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Datasheet for the decision of 14 December 2012

Case Number: T 0084/10 - 3.2.06

Application Number: 03078177.7

Publication Number: 1413384

IPC: B23K20/12

Language of the proceedings: EN

Title of invention:
Method of repairing a crack in a component utilizing stir welding

Patentee:
The Boeing Company

Opponent:
AIRBUS SAS/AIRBUS OPERATIONS/AIRBUS OPERATIONS Ltd
AIRBUS OPERATIONS GmbH/AIRBUS OPERATIONS S.L.

Headword:

Relevant legal provisions:
EPC 1973 Art. 100(b), 84
EPC Art. 123(2)
RPBA 12(4), 13(1)

Keyword:
main request - sufficiency of disclosure (no)
auxiliary requests - not prima facie allowable

Decisions cited:

Catchword:

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Case Number: T 0084/10 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 14 December 2012

Appellant: (Patent Proprietor)	The Boeing Company P.O. Box 516, M.S. S100-3365 St. Louis, MO 63166 (US)
Representative:	Land, Addick Adrianus Gosling Arnold & Siedsma Sweelinckplein 1 2517 GK Den Haag (NL)
Respondent: (Opponent)	AIRBUS SAS/AIRBUS OPERATIONS/AIRBUS OPERATIONS Ltd AIRBUS OPERATIONS GmbH/AIRBUS OPERATIONS S.L. 1 Rond-Point Maurice Bellonte 316 route de Bayonne/New Filton House Filton/Kreetslag 10/Avenida de John Lennon S/N F-31700 Blagnac/F-31060 Toulouse GB-Bristol BS99 7AR/D-21129 Hamburg Madrid, ES (FR)
Representative:	Lepelletier-Beaufond, François Santarelli 14 avenue de la Grande Armée B.P. 237 75822 Paris Cedex 17 (FR)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 25 January 2010 revoking European patent No. 1413384 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman:	M. Harrison
Members:	T. Rosenblatt
	R. Menapace

Summary of Facts and Submissions

I. The proprietor (appellant) filed an appeal against the decision of the opposition division dated 25 January 2010, by which European patent No. 1 413 384 was revoked.

II. Claim 1 of the patent as granted has the following wording

A method of repairing a crack (14) in a component (12) comprising:
- preparing a surrounding surface (22) of the crack (14) for repair; and
- friction stir welding a first portion (24) of the component (12) on a first side (26) of the crack (14) to a second portion (28) of the component (12) on a second side (30) of the crack (14) to form a fused crack area (50),
characterized by
- inserting a temporary plug into an existing hole of the component (12);
- friction stir welding said crack (14);
- disengaging a friction stir welding tool in a center of a partial exit hole (56); and
- removing said temporary plug from the component (12).

III. The opposition division found that the invention was not sufficiently disclosed over the entire scope of claim 1. The opposition division reasoned that the claim encompassed *inter alia* the case of temporary plugs which were smaller than the weld nugget and which were consequently completely consumed by the welding process so that they did not exist anymore after welding. In such a case, the skilled person could not find any teaching in the description or based on common

general knowledge to put into practice the last method step of removing the temporary plug. The auxiliary requests 1 to 7 were found not to be allowable for similar reasons. Auxiliary request 8 was filed during the oral proceedings but was not admitted into the proceedings.

IV. Together with the grounds of appeal the appellant requested that the decision be set aside and that the patent be maintained as granted, or as amended according to auxiliary requests I or II.

V. In a communication in preparation for oral proceedings the Board stated *inter alia* that the claimed invention apparently did not define any limitations to the temporary plug with respect to its function, its structural features (such as the material or its relative dimensions with respect to the crack) and therefore seemingly covered – as notably also argued by the appellant - also embodiments where the dimensions of the existing hole and the temporary plug were smaller than the weld nugget so that during stir welding the plug may be consumed entirely.

