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Datasheet for the decision of 29 July 2010

Case Number: T 0687/06 - 3.3.09

Application Number: 00920702.8

Publication Number: 1183151

IPC: B32B 15/01

Language of the proceedings: EN

Title of invention:
Brazing Sheet

Patent Proprietor:
Corus Aluminium Walzprodukte GmbH

Opponents:
Pechiney Rhenalu and Alcan France S.A.S.

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2), 123(3)
RPBA Art. 13

Relevant legal provisions (EPC 1973):
-

Keyword:
"Admissibility of late-filed documents and auxiliary request 1"
"Amendments - allowable under Article 123(2), 123(3)"
"Novelty - yes"
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0687/06 **-** 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 29 July 2010

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office announced orally on 24 January 2006 and posted 16 March 2006 revoking European patent No. 1183151 pursuant to Article 102(1),(3) EPC 1973.

Composition of the Board:

Chairman: W. Sieber
Members: N. Perakis
K. Garnett

Summary of Facts and Submissions

I. Mention of the grant of European patent No 1 183 151 in respect of European patent application No 00920702.8 in the name of Corus Aluminium Walzprodukte GmbH, which had been filed as International Application No. PCT/EP00/03335 on 12 April 2000 and published as WO 00/63008 on 26 October 2000, was announced on 2 July 2003 (Bulletin 2003/27). The patent entitled "Brazing sheet" was granted with eleven claims. Independent product Claim 1 reads as follows:

"1. Brazing sheet having either a two-layer structure having a core sheet made of an aluminium alloy core and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element and said two-layer structure is devoid of a sacrificial anode clad layer, or a three-layer structure having a core sheet made of an aluminium alloy core material and on both sides thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, wherein the aluminium alloy of the core sheet has the composition (in weight %):-

Mn	0.5 to 1.5
Cu	0.5 to 2.0
Si	0.4 to 0.8
Mg	< 0.05
Fe	< 0.4
Ti	< 0.15
Cr	< 0.35
Zr and/or V	< 0.35 in total
Zn	< 0.25
Ti	< 0.15

balance aluminium and unavoidable impurities,

and wherein said brazing sheet has a post-braze 0.2% yield strength of at least 50 MPa and having in the post-brazing state a corrosion life of more than 12 days in a SWAAT test without perforations in accordance with ASTM G-85."

Claims 2 to 8 were dependent claims directed to preferred embodiments of the brazing sheet of Claim 1. Claims 9 to 11 were independent claims relating to a method of making a brazing sheet according to Claim 1, a brazed assembly comprising a brazing sheet according to Claim 1 and a brazed heat exchanger comprising a brazing sheet according to Claim 1.

II. A notice of opposition was filed jointly by Pechiney Rhenalu and Pechiney (now Alcan France S.A.S) on 30 March 2004 requesting revocation of the patent in its entirety, relying on Article 100(a) EPC, namely that the claimed subject-matter lacked novelty and did not involve an inventive step.

During the opposition proceedings the following documents were cited:

D1: R. Benedictus *et al* "Influence of Alloying Additions on Corrosion Behaviour of Aluminium Brazing Sheet", Aluminum Alloys, vol 3, Proceedings of the 6th ICAA, The Japan Institute of Light Metals, 5-10 July 1998, 1577-1582;

D2: WO 94/22633 A1;

D3: EP 0 718 072 A1;

D4: EP 0 718 072 B1;

D5: US 4 649 087;

D6: GB 2 321 869 A;

D7: abstract JP 7003370, esp@cenet - Document Bibliography and Abstract; and

D11: EP 0 556 798 A1 (cited by the opposition division).

In the course of the opposition proceedings the patent proprietor filed various auxiliary requests. Claim 1 of Auxiliary Request 1 filed with letter dated 8 November 2004 differed from granted Claim 1 only with regard to the copper-content, which was amended to 0.8 to 1.5 wt%.

