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(71) Applicant (for all designated States except US): **PRAXAIR TECHNOLOGY, INC.** [US/US]; 39 Old Ridgebury Road, Danbury, CT 06810 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SARIGIANNIS, Demetrius** [US/US]; 21 Parkview Drive, Grand Island, NY 14072 (US). **HOOVER, Cynthia, A.** [US/US]; 279 Forest Creek Lane, Grand Island, NY 14072 (US). **KRAUSE, Michael, Joseph** [US/US]; 37 Braunview Way, Orchard Park, NY 14127 (US). **PRYOR, Edward** [US/US]; 4531 Laurie Michelle, San Antonio, TX 78261(US). **CHESTERS, Stephen** [US/US]; 1502 Constellation Drive, Allen, TX 75013 (US). **SPOHN, Ronald** [US/US]; 112 Woodshire South, Getzville, NY 14068 (US).(74) Agent: **SCHWARTZ, Iurie, A.**; Praxair, Inc., 39 Old Ridgebury Road, Danbury, CT 06810 (US).

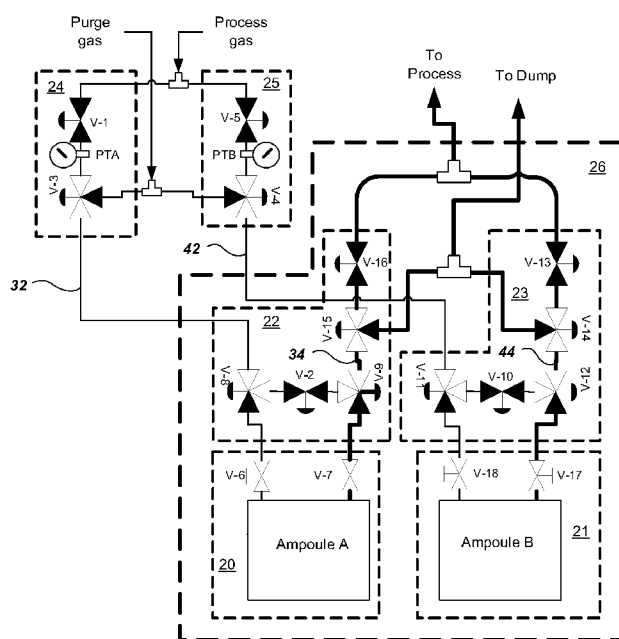
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[Continued on next page]

(54) Title: MULTIPLE AMPOULE DELIVERY SYSTEMS

Fig. 1



(57) Abstract: This invention relates to an integrated vapor or liquid phase reagent dispensing apparatus having a plurality of vessels and a plurality of carrier or inert gas feed/vapor or liquid phase reagent delivery manifolds, that may be used for continuously dispensing vapor or liquid phase reagents such as precursors for deposition of materials in the manufacture of semiconductor materials and devices.



OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/033865

A. CLASSIFICATION OF SUBJECT MATTER

INV. C23C16/448

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)

C23C

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, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2006/065627 A2 (PRAXAIR TECHNOLOGY INC [US]; PETERS DAVID WALTER [US]) 22 June 2006 (2006-06-22) figure 1	1,3-6,8, 10
Y	EP 0 555 614 A1 (IBM [US]) 18 August 1993 (1993-08-18) figure 5	1,3-8,10
Y	US 5 186 120 A (OHNISHI HIROSHI [JP] ET AL) 16 February 1993 (1993-02-16) the whole document	1,3-8,10
Y	US 6 432 205 B1 (LEE KYU HONG [KR] ET AL) 13 August 2002 (2002-08-13) the whole document	1,3-8,10
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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

15 July 2009

Date of mailing of the international search report

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Name and mailing address of the ISA/

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

Authorized officer

Brisson, Olivier

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/033865

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 280 012 A (KIRLIN PETER S [US] ET AL) 18 January 1994 (1994-01-18) the whole document figures 4-5 -----	1,3-8,10
Y	WO 2007/085928 A2 (AIR LIQUIDE [FR]; ZNAMENSKY DMITRY [US]) 2 August 2007 (2007-08-02) the whole document -----	1,3-8,10
Y	WO 03/016590 A2 (INFINEON TECHNOLOGIES AG [DE]; KOGLER RUDOLF [AT]; SCHOENHERR HELMUT []) 27 February 2003 (2003-02-27) the whole document -----	1,3-8,10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/033865

Box No. 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 No. 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 fees, this Authority did not invite payment of additional fees.
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.:

see additional sheet(s)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ 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, 8(completely); 3-7, 10(partially)

An integrated vapor phase reagent dispensing apparatus comprising a plurality of vessels having on the top a carrier gas feed inlet opening through which carrier gas can be fed into said inner gas volume above the fill level to cause vapor of said source chemical to become entrained in said carrier gas to produce vapor phase reagent; and also on the top a vapor phase reagent outlet opening through which said vapor phase reagent can be dispensed from said vessels. A method for delivery of a vapor phase reagent to a deposition chamber making use of such an apparatus.

2. claims: 2, 9(completely); 3-7, 10(partially)

An integrated vapor phase reagent dispensing apparatus comprising a plurality of vessels having on the top a carrier gas feed inlet opening comprising a bubbler tube that extends through the inner gas volume into the source chemical and through which said carrier gas can be bubbled into the source chemical to cause at least a portion of source chemical vapor to become entrained in said carrier gas to produce a flow of vapor phase reagent to said inner gas volume above the fill level, said bubbler tube having an inlet end adjacent to the top and an outlet end adjacent to the bottom of the vessels and also on the top a vapor phase reagent outlet opening through which said vapor phase reagent can be dispensed from said vessels. A method for delivery of a vapor phase reagent to a deposition chamber making use of such an apparatus.

3. claims: 11-15

An integrated liquid phase reagent dispensing apparatus comprising a plurality of vessels having on the top a carrier gas feed inlet opening through which carrier gas can be fed into said inner gas volume above the fill level to pressurize the inner gas volume above the fill level; and also on the top a liquid phase reagent outlet opening comprising a dip tube that extends through the inner gas volume into the source chemical and through which liquid phase reagent can be dispensed from said apparatus. A method for delivery of a liquid phase reagent to a deposition chamber making use of such an apparatus.

4. claims: 16-20

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

An integrated vapor phase reagent dispensing apparatus comprising a plurality of vessels having on the top a vapor phase reagent outlet opening through which a vapor phase reagent can be dispensed from said vessel. A method for delivery of a vapor phase reagent to a deposition chamber making use of such an apparatus.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/033865

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