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**Datasheet for the decision
of 12 January 2010**

Case Number: T 0581/08 - 3.2.06

Application Number: 02077907.0

Publication Number: 1285707

IPC: B21D 22/14

Language of the proceedings: EN

Title of invention:

Methods of manufacture of large diameter domes

Patentee:

The Boeing Company

Opponent:

MT Aerospace AG

Headword:

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Relevant legal provisions:

-

Relevant legal provisions (EPC 1973):

EPC Art. 56

RPBA Art. 13(1)

Keyword:

"Inventive step (no) - main and first auxiliary request"

"Late filed requests - not admitted - second to fourth
auxiliary requests"

Decisions cited:

-

Catchword:

-



Case Number: T 0581/08 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 12 January 2010

Appellant:
(Patent Proprietor)

The Boeing Company
100 North Riverside
Chicago
IL 60606-1596 (US)

Representative:

Howson, Richard G.B.
Kilburn & Strode LLP
20 Red Lion Street
London WC1R 4PJ (GB)

Respondent:
(Opponent)

MT Aerospace AG
Franz-Josef-Strauss-Strasse 5
D-86153 Augsburg (DE)

Representative:

Grape & Schwarzensteiner
Patentanwälte
Sebastiansplatz 7
D-80331 München (DE)

Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 1 February 2008
revoking European patent No. 1285707 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: K. Garnett
Members: G. Pricolo
M. Harrison

Summary of Facts and Submissions

I. The appeal is from the decision of the Opposition Division posted on 1 February 2008 revoking European patent No. 1 285 707.

II. Claim 1 of the patent as granted reads as follows:

"1. A method of spin-forming large hemispheric domes, comprising: providing at least two plates (20a, 20b) of material having abutting edges; friction stir welding the two plates together along the abutting edges to form a blank (40); and spin forming the blank into a dome characterized in that said large hemispheric dome comprises a dome for a rocket tank."

III. The opposition division considered that the subject-matter of claim 1 according to the patent as granted and according to the auxiliary requests filed by the patentee lacked an inventive step in particular having regard to the disclosure of documents

E4 : "Effective manufacturing of launcher structural components by introduction of alternative forming concepts and materials", by E. Sperlich et al., Proceedings of the Int. Symp. on Advanced Materials for Lightweight Structures, ESTEC, Noordwijk, March 1994;

and

E3 : "Reusable Cryogenic Tank System", published in "Reusable Launch vehicle: Technology Development and Test Program" by The National Academy of Sciences, 1995, pages 28 to 36.

IV. The appellant (patentee) filed an appeal, received at the EPO on 26 March 2008, against this decision and paid the appeal fee on the same day. With the statement setting out the grounds of appeal, received at the EPO on 11 June 2008, the appellant filed a set of amended claims according to a first auxiliary request and document

E28 : Witness Statement of Henry Wolfgang Babel, dated 9 June 2008.

V. Claim 1 according to the first auxiliary request reads as follows:

"1. A method of spin-forming large hemispheric domes, comprising: providing at least two plates (20a, 20b) of material having abutting edges; friction stir welding the two plates together along the abutting edges to form a blank (40); and spin forming the blank into a dome wherein said large hemispheric dome comprises a dome for a rocket tank, and wherein the plates are at least 1 inch (2.5 cm) thick, the method including stretching the blank during the spin forming step."

VI. In a communication accompanying the summons to oral proceedings pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal, the Board expressed a preliminary view according to which the witness statement E28 appeared to include to a great extent arguments in support of inventive step rather than evidence and that such arguments would be taken into consideration. The Board further expressed the preliminary view that the subject-matter of claim 1

according to the main and auxiliary requests lacked an inventive step over the disclosure of documents E4 and E3.

- VII. By letter dated 11 December 2009 the appellant filed three sets of claims as second to fourth auxiliary requests.
- VIII. Oral proceedings, at the end of which the decision of the Board was announced, took place on 12 January 2010.

