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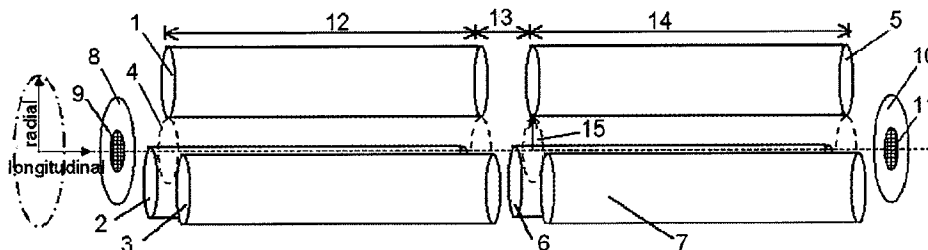
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(54) Title: PHASE SHIFT RF ION TRAP DEVICE

FIG. 1



(57) Abstract: The present invention provides a novel ion trap which comprises at least two ion guides (12, 14) separated by a gap (13). Each ion guide (12, 14) consists of three or more rod-like electrodes (1, 2, 3, 5, 6, 7) and phase-delayed radio frequency (RF) voltage is applied to these electrodes. Ions can be focused to a small gap space with high efficiency of ion accumulation.



WO 2009/037598 A3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER		
Int.Cl. H01J49/42 (2006.01) i		
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)		
Int.Cl. H01J49/42		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2009 Registered utility model specifications of Japan 1996-2009 Published registered utility model applications of Japan 1994-2009		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
Science Direct, IEEE Xplore, CiNii, ACS PUBLICATIONS, JSTPlus(JDreamII), JST7580(JDreamII)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-263970 A (Tsutomu Masujima) 2003.09.19, [0012], [0019], Fig.3,8 (No Family)	1-30
Y	WO 2007/027764 A1 (ROCKEFELLER UNIVERSITY) 2007.03.08, the whole document & US 2007/0045533 A1 & EP 1928582 A & WO 2007/027764 A2 & CA 2620608 A	1-30
Y	US 2006/0163472 A1 (Varian, Inc.) 2006.07.27, [0012] & EP 1856715 A & JP 2008-529219 A & US 2006/0163472 A1 & WO 2006/081075 A2	19
Y	JP 2003-115278 A (NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY) 2003.04.18, the whole document (No Family)	21
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> 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 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		
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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.
Y	JP 11-510946 A (MDS HEALTH GROUP LIMITED) 1999.09.21, the whole document & US 5847386 A & EP 843887 A & WO 1997/007530 A1 & AU 6653296 A & CA 2229070 A	25
Y	JP 2005-093152 A (Hitachi High-Technologies Corporation) 2005.04.07, the whole document (No Family)	26
Y	JP 11-513838 A (CALIFORNIA INSTITUTE OF TECHNOLOGY) 1999.11.24, the whole document & US 5596193 A & GB 2321131 A & WO 1997/014174 A1 & DE 19681632 T & AU 7515996 A	30
A	WO 2005/074004 A1 (THERMO FINNIGAN LLC) 2005.08.11, [0014], [0027] & JP 2007-524202 A & US 2005/0263695 A1 & EP 1706890 A & CA 2550029 A	1-30
A	JP 2004-520685 A (UNIVERSITY OF WARWICK) 2004.07.08, the whole document & US 2004/0046124 A1 & GB 2373630 A & EP 1336192 A & WO 2002/043105 A1 & AU 2308602 A	1-30
A	WO 2006/098230 A1 (SHIMADZU Corporation) 2006.09.21, the whole document (No Family)	1-30
A	Gary Abdiel Salazar, Tsutomu Masujima, "Computer Simulations of a New Three Rods Ion Optic(TRIPOLE) with High Focusing and Mass Filtering Capabilities", Journal of the American Society for Mass Spectrometry, 2007.03.03, Volume 18, Issue 3, pages 413-421	1-30
T, A	Gary A. Salazar, Tsutomu Masujima, "Computer Simulation of Gap-Tripole Ion Trap with Linear Injection, 3D Ion Accumulation, and Versatile Packet Ejection", Journal of the American Society for Mass Spectrometry, 2008.09, Volume 19, Issue 9,, Pages 1367-1374	1-30

INTERNATIONAL SEARCH REPORT

International application No.

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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:

The "special technical features" of claim 1 relates to a RF ion trap comprising at least two RF ion guides which are supplied with phase-delayed RF voltage, while the "special technical features" of claim 28 relates to a RF ion trap whose pseudo-potential forces the electrically charged particles into a center of the trap.

There is no technical relationship among those inventions involving one or more of the same or corresponding technical features. Therefore, these groups of inventions are not so linked as to form a single general inventive concept.

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 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.:

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.