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**Datasheet for the decision
of 6 February 2019**

Case Number: T 0192/18 - 3.2.08
Application Number: 12162062.9
Publication Number: 2517817
IPC: B23H7/08, B21C37/04, C23C2/06,
C23C2/26, C23C2/38
Language of the proceedings: EN

Title of invention:

Electrode wire for electro-discharge machining and method for
manufacturing the same

Patent Proprietor:

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Seong, Hyun-Soo
Seong, Hyun-Kook

Opponent:

Berkenhoff GmbH

Headword:

Relevant legal provisions:

EPC Art. 54, 56
RPBA Art. 12, 13

Keyword:

Novelty
Inventive step

Decisions cited:

G 0001/92

Catchword:



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Case Number: T 0192/18 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 6 February 2019

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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted on 20 November 2017 rejecting the opposition filed against European patent No. 2517817 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman C. Herberhold
Members: M. Alvazzi Delfrate
 C. Schmidt

Summary of Facts and Submissions

I. The appeal is directed against the decision posted on 20 November 2017 in which the opposition division rejected the opposition against European patent No. 2517817.

II. At the end of the oral proceedings before the Board of appeal, held on 6 February 2019, the requests of the parties were as follows:

The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed, i.e. that the patent be maintained as granted (main request) or that the patent be maintained on the basis of the first, second or third auxiliary request filed during the opposition proceedings with letter dated 29 September 2017.

III. Independent claims 1 and 5 of the main request read as follows:

"1. An electrode wire for electro-discharge machining, the electrode wire comprising:

a core wire including a first metal;

a first alloy layer (22) formed at a boundary region between the core wire and a second metal plated on an outer surface of the core wire due to mutual diffusion between the core wire and the second metal; and

a second alloy layer (23) formed at an outer portion of the first alloy layer (22) due to diffusion of the first metal to the second metal,

wherein a core wire material is erupted onto a surface of the electrode wire for electro-discharge machining, which includes at least the core wire, the first alloy layer (22), and the second alloy layer (23), along cracks appearing on the second alloy layer (23), so that a plurality of grains are formed on the surface of the electrode wire, and

wherein the grain including at least the core wire material and a second alloy material is distributed onto the surface of the electrode wire for electro-discharge machining.

characterized in that

the grain including the core wire material is arranged in a direction substantially perpendicular to a longitudinal direction of the electrode wire for electro-discharge machining, and has a length twice to ten times greater than a width of the grain."

"5. A method of manufacturing an electrode wire for electro-discharge machining, the method comprising:

preparing an intermediate wire rod, which includes a first metal and has a first diameter, as a core wire;

plating the core wire (12) with a second metal;

performing a heat treatment process to make the plated core wire (12) representing tensile strength of about 500N/mm² or less and elongation percentage of 5 or more

and to form a first alloy layer (22) in at least a boundary region between the core wire (12) and the second metal due to mutual diffusion between the core wire (12) and the second metal and to form a second alloy layer (23) on an outer portion of the first alloy layer (22) through diffusion of the first metal to the second metal; and

forming a grain including at least a core wire material and a second alloy material on a surface of the electrode wire for electro-discharge machining by erupting the core wire material through a crack appearing on the second alloy layer (23) when performing a fine wire process of making the electrode wire for electro-discharge machining which includes the first alloy layer (22), the second alloy layer (23), and the core wire (12) and has a second diameter,

characterized in that,

before the electrode wire for electro-discharge machining is drawn to have a second diameter in the forming of the grain, the electrode wire for electro-discharge machining is forcibly twisted in at least one of up, down, left, and right directions."

