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**Datasheet for the decision
of 12 October 2007**

Case Number: T 1699/06 - 3.2.02

Application Number: 02721512.8

Publication Number: 1325158

IPC: C21B 9/12

Language of the proceedings: EN

Title of invention:

Oxy-fuel combustion system and uses therefor

Applicant:

Jupiter Oxygen Corp.

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 84, 123, 56

Keyword:

"Clarity - (no)"

"Amendments disclosed in the application as filed - (no)"

"Inventive step - (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 1699/06 - 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 12 October 2007

Appellant: Jupiter Oxygen Corp.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 6 June 2006
refusing European application No. 02721512.8
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: T. Kriner
Members: R. Ries
A. Pignatelli

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 6 June 2006 to refuse European patent application No. 02 721 512.8.

The application was refused on the grounds that the subject matter of claim 1 lacked an inventive step, given that the technical features of claim 1 were either known from document

D3: M. W. Paget et al.: "A Novel Burner Retrofit Used to Increase Productivity in an Aluminum Rotary Furnace and Reduced Baghouse Loading", Second International Symposium Recycling of Metals and Engineering Materials, Edited by Jan H. van Linden, The Minerals, Metals and Materials Society, 1990, pages 671 to 678

or fell within the basic knowledge of a person skilled in the field of oxy-fuel burners.

II. On 8 August 2006 the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee on the same day. On 6 October 2006 a statement of grounds was received by the EPO.

III. To meet the appellant's request for accelerated processing of the appeal, oral proceedings were scheduled for the 12 October 2007. In its provisional opinion given in the annex to the summons, the Board referred, in addition to D3, to document

D4: Lars O. Frisk and L. J. Burfield: "New oxy-fuel burner system for reheat furnaces at Timken", Iron and Steel Engineer, 71(1994), April, No. 4, pages 112 to 114

which also disclosed the use of oxy-fuel burners for reheating furnaces to solve the problems addressed by the application. In the Board's provisional conclusion, the combustion process set out in claim 1 of all requests then on file lacked an inventive step with respect to the technical disclosure of D3 and D4.

At the end of the oral proceedings, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the sets of claims

- according to the main request filed on 25 September 2007 or
- according to the first auxiliary request filed on 25 September 2007 or
- according to any one of the second to 6th auxiliary requests as filed during the oral proceedings before the Board.

Claim 1 according to the main request reads as follows:

"1. A process of combustion comprising supplying oxygen and a carbon based fuel through inlets (152, 154) to at least one burner (84) in a furnace (14, 16, 166) having substantially no in-leakage from an external environment, so that oxygen is introduced to the burning formula rather than air, characterized in that

the oxygen is supplied to the burner with a purity of at least 85%; any excess of one of the oxygen and the fuel delivered to the burner is limited to less than 5% over the stoichiometric proportion; the combustion of the fuel is controlled to produce a flame temperature of at least 4500°F (2480°C) and create a radiant heat transfer zone within the furnace in the absence of air in which the principle mode of heat transfer is radiant and the furnace (14, 16, 166) is directly exposed to radiant heat from the burning fuel; and an exhaust gas stream temperature from the furnace prior to any heat recovery of no more than 1100°F (595°C)."

Claim 1 of the first auxiliary request additionally includes the wording (in bold letters):

"1. A process...the burning fuel; **and the amounts of fuel and oxygen flowing to the burner inlets (152, 154) are controlled to maintain** an exhaust gas stream temperature prior at any heat recovery of no more than 1100°F (595°C)."

Claim 1 of the 2nd and 3rd auxiliary requests reads as that of main request and the first auxiliary request, respectively, but with the term "**prior to any heat recovery**" being deleted.

The wording of claim 1 of the 4th auxiliary request corresponds to that of the 3rd auxiliary, but additionally includes the term "**of a boiler,**" in the third line after "...furnace (14, 16, 166)" and before "...the furnace having...".

Claim 1 of the 5th auxiliary corresponds to that of the 3rd auxiliary request but additionally comprises the wording (in bold letters):

"1. A process....and the combustion of the fuel **produces zero NOx other than from fuel borne sources, and** is controlled...".

Compared to claim 1 of the 5th auxiliary request, claim 1 of the 6th auxiliary further includes the wording (in bold letters):

"1. A process ... characterized in that **the environment of the furnace (14) has substantially no nitrogen;...**"

IV. The appellant's arguments can be summarized as follows:

As to the requirement of measuring the exhaust gas stream temperature prior to any heat treatment, paragraph [0129] of the application in combination with Figure 4 showed that the flue gases from the furnaces (14, 16) are directed to one side of the heat exchanger (204). The flue gas temperature was measured at the exit where the exhaust gases left the furnace, although no specific disclosure on that point was found in the application.

With respect to controlling the amounts of oxygen and fuel to maintain an exhaust gas stream temperature of not more than 1100°C, reference was made to paragraphs [0012], [0016] [0098], [0099] and [0116] of the application. It was apparent from these paragraphs and the combustion process per se that the supply of oxygen and fuel alone contributed to the volume and

temperature level of the exhaust gases. Therefore this feature was sufficiently supported by the application.

Document D3 dealt with oxy-fuel burners but the oxy-fuel flame was shielded by an outer air-fuel flame envelope. Such a shielding envelope is not provided in the claimed combustion process. D3 always described the combustion process as an air/oxygen/fuel combined system in which the oxy-fuel burner was never used alone, contrary to process claimed in the application.

Document D4, on the other hand, disclosed oxy-fuel combustion but provided the recirculation of the relatively cool combustion products to create a protective envelope for the oxy-fuel flame. This was, however, avoided by the claimed process which uses an "open" flame by which the heat transfer by radiation is highly improved. The claimed process therefore satisfied the requirements of Articles 84, 123(2) and 56 EPC.

