US009480476B2

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

(10) **Patent No.: US 9,480,476 B2**
(45) **Date of Patent: Nov. 1, 2016**

(54) **TISSUE THICKNESS COMPENSATOR COMPRISING RESILIENT MEMBERS**

(75) Inventors: **Jeffrey L. Aldridge**, Lebanon, OH (US); **Chunlin Yang**, Belle Mead, NJ (US); **Charles J. Scheib**, Loveland, OH (US); **Venkataramanan Mandakolathur Vasudevan**, Mumbai (IN); **Taylor W. Aronhalt**, Loveland, OH (US); **Joseph H. Contiliano**, Stewartsville, NJ (US); **Michael S. Cropper**, Edgewood, KY (US); **Eugene L. Timperman**, Cincinnati, OH (US); **Cortney E. Henderson**, Loveland, OH (US); **Katherine J. Schmid**, Cincinnati, OH (US); **Frederick E. Shelton, IV**, Hillsboro, OH (US)

(73) Assignee: **Ethicon Endo-Surgery, LLC**, Los Frailes Industrial Park Guaynabo, PR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1087 days.

(21) Appl. No.: **13/433,155**

(22) Filed: **Mar. 28, 2012**

(65) **Prior Publication Data**

US 2012/0241502 A1 Sep. 27, 2012

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/097,891, filed on Apr. 29, 2011, now Pat. No. 8,864,009, which is a continuation-in-part of application No. 12/894,377, filed on Sep. 30, 2010, now Pat. No. 8,393,514.

(51) **Int. Cl.**
A61B 17/03 (2006.01)
A61B 17/072 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ... ***A61B 17/07292*** (2013.01); ***A61B 17/00491*** (2013.01); ***A61B 17/0643*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A61B 17/07207; A61B 17/068; A61B 2017/07242; A61B 2017/07271; A61B 2017/07214; A61B 2017/07264; A61B 17/07292; A61B 2017/00004
USPC 227/175.1, 175.2, 175.3, 175.4, 176.1, 227/177.1, 178.1, 179.1, 180.1, 181.1, 227/182.1; 606/219
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

66,052 A 6/1867 Smith
662,587 A 11/1900 Blake
(Continued)

FOREIGN PATENT DOCUMENTS

AU 2008207624 A1 3/2009
AU 2010214687 A1 9/2010
(Continued)

OTHER PUBLICATIONS

ASTM procedure D2240-00, "Standard Test Method for Rubber Property—Durometer Hardness," (Published Aug. 2000).
(Continued)

Primary Examiner — Gloria R Weeks
Assistant Examiner — Eyamindae Jallow

(57) **ABSTRACT**

A tissue thickness compensator comprising at least one woven lattice can be positioned in the end effector of a surgical instrument. A fastener cartridge that is positioned in the end effector can comprise at least one cavity configured to receive a fastener. The fastener can be moveable between an initial position, wherein the fastener is at least partially position in a cavity, and a fired position, wherein the fastener is configured to compress a woven lattice of the tissue thickness compensator. The woven lattice can comprise a resilient material such that compression of the woven lattice generates a restoring force. The woven lattice can also comprise an axis that can laterally traverse the fastener cartridge, diagonally traverse the fastener cartridge, or intersect a deck surface of the fastener cartridge. The woven lattice can comprise a hydrophilic substance, which can expand when the woven lattice is severed by a cutting element.

15 Claims, 143 Drawing Sheets