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**D E C I S I O N**  
of 9 December 1996

**Case Number:** T 0819/95 - 3.2.3  
**Application Number:** 88309936.8  
**Publication Number:** 0314404  
**IPC:** F27B 3/04, F27D 17/00, C22B 7/00,  
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**Language of the proceedings:** EN

**Title of invention:**  
Improvements in or relating to furnaces

**Patentee:**  
COPERMILL LIMITED

**Opponent:**  
SCHMITZ + APELT LOI Industrieofenanlagen GmbH

**Headword:**  
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**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step - (yes) after amendment"

**Decisions cited:**  
T 0068/85

**Catchword:**  
-



Case Number: T 0819/95 - 3.2.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.3  
of 9 December 1996

**Appellant:**  
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**Respondent:**  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 04 August 1995  
revoking European patent No. 0 314 404 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** C. T. Wilson  
**Members:** H. Andrae  
L. C. Mancini

## Summary of Facts and Submissions

- I. European patent No. 0 314 404 was granted on 23 June 1993 on the basis of European patent specification No. 88 309 936.8.
- II. The patent was opposed by the Respondent (Opponent) on the grounds that the subject-matter of the patent was neither novel nor inventive. In support of his arguments, the Respondent referred to the following documents:
  - (D1) DE-A-3444181
  - (D2) US-A-2264740
  - (D3) Drawing No. F67610-1 dated 28 October 1983 of the company Gautschí Electro-Fours S.A.
- III. The patent was revoked by decision of the Opposition Division dated 4 August 1995 on the ground that the subject-matter of Claim 1 in the version as granted was not novel.
- IV. The Appellant (Patentee) filed an appeal against this decision on 3 October 1995 paying the appeal fee on the same day. The Statement of Grounds of Appeal was filed on 8 December 1995.
- V. In a communication pursuant to Article 11(2) RPBA dated 28 October 1996, the Board set out a provisional opinion with regard to the questions of novelty and inventive step of Claim 1.
- VI. At the oral proceedings held on 9 December 1996, the Appellant requested that the decision under appeal be set aside and that the patent be maintained with new Claims 1 to 10, a new description, columns 1 to 5, and Figures 1 to 6 of the drawings all submitted at the

oral proceedings according to his main request. Subsidiarily, the Appellant requested that the patent be maintained on the basis of Claim 1 filed with the letter dated 8 December 1995 as auxiliary request 2 (present auxiliary request 1) or on the basis of a Claim 1 consisting of the combination of the features according to Claims 1 and 5 filed with the letter dated 8 December 1995 as auxiliary request 1 (present auxiliary request 2).

VII. Claim 1 according to the main request reads as follows:

"A closed well furnace for melting aluminium scrap the furnace comprising a main heating chamber (10) and a closed well melting chamber (20), a refractory dividing wall (30) separating the main heating chamber and the closed well melting chamber the floor of the well (42) being continuous over the entire length of the closed well melting chamber and the main heating chamber (10) the refractory wall (30) being a suspended wall not descending to the floor of the well and the floor of the well sloping over substantially its entire width and length in a downward direction from the closed well melting chamber (20) to the main heating chamber (10) to assist the circulation of molten liquid between the main heating chamber (10) and the closed well melting chamber (20) of the furnace."

VIII. The Appellant's arguments set forth in his written and oral statements can be summarised as follows:

(D2) describes a closed well furnace for melting non-ferrous metals, in particular scrap metal, comprising a main heating chamber and a closed well melting chamber. The floor of the furnace slopes over the closed well melting chamber but is

flat over the entire length of the main heating chamber so that the scrap stays essentially in the closed well melting chamber. Due to this configuration, the scrap only melts slowly with a correspondingly low furnace efficiency.

The furnace known from (D1) or (D3) is of the tilting type which after a melting process is completely emptied. The scrap metal is exposed to the flames or the hot gases of the burners so that the metal surface would oxidize. This furnace cannot, therefore, function as a closed well furnace. Furthermore, due to the opening at the bottom of the separating wall being of limited size, no circulation from the right-hand chamber to the left-hand chamber according to Figure 1 of (D1) is possible.

A solution according to which a circulation between the two chambers is effected otherwise than according to the invention such as for example by means of a liquid metal pump, does not recommend itself because any failure of the pump would result inevitably in production losses besides implying increased investment costs in comparison with the invention.