III. By a decision announced orally on 24 January 2006 and issued in writing on 16 March 2006 the opposition division revoked the patent. It considered that the subject-matter of Claim 1 of all requests lacked an inventive step.

In particular with regard to **Auxiliary Request 1**, which became the patent proprietor's main request when it lodged an appeal against this decision, the opposition division considered that the subject-matter of Claim 1 was obvious in view of the disclosure of D3 when taking into account the general technical knowledge of the skilled person in the art. According to the opposition division the claimed subject-matter differed from the disclosure of D3 only in the use of a lower Mg-content in the core alloy, namely less than 0.05 wt%, instead of 0.1-0.6 wt% disclosed by D3. This Mg-content reduction would however be obvious to the skilled person on the basis of his general technical knowledge (as illustrated by D2, D5, D6 and D11), according to which the Mg-content should be kept low in aluminium core alloys since higher contents seemed to be detrimental to brazeability. Thus the skilled person

would either reduce the Mg-content or even completely exclude it from the core alloy composition.

IV. The patent proprietor appealed the decision of the opposition division on 9 May 2006 and paid the appeal fee on the same day. The statement setting out the grounds of appeal was submitted on 25 July 2006. The appellant's main request was to maintain the patent with the claims as filed on 8 November 2004 (Auxiliary Request 1 of the contested decision). The appellant filed also Auxiliary Requests 1 to 5.

With a subsequent letter dated 29 June 2010, the appellant withdrew Auxiliary Requests 4 and 5 and filed new Auxiliary Requests 4-6.

V. In their observations filed on 29 November 2006, the respondents (opponents) defended the decision of the opposition division. They submitted further documents D8-D10 to illustrate the general technical knowledge of the skilled person in the art.

D8: R.S. Timsit *et al*, "A Novel Brazing Technique for Aluminum", Supplement to the *Welding Journal*, June 1994, 119-128;

D9: R.K. Bolingbroke *et al*, "Advances in the Manufacture and Performance of Aluminium Heat Exchanger Materials", SAE Proceedings 971798, 1997, 203-210;

D9a: R.K. Bolingbroke *et al*, "Optimisation of Nocolok (TM) Brazing Conditions for Higher Strength Brazing Sheet", SAE Proceedings 971861, 1997, 757-762; and

D10: M. Yamaguchi *et al*, "Brazeability of Al-Mg Alloys in Non-Corrosive Flux Brazing, *Furukawa Review*, 1993 (12), 139-144.

With a letter dated 24 June 2010 they filed D7a, a computer translation of D7.

VI. Oral proceedings were held before the board on 29 July 2010. At the oral proceedings the appellant filed new auxiliary requests. Later during those proceedings it withdrew all requests except the "first auxiliary request", which became its sole request.

Claim 1 of this request reads as follows:

"1. Brazing sheet having either a two-layer structure having a core sheet made of an aluminium alloy core and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element and said two-layer structure is devoid of a sacrificial anode clad layer, or a three-layer structure having a core sheet made of an aluminium alloy core material and on both sides thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, wherein the aluminium alloy of the core sheet has the composition (in weight %):-

Mn	0.7 to 1.4
Cu	0.8 to 1.5
Si	0.4 to 0.8
Mg	< 0.03
Fe	< 0.3
Ti	< 0.15
Cr	0.05 to 0.25
Zr	0.05 to 0.25
Zn	< 0.25

balance aluminium and unavoidable impurities, and wherein said brazing sheet has a post-braze 0.2% yield strength of at least 50 MPa and having in the post-brazing state a corrosion life of more than 20 days in a SWAAT test without perforations in accordance with ASTM G-85."

Claims 2 to 6 correspond to Claims 7-11 as granted.

VII. The appellant (patent proprietor) requested that:
(1) The decision under appeal be set aside;
(2) The patent be maintained on the basis of the "first auxiliary request" filed during the oral proceedings;
(3) Document D4 to D10 (including D7a and D9a) be not admitted into the proceedings.

The respondents requested that the appeal be dismissed.