VI. With the letter of 7 December 2012 the appellant replied to the Board's communication and filed amended versions of auxiliary requests I and II and an additional auxiliary request III.

VII. Oral proceedings were held on 14 December 2012 in the course of which the appellant filed an amended auxiliary request I and withdrew auxiliary request II.

VIII. The appellant requested that the decision under appeal be set aside and the patent be maintained as granted (main request) or on the basis of the first auxiliary

request filed during the oral procedure before the Board or on the basis of the third auxiliary request filed on 7 December 2012.

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

X. The characterising portion of claim 1 of auxiliary request I has been amended in the following way (marked in bold):

- inserting a temporary plug into an existing hole of the component (12), ***wherein the existing hole is larger in diameter than the diameter of a friction stir welding tool pin such that the temporary plug is removable from the component by drilling;***
- friction stir welding said crack (14);
- disengaging ***the*** *friction stir welding tool in a center of a partial exit hole (56); and*
- removing said temporary plug from the component (12) ***by drilling it out.***

XI. The characterising portion of claim 1 of auxiliary request III contains the following amendments (marked in bold):

- inserting a temporary plug into an existing hole of the component (12), ***wherein the plug is of a material having a higher melting point such the plug is not fused to the component during friction welding the component;***
- friction stir welding said crack (14);
- disengaging ***the*** *friction stir welding tool in a center of a partial exit hole (56); and*
- removing said temporary plug from the component (12), ***wherein the existing hole is larger in diameter than a***

diameter of a friction stir welding tool pin such that the temporary plug is removable from the component by drilling.

XII. The arguments of the appellant may be summarised as follows.

a) The patent dealt with the repair of fatigue cracks in aircraft components, see paragraph [0001] of the patent specification. These cracks usually had dimensions in the order of magnitude of micrometers. In contrast, the existing hole, as defined in claim 1, in such components was to be understood as being a functional hole formed for a specific purpose, like receiving a fastener, and had consequently dimensions in the order of magnitude of centimeters. The embodiments contemplated by the opponent in which the existing hole and the temporary plug were smaller than the weld nugget did not need to be considered. The skilled person knew that a fatigue crack would be welded by a friction stir welding pin having a much smaller diameter than the existing hole.

b) Granted claim 1 however covered methods in which the welding proceeded through the plug so that as a result it was entirely consumed in the weld nugget.

c) The steps in claim 1 were not listed in strictly chronological order; rather the steps could be carried out in a different order or even simultaneously, as was also apparent from paragraph [0043] of the patent specification. The step of "removing the plug" covered embodiments where the plug was simultaneously consumed when

friction stir welding the crack and the existing hole. Removing the temporary plug should therefore be understood as removing the physical appearance of the plug from the component.

d) Moreover, in an aircraft component, to which the invention was primarily directed, the existing hole had a function and had therefore to be recreated after it had been closed by the plug and friction stir welded. The step of removing the temporary plug was thus accomplished when the plugged hole was recreated by drilling it again at its known original position. Depending on the relative size of the existing hole or plug compared to the width of the weld nugget, at least some of the plug's material would be removed by recreating the hole. In this sense, the step of removing the temporary plug from the component meant removing material from the component from the location of the plug by recreating the existing hole.

e) The amendments to claim 1 of auxiliary request I were based on paragraph [0033] of the application. The expression "existing hole" in step 110 of the flow chart in Figure 3 constituted an error and should have read correctly "exit hole", as was clear from paragraphs [0031] and [0034]. The claim was now limited to a method in which the plug could be removed by drilling since it was not entirely consumed and continued to exist at least partially after welding. The outer border of the plug would still be visible to a certain extent. The skilled person would know how to choose the diameter of the friction stir welding pin so that the width of the resulting weld nugget would be

smaller than the diameter of the plug or existing hole.

f) The amendments to claim 1 of auxiliary request III were motivated by the statements in the Board's preliminary written opinion, that the claim did not define any limitation with respect to the materials.