The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted or alternatively that the patent be maintained in an amended form on the basis of the first auxiliary request filed with the grounds of appeal or the second to fourth auxiliary requests filed with the letter of 12 December 2009.

The respondent (opponent) requested that the appeal be dismissed.

- IX. Claim 1 according to the second auxiliary request differs from claim 1 according to the first auxiliary request in that it includes, after the feature "spin forming the blank into a dome", the following feature:

"and heating the blank during the spin forming,".

Claim 1 according to the third auxiliary request differs from claim 1 according to the first auxiliary request in that it includes, prior to the feature "spin forming the blank into a dome", the following feature:

"performing on the welded-blank a two-step anneal beginning with a solution heat treatment followed by a furnace cool to a standard annealing temperature of the material and performing at that temperature a standard anneal for the material; and then".

Claim 1 according to the fourth auxiliary request differs from claim 1 according to the first auxiliary request in that it includes, after the feature "providing at least two plates (20a, 20b) of material having abutting edges;", the following feature:

"placing a material that retards grain growth between the abutting edges of the plates, the material that retards growth being an aluminium-scandium alloy; and then".

- X. The appellant's arguments in support of its requests may be summarised as follows:

The closest prior art E4 disclosed a method for forming a large rocket tank dome comprising joining two plates together by conventional welding to form a blank and then spin forming the blank into a dome. E4 referred to this method merely as a "concept" and as "development studies". In fact, the method disclosed in E4 had been discounted as a viable production process and therefore the skilled person would not consider persevering with it. The distinguishing feature of claim 1, according to which the plates were welded by friction stir welding, provided the technical effect that the solid state joint was essentially indistinguishable from the remainder of the piece, with minimal grain growth and subsequent reduced potential for cracks or tearing of

the material during the spinning and/or stretching steps. Thus, the claimed invention provided a fabrication technique for forming large domes from blanks made up of smaller welded plates in which the blank was less likely to fail during spinning and/or stretching. Accordingly, the claimed invention provided a solution to the problem of forming large domes from smaller plates that was a viable production process. In E4 there was no mention or hint of replacing conventional fusion welding by friction stir welding to solve this problem. In fact, the skilled reader would infer from E4 that conventional welding techniques were adequate and that further improvements would only be possible if larger blanks were available, when joining of two blanks by welding would not be necessary. Document E3 did not relate to the fabrication of rocket tank domes, but to forming the cylindrical sections of a rocket tank. There was nothing in this document to suggest that friction stir welding was particularly suited to applications in which welded joints were subsequently spun and/or stretched. The skilled person would not be inclined to try friction stir welding with the E4 method because there was no realistic expectation of success. Indeed friction stir welding was, in the words of E3, "in an early stage of development and extensive tests were needed to determine the feasibility of using this technology". Moreover, considering that E4 dated from 1994 and that friction stir welding was extensively developed after its invention in 1991, if it had been obvious to use friction stir welding in the method of E4, then this would have been done well before the priority date of the patent in suit. Accordingly, the subject-matter of claim 1 as granted involved an inventive step.

The use of plates with a thickness greater than 2.5 cm in accordance with claim 1 according to the first auxiliary request allowed ancillary features and components to be formed integrally with the remainder of the dome. Examples of such features and components would be flanges and stiffening rings. E4 mentioned subscale domes of 1 m in diameter and 1.27 mm in thickness; accordingly, the thickness of the material in E4 was 20 times less than that specified in claim 1. Welds created by friction stir welding were better able to withstand the very high forces needed to deform and to stretch such very thick plates. Thus, there was a synergy between the features of thick plates, friction stir welding and stretching during spin forming. This synergistic technical effect was indicative of non-obviousness. E3 disclosed that plates 1/4 inch thick were joined by friction stir welding and that the feasibility of using this process on thinner plates required extensive tests. There was nothing to even suggest that friction stir welding might be suited for welding plates in excess of 2.54 cm thick.

