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(54) Title: A PLASMA LIGHT SOURCE WITH LOW METAL HALIDE DOSE

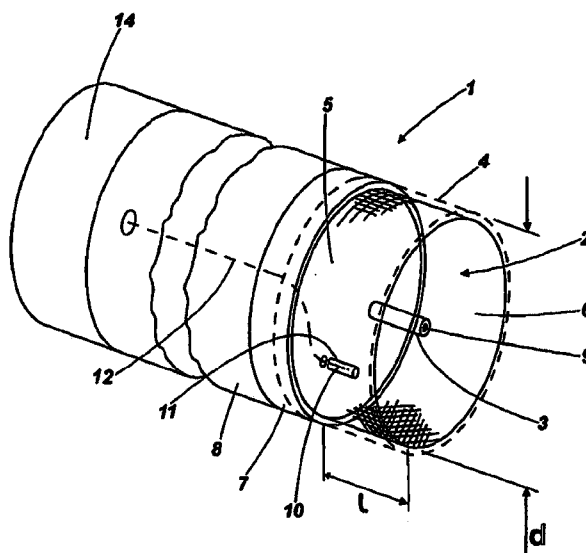


Figure 3 (Fig. 1 of WO2010/133822)

(57) Abstract: A low-dose, preferably unsaturated, fill of microwave excitable material 9, including one metal halide in a noble gas with an optional mercury buffer, is contained in a plasma crucible 2 to form a light emitting plasma therein.

Published:

- *with international search report (Art. 21(3))*
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(88) Date of publication of the international search report:

23 January 2020 (23.01.2020)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2019/051603

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01J61/12 H01J61/20 H01J65/04
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, 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	US 5 382 873 A (SCHOLL ROBERT PETER [NL] ET AL) 17 January 1995 (1995-01-17) abstract column 1, line 67 - column 2, line 50 column 3, line 19 - column 4, line 38; tables 2,4 column 5, lines 8-39; figure 1 -----	1,4,7, 9-11, 14-18
X	US 2010/060165 A1 (VRUGT PETER JOZEF [NL] ET AL) 11 March 2010 (2010-03-11) abstract paragraphs [0009], [0024] - [0032], [0034], [0038], [0042] - [0043], [0051], [0055]; figures 1,2 ----- -/--	1-4,7, 9-11, 13-18



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

20 September 2019

Date of mailing of the international search report

17/12/2019

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2019/051603

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.:

1-4, 7, 9-11, 14-18(completely); 13(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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2019/051603

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 587 238 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]) 16 March 1994 (1994-03-16) abstract column 10, lines 12-50; figure 1 -----	1
A	WO 2005/088675 A1 (KONINKL PHILIPS ELECTRONICS NV [NL] ET AL.) 22 September 2005 (2005-09-22) abstract page 5, line 3 - page 6, line 3; figures 1,2 tables I,II,II page 10, lines 1-17 -----	1
A	EP 0 215 524 A1 (PHILIPS NV [NL]) 25 March 1987 (1987-03-25) abstract page 9, line 8 - page 10, line 7; figure 1 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2019/051603

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5382873	A	17-01-1995	CN 1074554 A 21-07-1993
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4, 7, 9-11, 14-18(completely); 13(partially)

A plasma light source comprising a lucent envelope or a lucent crucible having a sealed void containing material excitable as a plasma, including one metal halide and an inert gas; the metal halide together being provided in a concentration in use of less than 5.0×10^{-6} mol/cm of an inner wall-to-wall distance within the void with electrical energy being applied to excite the discharge with its electric field being in the direction of the wall-to-wall distance (claim 1), wherein the concentration of halide is such that the vapour within the void is unsaturated in use (claim 2), or wherein there is no pool of excitable material in use (claim 3).

2. claims: 5, 6(completely); 8(partially)

A plasma light source as claimed in claim 1, wherein the lucent envelope is a lucent tube sealed at its ends to provide the sealed void, the length of the tube being in the direction of the wall-to-wall distance (claim 4), wherein the lucent envelope is provided within a central longitudinal bore in a separate lucent body (claims 5-6; claim 8 when dependent thereon).

3. claim: 8(partially)

A plasma light source as claimed in claim 1, wherein the lucent crucible is a body of lucent material having a sealed, central longitudinal bore which provides the sealed void, the length of the bore being in the direction of the wall-to-wall distance (claim 7), wherein the crucible or lucent body is enclosed by an HF electromagnetic-wave-enclosing Faraday cage surrounding the crucible on an outside and an end thereof and being at least partially light transmitting for light exit from the plasma crucible, the arrangement being such that light from a plasma in the void can pass through the plasma crucible and radiate from it via the cage.

4. claim: 12

A plasma light source as claimed in claim 1, wherein the halide is chosen from fluorides and the lucent envelope or crucible is ceramic material.

5. claim: 13(partially)

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A plasma light source as claimed in claim 1, wherein the halide is chosen from the halides of Al, As, Bi, Cd, Ga, Ge, Nb, Pb, Sb, Sn, Ti, V, Zn.