VIII. The arguments put forward by the appellant in its written submissions and at the oral proceedings can be summarized as follows:

Admissibility of D4-D10

- Documents D4 to D7 were late-filed before the opposition division and should not be admitted in the procedure.
- Documents D8 to D10 were filed in the appeal proceedings. They were late-filed and less relevant than the other documents on file. They should therefore not be admitted in the proceedings.
- D7a, the computer translation of D7, was filed only one month before the oral proceedings and it was not ***prima facie*** relevant for the issue of inventive step; at least not more relevant than the other documents

on file. D7a could not be considered to represent the closest state of the art since it dealt with a different problem, *ie* the deliberate addition of Fe in order to improve strength and to counterbalance the action of Si and Cu, which both lower the melting point of the alloy. Thus, D7a should also not be admitted into the proceedings.

Inventive step

- D3 (Table 1; Alloys C6 and C8) should be considered to represent the closest state of the art. D3 does not disclose a core alloy which combines a Mg-content of less than 0.03 wt%, a Fe-content of less than 0.3 wt%, a Cr-content of 0.05-0.25 wt% and a Zr-content of 0.05-0.25 wt%.
- The technical problem in view of the disclosure of D3 is to provide a brazing sheet with balanced properties of excellent brazeability during flux brazing, improved post-braze strength and corrosion resistance. This problem is not addressed by D3, which is silent about brazeability.
- The skilled person faced with the cited technical problem would not have modified the core alloy of D3 so that it fell within the claimed core alloy, since he would not find any motivation for doing so in the art.
- Concerning the Mg-content, D3 would dissuade the skilled person from reducing it because the best results for SWAAT corrosion and post-braze properties were obtained with Alloy C8, which had a high Mg-content (0.5 wt%). The skilled person would have had no reason to modify the best alloy of D3.
- But even if the skilled person had considered the reduction of Mg-content in order to improve

brazeability - despite the expected worsening of mechanical strength - he would not have gone beyond the lowest limit of 0.1 wt% Mg in the core alloy.

- With regard to the compensation of Mg by Cu, the respondents misinterpreted the disclosure of D3. In fact, D3 does not disclose that a reduction of Mg below 0.1 wt% could be compensated by a high Cu-content. Mg has to be present within the limits of 0.1 wt% to 0.6 wt%.
- The argument of the respondents that the skilled person would reduce the Mg-content to values beyond 0.1 wt% - the lower limit of D3 - was based on hindsight.
- Concerning the Fe-content, D3 discloses a Fe-content of less than 0.8 wt% and D6 a Fe-content of 2.0 wt% or less. Thus neither D3 itself nor D6 nor the other state of the art would prompt the skilled person to lower the Fe-content towards the claimed value of less than 0.3 wt% in order to improve corrosion resistance. In particular the comparison of Alloys 1 and 3 in the patent specification illustrates the criticality of the Fe-content on the corrosion resistance of the brazing sheet. This is not derivable from the state of the art.
- Concerning the Zr- and Cr-content, these metals do not belong to the alloy compositions C6 and C8 of D3, which should be considered as the closest state of the art. In D3, Zr and Cr are optional components. Furthermore, D3 contains no hint that these metals, at the claimed amounts, combined with the alloy compositions C6 and/or C8, would solve the technical problem of providing a brazing sheet with balanced properties of excellent brazeability during flux

brazing, improved mechanical strength and corrosion resistance.

- The other cited documents, namely D2, D5 and D11, would not prompt the skilled person to modify the disclosure of D3 in such a manner to arrive at the claimed subject-matter.
- D8-D10, though disclosing a negative effect of Mg-content on brazeability under flux, does not disclose the use of a brazing sheet having less than 0.03 wt% Mg.
- Consequently none of the prior art documents would give any hint to the person skilled in the art to reduce the Mg-content to less than 0.03 wt%.

