



US008755421B2

(12) **United States Patent**
Volodin

(10) **Patent No.:** **US 8,755,421 B2**
(45) **Date of Patent:** ***Jun. 17, 2014**

(54) **HIGH-POWER, PHASE-LOCKED, LASER ARRAYS**

372/50.12, 50.123, 99, 102; 359/27,
359/337.21, 349, 583

See application file for complete search history.

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

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3,145,252 A 8/1964 Herriott
3,396,343 A 8/1968 Adolf

(Continued)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

FOREIGN PATENT DOCUMENTS

This patent is subject to a terminal disclaimer.

EP 0310438 A1 4/1989
EP 0322218 A2 6/1989

(Continued)

(21) Appl. No.: **13/682,849**

OTHER PUBLICATIONS

(22) Filed: **Nov. 21, 2012**

Advanced Dicing Technologies, "Dicing Solutions for DWDM optical filter applications", advertising brochure of ADT, Stockholm, Sweden, 2003, 2 pages.

(65) **Prior Publication Data**

US 2013/0077645 A1 Mar. 28, 2013

(Continued)

Related U.S. Application Data

Primary Examiner — Yuanda Zhang

(63) Continuation of application No. 13/113,976, filed on May 23, 2011, now Pat. No. 8,340,150, which is a continuation of application No. 11/346,667, filed on Feb. 3, 2006, now Pat. No. 7,949,030.

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(60) Provisional application No. 60/649,489, filed on Feb. 3, 2005.

(57) **ABSTRACT**

(51) **Int. Cl.**
H01S 5/00 (2006.01)

High-power, phased-locked, laser arrays as disclosed herein utilize a system of optical elements that may be external to the laser oscillator array. Such an external optical system may achieve mutually coherent operation of all the emitters in a laser array, and coherent combination of the output of all the lasers in the array into a single beam. Such an "external gain harness" system may include: an optical lens/mirror system that mixes the output of all the emitters in the array; a holographic optical element that combines the output of all the lasers in the array, and an output coupler that selects a single path for the combined output and also selects a common operating frequency for all the coupled gain regions.

(52) **U.S. Cl.**
USPC **372/50.123**; 372/29.014; 372/29.016;
372/29.023; 372/50.11; 372/50.12; 372/99;
372/102; 359/27; 359/337.21; 359/349; 359/583

(58) **Field of Classification Search**
USPC 372/29.014, 29.016, 29.023, 50.11,

10 Claims, 9 Drawing Sheets