IX. The Respondent requests that the appeal be dismissed. In support of his request, he argued essentially as follows:

The relevant prior art is described by (D1) which shows a closed well furnace. The furnace is characterised by two closed chambers, i.e. a melting chamber and a heating chamber, separated by a downward extending wall in which below the surface of the molten liquid an opening is provided for guiding a flow of liquid metal into the heating chamber. The floor is sloping over the

entire length and width of the two chambers. Between these chambers a circulation of liquid is effected due to variations of the level of liquid in the two chambers in accordance with the principle of communicating ducts.

The only difference between this prior art and the patent in suit is that according to the latter the dividing wall does not descend to the floor of the well. This feature is, however, known from the closed well furnace described in (D2) which comprises a separating wall between the two chambers not extending to the floor of the well. By means of two vertically displaceable doors arranged near the separating wall the closed well furnace can be divided as far as below the metal surface into two separated chambers.

Having regard to the distribution of temperature of the molten metal the depth of immersion of the dividing wall and thus the degree of circulation of the metal in the melting bath is decisive. This is proven by a computer analysis made by the Respondent which shows clearly that by external circulation of the molten metal in a two-chamber furnace a rather uniform temperature distribution in the metal bath is obtained.

In the independent Claim 1 of the patent in suit, the extent of immersion of the dividing wall as the decisive value for solving the problem is not indicated. Thus, Claim 1 does not only lack an inventive step, but is also not clear.

## Reasons for the Decision

1. The appeal is admissible.

### *Main Request*

2. Articles 84 and 123 EPC.

- 2.1 Claim 1 is supported essentially by the original Claim 7 in combination with page 8, paragraph 1 of the original description. The features of Claim 1 that the floor of the well is continuous over the entire length of the closed well melting chamber and the main heating chamber, that the refractory wall is a suspended wall not descending to the floor of the well and that the sloping of the floor is effected over substantially its entire width and length derive from Figures 1 and 4 of the original drawings.

Claims 2, 3 and 4 correspond with the original Claims 8, 9 and 10, respectively, Claims 6 to 10 are supported by the original Claims 1 to 5, respectively, and Claim 5 derives from page 9, paragraph 1 of the original description.

Hence, Claims 1 to 10 satisfy the requirements of Article 123(2) EPC.

Claim 1 comprises all the features according to Claim 1 in the version as granted. The additional features of Claim 1 relating to the floor of the well being continuous and the refractory wall being a suspended

wall not descending to the floor of the well are both of a character limiting the scope of protection of the claim.

Thus, the claims also satisfy the requirement of Article 123(3) EPC.

- 2.2 The Respondent raised an objection under Article 84 EPC arguing that Claim 1 did not specify the depth of immersion of the dividing wall into the molten metal so that the skilled person was not taught by the claim how to solve the inherent problem.

Claim 1 specifies among other features

- (a) that the floor of the well is continuous over the entire length of the closed well melting chamber and the main heating chamber,
- (b) that the refractory wall is a suspended wall not descending to the floor of the well and
- (c) that the floor of the well slopes over substantially its entire width and length in a downward direction from the closed well melting chamber to the main heating chamber to assist the circulation of molten liquid between the main heating chamber and the closed well melting chamber of the furnace.

It is clear to the skilled person from the basic knowledge of flow mechanics that the configuration of the floor of the well (above feature (a)) the depth of immersion of the refractory wall into the liquid (above feature (b)) and the degree and extension of floor sloping (above feature (c)) have an impact upon the circulation of molten liquid between the two chambers. It is for example clear that an increase of the slope



of the well floor would lead to an increased velocity of circulation of the liquid whereas an increased depth of immersion of the refractory wall into the liquid would decrease the velocity of circulation. There are other values influencing the circulation such as for instance the density and the viscosity of the molten metal. It would be unreasonable to insist that all of these physical values be referred to in the independent claim because this would limit unduly the scope of the invention.

According to the jurisprudence of the Boards of Appeal, the independent claim must state the essential features of an invention (cf Decision T 0068/85 OJ EPO 1987, 228, section 8.2). The use of functional features in a claim is a usual way of defining the invention in the most general terms possible in order to secure adequate and reasonable protection. The prerequisite is however, that the features provide instructions which are sufficiently clear for the expert to reduce them to practice without undue burden, if necessary, with reasonable experiments (cf above-cited decision, section 8.4).