IX. The arguments put forward by the respondents in their written submissions and at the oral proceedings can be summarized as follows:

Documents D4-D10

- Documents D4 to D7 had been filed during the opposition division proceedings and had been considered in the appealed decision.
- Documents D8 to D10, which were scientific articles, should be admitted because they were submitted as a reaction to the appellant's criticism that it was not appropriate to seek to derive the general technical knowledge concerning the detrimental effect of Mg-content on flux brazing from patent documents.
- D7a (example 8), the computer translation of D7, was filed to substantiate also the detrimental effect of Mg-content on brazeability.

Inventive step

- The subject-matter of Claim 1 of the main request lacked an inventive step over D3, which had to be considered to represent the closest state of the art.
- The claimed subject-matter differed from the disclosure of D3 regarding the Mg-, Fe-, Cr- and Zr-contents.
- The technical problem mentioned in the opposed patent [0005] was to provide a brazing sheet which met the requirements of excellent brazeability during flux brazing, while having improved post-braze strength and simultaneously having a good corrosion resistance.
- Concerning the Mg-content, the reduction of the content disclosed in D3 to the values claimed would be obvious to the skilled person in view of his general technical knowledge.
- D8-D10 disclosed the adverse effect of Mg on flux brazing.
- Documents D2, D5, D6 and D11 disclosed the general technical knowledge of the skilled person in the art, according to which the Mg-content should be reduced or completely excluded in order to guarantee excellent brazeability.
- The appellant was incorrect in arguing that D3 would dissuade the skilled person from reducing the Mg-content beyond 0.25 wt%, if the yield strength had to be of at least 50 MPa. On the contrary, the condition Cu + Mg > 0.7 wt%, preferably 1.0 wt%, and more preferably 1.2 wt%, provided the skilled person with the possibility of reducing the Mg-content in order to improve the flux brazeability and at the same time of compensating the loss in yield strength

due to the Mg-content reduction by simultaneously increasing the Cu-content.

- Cu and Mg were both hardening elements and the mechanical strength of the alloy was the sum of their respective contributions. This was shown in D3 (Tables 1 and 3), in which the 0.2% post braze yield strength of the exemplified Alloys C5 and C7 was of 65 and 70 MPa respectively, ***ie*** much higher than that of Claim 1. Consequently with this, a value of "at least 50 MPa" could have been obtained even with a very low Mg-content.
- Furthermore, D3 would not dissuade the skilled person from increasing the Cu content given in the examples (0.3-0.75 wt%). Such an increase would not have any negative effect on yield strength.
- Thus the skilled person starting from D3 and seeking to optimize the flux brazeability would have been prompted by his general background knowledge either to refrain from adding Mg in the core alloy composition or to limit it to a content corresponding to the impurities level.
- Once the problem of brazeability was dealt with, the skilled person seeking to guarantee sufficient post-braze mechanical strength to the core alloy composition would rely on Examples C6/C8 of D3. These examples illustrated that a Mg-content reduction by 0.25 wt% (from 0.50 wt% to 0.25 wt%), though leading to a deterioration of the mechanical properties by 9 MPa, still provided a mechanical strength of 68 MPa, which was above the lower limit of 50 MPa set in Claim 1. The skilled person would also be able to calculate by extrapolation the post-braze strength resulting from the reduction of the Mg-content to values of less than 2.5 wt%, ***ie*** to the

claimed impurities value. This extrapolated value would be anticipated to be acceptable, *ie* around the lower level of 50 MPa. Anyway the skilled person would be aware that this value could be adjusted by increasing the Cu-content.

