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**Datasheet for the decision
of 29 March 2011**

Case Number: T 1162/10 - 3.2.05

Application Number: 01991097.5

Publication Number: WO 02/50471

IPC: F16T 1/00

Language of the proceedings: EN

Title of invention:

Oxygen separation and combustion apparatus and method

Applicant:

PRAXAIR TECHNOLOGY, INC.

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Relevant legal provisions (EPC 1973):

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Keyword:

"Novelty - yes"

"Inventive step - yes"

Decisions cited:

-

Catchword:

-



Case Number: T 1162/10 - 3.2.05

D E C I S I O N
of the Technical Board of Appeal 3.2.05
of 29 March 2011

Appellant:
(Applicant)

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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 8 January 2010
refusing European patent application
No. 01991097.5 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: W. Zellhuber
Members: H. Schram
M. J. Vogel

Summary of Facts and Submissions

- I. The appeal is against the decision of the Examining Division posted on 8 January 2010 refusing European patent application No. 01 991 097.5 (International Publication No. WO 02/50471) on the grounds that the subject-matter of claims 1 and 6 of the main request was not new (Article 54 EPC) and that claims 1 and 6 of the auxiliary request introduced subject-matter extending beyond the content of the application as filed (Article 123(2) EPC).
- II. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 9 filed on 1 April 2008.
- III. Claims 1 and 6 according to the sole request of the appellant read as follows:
- "1. A oxygen separation and combustion apparatus (1; 2; 3) comprising:
- a combustion chamber (10);
 - a plurality of parallel oxygen transport membranes (12, 14, 16) located within said combustion chamber (10) to separate oxygen from an oxygen containing gas, thereby to provide the oxygen within the combustion chamber (10) to support combustion of a fuel and thereby generate heat;
 - a plurality of fluid passages (18, 20, 22, 23) passing through said combustion chamber (10);
 - said fluid passages (18, 20, 22, 23) positioned so that a portion of the heat is transferred from the combustion to said oxygen transport membranes (12, 14, 16) to heat said oxygen transport membranes (12, 14,

16) to an operational temperature and a further portion of the heat is transferred from the combustion to said fluid passages (18, 20, 22, 23) to provide heat to heat fluid and to promote stabilization of the operational temperature of said oxygen transport membranes (12, 14, 16);

at least one inlet (38; 38' ; 57) for introducing at least the fuel into said combustion chamber (10); and

an exhaust (54 ; 54' 54'') from said combustion chamber (10) to discharge combustion products arising from combustion of the fuel;

the exhaust (54 ; 54' 54'') and said at least one inlet (38 ; 38' ; 57) spaced apart from one another so that said combustion products flow in a direction predominantly parallel to said oxygen transport membranes (12, 14, 16).

"6. An oxygen separation and combustion method comprising:

introducing an oxygen containing gas into a plurality of parallel oxygen transport membranes (12, 14, 16) located within a combustion chamber (10);

separating oxygen from the oxygen containing gas within the plurality of parallel oxygen transport membranes (12, 14, 16), thereby to provide oxygen within the combustion chamber (10);

introducing fuel into the combustion chamber (10);

combusting the fuel within the combustion chamber (10) in the presence of the oxygen to generate heat;

passing a fluid through a plurality of fluid passages (18, 20, 22, 23) located within the combustion chamber (10);

discharging combustion products from the combustion chamber (10);

the combustion products being discharged from the combustion chamber (10) and the fuel being introduced so that the combustion products flow in a direction predominantly parallel to said oxygen transport membranes (12, 14, 16) to provide a reactive purge to promote the separation of the oxygen from the oxygen containing gas; and

the fluid passages (18, 20, 22, 23) being positioned so that a portion of the heat is transferred from the combustion to said oxygen transport membranes (12, 14, 16) to heat said oxygen transport membranes (12, 14, 16) to an operational temperature and a further portion of the heat is transferred from the combustion to said fluid passages (18, 20, 22, 23) to provide heat to heat the fluid and to promote stabilization of the operational temperature of said oxygen transport membranes (12, 14,16)."

IV. The following document is referred to in the present decision:

D1 EP-A 0 984 500

V. In support of his request, the appellant submitted that the present invention was distinguished from the reactor shown in Figure 6 of document D1 in that the fluid passages were located within the combustion chamber. The dictionary definition of a combustion chamber was "an enclosed space, in which combustion takes place". (whereas in document D1 the fluid passages were located around the combustion chamber).

