Europäisches Patentamt
Beschwerdekammern

European Patent Office
Boards of Appeal

Office européen des brevets
Chambres de recours

Aktenzeichen / Case Number / N° du recours : T 51/86 - 3.2.1

Anmeldenummer / Filing No / N° de la demande : 80 100 172.8

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 014 335

Bezeichnung der Erfindung: Homogeneous, ductile brazing foils
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : B 23K 35/02, B 23K 35/30

ENTSCHEIDUNG / DECISION
vom / of / du 19 July 1988

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : Allied Corporation

Einsprechender / Opponent / Opposant : Vacuumschmelze GmbH

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 56, 123

Schlagwort / Keyword / Mot clé : Inventive step (yes) - combinatory effect - features of different relevance for the solution - disclaimer allowable - adjustment of ranges allowable.

Leitsatz / Headnote / Sommaire

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 51 /86 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 19 July 1988

Appellant : (Opponent)
Vacuumschmelze GmbH,
Postfach 2253
D-6450 Hanau 1 (DE)

Representative :

Respondent : (Proprietor of the patent)
Allied Corporation
Columbia Road and Park Avenue
P.O. Box 2245R
Morristown New Jersey 07960 (US)

Representative :
Collier, Jeremy Austin Grey et al.
J.A. Kemp & Co.
14 South Square
Gray's Inn
London WC 1R 5EU (GB)

Decision under appeal :
Interlocutory decision of the Opposition Division of the European Patent Office dated 17 December 1985 concerning maintenance of European Patent No. 0 014 335 in amended form.

Composition of the Board :

Chairman : P. Delbecque
Members : F. Gumbel
G.D. Paterson

Summary of Facts and Submissions

I. European patent No. 0 014 335 was granted on 22 June 1983 with two claims in response to European patent application No. 80 100 172.8, filed on 15 January 1980.

II. A notice of opposition to this patent was filed on 8 March 1984 by the Appellant, requesting that it be revoked in its entirety. The opposition was based on grounds of Article 100(a) EPC with respect to lack of novelty and inventive step having particular regard to the prior art reflected by DE-A-2 755 435 (which substantially corresponds to the document FR-A-2 374 128 cited in the search report). Furthermore, the grant of the patent was opposed on grounds of Article 100(c) EPC with respect to the feature "from more than 16 to 19 atom percent" contained in Claim 1 as granted.

During oral proceedings held before the Opposition Division the Opponent (Appellant) additionally supported his view according to which the subject-matter of Claims 1 and 2 as granted lacked an inventive step by reference to the document "Welding Journal" also cited in the search report.

III. Following the oral proceedings the Proprietor (Respondent) filed amendments to Claim 1 and the description. The proceedings under Rule 58(4) EPC were carried out and the Opponent (Appellant) maintained his objections under Article 100(a) EPC concerning lack of novelty and inventive step and also under Article 100(c) EPC with regard to added subject-matter.

IV. By an interlocutory decision dated 17 December 1985 the Opposition Division maintained the patent as amended by the Respondent.

V. The Appellant lodged an appeal against this decision on 6 February 1986. The appeal fee was paid on 10 February 1986 and the statement of grounds of appeal was filed on 19 April 1986. In this statement, reference was made to the same documents relied upon in the opposition proceedings, namely:

(1) DE-A-2 755 435 and
(2) Welding Journal, Volume 57, July 1978, pages 33 to 38.

The Appellant upheld his opinion according to which the subject-matter of Claim 1 and likewise of Claim 2 did not involve an inventive step having regard to the above prior art. Moreover, he doubted whether the disclaimer contained in Claim 1 was allowable and was suitable for clearly defining the matter for which protection is sought. He requested that the impugned decision be set aside and that the patent be revoked.

VI. In response to a communication pursuant to Article 110(2) EPC dated 24 March 1987, in which the Rapporteur, on behalf of the Board, took the preliminary view that Claim 1 apparently did not involve an inventive step, the Respondent maintained that the available prior art would not render the subject-matter of Claim 1 obvious. In the event that the Board did not favourably consider this claim he suggested to take into consideration a single claim combining Claims 1 and 2.