- Alloys C6 and C8 of D3 showed also that the reduction of the Mg-content not only maintained the post-braze mechanical strength at a very good level but also that it did not influence the corrosion resistance, which was maintained at an average SWAAT life of at least 24 days in Nocolok flux brazing; better than the lower claimed value of 20 days.
- Concerning the Fe-content, it was known in the art (D1, D2, D6) that the Fe-content was detrimental to corrosion resistance and to brazing and that its content should be kept low.
- Furthermore the skilled person would know (see Norms of the aluminium Association AA1050) that the Fe-content (as a normal impurity) of aluminium used for core alloys to be used in radiators had a content of 0.15-0.25 wt%. This Fe-content was implicit in Example 1 of D3.
- Concerning the Cr- and Zr-content, D3 disclosed the claimed ranges and the fact that these elements improved post-braze mechanical strength. Thus the skilled person would be motivated to make use of them in order to counterbalance the loss of mechanical strength resulting from the reduction of the Mg-content without involving any inventive skill.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of documents D4 to D10*

2.1 Documents D4 to D7

With the statement of grounds of appeal the appellant had requested "to hold prior art documents D4 to D7 inadmissible on being late filed". Although D4 to D7 had been filed after the time limit foreseen by Article 99(1) EPC, it is evident from the appealed decision that the opposition division had at least to some extent dealt with these documents (see page 9 of the appealed decision: "The disclosure of D4 to D7 is neither detrimental to the novelty of the claimed product."). Thus, these documents are apparently already in the proceedings. Furthermore, there is nothing on file which would indicate that in this respect the opposition division exercised its discretion in the wrong way.

Consequently, the appellant's request that D4 to D7 should not be admitted into the proceedings is refused.

2.2 Documents D8 to D10

These documents were filed as a reaction to the criticism of the appellant that it was not appropriate to seek to derive the general technical knowledge of the skilled person from patent documents such as D1 to D7. Documents D8 to D10 are scientific articles which, though specific, illustrate the background technical

knowledge of the skilled person concerning the generally recognized detrimental effect of Mg-content on flux brazeability.

In view of the above considerations the board decided to admit these documents into the proceedings.

2.3 Document D7a (computer translation of D7)

The board took a different view with regard to D7a, a document filed only one month before the oral proceedings. Not only was it late-filed but also neither novelty destroying (this was not disputed) nor could ***prima facie*** be considered to represent the closest state of the art. Therefore the board declined to exercise its discretion under Article 13 RPBA to admit D7a into the proceedings.

3. *Admissibility of the first auxiliary request*

The appellant's sole request corresponds to the first auxiliary request filed during the oral proceedings; all other requests were withdrawn during those proceedings. The respondents did not raise any objection concerning its admissibility. Also the board saw no reason to raise any objection of its own, because the amendments effected in Claim 1 of the new first auxiliary request were based on granted claims and/or amendments which had already been part of previously filed requests. Thus, exercising its discretion under Article 13 RPBA the board admitted the new first auxiliary request into the proceedings.

4. *Amendments - Article 123 EPC*

4.1 The subject-matter of product Claim 1 of the first auxiliary request corresponds to the subject-matter of Claim 1 as granted combined with preferred embodiments stemming from:

- granted Claim 2 (≡ Claim 2 as filed; Mg content),
- granted Claim 4 (≡ Claim 4 as filed; Mn content),
- granted Claim 5 (≡ Claim 5 as filed; Cu content),
- granted Claim 6 (≡ Claim 7 as filed; 20 days in a SWAAT test),
- page 7, lines 14-15, of the application as filed (Fe content),
- page 7, lines 20-21, of the application as filed (Cr content), and
- page 7, lines 25-26, of the application as filed (Zr content).

This combination of preferred and even most preferred values is not only implicitly clearly and unambiguously derivable from the application as filed, but it is also supported by explicit disclosure, namely by Alloys 2 and 5 of the example in the patent in suit. These two alloys exhibit all the features required in Claim 1 of the first auxiliary request. Hence, the subject-matter of Claim 1 fulfils the requirements of Article 123(2) EPC.

4.2 Claims 2 to 6 of the first auxiliary request correspond to granted Claims 7 to 11, with back references amended where necessary. Thus, no objections under Article 123(2) EPC against these claims arise.

4.3 Finally the subject-matter of the claims of the first auxiliary request is limited compared to the corresponding granted claims so that the claims of the first auxiliary request also meet the requirement of Article 123(3) EPC.

