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D E C I S I O N
of 27 September 1995

Case Number: T 0009/92 - 3.2.5

Application Number: 84306185.4

Publication Number: 0137734

IPC: B22D 11/10

Language of the proceedings: EN

Title of invention:
Fluxes for casting metals

Patentee:
FOSECO INTERNATIONAL LIMITED

Opponent:
METALLURGICA Gesellschaft für Hüttenwerkstechnik mbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 56, 114(2)

Keyword:
"Late submitted material - document admitted (no)"

Decisions cited:
-

Catchword:

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0009/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 27 September 1995

Appellant: (Opponent)
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Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office given orally on 26 November 1991 and posted on 23 December 1991 rejecting the opposition filed against European patent No. 0 137 734 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: C. V. Payraudeau
Members: H. P. Ostertag
A. Burkhart

Summary of facts and submissions

I. An opposition was filed against the grant of the European patent No. 0 137 734 on the grounds that the subject-matter of the European patent was not patentable within the terms of Articles 52 to 57 EPC (Article 100(a) EPC).

II. The opposition against the European patent was rejected pursuant to Article 102(2) EPC. In its decision the Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent as granted.

The documents DE-A-2 345 921 (D1), DE-B-2 614 957 (D2) and GB-A-2 024 046 (D3) referred to in the reasons for the decision of the Opposition Division are also relevant to the present decision.

III. Claims 1, 11 and 12 of the patent as granted read as follows:

"1. A flux for the casting of metals, in the form of granules of a composition containing carbonaceous powder in solid portions of the granules, characterised in that in the solid portions of the granules the proportion of carbonaceous powder in the surface of the granules is greater than the overall proportion of carbonaceous powder in the said solid portions of the granules."

"11. A method of making a casting flux according to claim 1 which comprises forming liquid-containing particles containing flux ingredients and evaporating the liquid from the particles to yield granules, characterised in that the flux ingredients include carbonaceous powder, and the evaporation of the liquid from the particles yields granules comprising solid

portions in which the proportion of carbonaceous powder in the surface of the granules is greater than the overall proportion of carbonaceous powder in the solid portions of the granules."

"12. A method of continuously casting steel in which a flux in the form of granules containing carbonaceous powder is applied to the top surface of molten steel in a continuous casting mould characterised in that in the solid portions of the granules the proportion of carbonaceous powder in the surface of the granules is greater than the overall proportion of carbonaceous powder in the said solid portions of the granules."

IV. The appellant (opponent) lodged an appeal against this decision of the Opposition Division and requested that the decision under appeal be set aside and that the patent be revoked.

V. On 21 September 1995 the appellant filed two additional documents by telecopy:

D4 "Manufacturing Processes for Ceramics", Toshihiro Mihara, an English translation of several passages of an article published in Japanese in "Ceramics, 16 (1981), No. 10", and

D5 "Continuous casting of Steel", Proceedings of the 2nd Process Technology Conference, Vol. 2, Chicago Meeting, February 23-25, 1981.

VI. Oral proceedings were held on 27 September 1995.

(i) The appellant requested that the decision under appeal be set aside and that the patent be revoked. He also requested that the board admit the documents D4 and D5 into the proceedings.

(ii) The respondent (patentee) requested that the appeal be dismissed, and that the patent be maintained as granted. He also requested that the board disregard the documents D4 and D5 pursuant to Article 114(2) EPC.

(iii) After having heard the arguments of the parties concerning the admissibility of the documents D4 and D5, the Chairman announced the following interlocutory decision: The board will disregard the documents filed by telecopy on 21 September pursuant to Article 114(2) EPC.

VII. In support of his request for revocation of the patent the appellant argued essentially as follows:

Although document D1 related to a cover material, rather than to a flux as claimed in the patent in suit, the respective areas were technologically related and were generally well known to the skilled person working in the field of the casting of steel. Moreover, cover materials and fluxes had a very similar chemical composition (for example, both the cover material according to Example 3 of document D1 and the flux according to documents D2 or D3 show substantial amounts of Al_2O3 and SiO_2, see document D3, page 3, lines 26 to 42), and had to satisfy very similar requirements, such as heat isolation and melt behaviour, see document D2, column 2, lines 7 to 12. Another point of similarity was that for both cover materials and fluxes the carbon interacted with the melting surface of the molten steel, see document D1, page 6, second paragraph. Document D1 disclosed the characterising feature of the invention, see page 6, third paragraph: "An embodiment is to be considered, whereby the spherical particles have a higher carbon density on the surface as in the core". The term "on the surface" in the referenced sentence was

equivalent to "in the surface", which was all the more clear from the particular embodiment on page 6, fourth paragraph, according to which the core is **coated** with a layer containing carbon.