IV. The following documents played a role in the present decision:

D1: US -A- 2008/179296;

D3: US -A- 6,492,036;

D4: US -A- 2002/0092831;

A1: "Untersuchungsbericht Wettbewerbs-OV- Drähte"
Muster Nr. 326, dated 12.03.2008;

A2: extract of GFE-inspection report of 5 February
2010, pages 1-10;

A2.1: pages 17 and 41 of the GFE-inspection report;
A3: Brochure of GF Agie Charmilles "Fils certifiés"
©2010;
A4: affidavit of Mr. Nöthe, dated 2 June 2016;
A5: Table "Package technology CUT Pxxx0";
A6: Handbook "Short" CUT P 350/550/800 and CUT S
350/550, AG Charmilles;
A7: Photo of device type CUT P 350;
A8: Photo of display of A7;
A9: affidavit of Mr. Dietrich, dated 22 March 2018;
A10: affidavit of Mr. Nöthe, dated 22 March 2018;
A11: affidavit of Mr. Ly, dated 5 February 2019;
A12: photography of a commercially available coil of
wire AC-Cut AH.

V. The appellant's arguments can be summarised as follows:

Documents A2, D4, A2.1 and A5-A12

A2 was already part of the opposition proceedings and should thus be considered.

Documents D4, A2.1 and A5-A10 had been submitted with the statement of grounds of appeal in response to points raised by the opposition division in the appealed decision. Hence, they should be admitted into the proceedings. The fact that A2.1 and A2 represented only a part of an experimental report was not an obstacle to them being taken into consideration, since there was no obligation to cite a full document. On the contrary, it was usual to cite only the relevant parts.

It was true that A11 was filed at a late stage in the proceedings. However, this document was not long and intended to address some of the issues concerning the

public availability of the wire to which A2 related. Hence, it should also be admitted into the proceedings.

There was no objection to the admission into the appeal proceedings of A12 (which was submitted by the respondent during the oral proceedings before the Board).

Novelty - public prior use

A1 and the internal report from which A2 and A2.1 were extracted pre-dated the priority of the patent in suit. They related to a commercially available wire with the name AC-Cut AH. This was confirmed by affidavits A4, A9 and A10 and was in accordance not only with A3, A5 and A6 but also A12 filed by the respondent. Hence, the wire examined in A2 and A2.1 was part of the prior art.

The wire exhibited all the features of claim 1. As shown in the graph on page 41 of A2.1 it comprised a core material of a α brass (dark grey in the micrographs) and an outer layer of a γ brass (light grey in the micrographs). Between these two phases, a transition formed a β brass diffusion phase. Although the latter phase was also dark grey in the micrographs, it could still be distinguished from the core material. Furthermore, the micrograph on page 17 of A2.1 showed a region where no outer coating was present and the core phase had erupted to the surface of the wire to form grains with this material on the surface. The presence of this core material on the surface was likewise detected in the EDX measurements shown on page 4 of A2. Even if they were made at 20 KV voltage, these measurements were also representative of the composition on the surface. The fact that the same results were not shown in the 5 kV voltage EDX

measurements on page 7 of A2 was merely a matter of the particular location of the sampling points and did not exclude the presence of the core material on the surface. The claimed orientation and size of the grains was likewise disclosed in the micrographs of A2.

Hence, the subject-matter of claim 1 lacked novelty.

Inventive step

The subject-matter of claim 1 also lacked an inventive step starting from the closest prior art D1. The sole distinguishing feature in view of this document was that the core material grains on the surface had a length twice to ten times greater than their width.

This feature was disclosed in Figure 4a of D4, which addressed the same problem as the patent in suit, namely, to improve machining speed.

Hence, the subject-matter of claim 1 was obvious in view of the combination of D1 and D4.

The same applied in view of the combination of D1 and D3, whose relevant disclosure differed from that of D4 only by a slightly poorer quality of the reproduction of Figure 4a.

VI. The respondent's arguments can be summarised as follows:

Documents A2, D4, A2.1 and A5-A12

A2 and A2.1 were only extracts of an internal report which had not been submitted in its entirety, as procedural fairness would have required. Thus, A2

should be excluded from the proceedings and the late-filed A2.1 should not be admitted into them.

The same applied to the other late-filed documents A5-A11 and D4, which were not more relevant than the documents already admitted into the proceedings. In addition, A11 was filed at such a late stage that the respondent received it only on the day of the oral proceedings, such that it could not adequately respond without adjournment of the proceedings.

As to A12, it had already been filed in opposition and should thus be considered.