5. *Novelty*

The only novelty objection raised in the appeal proceedings was based on the late-filed document D7a (computer translation of D7), which the board did not admit into the proceedings (point 2.3 above). Thus, this novelty objection is not substantiated and must fail. Since, furthermore, the board saw no reason to raise a novelty objection on its own based on any of the documents in the proceedings, novelty is not an issue in this appeal.

6. *Inventive step*

6.1 The closest state of the art

6.1.1 The patent in suit is directed to a brazing sheet which meets the requirements of excellent brazeability during flux brazing while having improved post-braze strength and simultaneously having good corrosion resistance (paragraphs [0005] and [0011] of the patent specification).

D3 relates to a brazing sheet having improved strength properties and at the same time good corrosion resistance without the need for a sacrificial anode (page 2, lines 7-10 and 30-32; page 4, lines 3-7; Claims 1, 13, 14, 21 and 23). The brazing sheet has a

core sheet of an aluminium alloy core material and a brazing layer of an aluminium alloy having silicon as the main alloying element on at least one side of the core sheet. The Mg-content of the aluminium alloy in the core sheet is 0.1 to 0.6 wt%. Thus, D3 not only lies in the same technical field as the claimed invention, but it further discloses technical effects, a purpose and an intended use very similar to the claimed subject-matter. Therefore, the board considers, in agreement with both parties, that D3 represents the closest state of the art and, hence, takes it as the starting point for the assessment of inventive step.

In particular Example 1 of D3 discloses in Table 1 two specific core sheet alloys, namely **Alloys C6 and C8**, with the following composition (wt%):

Alloy	Mn	Cu	Mg	Si
C6	1.1	0.75	0.25	0.5
C8	1.1	0.75	0.5	0.5
Balance Al, Fe at normal impurity level (less than 0.8) and unavoidable impurities				

The mechanical strength is disclosed to be 68 MPa (Alloy C6) and 77 MPa (Alloy C8) (Table 3). The corrosion resistance in Nocolok flux brazing (average SWAAT life) is for both alloys more than 24 days (Table 2).

6.1.2 The subject-matter of Claim 1 differs from the specific brazing sheets of D3 (Alloys C6 and C8) with regard to:

(a) the Mg-content, which has to be < 0.03 in Claim 1, *ie* much lower than the values disclosed in D3;

(b) the Cr-content, which is mandatory, whereas no Cr is used in Alloys C6 and C8;

(c) the Zr-content, which, like Cr is mandatory, whereas no Zr is used in Alloys C6 and C8; and

(d) the Fe-content, which is selected to be even lower than the disclosed content of less than 0.8 wt%.

6.2 The technical problem

6.2.1 As set out above, the opposed patent aims at the provision of a brazing sheet which meets the requirements of excellent brazeability during flux brazing, while having improved post-braze strength and simultaneously good corrosion resistance (paragraphs [0005] and [0011] of the patent specification).

6.2.2 As regards this technical problem, the patent specification specifically refers to D3. Thus, in paragraph [0005] it is stated: "From EP-A-0718072, brazing sheet is known having a core sheet of an aluminium alloy core material and on at least one side thereof a brazing layer of an aluminium alloy containing silicon as a main alloying element, wherein the aluminium alloy of the core sheet has the composition … . Although this brazing sheet may be processed by means of flux brazing, some difficulties are encountered due to the relatively high Mg content in the alloy which might influence the brazing flux applied during the brazing cycle. Further disadvantages of having a too high Mg-level in the core alloy, are that flow and/or wettabillity is decreased when applying the NOCOLOK brazing flux during the brazing cycle. However, lowering the Mg level in this known

aluminium core material would drastically lower the strength levels obtainable after brazing."

6.2.3 As regards the alleged improvement in post-braze strength, in particular post-braze 0.2% yield strength, it is conspicuous to the board that Alloys C6 and C8 of D3, *ie* the closest prior art, exhibit post-braze 0.2% yield strengths of 68 and 77 MPa, respectively (Table 3). These values are higher than the minimum value of 50 MPa required in Claim 1 and even higher than the best values obtained in the examples of the patent in suit (66 and 69 MPa for Alloys 2 and 5: Table 2 in the patent specification). Therefore, an improvement in post-braze 0.2% yield strength cannot be part of the objective technical problem.