Starting out from the flux known from document D2, the person skilled in the art would, according to the particular type of molten steel to be cast, include the feature known from document D1 in this known flux and thus arrive at the invention.

VIII. The above submissions were contested by the respondent who argued essentially as follows:

The fact that both flux and cover materials are products used in related technical fields does not mean that the person skilled in the art would take the teaching of a document relating to cover materials into account in order to solve a problem in the field of fluxes. Fluxes and cover materials had different properties and had to meet different requirements, i.e. a flux should melt in use, whereas a cover material should not melt, and hence had a different composition. It was a very significant feature of the fluxes according to the invention that carbonaceous powder is present in the surface of the granules as an integral part, as opposed to being present at the surface as a weakly bonded, applied layer, as exemplified by e.g. document D3. Such a coating would be prone to dusting and premature burning out. The carbon powder would also be easily picked up by the steel, which was sometimes, i.e. in the case of low carbon steel, undesirable. Apart from the fact that document D1 related to a cover material and not to a flux, the central teaching of the embodiment of page 6 of this document was **to coat** the granules with carbon-containing material, as is done in document D3. As an alternative embodiment of the cover material

according to document D1, it was proposed that the carbon content on the surface should be **lower** than the carbon content in the core (see page 7, second paragraph), which would be completely opposite to the teaching of the invention. Document D2, which related to a flux containing carbonaceous powder, did not give any hint or suggestion concerning the distribution of this powder.

It followed that none of the cited documents would give the person skilled in the art a hint or suggestion that he should provide a flux, a method of making a casting flux and a method of continuously casting steel with all the features of claims 1, 11 and 12, respectively.

Reasons for the decision

1. *Admissibility of the late-filed documents*

1.1 The appellant stated in the letter accompanying the documents D4 and D5, filed only six days before the oral proceedings before the board took place, that "the documents D4 and D5 were made available now for the first time during a search in relation with a revocation procedure of a Japanese patent corresponding to the patent in suit." This statement may be considered as a credible explanation but not as a justification for the lateness of the citation of these documents. A more thorough search made during the opposition period should normally have enabled the appellant to find the cited documents. The citation is thus considered not to have been made in due time (Article 114 EPC).

1.2 After examination of the documents D4 and D5, and after hearing the arguments submitted by the parties during the oral proceedings of 27 September 1995 on the

question of admissibility, the board has come to the conclusion that the new material cited by the appellant is not so relevant in the sense that the board would introduce it in the proceedings of its own motion. Document D4 is not concerned with fluxes, but relates to a totally different technical field, viz. ceramics, and document D5 is concerned with laboratory experiments on fluxes blended with a carbonaceous powder which could be of the type mentioned in the prior art cited in the patent.

1.3 The board has therefore decided to disregard the documents filed by telecopy on 21 September pursuant to Article 114(2) EPC.

2. *Novelty*

It is no longer disputed by the appellant that none of the documents D1, D2 or D3 discloses all the features of claims 1, 11 and 12 of the patent in suit (see also the appellant's letter of 15 November 1993, second paragraph). Hence there is no need for further substantiation of this matter.

The subject-matter of claims 1, 11 and 12 is therefore new within the meaning of Article 54 EPC.

3. *Technical problem and solution*

3.1 The invention relates to a flux for the casting of metals, in particular for the continuous casting of steel, in the form of granules of a composition containing carbonaceous powder.

As explained in the description of the patent in suit, carbon powder as a flux ingredient promotes the fusion of the flux to form discrete droplets, which inhibit

sintering of the flux granules. However, it is desirable to reduce the proportion of carbonaceous powder in the flux so as to reduce its surface tension in order to increase its melting rate, and thus obtaining a higher casting rate. The uncontrolled loss of carbon black from the granules in the form of dust (environmental pollution) or due to premature burning-out is undesirable, especially in cases where any pick-up of carbon from the flux by the steel should be minimal, e.g. with low carbon steels.

3.2 The problem that the present invention aims to solve is to provide a granular flux for the casting of metals allowing achieving a high melting rate suitable for high speed casting without incurring the disadvantages that arise when sintering of the flux occurs, and whereby the carbonaceous powder is firmly bonded to the granules. The present invention also seeks to provide a method for making this flux and a method of continuously casting steel using this flux.

3.3 This problem is solved by the flux, method of making a casting flux, and method of continuously casting steel according to claims 1, 11 and 12, respectively.

