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# Datasheet for the decision of 20 December 2007

**Case Number:** T 0612/06 - 3.2.02

**Application Number:** 01114811.1

**Publication Number:** 1167547

**IPC:** C21B 13/10

**Language of the proceedings:** EN

**Title of invention:**
Method of producing iron nuggets

**Appellant (Applicant):**
KABUSHIKI KAISHA KOBE SEIKO SHO

**Opponent:**
-

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 54, 84, 123(2)
RPBA Art. 15(1), 15(6)

**Relevant legal provisions (EPC 1973):**
EPC Art. 54

**Keyword:**
-

**Decisions cited:**
-

**Catchword:**
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

**Case Number:** T 0612/06 **-** 3.2.02

# D E C I S I O N
**of the Technical Board of Appeal 3.2.02**
**of 20 December 2007**

**Appellant:** KABUSHIKI KAISHA KOBE SEIKO SHO
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**Decision under appeal:** **Decision of the Examining Division of the European Patent Office posted 4 November 2005 refusing European application No. 01114811.1 pursuant to Article 97(1) EPC.**

**Composition of the Board:**

**Chairman:** E. Dufrasne
**Members:** R. Ries
S. Chowdhury

## Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 18 October 2005 and posted 4 November 2005 to refuse European patent application No. 01 114 811.1.

II. The application was refused on the ground that the subject matter of the claims 1 to 15 as originally filed (main request) and the claims set out in the auxiliary requests 1 to 4 then on file lacked novelty (Article 54 EPC (1973)) having particular regard to the document:

D1: EP-A-0 969 105

The examining division held that none of the method claims 1 set out in any of the requests comprised technical features which departed from the disclosure of document D1.

III. On 11 January 2006, the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee on 12 January 2006. Enclosed with the statement filed on 2 March 2006 setting out the grounds of appeal, the applicant submitted the request to grant a patent on basis of the claims as filed or, alternatively, on any of the auxiliary requests 1 to 4.

IV. Having carefully considered the appellant's submissions, the Board gave a preliminary and detailed assessment of the case in the annex to the summons for oral proceedings. In particular, the Board found that claim 1 of all requests appeared not to comprise novel

subject matter vis-à-vis the process disclosed in document D1.

No arguments, comments or further requests in response to the Board's reasoned communication were submitted by the appellant.

V. Oral proceedings were held on 20 December 2007. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of one of the following requests:

Main request comprising claims 1 to 15 as published;

1st auxiliary request comprising claims 1 to 14 filed with letter dated 9 September 2005;

2nd auxiliary request comprising claims 1 to 13 filed with letter dated 9 September 2005;

3rd auxiliary request comprising claims 1 to 14 filed on 2 March 2006;

4th auxiliary request comprising claims 1 to 14 filed on 2 March 2006;

5th auxiliary request filed at the oral proceedings on 20 December 2007.

Claim 1 as filed (main request) reads as follows:

"1. A method of producing metallic iron nuggets comprising the steps of heating raw material containing carbonaceous reducing agent and iron oxide containing

material in a reducing/melting furnace, reducing iron oxide in the raw material, and then heating and melting the metallic iron produced by the reduction and simultaneously making it coalesce while separating the metallic iron from slag component, characterized in that carbonaceous reducing agent having a high fixed carbon content ratio is used."

In addition to claim 1 as originally filed, claim 1 of the first auxiliary request includes the wording (in bold letters):

"1. A method of...is used**, wherein the fixed carbon content ratio in said carbonaceous reducing agent is at least 73% by mass."**

Compared to this claim, claim 1 of the second auxiliary request further includes the wording (in bold):

"1. A method of...by mass **and wherein volatile matter content in said raw material is not more than 3.9% by mass."**

In addition to claim 1 of the first auxiliary request, claim 1 of the third auxiliary request further comprises the wording (in bold):

"1. A method of...mass**, and wherein the heating step is a two-step heating step performing the solid reduction while keeping the internal temperature of the furnace in a range of 1200 to 1400°C and, after raising the internal temperature of the furnace to the range of 1400 to 1500°C, melting the partially remained iron**

**oxide simultaneously with reducing it and making it coalesce."**

Compared to this claim, claim 1 of the fourth auxiliary request includes the feature in bold:

"1. A method of...the internal temperature of the furnace **by 50 to 200°C to be** 1400 to 1500°C, ...coalesce."

