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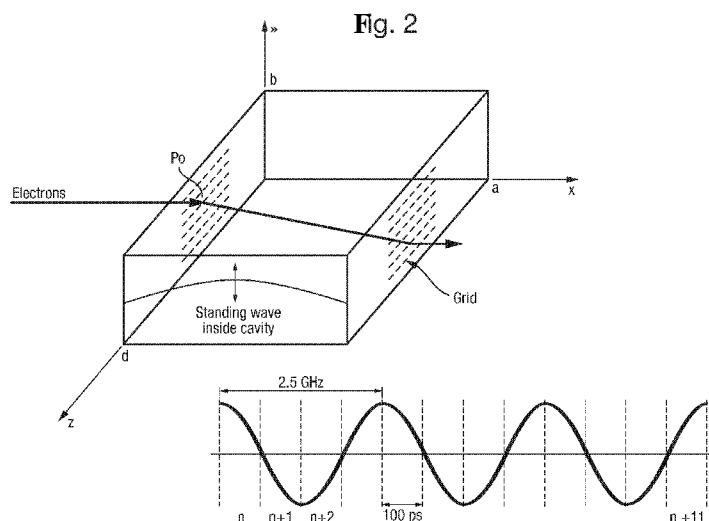
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(54) Title: MICROWAVE CAVITY RESONATOR DETECTOR



(57) Abstract: An ion detector system for a mass spectrometer is disclosed comprising a first device arranged and adapted to receive ions and emit or output first electrons and a microwave cavity resonator arranged and adapted to deflect the first electrons onto a first detector.



WO 2015/082939 A3

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/053627

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01J49/02 H01J49/40 H01J40/00
ADD.

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)
H01J

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	wo 2012/010894 AI (ISIS INNOVATION [GB] ; BROUARD MARK [GB] ; VALLANCE CLAIRE [GB] ; NOMEROT) 26 January 2012 (2012-01-26) cited in the appl icati on page 1, line 1 - page 3, line 9; figures 1,2,6 -----	1-41, 53-61
A	US 2009/272890 AI (OGAWA KIYOSHI [JP] ET AL) 5 November 2009 (2009-11-05) abstract; figures 1,5 -----	1-41, 53-61
A	US 2012/074313 AI (BLICK ROBERT H [US] ET AL) 29 March 2012 (2012-03-29) paragraphs [0005] - [0026] ; f i g u r e s 1,2 ----- - / - -	1-41, 53-61



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 but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

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"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

25 August 2015

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/053627

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Introduction to Mass Spectrometry", Chapter 2 The Mass Spectrometer ED - Watson J Throck ; Sparkman Orri n Davi d", 1 January 2007 (2007 -01 -01), INTRODUCTION TO MASS SPECTROMETRY : INSTRUMENTATION, APPLICATIONS, AND STRATEGIES FOR DATA INTERPRETATION, WILEY, CHICHESTER [U.A] , PAGE(S) 53 - 172, XP002740945 , ISBN: 978 -0-470-5 1634 - 8	42 , 50 -52
A	page s 74 , 75 , page s 139 - 145 -----	43 -49

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2014/053627

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.:

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: 1-41, 53-61

An ion or photon detector comprising a first device arranged and adapted to receive ions or photons and emit or output first electrons; and
a microwave cavity resonator arranged and adapted to deflect said first electrons onto a first detector.

2. claims: 42-52

A time of flight mass analyser comprising: a time of flight region; one or more orthogonal acceleration electrodes for orthogonally accelerating ions into said time of flight region; a first device configured to apply a voltage pulse to one or more orthogonal acceleration electrodes to orthogonally accelerate ions into the time of flight region; and a second device arranged and adapted to generate a beam of first electrons based on a timing of the voltage pulse applied to the one or more orthogonal acceleration electrodes and/or on a timing that ions are orthogonally accelerated into said time of flight region.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report			Publication date	Patent family member(s)			Publication date
wo	2012010894	AI	26-01-2012	EP	2596518	AI	29-05-2013
				US	2013187041	AI	25- 07-2013
				WO	2012010894	AI	26- 01-2012

US	2009272890	AI	05-11--2009	JP	4973659	B2	11--07--2012
				US	2009272890	AI	05- 11--2009
				WO	2007138679	AI	06- 12--2007

us	2012074313	AI	29-03--2012	NONE			