Novelty - public prior use

There was no proof that the wire examined in the internal reports of A1, A2 and A2.1 was the same as the one commercially available under the name AC-Cut AH. As could be seen in A12, the commercial wire carried the name AC-Cut AH on the coil, while this was not the case for the coil on the first page of A1.

Moreover, as stated in G 1/92, in case of a public prior use it had to be possible for the skilled person to discover the composition or the internal structure of the product and to reproduce it without undue burden in order for both the product and its composition or internal structure to become state of the art.

In any event, the measurements of A1 and A2, A2.1 did not prove that the examined wire had all the features of claim 1. First, it was disputed that the graph on page 41 represented evidence of the presence of a diffusion-formed alloy between the α brass of the core and the γ brass of the coating. Nor did the micrographs

show this diffusion-formed alloy. Moreover, even accepting that such a further phase was formed, there was no evidence that the surface grains indeed comprised the core material and not the diffusion alloy. The surface EDX measurements of page 7 of A2 taken at 5 kV did not show the presence of α brass. That type of brass was shown only by the EDX measurements on page 4 of A2, which, however were taken at 20 kV and thus represented the composition of the deeper layers.

Thus, the subject-matter of claim 1 was novel.

Inventive step

The closest prior art D1 did not disclose a diffusion layer between the γ brass coating layer and the α brass core material. Moreover, the surface grains did not exhibit the orientation and shape stipulated by claim 1.

Starting from D1, the problem solved by the patent was the improvement of machining speed.

Neither D4 nor D3 could render the claimed solution obvious because they did not disclose the differentiating features. In particular, the surface of the wire shown in the figures of these documents did not exhibit surface grains of the core material but rather cracks produced during drawing, which formed a porous coating layer.

Therefore, the subject-matter of claim 1 involved an inventive step.

Reasons for the Decision

1. Documents A2, D4, A2.1 and A5-A12
 - 1.1 A2 was submitted with the notice of opposition and considered by the opposition division in the decision under appeal. Therefore, it cannot be excluded from the proceedings.
 - 1.2 As to documents D4, A2.1 and A5-A10, they were submitted at the earliest possible stage in the appeal (with the statements of grounds). Moreover, they relate to lines of attack already brought forward in opposition, and their submission can be considered as a response to the appealed decision. Hence, the Board decided to admit them into the proceedings (Article 12 RPBA).
 - 1.3 By contrast, A11 was filed by the appellant at an extremely late stage of the proceedings, namely the afternoon prior to the oral proceedings. Thus, if A11 had been admitted into the proceedings, the respondent would have had no possibility to respond to this document without an adjournment of the oral proceedings. Thus, the Board decided not to admit it into the proceedings (Article 13 RPBA).
 - 1.4 A12 is a simple document (one photo) which had already been submitted (by the respondent) during the opposition proceedings. There was no objection from the appellant to its re-submission by the respondent at the oral proceedings before the Board. Thus, the Board decided to take it into consideration.

2. Novelty - public prior use

2.1 Both A1 and the report from which A2 and A2.1 are extracted pre-date the priority date of the patent in suit. Although these documents as such are not part of the prior art, the Board is satisfied that they relate to a wire which was commercially available at the time under the name AC-Cut AH.