In the present case, Claim 1 contains the above-cited features (a) to (c) which provide the decisive instructions, for carrying out the invention, that is to slope the floor of the well substantially over both chambers the floor being continuous, and to provide a distance between the bottom of the dividing wall and the floor in order to achieve an increased circulation between the two chambers of the furnace. It comes within the professional knowledge of the skilled person to elaborate on the details of this teaching and, if, for example, a particular speed of circulation of the liquid is desired, to modify the physical values relevant therefor in the frame of experimental or theoretical investigations. Claim 1 is, therefore

sufficiently clear for the invention to be carried out by the skilled person. For the above reasons, Claim 1 satisfies Article 84 EPC.

- 2.3 It is noted that Claim 1 is not drafted in the two-part form such as required by Rule 29(1) EPC. However, as provided by Rule 29(1) EPC, second sentence, the two-part formulation of the claim need be used only in appropriate cases. In the present case, the Board considers that the two-part formulation would give a misleading picture of the prior art. For this reason, an independent claim in the two-part form is not appropriate.

3. *Novelty*

- 3.1 The nearest prior art with regard to the subject-matter of Claim 1 is disclosed in (D1). This citation describes a furnace for melting aluminium scrap. The furnace has two chambers with a sloping floor, (i.e. a melting chamber and a heating chamber), the chambers being separated by a refractory dividing wall extending to the floor of the furnace with an opening at the bottom of the dividing wall which opening extends over part of the width of the dividing wall. The floor of the melting chamber slopes over substantially its entire width and length in a downward direction towards the main heating chamber, the sloping continuing through the opening in the dividing wall and, more gently, through a substantial portion of the main heating chamber.

- 3.2 Claim 1 differs from the furnace known from (D1) in that the refractory dividing wall is a suspended wall not descending to the floor of the well and in that a circulation of molten liquid between the main heating chamber and the closed well chamber of the furnace is effected. As a further difference, according to Claim 1

the floor of the well as a whole slopes over its entire width and length from the melting chamber to the main heating chamber whereas according to (D1) at the locations where the dividing wall extends down to the floor of the well, a floor in the sense of an area to be contacted by a flowing medium is not defined.

3.3 It follows from the above analysis of the most relevant prior art that Claim 1 is novel in the sense of Article 54 EPC. Since novelty of Claim 1 has not been in dispute in the appeal proceedings further consideration of this issue is not necessary.

4. *Inventive step*

4.1 In the furnace known from (D1) (see section 3.1 above) the refractory wall dividing the two chambers of the furnace extends to the floor of the well, an opening of relatively small width being provided at the bottom of the dividing wall. This opening in the dividing wall is arranged at a position in which the floor of the well slopes considerably so that molten metal can pass from the melting chamber to the heating chamber. The thermal burden of melting the scrap metal lies exclusively on the heat conducted to the melting chamber which may impair the speed and efficiency of the melting process.

The problem to be solved is therefore seen in providing a closed well furnace which is more efficient than the furnace according to the relevant prior art.

The solution to this problem as indicated in Claim 1 is based on the effect that the slope of the floor of the well along both chambers assists in providing a convection current between the two chambers which circulates the scrap metal and the molten metal, respectively, achieving thus an increased speed of melting and a higher throughput of the furnace.

- 4.2 It is to be investigated now whether the prior art according to (D1) considered the closest prior art also by the Respondent provides any lead to Claim 1.

The problem underlying the known furnace is seen in achieving energy saving by an improved use of the heat of the furnace exhaust gases, in particular improving the heat transfer to the metal scrap whereby extended transport paths caused by preheating of the scrap at sites remote from the furnace are to be avoided. This problem is solved in accordance with Claim 1 of the citation by a particular furnace feeding device comprising a preheating chamber in which a displaceable container to be charged with scrap metal is arranged, nozzles being provided in the preheating chamber to preheat the scrap metal by means of hot furnace gases.

Thus, the citation relates in particular to improvements concerning the feeding device of the furnace and does not tackle the problem of improving the melting process within the core of the furnace as according to Claim 1 of the patent in suit. (D1) does not, therefore, give any pointer to the subject-matter of this claim.

- 4.3 The Respondent argues that the subject-matter of Claim 1 is arrived at in an obvious way by a combination of features of (D1) and (D2). Further according to him, this relates in particular to the feature that the refractory wall is a suspended wall not descending to the floor of the well which is clearly known from (D2).