Claim 1 of the fifth auxiliary request submitted at the oral proceedings reads:

"1. A method of producing metallic iron nuggets **having a grain diameter of 2 to 50 mm,** comprising the steps of heating raw material containing carbonaceous reducing agent and iron oxide containing material **in compacted form and having a diameter of 3 to 30 mm** in a reducing/melting furnace, reducing iron oxide in the raw material, and then heating and melting the metallic iron produced by the reduction and simultaneously making it coalesce while separating the metallic iron from slag component, characterized in that carbonaceous reducing agent having a high fixed carbon content ratio is used, **wherein the fixed carbon content ratio in said carbonaceous reducing agent is at least 73% by mass**."

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

Document D1 was concerned with a method for operating a rotary furnace, whereby a layer of iron ore fines mixed with fine carbonaceous material was stacked onto a horizontally travelling hearth. The charge was preheated via heat transfer from above the hearth, the

iron ore was reduced and passed to a zone where melting of the iron and the slag occurred.

The known method did not, however, describe a method for producing iron nuggets, as claimed in the application, but resulted in the production of reduced iron lumps which were crushed and underwent e.g. magnetic separation of the metallic iron from the slag. The technical problem underlying the invention therefore resided in providing a direct reduction method for producing iron nuggets having an appropriate size and a high yield, even if low quality carbonaceous material was used as the reducing agent.

Although the examples given in table 1 of D1 mentioned a high fixed carbon content ratio of the reducing agent, the document failed to disclose the relationship between the high fixed carbon content ratio of the reducing agent and the yield of large sized iron nuggets that resulted from the claimed direct reduction process. Moreover, D1 disclosed a one-step process rather than the two-step reduction process requested in claim 1 of the third and fourth auxiliary requests.

The late filing of the fifth auxiliary request was explained by the representative with the appellant's reluctance to accept further amendments to the claims until one day before the oral proceedings took place. Therefore, it was impossible to submit this request earlier and within the one month time period set in the Board's communication.

## Reasons for the Decision

1. The appeal is admissible.

2. There are no formal objections under Article 123(2) EPC to the claims according to the main and first to fourth auxiliary requests.

3. *Novelty, main request*

3.1 Like the application, document D1 is concerned with the reduction of iron ore fines with carbon as the reducing agent in a travelling or rotary hearth furnace. A layer comprising a mixture of iron ore fines, carbonaceous reductant and slag forming agents (gangue, limestone) is preferably used, wherein the components exhibit a particle size of less than 8 mm (cf. D1, [0033]). Alternatively, a layer of previously granulated or otherwise treated material may also be stacked on the furnace hearth and is then subjected to reduction and melting (cf. D1, [0023]). The sequence of steps the charge undergoes continuously in the rotary hearth furnace is disclosed in D1, paragraphs [0015], [0022], [0036] to [0038] and Figure 5:

The iron ore/carbon reductant mixture is

(i) preheated in zone $L_1$,

(ii) reduced at a temperature of about 1300°C in zone $L_2$,

(iii) melted by raising the temperature to more than 1450 °C in zone $L_3$,

(iv) cooled down in cooling zone $L_4$, followed by

(v) crushing and separating the metallic iron from the slag.

Table 1 of D1 shows that either char or coke having a "high" fixed carbon content of 82.08 % or 87.7 % and a volatile material content of 2% or 0.9%, respectively, are used as reducing agents, but also mixtures of char or coke with normal coal having a fixed carbon content of 56,8% and a volatile matter content of 32.8% may be used. Reference is made to D1, Table 2, examples 13 to 16, disclosing e.g. a mixture of 41.5% char or coke + 58.5% iron ore (or a iron oxide containing component and gangue) which is reduced and melted at 1480°C to obtain a "reduced iron yield" (= the metallisation ratio) of 92 % or more. Similar iron recovery results are obtained by the examples described in Tables 3, 4, 5 (Runs 17 to 21), all using coal char as reductant, and by examples 24, 26, 27 and 30 described in Table 8 of D1. It is also noted that the fixed carbon content ratio of coke, coal char and anthracite of more than 82%, used as (single) reducing agents in the examples given in document D1, is "high" and always results in a "reduced iron yield" of 92% or more. The method given in D1 thus anticipates all the process steps inclusively the requirement of "a high fixed carbon content ratio" set out in claim 1 as filed (main request).

3.2 The appellant has argued that D1 failed to teach or suggest that iron "nuggets" having a large or appropriate diameter could be produced by the known method and that no explanation could be found about the causal relationship between the high fixed carbon content ratio of the reducing agent and the raw material and the production of "nuggets" having an appropriate size. In addition, D1 did not disclose the

two-step heating process featuring in claim 1 of the third and fourth auxiliary requests either.