XIII. The arguments of the respondent may be summarised as follows.

a) The patent specification did not provide any teaching how plugs which were smaller than the weld nugget could be removed. The appellant's interpretation that the step of removing the temporary plug from the component was achieved by it being consumed during the welding process, or that this step corresponded to drilling out some material from the weld nugget equivalent in quantity to that of the temporary plug, could not be derived from the patent specification.

b) The amendments to claim 1 of auxiliary request I lacked clarity because the diameter of the pin was not clearly defined, since it did not specify any relationship between the width of the weld nugget and the existing hole. The subject-matter of claim 1 furthermore constituted an unallowable intermediate generalisation of the statement in paragraph [0033] since the term "removable" was not disclosed. Finally, the claim still covered cases in which the plug was totally consumed so that the objection raised with respect to the main request was not overcome.

c) Auxiliary request III should not be admitted into the proceedings, since it was a new request which had not been submitted before and which came as a surprise to the respondent. The amended claim did not solve the issue of sufficiency of disclosure. It was not even clear how the welding process could be carried out when the material of the plug could not be welded.

Reasons for the Decision

1. The appeal is admissible.

Main request - Article 100(b) EPC 1973

2. Interpretation of granted claim 1

2.1 Claim 1 is directed to a method of repairing an unspecified crack in an unspecified component by friction stir welding. The granted claim does not define any limitation for the size of the crack to be repaired, of the temporary plug or the existing hole, let alone their relative sizes. The description furthermore states that the crack and the temporary plug may be of various size and shape (see column 4, lines 39/40; column 5, lines 2 to 4).

The appellant argued that the claimed method would be understood by the skilled person to be directed to the repair of micro or fatigue cracks in aircraft as stated in the introductory portion of the patent specification. The skilled person would then have understood that an existing hole in a component, which had a particular function, would be much bigger than the width of the cracks which appeared as a result of fatigue and generally initiated from such existing

holes. The weld nugget would therefore always be narrow compared to the diameter of the existing hole and the temporary plug, so that the temporary plug would still exist after the welding and could therefore be removed.

This argument is unconvincing, because the claim is not limited to such specific use and the description of the patent specification discloses that the method may be adapted for various applications, such as aeronautical vehicles, land-based vehicles or nautical vehicles (see paragraph [0016]). Consequently the claim cannot be understood (even implicitly) to be limited to the relative dimensions considered by the appellant.

2.2 The claim defines a number of separate steps in a certain order. The skilled person would not understand from the ordinary meaning of the claim language that the order of the steps might be altered or that some of the steps may be carried out simultaneously. Paragraph [0043] of the patent states that method steps described in the preceding paragraphs are meant to be an illustrative example and that the steps may be performed, within the scope of the claims, sequentially, synchronously or in a different order, depending upon the application. This statement hence relates to the steps of the disclosed embodiment of a repair method, which comprises many more alternative or additional steps not defined in the claim. It cannot be construed to mean that the sequence of the claimed method steps may be arbitrarily altered or that any of the claimed separate steps may be omitted or may have been carried out by the execution of some earlier step.

2.3 According to the appellant's own interpretation, claim 1 of the patent in suit covers embodiments in which the

temporary plug is entirely consumed during the friction stir welding process.

This would occur when the width of the weld nugget (i.e. the friction stir weld being produced as a result of the friction stir welding process) is larger than the diameter of the existing hole or of the temporary plug inserted therein. If the temporary plug is entirely consumed by the welding process, its material would be spread by the stirring action of the rotating welding tool pin and the shoulder above it, and by its forward movement, over a certain portion along the weld nugget. After welding through it, the temporary plug therefore does not exist anymore as a physical entity.

3. The patent does not contain any information how such a no-longer-existing temporary plug could then be removed according to the final step of the method of claim 1. For this case, the skilled person is not able to carry out the claimed method.