The second to fourth auxiliary requests were filed in response to the negative opinion expressed by the Board in its communication. They did not introduce complex subject-matter. Claim 1 of the second and fourth auxiliary requests was essentially a combination of granted claims. Claim 1 according to the third auxiliary request was amended by introducing a feature taken from the description which referred to a standard annealing temperature of, and a standard anneal for, the material. It was clear for a skilled person what was intended by these terms.

XI. The respondent's reply can be summarized as follows:

Even if the method for forming a large rocket tank dome by initially welding two plates was designated in E4 as a "concept", the skilled person would still consider it as a realistic starting point. E4 did not mention a specific welding process, but disclosed that a development issue was to develop high quality welds capable of sustaining spin forming. The skilled person was therefore inevitably prompted to look for suitable welding processes. Friction stir welding was known for providing high quality welds due to the fact that the weld had material properties very similar to the surrounding base material. In fact, the advantages of friction stir welding were largely discussed in several publications following its invention in 1991. Moreover, E3 disclosed that friction stir welding was particularly advantageous for welding the aluminium material disclosed in E4. Therefore, the skilled person would consider it as obvious to use friction stir welding in the method according to E4, thereby arriving at the subject-matter of claim 1 according to the main request without the exercise of inventive skill.

E4 further disclosed that the plates were pre-contoured by milling after welding and prior to spin forming. Accordingly, E4 disclosed that the plates were thicker than the membrane of the finished rocket tank dome, which for the exemplary subscale dome of 1 m in diameter was 1.27 mm thick. The choice of the thickness of the starting plates was a matter of normal design procedure. It depended, in particular, on the final product requirements such as the thickness of dome

portions other than the membrane and the diameter of the dome. A thickness greater than 2.5 cm was an obvious choice for large domes having a diameter of some metres. Accordingly, also the subject-matter of claim 1 according to the first auxiliary request lacked an inventive step.

The second to fourth auxiliary requests filed shortly before the oral proceedings should not be admitted. In particular, the amendments made were not clear and introduced complex subject-matter. Furthermore, the amendment made in accordance with the third auxiliary request resulted in broadening the scope of protection.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request (patent as granted)*
 - 2.1 The Board concurs with the Opposition Division that the closest prior art is represented by the method of E4 disclosed in section 3 of this document, starting on page 456, which is a method of spin forming large hemispherical domes, comprising: providing at least two plates of material having abutting edges (step 1 in Fig. 3); welding the two plates together along the abutting edges to form a blank (step 1 in Fig. 3); and spin forming the blank into a dome (step 3 in Fig. 3), said large hemispheric dome comprising a dome for a rocket tank (the dome is a tank bulkhead).

E4 undisputedly does not disclose that the two plates are welded together by friction stir welding.

- 2.2 The appellant argued that the passages in E4 referring to the necessity of repairing weld defects before spin forming, such as pores (see in particular page 458, right-hand column), implied that conventional fusion welding was meant. Weld defects might however arise with any welding technique, even with friction stir welding, and this was not contested by the appellant during the oral proceedings. Nor does the patent in suit mention that friction stir welding avoids the formation of defects. It discloses that friction stir welding produces a joint which is relatively smooth and void-free (see par. [0016]) and that has material properties very similar to the surrounding base material (see par. [0007]). Even accepting that the reference to pores in E4 might be regarded as an indication that a fusion welding process is used, the fact remains that this document does not disclose what fusion welding process, such as "conventional" arc welding, laser welding or electron beam welding (which are also well-known and thus "conventional" welding techniques), is used. Therefore, the technical effect of providing friction stir welding in the method of E4 can only be assessed on the assumption that the welding process according to E4 is one in which weld defects, in particular pores, may be formed, but which at the same time provides a weld joint, possibly after repair, which is of sufficiently high standard to survive spin forming (see in particular page 460, section 6, 2nd paragraph).

On this basis, the technical effect of providing friction stir welding in the method of E4 can only be regarded as providing a welding technique which allows the production of a weld joint capable of withstanding spin forming.

Accordingly, starting from E4, the objective technical problem consists in finding an appropriate welding technique.

