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**Datasheet for the decision
of 15 July 2014**

Case Number: T 0040/11 - 3.2.06

Application Number: 01983016.5

Publication Number: 1347859

IPC: B23K35/30

Language of the proceedings: EN

Title of invention:

MATERIAL FOR JOINING AND PRODUCT PRODUCED THEREWITH

Patent Proprietor:

Alfa Laval Corporate AB

Opponents:

SWEP International AB
Höganäs AB

Relevant legal provisions:

EPC Art. 54, 56, 100(b), 123(2)
RPBA Art. 13(1), 13(1)

Keyword:

Sufficiency of disclosure - enabling disclosure (yes)
Novelty - main request (yes)
Inventive step - main request (no)
1st and 2nd auxiliary request - late filed - not admitted

Decisions cited:

T 0666/89, T 1130/09, T 0198/84



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Boards of Appeal
Chambres de recours**

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Case Number: T 0040/11 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 15 July 2014

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 12 November
2010 revoking European patent No. 1347859
pursuant to Article 101(3) (b) EPC.**

Composition of the Board:

Chairman	M. Harrison
Members:	G. de Crignis
	W. Ungler

Summary of Facts and Submissions

- I. European patent No. 1 347 859 was revoked by the opposition division by way of its decision posted on 12 November 2010.
- II. The opposition division held that the subject-matter of claim 1 according to the main request and according to auxiliary request 1 did not meet the requirement of Article 54 EPC as it lacked novelty over example 14 in
D11 JP-A-02 207995.
Concerning auxiliary requests 2 and 3, it held that the subject-matter of claim 1 was not novel, in view of
D6 US-A-5 118 028.
The subject-matter of claim 1 of auxiliary requests 4, 5 and 6 was held to lack an inventive step when starting the assessment of inventive step from
D1 US-A-4 410 604.
- III. The appellant (patent proprietor) filed an appeal against this decision and paid the appeal fee. A statement setting out the grounds of appeal was received at the European Patent Office on 22 March 2011 together with the request to set aside the decision of the opposition division and to maintain the patent on the basis of an amended main request, in the alternative on the basis of one of the submitted first to ninth auxiliary requests. Experimental test results were submitted additionally.

- IV. In their replies, the respondents (OI and OII) filed observations and requested revocation of the patent in its entirety.

Respondent-Opponent OII additionally filed

Annex 1: Experimental results in respect of corrosion induced weight loss of brazing materials.

- V. With its communication annexed to a summons to oral proceedings, the Board indicated that the omission of the feature "at least 50% Fe" in the wording of claim 1 of the main request and auxiliary requests 1 to 7 appeared to result in subject-matter extending beyond the content of the application as filed. Further issues concerning clarity, sufficiency of disclosure, novelty and inventive step were also mentioned.

- VI. With letter of 13 June 2014, the appellant filed three amended sets of claim requests (main, first and second auxiliary requests) in four sub-sets (i, ii, iii and iv) and in two options (A or B), with amended pages of the description corresponding to each of these requests, and further submitted:

Annex I corrosion test data

Annex II Differential thermal analysis (DTA) test data relating to blends vs alloys

Annex III CrB formation test data

Extract from ASM Handbook Vol. 6 - Fundamentals of brazing (wettability).

- VII. Oral proceedings were held before the Board on 15 July 2014.

As its final requests, the appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the main request, the first auxiliary request or the second auxiliary request, all as filed during the oral proceedings.

Respondents I and II (opponents 1 and 2) requested that the appeal be dismissed.

VIII. Claim 1 according to the main request reads:

"An iron based brazing material comprising an alloy which contains

(i) 9 to 30 wt% Cr;

(ii) 0 to 5 wt% Mn;

(iii) 0 to 25 wt% Ni;

(iv) 0 to 7 wt% Mo;

(v) 0 to 1 wt% N;

(vi) 6 to 20 wt% Si in an amount effective to lower the temperature at which the brazing material is completely melted;

(vii) optionally micro alloying elements selected from V, Ti, W, Al, Nb, or Ta;

(viii) Fe in an amount of at least 50 wt%; and

(ix) B being present in an amount less than 1.5 wt%; the alloy being balanced with the Fe, and small inevitable amounts of contaminating elements as C, O and S."

Claim 1 according to the 1st auxiliary request reads:

"A product comprising components made of an iron based material and brazed together with an iron-based brazing material, wherein the components are heat exchanger plates, the product being a plate heat exchanger intended for at least two heat exchanging media and

comprising at least one plate package including several thin walled heat exchanger plates of an iron based material brazed together with the brazing material at the brazed joints having a metallurgical composition close to, and with a higher amount of Si than, the composition of the iron based plate material, the iron-based brazing material comprising an alloy which contains

- (i) 9 to 30 wt% Cr;
 - (ii) 0 to 5 wt% Mn;
 - (iii) 0 to 25 wt% Ni;
 - (iv) 0 to 7 wt% Mo;
 - (v) 0 to 1 wt% N;
 - (vi) 6 to 20 wt% Si in an amount effective to lower the temperature at which the brazing material is completely melted;
 - (vii) optionally micro alloying elements selected from V, Ti, W, Al, Nb, or Ta;
 - (viii) Fe in an amount of at least 50 wt%; and
 - (ix) B being present in an amount less than 1.5 wt%;
- the alloy being balanced with the Fe, and small inevitable amounts of contaminating elements as C, O and S."

Claim 1 according to the 2nd auxiliary request differs from claim 1 according to the 1st auxiliary request in that the iron based material is further defined in the claim. Accordingly, the first part of the claim reads as follows (the remainder thereof not being changed):
"A product comprising components made of an iron based material and brazed together with an iron-based brazing material, wherein the iron based material comprises max 2 wt% Mn, 16.5 - 18 wt% Cr, 10.0 - 13.0 wt% Ni, 2.0 - 2.5 wt% Mo, being balanced with Fe and small inevitable amounts of contaminating elements, and wherein the components are heat exchanger plates,..."