In particular, these claims are characterized by the feature that "the proportion of carbonaceous powder in the surface of the granules is greater than the overall proportion of carbonaceous powder in the granules" (whereby the carbon content pertains to the solid portions of the granules).

To avoid any ambiguity, the term "the proportion of carbonaceous powder in the surface of the granules" is explained in the description as meaning that the carbonaceous powder is present in the surface of the

granules as an integral part of the granules, as opposed to being present at the surface as an applied layer.

4. *Inventive step with respect to the cited prior art*

4.1 In the opinion of the board, document D2 represents the closest state of the art. This document discloses (see column 2, lines 26 to 36) a casting flux in the form of hollow granules ("spherulites") containing carbonaceous powder, which is obtained by forming a slurry of a mixture of the casting powder, possibly a lubricant and a swelling agent, and by spray drying this solution.

This document is completely silent about the characterizing feature of the invention, viz. that the density of the carbonaceous powder should be higher in the surface than in the core of the solid portion of the granules.

4.2 The document D3, which is cited in the description of the patent in suit in column 1, lines 51 to 59, and upon which the preamble of the independent claims is based, discloses (see page 2, lines 17 to 22) a process for the production of a flux in the form of hollow spheroidal granules for use in continuous steel casting, whereby the last manufacturing step comprises the coating of the granules with a powdered carbon-containing material.

Consequently, document D3 is seen to point away from the invention since the carbonaceous powder is present as an applied layer, and not present in the surface, and as an integral part, of the granules.

4.3 Document D1 relates to a cover material. Cover materials are products that are employed in adjacent, and technically related fields, so that a person skilled in the art of designing fluxes for the casting of steel

will be familiar with cover materials and their properties.

The appellant has argued that cover materials and fluxes would satisfy similar requirements, and would have similar properties. The board accepts that fluxes and cover materials must meet several requirements, some of which are the same, such as reducing the loss of heat upwards from the top surface of the steel in the mould, protecting the surface of the steel from oxidation, and removing impurities, i.e. various oxides in the form of solid fragments, from the steel (see e.g. column 1, lines 13 to 50, of the patent specification, and document D3, page 1, lines 9 to 27). However, the main reason to apply a flux during the continuous casting of steel is to provide lubrication between the mould walls and the adjacent solidified layer of steel, i.e. the flux should rapidly melt at the contact surface with the steel. In contrast, melting of the cover material should be avoided, since the prime purpose of employing a cover material is heat isolating the molten steel. This property will deteriorate if the material melts.

The person skilled in the art seeking to solve the problem addressed by the present invention of providing a granular flux allowing to achieve a high melting rate suitable for high speed casting without incurring the disadvantages that arise when sintering of the flux occurs, would therefore not take document D1 into account.

4.4 Even if one were to assume that the person skilled in the art would be aware of the teaching of document D1, he would not arrive at the invention for the following reason.

On page 6, third paragraph, of document D1 it is stated that "An embodiment is to be considered, whereby the spherical particles have a higher carbon density on the surface as in the core". D1 continues (page 6, fourth paragraph): "In particular, the spherical particles may have a core substantially free of carbon, which is covered by a carbon containing material".

Although a literal interpretation of the passage on page 6, third paragraph, does not exclude the possibility that in the embodiment described therein the carbon powder is present as an integral part of the granules (and with a density distribution in accordance with the present invention), in the view of the board the person skilled in the art would, when reading the third and the fourth paragraph in conjunction, interpret this passage as meaning an embodiment, wherein the spherical particles have a (low proportion) carbon containing core, which is covered by a (high proportion) carbon containing material.

The person skilled in the art seeking to improve the flux according to document D2 would therefore only find a confirmation of the teaching of document D3 in the particular embodiments of a cover material described at page 6 of D1.

In the alternative embodiment of the cover material according to document D1 on page 7, second paragraph, the carbon content on the surface - in this case as an integral part of the granules - should be **lower** than the carbon content in the core, so that this embodiment is seen to point away from the present invention.

4.5 The person skilled in the art, starting from the casting flux according to document D2, will therefore not arrive at the subject-matter according to claim 1, either using

his expert knowledge alone, or in combination with any other teaching of the cited prior art.

4.6 Hence the subject-matter of claim 1 as granted involves an inventive step within the meaning of Article 56 EPC.

The above considerations apply equally to the subject-matter of claims 11 and 12, which relates to a method of making a casting flux according to claim 1, and to a method of continuously casting steel in which this flux is applied, respectively.

5. In view of the above, the patent can be maintained as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

A. Townend

The Chairman:

C. Payraudeau