Title: SOLID OXIDE FUEL CELL AND SYSTEM

Abstract: The solid oxide fuel cell (2) and system includes a textured electrolyte in one embodiment. In another embodiment, the solid oxide fuel cell system is used to drive refrigeration systems. The amount of electrical energy produced and the cooling capacity obtainable are well matched to electronic data center (6) power and cooling needs.
Published:
— with international search report

(88) Date of publication of the international search report:
25 March 2004

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 application No.
PCT/US03/04989

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H01M 8/04, 8/12
US CL. : 429/13, 26, 30
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)
U.S. : 429/12, 13, 26, 30, 31, 32

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)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<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>X</td>
<td>EP 0823742 A1 (SULZER INNOTEC AG) 11 February 1998, see Figs. 2 and 5; col. 3, lines 44-56.</td>
<td>6-8, 10, 11</td>
</tr>
<tr>
<td>X</td>
<td>US 2002/006538 A1 (STROEHLE et al) 17 January 2002, see Figure 1; paragraph 19.</td>
<td>6-8, 10, 11</td>
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<td>P, X</td>
<td>US 2002/0114985 A1 (SHKOLNIK et al) 22 August 2002, see the Figures; paragraph 22.</td>
<td>6-8, 10, 11</td>
</tr>
<tr>
<td>E, A</td>
<td>US 6,605,377 B1 (KIMBARA et al) 12 August 2003, see the abstract; col. 3, line 7.</td>
<td>1-11</td>
</tr>
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<td>E, A</td>
<td>JP 2003-083634 A (SEKISUI CHEM CO LTD) 19 March 2003, see abstract.</td>
<td>1-11</td>
</tr>
<tr>
<td>A</td>
<td>JP 06-101932 A (HITACHI LTD) 12 April 1994, see abstract; Figure 1.</td>
<td>1-11</td>
</tr>
</tbody>
</table>

☐ 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
  "E" earlier application or patent 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

"I" 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
04 September 2003 (04.09.2003)

Date of mailing of the international search report
25 SEP 2003

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
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Alexandria, Virginia 22313-1450
Facsimile No. (703)305-3230

Authorized officer
Kandy Malakowski
Telephone No. 308-0651

Form PCT/ISA/210 (second sheet) (July 1998)
## INTERNATIONAL SEARCH REPORT

### Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
   - because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim 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. ☐ Claim 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:

Please See Continuation Sheet

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<table>
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<tbody>
<tr>
<td>1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</td>
<td></td>
</tr>
<tr>
<td>2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.</td>
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</tr>
<tr>
<td>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.:</td>
<td></td>
</tr>
<tr>
<td>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.: 1-11</td>
<td></td>
</tr>
</tbody>
</table>

**Remark on Protest**

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

*Form PCT/ISA/210 (continuation of first sheet(1)) (July 1998)*
BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

I. Claims 1-11, drawn to a power generation system.
II. Claims 12-21, drawn to an electrolyte.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The claims of Group I require a heat pump, which is not required by Group II, and the claims of Group II require a non-uniform surface portion electrolyte, which is not required by Group I. Thus, there is no special technical feature that is shared by Groups I and II.

Continuation of B. FIELDS SEARCHED Item 3:
USPAT, USPGPUB, EPAB, JPAB, Derwent
search terms: fuel cell, solid oxide, sofoc, heat pump, absor*, cool*, computer, device, appliance