IX. The appellant argued essentially as follows as regards its (final) requests:

The main request should be admitted into proceedings. Its filing was in response to the submissions made during the oral proceedings. Claim 1 had already accordingly been amended in the 8th and 9th auxiliary requests which had been submitted with the grounds of appeal to include the feature "at least 50% Fe" which feature was also present in originally filed claim 1. The skilled person would understand that such a content had to be read in combination with the alloy being balanced with Fe. The claimed range for the content of B was a preferred embodiment of the application as filed, its inclusion into the claimed brazing material represented a disclosed and more limited scope of claim 1. The requirements of Article 123 EPC were met.

Concerning sufficient disclosure with regard to feature (vi), the skilled person would understand that the range for the amount of Si defined in the claim referred to the percentage which would be obtained when analyzed but that there was also a second condition to be met at the same time, namely that Si had to be present in an amount effective to lower the temperature at which the brazing material was completely melted.

For such verification, either visual inspection (as referred to in paragraph [0030]) or DTA analysis (see paragraphs [0032] and [0033] and Figures 1 to 3) could be performed. Accordingly, the skilled person could easily determine whether the claimed brazing material had completely melted. The temperature to be considered depended on the brazing material which had to be considered as the alloy without Si and B. Paragraph

[0013] of the patent in suit gave the background information that it was the "active, dissolved amount of Si" which was responsible for achieving the desired lowering of the melting point.

With respect to claim 7, the term "close to" concerned the metallurgical composition of the brazing material at the brazed joints and the skilled person had no difficulty in understanding that it meant that the composition had to match closely the iron based material. The requirements of Article 83 EPC were met.

The subject-matter of claim 1 was novel over the disclosure in D1. Although D1 referred to an addition of B, it did so in the context of providing an addition of B either in combination with or in the alternative to the addition of Si which could be added to the braze alloy mixture to depress the melting point thereof (col. 1, l. 67/68). Moreover, D1, in column 3, lines 4 to 11 gave only a very general indication of what could be included in its brazing alloy since it referred to an amount of from 0 to 5 % of B and from 0 to 12 % of Si, whereby it was clear that selections already had to be made from these broad ranges to fall within claim 1, which required not only that both elements were present, but present specifically with less than 1.5 wt% B and 6 to 20 wt% Si. Additionally, the examples given in D1, relevant to Fe-based alloys, did not refer to amounts of Si and B which were remote from each other, like they were in claim 1; in the examples of D1 where both elements were present, at least with respect to B, the amounts were far away from the ranges defined in claim 1, it being noted that the absolute minimum given in claim 1 of D1 was 2 wt%. Accordingly, the skilled person had to make multiple selections from D1 in order to arrive at the claimed subject-matter;

this required inventive selections and such considerations were not relevant to the assessment of novelty.

In order to further explain that many of the examples given in D1 were only blends of alloys and not true alloys, Annex II had been submitted. The DTA test data thereof demonstrated the differences in melting behaviour. Therefore, Annex II should be admitted into the proceedings as it showed further differences of claim 1 compared to D1 when taking account of the results given therein.

Annex I should be admitted into the proceedings; it provided further evidence regarding corrosion of three iron-based brazing materials comprising 9.5 wt% Cr, and demonstrated that a sample brazed with an alloy comprising 3.5 wt% B suffered more corrosion than a sample comprising 1.5 wt% B.

Annex III provided evidence that for test samples of stainless steel type 316 when being brazed with iron-based brazing materials having higher amounts of B (3 wt% and 4 wt%), CrB had formed within the plate material which would decrease the mechanical properties and corrosion resistance of the plate material and the brazed joint.

Concerning inventive step, D1 could be regarded as representing the closest prior art. The distinguishing feature of claim 1 compared to D1 was the mandatory presence and specific maximum content of B. The technical effect of B when added in the claimed amount in addition to a content of Si was that it increased wettability of the brazing material and minimised

corrosion of the brazing material while also lowering the melting point.

Even discounting the data in the annexes, the problem to be solved when starting from D1 was to provide a balance of wettability and corrosion characteristics in respect of the brazing properties of the substance to be brazed.

Pages 1 to 3 of the experimental data submitted with the grounds of appeal showed that addition of B reduced the wetting angle to less than 90° and increased the wetting area. Pages 4 to 5 of this data also showed that brazing materials comprising more than 1.5% B resulted in significantly greater corrosion.

D1 did not mention corrosion resistance. Moreover, D1 not only taught away from the inclusion of B in an amount of less than 1.5 wt% in that its claim 1 specified a range of between 2 wt% and 5 wt% B, but also provided no indication that B might be present in such low amounts while also providing improved wettability and improved corrosion resistance. Accordingly, the subject-matter of claim 1 involved an inventive step.

The first auxiliary request should be admitted into the proceedings. Claim 1 represented merely a combination of granted claims. No objections under Article 123(2) EPC arose. This subject-matter had always been present when considering the complete requests including dependent claims. The request was mainly based upon the 1st auxiliary request (ii) - option A, which had been filed in reply to the communication of the Board sent with the summons to oral proceedings and a similar claim 1 was decided upon

by the opposition division in the form of the sixth auxiliary request during the proceedings in the first instance. The subject-matter of claim 1 was clearly far removed from D2 - when considering the range for the amount of B - and also in particular clearly more remote from D1 in that it required the brazing material at the brazed joints to have a metallurgical composition which matched the composition of the iron based plate material. The request could not reasonably have been filed earlier since this would have increased the number of requests further. Accordingly, the filing of this request only at a later stage of proceedings reduced complexity.

