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AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: DOUBLE-PULSE LASER SYSTEM

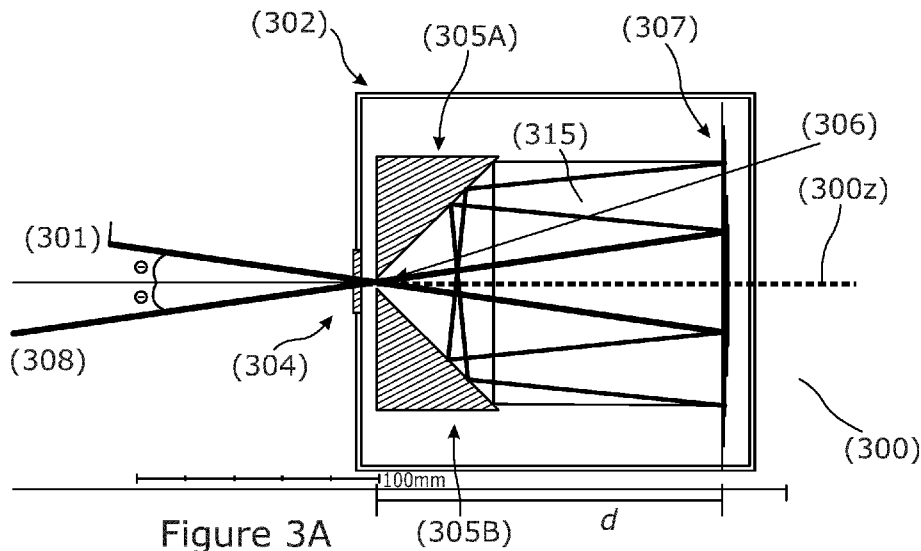


Figure 3A

(57) Abstract: A double-pulse laser system for generating first and second laser pulses, comprising a multipass cell (300) arranged to delay the second laser pulse with respect to the first laser pulse, wherein the multipass cell comprises first (305A, 305B) and second (307) reflector arrangements defining an optical cavity (315) in which the delayed second laser pulse is reflected back and forth multiple times between the first (305A, 305B) and second (307) reflector arrangements to provide a temporal delay between the first and second pulses of 1 ns or greater.



(88) Date of publication of the international search report:
18 November 2021 (18.11.2021)

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. H01S3/00
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)
H01S G02B G03F B23K

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, INSPEC, 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 2017/365475 A1 (OHKUBO TOMOYUKI [JP] ET AL) 21 December 2017 (2017-12-21)	1-6,15, 16,24, 34-38
A	figures figure 3A, 3B,6C -----	7
X	US 6 389 045 B1 (MANN KLAUS [DE] ET AL) 14 May 2002 (2002-05-14) line 39 - column 3, line 41; figures 5,6 -----	1,12, 15-22,25
X	US 2009/052480 A1 (COBB JOSHUA MONROE [US] ET AL) 26 February 2009 (2009-02-26)	1,24-27, 33
Y	paragraph [0040]; figures 1E,2,3 -----	13,14
X	EP 0 552 093 A1 (THOMSON CSF [FR]) 21 July 1993 (1993-07-21)	1
Y	figures 1,2 -----	13,14
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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
- "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)
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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
- "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 6 October 2021	Date of mailing of the international search report 18/10/2021
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 Lendroit, Stéphane

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/056946

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 2004/136417 A1 (WEBB R KYLE [US] ET AL) 15 July 2004 (2004-07-15) figures 2,2B -----	1
X	US 2015/372446 A1 (CHUANG YUNG-HO ALEX [US] ET AL) 24 December 2015 (2015-12-24) figure 6 -----	1
X	US 2012/325784 A1 (MOFFATT STEPHEN [US] ET AL) 27 December 2012 (2012-12-27) figure 3A -----	1
X	HSIUNG P ET AL: "High-speed path length scanning using a herrlott cell delay line", CONFERENCE ON LASERS AND ELECTRO-OPTICS. (CLEO 2001). TECHNICAL DIGEST. POSTCONFERENCE EDITION. BALTIMORE, MD, MAY 6-11, 2001; [TRENDS IN OPTICS AND PHOTONICS. (TOPS)], US, WASHINGTON, WA : OSA, US, vol. VOL. 56, 6 May 2001 (2001-05-06), pages 308-309, XP010559874, DOI: 10.1109/CLEO.2001.947844 ISBN: 978-1-55752-662-5 abstract; figure 1 -----	1
A	abstract; figure 1 -----	8-11
X	DE 10 2009 025314 A1 (LPKF LASER & ELECTRONICS AG [DE]) 16 December 2010 (2010-12-16) figure 1 -----	1
X	GB 2 517 187 A (DUVAS TECHNOLOGIES LTD [GB]) 18 February 2015 (2015-02-18) abstract; figure 2 -----	1
A	abstract; figure 2 -----	8-11
A	FR 3 063 395 A1 (CENTRE NAT RECH SCIENT [FR] ET AL.) 31 August 2018 (2018-08-31) abstract; figure 2 -----	1
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A	US 2011/122483 A1 (LUNDQUIST PAUL B [US] ET AL) 26 May 2011 (2011-05-26) figure 23B -----	8-11
A	US 3 942 127 A (FLUHR FREDERICK R ET AL) 2 March 1976 (1976-03-02) figure 1 -----	8-11
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/056946

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2010 286289 A (GEN PACKER CO LTD; NISSHO ELECTRONICS) 24 December 2010 (2010-12-24) abstract; figure 3 -----	13,14
Y	CN 106 442 354 A (GENERAL DESIGNING INST HUBEI SPACE TECH ACAD) 22 February 2017 (2017-02-22) the incident angle of the incident light can be adjusted, and the total optical length can be adjusted.; figure 1a -----	13,14
Y	US 2012/092782 A1 (SO STEPHEN [US] ET AL) 19 April 2012 (2012-04-19) the angle of tilting of the mirrors can be varied to find a configuration which satisfies the necessary constraints.; figure 2 -----	13,14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2021/056946

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.:

1-22, 24-27, 33-38

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: 1-7, 12, 15-22, 24-27, 33-38

positioning of an optical splitting device of a double-pulse laser system

2. claims: 8-11

design of an aperture in a reflective surface of an optical splitting device of a double-pulse laser system.

3. claims: 13, 14

angular orientation at which a second laser pulse is directed into a multipass cell of a double-pulse laser system.

4. claim: 23

design of a corner reflector of a multipass cell of a double-pulse laser system

5. claims: 28-32

design of an aperture in a reflector arrangement of a multipass cell of the double-pulse laser system

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2021/056946

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