3.1 The appellant could not indicate any basis in the description of the patent for its contention that the removing step would be understood by the skilled person as being achieved with the plug being simultaneously consumed during the welding process. As has been already indicated above, paragraph [0043] does not specifically relate to any of the steps defined in the claimed method, let alone the removing step. It can therefore not serve as a basis for this interpretation.

3.2 Similarly, the argument that the removing step should be understood as meaning the removal of an amount of material equivalent to that of the temporary plug by recreating the existing hole in order to re-establish the hole's function, is unconvincing. The basis

indicated by the appellant, in particular paragraphs [0036] and [0037], does not support this interpretation. Paragraph [0036] relates to a particular step (116) in a repair method according to an embodiment of the invention which is illustrated in a flow chart in Figure 3. Step 116 concerns the very case where the friction stir welding pin, and thereby also the resulting weld nugget, is larger in diameter than the existing hole. In this case, friction stir welding along the crack is said to continue through and beyond the existing hole, which after welding does not exist any more. In the following paragraph [0037], another step 118 of the embodiment of the repair method is described which may follow upon completion of *inter alia* step 116. According to step 118 the existing hole and the exit hole may be drilled larger to reduce stress intensification. The two paragraphs do not mention a temporary plug. It is also not directly and unambiguously derivable from the remaining disclosure that a temporary plug should have been present in step 116 of the embodiment of the repair method, since the repair method may also comprise alternative steps to the step of insertion of a temporary plug, namely "friction stir plug welding" of the existing hole (col. 5, lines 14/15, paragraph [0025]). There is anyway no indication in these paragraphs, nor in the remaining parts of the patent, that an equivalent amount of material corresponding to that of a previously inserted and entirely consumed temporary plug should be drilled out of the component in case a temporary plug might have been entirely consumed.

3.3 Based on the appellant's own interpretation of claim 1 that it definitely covers crack repair methods in which a temporary plug is inserted in an existing hole and is entirely consumed during the friction stir welding

process, the Board concludes that the claimed invention is not disclosed in a manner sufficiently clear and complete for it to be carried out by a skilled person in the art. The ground of opposition under Article 100(b) EPC 1973 is thus prejudicial to maintenance of the patent as granted.

Auxiliary request I - Article 13(1) RPBA

4. Auxiliary request I was filed during the oral proceedings before the Board and constitutes thereby an amendment to the appellant's case which may be admitted and considered at the Board's discretion according to Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA).

4.1 Claim 1 of this request has been amended with respect to claim 1 as granted by introducing a feature derived from paragraph [0033] of the description of the patent in suit. It defines that the size of the existing hole is larger in diameter than the diameter of a friction stir welding tool pin such that the temporary plug is removable from the component. The condition "such that the temporary plug is removable from the component" leaves the relative sizes of the existing hole and the tool pin undefined. Given that a temporary plug inserted in a hole having a diameter of, for example, two or more times the diameter of the welding pin will also be consumed to a certain extent, it remains unclear how much of a temporary plug can be consumed, or how much larger it should be compared to the size of the welding pin, for it still to be considered as "removable" after welding. According to the appellant the skilled person would understand that merely the border of the existing hole and the temporary plug should remain visible, at least in part. The Board

considers however that this interpretation, which is anyway bare of any support in the patent, does not limit the claimed subject-matter in a clear manner. Moreover, the size relationship between the hole diameter and the pin diameter is not even crucial for the question of how much of a border might remain visible. To which extent the temporary plug is consumed during the welding process depends in particular on the width of the resulting weld nugget, which in turn is determined by other parameters, such as for example the diameter of a shoulder on the friction stir welding tool that is larger than the diameter of the tool's pin, which features are however not defined in the claim. The Board therefore concludes that the subject-matter of claim 1 of auxiliary request I lacks clarity (Article 84 EPC 1973).