The second auxiliary request should be admitted into the proceedings. By means of this request, claim 1 was further limited to the product being a particular plate heat exchanger and the iron-based plate material composition of a 316 alloy was defined. The requirement of Article 123(2) EPC was fulfilled because its subject-matter was a combination of granted claims 1, 5, 6 and 7. The stainless steel alloy 316 which was now defined as the iron based material was disclosed on originally filed page 7, lines 13 to 21 and linked to the brazing process resulting in a brazed product having mainly the same composition in the brazed objects as in the brazing joints. On page 4, third paragraph it was also disclosed that the brazing joints had a metallurgical composition close to the composition of the iron based plate material. The terminology "close to" would be understood by the skilled person to mean "as close as possible to". Page 4, lines 9 to 14 referred to the brazed product being a plate heat exchanger as well as claim 7. Thus, there could be no doubt about the claimed alloy and the iron based material being related in the claimed

relationship. It was not necessary that the paragraph on page 7, lines 13 to 21, which disclosed the iron-based material exemplarily in the definition of alloy 316, was linked to a range of B of below 1.5 wt% in the brazing alloy composition, as such teaching resulted from the natural progression of the disclosure and teaching of the patent specification.

X. The respondents essentially argued:

The amended main request should not be admitted into the proceedings. There was no basis in the application as filed for the amount of Fe being above 50% together with it being used for balancing the alloy. In this context, it was also not disclosed that B could have a value of zero, which was now allowed by the wording of the claim. The requirement of Article 123(2) EPC was thus not met.

Contrary to the requirement of Article 83 EPC, the patent did not disclose how to determine or obtain the active, dissolved amount of silicon. Also it was not disclosed how to arrive at the amount which was "effective to lower the temperature" for complete melting, which was a second condition in addition to the claimed amount of 6 to 20 wt%. In comparison to which alloy or which temperature a lowering of the temperature had to be present or how to test whether the brazing material was "completely melted" was also not stated. Due to the absence of this information, the invention was not disclosed in a manner sufficiently clear and complete for it to be carried out by the skilled person. Additional evidence for the insufficient disclosure was present in the patent in suit when considering Table 3, melt number 6, which did not reach the liquid state although according to Tables

1 and 2, its composition was in accordance with the claimed alloy.

Claim 7 included the feature of the brazing material at the brazed joints having a metallurgical composition "close to" the composition of the iron based plate material. The patent in suit only referred to alloy 316 as the iron based material for brazing. However, the subject-matter of claim 7 was not limited to such a material and accordingly, the term "close to" was unclear to an extent that the skilled person did not know how to carry out the invention in this context.

The subject-matter of claim 1 was not novel over D1. In particular, the disclosure in D1 at col. 2, l. 14 to 66 and col. 3, l. 4 to 11, anticipated the claimed subject-matter due to the overlaps with the claimed ranges. In accordance with the established case law of the Boards of Appeal (see e.g. Case Law Book 7th Edition I.C.5.2.1 and 5.2.2 and in particular T666/89), the total information content had to be taken into account when considering whether a skilled person would seriously contemplate applying the technical teaching of the prior art in the range of overlap. The numerical end points of the disclosed ranges were anyway specific disclosures. The claimed ranges were also not narrow compared to those disclosed, nor sufficiently removed from the known ranges as illustrated by examples, nor were they far removed from the end points.

Annexes I, II and III submitted with letter of 13 June 2014 by the appellant should not be admitted. Such data could and should have been provided earlier. Insufficient time was available to respond to the data. The conditions under which the test data was obtained were not adequately complete, and the test data were

not relevant with regard to the full scope of the claim. Annex I lacked conclusive results in that it only concerned brazing materials comprising specifically 9.5 wt% Cr, which did not allow any conclusion to be drawn for other materials falling within the claims. Annex II was filed too late to allow a verification of the alleged difference between blends and alloys. D1 had been cited with regard to lack of novelty and inventive step during the whole opposition proceedings and accordingly, such data should have been filed in the first instance proceedings. Also, the results obtained would have depended on how the blends were formed and the grain size used. The tests concerned the melting behaviour of samples whose composition was selected in correspondence with the components of the last entry in Table III. The test results in annex III concerned the formation of CrB in dependency on the B content when applied on stainless steel type 316 material. Such tests did not give any conclusive evidence when considering the claimed ranges. They provided confirmation that in a brazing material containing 17wt% Cr, CrB was mainly to be found in the centre of the braze joint when B was present in an amount of 0.6 wt%, whereas more borides were formed in the samples having a content of 3wt% or 4wt% B. Such specific data were irrelevant in view of the scope of claim 1.

Concerning inventive step, D1, col. 3, l. 4 - 11, could be taken as representing the closest prior art. Additionally, D1 taught the use of 5 to 12 % Si and 2 to 5 % B in its claim 1 to remain under a melting temperature of 1204 °C. Accordingly, the skilled person could choose the range for Si to be extended merely based on the characteristics desired from the iron based brazing alloy. In view of D1 mainly dealing with

a type 409 stainless steel, the contents of the brazing alloy would simply be adapted when dealing with a different type of steel such as a type 316 stainless steel as described in the patent. The objective technical problem thus was the provision of an alternative brazing alloy which should take into account the particular stainless steel to be brazed. When desiring to adapt the brazing alloy to stainless steel having a higher amount of Cr, the corrosion characteristics necessarily had to be considered. The skilled person knew that CrB decreased the corrosion resistance and higher amounts should be avoided. It was also known from

D10: US-A-4 444 587

that small amounts of B could be present. Accordingly the amounts of Si and B would be adapted in the way claimed without requiring an inventive step.

Annex 1 submitted with letter of 28 July 2011 by respondent OII showed that the highest corrosion resistance was not obtained for a B content below 1.5 wt% but for a B content of 3.5 wt% for an alloy having a Cr content of around 9.5 wt%.

