US009410842B2

(12) **United States Patent**
Ida

(10) **Patent No.: US 9,410,842 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **PHOTOACOUSTIC WAVE MEASUREMENT DEVICE**

(71) Applicant: **ADVANTEST CORPORATION**, Tokyo (JP)

(72) Inventor: **Taiichiro Ida**, Gunma (JP)

(73) Assignee: **ADVANTEST CORPORATION**, Tokyo (JP)

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

(21) Appl. No.: **14/397,939**

(22) PCT Filed: **Jul. 19, 2013**

(86) PCT No.: **PCT/JP2013/070263**
§ 371 (c)(1),
(2) Date: **Oct. 30, 2014**

(87) PCT Pub. No.: **WO2014/030491**
PCT Pub. Date: **Feb. 27, 2014**

(65) **Prior Publication Data**

US 2015/0122036 A1 May 7, 2015

(30) **Foreign Application Priority Data**

Aug. 20, 2012 (JP) 2012-181435

(51) **Int. Cl.**
G01D 5/32 (2006.01)
G01H 9/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G01H 9/00*** (2013.01); ***A61B 5/0095*** (2013.01); ***G01H 9/004*** (2013.01); ***G01N 21/1702*** (2013.01); ***G01N 29/2418*** (2013.01)

(58) **Field of Classification Search**
CPC G01H 9/00; G01H 9/004; G01H 29/2418; G01H 21/1702; A61B 5/0095
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,543,486 A * 9/1985 Rose B23K 26/03 219/121.14
5,125,749 A 6/1992 Leugers et al.
(Continued)

FOREIGN PATENT DOCUMENTS

JP 4-264236 9/1992
JP 10-197496 7/1998
(Continued)

OTHER PUBLICATIONS

Taiichiro Ida et al., "Real Time Hikari Onkyo Imaging-ho ni yoru Nessho Shindan", Diagnose of Burns by real time photoacoustic imaging, Journal of Medical Ultrasonics, vol. 39, Supplement, the Japan Society of Ultrasonics in Medicine, Apr. 15, 2012, pp. S489.
(Continued)

Primary Examiner — Harshad R Patel
Assistant Examiner — Samir M Shah
(74) *Attorney, Agent, or Firm* — Greenblum & Bernstein P.L.C.

(57) **ABSTRACT**

A photoacoustic wave measurement device according to the present invention includes: an optical fiber that outputs pulsed light; an external spacer that is disposed between a pulsed-light output end of the optical fiber and a measurement object, and which is adapted to allow the pulsed light to pass therethrough; a piezoelectric element that receives a photoacoustic wave generated by the pulsed light from the measurement object and converts the photoacoustic wave into an electric signal; and a spacer that is disposed between the external spacer and the piezoelectric element, and which is adapted to allow the photoacoustic wave to pass therethrough. The piezoelectric element is farther from the measurement object than the pulsed-light output end. A part of the optical fiber is disposed within the spacer.

6 Claims, 3 Drawing Sheets