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D E C I S I O N
of 8 November 2005

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Language of the proceedings: EN

Title of invention:
Lightweight compact waste treatment furnace

Applicant:
Pyrogenesis Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) "

Decisions cited:
-

Catchword:
-



Case Number: T 0395/03 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 8 November 2005

Appellant:

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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 2 December 2002
refusing European patent application
No. 96944794.5 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
J. Seitz

Summary of Facts and Submissions

I. This appeal lies from the decision of the examining division, posted 2 December 2002, to refuse patent application 96 944 794. The examining division concluded that the furnace wall, as defined in claim 1, lacks novelty (Articles 52(1) and 54 EPC) with respect to either EP-A-0 647 598 (D1), US-A-4 644 877 (D2) or US-A-4770109 (D3). As a further ground for refusal, the examining division considered the failure to identify document US-A-4 398 474 (D4) in the description to be a breach of Rule 27(1) (b) EPC.

The applicant lodged an appeal, received 6 February 2003, against the above decision. The Board issued a communication, dated 22 March 2005, under Article 11(1) of the Rules of Procedure of the Boards of Appeal (RPBA) together with a summons to oral proceedings, in which inventive step in light of D1 and D3 was queried. Oral proceedings before the Board were held on 8 November 2005, during which the appellant filed an amended set of claims.

II. Claim 1 reads as follows:

"1. A lightweight wall for a plasma furnace having a hot chamber interior which comprises an inner wall structure (46, 47, 48) made of a metal having good mechanical properties at high operating temperature, one side of said inner wall structure (46, 47, 48) facing the hot chamber interior, and at the other side of said inner wall structure (46, 47, 48) there is provided a gap (50) and means (59) are connected to said gap for passing cooling air through said gap (50)

to produce a dynamic controlled cooling of said inner wall structure (46, 47, 48), said gap (50) being followed by an outer steel shell (56)."

Dependent claims 2 to 9 describe preferred embodiments of the lightweight wall of claim 1.

III. Claim 1 before the examining division was not limited to any particular type of furnace, and was considered to be anticipated by D1. In particular, the examining division was of the view (see paragraph 12 of the contested decision) that the gap (13) between the walls of the furnace of D1, through which cooling water flows, is suitable for use with air as the coolant. The examining division then went on further to say that claim 1 is anticipated by any furnace (such as in D2 or D3) having jacketed walls through which cooling water is circulated.

The examining division also argued that the use of air as a cooling medium in place of water does not involve an inventive step, since they are well known alternatives, for example both means are used for cooling vehicle engines. The Board also questioned inventive step in its communication under Article 11(1) RPBA, since D3, which also relates to a plasma furnace, discloses that cooling can be accomplished by water or gas cooling (see paragraph 8, lines 26 to 30).

The appellant agreed that D1 discloses the same type of furnace as that of the application. However, the furnace defined in claim 1 differs in that cooling is achieved by using air and is controlled dynamically, i.e. is continuously monitored and adjusted accordingly.

He explained that the skilled person is aware of the fact that water is denser and heavier and consequently is a much better medium for absorbing heat than air, it being about a thousand times more efficient as a coolant. In addition, a furnace cooled by air requires the walls to be lined with heavy refractory bricks, in order to compensate for the poorer cooling effect. Given the disadvantages associated with air, it is not obvious to the skilled person that water should be replaced by air as the coolant. However, it is an aim of the invention to provide a furnace having short start-up and shut-down times, and this is achieved by using air, which is more responsive than water, as the coolant. The purpose of the invention is also to provide a light weight furnace, and this means avoiding the use of heavy refractory bricks. Air can be used effectively as a coolant for the walls of a plasma furnace without having a refractory brick lining, if there is dynamic control of the cooling.

The appellant argued that the replacement of water by air is also not rendered obvious by the teaching of D3, because D3 concerns a different type of furnace to that of D1. In particular,

- (a) the furnace wall of D3 is not lightweight, but is a single-layered thick wall;
- (b) there is no inner wall structure;
- (c) there is no gap in the wall structure itself;
- (d) there is no means for passing cooling air through the wall, D3 describes a means for spraying water onto the wall;
- (e) there can be no dynamic controlled cooling, because the cooling system of D3 is not sealed, and thus the pressure cannot be controlled.

He concluded that the differences are such that the teachings of D1 and D3 cannot be combined to derive the claimed invention.

IV. Request

The appellant requested that the decision under appeal be set aside and that the patent be granted on the basis of claims 1 to 9 of the sole request filed during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

Novelty

2. The application concerns a furnace for the treatment of waste, which is lightweight and suitable for use, for example, on board ships.

D1 is considered to be the most relevant prior art document. It discloses a wall structure for a plasma furnace, which does not have a heavy conventional refractory liner, and as such can be termed "lightweight" within the meaning of the application (see for example, page 7, lines 3 to 8, page 8, lines 9 to 11 and page 14, lines 17 to 20). The double-wall structure has a gap (13), through which cooling water is pumped.

