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**Datasheet for the decision  
of 10 March 2009**

**Case Number:** T 1474/07 - 3.2.08

**Application Number:** 01965826.9

**Publication Number:** 1290235

**IPC:** C22C 21/08

**Language of the proceedings:** EN

**Title of invention:**

Corrosion resistant 6000 series alloy suitable for aerospace applications

**Patentee:**

Alcoa Inc.

**Opponent:**

Aleris Aluminum Koblenz GmbH

**Headword:**

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**Relevant legal provisions:**

EPC Art. 54, 56

**Relevant legal provisions (EPC 1973):**

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**Keyword:**

"Novetly (no) - main request"

"Novelty and inventive step (yes) - auxiliary request"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 1474/07 - 3.2.08

**D E C I S I O N**  
**of the Technical Board of Appeal 3.2.08**  
**of 10 March 2009**

**Appellant I:**  
(Opponent)

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**Decision under appeal:**

**Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
4 July 2007 concerning maintenance of European  
patent No. 1290235 in amended form.**

**Composition of the Board:**

**Chairman:** T. Kriner  
**Members:** R. Ries  
A. Pignatelli

## Summary of Facts and Submissions

I. In its decision posted on 4 July 2007, the opposition division held that European patent No. 1290235, on the basis of the amended set of claims 1 to 23 according to the second auxiliary request then on file, satisfied the requirements of the Convention and maintained the patent in amended form.

II. The patent proprietor (appellant-patentee) lodged an appeal against the above decision on 4 September 2007, paying the appeal fee at the same time. The statement containing the grounds of appeal was filed on 2 November 2007.

The opponent (appellant-opponent) also filed an appeal against the above decision on 11 September 2007 and paid the appeal fee on the same day. The statement setting out the grounds of appeal was filed on 8 November 2007.

III. Oral proceeding before the Board took place on 10 March 2009, at the end of which the following requests were made:

The appellant-patentee requested that

- the decision under appeal be set aside and
- the patent be maintained as granted, or  
as an auxiliary request that the appeal of the opponent be dismissed.

The appellant-opponent requested that the patent be revoked in its entirety and that the appeal of the patent proprietor be dismissed.

Independent claim 1 as granted reads as follows:

"1. An aerospace alloy having improved corrosion resistance performance, said alloy consisting of: 0.6 - 1.15 wt.% silicon, 0.6-1.0 wt.% copper, 0.8-1.2 wt.% magnesium, 0.55-0.86 wt.% zinc, less than 0.1 wt.% manganese, 0.2-0.3 wt.% chromium and optionally up to 0.2 wt.% iron, up to 0.1 wt.% zirconium and up to 0.1 wt.% silver, the balance aluminum and impurities."

Independent claim 1 of the auxiliary request additionally includes the following wording (in bold letters):

"1. An aerospace alloy....aluminum and impurities, **the alloy having been tempered to a T6-type condition and a typical yield strength of at least 362 MPa (54 ksi).**"

IV. On appeal, the following documents have played a major role:

D3: US-A-5 888 320

D4: R. Chadwick et al.: "The Effect of Iron, Manganese, and Chromium on the Properties in Sheet Form of Aluminium Alloys Containing 0.7% Magnesium and 1.0% Silicon", Journal of the Institute of Metals, 75, 1953-54, volume 82, pages 75 to 80

D6: US-A-4 589 932

D8: H. Uchida et al.: "Development of high strength Al-Mg-Si-Cu alloy with corrosion resistance",

Materials Science Forum Vols. 217-227, (1996),  
pages 1753 to 1758

D10: US-A-5 858 134

D14: JP-A-6-240 424 together with the translation into  
English language D14b submitted by the patentee  
during the oral proceedings before the opposition  
division

D18: US-A-4 082 578

V. The arguments of the appellant-patentee are summarized  
as follows:

The composition of the alloy set out in claim 1 as  
granted was novel with respect to the Al alloy  
disclosed in document D14/D14b since it satisfied the  
criteria for a novel selection. According to the alloy  
definition given in D14/D14b, paragraph 0013, only Si  
and Mg were compulsory components, all the other  
elements Cu, Zn, Mn, Cr, Zr, V, Fe and Ti being merely  
optional. Neither Cu, Cr nor Zr was regarded  
indispensable, contrary to the alloy claimed in the  
present patent. Hence, the general teaching of D14/D14b  
was extremely broad. Put the other way, the elemental  
ranges selected for the Al alloy of claim 1 as granted  
were narrow compared to the broad disclosure of  
D14/D14b. Consequently, criterion (i) for a novel  
selection was met.

