



(51) International Patent Classification:
C02F 1/469 (2006.01)

(21) International Application Number:
PCT/US2008/013286

(22) International Filing Date:
1 December 2008 (01.12.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/991,316 30 November 2007 (30.11.2007) US

(71) Applicant (for all designated States except US):
SIEMENS WATER TECHNOLOGIES CORP.
[US/US]; 181 Thorn Hill Road, Warrendale, Pennsylvania 15086 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FREYDINA, Evgeniya** [RU/US]; 21 Birch Ridge Road, Acton, Massachusetts 01720 (US). **GIFFORD, Joseph D.** [US/US]; 8 MacIntosh Ave., Marlborough, Massachusetts 01752 (US).

(74) Agents: **MUSACCHIO, Pasquale** et al.; Siemens Corporation- Intellectual Property Dept., 170 Wood Avenue South, Iselin, New Jersey 08830 (US).

(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, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: SYSTEMS AND METHODS FOR WATER TREATMENT

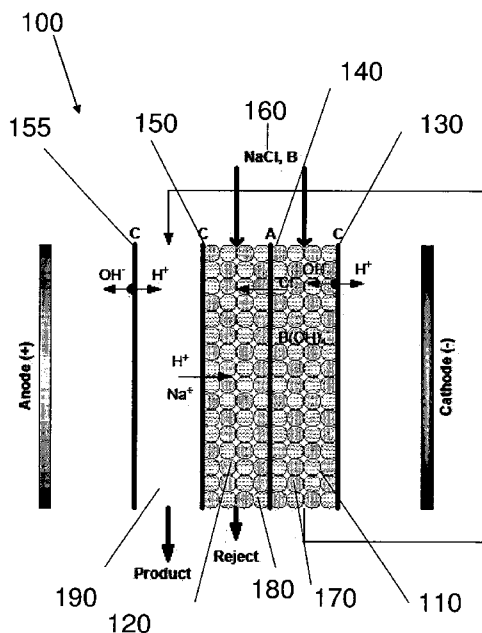


FIG. 1

(57) Abstract: Electrochemical devices and methods for water treatment are disclosed. An electrodeionization device (100) may include one or more compartments (110) containing an ionselective media, such as boron-selective resin (170). Cyclic adsorption of target ions and regeneration of the media in-situ is used to treat process water, and may be driven by the promotion of various pH conditions within the electrochemical device.

WO 2009/073175 A3



Published:

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

20 August 2009

- *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))*

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/013286

A. CLASSIFICATION OF SUBJECT MATTER
INV. C02F1/469

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)
C02F

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 practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/112943 A (VATTENFALL AB [SE]; YAN JINYING [SE]; VELIN ANNA [SE]; BENGTSSON BERNT) 29 December 2004 (2004-12-29) figure 1 page 1, line 6 - line 13 page 5, line 15 - line 29 page 6, line 7 - line 21	16-23
X	EP 1 222 954 A (KURITA WATER IND LTD [JP]) 17 July 2002 (2002-07-17) figure 1 paragraphs [0003], [0009], [0029] paragraphs [0019] - [0022] -/--	1-10, 16-23

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 document 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 19 February 2009	Date of mailing of the international search report 09/07/2009
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Galiana López, Paula

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/013286

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/096807 A (UNITED STATES FILTER CORP [US]; LIANG LI-SHIANG [US]; JHA ANIL [US]; A) 5 December 2002 (2002-12-05) figure 3 page 1, line 5 - line 8 page 5, line 24 - line 32 page 6, line 12 - line 20 page 9, line 13 - line 25 -----	11-23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/013286

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 allsearchable 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.:

1 - 23

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: 1-23

Claims 1-10, 11-15 and 16-23 directed to a method and a system for water treatment comprising an electrically driven separation device comprising a compartment and a boron-binding media (resin bed).

1.1. claims: 1-10 16-23

Claims 1-10 and 16-23 directed to a method for treating seawater comprising chloride ions and boron-containing compounds and a system for water treatment comprising an electrically driven separation device comprising a compartment with a boron selective media.

1.2. claims: 11-15

Claims 11-15 directed to a method of operating a electrodeionization device by promoting different pH ranges in the compartments and adsorbing borate ions on a resin bed.

2. claims: 24-42

Claims 24-29 and 30-42 directed to a method and a device for treating seawater by introducing the water in a electrically driven separation device comprising a target species adsorbing media, an anion permeable membrane and two cation permeable membranes.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/013286

Patent document cited in search report	A	Publication date		Patent family member(s)	Publication date
WO 2004112943	A	29-12-2004		AU 2003243093 A1	04-01-2005
				CA 2528750 A1	29-12-2004
				CN 1809415 A	26-07-2006
				EP 1638672 A1	29-03-2006
				JP 2007534453 T	29-11-2007
				US 2006249390 A1	09-11-2006
			<hr/>		
EP 1222954	A	17-07-2002		DE 60106854 D1	09-12-2004
				DE 60106854 T2	24-03-2005
				JP 3794268 B2	05-07-2006
				JP 2002205069 A	23-07-2002
				KR 20020057820 A	12-07-2002
				SG 104954 A1	27-07-2004
				US 2002125137 A1	12-09-2002
<hr/>					
WO 02096807	A	05-12-2002		CA 2449349 A1	05-12-2002
				CN 1520384 A	11-08-2004
				EP 1395522 A2	10-03-2004
				JP 3940802 B2	04-07-2007
				JP 2005508729 T	07-04-2005
				US 2004089551 A1	13-05-2004
				US 2002189951 A1	19-12-2002