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**Datasheet for the decision
of 27 January 2009**

Case Number: T 1156/07 - 3.2.06

Application Number: 95203448.6

Publication Number: 0718072

IPC: B23K 35/28

Language of the proceedings: EN

Title of invention:

Brazing sheet

Patentee:

Corus Aluminium Walzprodukte GmbH

Opponent:

ALCAN FRANCE S.A.S

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

RPBA Art. 13(1)

Relevant legal provisions (EPC 1973):

-

Keyword:

"Novelty - no (auxiliary request 1, 3) - product by process features"

"Late-filed requests 9 and 10 - not admitted"

"Inventive step - no (auxiliary request 4)"

Decisions cited:

-

Catchword:

-



Case Number: T 1156/07 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 27 January 2009

Appellant: Corus Aluminium Walzprodukte GmbH
(Patent Proprietor) Carl-Spaeter-Strasse 10
D-56070 Koblenz (DE)

Representative: Müller, Frank Peter
Müller Schupfner & Partner
Patentanwälte
Bavariaring 11
D-80336 München (DE)

Respondents: ALCAN FRANCE S.A.S
(Opponent) 7 Place du Chancelier Adenauer
F-75218 Paris Cedex 16 (FR)

Representative: Fénot, Dominique
Alcan France S.A.S.
Propriété Industrielle
217, cours Lafayette
F-69451 Lyon Cedex 06 (FR)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 14 May 2007
revoking European patent No. 0718072 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting Van Geusau
Members: G. de Crignis
R. Menapace

Summary of Facts and Submissions

- I. European patent No. 0 718 072 granted on application No. 95203448.6, was revoked by the opposition division by decision announced during the oral proceedings on 24 April 2007 and posted on 14 May 2007.

The decision of the opposition division was based on the finding that the subject-matter of claim 1 of the main request lacked novelty over the disclosure of

D10 JP-A-2-50934 (D10': Translation into English).

With regard to the auxiliary request it was found that the amendment in claim 1 referred to a process feature which could not produce unambiguously identifiable features on the product. Accordingly the objection with regard to lack of novelty was not overcome.

- II. With its letter dated 11 July 2007 the appellant (patent proprietor) filed an appeal against the decision of the opposition division and on the same day paid the appeal fee. With its letter of 20 September 2007 the statement of grounds of appeal was filed, together with a main request to set aside the decision of the opposition division and to maintain the patent as granted, auxiliarily to maintain the patent in amended form according to auxiliary requests 1 to 7. The following documents were submitted:

D11 Declaration Dr. Vieregge and

D12 Aluminium Taschenbuch, 1. Grundlage und Werkstoffe, 14. Auflage, Aluminium-Verlag, Düsseldorf 1988, 130-131.

The documents:

D2 EP-A-0 326 337

D9 US-A-5 476 725 which was pre-published as D9bis
WO-A-94/13472

cited during the first instance proceedings are also relevant for the present decision.

III. In a communication in preparation for the oral proceedings pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal dated 12 September 2008, the Board indicated that D10 had been found relevant for the decision of the opposition division and thus the discretionary power of the opposition division for allowing late-filed documents appeared to be correctly exercised. It took the preliminary view that with regard to the main request the decision under appeal appeared to be correct and commented on the auxiliary requests in particular on the question of whether or not a brazing sheet could be distinguished from the prior art *via* its capability of obtaining specific values.

IV. Oral proceedings were held before the Board on 27 January 2008, during which the appellant maintained his request that the decision under appeal be set aside and the patent be maintained on the basis of one of the auxiliary requests 1 or 3 filed with the grounds of appeal on 20 September 2007, auxiliary request 9, filed

on 27 May 2008 or auxiliary request 10 or 4 filed during the oral proceedings.

The respondent requested the dismissal of the appeal.

