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**Datasheet for the decision  
of 7 July 2016**

**Case Number:** T 1832/14 - 3.2.08

**Application Number:** 07725511.5

**Publication Number:** 2035590

**IPC:** C22B1/24

**Language of the proceedings:** EN

**Title of invention:**

PROCESS FOR RECYCLING OF STEEL INDUSTRY IRON-BEARING BY-  
PRODUCTS BY TREATING PELLETS IN DIRECT REDUCTION FURNACES

**Patent Proprietor:**

Saudi Basic Industries Corporation

**Opponent:**

ZACCO SWEDEN AB

**Headword:**

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
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European Patent Office  
D-80298 MUNICH  
GERMANY  
Tel. +49 (0) 89 2399-0  
Fax +49 (0) 89 2399-4465

Case Number: T 1832/14 - 3.2.08

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.08**  
**of 7 July 2016**

**Appellant:** ZACCO SWEDEN AB  
(Opponent) P.O. Box 23101  
104 35 Stockholm (SE)

**Representative:** Zacco Sweden AB  
P.O. Box 5581  
114 85 Stockholm (SE)

**Respondent:** Saudi Basic Industries Corporation  
(Patent Proprietor) P.O. Box 5101  
11422 Riyadh (SA)

**Representative:** Modiano, Micaela Nadia  
Modiano & Partners  
Thierschstrasse 11  
80538 München (DE)

**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 7 July 2014  
rejecting the opposition filed against European  
patent No. 2035590 pursuant to Article 101(2)  
EPC.**

**Composition of the Board:**

**Chairwoman** P. Acton  
**Members:** M. Alvazzi Delfrate  
P. Schmitz

## **Summary of Facts and Submissions**

- I. By its decision posted on 7 July 2014 the opposition division rejected the opposition against European patent No.2035590.

The opposition division was of the view that, starting from the closest prior art

A2: G. A. Zinyagin et al. "Iron Production, Bringing technology on stream at Okol'sk electrometallurgical works for producing pellets by use of rolling scale", (1999) Steel in Translation Vol. 29 No. 4, pages 1-4

it was not obvious to provide the two distinguishing features of the claimed method.

- II. The appellant (opponent) lodged an appeal against that decision in the prescribed form and within the prescribed time limit.

- III. Oral proceedings before the Board of Appeal were held on 7 July 2016.

As announced by letter of 9 June 2016, the appellant did not attend the oral proceedings. In the written procedure the appellant 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 and that the opposition be rejected or that the patent be maintained on the basis of the first or the second auxiliary request filed with letter 20 March 2015. Additionally, the respondent requested

that documents A6 (parts) and A7 to A19 not be admitted.

IV. Claim 1 of the **main request** (patent as granted) reads as follows:

"Process for the recycling of steel industry iron bearing by-products into pellets suitable for feeding into a direct reduction furnace, comprising the steps of:

i. mixing and grinding 50 to 99 wt% of ore and pellet fines and 1 to 50 wt% of slurry, mill scale and/or bag house dust and adding less than 3 wt% binder to the mixture,

ii. pelletizing the mixture to produce green pellets,

iii. indurating the green pellets by heating these for 5 to 60 minutes at a temperature in the range of 1100 to 1350°C."

Claim 1 of **auxiliary request 1** reads as follows (differences with respect to the main request emphasised):

"Process for the recycling of steel industry iron bearing by-products into pellets suitable for feeding into a direct reduction shaft furnace, comprising the steps of:

i. mixing and grinding 48 to 97 wt% of ore and pellet fines and 1 to 50 wt% of slurry, 1 to 50 wt% of mill scale and 1 to 50 wt% of bag house dust and adding less than 3 wt% binder to the mixture,

- ii. pelletizing the mixture to produce green pellets,
- iii. indurating the green pellets by heating these for 5 to 60 minutes at a temperature in the range of 1100 to 1350°C, further comprising  
(iv) charging the pellets directly as feed into a direct reduction shaft furnace."