VII. During the oral proceedings held before the Board on 19 July 1988 both parties defended their cases on the

basis of the arguments previously put forward in written form, while taking the opportunity to submit their views in more detail.

The Respondent filed an amended description and claim, and requested (i) that the patent be maintained with the description, the drawing and claims as allowed by the Opposition Division (main request); (ii) with the description, the drawing and the single claim as filed during the oral proceedings (subsidiary request).

The Appellant maintained his request to set aside the impugned decision and to revoke the patent, both with respect to the main request and to the subsidiary request.

At the conclusion of the oral proceedings, the decision was announced that the decision of the Opposition Division was set aside, that the Respondent's main request was refused, and that his subsidiary request was allowed.

VIII. The claims of the main request read as follows:

"1. A homogeneous, ductile brazing foil composed of metastable material having at least 50 percent glassy structure having a composition consisting essentially of 0 to 4 atom percent iron, 0 to 21 atom percent chromium, boron, 0 to 12 atom percent silicon, 0 to 22 atom percent phosphorus and the balance essentially nickel and incidental impurities, wherein the composition is such that the total of iron, chromium and nickel is from 76 to 84 atom percent and the total of boron, phosphorus and silicon is from 16 to 24 atom percent, characterised in that the foil has a thickness of from 1.27×10^{-3} cm to 3.556×10^{3} (0.0005 to 0.0014 inch) and contains from 0 to

19 atom percent boron but excluding the range from 0 to 16.2 atom percent boron.

2. A brazing process which comprises interposing a filler metal, having a melting point lower than that of metal parts to be joined together, between the metal parts to form an assembly, heating the assembly to a temperature sufficient to melt the filler metal, and then cooling to provide a brazed joint between the metal parts, characterised in that a single brazing foil as claimed in Claim 1 is used as the filler metal."

The single claim according to the subsidiary request has the following wording:

"A brazing process which comprises interposing a filler metal, having a melting point lower than that of metal parts to be joined together, between the metal parts to form an assembly, heating the assembly to a temperature sufficient to melt the filler metal, and then cooling to provide a brazed joint between the metal parts, whereby there is used as the filler metal a single homogeneous, ductile brazing foil 1.27 times 10^{-3} to 3.556 times 10^{-3} cm (0.0005 to 0.0014 inch) thick and composed of metastable material having at least 50 percent glassy structure having a composition consisting essentially of 0 to 4 atom percent iron, 0 to 21 atom percent chromium, 0 to 19 atom percent boron excluding the range 0 to 16.2 atom percent, 0 to 12 atom percent silicon, 0 to 22 atom percent phosphorus and the balance essentially nickel and incidental impurities, wherein the composition is such that the total of iron, chromium and nickel is from 76 to less than 83.8 atom percent and total of boron, phosphorus and silicon is from more than 16.2 to 24 atom percent."

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rules 1(1) and 64 EPC and is admissible.

2. Concerning formal aspects of the claims, both according to the main request and to the subsidiary request, the following is to be observed:

2.1 The version of Claim 1 according to the main request was suggested by the Opposition Division in order to take account of the range of boron atom percent known from DE-A-2 755 435 (or the corresponding FR-A-2 374 128) to which the preamble of Claim 1 is related. On the other hand, as can be seen from page 10 of the decision under appeal, the Opposition Division was not prepared to allow a positive formulation of the remaining boron range ("more than 16.2 to 19 atom percent") in order not to offend against Article 123(2) EPC, since such a range was not explicitly disclosed in the application as filed. Hence, the present version containing a disclaimer was suggested by the Division and adopted by the proprietor.

Subject-matter may be excluded from a claim by a disclaimer, provided that the subject-matter of the amended claim was originally disclosed as part of the invention (Article 123(2) EPC) and is clearly defined by technical features (Article 84 EPC) (see e.g. Decision T 04/80, OJ EPO 1982, 149). It is considered that this is the case with present Claim 1 of the main request and with the single claim of the subsidiary request. The range 0 to 16.2 being now disclaimed gives a clear definition of what is to be excluded, and this range was part of the original disclosure 0 to 19. Furthermore, a skilled man being aware of the prior art composition described in DE-A-2 755 435, i.e. a composition comprising from 0 to <u>about</u> 16 atom

percent boron and knowing from a specific example that the value 16.2 atom percent falls within the meaning of about 16 atom percent, would clearly recognise the range 0 to 16.2 atom percent as falling within the nearest prior art. Hence, the Respondent is allowed to exclude this range from the extent of protection sought.

