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**B01D 53/18** (2006.01)    **C07D 241/00** (2006.01)  
**B01D 53/74** (2006.01)    **C07D 295/13** (2006.01)  
**B01D 53/75** (2006.01)    **C07D 295/12** (2006.01)  
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(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, IR, IS, JP, KE, KG, 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, SA, 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, KM, 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))

[Continued on next page]

(54) Title: SPLIT LINE SYSTEM, METHOD AND PROCESS FOR CO2 RECOVERY

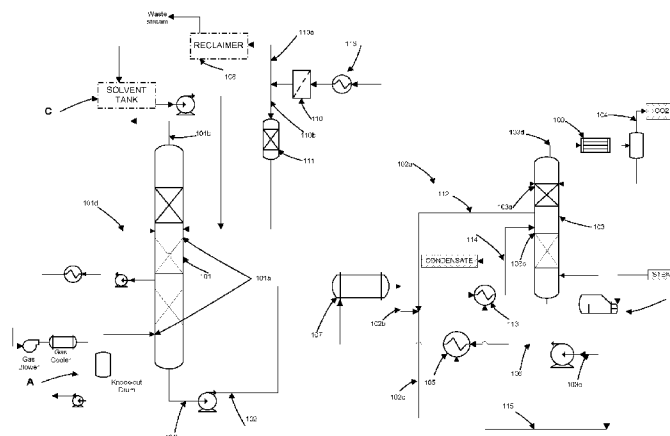


FIG. 4

(57) Abstract: A process, system or apparatus for recovering CO2 from a gas has an absorption section, cooling section, regeneration section and more than three heating sections and involves a split in the CO2 rich stream from the first heating section. A solvent for recovering CO2 from a gaseous mixture comprising a primary amino hindered alcohol or tertiary amine in combination with a derivative of piperazine with three or more amino groups as promoter and a carbonate buffer is also disclosed.

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13 August 2015

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2014/002368

## A. CLASSIFICATION OF SUBJECT MATTER

**B01D 53/62 (2006.01)**    **B01D 53/14 (2006.01)**    **B01D 53/18 (2006.01)**    **B01D 53/74 (2006.01)**    **B01D 53/75 (2006.01)**  
**B01D 53/77 (2006.01)**    **B01D 53/78 (2006.01)**    **C01B 31/20 (2006.01)**    **C07D 241/00 (2006.01)**    **C07D 295/13 (2006.01)**  
**C07D 295/12 (2006.01)**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

B01D53/LOW, B01D2257/50, B01D2257/504, B01D2256/22, C01B31/20, B01D15/18, c07d241/low, c07d295/13, c07d295/12, c07d295/125 and carbon dioxide or co2, absorp+, adsorp+, Regenerat+, recover+, steam+, boiler, reboiler, Heat+, cool+, exchang+, integrat+, recov+, utili+, condens+, util+, Liquid?, fluid+, aqueous, solvent?, solut+, Section+,stage+, tower?, amin+, piperazine, here, "3", multi+, amino, carbonate, buffer

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

 Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 5 May 2015	Date of mailing of the international search report 05 May 2015
<b>Name and mailing address of the ISA/AU</b>  AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaaustralia.gov.au	<b>Authorised officer</b>  Gregory Diven AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832992

<b>INTERNATIONAL SEARCH REPORT</b>		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		<b>PCT/IB2014/002368</b>
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 2414615 A1 (MITSUBISHI HEAVY INDUSTRIES LTD) 31 July 2003 abstract, claims	1-6, 7-10, 15
A	EP 2578290 A1 (MITSUBISHI HEAVY INDUSTRIES LTD) 10 April 2013 abstract, claims	1-6, 7-10, 15
A	AU 2011353671 A1 (ALSTOM TECHNOLOGY LTD) 12 July 2012 abstract, claims	1-6, 7-10, 15
A	EP 1736231 A1 (MITSUBISHI HEAVY INDUSTRIES LTD) 27 December 2006 abstract, claims	1-6, 7-10, 15
A	US 2008/0184887 A1 (MAK) 07 August 2008 abstract, claims	1-6, 7-10, 15
X	US 2013/0164204 A1 (BUMB) 27 June 2013 abstract, claims, [0009]-[0010]	11-14
A	US 2010/0263534 A1 (CHUANG) 21 October 2010 abstract, claims	11-14
A	US 4510124 A (SEARS ET AL) 09 April 1985 abstract, claims	11-14
A	WO 2012/038330 A2 (SIEMENS AKTIENGESELLSCHAFT) 29 March 2012 abstract, claims	11-14
A	CA 2851092 A1 (MITSUBISHI HEAVY INDUSTRIES LTD ET AL) 25 April 2013 abstract, claims	11-14
P,X	WO 2014/118633 A2 (CARBON CLEAN SOLUTIONS PVT LTD) 07 August 2014 abstract, claims	11-14

**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:  
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
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 Supplemental Box for Details**

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 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.

**Supplemental Box****Continuation of: Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1-6, 7-10, 15 are directed to an apparatus for recovering CO<sub>2</sub> from a gas containing CO<sub>2</sub>, the apparatus comprising the features of an absorption section, a cooling section, a regeneration section, a first heating section, a second heating section, third heating section and fourth heating section as well as a process for recovering the CO<sub>2</sub>. The feature of an apparatus for recovering CO<sub>2</sub> from a gas containing CO<sub>2</sub>, the apparatus comprising the features of an absorption section, a cooling section, a regeneration section, a first heating section, a second heating section, third heating section and fourth heating section as well as a process for recovering the CO<sub>2</sub> is specific to this group of claims.
- Claims 11-12 are directed to a solvent for recovery of CO<sub>2</sub> from gaseous mixture comprising a primary amino hindered alcohol, a derivative of piperazine with three or more amino groups, and a carbonate buffer. The feature of a solvent for recovery of CO<sub>2</sub> from gaseous mixture comprising a primary amino hindered alcohol, a derivative of piperazine with three or more amino groups, and a carbonate buffer is specific to this group of claims.
- Claims 13-14 are directed to a solvent for recovery of CO<sub>2</sub> from gaseous mixture comprising tertiary amine, derivative of piperazine with three or more amino groups, and a carbonate buffer. The feature of a solvent for recovery of CO<sub>2</sub> from gaseous mixture comprising tertiary amine, derivative of piperazine with three or more amino groups, and a carbonate buffer is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a priori*.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/IB2014/002368**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<b>Patent Document/s Cited in Search Report</b>		<b>Patent Family Member/s</b>	
<b>Publication Number</b>	<b>Publication Date</b>	<b>Publication Number</b>	<b>Publication Date</b>
CA 2414615 A1	31 July 2003	EP 1336724 A1	20 Aug 2003
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WO 2005097299 A1	20 Oct 2005		
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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/IB2014/002368**

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/IB2014/002368**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<b>Patent Document/s Cited in Search Report</b>		<b>Patent Family Member/s</b>	
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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)

**INTERNATIONAL SEARCH REPORT**

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**End of Annex**