(D2) describes a closed well furnace for melting scrap metal, the furnace comprising a main heating chamber and a closed well melting chamber, a refractory dividing wall separating the two chambers. The bottom of the melting chamber is inclined downward towards the

main heating chamber the inclination stopping adjacent the dividing wall and being joined by a dam extending upwards and parallel to the dividing wall. The dam passes over to a horizontal floor of the well extending over the length and width of the main heating chamber.

Vertically displaceable doors are provided in the region between the two chambers for the purpose of regulating the extent of communication between the two chambers.

Although (D2) is concerned with the issue of rendering the furnace more efficient, this relates rather to an improved use of the hot gases by circulation thereof above the molten metal than to influencing directly the flow configuration of the melting or molten metal in the sense of an increased circulation. According to the citation vertically displaceable doors (30, 33) are provided for regulating the extent of communication between the feeding or melting chamber (20) and the heating chamber (15). In the case of the doors being retracted an unimpeded natural convection of the liquid metal is possible which manifestly satisfies the requirements of (D2).

The problem of achieving an improved throughput of the furnace by speeding up the melting process is not addressed.

Having regard to the solution disclosed in (D2) the sloping of the floor does not extend substantially over the entire width and length of the two chambers separated by the dividing wall. Furthermore, the floor of the well is not continuous over the entire length of

both chambers but a dam is provided at the floor near the dividing wall forming a discontinuity opposed to any circulation of liquid between the two chambers.

In the judgement of the Board, the skilled person starting out from the prior art known from (D1) and striving for an increased furnace throughput and efficiency, would not be motivated to look closer at the furnace described by (D2) since this furnace due to its mainly flat configuration of the well floor in combination with an obstruction between the two chambers would not promise any success.

The skilled person would also not sort out a single feature, that is in the present case the feature concerning the dividing wall not descending to the floor of the well, from the construction in which it is disclosed and transfer it to a different situation such as according to (D1) in which a circulation of the liquid between the two chambers is not desired, but where rather a connection of limited size between these chambers is intentionally provided for the purpose of keeping molten metal in the heating chamber with the liquid having a uniform temperature distribution at a high level and being appropriate for tapping.

Taking account of the fact that (D1) and (D2) do not recommend each other having regard to the problem to be solved by Claim 1 of the patent in suit, the argumentation of the Respondent is based on an inadmissible *ex-post-facto* analysis with the benefit of the knowledge of the invention.

- 4.4 The computer analysis submitted by the Respondent in the oral proceedings shows that the distribution of the speed and the temperature of the molten metal in the well depend largely on the question whether an external circulation is imposed upon the liquid or not.

It appears from this analysis that a forced circulation of the liquid leads to a rather uniform temperature distribution in the metal bath.

Claim 1 of the patent in suit does not, however, require any external circulation means such as a metal pump. This circumstance must be regarded as a further indicator of the presence of an inventive step since the circulation in the two-chamber furnace is improved with rather simple structural means whilst avoiding the risks, resulting from the use of a metal pump, that is in particular production losses in case of a failure of the pump.

- 4.5 As already outlined in the Board's communication dated 28 October 1996, the alleged prior use (D3) is deficient as regards its substantiation, in particular as to the identity of the person receiving the drawing, the circumstances of the delivery thereof and the question of availability to the public (see the inscription "Patent gemeldet" on the drawing which points to a secrecy agreement between the proprietor and the addressee of the drawing).

These questions require, however, no further consideration. Since (D3) does not show that there is a common floor sloping over the entire width and length of the well, it would even in the case where it had been proven to form part of the prior art be less relevant than (D1) and is not, therefore of importance for the decision to be taken.

- 4.6 For the reasons given above the subject-matter of Claim 1 according to the main request involves an inventive step (Article 56 EPC) and is patentable under Article 52(1) EPC.

5. Claims 2 to 10 are dependent upon Claim 1 and relate to preferred embodiments thereof, and are also therefore patentable.
6. The amendments to the description relate to the adaption thereof to the independent claim and to the indication of the relevant prior art in accordance with Rule 27(1)EPC. The description is therefore also appropriate for maintaining the patent in an amended version.

**Auxiliary requests:**

Since the patent can be maintained in the version according to the main request, it is not necessary to consider the auxiliary requests.

**Order**

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

1. The contested decision is set aside.
2. The case is remitted to the first instance with the order to maintain the patent with the documents submitted during the oral proceedings (section VI above).

The Registrar:



N. Maslin

The Chairman:



C. T. Wilson