The preferred embodiment of the known alloy in the form  
of example A1 was, at least by its Mg content of  
0.64 wt%, sufficiently far removed from the claimed

range of 0.80 to 1.2 wt% Mg. The other examples A2 to A4 given in Table 1 of D14/D14b showed an interrelationship between the contents of Mg, Si and also Cu and Zn. Hence a skilled person starting from example 1 would have to increase not only the Mg content but had to change the contents of Si, Cu and Zn as well. Consequently, one would not arrive at the claimed alloy simply by increasing the Mg content of example A1 in D14/D14b. Therefore, criterion (ii) was also satisfied.

The selection of the alloys of claim 1 was made on purpose rather than by guesswork. The amounts of Mg, Si and Cu on the one hand and of Cu, Cr, Zn on the other hand were carefully balanced in order to result in a weldable high-strength Al alloy that was also resistant to intergranular corrosion, thus making the alloy suitable for aerospace applications. The combination of properties reported in the patent specification was not achieved by the alloy of D14/D14b which was designed to exhibit excellent bake hardening (BH) properties in the paint baking process and thus exhibited a rather low YS of only 148 N/mm<sup>2</sup> before and of 225 N/mm<sup>2</sup> after the BH step (see D14/D14b, Table 1 and 3, example 1).

Consequently, the criteria (i) to (iii) for the novelty of a selection vis-à-vis the alloy known from document D14/D14b were met by the composition of the Al-alloy defined in claim 1 as granted.

VI. The arguments of the appellant-opponent are summarized as follows:

Document D14/D14b disclosed the composition of an Al alloy overlapping the claimed composition according to claim 1 as granted, the example Al of D14/D14b coming close to the alloy. The aluminium alloy per se defined in claim 1 as granted and also addressed in claim 1 of the auxiliary request was therefore known from document D14/D14b. Although the known alloy related to producing sheet material for forming applications followed by paint bake-hardening, e.g. for producing automotive body parts, this alloy was also suitable for forming aerospace structural parts referred to in the patent.

The subject matter of claim 1 of the auxiliary request differed from the disclosure of D14/D14b in that the claimed alloy was peak-aged to the T6 condition and exhibited a yield strength (YS) of at least 362 MPa (54 ksi).

Starting from D14/D14b as the closest prior art, the problem underlying the patent at issue thus resided in finding an appropriate heat treatment resulting in improved performance properties, in particular an increased YS and resistance to intergranular corrosion.

To solve this problem, the skilled person would turn to any of documents D6, D10, D18 or D3 which all dealt with peak-aging AlMgSi alloys of the claimed type. The composition of the alloys described in D6 was closely related to the claimed alloy, and in column 6, lines 39 to 55, in particular line 49, column 8, lines 14 to 17, it was disclosed that after shaping, the structural parts can be artificially aged to the T6 condition in order to increase their strength, as did D3 in column 4, lines 58 to 62. Hence, D6 gave a strong incentive to a

skilled person as to how the strength of the Al-alloys under consideration could be successfully improved. The teaching of D6 was supported by that of document D18 which suggested in column 12, lines 9 to 26 and column 17, lines 5 to 12 that artificially ageing to the T6 condition rather than T4 resulted in a significant increase of strength in the range of 10 to 20 ksi. Peak aging to T6 was also mentioned in D10, example 1 as standard anneal which resulted in a YS  $R_{0.2}$  = 375 MPa (see D10, column 5, lines 12 to 17) which was above the lower limit of 362 MPa claimed. In conclusion, the skilled person faced with the identified problem and taking into account the teaching of D6 or D18 or D10 would, without inventive thinking, consider peak aging to the T6 condition to improve the YS of the alloy known and disclosed in D14/D14b.

