

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
24 December 2008 (24.12.2008)

PCT

(10) International Publication Number  
**WO 2008/156361 A3**

(51) International Patent Classification:

*H01J 35/04* (2006.01)      *H01J 35/16* (2006.01)  
*H01J 35/08* (2006.01)      *H01J 35/32* (2006.01)  
*H01J 35/14* (2006.01)

(21) International Application Number:

PCT/NL2008/050400

(22) International Filing Date: 19 June 2008 (19.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

07110601.7      19 June 2007 (19.06.2007)      EP

(71) Applicant (for all designated States except US): **NED-ERLANDSE ORGANISATIE VOOR TOEGEPAST-NATUURWETENSCHAPPELIJK ONDERZOEK TNO** [NL/NL]; Schoemakerstraat 97, NL-2628 VK Delft (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GUBBELS, Godefridus Hendricus Maria** [NL/NL]; Rupelstraat 64, NL-5704 AX Helmond (NL). **SIMONIS, Frank** [NL/NL]; De Korenaar 83, NL-5688 RX Oirschot (NL).

(74) Agent: **HATZMANN, M.J.**; Vereenigde, Johan de Witt-  
laan 7, NL-2517 JR Den Haag (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, 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:  
5 March 2009

(54) Title: MINIATURE X-RAY SOURCE WITH GUIDING MEANS FOR ELECTRONS AND / OR IONS

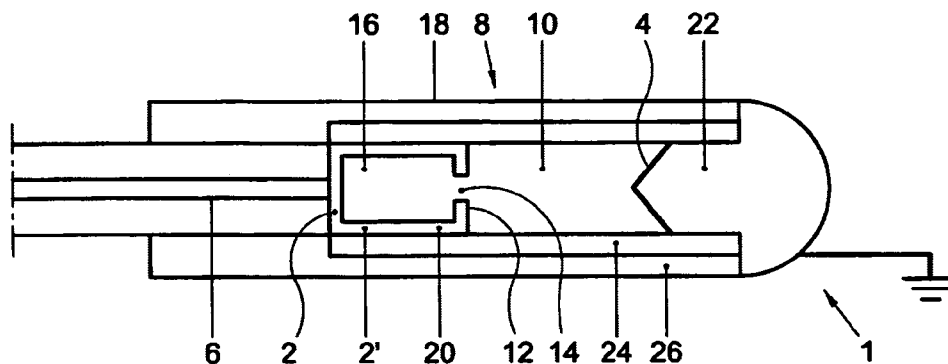


Fig. 1a

(57) Abstract: The invention relates to a miniature X-ray source comprising a vacuum tube containing a cathode and an anode spaced apart from each other, and guiding means for guiding electrons and/or ions to prevent the electrons and/or ions from impacting at least a part of a wall of the vacuum tube, e.g. at the wall of the vacuum tube in a region of the vacuum tube where, in use, an electric field is present.

WO 2008/156361 A3

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/NL2008/050400

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. H01J35/04 H01J35/08 H01J35/14 H01J35/16 H01J35/32

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)  
H05G G21K 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 practical, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 03/006108 A (MEDTRONIC AVE INC [US]) 23 January 2003 (2003-01-23)  page 3, lines 17-29 page 6, line 27 - page 7, line 23 page 10, line 29 - page 12, line 12 figures 2,5,6	1,2,6, 9-11, 14-16,19
X	US 6 134 300 A (TREBES JAMES E [US] ET AL) 17 October 2000 (2000-10-17) abstract column 5, line 49 - column 6, line 31 figure 1	1,2,6,9, 14,15

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.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

26 January 2009

Date of mailing of the international search report

03/02/2009

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

Angloher, Godehard

## INTERNATIONAL SEARCH REPORT

International application No

PCT/NL2008/050400

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/105332 A (MOXTEK INC [US]; BARD ERIK [US]; JENSEN CHARLES [US]; REYES ARTURO [US]) 5 October 2006 (2006-10-05) abstract page 6, line 18 - page 7, line 17 page 10, line 32 - page 11, line 6 figure 1	1,2,6,9, 14
X	----- US 2003/021377 A1 (TURNER CLARK [US] ET AL) 30 January 2003 (2003-01-30) abstract paragraphs [0035] - [0055] figures 1-3	1-4,6-9, 14
X	----- SU 1 602 381 A1 (MISHCHENKO YU V [RU]; PETUKHOV V G [RU]; OVCHARENKO A A [RU]; GRIGOREV) 30 May 1994 (1994-05-30) abstract figure 1 see DERWENT abstract -& DATABASE WPI Week 199507 Thomson Scientific, London, GB; AN 1995-049977 XP002456458 & SU 1 602 381 A1 (MISHCHENKO YU V) 30 May 1994 (1994-05-30) abstract	1-9,11
X	----- WO 97/07740 A (INTERVENTIONAL INNOVATIONS COR [US]) 6 March 1997 (1997-03-06) page 7, line 4 - page 8, line 24 page 12, lines 1-15 figures 1A,3A,3B	1,3,6,9, 14-18
X	----- US 5 090 043 A (PARKER WILLIAM J [US] ET AL) 18 February 1992 (1992-02-18) column 2, lines 2-4 column 9, lines 41-43 figure 8H(a)	1,2,6,9, 14,15

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NL2008/050400

## 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.:  
  
1-11, 14-19
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: 1-11

features of claim 1;  
electrons / ions are prevented from impacting the wall in a region where an electric field is present (in use)  
---

2. claims: 1,12,13,24

features of claim 1;  
cold cathode comprising carbon nanotubes  
---

3. claims: 1,14-19

features of claim 1;  
vacuum tube at least partially made of electrically isolating material  
---

4. claims: 1,20

features of claim 1;  
outside surface of triple junctions provided with conducting layer  
---

5. claims: 1,21

features of claim 1;  
inside and / or outside of vacuum tube provided with high resistivity coating connected to anode and cathode  
---

6. claims: 1,22

features of claim 1;  
anode has flat X-ray emitting surface  
---

7. claims: 1,23

features of claim 1;  
dual layer anode  
---

8. claims: 1,25

features of claim 1;  
anode displaceably located with respect to exit window  
---

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

9. claims: 1,26

features of claim 1;  
cylindrical X-ray source with diameter of 1 - 2.5 mm and  
length of 2 - 3 cm  
---

10. claims: 1,27

features of claim 1;  
cooling means at least for anode  
---

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/NL2008/050400
---

Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
WO 03006108	A	23-01-2003	EP 1407469 A2	14-04-2004
			JP 2005501579 T	20-01-2005
			US 2003012339 A1	16-01-2003
US 6134300	A	17-10-2000	NONE	
WO 2006105332	A	05-10-2006	EP 1864311 A2	12-12-2007
			JP 2008535183 T	28-08-2008
			KR 20070114741 A	04-12-2007
			US 2007025516 A1	01-02-2007
US 2003021377	A1	30-01-2003	EP 1412961 A2	28-04-2004
			JP 2005523558 T	04-08-2005
			WO 03012816 A2	13-02-2003
SU 1602381	A1	30-05-1994	NONE	
WO 9707740	A	06-03-1997	AU 6857796 A	19-03-1997
			EP 0847249 A1	17-06-1998
			US 6799075 B1	28-09-2004
US 5090043	A	18-02-1992	EP 0560906 A1	22-09-1993
			JP 6502559 T	24-03-1994
			WO 9209998 A1	11-06-1992
			US RE34421 E	26-10-1993