

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
4 September 2003 (04.09.2003)

PCT

(10) International Publication Number  
**WO 03/073529 A3**

(51) International Patent Classification<sup>7</sup>: **H01M 8/06**,  
F28C 1/00, F28D 5/00

(21) International Application Number: PCT/US03/05748

(22) International Filing Date: 24 February 2003 (24.02.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/358,907 22 February 2002 (22.02.2002) US

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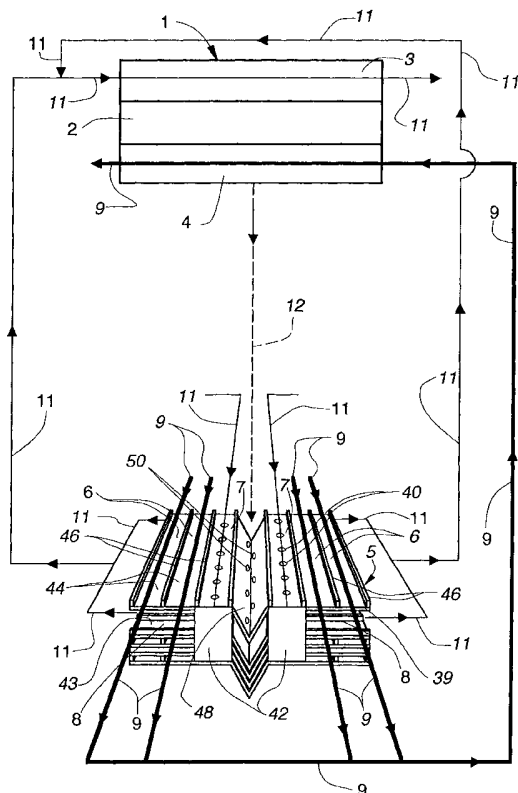
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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,  
SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC,  
VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: FUEL CELL SYSTEMS WITH EVAPORATIVE COOLING AND METHODS FOR HUMIDIFYING AND ADJUST-  
ING THE TEMPERATURE OF THE REACTANT STREAMS



(57) Abstract: A fuel cell (1) using fuel (11) and oxidant (9) resulting in the production of water (12) and heat in addition to electrical power. The fuel cell (1) employs an evaporative cooler (5) and has methods to adjust the moisture and temperature for the fuel (11) and oxidant (9) flows to improve the fuel cell efficiency. The water (12) produced by the fuel cell (1) is used to provide the water for the wet channels (8) of the evaporative cooler (5). The evaporative cooler (5) has separate product channels (6) and dry working channels (7) that are cooled by heat transfer across a heat exchanger plate (39). The heat exchanger plate (39) forms a part of each wet working channel (8) on the wet side (43) of the heat exchanger plate (39) and part of the product channel (6) and the dry working channel (7) on the dry side (44). The fuel (11) passes first through the dry working channel (7) then the wet working channel (8) becoming humidified by the evaporation therein and cooling the heat exchanger plate (39) before going to the anode (3) of the fuel cell (1). The oxidant (9) is cooled by passing through the product channel (6) before being directed to the cathode (4). In another embodiment, the evaporative cooler is incorporated with the fuel cell.



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**(88) Date of publication of the international search report:**

18 December 2003

**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*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/US03/05748

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : H01M 8/06; F28C 1/00; F28D 5/00

US CL : 429/17, 20, 26; 423/652; 62/121, 314

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. : 429/17, 20, 26; 423/652; 62/121, 314

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)

EAST

search terms: fuel cell, evaporative cooler, heat exchange

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,994,331 A (COHEN) 19 February 1991, col. 2, lines 15-64	1-37
A	US 4,795,683 A (McELROY) 03 January 1989, col. 3, lines 4-55, col. 4, lines 39-64	1-37
A	US 4,824,740 A (ABRAMS et al) 25 April 1989, col. 2, lines 4-63, col. 3, lines 15-65	1-37

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 28 SEPTEMBER 2003	Date of mailing of the international search report 21 OCT 2003
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