2.2 As a consequence of the admissible introduction of the disclaimer, it is immediately apparent to the skilled person that the lower limit of the range 16 to 24 atom percent for the total of metalloids (boron, phosphorus and silicon) can no longer be maintained and that the same applies to the upper limit of the range 76 to 84 atom percent for the total of metals (iron, chromium and nickel) in order not to arrive at a total for all constituents exceeding 100 percent. In this context, Claim 1 of the main request which does not take account of these discrepancies is subject to objection.

2.3 The single claim according to the subsidiary request, on the other hand, removes this objection by altering the respective limits referred to above in the sense which the skilled person would automatically have considered as a logical consequence of the introduction of the disclaimer. Since this disclaimer is admissible, the consequent alteration of those ranges must, in the Board's view, also be admissible. No offence against Article 123(2) EPC can be seen so far and, since both ranges as altered have become narrower as compared with the ranges as granted, there is no objection under Article 123(3) EPC either. Furthermore, the Board is satisfied with this claim being drafted in the one-part form, as the absence of a disclosure in the prior art of these new ranges concerning the total amounts of metals and metalloids, respectively, makes the two-part form chosen for Claim 1 as granted not longer appropriate.

3. Regarding patentability of the subject-matter of the respective claims under discussion, it is immediately clear from a comparison of those subject-matters with the disclosure of each individual cited document that they are novel, since there is nowhere disclosed a brazing foil having all the features set out in Claim 1 of the main request, or a process making use of such a foil as claimed in Claim 2 of the main request and in the single claim of the subsidiary request.

Since the Appellant no longer maintained his previous objection concerning lack of novelty, as was explicitly stated during the oral proceedings, no further substantiation of this matter appears to be necessary.

4. What was disputed in essence during the opposition and appeal proceedings is the existence of an inventive step in the claimed subject-matter. Having regard to Claim 1 of the main request the examination of this question by the Board results in the following observations:

4.1 The brazing foil specified in Claim 1 differs from the brazing foil disclosed in document (1) (DE-A-2 755 435) in the sense that

(a) its thickness is from 1.27 to 3.556 x 10^{-3} cm (0.0005 to 0.0014 inch);

(b) it contains from more than 16.2 to 19 atom percent boron.

4.2 As can be seen from the whole content of the application as filed, feature (a) was considered as being causal for obtaining the desired advantages (see original Claims 1 to 3, page 3, lines 25 to 35, examples 7 to 11 and the

resulting final statement in the paragraph bridging pages 17 and 18 and also the sole drawing). However, there is a clear disclosure of this dominant feature in document (2) ("Welding Journal"), which describes a brazing foil closely related to the one disclosed in document (1) (see footnote on page 33 pointing to the common "parent" -US application, Serial No. 751 000). On page 36, right-hand column of this document it is clearly indicated that the foils can have a thickness ranging from 0.5 to 2.0 mils (0.0005 to 0.002 inch) which means 1.27 to 5.08 x 10^{-3} cm.

The argument put forward by the Respondent in his response to the statement of grounds of appeal and in the oral proceedings was that this passage of document (2) merely says that foils of such a thickness "can be produced". This was not disputed. What was disputed, however, was that the use of an individual foil having a thickness lower than 1.5 mils (see page 37, paragraph headed "Metglas Foil Brazing Performance) has ever been taught by this disclosure. This argument is not accepted in view of the clear wording of document (2). Furthermore it is to be noted that Claim 1 under discussion claims protection for the foil as such and not for the use of an individual or single foil of this thickness (as does the claim of the subsidiary request, which will be discussed later on).

Hence, the Board holds that brazing foils of a very similar composition to the one specified in Claim 1 and having a thickness totally covering the range according to above feature (a) is known from document (2).

