(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 July 2013 (11.07.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/103846 A3

(51) International Patent Classification:
C02F 1/68 (2006.01) *A01N 25/10* (2006.01)
C02F 1/76 (2006.01) *A01N 59/00* (2006.01)

(21) International Application Number:
PCT/US2013/020321

(22) International Filing Date:
4 January 2013 (04.01.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/583,776 6 January 2012 (06.01.2012) US

(71) Applicant: **THE WATER INITIATIVE, LLC** [US/US]; 10 Wall Street, 1st Floor, Norwalk, Connecticut 06850 (US).

(72) Inventors: **LANGDO, Thomas A.**; 11 Lilac Court, Cambridge, Massachusetts 02141 (US). **FITZGERALD, Eugene, A.**; 7 Camelot Road, Windham, New Hampshire 03087 (US). **RENJILIAN, Richard**; 7125 Brae Court, Gurnee, Illinois 60031 (US). **BROWN, Larry, R.**; 25 Sumner Street, Newton, Massachusetts 02459 (US). **LANGER, Robert, S.**; 98 Montvale Road, Newton, Massachusetts 02459 (US).

(74) Agents: **MORENCY, Michel** et al.; Foley & Lardner LLP, 3000 K Street N.W., Suite 600, Washington, District of Columbia 20007-5109 (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, 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))*

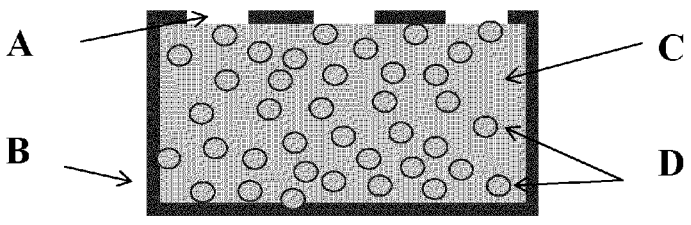
Published:

— *with international search report (Art. 21(3))*

[Continued on next page]

(54) Title: CONTROLLED RELEASE APPARATUS AND USES THEREOF

FIG. 1



(57) Abstract: An apparatus is provided comprising one or more matrices contained within a shell, wherein the one or more matrices comprise between 1-99 wt % of a water-insoluble host material and between 1-99 wt % of a guest substrate, wherein the guest substrate comprises between 1-100 wt % of one or more disinfectant compounds or one or more beneficial compounds; and wherein the shell comprises a water-insoluble shell polymer, and one or more apertures. The host material may be a polymer. The apparatus is used for treating an aqueous medium with one or more disinfectant compounds or one or more beneficial compounds.

WO 2013/103846 A3

— *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:
19 September 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/020321

A. CLASSIFICATION OF SUBJECT MATTER
INV. C02F1/68 C02F1/76 A01N25/10 A01N25/34 A01N59/00
ADD.

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 practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 968 439 A (LEVEEN HARRY H [US] ET AL) 6 November 1990 (1990-11-06) figures 1-3 column 2, line 27 - column 3, line 47 -----	1-6, 11-50
A	POLYURETHANE FOAM ASSICIATION: "In Touch Information on flexible polyurethane foam", INTERNET CITATION, 1 May 1991 (1991-05-01), pages 1-4, XP002669529, Retrieved from the Internet: URL:http://web.archive.org/web/20040611094033/http://www.pfa.org/intouch/new_pdf/hr_IntouchV1.2.pdf [retrieved on 2012-02-13] page 1 -----	3
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] 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

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 April 2013	19/07/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Châtellier, Xavier

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/020321

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/304868 A1 (SUNDARAM MAGESH [US] ET AL) 10 December 2009 (2009-12-10) figure 3 paragraph [0018] paragraph [0045] - paragraph [0149] paragraph [0180] - paragraph [0188] -----	1-6, 11-50

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/020321

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4968439 A	06-11-1990	NONE	
US 2009304868 A1	10-12-2009	NONE	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/020321

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.:

3(completely); 1, 2, 4-6, 11-50(partially)

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: 3(completely); 1, 2, 4-6, 11-50(partially)

   An apparatus in which the matrix comprises between 40 and 80% of the guest substrate

   ---

2. claims: 5(completely); 1-4, 6, 11-50(partially)

   An apparatus in which the disinfectant comprises the element chlorine.

   ---

3. claims: 1-5, 11-50(all partially)

   An apparatus in which the disinfectant comprises DBDMH.

   ---

4. claims: 1-5, 11-50(all partially)

   An apparatus in which the disinfectant comprises potassium iodide.

   ---

5. claims: 8(completely); 7, 11-50(partially)

   An apparatus comprising a vitamin.

   ---

6. claims: 9(completely); 7, 11-50(partially)

   An apparatus comprising a pharmaceutical

   ---

7. claims: 10(completely); 7, 11-50(partially)

   An apparatus comprising a mineral.

   ---

8. claims: 12(completely); 1-10, 13-50(partially)

   An apparatus in which the host mineral is calcium carbonate.

   ---

9. claims: 19-21(completely); 1-18, 22-50(partially)

   An apparatus in which apertures are sealed with a hydrophilic polymer.

   ---

10. claims: 1-11, 13-50(all partially)

    An apparatus in which the host material/shell is EVA.

---

11. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is polyvinyl alcohol.

---

12. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is silicone rubber.

---

13. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is polyethylene.

---

14. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is polypropylene.

---

15. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is PS.

---

16. claims: 1-11, 13-50(all partially)

An apparatus in which the host material/shell is PE.

---

17. claims: 29, 30(completely); 1-28, 31-50(partially)

An apparatus in which the shell has a thickness of 1-500 microns.

---

18. claims: 32-34(completely); 1-31, 35-50(partially)

An apparatus in which the matrix has a particle size of 1-2000 microns.

---

19. claims: 35, 36(completely); 1-34, 37-50(partially)

An apparatus in which the distance between apertures is greater than or equal to half the thickness of the matrix.

---

20. claims: 37, 38(completely); 1-36, 39-50(partially)

An apparatus in which each aperture has a diameter than is less than or equal to twice the thickness of the matrix.

---

21. claims: 43-46(completely); 1-42, 47-50(partially)

An apparatus in which the guest substrate further comprises an additive.

---

22. claims: 56, 57(completely); 51-55(partially)

A method in which the disinfectant is released at a rate of 0.2-10 mg/l.

---

23. claims: 60-62(completely); 51(partially)

A method with a disinfection efficacy CT of 0.01-20 [(mg/L)min] for a minimum of 1 log reduction.