**Auxiliary request 2** is not relevant for the present decision.

- V. Additionally to A2 the following documents have been referred to in the arguments submitted in appeal:

A4: WO -A- 03/002775;

A6: Kurt Meyer, Pelletizing of Iron Ores, Springer Verlag Berlin, 1980;

A7: US -A- 3,003,864;

A8: Sabanero et al. "Production of High Quality DR Grade Pellets at IMEXSA" Skillings Mining Review, 11 December 1999, pages 4-8;

A9: US -A- 2005/0092130;

A10: Cano et al. "Development of direct reduction pellets containing MgO by Samarco Mineração S/A" Mining Engineering, June 1993, pages 633-636;

A11: Fournier et al. "Blast Furnace and Direct Reduction Pellet Quality Maximization at Quebec Cartier Mining Company" ICSTI/Ironmaking Conference Proceedings 1998, pages 979-986;

A12: "Samarco's Iron Ore Operations at Alegria and Ponta Ubu" Skillings Mining Review (May 4, 1996), pages 4-8;

A13: Bandeira de Mello et al. "25 Years of Pelletizing at CVRD", 1996 Ironmaking Conference Proceedings, pages 503-512;

- A14: Doctoral Thesis of S. Forsmo: "Influence of green Pellet Properties on Pelletizing of Magnetite Ore" and annexed articles I to VII;
- A15: Notice regarding presentation of the Doctoral Thesis of S. Forsmo;
- A16: Affidavit of S. Forsmo;
- A17: Photograph of S. Forsmo;
- A18: Extract from Feinman J et al. "Direct Reduced Iron - Technology and Economics of Production and Use";
- A19: Extract from Norm ISO 11323:2010.

VI. The arguments submitted by the appellant can be summarised as follows:

*Late-filed documents*

A6 had already been cited in the opposition proceedings and was automatically part of the appeal proceedings. A7 had not been admitted into the proceedings by the opposition division, which found that it was not relevant. However, this document was indeed relevant because the processes for making blast furnace pellets and DRI furnace pellets were very similar, as shown by A8-A13. Hence, A7-A13 should be admitted into the proceedings.

Moreover, the differentiating features of claim 1 as granted were also rendered obvious by Article VII annexed to the thesis A14, whose publication date was proven by A15-A17. Since the claimed priority was not valid, Article VII was part of the prior art. A18 too rendered it obvious to mix and grind together the different components. Furthermore, A18 and A19 showed that sintering and indurating could not be differentiated. Hence, A14 to A19 were also to be admitted into the proceedings.

*Main request*

The claimed process differed from the closest prior art A2 by mixing and grinding together the different components and by carrying out the induration step for a time period of 5 to 60 min. There was no evidence of an effect of these differentiating features, which solved separate technical problems.

Mixing and grinding the materials together was a mere alternative to the process of A2 and was an obvious measure aimed at achieving an optimum mixing, as disclosed, for instance, in A6.

The duration of the induration treatment did not achieve any particular effect and was standard for this treatment, as shown in A6. Hence, it would be chosen by the person skilled in the art without any inventive activity.

Therefore, the subject-matter of claim 1 did not involve an inventive step.

*First auxiliary request*

In respect of the use of baghouse dust, to be found in granted claim 2, reference was made to A4, which rendered this feature obvious.

- VII. The arguments submitted in reply by the respondent can be summarised as follows:

*Late-filed documents*

A6 was filed only in part in opposition proceedings. There was no reason for filing this document entirely



in appeal, especially because, in addition to the passages already discussed in opposition, only page 74 was discussed. Hence, there was no reason to admit the entirety of A6 in appeal. A7 should not be introduced into the proceedings either, because it concerned sintered agglomerates. A8 to A13 were not relevant either and thus not to be admitted into the proceedings. The same applied to A14 to A19. There was no evidence, in particular from A15 to A17, that the annexes of A14 belonged to the prior art. A18 and A19 did not disclose any induration step according to claim 1.

*Main request*

None of the features distinguishing the claimed method from the closest prior art A2 was rendered obvious by the prior art.

A2 itself disclosed in Figure 1 that the slime and the ore were not milled together with the scale. Since, as shown in Table 2, the milling time was important, A2 taught away from milling the different materials together. A6 disclosed on page 77 that differences in grindability of different materials could be a problem. Therefore, A6 also taught against mixing and grinding together the different materials, as required by claim 1.