The experimental evidence submitted by the appellant with the grounds of appeal failed to support the allegation of a purposive selection for the sub-ranges of Si and B combined and in particular for the overlapping sub-range for Si. The sub-range selected for Si was a random selection. The experimental evidence at most indicated that an increased wettability was associated with the presence of B as compared with the absence of B in the alloy. However, the objective technical problem was not linked to

wettability and these experimental test results were therefore not relevant for the assessment of inventive step.

The 1st auxiliary request should not be admitted. No request concerning a product was filed with the grounds of appeal. A similar independent claim (related to a product) had been present during the oral proceedings before the opposition division in the form of auxiliary request 6 then on file; such request was however not pursued. The opposition division held the subject-matter of that claim 1 as lacking an inventive step when considering D1. Accordingly, *prima facie* such a claim should not be admitted when filed at such a late stage of proceedings. In preparation of the current oral proceedings, no request was pursued having as a sole independent claim a claim related to a product. In view of this amended subject-matter, the arguments would have had to be shifted to either

D2: US-A-4 516 716

or D6 as representing the closest prior art. Accordingly, the arguments with regard to objections concerning novelty and inventive step had to be developed in a completely new direction. This change of case was particularly complex and would require consideration of entirely new matters and lines of argument for the first time during the oral proceedings.

The 2nd auxiliary request should not be admitted. There was no basis in the application as filed for the claimed combination of features. Accordingly, it was clearly not allowable under Article 123(2) EPC.

Reasons for the Decision

1. Admittance of the amended main request

1.1 According to Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA), it lies within the discretion of the Board to admit any amendment to a party's case after it has filed its grounds of appeal or reply. In accordance with the case law developed by the Boards, in order to be admitted at such a late stage of proceedings, a request should be clearly allowable at least in the sense that it overcomes the objections raised and does not give rise to new objections.

1.2 In comparison with claim 1 as granted, claim 1 includes additionally the feature of "Fe in an amount of at least 50wt%". Additionally the optional content of P in the alternative to B has been excluded. The addition of the feature concerning the amount of Fe can clearly be understood as a reaction to the objection under Article 123(2) EPC raised by the opponent and - although not accepted by the opposition division - mentioned also by the Board in the communication under Article 15(1) RPBA. The deletion of the optional content of P in the alloy limits the subject-matter of claim 1 to one of the alternative possibilities and such limitation had already been present in auxiliary requests 4 to 9 submitted with the grounds of appeal. Accordingly, such amendments were found reasonable in the circumstances and did not raise any surprising issues for the parties or the Board.

1.3 Furthermore, in comparison with claim 1 of all the requests filed with the grounds of appeal, the

functional feature concerning B "to act as a melting point lowering supplement to Si and to increase the wettability of the brazing material" was deleted as a reaction to the objections under Rule 80 EPC and Article 84 EPC raised in the communication of the Board and also raised in the discussion in relation to the requests on file at the beginning of the oral proceedings which were later withdrawn. The deletion of this wording limits the feature (ix) concerning B to the wording of the claims in the patent in suit. Accordingly, it did not change the underlying arguments put forward by the respondent in relation to claim 1 with respect to novelty and inventive step.

- 1.4 The respondents argued that the line of argument was indeed changed because the amendment of the claim to remove the functional terminology relating to B allowed the claim to be interpreted such that "B being present in an amount less than 1.5 wt% B" could then mean that B could have a value of 0 wt% such that it was not present at all or that it was merely present on a contaminant level. This the Board cannot however accept, since the claim defines first that "B is present" which excludes the possibility that the claim can reasonably be understood to mean that B can have a value of 0. The wording is also distinguished compared to the wording of other elements which may be contained within the alloy and which are thus defined with a lower value of "0 to...". Similarly, the possibility of B being present merely at a contaminant level is not encompassed by the claim on any reasonable interpretation, since contaminants are dealt with in the balancing of the alloy.

- 1.5 Hence, the Board concluded that the amendments overcame the particular objections raised under

Article 123(2) EPC also by the Board, Article 84 EPC and Rule 80 EPC, and did not give rise *prima facie* to further objections with respect to these provisions. Also, none of the amendments resulted in a complexity which could not reasonably be handled by the parties or the Board. Accordingly, the Board exercised its discretion under Article 13(1) RPBA to admit the request into the proceedings.

2. *Main request - Article 123(2) EPC*

2.1 The wording of claim 1 includes the feature of the alloy comprising "Fe in an amount of at least 50 wt%". This feature had already been present in originally filed claim 1. The respondents objected that the combination of this feature with the feature of "the alloy being balanced with the Fe" was not disclosed in the originally filed application.

2.2 It is true that originally filed claim 1 did not include the feature referring to the alloy being balanced with the Fe. But, when taking into account the underlying description, this relates to the use of a brazing material with mainly the same composition as the base material used for producing the product - the base material being iron based materials - only such an alloy is possible. Specifically, the description refers to the brazing material as consisting of an alloy which contains at least 50% Fe (page 2, lines 22 to 30 of the application as filed). Hence, the Board finds that a skilled person would unambiguously conclude that the alloy should be balanced with Fe. Such conclusion is further supported by the originally filed description on page 5, lines 15 to 20 - referring to alloys suitable for iron materials - and page 7, lines 13 to 21 - referring to stainless steel, alloy 316, an Fe-

based material - and the experimental melt number 11 of Table 4 - which is balanced by Fe. It may also be noted that whilst many of the Tables in the application no longer relate to the more limited invention claimed, all the experimental results in those Tables use a balance of Fe and in the vast majority of cases with a Fe content of at least 50 wt%. Merely by the limitation of claim 1, the skilled person does not receive an altered perception of the original disclosure in a new context. Accordingly, the requirement of Article 123(2) EPC is met.

2.3 Concerning the range for the amount of B ("to be present in an amount less than 1.5 wt%"), originally filed claim 2 referred to this preferred range. Additionally, melt number 11 of Table 4 includes B in an amount falling in this preferred range. Its combination with the feature of the alloy being balanced with Fe is disclosed in view of the above conclusion concerning the content of Fe. Accordingly, also this combination of features meets the requirement of Article 123(2) EPC.