Claim 1 of the auxiliary request 1:

"Brazing sheet for use in the manufacture of brazed assemblies such as automotive radiators, consisting of a sheet made of an aluminium alloy core material and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, the brazing sheet thus being devoid of a sacrificial anode layer, characterised in that the aluminium alloy core material has the composition (in weight%)

Mn	0.7 - 1.5
Cu	0.65 - 2.0
Mg	0.1 - 0.6
Si	> 0.20 - 1.0
Fe	up to 0.8
Ti	optional < 0.1
Cr	optional, up to 0.35
Zr and/or V	optional, up to 0.25 in total
Zn	< 0.25

other elements each < 0.05, with a total < 0.15 balance Al, with the proviso that (Cu + Mg) > 1.0, so as to obtain a good post-brazing corrosion resistance in the absence of a sacrificial anode layer, wherein the brazing sheet is capable of obtaining, following brazing and post-brazing ageing, a 0.2% yield strength of at least 70 MPa, wherein said aluminium alloy of said core sheet is a cast material which has not been subjected to a homogenization treatment after its casting prior to a

hot rolling performed after the application to it of said brazing layer or layers."

Claim 1 of auxiliary request 3 differs from claim 1 of the auxiliary request 1 in that the silicon content is now to lie within the range of between >0.30 and 1.0 weight%, and in that it is added: "and having a good post-brazing corrosion resistance of at least 600 hours as determined in a SWAAT (ASTM G85) corrosion test."

Claim 1 of auxiliary request 9 differs from claim 1 of auxiliary request 1 in that the silicon content is required to lie within the range of between >0.40 and 1.0 weight% and in that it is added: "which brazing sheet is capable of obtaining, after brazing at 600°C and post-brazing ageing at 165 °C during a time in the range 10 to 100 hours, a 0.2% yield strength which is at least twice its 0.2% yield strength immediately after brazing."

Claim 1 of auxiliary request 4 reads:

"A method of making a brazing sheet for use in the manufacture of brazed assemblies such as automotive radiators, consisting of a sheet made of an aluminium alloy core material and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, the brazing sheet thus being devoid of a sacrificial anode layer, comprising the steps of
i) casting an aluminium alloy core material having the composition (in weight%)

Mn	0.7 - 1.5
Cu	0.65 - 2.0
Mg	0.1 - 0.6
Si	> 0.30 - 1.0

Fe up to 0.8
Ti optional < 0.1
Cr optional, up to 0.35
Zr and/or V optional, up to 0.25 in total
Zn < 0.25

other elements each < 0.05, with a total < 0.15

balance Al, with the proviso that (Cu + Mg) > 1.0,

ii) applying said brazing layer to a sheet of said aluminium alloy core material;

iii) hot rolling the said aluminium alloy core material sheet and said brazing layer;

iv) cold rolling the hot rolled product from step (iii), wherein between steps (i) and (ii) said aluminium alloy core material is not subjected to a homogenization treatment and between said steps (iii) and (iv) said product is not subjected to an annealing treatment, so as to obtain a good post-brazing corrosion resistance in the absence of a sacrificial anode layer, wherein the brazing sheet is capable of obtaining, following brazing and post-brazing aging, a 0.2% yield strength of at least 70 MPa."

V. In support of its requests the appellant essentially relied upon the following submissions:

The subject-matter of claim 1 of auxiliary request 1 differed from the disclosure of D10 in requiring that the brazing sheet was not subjected to a homogenization treatment. The object of such treatment was to improve post-brazed corrosion resistance. The results of the SWAAT corrosion test given in D11 were proof for the possibility to identify such an accompanying effect in the product. According to further oral information obtained by Dr. Vieregge (which was the author of D11),

the test samples of D11 had been subjected to vacuum-brazing at 590-610°C for a few minutes in order to simulate brazing conditions. Moreover, the absence of homogenization produced a different microstructure and accordingly the omission of such a process step could also in this way be found out on the product.

The brazing sheet of claim 1 of auxiliary request 3 differed further from the disclosure of D10 in that it required a good post-brazing corrosion resistance in the SWAAT corrosion test. D11 provided the proof that the omission of homogenization was responsible for such an effect.

The subject-matter of claim 1 of auxiliary request 9 additionally defined the relation of post-brazing yield strength to post-brazing ageing yield strength. No document referred to such results.