- 2.3 The appellant submitted that the method disclosed in E4 was a research project that was not, in the end, considered as a viable production process. However, the mere fact of presenting the method as a research project, or as a concept, would not deter the skilled person from putting it into practice and improving it. As stated in E4, on page 456, right column, the spin forming technique was limited to bulkheads with axisymmetric wall thickness distribution up to approximately 3 m in diameter due to the limited size of aluminium plates. By welding smaller plates in accordance with the disclosed method it becomes possible to spin form aluminium bulkheads of more than 4 m in diameter and non-axisymmetric thickness distribution. There is therefore a strong incentive to consider the method of E4 as a starting point for further development for the person skilled in the art who desires, on the one hand, to manufacture a large bulkhead and, on the other hand, to profit from the advantages of the spin forming technique over other known techniques (such as bulkhead manufacture by welding of gore panels - see E4, page 456, left-hand column). Furthermore, E4 itself suggests in which direction further development should be made (see

page 457, left-hand column, the paragraph before the beginning of section 4; see also page 460, left column). In particular, E4 suggests developing high quality welds capable of sustaining spin forming. Therefore, even though, as submitted by the appellant, the skilled person might have concerns about the risk of tearing of a blank during spin forming, he would not have discarded the method according to E4 simply on that basis, but would instead have considered that, with the appropriate welding technique, this risk would be low or insignificant, whereby the production process would be a viable one. Therefore, the skilled person would focus on the problem of finding an appropriate welding technique. The appellant also pointed out that E4 discloses that further improvements of bulkhead manufacturing processes would be possible if larger aluminium blanks would be available, whereby the joining of two blanks by welding would not be necessary (see page 460, left-hand column). This disclosure however depicts an ideal situation contrasting with industrial reality in which there is a practical limit to the size of blanks. In the absence of such large blanks, the skilled person desiring to manufacture large bulkheads by spin forming would have no other choice than to use the method of E4 in which a blank is formed by joining plates together by means of welding.

- 2.4 The rocket bulkheads in accordance with E4 are made of high strength aluminium-lithium alloys, specifically of alloy AA2219 and preferably alloy AA2195 (see the abstract, page 455, the paragraph below Fig. 1, and page 459, right-hand column, first paragraph). Since aluminium alloys are generally difficult to weld, some alloys more than others, the skilled person faced with

the above-mentioned technical problem would look in the available prior art for welding techniques suitable for welding these specific aluminium alloys. He would turn to E3 because it is in the same general technical field of manufacturing cryogenic tank systems as E4, and because it relates to welding of the same aluminium-lithium alloys, in particular alloy AA2195 (see page 30). E3 confirms (see page 33, first paragraph of the section "Welding") that aluminium-lithium alloys are difficult to weld with existing filler materials, i.e. by fusion welding, and that a promising solution to the problem of welding these alloys, including AA2195, is to use friction stir welding (see the paragraph bridging pages 33 and 34). Accordingly, E3 suggests to the skilled person that, in order to obtain the best weld quality, friction stir welding would most probably provide the best solution.

The appellant submitted, correctly, that E3 does not disclose friction stir welding of domes for rocket tanks, and also that E3 does not disclose that the welds obtained by friction stir welding would be capable of withstanding spin forming. Hence, in the appellant's view, the skilled person would have no realistic expectation of success in using friction stir welding in the method of E4. However, since the skilled person is taught by E4 that the crucial issue in the method of E4 is the weld quality (see in particular section 6 of E4) and since E3 suggests, as explained above, that friction stir welding promises the best weld quality, the skilled person would consider that friction stir welding is probably the most effective for the method of E4. The skilled person would therefore be motivated by the teaching of E3 to use

friction stir welding in the method of E4 in order to solve the above-mentioned technical problem.