Reasons for the Decision

1. The appeal is admissible.
2. Amendments, Article 123(2) EPC; first and 3rd to 6th auxiliary requests:

In claim 1 of the first and 3rd to 6th auxiliary requests, the wording that "*the amounts of fuel and oxygen flowing to the burner inlets (152, 154) are controlled to maintain an exhaust gas stream*"

temperature prior at any heat recovery of no more than 1100°F (595°C)" has been introduced.

In support of this amendment, the appellant pointed essentially to the passages [0012], [0016] [0098] and [0116] of the application and particularly referred to the explanation that "*the combustion of the carbon based fuel provides a flame temperature in excess of about 4500°F, and an exhaust gas stream from the furnace having a temperature of not more than about 1100°C*" given in the last sentence of paragraphs [0012] and [0016] of the application.

In the Board's understanding, however, paragraph [0012] does not qualify unambiguously the exhaust gas temperature as the (main or even only) parameter that is used to control the supply of oxygen and fuel. The cited passage merely reflects a statement about the temperatures of the flame and the flue gas that are generally obtainable by the claimed oxy-fuel combustion process. The Board's interpretation of this passage is confirmed by the detailed explanations given in the following paragraph [0013] which specifically addresses the control system for controlling the supply of oxygen and fuel to the furnace. It makes clear that the (amounts of) oxygen and fuel supply are controlled by the predetermined molten aluminium temperature in the furnace. This makes sense to the skilled reader since in the first place the furnace is controlled to provide a pool of liquid metal having a predetermined temperature rather than a low temperature exhaust gas. Likewise, paragraphs [0098] and [0116] confirm that the main process input variable used to control the combustion system is the metal bath temperature in the furnace, although the control scheme includes further

inputs from thermocouples located in the furnace upper wall, the furnace roof and in the exhaust stack to prevent overheating and damaging the refractory lining. No basis is however found in the application that the supply for oxygen and fuel is controlled mainly or even exclusively by the exhaust gas temperature, or rather in order to maintain a predetermined exhaust gas temperature.

Hence claim 1 of the first and 3rd to 6th auxiliary requests is not allowable since it comprises subject matter which extends beyond the content of the application as filed and therefore fails to satisfy the requirements of Article 123(2) EPC.

3. Article 84 EPC; main request; 2nd auxiliary request

3.1 Claim 1 of the main request specifies "*an exhaust gas stream temperature from the furnace prior to any heat recovery of no more than 1100°F (595°C)*". In this context the appellant referred to paragraph [0129] of the application and argued that the flue gas temperature is generally measured at the exit where the exhaust gas leaves the furnace.

Apart from the fact that this feature describes one possible result to be achieved by the claimed combustion process, it remains speculative and unclear where, i.e. at which location or distance from the furnace prior to the entry in the heat exchanger, the flue gas temperature is to be determined. It is generally known in the art that the temperature of the flue gases decreases when the gases leave the furnace and flow through the stack 80 to the heat exchanger 204

(see for example Figure 4; paragraph [0077]). Even if paragraph [0086], third sentence suggests that in this exemplifying embodiment the stack temperature corresponds to the exhaust gas temperature, the term .."from the furnace prior to any heat recovery " cannot be considered as a clear teaching at which location the exhaust gas temperature should be actually determined.

Hence, the wording of claim 1 of the main request fails to meet the requirements of Article 84 EPC.

The same statement applies even more to claim 1 of the 2nd auxiliary request given that it does not comprise the wording "prior to any heat recovery", and the location for determining the exhaust gas temperature is even more speculative.

4. Inventive step; Article 56 EPC:

4.1 Even when disregarding the unclear feature referred to above, claim 1 of the main request and of the 2nd auxiliary request does not seem to comprise subject matter which involves an inventive step. Turning to document D3, the passage from page 673 to page 676 reflects the general experience that installing burners which are specifically designed to use (pure) oxygen instead of air results in the greatest operating cost savings, reduces the volume of the flue gases by up to 80% and provides an adiabatic flame temperature of 5000°F or higher for stoichiometric combustion. It is also beyond dispute that, at a flame temperature in the order of about 4500°F to 5000°F, the principle mode of heat transfer is by radiation (and not by thermal

convection or conduction) to which the charge and the interior refractory lining of the furnace are exposed. It may be true that for melting aluminium, a hybrid air/oxygen/fuel combustion system provides the best results and is, therefore, favoured in D3, as alleged by the applicant. This teaching does, however, not exclude the possibility of using an oxygen-fuel burner alone as it is pointed out in D3, page 676, first sentence, underlining that the known air/oxygen/fuel burner provides the skilled aluminium melter with the flexibility of using either burner or a combination of both burners.

- 4.2 A similar technical disclosure is given in document D4, e.g. page 113, first column, second paragraph and page 114, second column, 4th to 9th paragraph. Specifically, document D4 addresses the necessity of using a reasonably tight furnace and a low-nitrogen fuel. In doing so, the oxy-fuel combustion under stoichiometric conditions results in extremely low NO_x emissions, as it is shown for instance in D4, Figure 4. The fact that the authors of D4 propagate the recirculation of relatively cool combustion products to create a protective envelope has no bearing on the matter, since it does not prevent the oxy-fuel flame from being highly radiant and is not excluded from the claimed combustion process.
- 4.3 It is therefore concluded that the technical features making up the claimed process amount to nothing more than what is conventionally done and known in the art about energy efficient oxy-fuel combustion processes within a tight furnace. The claimed combustion process therefore does not involve an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

V. Commare

T. Kriner