4.3 From the paragraphs following the disclosure of the thickness range of the foils in document (2) and especially from the paragraph headed "Metglas Foil Brazing Performance" on page 37 in combination with Table 3,

page 35 and Table 1, page 34, the skilled person further learns that foils of this thickness and having a composition substantially comparable with the composition of Claim 1, perform very well with respect to flexibility, chemical homogeneity and braze joint strength. Exactly these properties are aimed at according to the problem underlying the patent-in-suit (see page 2, lines 27/28 of the patent specification). It would therefore be obvious to a person skilled in the art to arrive at the idea that foils with the specific composition set out in Claim 1 should also be produced with such a low thickness in order to arrive at the same advantages. The selection of 3.556×10^{-3}cm, (0.0014 inch) as the upper value of the range does not appear to be of inventive nature but rather seems to be the result of routine experiments. At least there is no indication in the patent of a specific, surprising effect related to that specific narrower range.

4.4 As to the second differing feature (b) relating to the higher boron content, the Board takes the view that it does not contribute to the existence of an inventive step either. Generally, it appears to be of secondary importance, since there cannot be found a disclosure in the application documents showing that the higher boron content is causal for the solution of the problem, either taken individually or in combination with the thickness of the foil according to feature (a). The proprietor, although stressing in his letter dated 4 September 1986 and during the oral proceedings that features (a) and (b) must be considered in combination, did not succeed in providing evidence for such a combinatory effect or even any specific effect related to the presence of boron in high percentage. The mere fact that in Examples 1 to 5 of the patent specification the boron content is 18 atom percent and hence lies in the range of feature (b) does

not prove that this feature is of importance with respect to the solution of the problem. In the absence of such evidence the Board takes the view that a man skilled in the art knowing from DE-A-755 435 (1) that compositions comprising boron in a concentration of up to 16.2 atom percent furnish satisfactory results, would normally take into account in his routine experiments boron values immediately neighbouring this known range and thus would more or less automatically arrive at boron values coming within the claimed range.

4.5 The Respondent argued that the skilled man would not have considered higher boron contents because of the formation of disadvantageous borides. However, although it is clear that borides stemming from the boron in the brazing foil and diffusing with the base metal elements to be joined (see document (2), page 37, Figure 7) would increase with increasing boron content, this increase appears to be relatively low as compared with the influence of the thickness of the foil on the amount of boron contained in the foil, and therefore the skilled person would not be deterred from considering higher boron contents with thin foils. Furthermore, it is known to the practitioner and clearly stated under the heading "Metallic Glass Compositions" on pages 35 and 36 of (2) that the glass forming alloys should always be near the eutectic composition. In the case of a binary alloy consisting of nickel and boron - as covered by present Claim 1 in its broadest sense - this means that one would choose a boron content meeting this requirement, i.e. a boron content between 18 and 19 atom percent.

4.6 Having regard to the point whether or not the high boron content is causal of the properties achieved, in particular of the relatively high joint shear strength, the Respondent stressed Example 6 of the original

disclosure which shows a direct comparison of a brazing foil according to Claim 1 (Sample 8) with a brazing foil containing 16 atom percent boron (Sample 9). In the Board's view, this example is not suitable for proving the superiority of alloys with high boron content, since on the one hand the highest singular value is achieved with Sample 9 (18, 560 psi) and, on the other hand, the test conditions were not the same: with Sample 8 the foil was 50μm thick whereas with Sample 9 the thickness was 40μm. Furthermore, there were different amounts of chromium present in the compositions. After all, the Board is of the opinion that the higher boron content is not crucial to the joint strength achieved and that there is no combinatory effect in the sense that the above differing features (a) and (b), if taken together, lead to an effect which could not have been expected from the disclosure of the prior art.

4.7 Since, as has been shown above, it was suggested to the skilled person by document (2) to utilise brazing foils in the thickness range according to present feature (a) and since the selection of boron contents as claimed in feature (b) also did not need the exercise of inventive considerations, as set out in detail above, and, moreover, since no unexpected combinatory effect (as it was the case in the decision T 265/84 of this Board, referred to by the Respondent), could be shown, which could have supported the existence of an inventive step, it follows without the exercise of any ex-post-facto analysis, as contended by the Respondent, that the brazing foil as claimed in Claim 1 does in itself not involve an inventive step under Article 56 EPC and that, consequently, Claim 1 is not allowable.