2.5 The conclusion that the skilled person would be motivated by the teaching of E3 to use friction stir welding in the method of E4 is valid even if the appellant's argument were accepted, namely that the technical problem consists in providing a viable production process for forming large hemi-spherical domes for rocket tanks from smaller plates of material, and that E4 discloses conventional fusion welding. The skilled person faced with this problem would realize that the crucial issue in the method of E4 is the weld quality, as explained above. Therefore, in order to solve this problem, the skilled person would look for welding techniques allowing better quality than conventional fusing welding. Since E3 discloses (see the explanation given above) that friction stir welding seems to provide better welds than conventional fusion welding with a filler wire (see above), the skilled person would be motivated to replace conventional fusion welding in the method of E4 with friction stir welding for solving the problem.

2.6 It follows that the subject-matter of claim 1 of the patent as granted lacks an inventive step (Article 56 EPC).

3. *First auxiliary request*

3.1 Claim 1 according to the first auxiliary request is amended compared to claim 1 as granted by adding the features of granted claims 2 and 5 according to which the plates are at least 1 inch (2.5 cm) thick and the

method includes stretching the blank during the spin forming step.

E4 is silent about the thickness of the plates constituting the blank but discloses stretching the blank during the spin forming step (see Fig. 3, step 6: "stretching by spinforming"). Therefore, the subject-matter of claim 1 differs from the method of E4 in that (i) the two plates are welded together by friction stir welding; and (ii) the plates are at least 1 inch (2.5 cm) thick.

- 3.2 According to E4, subscale domes 1 m in diameter obtained by spin forming a blank consisting of two plates joined by welding have membrane thicknesses as thin as 1.27 mm (see page 459, first paragraph of the right-hand column). The membrane thickness of a finished dome is smaller than the thickness of the plates constituting the blank, since according to the teaching of E4 the blank is pre-contoured by milling before spin forming (see Fig. 3, step 2 and the passage on page 457, right-hand column, second bullet point). This pre-contouring results in a blank having thin portions and thicker contours. The contours can be regarded, generally, as "ancillary features and components". Thus, the method of E4 allows ancillary features and components to be formed integrally with the remainder of the dome, as allegedly does the method of claim 1 (according to the appellant). It is clear that the thickness of the plates must be selected depending on the thickness of the contours to be obtained. The latter depends on the final requirements of the product, in particular dome diameter, resistance to applied loads, connections to the rocket tank, etc.

Therefore, the provision of plates that are at least 2.5 cm thick has the effect of allowing the fabrication of a dome having contour thicknesses that are appropriate for the finished product.

It follows that the objective technical problem solved by the distinguishing features (i) and (ii) consists in finding appropriate thicknesses for the dome and an appropriate welding technique for joining the plates together to form a blank (see above point 2.2).

- 3.3 The person skilled in the art is capable, using his average technical skills, of determining the thickness(es) of the contour(s) of the finished dome, which, as acknowledged in the patent in suit (see col. 5, lines 44 to 47), depends on the final product requirements. Clearly, as correctly stated by the Opposition Division in the decision under appeal (see page 14, point 5.3 iii), the larger the diameter of the dome and the higher the pressure which the tank must withstand, the larger will be the dome thicknesses. For large domes being some meters in diameter (and thus having a membrane thickness greater than the value of 1.27 mm disclosed in E4 for the dome having a diameter of 1 m) thick contours of about or more than 2.5 cm can be expected as the result of a normal design procedure. In fact, the patent in suit discloses that the thickness of the plates may range from about 1.3 cm up to about 6.1 cm, and that it depends on the final product requirements, and also on whether stretching will be used, which results in some reduction in thickness. Since "some reduction in thickness" clearly does not imply a substantial reduction in thickness such as passing from an initial thickness of

e.g. 6.1 cm to a final thickness of e.g. 2.5 cm (this would imply a great increase in diameter of the blank during spin-forming), it is clear that thicknesses of more than 2.5 cm for the final product are also envisaged by the patent in suit and are therefore realistic. Considering that the thickness of these contours is related to the thickness of the plates forming the blank (as explained above, the plates are pre-contoured by milling and thereafter the blank is spin formed), the skilled person would regard it as obvious to choose the same, or (depending on the amount of stretching during spin forming) greater thickness for the plates.