3. *Main request - Sufficiency of disclosure - Article 83/100(b) EPC*

3.1 The objection raised in relation to sufficiency of disclosure with respect to feature (vi) in claim 1, concerns the definition of a content of "6 to 20 wt% Si in an amount effective to lower the temperature at which the brazing material is completely melted".

3.2 This feature is understood by the Board to represent two conditions for the claimed alloy. The first condition is that the amount of Si has to lie within the claimed range. Additionally, the amount has to be

effective to lower the temperature at which the brazing material is completely melted.

3.3 The respondent's view that this feature only represents one condition is not accepted. In such case the functional feature would be redundant or superfluous, which, however, cannot be considered correct as explained below.

3.4 The skilled person is aware of Si and B generally acting as melting-point decreasing elements (see e.g. D1, col. 1, l. 66-68; D6, col. 5, l. 25/26; D10, col. 3, l. 51-55). Accordingly, these components have to be absent when determining whether such effect is present. Although any amount of Si and B would presumably influence the melting temperature, it has to be verified whether for a claimed alloy the amount of Si acts in such a manner.

3.5 The first condition - that the amount of Si has to lie within the claimed range - can easily be established - by analysing the amount by known methods. Evidence for such methods being available is present for example in the Tables of D1 and the amounts for Si disclosed in D2.

3.6 The second condition - "in an amount effective to lower the temperature at which the brazing material is completely melted" - is measured by comparing the amount to another amount and seeing if the temperature is lowered at which complete melting takes place; a test to see if complete melting has occurred is apparently available by well known DTA-analysis (such as set out in paragraphs [0032] and [0033] and such as shown in Figures 1 to 3 of the patent in suit) or by

visual inspection (such as set out in paragraph [0030] of the patent in suit).

3.7 In the context of the example given for melt 6 in Table 3 of the patent in suit, which is specified as not reaching the liquid state, the respondent's view was that there would be no teaching in the description "of the amounts of additional components necessary to reach a certain desired liquidus temperature - if possible at all - in a composition comprising 6 % Si." - However, the condition of the brazing material being completely melted is not linked in claim 1 to a specific liquidus temperature.

3.8 Melt 6 in Table 3 in the patent in suit includes an amount of approximately 6% Si and less than 1.5 wt% B. Accordingly, it represents an example at the boundaries of the claimed invention. No temperature for the alloy being completely melted is given - neither is such or any other temperature claimed. The specimens were examined visually at 1190°C. Thus, the only information which can be gained from melt 6 in Table 3 is that its liquidus temperature is not obtained at 1190 °C. As no data are available as to whether the temperature at which the brazing material is completely melted is lowered, it cannot be decided as to whether this requirement of claim 1 is met and accordingly, whether melt 6 falls under the scope of claim 1 or not. However, the verification of such issue falls within the normal capabilities of the skilled person and so the mere fact that such data are not given cannot result in an insufficient disclosure of the invention defined in the claims as such example does not contradict the claimed functional feature. To the contrary, it can be reasonably assumed - via the content and the known function of Si and B - that the

melting temperature of the brazing material has effectively been lowered. The respondents have not provided any evidence to the contrary nor convincing argument based on known properties, but merely rely on an alleged inability to carry out the invention.

- 3.9 The respondent's reference to Figure 1 of the patent whereby it would allegedly not be possible to define a liquidus temperature also does not contradict the ability of the skilled person to carry out the claimed invention. This Figure (as well as Figures 2 and 3) concerns a melt which does not fall under the scope of claim 1 as it does not include any amount of B. Accordingly, the argument based on this Figure is not persuasive.
- 3.10 Paragraph [0013] of the patent in suit indicates that it is the "active, dissolved amount of Si" which should be responsible for achieving the desired lowering of the melting point. This however represents additional ("background") information, but cannot be understood to have any relevance to the issue of sufficient disclosure. The analysed amount is an amount which can be understood to be compared to the claim; whether that amount also lowers the melting point can indeed be conducted by a separate test.
- 3.11 With respect to the respondent's objection to claim 7 and the term "close to" which concerns the metallurgical composition of the brazing material at the brazed joints, the skilled person would have no difficulty in carrying out the invention in this respect since, in the broad manner claimed, it is evident that the composition merely has to match the iron based material closely. Rather than giving rise to a valid objection under Article 83 EPC/Article 100(b)

EPC, the objection appears instead only to provide an indication that the claim can be given a broader interpretation than merely being limited to a brazing material which is exactly matched to the plate material.

3.12 The requirements of Article 83 EPC are thus met and the ground of opposition under Article 100(b) EPC is not prejudicial to maintenance of the patent.

4. *Main Request - novelty*

4.1 D1 discloses an iron-based brazing alloy composition (title). The general disclosure in col. 2, lines 14 to 66, explains the content of the elements Ni, Cr, B, Si and Fe with regard to their function and the boundaries of amounts. Additionally reference is made to the braze alloy as having a flow temperature of less than 1200°C and ideally less than 1150°C.

4.2 D1 discloses a preferred brazing alloy in col. 3, lines 4 to 11. A comparison of this preferred brazing alloy with the claimed alloy is given:

	D1	claim 1
Fe	> 50 wt%	> 50 wt%
Cr	max. 20 wt%	9 to 30 wt%
Ni	18 to 22 wt%	0 to 25 wt%
C	< 0,1 wt%	inevitable amounts
B	max. 5 wt%	less than 1.5 wt%
Si	max. 12 wt%	6 to 20 wt%

4.3 The appellant argued that in order to arrive at the subject-matter of claim 1 from D1, several selections had to be made. It was necessary to further select a value of less than 1.5 wt% B when first selecting a value of Si to lie within the claimed range.