Auxiliary request 10 should be admitted. The subject-matter of its claim 1 was limited to the embodiment represented by test alloy C8 of the patent in suit. This test alloy demonstrated that the desired results were indeed obtained.

Claim 1 of auxiliary request 4 referred to the method. Accordingly, the subject-matter of this claim was novel as it excluded the homogenization treatment whereas the examples in D10 required homogenization. The object was to improve post-brazing corrosion resistance of the products. Although D2 as well as D9 suggested in order to obtain such an effect the omission of homogenization, these suggestions would have been disregarded by the skilled person. According to D2 the silicon content

would be too high for being suitable for such a process step. D9 did not refer to an unambiguous teaching as it relied upon a variety of different alloys, different layers and different process steps. Hence, an inventive step was necessary to arrive at the claimed method.

VI. The respondent essentially argued as follows:

Although a homogenization treatment was disclosed in D10, the product disclosed therein could not be distinguished from the claimed brazing sheet. The omission of the homogenization treatment represented a process step which was not to be recognized on the product. The post-brazed characteristics of a brazing sheet were significantly influenced by the brazing conditions which were not specified in the claim. The test results in D11 did not refer to a brazed material and thus were not significant. The alleged differences in microstructure were not based upon any evidence. Accordingly, the subject-matter of claim 1 of the auxiliary request 1 was not novel.

With regard to the brazing sheet claimed in claim 1 of the auxiliary requests 3 and 9, the same arguments applied. The capability of obtaining certain post-brazing characteristics (relation of yield strength, corrosion resistance) was dependent on the brazing conditions (kind of brazing/time/temperature) and the concerned layers (composition, thicknesses). Accordingly, provided that the brazing conditions were appropriately chosen, comparable results could be obtained for similar alloys. The brazing conditions not being specified in the claim, the yield strengths and corrosion resistances of the brazed products

represented only desirable features. Thus, no features were added which rendered the subject-matter of the respective claims 1 distinguishable and thus novel. Moreover auxiliary request 9 was late-filed, did not overcome a *priori* the raised objections and thus should not be admitted.

Auxiliary request 10 was late-filed. The additional subject-matter came from the description and envisaged to overcome the objections raised in the appealed decision and confirmed in the annex to the summons. Such a request could have been submitted earlier and it should not be admitted into the proceedings.

Auxiliary request 4 referred in its claim 1 to the method. The skilled person knew that generally the omission of the homogenization treatment leads to good corrosion resistance. For the skilled person desiring to improve corrosion resistance, the omission of homogenization represented an obvious first attempt and could not support an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of D11*

D11 discloses test results of corrosion resistance for two alloys in the SWAAT (G85-A3) test. The alloys represent a chemical composition which is very close to the C8 test alloy disclosed in the patent in suit. The test results concern corrosion resistance with and

without homogenization. Accordingly, D11 adds further information concerning the homogenization step and, therefore, was considered sufficiently relevant to be admitted to the proceedings.

3. *Auxiliary request 1*

3.1 Amendments

The additional wording of claim 1 is based upon originally filed dependent claim 11. Accordingly, the requirements of Article 123 EPC are met.

3.2 Novelty of claim 1

3.2.1 The opposition division found that D10 disclosed a brazing sheet as claimed in claim 1. Although the limit of 70 MPa for the 0.2% yield strength was not explicitly shown therein, it was found to be unambiguously obtained by alloys A and C when used as alloy core material as shown in Table 2 of D10' (Reasons of the decision, point 3.1, page 7/8). Although the omission of a homogenization treatment was not disclosed in D10, such a process feature was considered as not producing unambiguously identifiable features on the product and thus the brazing sheet was not considered novel (point 4.3a on page 11).

3.2.2 D10 refers to aluminium brazing sheets for heat-exchanger members. Alloys A and C disclosed therein are specified as having the same composition as the one specified in claim 1 of the patent in suit. Concerning corrosion resistance, D10 discloses results of the CASS test which determines the maximum pitting corrosion

depth after 200 h. According to Table 2, the maximum pitting depth of the inventive examples including alloys A and C was significantly lower than the one for comparative brazing sheets. Accordingly, D10 provides brazing sheets having relatively "good" post-brazing corrosion resistance. The examples disclosed in D10 included a homogenization step of 3 hours at 580 °C. The microstructure is generally discussed in relation to the composition including Mg₂Si, Cr, Zr, Hf, Ti and B (D10': page 7, second and third paragraph).