In the decision under appeal, the finding of lack of novelty was based on the view that in document D1 the reactor shell 60, 100 formed the combustion chamber of the oxygen separation and combustion apparatus (cf Figures 6 and 8). This was not correct, since the combustion took place in the combustion passage 44 / combustion site 20, which therefore formed the combustion chamber. It followed that in document D1 the fluid passages were located around the combustion chamber.

The reactor design according to the invention had the advantage that the fluid passages were heated in a particularly efficient manner, whereby thermal runaway of the oxygen transport membranes was avoided. None of the prior art documents disclosed an apparatus and a method for oxygen separation and combustion, whereby a plurality of parallel oxygen transport membranes were located within the combustion chamber and a plurality of fluid passages were passing through said combustion chamber. The subject-matter of claims 1 and 6 of the main request was thus novel and involved an inventive step.

Reasons for the Decision

1. Interpretation of claims 1 and 6

Claim 1 is directed to an oxygen separation and combustion apparatus (1; 2; 3) comprising: a combustion chamber (10); An example of an oxygen separation and combustion apparatus is a boiler, see page 3, lines 28 and 29, and in particular page 10, line 25, to

page 15, line 12, and Figures 1 to 3, wherein the apparatus is referred to as a boiler (1, 2, 3). A combustion apparatus is an apparatus wherein combustion of a fuel takes place and heat is generated.

In the judgment of the Board, the term "combustion chamber (10)" in claims 1 and 6 must be narrowly construed in the light of the application documents as a whole to mean the enclosed space in which the *actual* combustion takes place, and not as the oxygen separation and combustion apparatus itself, ie the space enclosed by the outer casing thereof.

2. *Objection of lack of novelty, Article 54 EPC, and lack of inventive step, Article 56 EPC*

In the reactor known from document D1 a combustion reaction provides heat to an endothermic reaction which occurs within reaction passage 10 (see column 8, lines 42 to 45). The reaction passage 10 cannot be identified as a combustion chamber in the sense of claims 1 and 6 of the sole request of the appellant, since no heat is generated in said passage.

In document D1 the enclosed space in which the actual combustion takes place is the combustion passage 44 / combustion site 20, see Figure 3, paragraph [0041] and the passage in paragraph [0056] of document D1, wherein it is stated that "[The] energy to support the reforming reaction is provided by combustion of the fuel 32 in a combustion passage 44 ...". It may be noticed that the Examiner entrusted with the examination of the application, in a first Communication dated 21 September 2007, identified the

combustion site 20 of document D1 as the combustion chamber, but that this view was abandoned in a second and last Communication dated 24 April 2009 by the Examining Division in favour of "vessel 60 and 100 in which a combustion takes place". The latter view was repeated without any explanation in the decision under appeal, although the appellant had noted in its reply dated 14 August 2009 that the Examining Division no longer considered the combustion site 20 / combustion passage 44 to form the combustion chamber, but instead considered the entire reactor shell 60 as the combustion chamber.

It follows from the above that document D1 does not disclose the feature "a plurality of fluid passages (18, 20, 22, 23) passing through said combustion chamber (10)" and "passing a fluid through a plurality of fluid passages (18, 20, 22, 23) located within the combustion chamber (10)", present in claims 1 and 6 of the sole request of the appellant, respectively.

For the above reason alone the subject-matter of claims 1 and 6 of the sole request is new with respect to document D1.

Locating the plurality of parallel oxygen transport membranes 12, 14, 16 within the combustion chamber (10) and locating and positioning the plurality of fluid passages 18, 20, 22, 23 as claimed in claims 1 and 6 of the sole request has the advantage that energy expenditure can be reduced and that the operational temperature of said oxygen transport membranes is stabilized, see page 3, line 26 to page 4, line 22, and page 7, line 8 to page 8, line 2.

In the judgment of the Board, the subject-matter of claims 1 and 6 of the sole request also involves an inventive step, since locating and positioning the oxygen transport membranes and the plurality of fluid passages as claimed is not known from, or suggested by any of the prior art documents cited in the International Search Report or in the Supplementary European Search Report.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the following documents:

Claims, No.:

1 to 9 filed on 1 April 2008;

Description, pages:

1, 2, 4 to 14 and 16 as originally filed;
3, 3A and 15 filed on 1 April 2008; and

Drawings, sheets:

1/2 as originally filed;
2/2 filed on 1 April 2008.

The Registrar:

The Chairman:

D. Meyfarth

W. Zellhuber