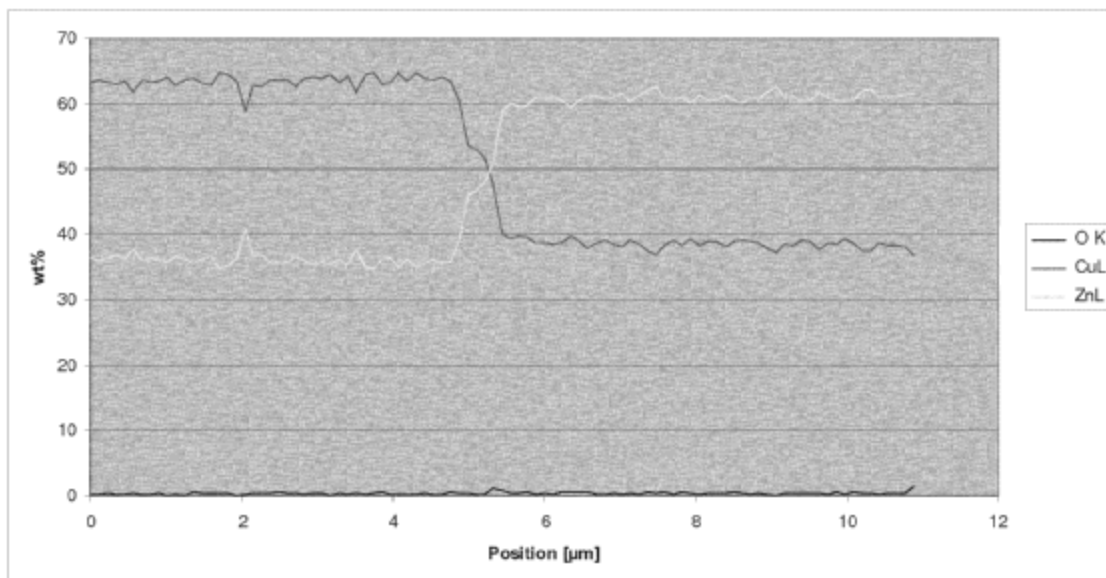
This has been proven by affidavits A4, A9 and A10 and is consistent not only with further evidence A3, A5-A7 submitted by the appellant but also with the fact that the wire coil in the picture on the first page of A1 has the same reference number (G10372) visible on the commercially available coil depicted in A12, submitted by the respondent.

Since the person skilled in the art would have been able to discover the composition and the internal structure of this wire (the measurements reproduced in A1, A2 and A2.1 being standard measurements) and reproduce it without undue burden, both the wire analysed in A1 and A2, A2.1 and its composition and internal structure are part of the prior art (see G 1/92, OJ EPO 1993, 277, point 1.4 of the reasons).

2.2 However, the appellant failed to prove that this wire exhibited all the features of claim 1.

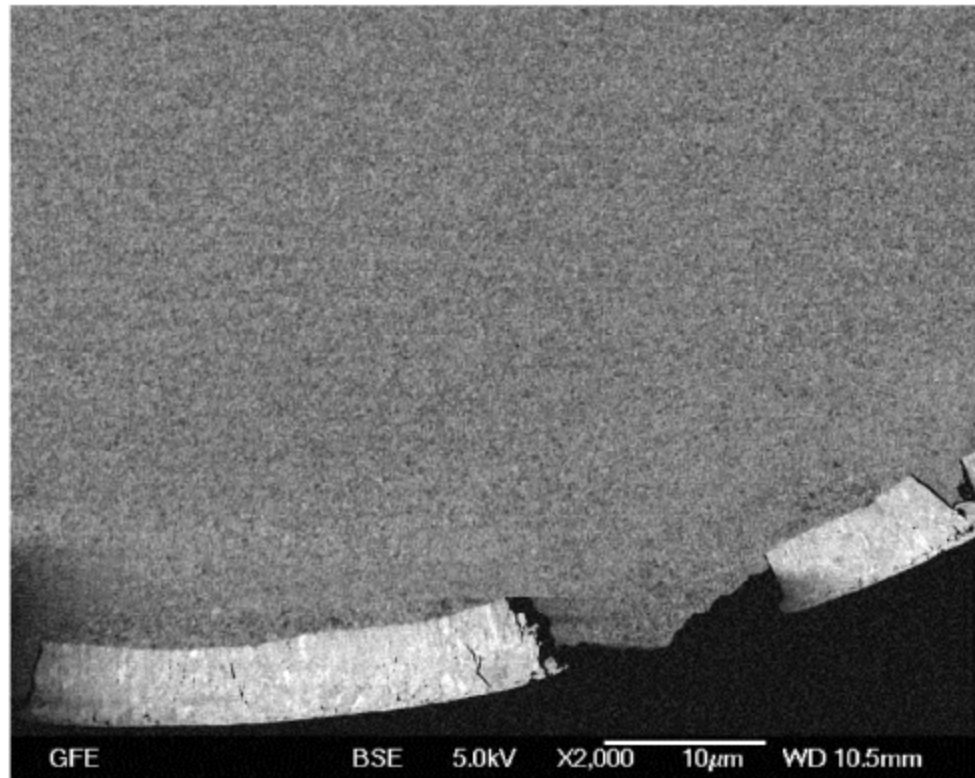
A2 and A2.1 relate to an electrode wire for electro-discharge machining. As shown in the graph on page 41 of A2.1 (reproduced here as Figure 1), the electrode wire comprises a core wire with Cu and Zn contents as in a α brass (dark grey in the micrographs) and an outer layer with Cu and Zn contents as in a γ brass (light grey in the micrographs). Between these two