- 3.2.3 In accordance with the view expressed by the parties, the only question to be answered in relation to novelty is whether the brazing sheet of claim 1 is distinguishable from the brazing sheet of D10 by the feature concerning the absence of a homogenization treatment. The appellant's view that such distinction would be possible *via* the post-brazed corrosion resistance as well as *via* the microstructure is neither supported by any evidence nor is there any other basis for such a conclusion.
- 3.2.4 According to the patent in suit the inventive product is represented by test alloy C8. This test alloy C8 is clad on one side with an AA 4045 type aluminium alloy with 9 - 11% silicon as the main alloying element, hot rolled and cold rolled to a thickness of 0.39 mm without intermediate annealing. After having been subjected to Nocolok- or vacuum-brazing, the samples were cooled in air of ambient temperature (paragraphs [0039]-[0045] of the patent in suit). Concerning corrosion resistance, the C8 alloyed brazing sheet showed an average SWAAT life of >24 days in the Nocolok and of >25 days in the vacuum brazed condition (Table 2

in the patent in suit). With regard to the microstructure, there is a general disclosure to the effects of post-brazing cooling rates on Mg, Si and Cu (paragraph [0036]) precipitation in coarse particles.

3.2.5 In an attempt to provide evidence for the influence of homogenization leading to recognizable properties of the alloy core material, D11 has been submitted. D11 investigates the influence of homogenization on two alloy samples which are both similar in composition to the C8 test alloy. Alloy 2 which was not subjected to a homogenization treatment showed corrosion resistance of 34 days (page 6, point 24) whereas alloy 1 which was subjected to homogenization treatment showed perforations after 3 days (page 3, point 10); both alloys were tested in a SWAAT (ASTM G85-A3) test. However, D11 neither specifies how brazing is carried out nor is there any specific information available about the cladding materials ("cladding with liner plates" on page 2 instead of cladding on one side as in C8). Furthermore, any information about the microstructure of the tested alloys is lacking.

3.2.6 Therefore, even if the results of D11 may provide some information about characteristics of the tested alloys, they cannot lead to definite conclusions about the post-brazing characteristics of a brazing sheet in accordance with C8. Hence, the results provided in D11 do not support the allegation that the omission of the homogenization step could be recognised in the claimed brazing sheet. Even if the oral statement of the appellant that alloys 1 and 2 of D11 were vacuum-brazed were accepted, this would not overcome this objection. Besides the core alloy used, the further

layer(s)/sheet(s), the thickness of the concerned layers and the brazing conditions (time/temperature relations) are of significant influence on the characteristics of the resultant brazing sheet in particular as regards microstructure and corrosion resistance after brazing.

3.2.7 It follows that neither the patent in suit nor D11 show that by using the claimed alloy compositions in a brazing sheet, the post-brazing characteristic of "good" corrosion resistance would be obtained independently of, amongst others, the brazing process conditions. Consequently, D11 merely confirms the general teaching of D2 as well as of D9 that corrosion resistance can be improved by omitting the homogenization step.

3.2.8 It is further to be noted that besides pre-heating, hot-rolling and annealing treatments, a variety of further process steps are also of significant influence and whereby their temperature/time relation can be adapted to obtain desired results. As temperatures and process times have a substantial overlap in these treatments, the process-related term "not subjected to a homogenizing treatment" does not restrict the scope of the claim in such a way that the claimed brazing sheet could be unambiguously distinguished from other brazing sheets. Consequently, the product-by-process feature of claim 1 does not support the finding that the claimed brazing sheet itself is novel over the prior art brazing sheets.

3.2.9 Contrary to the appellant's further arguments, the formation of pancake-type grains by Mn-bearing precipitates in brazing sheets is not necessarily related to the omission of a homogenizing step but can - as disclosed in D2, page 3, l. 45 - 62 - be due to hot rolling and/or annealing process steps. For these reasons, the recognition of the absence of an earlier homogenization treatment via the microstructure is not conclusive. Even in the absence of such homogenisation the other method steps may very well cause precipitation and thereby negatively influence the corrosion resistance (see also D11, point 12 on page 3).