- 4.4 In situations of "overlap" or "selection" an investigation of the disclosure in terms of assessing novelty should include whether or not a skilled person would, in the light of all the technical facts at his disposal, seriously contemplate applying the technical teaching of the prior art document in the range of overlap. If it could reasonably be assumed that he would do so, then the subject-matter of the claim would lack novelty. This is also in accordance with established case law of the Boards of Appeal (see e.g. T 666/89 (OJ 1993, 495)) and agreed by the parties to be the relevant standard when considering novelty in regard to the claimed alloy.
- 4.5 For assessing this issue, the general description and the examples of D1 have to be considered.
- 4.5.1 According to the description, B and Si can be alternative components (see D1, col. 1, l. 66/67 - "... boron and/or silicon are added to the braze alloy mixture", and also col. 2, l. 33 - 36, where it is specified that "Boron which was previously mentioned as included in the braze alloy composition as a desirable element from the standpoint of melting point depression may vary from 0 to 5 % by weight. ... silicon may be included in the braze alloy composition ... in amounts of from 0 to 12 weight percent."). This concept is consistent with the above referenced preferred alloy in col. 3, l. 4 to 11.
- 4.5.2 In D1, in all its examples including both elements, B and Si, the amount of B lies in a range between 1.91 wt % and 3.9 wt% and the amount of Si lies in the range between 4.1 wt% and 10.8 wt%.

- 4.6 Importantly, the features concerning the amounts of Si and B cannot be considered separately (i.e. these are not ranges which can be compared to the claimed ranges of these elements in isolation from each other). Initially, a first selection has to be made to necessarily include both elements, B as well as Si, in the alloy. A further selection concerns the inclusion of B in a lower amount than shown in the examples of D1. Such multiple selections already confer novelty on the claim as there are interactions between the various elements.
- 4.7 When considering for example the criteria developed for a selection invention (see e.g. T1130/09 and T0198/84) to the sub-range selected for B, the Board accepts that the selected sub-range is narrow (present, but in an amount less than 1.5wt%) compared to the known range (0wt% to 5wt%); the selected sub-range is sufficiently far removed from any specific examples disclosed in D1 (none of which discloses a value below 1.91 wt% B) and from the end-points of the known range (0wt% not being included in the claimed range of the claim under consideration and 5 wt % far-off the claimed end-point of 1.5 wt%). It may be questioned whether the third criteria mentioned in T0198/84 has to be considered when assessing novelty. However, taking this into consideration, the selected range is also not found to be an arbitrary selection, but a purposive selection with regard to wetting, corrosion and melting characteristics of the alloy (see paragraphs [0012], [0019], [0025], [0026] of the patent in suit). Hence, when considering B in the context of the alloy more generally disclosed in D1, the subject-matter of claim 1 is novel.

- 4.8 Thus, there is no clear and unambiguous disclosure in D1 for an alloy having an iron-based composition including at the same time Si in an amount of 6 to 20 wt% and B in an amount of less than 1.5 wt%. Accordingly, the subject-matter of claim 1 is novel.
5. *Non-admittance of Annexes I and II; possible relevance of Annex III*
- 5.1 Experimental test data were submitted as Annexes I, II and III by the appellant with letter of 13 June 2014, hence well after the submission of the statement setting out the grounds of appeal and after the communication of the Board. It thus represents a change of the appellant's case and its possible admittance needed to be considered under Article 13(1) RPBA.
- 5.2 Annex I provides test data concerning corrosion for three iron-based brazing materials comprising 9.5 wt% Cr. It is understood that it was submitted in order to provide evidence that a sample brazed with an alloy comprising 3.5 wt% B suffered more corrosion than a sample comprising 1.5 wt% B - contrary to the respondent's (OII's) submission in Annex 1 of 28 July 2011.
- 5.3 No alloys including other amounts of Cr are tested and hence, no conclusions concerning related alloys which are however included in the scope of claim 1 can be drawn from these data. Hence, Annex I lacks sufficiently relevant comparative results. Therefore, the Board exercised its discretion not to admit Annex I into the proceedings (Article 13(1) RPBA).
- 5.4 Annex II provides data and DTA graphs concerning the melting behaviour of a sample (1A, 1B, 1C) which was

prepared by blending a powder (2) consisting of 83.8 wt % Fe and 16.2 wt% B with another powder (3) having a composition of 55.3 wt% Fe, 17.6 wt% Cr, 1.5 wt% Mn, 12.54 wt% Ni, 1.87 wt% Mo, 10.62 wt% Si and 0.59 wt% B in a blend of 12.4 wt% powder (2) with 87.7 wt% powder (3). The heating and cooling curves by means of DTA using DSC are provided for the powder blend and for the alloy. Additionally a Table is present which registers the different temperatures when a peak was measured. Such data were provided in order to demonstrate that in D1 blends are present which are different to alloys, and that the blends of D1 could therefore not be compared to the claimed alloys.

5.5 The relevance of this data is not immediately apparent to the Board since it is not clear how the blends were formed. Due to this lack of information concerning the formation of the blends and their particular composition, the data are quite complex. Also, the respondent disputed that there would be a difference in the behaviour between blends and alloys and referred to the issue that any results would depend for example on grain size of the samples, and to the fact that D1 had been present from the beginning of the opposition proceedings, that such data did not represent a reaction to the communication of the Board and that no reason was conceivable why such data had not been provided earlier.

5.6 The data concern only one sample in relation to D1 (the sample of the last entry in Table III of D1) and hence, the relevance of this data with regard to the claimed subject-matter is seemingly limited to this specific composition (which contrary to the claimed subject-matter included less than 50 wt% Fe). Further, Annex II was supplied very late in the proceedings allowing the

respondents seemingly no chance to properly check the findings by means of their own tests or to supply further test results themselves. The argument that the grain size of the blends may well affect the results is also found fully credible. Therefore, the Board exercised its discretion not to admit Annex II into the proceedings (Article 13(1) RPBA).