phases, a transition zone is shown which is at least consistent with the formation of a possibly very narrow β brass diffusion phase between them.



(Figure 1)

However, in the SEM (scanning electron microscope) images, this diffusion phase - if present - shows up in the same dark grey as the α brass (see the micrograph of page 17 of A2.1 reproduced here as Figure 2). Thus, contrary to the opinion of the appellant, it cannot be distinguished from it. The micrographs also show regions where no light grey coating is present and in which the inner dark grey area erupts at the surface. However, from the micrographs, which do not distinguish between α brass and β brass diffusion phases, it cannot be directly and unambiguously derived that the layer erupted at the surface is formed by α brass core wire material to form grains including the core wire material and a second alloy material distributed onto the surface, as required by claim 1.



(Figure 2)

Indeed, the EDX measurements of page 7 of A2, which being taken at 5 kV represent the composition of a superficial layer, do not show any evidence of presence of the α brass but only of the γ brass and of a composition with about 55 wt% Cu, which could correspond to the diffusion layer discussed above.

As to the EDX measurements of page 4 of A2, which also show compositions in the range of an α brass, they have been taken at a higher voltage (20kV). Hence, even if they may be in part influenced by the composition at the surface, these measurements also take into account the composition of more inward layers. Thus, they do not directly and unambiguously demonstrate the presence of a superficial layer with a composition as claimed.

In this context, the opponent carries the burden of proving that the prior art wire exhibited all the features as claimed.

2.3 Thus, the subject-matter of claim 1 is novel.

3. Inventive step

3.1 It is common ground that D1 represents the closest prior art. D1 discloses an electrode wire for electro-discharge machining (paragraph [0001]). The electrode wire comprises a core wire including a first metal (paragraph [0051]). The core is coated with Zn and then heat treated, so that, by diffusion, a γ brass layer is formed (paragraphs [0060]-[0061]). In a final drawing step (paragraph [0063]), cracks in the coating are formed, so that the inner material is erupted onto a surface to form grains onto the surface of the electrode wire, as can be seen in Figures 7 and 8.

It is undisputed that the claimed wire is distinguished over D1 at least by the feature that said grains have a length twice to ten times greater than their width.

3.2 It is also undisputed that the problem solved starting from D1 is in the improvement of machining speed (paragraphs [0041] and [0044] of the patent specification).

3.3 Contrary to the appellant's view neither D4 nor D3 rendered it obvious to solve this problem by providing the wire of D1 with said differentiating feature.

It is true that D4 relates to the problem of improving a machining speed (paragraphs [0015] and [0016]) and discloses in Figure 4a a wire whose surface has some

elements with a length/width ratio in accordance with present claim 1. However, these elements are not grains of the core material erupted to the surface but rather cracks. This represents part of the essential teaching of D4 (claim 1), and these cracks are formed during the drawing, resulting in a porous coating layer (D4, paragraph [0036]). Neither grains formed by core material erupted to the surface of the wire along said cracks or otherwise nor a possible importance of the length/width ratio of the cracks are disclosed in D4. Applying the teaching of D4 to solve the problem above would thus not lead to the claimed wire but rather to a wire with a porous coating.

The same considerations apply in view of D3, whose disclosure is similar to that of D4 (see Figure 4a, claims 1 and 2, column 4, lines 22-42 of D3).

Therefore, the subject-matter of claim 1 involves an inventive step.

4. No objection has been submitted against the other independent claim (process claim 5). Nor does the Board see any reason to question the patentability of its subject-matter. Hence, the patent can be maintained as granted and there is no need to consider the auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Moser

C. Herberhold

Decision electronically authenticated