In view of these considerations the technical problem has to be reformulated in a less ambitious way. Hence, the objective technical problem has to be seen in the provision of a brazing sheet which meets the requirements of excellent brazeability during flux brazing, while having good post-braze 0.2% yield strength and simultaneously good corrosion resistance.

6.2.4 The proposed solution to the above defined technical problem is the brazing sheet as defined in Claim 1.

The experimental data in the patent specification demonstrate that this technical problem is indeed successfully solved by the features of Claim 1. Tables 1 and 2 disclose Alloys 2 and 5, which have the chemical composition of the alloys of the claimed brazing sheets. With regard to the properties of these alloys the board is not in doubt that Alloys 2 and 5

have an excellent brazeability, which is in fact the immediate result of the low Mg-content in the brazing sheet. This was also not contested by the respondents. Furthermore, the relation between brazeability and low Mg-content is undeniably very well documented in the art. The respondents have filed numerous documents which explicitly disclose this relation, namely D2, D5, D6, D8, D9, D9a, and D10.

Additionally, Alloys 2 and 5 show good post-braze 0.2% yield strength (66 MPa and 69 MPa respectively), the best of the exemplified alloys, while maintaining good corrosion resistance (more than 28 days in the SWAAT-test respectively). Thus the board is satisfied that the above defined objective technical problem is actually solved.

6.3 Obviousness

6.3.1 The question which remains to be answered is whether the skilled person starting from the disclosure of D3, specifically from Alloys C6 and C8, and aiming at providing a brazing sheet with excellent brazeability, good mechanical strength and corrosion resistance would find it obvious to modify the core aluminium alloy of D3:

(a) by reducing the Mg-content beyond the disclosure of D3, which improves brazeability during flux brazing;

(b) by inserting Cr and Zr in amounts ranging between 0.05-0.25 wt% in order to counterbalance the post-braze properties of the alloy, namely the 0.2% yield strength and the corrosion resistance, due to the reduction of the Mg-content; and

(c) by selecting as Fe-content the lower third of the Fe-content of D3.

6.3.2 The board concurs with the respondents that the skilled person in the technical field of brazing aluminium alloy sheets would find ample information in the state of the art concerning (i) the detrimental effect of Mg-content on aluminium alloys during flux brazing and (ii) aluminium alloys having either a very low Mg-content or containing no Mg at all in order to provide satisfactory brazeability during flux brazing. This is reported, for example, in D2 (page 10, lines 27-31), D5 (column 3, lines 17-18), D6 (page 16, lines 7-10), D8 (page 122, middle column last paragraph to right column paragraph above Aluminum/Cu Joints), D9 (page 204, right column, first full paragraph), D9a (full page 757) and D10 (abstract). In view of this prior art, the argument of the appellant that the skilled person would not go below the lower limit of 0.1 wt% disclosed in D3 for magnesium is not sustainable. On the contrary the board accepts that the cited state of the art would prompt the skilled person seeking to further improve brazeability to reduce the Mg-content below the lower limit disclosed in D3.

6.3.3 However, the present invention is not simply based on the finding that a lowering of the Mg-content below the 0.1% disclosed in D3 improves brazeability. The gist of the present invention specifically lies in the finding that **a carful choice of the core alloy composition** can compensate for the inevitable loss in strength levels when lowering the Mg-content (essentially using no magnesium at all), and simultaneously provides good corrosion resistance.

Thus, even if the skilled person might have had an incentive to reduce the Mg-content disclosed in D3, the relevant question is whether or not he would have amended the closest prior art in a manner to arrive at a brazing sheet falling within the scope of Claim 1 of the first auxiliary request.