A further problem-solution approach could be made by choosing D10 as representing the closest prior art which described Al alloys of the 6000 series provided for structural parts used in the aeronautical industry and which were in the T6 condition (see D10, column 5, line 12, column 6, lines 14 to 18 and 34 to 38). The essential difference to the claimed alloy resided in the Mn-content which was higher than in the claimed AlMgSi alloy and possibly impaired the anti-corrosion properties. To this end, D10 proposed a desensitisation treatment to improve the alloy's resistance to intergranular corrosion (see D10, column 6, lines 30 to 38).

Starting from D10, the problem underlying the patent at issue thus was to improve the intergranular corrosion resistance of the alloy known from D10 even when peak



aged to T6 without the need of a desensitisation treatment. This problem was solved by replacing Mn by appropriate amounts of Cr, as proposed in D3, column 7, lines 61 to 64 or column 8, lines 45 to 48 or D4, page 79, right hand column, 2nd and 3rd paragraphs, or D8, page 1756, 1st paragraph. Substituting Mn with Cr to improve the alloy's resistance to intergranular corrosion was therefore known in the art and close at hand for a person skilled in the field of AlMgSi alloys.

The subject matter of claim 1 according to the auxiliary request therefore lacked an inventive step.

### **Reasons for the Decision**

1. The appeals are admissible.
2. Claim 1 as granted; novelty
  - 2.1 The appellant-patentee held the view that the decision under appeal was erroneous in concluding that the composition of the aerospace Al alloy defined in claim 1 as granted was not a novel selection from the Al alloys known from D14/D14b and thus was anticipated by the disclosure of document D14/D14b.
  - 2.2 Firstly it is noted that the term "aerospace alloy" featuring in claim 1 as granted does not limit the alloy to a particular use because it only indicates the structural features which make the alloy suitable for that use. Hence, claim 1 as granted is directed to the alloy per se, irrespective of its intended use. This wording in claim 1 does not effect a patentable

distinction from alloys of the prior art which exhibit the same composition but are provided for a different purpose such as automotive body sheet or the like, as set out for instance in document D14/D14b.

2.3 The compositions of the claimed Al-alloy and the one disclosed in document D14/D14b are compared in the following table.

Element	claim 1 as granted	Document D14/D14b		D14/D14b, sample A1 (Table 1)
Si	0.6-1.15	0.5-2.5		0.78
Cu	0.6-1.0	0.03-1.2	*	0.81
Mg	0.8-1.2	0.3-1.5		<b>0.64</b> ↓
Zn	0.55-0.86	0.03-1.5	*	0.60
Cr	0.2-0.3	0.03-0.4	*	0.20
Mn	<0.1	0.03-0.4	*	0.07
Fe	≤0.2	0.03-0.5	*	0.12
Zr	≤0.1	0.03-0.4	*	
Ag	≤0.1			
Ti		0.005-0.2	*	0.01 ↑
Al	balance	balance		balance

(\*)optionally one or more

As can be seen, an overlap exists between the claimed composition and the one known from document D14/D14b. The issue therefore arises whether the composition of the claimed alloy satisfies the requirements for a novel selection from the known composition of document D14/D14b, i.e. whether each of the three criteria (i) to (iii) summarized in Chapter 4.2.1 of the Case Law of the Boards of Appeal of the EPO is met, and whether the

person skilled in the art would seriously contemplate applying the technical teaching of D14/D14b in the range of overlap.

- 2.4 Turning to example A1 of document D14/D14b as one preferred embodiment of the known alloy, it is evident that the contents of all alloying elements are within the claimed ranges, except for Ti and Mg. While the appellant-patentee did not contest considering the amount of Ti as falling within the impurity level, the content of 0.64 wt% Mg was held to be sufficiently far removed from the claimed range of 0.8 to 1.2% Mg. For the following reasons, the Board cannot agree with the appellant's view.

