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11152853.5 1 February 2011 (01.02.2011) EP(71) Applicant (for all designated States except DE, US):
KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).(71) Applicant (for DE only): **PHILIPS INTELLECTUAL PROPERTY & STANDARDS GMBH** [DE/DE]; Lübeckertordamm 5, 20099 Hamburg (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **RÖSSL, Ewald** [AT/DE]; c/o High Tech Campus Building 44, NL-5656 AE Eindhoven (NL). **KOEHLER, Thomas** [DE/DE]; c/o High Tech Campus Building 44, NL-5656 AE Eindhoven (NL).(74) Agents: **VAN VELZEN, Maaïke, M.** et al.; High Tech Campus 44, NL-5656 AE Eindhoven (NL).

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(88) Date of publication of the international search report:
1 November 2012

(54) Title: DIFFERENTIAL PHASE-CONTRAST IMAGING WITH FOCUSING DEFLECTION STRUCTURE PLATES

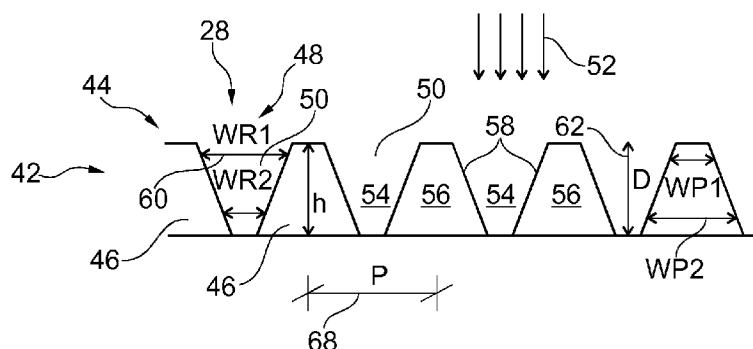


Fig. 3

(57) Abstract: The present invention relates to X-ray differential phase-contrast imaging, in particular to a deflection device for X-ray differential phase-contrast imaging. In order to provide differential phase-contrast imaging with improved dose efficiency, a deflection device (28) for X-ray differential phase-contrast imaging is provided, comprising a deflection structure (41) with a first plurality (44) of first areas (46), and a second plurality (48) of second areas (50). The first areas are provided to change the phase and/or amplitude of an X-ray radiation; and wherein the second areas are X-ray transparent. The first and second areas are arranged periodically such that, in the cross section, the deflection structure is provided with a profile arranged such that the second areas are provided in form of groove-like recesses (54) formed between first areas provided as projections (56). The adjacent projections form respective side surfaces (58) partly enclosing the respective recess arranged in between. The side surfaces of each recess have a varying distance (60) across the depth (62) of the recess.



INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2012/050418

A. CLASSIFICATION OF SUBJECT MATTER

INV. G21K1/06
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)

G21K

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.
X	WO 2010/082688 A2 (CANON KK [JP]; MUKAIDA TAIHEI [JP]; TAKADA KAZUHIRO [JP]; FUKUDA KAZUN) 22 July 2010 (2010-07-22) paragraphs [0014], [0064]; figure 4 -----	1,3,6,7



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

"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

8 May 2012

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13/08/2012

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

Oestreich, Sebastian

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2012/050418

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.:

1, 2(completely); 3-7, 9-15(partially)

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, 2(completely); 3-7, 9-15(partially)

Deflection device for X-ray differential phase contrast imaging with a periodical structure in which Every period of the deflection structure is adapted to function as a micro-lens focusing x-ray radiation such that at a distance from the micro-lens structure, intensity maxima are obtained.

2. claims: 5-7, 9-13(all partially)

Deflection device for X-ray differential phase contrast imaging with a periodical structure in which the profile has a discretized shape.

3. claims: 8(completely); 9-15(partially)

Periodical structure with opaque areas and transparent fillings between these areas which have a wider cross section than the opaque areas.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2012/050418

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010082688 A2	22-07-2010	CN 102272860 A	07-12-2011
		DE 112010000789 T5	19-07-2012
		GB 2479328 A	05-10-2011
		JP 2011125668 A	30-06-2011
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