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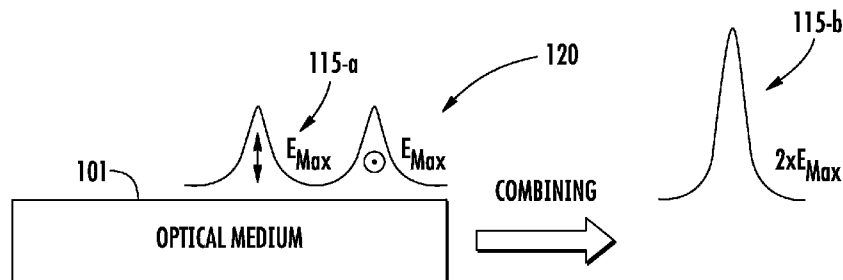
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(54) Title: OPTICAL PULSE SOURCE WITH INCREASED PEAK POWER



**FIG. 1B**

(57) Abstract: In at least one embodiment time separated pulse pairs are generated, followed by amplification to increase the available peak and/or average power. The pulses are characterized by a time separation that exceeds the input pulse width and with distinct polarization states. The time and polarization discrimination allows easy extraction of the pulses after amplification. In some embodiments polarization maintaining (PM) fibers and/or amplifiers are utilized which provides a compact arrangement. At least one implementation provides for seeding of a solid state amplifier or large core fiber amplifier with time delayed, polarization split pulses, with capability for recombining the time separated pulses at an amplifier output. In various implementations suitable combinations of bulk optics and fibers may be utilized. In some implementations wavelength converted pulse trains are generated. A method and system of the present invention can be used in time domain applications utilizing multiple beam paths, for example spectroscopy.



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/26748

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(8) - H01S 3/10 (2012.01) USPC - 372/27 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC(8): H01S 3/10 (2012.01) USPC: 372/27 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC(8): H01S 3/10 (2012.01) (keyword limited, see terms below) USPC: 372/25, 27, 29.02, 30, 39, 98-101, 106; (keyword limited, see terms below) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWEST(PGPB, USPT, EPAB, JPAB), Google Scholar, Thomson Innovation. Search terms used: Pulse, laser, peak, maximum, power, polarization, splitter, medium, time, delay, dual, two, both, combine, seed, optical, amplifier, increase, raise, source, different, modify, change, double, state, fiber, gain, maintaining, linear, passive, active, raman, Jing		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/0201575 A1 (FERMANN et al.) 13 August 2009 (13.08.2009) entire document, especially : Fig 1, para [0019], [0021], [0024], [0062], [0063], [0066], [0073], [0075], [0079], [0080], [0081], [0087], [0090], [0091], [0093], [0096], [0112], [0114], [0115], [0119], [0120], [0166], [0167], [0168], [0185], [0186]	1-44
Y	US 2004/0126048 A1 (DAVE et al.) 01 July 2004 (01.07.2004) Fig 2, para [0038]	1-44
Y	US 2009/0080883 A1 (GRANOT et al.) 26 March 2009 (26.03.2009) Fig 10, para [0054])	1-44
Y	US 2010/0272129 A1 (HARTER et al.) 28 October 2010 (28.10.2010) para [0017], [0172]	5, 15, 16, 27, 28, 39
A	US 2008/0267241 A1 (BROWN et al.) 30 October 2008 (30.10.2008) entire document	1-44
A	Yan et al. "Programmable group-delay module using binary polarization switching," Lightwave Technology, Journal of , vol.21, no.7, pp. 1676- 1684, July 2003, [retrieved on 02 August 2012, on-line from URL: <a href="http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=1219532&amp;isnumber=27405">http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=1219532&amp;isnumber=27405</a> ], entire documents	1-44
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		
* 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 28 July 2012 (28.07.2012)		Date of mailing of the international search report <b>16 AUG 2012</b>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US 12/26748

**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:

Group I: Claims 1-44  
Group II: Claims 45-53

---see extra 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 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.:  
1-44

**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/US 12/26748

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-44, drawn to a pulsed laser system, comprising: a seed source, a polarization splitter, a delay generator, a medium in which said time separated pulses having said different polarization states propagate, and a combiner that substantially re-combines the time separated pulses.

Group II: Claims 45-53, drawn to a pulsed laser system, comprising:  
an input providing time separated pulses, each pulse having a different polarization state; and  
a medium in which said time separated pulses propagates, and provide for synchronization of time separated pulses.

The inventions listed as Groups I though II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group II does not require a seed source, a polarization splitter, or a delay generator, as required by group I.

Group I does not require synchronization of time separated pulses, as required by group II.

Although both groups I and II are drawn to a pulsed laser having different polarization states, such pulsed lasers were well known in the art of lasers as shown in US 7,756,167 B2 to Veitch, issued July 13, 2010, entitled "Q-switched laser," see abstract and col 4, ln. 5-15. Thus, the pulsed laser having different polarization states fails to unify the groups.

Groups I through II therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.