As proven by example A1, an alloy of the claimed composition has already been put into practice and disclosed in the D14/D14b. The only distinction to the claimed composition resides in the amount of 0.64% Mg which is, in the Boards assessment, slightly outside but not far removed from the claimed range of 0.80 wt% to 1.20 wt% Mg. It is noted that the patent specification fails to present any information as to why the lower limit 0.80 wt% for Mg has to be adhered to and about its impact on the alloy's overall performance. Rather more, the patent points out in paragraph [0005], last sentence that the desired combination of properties described in paragraphs [0004] and [0007] (weldability, improved intergranular corrosion resistance in the T6 and under-aged condition, high strength) is not obtained unless chromium is added into the alloy and manganese is reduced to the specific ranges given in the Table above, respectively. These important conditions for Cr and Mn are, however,

satisfied by example A1 of D14/D14b. It therefore can be duly assumed that the alloy according to D14/D14b, example A1, exhibits essentially the same combination of mechanical and anti-corrosion properties obtained by the claimed alloy per se and is, therefore, suitable for the purpose intended by the patent.

Contrary to the appellant's perception of the technical teaching of document D14/D14b, the Board cannot find any pointer in this document implying that the amounts of Mg and Si are closely linked by a special correlation rule so that a person skilled in the art would be dissuaded from increasing the Mg content specified in example A1 while leaving the contents of the other elements unchanged. According to paragraph [0011], document D14/D14b aims at providing a method for manufacturing an aluminium alloy sheet having a good formability and an excellent bake-hardening (BH) effect during the paint-baking process. These objects are achieved by (a) adhering to the composition of a specific aluminium alloy and (b) carrying out the mechanical and thermal treatment within the ranges for the process parameters set out in detail in paragraph [0013]. D14/D14b teaches in paragraphs [0014] to [0018] that the amounts of the compulsory elements Mg and Si as well as all the other optional components can be selected and combined freely, provided they do fall within the specific elemental ranges. No indication is found anywhere in the description of D14/D14b or in the examples implying that specific combinations of Mg and Si actually do not work or fail to result in the desired combination of formability and the BH-effect, contrary to what has been alleged by the appellant-patentee.

2.5 Taking into account that criterion (ii) for the novelty of selection is not met by the claimed alloy composition and the fact that, on the basis of the whole technical content of document D14/D14b, a skilled person putting into practice the known alloy would not be dissuaded, but would seriously contemplate working in the range of overlap, it is concluded that the subject matter of claim 1 as granted lacks novelty over the disclosure of document D14/D14b.

### 3. Auxiliary request

3.1 The subject matter of claim 1 of the auxiliary request results from a combination of claim 1, 6 and 8 as granted. Consequently, there are no formal objections to the claim 1 under Article 123(2) and (3) EPC.

### 3.2 Novelty

Given that the alloys set out in D14/D14b, Table 3 exhibit a yield strength (YS) of about 145 MPa (sample A1) or lower, this document fails to disclose the claimed yield strength of at least 382 MPa (54 ksi). In addition, the T6 temper condition for the Al alloys is not mentioned. The subject matter of claim 1 is therefore novel over D14/D14b.

Turning to the other documents referred to on appeal, the copper content of the alloy defined D3 is restricted to not more than 0.6 wt%, preferably  $\leq 0.5$  wt%, whereas the alloys described in documents D4, D6, D8 and D18 do not comprise zinc, and copper (D4) within the claimed ranges. Moreover, the manganese content of

0.3 to 0.8 wt% of the alloy known from document D10 is outside the claimed range.

In conclusion, none of the documents D14/D14b, D3, D4, D6, D8, D10 and D18 anticipates the subject matter of claim 1 of the auxiliary request. Besides, novelty of the subject matter of claim 1 of the auxiliary request was not contested by the appellant-opponent in the oral proceedings before the Board. Hence there is no need to deal with this issue in more detail.