5.7 Annex III provides test results concerning the formation of CrB. Three iron-based brazing materials having varying B content were prepared and the samples were brazed to a circular plate made of stainless steel type 316. Pictures of the cross-sections of the samples are provided. No reference was made to annex III in regard to the final requests of the appellant during the oral proceedings before the Board. Accordingly, any possible relevance of annex III to the final requests and also admittance of annex III can be left undecided.

6. *Main Request - inventive step*

6.1 D1 represents the closest prior art. This was not contested by the parties. It discloses a brazing alloy composition which is used for alloying plate-fin sandwiches for manufacturing heat exchangers. D1 concerns the provision of an alternative material to the nickel-based filler metals for economical reasons. It provides an iron-based brazing alloy in which the filler is substantially iron with addition of further elements for improved high temperature service and the addition of B and/or Si for melting point depression. D1 discloses test results which are performed on 409-type stainless steel plate-fin sandwiches (examples III to V). The tested brazing compositions have a metallurgical composition which is close to and has a higher Si content than the plate material (Tables I,

III to V). D1 states that an addition of B will decrease the melting temperature and is included in the braze alloy composition as a desirable element in the range of from 0 to 5 wt% (column 2, l. 33 - 36) and as already set out in the reasoning concerning novelty above, D1 refers to the option of B and/or Si being used (col. 1, lines 66 to 68). Following on from the disclosure of B being desirably used for its properties of melting point reduction, column 2, lines 37 to 41 notes that Si "in a similar vein" may be included to reduce the melting point of the braze alloy.

6.2 When starting the assessment of inventive step from the preferred alloy set out in col. 3, lines 4 to 11 of D1 (see points 4.1 and 4.2 above), the brazing material of claim 1 differs from the alloy in D1 in that both of the elements, B and Si, have to be present and in that particular boundaries for the ranges for the content of these elements have been chosen, most importantly the boundary for the maximum content of B. No further differences were identified by the appellant.

6.3 The objective technical problem when starting from D1 is that of providing an alternative alloy. The appellant argued that a different objective problem was involved, namely a brazing alloy which provided a balance of improved wettability and brazing properties. However, the Board does not find the appellant's alleged problem to be an objective problem because an improvement in this sense of the alloys over the whole scope of claim 1 compared to those in D1 has not been proven by way of comparative tests. Also, no other evidence relating to any improvement in respect of these alloys (i.e. the alloys over the whole scope of claim 1 having regard to the element ranges therein) has been provided.

- 6.4 When desiring to find an alternative brazing alloy - for example for the stainless steel alloy 316 which underlies all the examples in the patent in suit and which includes 16 to 18 wt% of Cr -, the skilled person would have taken into account the known effects of altered contents of B and Si related to melting point and corrosion resistance of the alloy.
- 6.5 Such conclusion can be drawn for example from paragraph [0026] of the patent in suit where reference is made to the link of a high content of B to the increased formation of CrB and its relation to reduced corrosion resistance, increased stress concentration and formation of cracks. The skilled person considering the avoidance of corrosion accordingly had a reason to reduce B so as to bring the content of B outside of the range included in the examples of D1 when desiring to provide an alloy for a high-Cr material. The skilled person's general knowledge concerning corrosion in relation to high-Cr material is confirmed and set out in D10. D10 (col. 3, l. 53 - 64) explains the disadvantageous characteristics of CrB; however, it teaches that a small content of B may still very well be used as a melting point depressant (D10: col. 4, l. 10 - 14). The influence of both elements, Si and B with regard to the melting point depression is disclosed in D1 (col. 1, l. 38/39; col. 2, l. 35) and in D2 (as acknowledged in paragraph [0024] of the patent in suit) and hence, is also well-known. Accordingly, when considering an alternative brazing alloy and, if it is wished, for example, to lower the melting point and at the same time reduce the amount of B for reasons of increasing corrosion resistance, the amount of Si would need to be increased since otherwise the desired melting point would not be obtained.

6.6 Hence, for an alternative brazing alloy, the skilled person would consider a range of less than 1.5% B from the complete range disclosed in D1 (i.e. 0 to 5%) and at the same time maintain the Si-content as stated in D1 in order to arrive at a sufficiently low melting point temperature. It should be taken into account here that the melting point depression considered according to D1 is much larger than the one considered according to the patent in suit in view of the different materials which are being brazed in the respective disclosures. Accordingly, the amount of temperature depressant to be added could also be lowered.

6.7 According to the description of the patent in suit, reference is additionally made to the addition of B as increasing the wettability of the brazing material (paragraph [0012]). However, this further effect is implicitly obtained when adding B for whatever reason. This was not disputed. Accordingly, such improvement can only be understood to constitute a bonus or unavoidable effect when adding B, which bonus effect cannot be taken into account for the assessment of inventive step. Moreover, there are no related data provided in the patent in suit as regards wettability improvement and therefore, it is irrelevant whether the controversially discussed experiments submitted with the grounds of appeal are taken into account or not.

6.8 Hence, the skilled person would immediately recognize the possibility that the alloy composition in D1 could be altered by reducing its content of B when at the same time the content of Si is increased for depressing the melting point; thereby at least the benefit of improved corrosion resistance of the brazed article could be gained (as is anyway known from D10) and the

possibility of tailoring the alloy to suit the desired melting characteristics would be obtained for the particular material to be brazed. The skilled person would consider these advantages and select suitable amounts of Si and B from D1 and thus arrive at the subject-matter of claim 1 without the exercise of inventive skill.

- 6.9 The appellant's view that according to claim 1 of D1 the brazing alloy composition required an amount of 2 to 5 wt% B and thus taught away from the claimed composition is not convincing. On the one hand, the alloy composition in claim 1 is specifically directed to a flow temperature of below 2200°F (1204°C) whereas the patent in suit considers liquidus temperatures of below 1220°C. On the other hand, the preferred alloy composition in col. 3, l. 5 to 10 of D1 is defined with a content of maximum of 5 wt% B including 0 % - consistent with the description of the preferred embodiments in column 1, l. 66 - 68 and col. 2, l. 33 - 36. Accordingly, the description of the preferred embodiments in D1 enables the skilled person to choose within the whole disclosed range the appropriate amount of B.

