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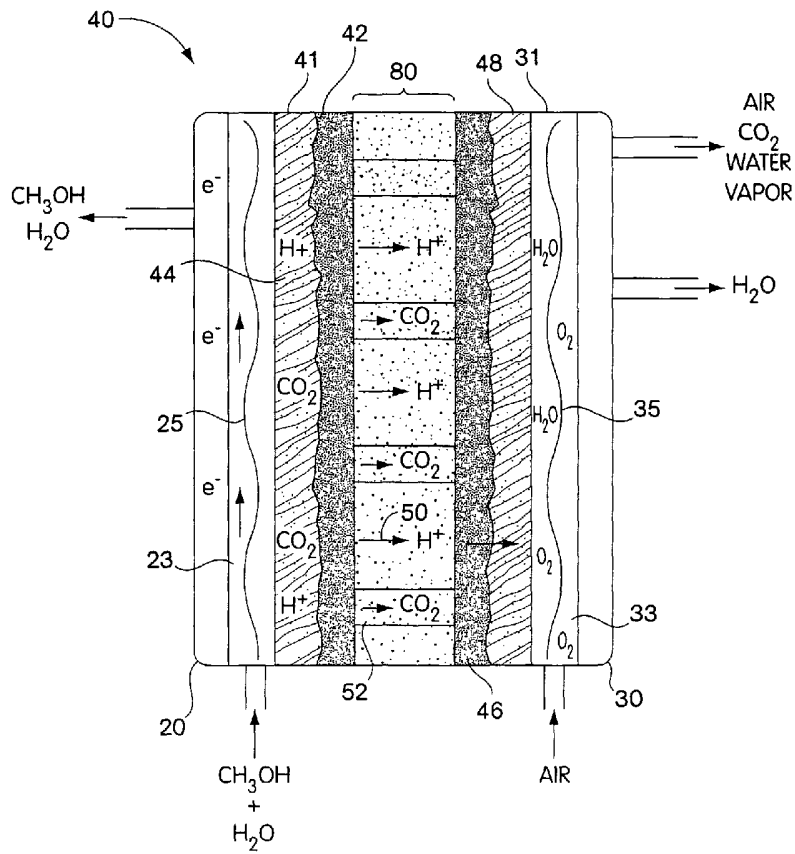
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[Continued on next page]

(54) Title: FUEL CELL MEMBRANE AND SYSTEM WITH INTEGRATED GAS SEPARATION



(57) Abstract: The present invention provides a protonically conductive membrane for use in a direct methanol fuel cell wherein a portion of said membrane conducts protons from the anode face of said membrane to the cathode face of said membrane, and a portion of which evolves gas from the anode side of said membrane to the cathode side of said membrane where it is vented to the environment. The present invention also includes a membrane electrode assembly, fuel cell and fuel cell system which are comprised of said protonically conductive membrane and which evolve gas from the anode side of said membrane to the cathode side of said membrane, where it is vented to the ambient environment. The first portion may comprise NAFION, perfluorosulfonic substituted PTFE, polyetheretherketone, polybenzimidazole, polyvaniladine fluoride. The second portion may comprise ZINTEX, expanded PTFE.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Classification No
PCT/US 01/45353A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01M8/10

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 7 H01M C08J H01B 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)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, CHEM ABS 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 89 06055 A (HUGHES AIRCRAFT CO) 29 June 1989 (1989-06-29) page 7, line 11 -page 8, line 20 page 9, line 8 - line 27 page 10, line 9 - line 18 page 11, line 12 - line 26 page 16, line 20 - line 34 --- -/--	1-4, 6-8, 15, 16, 24-28, 33-35, 38

 Further documents are listed in the continuation of box C. Patent family members are listed in 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 document 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.
- *G* document member of the same patent family

Date of the actual completion of the international search

18 July 2003

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INTERNATIONAL SEARCH REPORT

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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 97 41168 A (GORE & ASS) 6 November 1997 (1997-11-06) page 1, line 18 - line 23 page 4, line 10 - line 19 page 5, line 8 - line 15 page 5, line 32 - line 38 page 9, line 10 - line 24 page 12, line 8 -page 13, line 37 page 14, line 17 - line 21 page 16, line 13 - line 29; example 1 ---	1-7, 15-25
X	WO 92 07649 A (GORE & ASS ;DU PONT (US)) 14 May 1992 (1992-05-14) page 9, line 30 -page 10, line 3 page 10, line 23 -page 11, line 6 ---	1-7,15, 18-23
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 08, 6 October 2000 (2000-10-06) -& JP 2000 149965 A (TEIJIN LTD), 30 May 2000 (2000-05-30) abstract ---	1,2,4,7, 8,15,16, 25
A		33-35,38
A	WO 00 66652 A (LIN JUNG CHOU ;FENTON JAMES M (US); KUNZ H RUSSELL (US); CUTLIP MI) 9 November 2000 (2000-11-09) page 5, line 17 - line 19 page 7, line 19 -page 8, line 19 page 10, line 8 - line 14 page 11, line 16 - line 22 example 1 ---	1-5,7-9, 11-13, 15-18, 25,32, 33,35,38
A	J.C. LIN AND AL: "Preparation of high temperature composite membranes for hydrogen proton exchange membrane fuel cells" HAZARDOUS AND INDUSTRIAL WASTES, 1999, pages 65656-662, XP008019835 the whole document ---	1,9,10, 12
A	US 5 773 162 A (JEFFRIES-NAKAMURA BARBARA ET AL) 30 June 1998 (1998-06-30) the whole document -----	24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/45353

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:
see FURTHER INFORMATION sheet PCT/ISA/210

- 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:

- 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.:

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

Continuation of Box I.2

Present claims 1-23,25-40 relate to an extremely large number of possible membrane electrolyte. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, for only a very small proportion of the compounds claimed. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Consequently, the search has been carried out for those parts of the claims which appear to be supported and disclosed, namely those parts relating to the gas evolving, protonically conductive membrane electrolyte composed of 2 materials, the first being selected from perfluorosulfonic substituted polytetrafluoroethylene, Nafion-Teflon-phosphotungstic acid, Nafion-zirconium hydrogen phosphate, polyetheretherketone, polybenzimidazole, polyvinylidene fluoride and the second selected from Zintex or expanded PTFE (page 16-17 in the description).

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US01/45353

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Information on patent family members

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