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Volodin et al.

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(54) **COMPACT, LOW COST RAMAN MONITOR FOR SINGLE SUBSTANCES**

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G01J 3/1895 (2013.01); **G01J 3/44** (2013.01);
H01S 5/005 (2013.01); **H01S 5/32** (2013.01);
H01S 5/4012 (2013.01); **H01S 5/4087**
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(58) **Field of Classification Search**
CPC G06T 2219/2008; G06T 7/602; B60R 21/0134
USPC 356/302, 631, 603; 700/119, 103, 117, 700/97
See application file for complete search history.

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(56) **References Cited**

(65) **Prior Publication Data**

U.S. PATENT DOCUMENTS

US 2015/0276477 A1 Oct. 1, 2015

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Related U.S. Application Data

(Continued)

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(57) **ABSTRACT**

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Apparatus for performing Raman spectroscopy may include a first laser source having a first emission wavelength and a second laser source having a second emission wavelength. A separation between the first and second emission wavelengths may correspond to a width of a Raman band of a substance of interest. A switch may provide switching between the first and second laser sources. An ensemble of laser emitters may be provided. A Bragg grating element may receive laser light from the ensemble. An optical system may direct light from the Bragg grating element into an optical fiber. A combined beam through the optical fiber may contain light from each of the emitters.

20 Claims, 9 Drawing Sheets

