests 3 or 4 filed with the grounds of appeal.

VIII. The Respondent requested that the appeal be dismissed. Furthermore, the Respondent requested that the (amended) first auxiliary request not be admitted into the proceedings as being late-filed.

The Respondent also asked for a decision on the withdrawn requests.

Reasons for the Decision

1. The appeal is admissible.

2. *Main Request*

2.1 Novelty

Novelty was not in dispute in the opposition or appeal proceedings. In the Board's judgment, the subject-matter of the main request is indeed novel. The prior art information in the patent does not disclose in concrete terms how the entire hybrid composite structure is to be manufactured. In particular it is not indicated whether the metal layer is applied as a first layer directly onto the lay-up mandrel or as a second layer onto the polymeric matrix composite.
D5 does not disclose a honeycomb layer.

2.2 Inventive step

2.2.1 The patent in suit

The patent in suit is concerned with the preparation of multiply hybrid composite structures having a sandwich structure with a first and last layer formed from metallic gore strips and layers of a polymeric matrix composite material in an alternating order with the metallic layers. The layers are applied on a lay-up mandrel.
A honeycomb material is applied onto the resulting structure, namely the outermost layer of metallic gore

strips. The preparation steps for obtaining the sandwich structure are described in paragraphs [0001] and [0009] of the patent specification.
It is the aim of the invention to provide a process which minimizes material handling and reduces manual placing of the metal and honeycomb layers on the lay-up mandrel (paragraphs [0008] and [0009]).

Claim 1 of the main request does not contain any further essential features in addition to the above preparation steps. In particular, neither the shape of the hybrid composite structure is indicated nor is the first direction defined in which the metallic gore strips are applied onto the lay-up mandrel.

Claim 1 of the main request is therefore concerned with the preparation of a hybrid composite structure of any shape wherein

- a plurality of gore strips is applied onto a lay-up mandrel as a first layer;
- strips of a polymeric matrix composite material are applied over the first layer;
- a second layer of metallic gore strips is applied over the layer of the matrix composite material, thereby forming a skin structure having metallic gore strips as a first and last layer;
- a layer of honeycomb material is applied over the last metallic layer.

2.2.2 The closest prior art

As agreed by the parties the information in paragraphs [0003] and [0005] of the patent specification

concerning hybrid composite structures including metal layers, polymeric matrix layers and honeycomb material bonded to one another in a sandwich arrangement as well as their general manufacture including the application of layers from the various materials on a lay-up mandrel represents state of the art according to Article 54(2) EPC. In the Board's judgment this information is also the best starting point for the assessment of the obviousness of the claimed process.

2.2.3 Problem to be solved/obviousness

From this prior art the claimed process differs only by the technical concretisation of the general information, including the order of the application of the metallic layer and the polymeric matrix composite onto the lay-up mandrel, as well as the use of the so-called metallic gore strips.

In the oral proceedings the Appellant accepted that the general meaning of "gore strip" is a two-dimensional strip which is able to be transformed into a segment of three-dimensional shape; this term does not therefore include any meaning as regards its shape - apart from being a "strip" - or the direction in which it is laid onto the mandrel.

In the experimental evidence given in paragraphs [0022] to [0061] of the specification the Appellant has shown with reference to figures 1 to 5 that the application of the gore strips longitudinally to the mandrel axis and of the polymeric matrix composite transversely thereto can be automated, thereby reducing manual labour. However, the Appellant did not demonstrate that

the same effect can be achieved by applying the gore strips and the matrix composite in directions other than longitudinally/transversely relative to the axis of the lay-up mandrel.

Because neither the direction in which the gore-strips are applied nor the length of the strips are defined in Claim 1, the problem to be solved can only be the provision of an alternative process for preparing a hybrid composite structure, without any restriction of its purpose.

The preparation of a multiply hybrid composite structure by winding a (two-dimensional) metal tape as a first layer on a mandrel, a fibre-reinforced composite over this first layer and a second metal layer over the composite layer is, however, known from D5 (cf. column lines 12 to 26 in conjunction with figure 1). The helically wound metal tape of D5 meets the above mentioned definition of a "gore strip" (it is of limited length, two-dimensional and is transformed into a three-dimensional shape). Thus D5 offers all the necessary information in order to put the state of the art information concerning the arrangement of the metal and polymeric matrix layers given in the patent into practice.

Therefore, the subject-matter of Claim 1 according to the main request is obvious over a combination of the prior art mentioned in paragraphs [0003] and [0005] of the patent specification and D5.

As a consequence, the main request is not allowable.

3. *First auxiliary request*

3.1 Admissibility

The Appellant submitted the amended first auxiliary request in reaction to the Board's concerns, put forward for the first time in the oral proceedings, that the process steps (b) and (c) of the previous first auxiliary request did not contribute to the solution of the problem defined in paragraph [0009] of the patent specification, namely to minimize material handling and maximize lay-up efficiency.

