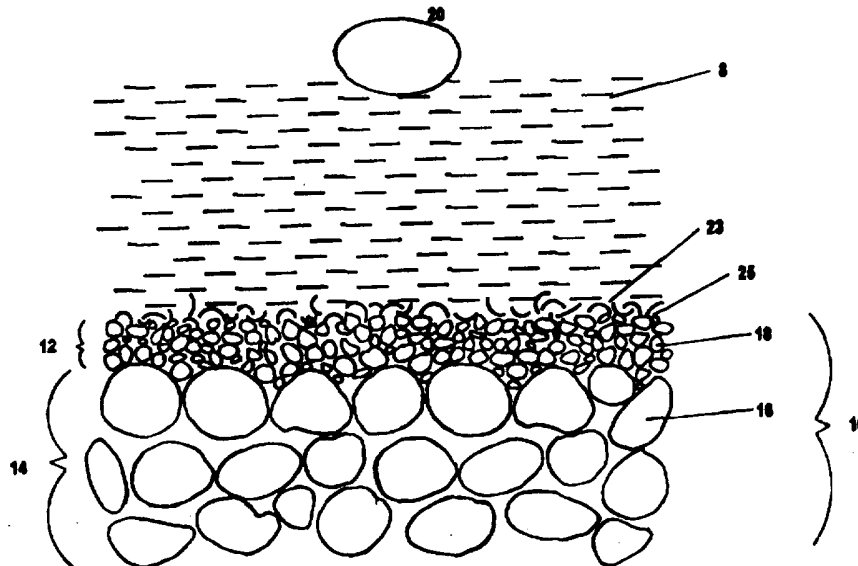




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : B01D 71/02, 39/20, 65/02, 35/06, 61/42</p>	<p>A3</p>	<p>(11) International Publication Number: WO 96/10453 (43) International Publication Date: 11 April 1996 (11.04.96)</p>
<p>(21) International Application Number: PCT/GB95/02334 (22) International Filing Date: 2 October 1995 (02.10.95) (30) Priority Data: 9419819.9 1 October 1994 (01.10.94) GB 9505038.1 13 March 1995 (13.03.95) GB (71) Applicant (for all designated States except US): IMAS (UK) LIMITED [GB/GB]; 5 Willes Road, Leamington Spa, Warwickshire CV32 4PP (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): BRAY, David, James [GB/GB]; 5 Willes Road, Leamington Spa, Warwickshire CV32 4PP (GB). DAVIDSON, Alexander, Philip [GB/GB]; Wood Farm House, Whichford, Shipston-on-Stour, Warwickshire CV36 5PG (GB). (74) Agent: DEMPSTER, Benjamin, John, Naftel; Withers & Rogers, 4 Dyer's Buildings, Holborn, London EC1N 2JT (GB).</p>	<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 4 July 1996 (04.07.96)</p>	

(54) Title: A FILTER, APPARATUS INCLUDING THE FILTER AND A METHOD OF USE OF THE APPARATUS



(57) Abstract

A filter (10) is provided comprising a first filter layer (12) made of TiO₂ or Ti₄O₇ particles deposited on a second filter layer (14) by stainless steel particles. The first layer (12) has a smaller pore size than the second layer (14). The construction of the filter (10), the relative thicknesses of the layers (12, 14) and the resistance thereof to movement therethrough of electrolytically generated gas located between the two layers (12, 14) when the filter (10) is permeated with liquid being such that such gas reaches the upstream side of the filter before the downstream side. Thus in one embodiment stainless steel particles are sintered and rolled with a textured roller before ceramic particles are applied and rolled. An intermediate layer of metal particle peaks and ceramic filled troughs is thus provided which has high tortuosity. The resistance to flow at the metal/ceramic interface can be increased by electrodeposition of metal there.

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INTERNATIONAL SEARCH REPORT

Int. National Application No
PCT/GB 95/02334

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B01D71/02 B01D39/20 B01D65/02 B01D35/06 B01D61/42

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)
IPC 6 B01D

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	L. CECILLE 'Future industrial prospects of membrane processes', ELSEVIER APPLIED SCIENCE, LONDON, XP0000077688 see abstract see page 77, line 28 - line 36 see page 78, paragraph 2 see page 84, line 31 - page 87, line 21 see page 90, line 6 - line 23 see figures 10,11,13,14B	1-7,25, 29, 32-35,60
Y	--- -/--	41

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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- *&* document member of the same patent family