3.3 Inventive step

3.4 The appellant-opponent held that document D14/D14b qualified as the closest prior art, since it related to the same composition as the claimed Al-alloy and was rolled into sheet material, solution heat treated, quenched and aged and could be used as aerospace panels. Only the reported YS was too low. Starting from D14/D14b, the problem underlying the opposed patent thus resided in finding a heat treatment resulting in an improved strength and intergranular corrosion resistance. The solution to this problem was found in either document D6, D10 or D18, all of them teaching the skilled person that the strength of the shaped panel members could be increased by artificial ageing to peak strength (T6 temper) thus leading to the required YS of at least 362 MPa.

3.5 The Board cannot agree with this approach. A first reason is that the object defined in D14/D14b is different to that underlying the patent since D14/D14b aims at providing an Al alloy sheet having improved formability and bake-hardenability, only a negligible

change of its properties at room temperature and no decline in formability due to natural ageing when stored for extended periods (see D14/D14b, paragraph [0011]). Consequently, a skilled person, faced with the problem of finding a high-strength intergranular-corrosion resistant alloy, had no motivation at all to turn to the alloys of D14/D14b and to carry out peak-aging (T6 temper) instead of bake-hardening to solve the problem underlying the patent at issue. Doing so would mean acting against the teaching of document D14/D14b. Hence in the Board's assessment, document D14/D14b does not qualify as representing the closest prior art.

- 3.6 It is not disputed that peak aging as such is generally known to increase the strength of Al alloys from the above mentioned documents D3, D4, D6, D8, D10 and D18. However, the teaching of these documents read in combination with that of D14/D14b does not lead in an obvious way to the claimed alloy since these documents are concerned with carefully balanced Al-alloy compositions different to that claimed. The person skilled in the field of material science and metallurgy knows very well that the final performance of an alloy cannot be simply predicted when changing the composition and or its temper treatment. Due to the interaction of all components, small changes in the composition of the alloy can have a large effect on the balance of properties obtained. In that respect it can be learned from any of the above mentioned documents that the composition of the Al alloys has been carefully designed and tempered on purpose in order to result in the desired combination of physical and anti-

corrosion properties that are required by the intended use.

As to the alloy composition given in document D3 and provided for the claimed purpose (aircraft fuselage skin), this document recommends copper levels of 0.6 wt% or less, preferably below 0.5 wt%, to prevent corrosion damage, and Zn to compensate for the loss of copper (see D3, column 3, lines 29 to 40). On the other hand, the Al-alloys investigated in D4 Table 1 neither comprise copper nor zinc, contrary to D3 which identifies Zn in significant amounts as an indispensable element to provide sufficient strength without adversely affecting the corrosion resistance (see D3, column 3, lines 32 to 34; lines 42 to 54). Document D6 teaches on the one hand to add manganese in the range of 0.1 to 1.0%, preferably 0.25 to 0.6 wt%, for better strength, but on the other hand to limit Cr to 0.1 wt% or lower, preferably 0.05 wt%, and zinc to not more than 0.3 wt% to improve the alloy's resistance to corrosion (see D6, column 3, lines 52 to 64). Likewise the high strength AlMgSiCu alloy developed in D8 for aircraft structural parts having a low susceptibility to intergranular corrosion comprise only residual amounts of Zn, but 1.64 wt% Cu which exceeds by far the claimed upper limit of 1.0 wt% for Cu. The intergranular corrosion resistant alloy given in D10 also used for structural elements for aircraft fuselages requires 0.3 to 0.8 wt% of manganese to provide sufficient strength (see D10, column 6, lines 34 to 38 and claim 1) and in the exemplifying alloys, Cr features only as an impurity rather than as an element added on purpose.