In the Board's judgment, it was prima facie apparent that the amendments introduced into the first auxiliary request overcome its concerns. They relate to subject-matter already contained in granted claims and in previous requests (cf. granted Claims 2 and 4; Claim 1 of auxiliary request 4). As to the wording "parallel to the longitudinal axis of the fuselage section" as compared to the wording "parallel to the longitudinal axis of the tubular mandrel" it is not contested that these expressions relate to the same technical circumstances (cf column 5, lines 13 to 15 of the A2 publication).

In view of the above, the Board exercising its discretionary power according to Article 114(2) EPC rejected the Respondent's objection to the admissibility of the request, in accordance with Article 13(3) of the Rules of Procedure of the Boards of Appeal.

This request is therefore admitted into the proceedings.

3.2 Amendments - Article 123(2) EPC; Correction under Rule 139 EPC

The amendments in Claim 1 of the first auxiliary request, namely that the first direction of the metallic gore strips is *"substantially parallel to a longitudinal axis of the fuselage section"* (feature (b)) and that the strips of polymeric matrix composite material are *"applied in the direction transverse to the first direction",* are disclosed in the application as filed (cf. column 5, line 13 to 15; column 5, line 53 to column 6, line 6 of the A2 publication). Thus they comply with Article 123(2) EPC.

The correction of the wording *"list layer"* in feature (b) of Claim 1 of the first auxiliary request to *"first layer"* is allowable in the sense of Rule 139 EPC. The term *"list layer"* does not convey any meaning; its replacement by *"first layer"* is obvious in view of the reference in feature (c) of Claim 1 of the application as filed to "*the first layer of gore strips*".

3.3 Novelty

The Board refers in this respect to point 2.1 as to the main request, applicable mutatis mutandis.

3.4 Inventive step

3.4.1 The claimed subject-matter

According to Claim 1 of the first auxiliary request the process is limited to the preparation of airplane

fuselage sections, and the direction in which the metallic gore-strips and the polymeric matrix composite are applied.

3.4.2 The closest prior art

In the Board's judgment, the closest prior art is again represented by paragraphs [0002], [0003] and [0005] of the patent specification, from which the claimed process differs in that gore strips are applied parallel to a longitudinal axis of the aircraft fuselage section and the polymeric matrix composite material is applied transversely thereto.

3.4.3 Problem to be solved/obviousness

The Appellant has shown, in particular in paragraphs [0026] to [0041] of the specification in conjunction with figures 3 to 5, that the application of the gore strips along the longitudinal axis of the lay-up mandrel and the lamination of the matrix composite transversely thereto can be automated, for instance by a strip laying machine (62) and a fibre placement machine (70) (cf. paragraphs [0033] and [0041]). Therefore, the problem of reducing manual handling is solved by these claimed measures.

D5 inter alia describes the preparation of composite structures having the shape of a prolate spheroid, where metal segments are arranged in the longitudinal direction relative to a given axis and the glass fibres are arranged transversely thereto (column 3, lines 11 to 20).

D5, however, is concerned with casings for rocket motors, tanks, pipes or pressure vessels (column 1, lines 14 to 48) which - as the Appellant convincingly argued in the oral proceedings - are entirely different in shape and size when compared to aircraft fuselage sections, the latter having length and diameters of several meters.
The Board also shares the Appellant's view that the requirements concerning the mechanical strength and resistance to stress forces are different; according to D5 the focus is on the resistance to hoop stresses, whereas aircraft fuselages sections mainly have to withstand bending forces, hoop-stress resistance being of minor importance.

It is therefore considered unrealistic to assume that a skilled person intending to solve problems in connection with the preparation of aircraft fuselage sections would take into account prior art which is unrelated to their specific technical requirements. The fact that the applicant of D5 is an aeronautic company does not alter the situation, because a skilled person intending to solve a technical problem of the prior art would solely rely on the technical information actually given in the document; this information, however, contains no pointer towards the usability of the structures for aircraft fuselage sections.

For the above reasons, the person skilled in the art of aircraft fuselage sections would not consider a combination of the prior art mentioned in the patent specification, paragraphs [0002], [0003] and [0005], with D5 in order to solve the problem of the invention claimed according to the first auxiliary request.

Consequently, the subject-matter of the claims according to the first auxiliary request involves an inventive step.

4. Because the claims of the first auxiliary request are allowable, consideration of the subject-matter according to auxiliary requests 3 and 4 is redundant.

Nor was there any legal basis for the Board to state in its written decision on a request made and then withdrawn by the sole Appellant.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of Claims 1 to 11 of the first auxiliary request filed during the oral proceedings after any necessary adaptation of the description and the figures.

The Registrar The Chairman

C. Eickhoff P. Kitzmantel