Furthermore, as explained above in respect to the main request, the skilled person would be motivated to replace conventional fusion welding in the method of E4 with friction stir welding. It is true, as pointed out by the appellant, that E3 does not disclose friction stir welding of plates that are 2.5 cm thick or more but of 1/4-inch (0.63 cm) thick alloy 2195 plates (see page 34, first line), and that it discloses that results obtained from welding of these plates may not be scalable to thin sheet (less than 1/8 inch = 0.3 cm thick). The skilled person would however realize that the reason why results obtained from welding 1/4-inch thick plates may not be scalable to thin sheet is that friction stir welding of thin plates may be more difficult than friction stir welding of relatively thick plates. As a matter of fact, in friction stir welding, a non-consumable rotating probe travels along the interface between the adjacent surfaces of the workpieces, generating frictional heat and plasticizing the material (see par. [0015] and [0016] of the patent

in suit). The two workpieces are held tightly together to prevent separation during the friction stir welding process (see col. 3, lines 54 to 56 of the patent in suit) and the probe forces the plasticized material downward and backwards (see col. 4, lines 19 to 27 of the patent in suit). It is clear that under such circumstances thin plates are more difficult to friction stir weld than thick plates; due to the pressure applied at the edges of the plates to hold them together and the pressure applied by the probe onto the plasticized material at the edges, for thin plates there is a greater risk of the plasticized material extruding out of the joint. Accordingly, on reading E3 the skilled person would consider using the friction stir welding technique also for welding plates thicker than 1/4 of an inch, in particular plates 2.5 cm thick or more.

- 3.4 In its witness statement E28 (see point 9), Mr Babel acknowledges that membranes for rocket tanks made from 2219 alloys are very thin, typically 2 to 4 mm, and that greater thicknesses of about 2 to 4 times the membrane thickness are required at the end of a spin-formed dome at the apex and at the large diameter end, whereby the dome ends would at most be 12 mm thick and probably less. Therefore, the maximum thickness of the E4 plates would be no more than 12 mm. However, this statement of Mr. Babel does not constitute evidence in respect of the technical disclosure of E4 but represents his personal interpretation thereof. Moreover, this statement is very general and does not take into account the fact that large domes of more than 4 m in diameter as anticipated by E4 (see page 456, right-hand column, third paragraph and page 455, right-

hand column, penultimate paragraph, referring to a spin-formed bulkhead 5.4 m in diameter) might well require, depending on the circumstances, a maximum thickness greater than 2.5 cm (in fact, as explained above, such thicknesses are contemplated by the patent in suit).

3.5 Mr Babel (see point 10 of E28) further argues that a very thick blank in accordance with the patent in suit allows integral forming of thick portions of the dome by providing sufficient material to push around during spin forming, whereby the formed dome is then machined in places to provide membranes of much lower thickness between the desired thicker regions. However, the claim does not mention material being pushed around during the spin forming step to form thick portions. As a matter of fact, the patent in suit as a whole is silent about this. This argument cannot therefore be considered in the assessment of inventive step.

3.6 The appellant further submitted that there were no indications in the prior art suggesting that welds created by friction stir welding would better withstand the very high forces needed to deform and to stretch plates with a thickness of at least 2.5 cm. However, since, as explained above, E3 suggests to the skilled person that friction stir welding would most probably provide the best weld quality, the skilled person would consider that the welds obtained by friction stir welding would be capable of undergoing at least some deformation and stretching. In this respect it is noted that the claim does not specify what amount of stretching is performed. Also, in the description of the patent in suit it is disclosed that stretching

results in "some" reduction in thickness (see col. 5, lines 44 to 47) thereby suggesting that also in accordance with the patent in suit no substantial reduction in thickness necessarily takes place.