5. For the above reasons, the main request of the Respondent had to be refused, taking into account that the Board can

only decide on a request as a whole, no matter whether there was inventive subject-matter present in one of the following claims, here in Claim 2.

6.1 Concerning the single claim according to the subsidiary request it is to be noted that its subject-matter corresponds, in fact, to the subject-matter of Claim 2 of the main request, which already combined, by reference, the features of both claims of this request. Consequently, there are no objections as to formal requirements under Article 123.

6.2 Apart from some basic procedural steps forming part of general knowledge in the art of joining metal parts by a brazing process (see the features set out in the preamble of granted Claim 2, which are also described in document (1), page 1, paragraph 2), the subject-matter of the single claim of the subsidiary request contains the additional feature (c) that a single foil of the thickness and composition specified in Claim 1 of the main request is used in a brazing process.

6.3 As can be seen from the original disclosure and also from the patent specification (cf. in particular original Examples 7 to 11, which correspond to Examples 1 to 5 of the patent, in combination with the drawing) it is this additional feature in combination with the low thickness of the foil according to feature (a) referred to above, which is responsible for the high shear strength achieved by the invention.

6.4 There is no disclosure in the available prior art of the use of a single foil having a thickness falling within the range of 1.27 to 3.556 x 10^{-3}cm (0.5 to 1.4 mils).

Although document (2) refers to the production of brazing foils having a thickness of 0.5 to 2.0 mils this cannot, in the Board's view, be construed as a teaching that such foils are to be used in a single layer. In fact, the lowest value recommended in this document for use in a single layer is 1.5 mil (see page 37, righthand column, paragraph 3). The Appellant, in this context, also referred to Figure 7 (page 37) of this document, arguing that it clearly follows from the scale indicated in this figure that single brazing foils having a thickness as low as about 11 microns (1.1×10^{-3}cm) have been used in such processes. The Board cannot accept this argument, since Figure 7 shows the joint in its finished condition and no reliable conclusion can be drawn to the original thickness of the foil from this diagrammatic figure.

Document (1) also does not give a lead to the feature of using a single foil of the thickness as claimed. On the contrary, this document teaches on page 13, paragraph 2 that brazing foils should be used having a thickness of 1.5 to 2.5 mils and that if it is intended to use thinner foils those foils should be stacked such as to form an overall thickness of the above range. Hence, this document clearly recommends not to go below an overall foil thickness of 1.5 mil.

6.5 Concerning the arguments put forward by the Appellant that it was quite normal with the technique of squirting molten alloy on a rotating quenching surface to produce thin foils, whereas difficulties would arise with thick foils because of the necessity of an excessively high cooling rate, and that a skilled man would apply such thin foils in accordance with the requirements of the specific case, i.e. with the smoothness and the shape of the base metal parts to be joined, it is noted that in the absence of any further evidence and of a suggestion in the prior art,

these considerations appear to be of a speculative and somewhat hindsight nature. They merely show that there was a possibility for the skilled person at the priority date of the present patent to apply a single foil of the thickness as claimed; however, they are not sufficient to give an idea of what could have encouraged this person to provide a single foil of the kind specified in the claim in order to arrive at a solution to the problem stated above, especially of achieving joints of a very high mechanical strength.

6.6 Summarising, in the Board's judgement the process according to the single claim of the subsidiary request could not have been derived in an obvious manner from the available prior art and therefore must be considered to involve an inventive step pursuant to Article 56 EPC.

7. Consequently, the subject-matter of the single claim according to the subsidiary request is patentable (Article 52(1)) and the patent is to be maintained on the basis of this claim.

8. The description as amended is adapted to the wording of this claim and also appears to satisfy the further requirements of the EPC (Rule 27 EPC). It is not open to objections either.

9. Although further amendments were made to the patent during the oral proceedings, the Board did not consider it appropriate to proceed pursuant to Rule 58(4) EPC, since the amendments could be foreseen in view of the Respondent's latest letter and could easily be dealt with at the oral proceedings. Moreover, both parties explicitly declared that they did not desire proceedings under Rule 58(4) EPC.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The main request is refused.

3. The case is remitted to the first instance with an order to maintain the patent with description, drawing and single claim as filed during the oral proceedings in accordance with the subsidiary request.

The Registrar: The Chairman:

F. Klein P. Delbecque