Claim 1 differs principally from D1 in that air, rather than water, is passed through the gap to provide a

dynamic cooling of the wall. This difference does not simply mean, as stated in the decision under appeal, that the gap must merely be suitable for allowing air to be passed through it; rather it implies the entire means, as defined in claim 1, necessary for producing a dynamic controlled cooling of the wall. This would require, for example, the closed cooling circuit including the fluid pump of D1 to be adapted for use with air as the cooling medium, and the walls of the furnace to be further protected to withstand the higher temperatures associated with air cooling. Since this is not disclosed in D1, the claimed subject-matter is novel (Article 54(2) EPC).

Inventive Step

3. *Document D1*

Starting from D1, which is considered to be the best starting point for the invention, the objective problem is seen as how to make the furnace more compact, lighter and suitable for use on a ship. The proposed solution is to cool the furnace walls using air. The advantage of using air is that it is lighter than water, and hence contributes to weight reduction. Given the high temperatures associated with the treatment of molten waste in a plasma furnace, air is also safer than water. In addition, dynamic controlled cooling of the walls using air allows for a better control of the wall temperature and in particular, the ability to start-up and cool-down in a short time.

The Board considers that it is not obvious to cool the walls of the furnace of D1 using air for the following

reasons. In contrast to the advantages of using air set out in the previous paragraph, an important disadvantage is that it is a significantly less effective coolant compared with water. As explained by the appellant, water is approximately one thousand times as dense as air, and has about a thousand times the capacity to extract heat. Usually, if air is to be used, then the walls are additionally protected by a layer of refractory bricks. The purpose of the application is to avoid use of heavy refractory bricks, but nevertheless have air cooling. This is achieved by having dynamic control of the wall temperature and by lining the inner wall with a metal layer, which has good mechanical properties at the temperatures associated with the inside of a plasma furnace. The skilled person is aware of the type of alloys that would be suitable at such operating temperatures, and the application itself (see page 23, lines 14 to 17) suggests nickel-based superalloys as being appropriate. D1 itself uses a liner of stainless steel, which would not be suitable for protecting the wall at the higher temperatures that would result from using air as the coolant.

In the case of a plasma furnace, water-cooled walls cannot therefore simply be replaced by air-cooled ones without making further modifications. Consequently, the Board does not entirely agree with the conclusion of the examining division that the hollow steel walls of D1 would be suitable for air cooling. Given the high temperatures associated with a plasma furnace, and the disadvantage of air as a poor coolant compared with water, it cannot be said to be obvious to replace the

water coolant of D1 by air, particularly as significant modifications to the furnace would be required.

4. *Document D3*

D3 was considered in the proceedings as an important document in the assessment of inventive step, since it concerns a plasma furnace for incinerating waste, and appears to teach that such a furnace can be cooled equally by water or gas. The plasma furnace ("reactor" 200) of D3 is in the form of a drum rotating inside a closed vessel (see Figure 4). The Board agrees with the appellant that the side wall (219) of the drum (210) and the wall of the vessel (202) do not constitute a doubled-wall furnace, but rather a singled-walled furnace (210) rotating within a closed vessel (202).

There is a gap between the wall of the rotating drum and the wall of the closed vessel, and water is sprayed from a pipe (221) located within this gap onto the outer surface of the drum as it rotates passed the pipe. Alternatively, "gas cooling could be applied to the outer surfaces of drum (210) as required" (see column 8, lines 28 and 29). In either case, no control of the cooling occurs and the coolant cannot be said to pass through the gap, but rather is "applied" by spraying or the like to the outer surface of the rotating drum. It appears that gas cooling, without any sort of control, is possible for the furnace of D3 because it has a completely different design to that of D1. D3 explains (see column 4, lines 50 to 60) that rotation enables a better heat distribution and provides an opportunity for parts to cool. In addition, the drum 210 is rotated such that the waste material is forced against the

inner surface of the drum (see column 7, line 67 to column 8, line 2); this would have the effect of providing the wall with some protective heat insulation.

Given the significant differences between the types of furnaces described in D1 and D3, it is apparent that the teachings of one cannot be readily applied to the other. Consequently, the skilled person reading about the cooling of the furnace in D3 is in no position either to conclude that the furnace of D1 could be cooled by air, or to determine the modifications required to enable it to be cooled using air.

The furnace defined in claim 1 thus has an inventive step in accordance with Article 56 EPC. The embodiments defined in dependent claims 2 to 9 are likewise inventive.

5. Since document D1 is considered to be the most relevant prior art, it should be cited in the introductory portion of the description, when adapting the description, as stipulated in Rule 27(1)(b) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent based on the following documents:
 - claims 1 to 9, as filed during the oral proceedings;
 - a description to be adapted;
 - Figures 1 to 5, as originally filed.

The Registrar:

The Chairman:

G. Magouliotis

U. Krause