As to the induration time, it was true that induration times according to claim 1 were shown in Figure 84 of A6. However, these times were obtained by computer calculations for pellets that did not comprise recycled materials. As described on page 155 of A6, different compositions or different plants would require different heating cycles. Hence, it was not obvious to

apply the cycles shown in Figure 84 of A6 to the process of A2.

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

*First auxiliary request*

In respect of the use of baghouse dust disclosed in A4, it was pointed out that A4, contrary to A2 and the patent in suit, related to a sintering process.

**Reasons for the Decision**

1. Late-filed documents
  - 1.1 Only part of document A6 was submitted during the opposition proceedings, while the rest was submitted for the first time with the statement of grounds of appeal. A7 had been submitted during the opposition proceedings and not admitted into the proceedings. Documents A8 to A13 were submitted with the statement of grounds. It thus needs to be decided whether these late-filed documents are to be admitted into the proceedings or may be disregarded (Article 114(2) EPC).
  - 1.2 A6 had already been filed, although only in part, during the opposition proceedings and had been admitted into the proceedings. Moreover, the only passage cited by the appellant in addition to those already cited during the opposition is page 74, which relates to efficient ways of carrying out grinding, an issue linked to the inventive step debate during the opposition proceedings. For this reason, the Board

decided to admit (in addition to pages 1 to 15, 46 to 67, 76 to 77, 154 to 158 and 257 to 258 which were already admitted in the opposition proceedings) page 74 of A6 into the proceedings as well.

By contrast, the rest of document A6, whose relevance has not been substantiated (no arguments have been based on it), was not admitted into the proceedings.

- 1.3 In respect of the delay in the submission of A8 to A13, the appellant merely submitted (letter of 6 November 2014, page 2) that they were found in "an additional search conducted as a reaction to certain statements and presumptions made by the Opposition Division in the impugned decision". This submission fails, however, to provide a concrete explanation as to which statements and presumptions of the appealed decision are to be considered and why they allegedly justify an additional search. Hence, no good reason can be seen for the delay in filing A8 to A13.

Moreover, A8 to A13 purport to show that the processes for making DR (direct reduction) pellets and blast furnace pellets are similar. However, this alleged teaching is not relevant for the inventive step.

Under these circumstances, the Board decided not to admit A8 to A13 into the proceedings.

- 1.4 The appellant did not provide any justification at all for the delay in the submission of A14 to A19, which were filed at a very advanced stage of the proceedings (only five months before the oral proceedings before the Board).

Moreover, in the case of these documents too, their prima facie relevance is not apparent.

Even accepting, on the basis of A15 to A17, that the thesis A14 was available to the public prior to the filing date of the patent in suit, it is not clear whether the same applies to Article VII annexed to it. Hence, it is dubious whether or not it belongs to the prior art.

A18 is completely silent on the induration time, which is one of the features distinguishing the claimed method over the closest prior art A2.

Nor can A14, A18 or A19 be seen as evidence that the person skilled in the art could regard the sintering of pellets as a form of induration of pellets. A14 is a doctoral thesis that does not represent the common general knowledge of the person skilled in the art. Neither A18 nor A19 state that sintered pellets and indurated pellets are the same type of product.

Under these circumstances, the Board decided not to admit A14 to A19 into the proceedings.

- 1.5 The opposition division did not admit late-filed document A7 into the proceedings because it did not consider it to be prima facie relevant. The Board concurs with the analysis of the opposition division, because A7 relates to the sintering of pellets and not, as the patent in suit, to their induration. Therefore, the Board does not see any reason to admit A7 into the proceedings either.

2. Main request - Inventive step

2.1 It is undisputed that A2 discloses a process for the recycling of steel industry iron bearing by-products into pellets (page 1, first paragraph) suitable for feeding into a direct reduction furnace (Midrex furnace, page 1, first paragraph). In the process of A2 shown in Figure 1, mill scale and pellet fines are ground (in ball mill 9) and mixed together with slurry and ore. From the tables it results that the amounts of the raw materials are in accordance with claim 1. The mixture is pelletized in the charge pelletizer 12 of Figure 1 to produce green pellets. The green pellets are roasted in an induration step, at a maximum temperature of 1200°C. The length of the induration step is not specified.

Therefore, the subject-matter of claim 1 of the main request differs from the process of A2 (a) by the fact that the ore and the slurry are also ground with the mill scale and the fines and (b) by indurating the green pellets by heating them for 5 to 60 minutes at the indurating temperature.