Consequently, the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC).

7. *1st auxiliary request*

- 7.1 This request was filed during the oral proceedings. As set out above, according to Article 13(1) RPBA, it lies within the discretion of the Board to admit any amendment to a party's case after it has filed its grounds of appeal or reply. In order to be admitted at

such a late stage of proceedings, a request should be clearly allowable at least in the sense that it overcomes the objections raised and does not give rise to new objections.

7.2 Claim 1 defines a product and is based upon granted claims 1, 5 and 7, with deletion of the alternative of P being present and the addition of Fe being present in an amount of at least 50wt%. Accordingly it is not merely a combination of granted claims as argued by the appellant. No request including such a claim 1 was filed with the grounds of appeal although an independent claim specifying similar subject-matter had been present during the oral proceedings before the opposition division in form of auxiliary request 6 then on file.

7.3 In view of the amended subject-matter, the arguments concerning inventive step would be completely changed which would lead to a highly complex situation at a very late stage of proceedings. There was also no indication, at least *prima facie*, that such a request would be allowable; the opposition division at least did not find that similar request allowable with regard to lack of inventive step over the teaching of D1. However, D1 would no longer clearly be considered as representing the closest prior art as it is not an issue in D1 whether the brazing alloy has a composition similar to the material being brazed - contrary to the disclosure in D2 for example (see col. 1, l. 25 to 47). Although opponent OI had exhaustively argued in relation to inventive step when responding to the grounds of appeal with the combination of D1 and D10, the further options of D2 or D6 representing the closest prior art were also mentioned. These arguments and options were also not related to a product claim

and in particular not to whether the iron based material and the brazing material had to match with regard to their composition. Accordingly, the arguments with regard to objections concerning novelty and inventive step would have had to take a completely new direction to what had already been argued and at a very late stage of proceedings.

7.4 The argument of the appellant that such a request could not have been filed earlier in order to avoid an excessive number of requests and in order to reduce complexity is not persuasive, particularly in view of the number of requests filed with the grounds of appeal (main request and nine auxiliary requests) and in view of the multitude of requests filed in reply to the communication of the Board (main request and first and second auxiliary requests in two options (A, B) and in four sub-sets ((i) to (iv))).

7.5 Hence, the Board concluded that these amendments represented a change of case in a direction which had not been pursued in the appeal and which had a high level of complexity in relation to the prior art and the necessary considerations required regarding novelty and inventive step at such a late stage of proceedings. Accordingly, the Board exercised its discretion under Article 13(1) RPBA not to admit this request into the proceedings.

8. *Auxiliary request 2*

8.1 The subject-matter of claim 1 includes in addition to the subject-matter of claim 1 of auxiliary request 1 the composition of the iron based material and specifies this material in relation to an alloy comprising "max 2 wt% Mn, 16.5 - 18 wt% Cr, 10.0 - 13.0

wt% Ni, 2.0 - 2.5 wt% Mo, being balanced with Fe and small inevitable amounts of contaminating elements" (i.e. a 316 alloy as mentioned in various parts of the patent).

8.2 Disclosure of such an alloy *per se* is present in the application as filed on page 7, lines 13 - 21. In this paragraph the following is stated: "The present invention is of great value for brazing different kinds of objects of steel. As an example the stainless steel, alloy 316, may be mentioned. The chemical composition of this alloy is max. 2.0 % Mn, 16.5 - 18% Cr, 10.0-13.0 % Ni, 2.0-2.5% Mo, the balance being Fe. According to the invention, a brazing material is prepared with the same composition as the alloy but with a suitable amount of Si replacing the same amount of Fe by weight. After the brazing process the brazed product will have mainly the same composition in the brazed objects as in the brazing joints."

8.3 This alloy thus is mentioned as an example of stainless steel and, according to the invention, a brazing material is prepared with a matching composition. Accordingly, for such an exemplary steel composition it is not disclosed that a brazing material could be used which contains the elements in the breadth of the ranges as defined in present claim 1. Thus there is no disclosure, in combination, of the two ranges defined now in claim 1. In other words, there is no disclosure of the broad ranges for the various elements of the defined alloy braze material together with the more specifically defined iron based alloy. There is further, in particular, no disclosure for this defined iron based material being brazed with an alloy including B in an amount of below 1.5wt% as claimed.

The disclosure concerning this amount of B can be found on originally filed page 3, lines 6 to 9, and relates to the option of the material containing B. However, according to the description and the subject-matter of granted claim 1, the further option of replacing B by P is disclosed (see originally filed page 3, lines 24 - 26 and page 4, lines 24/25). Thus, there is no unambiguous link of such a selection (B) and preferred range (less than 1.5 wt% B) with the exemplary stainless steel alloy disclosed in page 7, lines 12 - 21. It may be added that the combination of the two alloys (as defined in the claim) with the inclusion of the terminology that one alloy has a composition which is "close to" the other, albeit that the ranges of the elements only overlap to a minor degree, rather reinforces - by this rather inconsistent language - that there is no disclosure of this particular combination.

8.4 The appellant's argument that the cited paragraphs on pages 3 and 4 were linked by a "natural flow" of the disclosure and teaching to the paragraph on page 7, and would be consistent with each other, does not result in an unambiguous disclosure to a skilled person but at best indicates that such a possibility was not specifically excluded.

8.5 Accordingly, at least *prima facie* claim 1 did not meet the requirement of Article 123(2) EPC and was not clearly allowable. Thus the Board exercised its discretion not to admit the second auxiliary request into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



M. Patin

M. Harrison

Decision electronically authenticated