US009510742B2

(12) **United States Patent**
Nishida et al.

(10) **Patent No.: US 9,510,742 B2**
(45) **Date of Patent: Dec. 6, 2016**

(54) **INTERNAL BODY OBSERVATION DEVICE**

(75) Inventors: **Hiroyuki Nishida**, Sagamihara (JP); **Hideyuki Takaoka**, Fuchu (JP)

(73) Assignee: **OLYMPUS 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 1618 days.

(21) Appl. No.: **13/037,731**

(22) Filed: **Mar. 1, 2011**

(65) **Prior Publication Data**

US 2011/0237887 A1 Sep. 29, 2011

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2009/055504, filed on Mar. 19, 2009.

(30) **Foreign Application Priority Data**

Sep. 1, 2008 (JP) 2008-223956

(51) **Int. Cl.**
A61B 1/04 (2006.01)
A61B 1/06 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A61B 1/0638*** (2013.01); ***A61B 1/00009*** (2013.01); ***A61B 1/00124*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A61B 1/043; A61B 1/06; A61B 1/07; A61B 1/0661; A61B 1/0638; A61B 1/00163; A61B 1/041; G01J 1/58; G01N 21/474; G02B 6/35
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,417,950 B1 * 7/2002 Cathey, Jr. H04N 9/045 348/E9.01
2013/0329224 A1 * 12/2013 Takaoka A61B 1/00096 356/402

FOREIGN PATENT DOCUMENTS

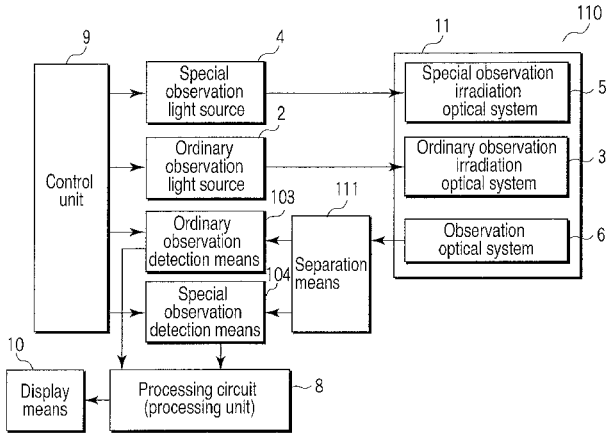
JP 9-154812 6/1997
JP 09-154812 A * 6/1997
(Continued)

OTHER PUBLICATIONS

Application No. JP 2005-275530, Publication No. 2007-082769, Sendai Tomoari, Date of Filling: Sep. 22, 2005, Applicant: Fujifilm Corp.*
(Continued)

Primary Examiner — John P Leubecker
Assistant Examiner — Rajaa El Alami
(74) *Attorney, Agent, or Firm* — Scully, Scott, Murphy & Presser, P.C.

(57) **ABSTRACT**

The invention relates to an internal body observation device which includes an ordinary observation light source, an ordinary observation irradiation optical system, a special observation light source, a special observation irradiation optical system, an observation optical system for transmitting the light from an observation target, a detection means configured to detect the light transmitted from the observation optical system as a detection signal, and a processing unit for separating the detection signal in the respective light sources and making the detection signal into images, wherein the light from any one of the ordinary observation light source and the special observation light source is modulated, and the modulated light can be radiated to the observation target together with the light from the other light source, and the detection signal detected by the detection means is separated by the processing unit based on the frequency of the modulation.

6 Claims, 3 Drawing Sheets