Date of the actual completion of the international search

14 February 1996

Date of mailing of the international search report

10 -05- 1996

Name and mailing address of the ISA

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Authorized officer

HOORNAERT, P

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 95/02334

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>EP,A,0 165 744 (UK ATOMIC ENERGY AUTHORITY) 27 December 1985</p> <p>see abstract; claims 1,3,6-10; figures 1-3 see page 3, line 3 - line 9 see example 3 & GB,A,2 160 545 cited in the application</p>	<p>1-7, 25-27, 29, 32-35,60</p>
X	<p>EP,A,0 380 266 (ALCAN INT LTD) 1 August 1990</p> <p>see abstract; claims 1,4,6,9-11; figure 1 see page 2, line 15 - line 17 see page 3, line 3 - line 30 see page 4, line 4 - line 55 see example 3</p>	<p>1-8, 23-26, 29-35,60</p>
X	<p>EP,A,0 344 961 (ALCAN INT LTD) 6 December 1989</p> <p>see abstract; claims 1,5,6,8,11 see column 2, line 27 - column 3, line 19 see column 7, line 13 - line 27 see example 5</p>	<p>1-7, 25-27, 29-32</p>
P,X	<p>US,A,5 364 586 (TRUSOV) 15 November 1994</p> <p>see abstract; claims 1,3,11-19,21,24,32,33,39 see column 2, line 28 - line 36 see column 3, line 3 - line 13 see examples 1,3 & WO,A,95 05256</p>	<p>1-11,25, 26,29-31</p>
X	<p>US,A,4 888 114 (GADDIS) 19 December 1989</p> <p>see abstract; claims 1-3 see column 2, line 31 - line 34 see example 2</p>	<p>1-7,25, 26,29-31</p>
X	<p>FR,A,2 642 984 (METAFRAM) 17 August 1990</p> <p>see the whole document</p>	<p>1-7,25, 26,29-31</p>
X	<p>US,A,5 186 833 (MCHENRY) 16 February 1993</p> <p>see abstract; claims 1-6 see column 1, line 22 - line 25 see column 2, line 31 - line 64</p>	<p>1-7,25; 26,29-31</p>
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INTERNATIONAL SEARCH REPORT

I. International Application No
PCT/GB 95/02334

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB,A,2 267 838 (UK ATOMIC ENERGY AUTHORITY) 22 December 1993 see abstract; claims 1,4; figures see page 1, line 1 - page 2, line 16 see page 3, line 30 - page 5, line 28 -----	41

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB95/02334

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

See annex

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 fee, this Authority did not invite payment of any additional fee.

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.:

1-36, 72 ; 38-41, 43-59, 60, 61, 65 (part).

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/210

1. Claims: 1-36, 38-41 (insofar as dependent on claim 33), 43-59 (insofar as dependent on claim 33), 60 (insofar as it refers back to claim 33), 61 (insofar as it refers back to claim 9: see claim 68), 65 (insofar as it refers back to claim 9: see claim 68), 72
2. Claims: 37, 38-41 (insofar as dependent on claim 37), 43-59 (insofar as dependent on claim 37), 60 (insofar as it refers back to claim 37).
3. Claims: 42, 43-59 (insofar as dependent on claim 42), 60 (insofar as it refers back to claim 42)
4. Claims: 61-64
5. Claims: 65-67, 69
6. Claims: 70, 71

INTERNATIONAL SEARCH REPORT

 International Application No
 PCT/GB 95/02334

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0165744	27-12-85	AU-B- 573844	23-06-88
		AU-B- 4366185	02-01-86
		CA-A- 1256396	27-06-89
		DE-A- 3564968	20-10-88
		GB-A, B 2160545	24-12-85
		JP-C- 1807298	10-12-93
		JP-B- 5016891	05-03-93
		JP-A- 61011107	18-01-86
		US-A- 4624760	25-11-86
		-----	-----
GB-A-2160545	24-12-85	AU-B- 573844	23-06-88
		AU-B- 4366185	02-01-86
		CA-A- 1256396	27-06-89
		DE-A- 3564968	20-10-88
		EP-A, B 0165744	27-12-85
		JP-C- 1807298	10-12-93
		JP-B- 5016891	05-03-93
		JP-A- 61011107	18-01-86
		US-A- 4624760	25-11-86
		-----	-----
EP-A-0380266	01-08-90	AU-B- 4873790	09-08-90
		CA-A- 2008437	25-07-90
		CN-A- 1045232	12-09-90
		JP-A- 2245209	01-10-90
-----	-----	-----	-----
EP-A-0344961	06-12-89	AU-B- 610803	23-05-91
		AU-B- 3509389	30-11-89
		AU-B- 619549	30-01-92
		AU-B- 3509589	30-11-89
		CA-A- 1336872	05-09-95
		EP-A, B 0348041	27-12-89
		JP-A- 2099126	11-04-90
		JP-A- 2035917	06-02-90
		US-A- 5376442	27-12-94
		US-A- 4935139	19-06-90
-----	-----	-----	-----
US-A-5364586	15-11-94	AU-B- 7258594	14-03-95
		CA-A- 2169537	23-02-95
		WO-A- 9505256	23-02-95
-----	-----	-----	-----

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 95/02334

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9505256	23-02-95	US-A- 5364586	15-11-94
		AU-B- 7258594	14-03-95
		CA-A- 2169537	23-02-95

US-A-4888114	19-12-89	AU-B- 613789	08-08-91
		AU-B- 4128689	16-08-90
		CA-A- 1325389	21-12-93
		CN-B- 1020330	21-04-93
		EP-A- 0381812	16-08-90
		IL-A- 91578	31-07-94
		JP-A- 2233117	14-09-90

FR-A-2642984	17-08-90	NONE	

US-A-5186833	16-02-93	CA-A- 2078743	11-04-93
		EP-A- 0537943	21-04-93
		JP-A- 5192546	03-08-93

GB-A-2267838	22-12-93	AT-T- 132391	15-01-96
		AU-B- 4121693	23-12-93
		DE-D- 69301197	15-02-96
		EP-A- 0576157	29-12-93
		JP-A- 6055016	01-03-94
		US-A- 5342514	30-08-94
