US010595823B2

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

(10) **Patent No.: US 10,595,823 B2**
(45) **Date of Patent: Mar. 24, 2020**

(54) **INTERNAL ULTRASOUND ASSEMBLY FLUID SEAL**

(71) Applicant: **Muffin Incorporated**, West Lafayette, IN (US)

(72) Inventors: **Peter S. McKinnis**, West Lafayette, IN (US); **Yun Zhou**, West Lafayette, IN (US); **Sarah Robbins**, Lafayette, IN (US); **Neal E. Fearnot**, West Lafayette, IN (US)

(73) Assignee: **Muffin Incorporated**, West lafayette, IN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 410 days.

(21) Appl. No.: **14/211,885**

(22) Filed: **Mar. 14, 2014**

(65) **Prior Publication Data**

US 2014/0276076 A1 Sep. 18, 2014

Related U.S. Application Data

(60) Provisional application No. 61/787,357, filed on Mar. 15, 2013.

(51) **Int. Cl.**
A61B 8/00 (2006.01)
A61B 8/08 (2006.01)
A61B 8/12 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 8/4483*** (2013.01); ***A61B 8/0891*** (2013.01); ***A61B 8/12*** (2013.01); ***A61B 8/445*** (2013.01)

(58) **Field of Classification Search**
CPC A61B 8/00; A61B 8/4483; A61B 8/0891; A61B 8/12; A61B 8/445; A61B 17/22004;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,790,095 A 4/1957 Peek et al.
4,014,342 A * 3/1977 Staub A61F 9/00763 606/170
(Continued)

FOREIGN PATENT DOCUMENTS

CN 1188401 7/1998
EP 0 129 878 A2 1/1985
(Continued)

OTHER PUBLICATIONS

International Search Report and Written Opinion issued in PCT/US2013/064570, dated Jan. 24, 2014.
(Continued)

Primary Examiner — Carolyn A Pehlke
(74) *Attorney, Agent, or Firm* — Woodard, Emhardt, Henry, Reeves & Wagner, LLP

(57) **ABSTRACT**

There are disclosed embodiments of devices and methods for imaging the inside of a body part, particularly a blood vessel. In particular embodiments, a catheter has a tip chamber, within which is an ultrasound transducer mounted on a pivot mechanism, a motor for turning the transducer, and an implement for pivoting the transducer. Examples of such an implement are a linear motor, a shaft or filament, and the pivot mechanism may be biased to return to a base position when the implement is not pivoting the transducer. In other embodiments, a mirror reflecting ultrasound signals from the transducer may be rotated and/or pivoted, using similar mechanisms.

18 Claims, 3 Drawing Sheets