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- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

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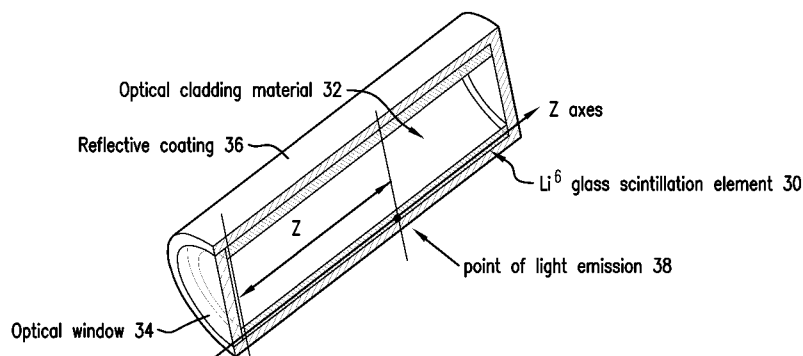


FIG. 5

(57) Abstract: A scintillation detector includes: a photodetector; a scintillating material configured to emit light in response to exposure to ionization particles; an optically transparent material having a light absorption coefficient that is less than a light absorption coefficient of the scintillating material, the optically transparent material optically coupled to a surface of the scintillating material and configured to transmit the emitted light; and a reflective material at least partially surrounding the scintillating material and the optically transparent material, the reflective material configured to reflect the emitted light and direct the emitted light toward the photodetector.



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/041237**A. CLASSIFICATION OF SUBJECT MATTER***G01V 11/00(2006.01)i, G01V 8/10(2006.01)i, G01V 5/14(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)

G01V 11/00; G06F 15/00; G01B 5/28; G01V 5/04; H01L 31/18; G01V 5/10; G01V 5/00; G01T 1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: neutron, gamma, photodetector, scintillation, detector, reflective

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6639210 B2 (ODOM et al.) 28 October 2003 See column 7 line 23-column 8 line 33, claim 1 and figure 1a.	1-21
A	US 2008-0191138 A1 (KASTALSKY et al.) 14 August 2008 See paragraph 0010, claim 1 and figure 2a.	1-21
A	US 2005-0258371 A1 (STEIN et al.) 24 November 2005 See paragraphs 0045,0050, claim 1 and figure 1.	1-21
A	US 2011-0029246 A1 (NIKITIN et al.) 03 February 2011 See paragraphs 0040,0052, claim 1 and figures 3,8A,8B.	1-21
A	US 4136278 A (OLIVER, DONALD W.) 23 January 1979 See claim 1 and figure 1.	1-21

 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

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"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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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6639210 B2	28.10.2003	CA 2375604 A1	14.09.2002
		CA 2375604 C	15.02.2011
		CA 2722199 A1	14.09.2002
		US 2002-0130258 A1	19.09.2002
US 2008-0191138 A1	14.08.2008	None	
US 2005-0258371 A1	24.11.2005	CA 2566008 A1	08.12.2005
		CA 2566008 C	05.07.2011
		CN 1989422 A	27.06.2007
		CN 1989422 B	08.09.2010
		EP 1668319 A1	14.06.2006
		EP 1668319 B1	23.04.2008
		EP 1747482 A1	31.01.2007
		IL 179147 D0	08.03.2007
		IL 201969 A	30.12.2010
		JP 2007-536532 A	13.12.2007
		JP 4658121 B2	23.03.2011
		US 2006-0225296 A1	12.10.2006
		US 2007-0210247 A1	13.09.2007
		US 2010-0001201 A1	07.01.2010
		US 7293366 B2	13.11.2007
		US 7485868 B2	03.02.2009
		US 7592587 B2	22.09.2009
US 7642518 B1	05.01.2010		
WO 2005-038406 A1	28.04.2005		
WO 2005-116692 A1	08.12.2005		
US 2011-0029246 A1	03.02.2011	GB 2484621 A	18.04.2012
		WO 2011-014538 A2	03.02.2011
		WO 2011-014538 A3	05.05.2011
US 4136278 A	23.01.1979	None	