2.2 The patent in suit does not disclose any effect of feature (a). Feature (b) is described as advantageous in paragraph [0037], without however describing which advantages are to be obtained by it. Nor can such an advantage be derived from Figures 2a and 2b, which depict two heating cycles in accordance with the claim but do not show any effect to be achieved in this way.

Hence, no synergy can be seen between these features, which are considered to address two different partial technical problems.

2.3 Feature (a) is seen as providing an efficient grinding/mixing.

It is part of the common general knowledge of the person skilled in the art, as evidenced by A6 (page 77, point 4.4.1, first two sentences), that an optimum mixing of different raw materials for pellet production can be achieved by a common grinding.

It is true that A6 adds that "possibly existing great differences in the grindability of ores or additives must be considered" (page 77, point 4.4.1, third sentence). However, nothing in A2 indicates that these differences may represent a problem in the case of the materials used in this document (indeed, no measure is taken to address the differences in grindability of the different materials in the patent in suit either).

Nor does the fact that A2 measures the mill operating time (Table 2) teach against the adoption of feature (a). Indeed, A2 itself accepts that an increase in the milling operating time may be necessary in order to recycle more material (Table 2).

Summarising, nothing teaches against the adoption of feature (a) in the process of A2. On the contrary, in the light of the common general knowledge of the person skilled in the art as described in A6, it was obvious to adopt it in order to provide an efficient/grinding mixing.

2.4 In the patent in suit no particular effect is associated with feature (b). Hence, starting from A2, which does not disclose the induration time to be used, the partial problem to be solved by means of this

feature is to select an induration time that achieves induration in a reasonable time.

Figure 84 on page 157 of A6 shows some computer-calculated heat treatment patterns for pellet induration. It is true that the composition of the pellets considered in this Figure does not comprise recycled materials and that, as described on page 155 of A6, different compositions or different plants would require different heating cycles. However, an obvious choice for attempting to solve the problem above are standard cycles, possibly to be adapted by some further experimentation to account for the different composition and furnace. Since Figure 84 of A6 shows standard cycles, it was obvious to choose one of them. Therefore, because these cycles comprise induration times in agreement with claim 1, it was also obvious to provide feature (b).

2.5 Accordingly, the subject-matter of claim 1 does not involve an inventive step.

3. First auxiliary request

3.1 Claim 1 of auxiliary request 1 is further limited inter alia by the feature that the materials that are mixed and ground comprise 1 to 50 wt% of bag house dust. This feature provides a further distinction over A2, which is focussed on recycling of the mill scale and does not mention the bag house dust at all.

3.2 When bag house dust is recycled, its Zn content can be increased, so that at the end a more valuable bag house dust can be obtained, that can be sold to Zn manufacturers as raw material (paragraph [0030] of the patent in suit). Hence, the problem to be solved by claim 1 of

auxiliary request 1 can be seen in the provision of a more efficient recycling of the waste materials from the steel production.

3.3 The solution provided by claim 1 is not rendered obvious by the prior art.

As explained above, A2 is completely silent on bag house dust.

It is true that A4 discloses the recycling of steel mill's flue gases dust (page 4, last paragraph). However, this document is silent on the Zn enrichment of bag house dust and, most importantly, relates to a sintering process (page 5, last paragraph), i.e. a process where the pellet components are fused together thanks also to the presence of an amount of solid fuel in the green pellets. By contrast, A2 and the patent in suit relate to induration, i.e. a process where hardening is accomplished without fusing the agglomerates and under the action of the external combustion of oil or gas. Hence, the person skilled in the art would not take into consideration A4 for solving the problem above starting from A2.

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



## **Order**

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

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the following documents:
  - Claims 1 to 3 of the first auxiliary request filed with letter of 20 March 2015,
  - Pages 4 to 8 of the description as filed during the oral proceedings before the Board,
  - Pages 2 and 3 of the description of the patent as granted,
  - Figure 1 as granted,
  - Figures 2a, 2b, 3, 4 and 5 as filed during the oral proceedings before the Board.

The Registrar:

The Chairwoman:



M.Kiehl

P. Acton

Decision electronically authenticated