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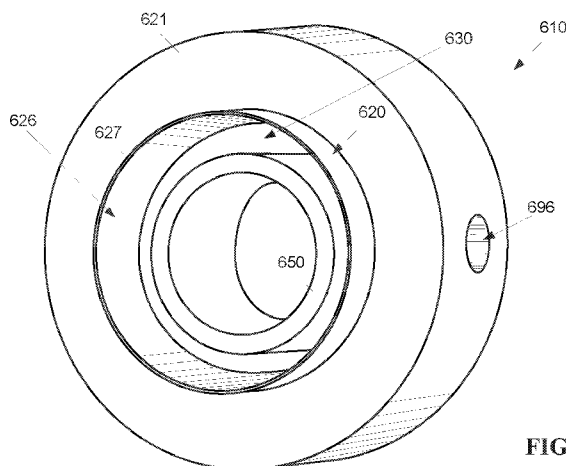


FIG. 7

(57) Abstract: A sealed high intensity illumination device (400) configured to receive a laser beam from a laser light source and method for making the same are disclosed. The device includes a sealed chamber (420) configured to contain an ionizable medium. The chamber may have a cylindrical wall (421) with an ingress and an egress window (426, 428) disposed opposite the ingress window. A fill portion (435) of e.g. nickel-cobalt ferrous alloy and/or an insulating tube insert may be disposed within the chamber.



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/031983

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01J61/10 H01J65/04 H01J61/54 H01J61/30
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)

EP0-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 4 420 690 A (KUEHL DONALD [US]) 13 December 1983 (1983-12-13) abstract column 3, line 65 - column 7, line 42; figures 1,2	1-3, 7-10,16
X	----- US 3 515 491 A (EMARY ROBERT J) 2 June 1970 (1970-06-02) abstract column 2, line 70 - column 5, line 68; figures 1-3	1,2,10, 16
X	----- US 7 294 839 B2 (RICH DAVID R [US] ET AL) 13 November 2007 (2007-11-13) abstract column 4, line 47 - column 6, line 41; figures 1-3	1,2,10, 16
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☒ 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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"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

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 622 464 A (SUKIGARA KUNIO [JP] ET AL) 11 November 1986 (1986-11-11) abstract column 3, line 41 - column 4, line 5; figures 3a,3b -----	1-4
A	DE 10 2011 113681 A1 (HERAEUS NOBLELIGHT GMBH [DE]) 21 March 2013 (2013-03-21) abstract figures 1,3,5 -----	1
A	JP S58 10363 A (KYORITSU DENKI KK) 20 January 1983 (1983-01-20) abstract columns 3-7; claim 1; figures 1-5 -----	5,6, 17-28
X	US 2008/280079 A1 (WATANABE KEIICHIRO [JP]) 13 November 2008 (2008-11-13) abstract paragraphs [0057] - [0062]; figures 1-8 -----	29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/031983

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.:
1-10, 16-29
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: 1-4, 7-10, 16

1. A sealed high intensity illumination device configured to receive a laser beam from a laser light source, the device comprising a sealed cylindrical chamber configured to contain an ionizable medium, the chamber comprising a cylindrical wall with an inner diameter, an ingress window transparent to a first wavelength range and an egress window disposed opposite the ingress window transparent to a second wavelength range (claim 1), wherein the insert is configured to allow the ionizable medium to flow between the insert interior portion and the insert exterior portion (claim 4).

2. claims: 5, 6, 17-29

The device of claim 1, further comprising a first electrode extending into the insert interior portion through a first insert side aperture; and a second electrode extending into the insert interior portion through a first insert side aperture substantially opposite the first electrode (claim 5); or
the device of claim 1, further comprising a passive non-electrode igniting agent incorporated into the insulating insert (claim 6); or
the method of claim 16, further comprising the step of embedding a passive non-electrode igniting agent into the insulating tube insert (claim 17); or
further comprising the steps of forming an aperture into a wall of the insulating tube insert; and inserting an electrode through the tube insert aperture (claim 18); or
a sealed high intensity illumination device configured to receive a laser beam from a laser light source, the device comprising a sealed cylindrical chamber configured to contain an ionizable medium, the chamber having a first diameter and a first center and further comprising a first cavity comprising a walled region within chamber having a first cavity diameter smaller than the chamber diameter and a first cavity center offset from the chamber center; a first electrode extending into the cavity and a second electrode extending into the cavity substantially opposite the first electrode, the first electrode and the second electrode sharing a common axis, a midpoint along the common axis between the first electrode and the second electrode; and wherein the midpoint is further located between the cavity wall and the first cavity center (claims 19-28); or
a sealed high intensity illumination device configured to receive a laser beam from a laser light source, the device comprising a sealed chamber configured to contain an ionizable medium, the chamber having volumetric profile that is asymmetrical in at least two dimensions; a first

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

electrode extending into the chamber; and a second electrode extending into the chamber, wherein an ignition position located between the first electrode and the second electrode is offset from at least one point of symmetry within the chamber (claim 29).

3. claims: 11, 12

The device of claim 1, wherein the egress window comprises a coating of a reflective material configured to reflect a specific range of wavelengths (claim 11); or wherein the egress window comprises a coating of a material configured to pass a specific range of wavelengths (claim 12).

4. claims: 13-15

The device of claim 1, further comprising a wall extending portion protruding into the chamber from the chamber cylindrical wall, wherein the insert is disposed within the wall extending portion.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/031983

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