



(51) International Patent Classification:

B01D 53/62 (2006.01) *F23J 15/00* (2006.01)
B01D 53/72 (2006.01) *F23C 6/04* (2006.01)
B01D 53/86 (2006.01) *F23G 7/06* (2006.01)

(21) International Application Number:

PCT/IB2013/052469

(22) International Filing Date:

27 March 2013 (27.03.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13/435,908 30 March 2012 (30.03.2012) US

(71) Applicant: **ALSTOM TECHNOLOGY LTD** [CH/CH];
Brown Boveri Strasse 7, CH-5400 Baden (CH).

(72) Inventors: **AJHAR, Marc**; Nicolaistrasse 20, 65193
Wiesbaden (DE). **GRUBBSTRÖM, Jörgen**; Seglarevägen
19, S-352 55 Växjö (SE).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,

NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,
ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

6 March 2014

(54) Title: METHOD AND APPARATUS FOR TREATMENT OF UNBURNTS

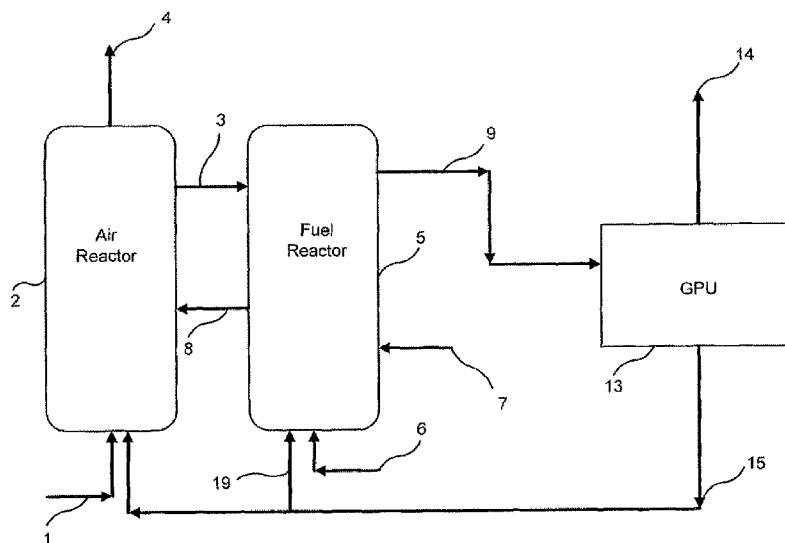


Fig. 2

(57) Abstract: A method and apparatus for treatment of unburnts in a flue stream 9 of a chemical looping combustion system. Unburnts present in the flue stream 9 are treated after CO₂ is removed from the flue stream in a gas processing unit 13. As shown in Fig. 2, oxidation of the unburnts occurs primarily in an air reactor 2 in the presence of air 1, allowing the system to maintain CO₂ capture effectiveness and removing the need for creation of enriched or pure oxygen 11.

WO 2013/144884 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2013/052469

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9, 15-20

An apparatus and a method for oxidising unburnts in a chemical looping combustion system

2. claims: 10-14

A method of oxidising unburnts in a flue stream

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2013/052469

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>TOBIAS MATTISSON ET AL: "Reactivity of some metal oxides supported on alumina with alternating methane and oxygen-application for chemical-looping combustion", ENERGY & FUELS, AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC, US, vol. 17, 1 January 2003 (2003-01-01), pages 643-651, XP009117198, ISSN: 0887-0624, DOI: 10.1021/EF020151I figure 2</p>	1,2,10, 11,15-20
A	<p>----- HOSSAIN M M ET AL: "Chemical-looping combustion (CLC) for inherent CO2 separations-a review", CHEMICAL ENGINEERING SCIENCE, OXFORD, GB, vol. 63, no. 18, 29 May 2008 (2008-05-29), pages 4433-4451, XP025467861, ISSN: 0009-2509, DOI: 10.1016/J.CES.2008.05.028 [retrieved on 2008-05-29] the whole document</p>	1-9, 15-20
A	<p>----- JUAN ADANEZ ET AL: "Progress in Chemical-Looping Combustion and Reforming technologies", PROGRESS IN ENERGY AND COMBUSTION SCIENCE, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 38, no. 2, 19 September 2011 (2011-09-19), pages 215-282, XP028395663, ISSN: 0360-1285, DOI: 10.1016/J.PECS.2011.09.001 [retrieved on 2011-09-29] the whole document</p>	1-9, 15-20
A	<p>----- US 2011/198861 A1 (JALLAIS SIMON [FR] ET AL) 18 August 2011 (2011-08-18) paragraphs [0014], [0024], [0058] figure 1</p>	1-20
A	<p>----- WO 2010/099555 A1 (UNIV WIEN TECH [AT]; PROELL TOBIAS [AT]; KOLBITSCH PHILIPP [AT]; BOLHA) 10 September 2010 (2010-09-10) figures 3-7</p> <p>-----</p>	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2013/052469

Patent document cited in search report	A1	Publication date		Patent family member(s)		Publication date
US 2011223083	A1	15-09-2011	AU	2011225795 A1		18-10-2012
			CA	2792730 A1		15-09-2011
			CN	102883996 A		16-01-2013
			EP	2544998 A1		16-01-2013
			JP	2013522149 A		13-06-2013
			US	2011223083 A1		15-09-2011
			WO	2011110915 A1		15-09-2011

US 2011198861	A1	18-08-2011	AU	2009305282 A1		22-04-2010
			CA	2737663 A1		22-04-2010
			CN	102187153 A		14-09-2011
			EP	2359059 A1		24-08-2011
			FR	2937119 A1		16-04-2010
			JP	2012506022 A		08-03-2012
			US	2011198861 A1		18-08-2011
			WO	2010043797 A1		22-04-2010

WO 2010099555	A1	10-09-2010	AT	507917 A1		15-09-2010
			WO	2010099555 A1		10-09-2010