6.3.4 D3 itself provides no hint whatsoever as to how one could compensate for the reduction in Mg. In this context it has to be born in mind that Mg is a key element of the alloys disclosed in D3. In other words, according to the teaching of D3, the Mg-content has to be within the limits required in D3, namely 0.1-0.6 wt%. Therefore the statement at page 4, lines 30-31, that "Preferably for strength and corrosion resistance (Cu+Mg) > 1.0, and in particular preferably > 1.2. Thereby not only a good corrosion resistance after Nocolok brazing, and also after vacuum brazing, is obtained." cannot be construed to mean that the proviso "(Cu+Mg) > 1.0" applies beyond the limits given in D3 for Mg, *ie* 0.1-0.6 wt%. Consequently, the respondents' argument in this regard is, in the board's view, a misinterpretation of the teaching of D3, and is based on hindsight.

6.3.5 With regard to the now-required Cr- and Zr-content, it is conspicuous to the board that Alloys C6 and C8 of D3 do not contain these metals at all. Furthermore, there is no teaching whatsoever in D3 that these metals could compensate for a loss in mechanical strength when omitting Mg. Nor would the skilled person find a hint in that direction in the other prior art documents.

6.3.6 Furthermore, with regard to the Fe-content, there is no disclosure in D3 or the other documents that the Fe-content would be of any importance when reducing the Mg-content. D3 discloses that the Fe-content should not exceed 0.8 wt%, and preferably not 0.4 wt% (page 4, lines 39-40). However, there is nothing in D3 which would suggest reducing the Fe-content to less than 0.3 wt%. In particular, there is nothing in D3 which would suggest a critical limit around 0.3 wt% for the Fe-content in the alloy composition having regard to its corrosion resistance. This criticality has been illustrated for the first time in the contested patent. A comparison of Alloy 1 (0.21 wt% Fe) and Alloy 3 (0.36 wt% Fe) shows that Alloy 1 has a good corrosion resistance of 25 days measured using the SWAAT Test whereas Alloy 3 has a corrosion resistance of only 13 days (Table 2 in the patent specification).

The criticality of an Fe-content of less than 0.3 wt% in the claimed compositions is also not derivable from the other cited prior art. It is true that D1, D2 and D6 disclose a low Fe-content for good corrosion resistance. Thus, D1 (Table 1, Alloy 6) discloses an Fe-content of 0.1 wt%, D2 (page 10, lines 14-19) an upper limit of Fe-content of 0.4 wt% and D6 (page 14, lines 21-22) an upper limit of Fe-content of 2.0 wt%. However, it is conspicuous to the board that these documents relate to different alloy compositions. Thus, Alloy 6 of D1 has a Cu content of 0.70 wt% which is outside the scope of Claim 1. D2 (page 10, lines 23-26) discloses that it is essential to control the Si-content, which should not be more than 0.15, preferably not more than 0.12 or 0.1 in order to get a τ phase precipitate of fine AlMnCu particles, the so called

Brown Band. Contrary thereto the Si-content in the composition of the core sheet of Claim 1 is much higher. D6 relates to a brazing sheet with the core alloy containing as the most important alloying elements Cu and Sn, this combination remarkably improving the corrosion resistance. However, in view of this particular combination of alloying elements D6 is of no relevance for other alloys with low Mg-content and D6 contains no incentive at all for the skilled person to combine it with D3. Again it appears that the importance of an Fe-content of below 0.3 wt% for the alloys of D3 can only be derived from other documents with the benefit of hindsight.

6.4 On the basis of the above considerations the board comes to the conclusion that the subject-matter of Claim 1 involves an inventive step. The subject-matter of Claims 2, 3, 5 and 6, which corresponds to preferred embodiments of the subject-matter of Claim 1, involves ***mutatis mutandis*** an inventive step. The same applies to the method of Claim 4 for the preparation of a product according to Claims 1 to 3.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent on the basis of Claims 1 to 6 of the "first auxiliary request" filed during the oral proceedings, after any necessary consequential amendment of the description.

The Registrar: The Chairman:

G. Röhn W. Sieber