3.3 As it is evident from the examples of D1 referred to above, the mixing content of the carbonaceous reducing agent, having a fixed carbon content of about 82% or higher in relation to the iron oxide bearing material, is not more than 45% by mass. Hence, the teaching of D1 already discloses the relationship referred to by the appellant, even if it is not explicitly addressed in D1. It is also noted that this relationship is not a technical feature that defines the method stipulated in claim 1 of any request.

Turning to the term "nugget", it is noted that claim 1 of the main request actually does not specify a particular particle size, and neither does claim 1 of any of the first to fourth auxiliary requests. Hence, the term "nugget" per se does not establish a technical distinction between the claimed subject matter and the subject matter of D1 even if this document does not mention this term.

Moreover, in the Board's view "iron nuggets" of the claimed type and size are likely to be formed also by the process known from document D1 in the melting zone $L_3$, given that the temperature of 1480°C in $L_3$ is close to the temperature level of "at least 1460°C" that is preferred in the melting section of the claimed process if a high iron yield is aimed at (cf. the application paragraphs [0031], [0034], [0057], Table 1 last line; Tables 2, 4, 6; claim 8). The appellant's argument that the process of D1 would be totally unsuited for

producing iron nuggets of the claimed type is therefore not supported by any evidence.

3.4 Consequently, the subject matter of claim 1 of the main request lacks novelty over the disclosure of document D1.

4. *First to fourth auxiliary requests*

4.1 As has been previously mentioned, "a fixed carbon content ratio of at least 73 %" featuring in claim 1 of the auxiliary requests 1 to 4 is satisfied by the procedural data given in document D1, Table 2, experiments 13 to 16, and so is the requirement for the volatile matter content of not more than 3.9% by mass set out in the second auxiliary request (cf. D1, Table 1; see also Table 4, A: Coal Char).

Consequently, the subject matter of claim 1 of the first and second auxiliary requests lack novelty over the disclosure of document D1.

4.2 Turning to claim 1 of the third and fourth auxiliary requests, Figure 5 of D1 and the accompanying text teach that a time interval is needed for the charge to travel through the reduction zone $L_2$ where it is heated to about 1300°C. The reduced material then enters the melting zone $L_3$ wherein the temperature is further raised to 1480°C which means an increase of 180°C in temperature vis-à-vis zone $L_2$ and results in melting of the reduced iron and the slag. Contrary to the appellant's position, it is the Board's understanding of D1 that this document does in fact disclose a two-

step heating process within the meaning of claim 1 according to the third and fourth auxiliary requests.

Consequently, claim 1 of the third and fourth auxiliary requests also does not comprise subject matter which is novel over to process known from D1.

5. *Fifth auxiliary request*

5.1 The set of claims according to the fifth auxiliary request was submitted during the oral proceedings. As to the criteria for the admissibility of such belated amendments in oral proceedings, the general principle is that the threshold for admissibility should be higher the later they are submitted in the stage of the proceedings. In this context the Rules of Procedure of the Boards of Appeal (RPBA, as last amended on 25 October 2007) have to be taken into account. Pursuant to Article 15(1) RPBA the Board had sent a communication drawing attention to matters which were of special significance, which means in the present case the lack of novelty of the subject matter of the claims of the requests then on file. According to Article 15(6) RPBA, the Boards shall ensure that each case is ready for decision at the end of the oral proceedings, unless there are special reasons to the contrary. This implies that amendments which bring up major new issues are not, without special reasons, to be admitted because the Board would be forced to decide on these issues within severe time constraint and in all likelihood without proper preparation.

5.2 The first amendment to claim 1 of the 5th auxiliary request resides in specifying the grain size of the iron nuggets of 2 to 50 mm. Although this range is specifically described on page 5, third line of the first full paragraph of the description as filed, this feature merely qualifies the result obtained by the process rather than the process step(s) by which it is brought about.

The second amendment resides in heating the raw material containing carbonaceous reducing agent and iron oxide containing material "in compacted form and having a diameter of 3 to 30 mm" in the furnace. However, claim 1 could be interpreted as defining the compacted form as relating to the iron ore fine alone whereas the passage in the description, starting with the last paragraph on page 6 to the first paragraph of page 7, referred to for support seems to specify that the raw material should include the carbonaceous material and the iron oxide containing material. Because of this inconsistency, it is concluded that the amendments to claim 1 of the fifth auxiliary request are not clearly permissible under the provisions of the EPC, in particular under Articles 84 and 123(2) EPC.

5.3 Given this situation, the claims of the fifth auxiliary request are not admitted to the proceedings.

## Order

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

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare E. Dufrasne