3.7 Therefore, also the subject-matter of claim 1 according to the first auxiliary request lacks an inventive step.

4. *Second to fourth auxiliary requests*

4.1 The second to fourth auxiliary requests were filed by the appellant one month before the date of oral proceedings. They represent an amendment to the appellant's case as set out in the grounds of appeal and may be admitted and considered at the Board's discretion pursuant to Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA). This Article makes clear that in exercising that discretion, the Board must consider a range of factors including *inter alia* the complexity of the new subject matter submitted, the current state of the proceedings and the need for procedural economy.

4.2 The appellant submitted that these requests were filed in response to the negative opinion expressed by the Board in the communication annexed to the summons to oral proceedings. In this communication, however, the Board essentially confirmed the view of the Opposition Division according to which claim 1 as granted (main request) did not involve an inventive step over E4 and E3. As regards the first auxiliary request, which consists of a combination of the first and second auxiliary requests considered by the Opposition Division (as acknowledged by the appellant in point 2.1

of the grounds of appeal), the Board's statement on obviousness essentially corresponded to the argument of the Opposition Division in respect of the second auxiliary request (the first auxiliary request considered by the Opposition Division was rejected for the same reasons as the main request because it introduced the additional feature that the blank was stretched during the spinning step which was known from E4; see points 4 and 5 of the decision under appeal). Accordingly, the appellant was not justified in filing the second to fourth auxiliary requests only after receiving the Board's communication, as the negative opinion expressed therein was based on facts and arguments already present in the decision under appeal.

- 4.3 In addition to the features of claim 1 according to the first auxiliary request, claim 1 according to the second auxiliary request includes the feature of heating the blank during the spin-forming. However, the introduction of this additional feature does not immediately appear to overcome the objection of lack of inventive step. As pointed out by the Board during the oral proceedings, heating a blank during spin-forming is a conventional measure. This is also acknowledged in the patent in suit: see col. 1, lines 49 to 52: "Traditional hot mandrel spinning methods have been effective...". Furthermore, although in accordance with the appellant's submissions, claim 1 results from the combination of granted claims 1, 2, 5 and 6, claim 1 omits the term "step" present in granted claim 6 which recites "heating during the spin-forming step". As submitted by the respondent, the expression "during the spin-forming" might be considered to refer to a more general context than "during the spin-forming step".

Claim 1 might for instance include steps intermediate two subsequent spin forming steps (such as the steps of solution heat treatment and spray quenching intermediate the spin forming steps 3 and 6 in Fig. 3 of E4) that are excluded by the wording of granted claim 6. Accordingly, the omission of the term "step" raises an issue of clarity under Article 84 EPC.

4.4 Claim 1 according to the third auxiliary request is amended compared to claim 1 according to the first auxiliary request by introducing the features of performing a two-step anneal on the welded blank beginning with a solution heat treatment followed by a furnace cool to a standard annealing temperature of the material, and performing at that temperature a standard anneal for the material. As acknowledged by the appellant, these features are taken from the description. The meaning of the terms "standard annealing temperature" and "standard anneal" were discussed during the oral proceedings, and the appellant submitted that the limitation introduced by these terms was clear for a skilled person. The Board is however not aware of any well-defined "standard" anneals and "standard" annealing temperatures that apply to the general class of metals and alloys covered by claim 1. Also, the patent in suit is silent in this respect. Accordingly, the introduction of features from the description leads to a lack of clarity under Article 84 EPC.

4.5 Claim 1 according to the fourth auxiliary request is amended compared to claim 1 according to the first auxiliary request by introducing the additional features of granted claims 10 and 11 according to which

an aluminium-scandium alloy that retards grain growth is placed between the abutting edges of the plates. Claim 1 does not include the additional limitations introduced in the second and third auxiliary request. The amendments made focus on grain growth, which is an aspect that played no role in the previous discussions during these proceedings. Therefore, claim 1 appears to shift the alleged invention in a new direction.

4.6 From the above it follows that the second and third auxiliary requests are not clearly allowable and that the fourth auxiliary request would initiate a diverging debate. Under these circumstances, the Board exercised its discretion under Article 13(1) RPBA not to admit the second, third and fourth auxiliary requests into the proceedings for reasons of procedural economy.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Patin

K. Garnett