4. *Auxiliary request 3*

4.1 Amendments

The subject-matter of claim 1 of the auxiliary request 3 includes further the subject-matter of originally filed claims 9, 13 and 14. Accordingly, the requirements of Article 123 EPC are met.

4.2 Novelty of claim 1

4.2.1 D10 refers to a range of from 0.4 to 1.2 weight% of silicon content. Hence, the amended silicon content does not delimit the subject-matter of the claim further from D10.

4.2.2 The amendment concerning the post-brazing corrosion resistance is not suitable for adding clearly recognizable features to the brazing sheet itself which would distinguish it from the brazing sheet of D10. The "good post-brazing corrosion resistance of at least

600 hours as determined in a SWAAT (ASTM G85) corrosion test" represents a mere wish without giving the details of how to obtain such a post-brazing corrosion resistance.

4.2.3 As already set out above with regard to the subject-matter of claim 1 of auxiliary request 1, the post-brazing characteristics are dependent on the complete set of process (brazing) conditions as well as that of the combinations of core and clad materials. The process steps (temperature/time relations, chemical composition and thickness of all relevant layers) influence the resultant properties of the brazing sheet. These brazing steps will be adapted by the skilled person as necessary for obtaining the desired post-brazing characteristics. Also the brazing sheet in D10 is said to have excellent resistance to pitting corrosion (page 15, last paragraph of D10'). Thus, the brazing sheet described in D10 is to be considered as having these desirable characteristic as well or as being susceptible to appropriate process steps in order to obtain such property. It follows that homogenization is not the only step influencing this property, rather other process steps, in view of their temperature/time profile, would do so as well. The claimed brazing sheet, thus, is only further defined by a desired post-brazed characteristic which is an inherent property of the known core alloy. Thus, the post-brazed characteristics in question are not suitable to distinguish the claimed brazing sheet from the brazing sheet of D10.

4.2.4 Consequently, the brazing sheet itself is not novel over the brazing sheet disclosed in D10 and the requirements of Article 54 EPC are not met.

5. Auxiliary request 9

5.1 The subject-matter of claim 1 of the auxiliary request 9 includes, further to the subject-matter of claim 1 of auxiliary request 1, the subject-matter of originally filed claims 10 and 15. Hence, the requirements of Article 123 EPC are met.

5.2 The additional subject-matter specifies further properties in the manner of "capable of obtaining". However, there is no reason to suppose that the brazing sheet of D10 were not "capable of obtaining" the claimed values. Hence, no clear and unambiguous distinction from the products of the prior art - in particular to brazing sheets of D10 - is possible so that the additional features do not render the subject-matter of claim 1 novel.

5.3 As this request was late-filed and not clearly allowable it was not admitted into the proceedings.

6. Auxiliary request 10

6.1 Claim 1 of auxiliary request 10 differs from claim 1 of auxiliary request 1 in that its subject-matter is limited to the brazing sheet comprising the brazing layer of an AA 4045 type aluminium alloy containing 9 to 11 % silicon as main alloying element and to further characteristics of the brazed C8 test alloy and the specific process steps thereof, like hot rolling and cold rolling without intermediate annealing.

6.2 These amendments concern further process features whereas the claim is directed to a product. There is no disclosure present which would clarify how to find out from the claimed product whether hot rolling and cold rolling took place without intermediate annealing. The amendments also limit the claim to vacuum-brazing and no evidence has been presented that a vacuum-brazed product can be distinguished from a product that was brazed with another method.

6.3 These amendments, therefore, add further process steps which are not suitable to identify the resultant product and, moreover, the above mentioned objections concerning the process step of omitting homogenization apply as well.

6.4 The auxiliary request 10, which was filed during the oral proceedings, i.e. at a very late stage, was not admitted into the proceedings for the same reasons as those given in point 5.3 above.