Last but not least, document D18 discloses in column 17, lines 8 to 12 and claim 1 a Zn-free AlSiMgCu alloy in the T6 condition comprising at least one of 0.2 to 0.8 wt% Mn, 0.1 to 0.3 wt% of Cr and 0.05 to 0.15 wt% Zr. It is however apparent from the dependent claims 4, 5 and 9 and column 3, lines 39 to 51, column 7, lines 22 to 24 and 52 to 68 of document D18 that 0.2 to 0.8% Mn is the compulsory and preferred component. The use of chromium is said to be less preferred since its presence can lead to problems by distortion or lowering the strength properties if the quenching rates are not carefully controlled. Moreover, copper is preferred to range from 0.25 to 0.50% (see D18, column 7, lines 21 to 24). Hence, document D18 is concerned with an Al alloy composition leading away from that claimed in the patent at issue.

In conclusion, the combination of the technical teaching of D14/D14b with any of the documents cited above does not lead to the claimed AlMgSi alloy, unless the composition of the alloys specifically designed according to the documents D3, D4, D6, D8 and D18 was significantly modified, contrary to the teaching given in any of these documents.

- 3.7 The appellant-opponent based a further line of argument against inventive step on document D10 as representing the closest prior art in combination with the technical disclosure of any of documents D8 or D4 or D3. However, this approach does not make the subject matter of claim 1 obvious either.

D10 discloses a high strength alloy, used in aeronautics and fuselages, with good intergranular

corrosion resistance and comprising 0.7 to 1.3 % Si, 0.6 to 1.1% Mg, 0.5 to 1.1% Cu, 0.3 to 0.8% Mn, <0.20% Zr, <1% Zn, <1% Ag, <0.25% Cr and the balance being Al and residual elements (see D10, claim 1). So as to prevent the sensitivity to intercrystalline (= intergranular) corrosion that is observed in the T6 tempered samples, the alloys of document D10 have undergone a intercrystalline desensitisation treatment, preferably with a two-plateau anneal between 150 to 250°C and further 170 to 270 °C (see D10, claims 1 to 3; column 4, lines 10 to 18; example 3; column 6, lines 11 to 38).

Starting from document D10, the problem to be solved resides in avoiding the desensitisation treatment without impairing the intergranular corrosion resistance. In the appellant-opponents view this problem could be solved by using Cr to replace Mn as a grain refining agent, as shown in D8, page 1756, first paragraph and alloy F, Table 1, wherein the improved corrosion resistance was attributed to the reduced number of Al-Mn dispersoids.

Although document D8 addresses the improvement in intergranular corrosion resistance by substituting Mn with Cr, the newly developed alloy F in Table 1 of D8 comprises only 0.15% Cr, high amounts of Cu (1.64%) and essentially no Zn, all these components being outside the ranges defined for the claimed alloy. Moreover, D10 dissuades against peak aging (T6 condition) so that doing so would mean acting against the teaching of document D10. Hence, the teaching of documents D10 and D8, taken individually or in combination, does not lead to the claimed Al-alloy in an obvious way.

It is not disputed that document D4 mentions on page 79, column 2, first and second full paragraph that in alloys containing 0.7 % Mg and 1.0 % Si, chromium reduces the susceptibility to intercrystalline attack to a greater extent than manganese and that the attack was more severe after artificial ageing. Apart from the fact that the AlMgSi alloys investigated in D4, Table 1 do not comprise any amounts of Cu and Zn so that the effect of these components on the overall properties of the alloys remains unknown, D4 also dissuades against peak aging these alloys (see D4, page 79, right hand column, second paragraph, last sentence).

Finally, D3 in fact considers adding chromium in the range of 0.05 to 0.3 wt% to improve the alloy's corrosion resistance (see D3, column 7, lines 61 to 64; claim 1) but the Mn-free examples 5 to 7 actually display only 0.15 wt% Cr and 0.47 wt% Cu or lower which are both outside the claimed ranges. Thus also the combination of the teaching given in D10 and D4 or D3 does not make the alloy claimed in the patent at issue obvious.

- 3.8 On the basis of the prior art referred to by the appellant-opponent, an inventive step of the subject matter defined in claim 1 of the auxiliary request cannot be denied.

**Order**

**For these reasons it is decided that:**

Both appeals are dismissed.

The Registrar:

The Chairman:

V. Commare

T. Kriner