

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
26 May 2006 (26.05.2006)

PCT

(10) International Publication Number  
**WO 2006/055490 A3**

(51) International Patent Classification:  
**B41J 2/19** (2006.01)

(21) International Application Number:  
PCT/US2005/041191

(22) International Filing Date:  
15 November 2005 (15.11.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
10/990,789 17 November 2004 (17.11.2004) US

(71) Applicant (for all designated States except US): **DI-MATIX, INC.** [US/US]; 109 Etna Road, Lebanon, New Hampshire 03766 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HOISINGTON, Paul A.** [US/US]; 179 Beaver Meadow Road, Norwich, Vermont 05055 (US). **BATTERTON, John C.** [US/US]; 116 Boyer Lane, Los Gatos, California 95030 (US). **BIBL, Andreas** [US/US]; 588 Harrington Avenue, Los Altos, California 94024 (US). **WALSH, Brian** [US/US]; 52 Berrill Farms, Hanover, New Hampshire 03755 (US).

(74) Agents: **GAGEL, John J.** et al.; Fish & Richardson P.C., P.o. Box 1022, Minneapolis, Minnesota 55440-1022 (US).

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

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

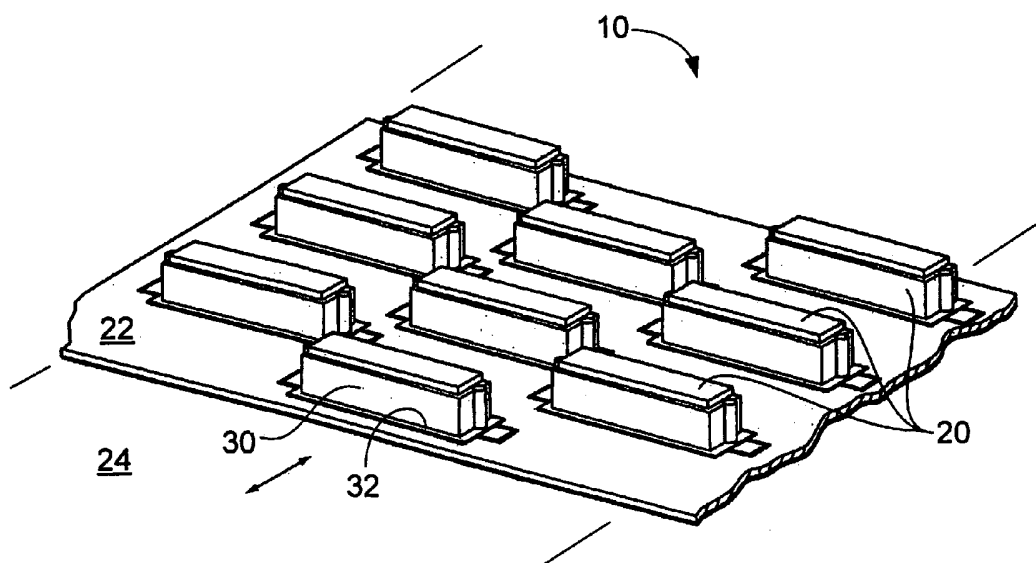
**Published:**

- 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

(88) Date of publication of the international search report:  
28 December 2006

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.

(54) Title: PRINthead



(57) Abstract: Devices used to degas and eject fluid drops are disclosed. Devices include a flow path (40) that includes a pumping chamber (80) in which fluid is pressurized for ejection of a fluid drop, and a semi-permeable membrane (50) including an inorganic material having an outer surface (52) positioned in fluid contact with the flow path. The membrane allows gases to pass therethrough, while preventing liquids from passing therethrough.

WO 2006/055490 A3

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2005/041191

## A. CLASSIFICATION OF SUBJECT MATTER

INV. B41J2/19

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)  
B41J

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)

EP0-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 701 148 A (MOYNIHAN ET AL) 23 December 1997 (1997-12-23)	1-9,12
A	column 5, lines 38-53; figure 1	10,11
Y	US 6 660 648 B1 (GALAMBOS PAUL CHARLES ET AL) 9 December 2003 (2003-12-09)	1-9,12
A	column 2, line 41 - column 4, line 6; figures 1,2	10,11
Y	US 4 788 556 A (HOISINGTON ET AL) 29 November 1988 (1988-11-29)	1-9
	column 3, line 9 - column 4, line 13; figure 2	
	----- -/-	

☒ 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 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.

"&" document member of the same patent family

Date of the actual completion of the international search

29 June 2006

Date of mailing of the international search report

06. 11. 2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Kulhanek, Peter

# INTERNATIONAL SEARCH REPORT

International application No

PCT/US2005/041191

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>PATENT ABSTRACTS OF JAPAN  vol. 010, no. 174 (M-490),  19 June 1986 (1986-06-19)  &amp; JP 61 024458 A (NIPPON DENKI KK),  3 February 1986 (1986-02-03)  abstract</p> <p>-----</p>	1-9

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2005/041191

### Box 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. ☐ 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 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:

see additional sheet

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.:

1-12

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

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-12

A drop ejector system having a membrane comprising a semi-permeable nitride positioned in fluid contact with a flow path

---

2. claims: 13-22

A drop ejector system having a membrane with a certain permeability positioned in fluid contact with a flow path

---

3. claims: 23-32

~~A drop ejector system having a membrane with fractures of a certain size positioned in fluid contact with a flow path~~

---

4. claims: 33-38

A drop ejector system having a membrane comprising an inorganic material formed by exposure to plasma and said membrane being positioned in fluid contact with a flow path

---

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2005/041191

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5701148	A	23-12-1997	US 5640184 A	17-06-1997
			US 5605659 A	25-02-1997
-----				
US 6660648	B1	09-12-2003	NONE	
-----				
US 4788556	A	29-11-1988	BR 8807029 A	17-10-1989
			CA 1304009 C	23-06-1992
			DE 3881475 T2	13-01-1994
			EP 0313598 A1	03-05-1989
			JP 8018434 B	28-02-1996
			JP 1502504 T	31-08-1989
			WO 8808515 A1	03-11-1988
-----				
JP 61024458	A	03-02-1986	NONE	
-----				