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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, 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, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW
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25 September 2008

(54) **Title:** MICRO-AND NANOCOMPOSITE SUPPORT STRUCTURES FOR REVERSE OSMOSIS THIN FILM MEMBRANES

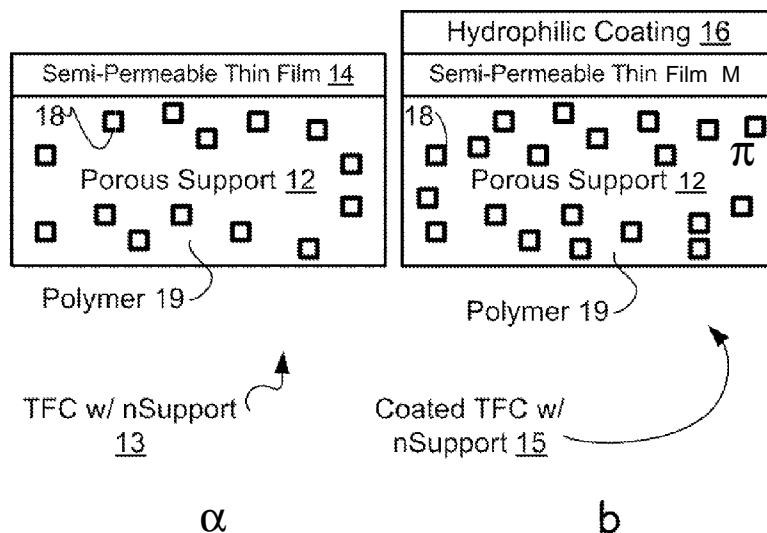


FIG. 4

α

b

(57) **Abstract:** Disclosed are compaction resistant thin film composite membranes having a porous polymeric support; a semi-permeable polymer film polymerized on the porous polymeric support; and particles, of a size in the range of microparticles and nanoparticles, dispersed in the porous polymeric support. Also disclosed are methods of making compaction resistant membranes by polymerizing a polymer film on a porous polymeric support with particles of a size in the range of microparticles and nanoparticles dispersed therein, the particles having been selected to improve flux flow characteristics over time of the semi-permeable membrane. Also disclosed are methods of purifying water using the disclosed membranes. This abstract is intended as a scanning tool for purposes of searching in the particular art and is not intended to be limiting of the present invention.

WO 2008/057842 A3



INTERNATIONAL SEARCH REPORT

International application No

PCT /JS 07/82901

<p>A CLASSIFICATION OF SUBJECT MATTER IPC(8) - B01 D 69/00, B01 D 71/40 (2008.04) USPC - 210/654, 210/500 38</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>																				
<p>B FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) USPC 210/654, 210/500 38</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC All classes</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWEST (PGPB, USPT, EPAB, JPAB), Google Scholar, Google Patents Keywords Filter, water, solution, liquid, pore, porous, polymer, support, core, particle, oxide, amorphous, crystalline, silica, alumina, clay, zeolite, carbon, flux, reduce, decline, mix, combine, resist, crush, compact, thickness, kpa, steady, state</p>																				
<p>C DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category'</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>US 5,002,590 A (FRIESEN βt al) 19 September 1989 (19 09 1989), col 6. In 38-53. col 6. In 62-67. col 7. In 1-27, col 7. In 54 to col 8. In 3, col 8, In 6-30</td> <td>1-3. 16-18, 30-32. 44-46, 59-61</td> </tr> <tr> <td>Y</td> <td>US 2006/0201884 A1 (KULPRATHIPANJA et al) 14 September 2006 (14 09 2006). para [0062], [0083], [0108H0110], 101 19]. [0121], [0149]-[0151]</td> <td>1-3. 16-18, 30-32, 44-46, 59-61</td> </tr> <tr> <td>Y</td> <td>US 5.173,189 A (HOSHI et al) 22 December 1992 (22 12 1992), col 8, In 39-51</td> <td>1-3, 16-18, 30-32, 44-46. 59-61</td> </tr> <tr> <td>Y</td> <td>US 5,650,479 A (GLUGLA βt al) 22 July 1997 (22 07 1997). col 9, In 19-22, col 17, In 49-57, Fig 3, 4</td> <td>2 3. 17. 18 30-32 45 46. 60, 61</td> </tr> <tr> <td>Y</td> <td>US 4,765,915 A (DIEHL) 23 August 1988 (23 08 1988), col 5, In 16-21, col 5, In 34-56</td> <td>16-18, 32. 59-61</td> </tr> </tbody> </table>			Category'	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No	Y	US 5,002,590 A (FRIESEN β t al) 19 September 1989 (19 09 1989), col 6. In 38-53. col 6. In 62-67. col 7. In 1-27, col 7. In 54 to col 8. In 3, col 8, In 6-30	1-3. 16-18, 30-32. 44-46, 59-61	Y	US 2006/0201884 A1 (KULPRATHIPANJA et al) 14 September 2006 (14 09 2006). para [0062], [0083], [0108H0110], 101 19]. [0121], [0149]-[0151]	1-3. 16-18, 30-32, 44-46, 59-61	Y	US 5.173,189 A (HOSHI et al) 22 December 1992 (22 12 1992), col 8, In 39-51	1-3, 16-18, 30-32, 44-46. 59-61	Y	US 5,650,479 A (GLUGLA β t al) 22 July 1997 (22 07 1997). col 9, In 19-22, col 17, In 49-57, Fig 3, 4	2 3. 17. 18 30-32 45 46. 60, 61	Y	US 4,765,915 A (DIEHL) 23 August 1988 (23 08 1988), col 5, In 16-21, col 5, In 34-56	16-18, 32. 59-61
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<p><input type="checkbox"/> Further documents are listed in the continuation of Box C <u> </u></p>																				
<p>* Special categories of cited documents</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"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</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"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</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date or another citation or other special reason (as specified)</td> <td>"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</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"g" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"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 or 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	"g" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed									
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<p>Date of the actual completion of the international search</p> <p>15Apr 2008 (15 04 2008)</p>	<p>Date of mailing of the international search report</p> <p>22 MAY 2008</p>																			
<p>Name and mailing address of the ISA/US</p> <p>Mall Stop PCT, Attn ISA/US, Commissioner for Patents P O Box 1450, Alexandria, Virginia 22313-1450 Facsimile No 571-273-3201</p>	<p>Authorized officer</p> <p>Lee W Young</p> <p>PCT Helpdesk. 571-272-4300 PCT QSP 571 272-7774</p>																			

INTERNATIONAL SEARCH REPORT

International application No

PCTVUS 07/82901

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 **D** 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 4-15, 19-29, 33-13, 47-58. and 62-70
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

- 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