7. *Auxiliary request 4*

7.1 Auxiliary request 4, which was filed during the oral proceedings, differs from auxiliary request 4 filed together with the grounds of appeal only in that dependent claims 6 and 7 are deleted, so that the parties as well as the Board saw no reason to not consider this request.

7.2 Amendments

The subject-matter of claim 1 of the auxiliary request 4 refers to a method of making a brazing sheet

which combines the subject-matter of originally filed claims 1, 6, 9, 11, 12 and 16. Accordingly, the requirements of Article 123 EPC are met.

7.3 Inventive step

7.3.1 D10 represents the closest prior art (see also point 3.2.2) and discloses a method for providing a brazing sheet having good brazing properties and outstanding strength and pitting corrosion resistance following brazing (page 3, first paragraph and page 5, 1. 1 - 3 of D10'). Accordingly, the object specified in D10 is consistent with the one referred to in the patent in suit (paragraphs [0015/0016]).

D10 specifies that cladding was carried out on either JIS 4004, JIS 4045 or JIS 7072 alloy brazing material and compared it to JIS 3003 and JOIS 6951 alloy core material. The cladding with the brazing material on the core material should be carried out to a thickness of preferably 3 to 15%. The method steps include a homogenization treatment after the application of the brazing layer to a sheet of aluminium alloy core material, and before hot rolling.

7.3.2 The subject-matter of claim 1 is distinguished from that of D10 by the homogenization step.

7.3.3 With regard to the claimed process and the feature distinguishing it from the process of D10, the objective technical problem to be solved is to be seen in simplifying the process while maintaining the capability to obtain good post-brazing strength and

corrosion resistance properties. This problem is solved by omitting the homogenization step.

7.3.4 Starting from D10, the skilled person desirous to consider the necessity of all the process steps disclosed therein, would reasonably question the necessity of the homogenization treatment on the basis of either one of D2 or D9. As set out in D2, both homogenization and inter-annealing have a negative effect on the corrosion resistance of a brazed product (page 3, l. 39 - 44) when considering in particular the AA3XXX alloys. D9 discloses (col. 11, l. 36 - 40) that by omitting homogenization after casting increased corrosion resistance is obtained, but it also referred mainly to AA3XXX alloys.

7.3.5 Hence, the skilled person expected the omission of homogenisation generally to have a positive effect on the post-brazing corrosion resistance and would recognize that such a step could be a first attempt when trying to simplify the manufacturing process. He then would follow this path in order to verify whether this general teaching applied also to the desired brazing sheet. Although mechanical strength and corrosion resistance might be counteracting features, the impact of the omission of homogenisation upon the claimed brazing sheet would be investigated as a matter of routine. Consequently, the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC).

7.3.6 The appellant's view that the skilled person would disregard the teaching of either one of D2 or D9 is not convincing. Although the silicon content of the alloys disclosed in D10 (0.4% - 1.2%) is higher than that of

the alloys according to D2 and D9 (no more than 0.15%), nothing prevents the skilled person from applying the obvious routine evaluation in view of this general teaching of D2 or D9. This all the more so, as in relation to corrosion resistance the reason for the low silicon content is related to the manganese solid solubility and band formation (D2: page 3, l. 20/21) and thus not to corrosion resistance. Moreover, the reference in favour of homogenization in D2 is specifically addressing the AA3XXX series and specifies the appropriate temperature range therefor (page 3, lines 39/40).

7.3.7 The appellant's arguments concerning the band of precipitates being formed in the core material and the different microstructure are not relevant for the issue under consideration. In the patent in suit (paragraph [0050]), it is even admitted that it is "yet uncertain whether a silicon-rich band of precipitates is formed in the core material". D2 as well as D9 comment on the microstructure concerning Mn, Si and/or Fe. However, all these considerations do not find any counterpart in the claimed subject-matter and are, thus, not relevant for the matter at issue here.

8. Consequently, the subject-matter of claim 1 of the appellant's auxiliary request 1 and 3 is not novel, the subject-matter of auxiliary request 4 is not allowable for lack of inventive step (Article 56 EP) and the auxiliary requests 9 and 10 were not admitted into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

M. Patin

P. Alting van Geusau