4.2 Furthermore, the amendment in claim 1 by way of auxiliary request I does not comply with the requirement of Article 123(2) EPC because the resulting subject-matter constitutes an unallowable intermediate generalisation of the content of the application as filed. Granted claim 1 covered methods in which the temporary plug could be removed by any method from the component after the welding tool was disengaged from the center of a partial exit hole. In auxiliary request I, that claim was limited by the amendment to a method in which the plug's removal was specifically carried out by drilling it out.

Paragraph [0033], on which the amendment is said to be based, discloses step 112 of the embodiment of the repair method. Step 112, i.e. "the plug 40 is removed by drilling out the plug 40 from the component", immediately follows on from step 110 which relates to the preceding disengagement of the welding tool from

the component. According to paragraph [0032], the tool is disengaged "in a center 60 of the exit hole 56". The only occurrence of the reference sign 60 in the drawings may be found in Figure 2, where it points to a circle which is additionally provided with the reference sign 16 of the existing hole, indicating hence that the exit hole and the existing hole coincide. In Figure 3 the corresponding flow chart box for disengaging step 110 contains the statement that the friction stir welding tool is disengaged "in a center of the existing hole". In view of the disclosure in Figure 2 (see above), it is not immediately clear that the expression "existing hole" in the flow chart box of step 110 constitutes a mistake nor that it should have read "exit hole", as alleged by the appellant. The description in combination with the drawings therefore disclose that, for the specific embodiment of the repair method in which the temporary plug is removed by drilling it out from the component, the friction stir welding tool is disengaged in a center of the existing hole. By the amendment of claim 1 the subject-matter is however more generally directed to methods of repair where the temporary plug is removed by drilling it out and where the tool is disengaged "in a center of a partial exit hole" which does not need to be coincident with the existing hole. The appellant pointed in this context to paragraphs [0031] and [0034]. These paragraphs relate however to the use of a retractable friction stir welding tool and friction stir welding in general, respectively, and do not contain any reference to the specific embodiment in which a temporary plug is removed by drilling it out. In the absence of any further basis in the application as filed which would support such generalisation, the resulting subject-matter extends beyond the content of the application as filed.

4.3 This request is consequently not *prima facie* allowable in the sense that it would overcome the outstanding objections with respect to the former requests without introducing new problems. The Board thus exercised its discretion under Article 13(1) RPBA, at least in view of the need for procedural efficiency, not to admit auxiliary request I (filed during the oral proceedings) into proceedings.

Auxiliary request III - Article 12(4), 13(1) RPBA

5. Auxiliary request III corresponds to auxiliary request 8 which was not admitted into the proceedings before the opposition division. The request was not filed together with the grounds of appeal, but only after the Board had issued its communication in preparation for the oral proceedings. According to Article 12(4) RPBA the Board may hold inadmissible requests which were not admitted in the first instance proceedings. When reviewing a decision relating to use of the discretionary power of the first instance, the Boards normally only overturn such a decision in particular circumstances, such as when the first instance department has wrongly exercised its discretionary power. In the present case, the appellant did not even assert that the opposition division committed an error in the exercise of its discretion and the Board is also unable to see any error in the exercise thereof. Instead the appellant argued that the amendment was motivated by the statements in the Board's communication concerning the absence in the claim of any limiting feature with respect to the temporary plug. The Board finds this argument non-persuasive since the communication only expressed the Board's preliminary view with respect to the claimed invention

and did not contain any invitation to amend the claims accordingly.

Moreover, as the request was filed after the Board's communication and therefore constitutes an amendment to the appellant's case, its admittance into the proceedings depends on the exercise of the Board's discretion again under Article 13(1) RPBA. The claim contains the same unclear feature as discussed already with respect to auxiliary request I, albeit added at a different position in the claim, which however has no impact on adding to its clarity. Therefore the request is also not *prima facie* allowable.

The Board thus decided to not admit auxiliary request III into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. H. A. Patin M. Harrison

Decision electronically authenticated