



(51) International Patent Classification:

A61B 17/06 (2006.01) A61B 17/00 (2006.01)
A61B 17/04 (2006.01)

(21) International Application Number:

PCT/US20 15/055241

(22) International Filing Date:

13 October 2015 (13.10.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/063,998 15 October 2014 (15.10.2014) US

(71) Applicant: SMITH & NEPHEW, INC. [—/US]; 1450
Brooks Road, Memphis, TN 381 16 (US).

(72) Inventors: CALLAGHAN, David; c/o Smith & Nephew,
Inc., 1450 Brooks Road, Memphis, TN 381 16 (US).
BOURQUE, Bernard, Joseph; c/o Smith & Nephew, Inc.,
1450 Brooks Road, Memphis, TN 381 16 (US).

(74) Agents: MARAIA, Joseph, M. et al; BURNS & LEVIN-
SON LLP, 125 Summer Street, Boston, MA 021 10 (US).

(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: ARTHROSCOPIC MENISCAL TEAR REPAIR DEVICE

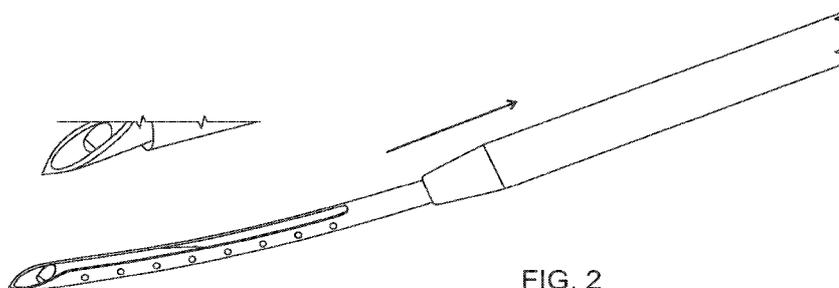


FIG. 2

(57) Abstract: Apparatus and methods for arthroscopic meniscal tear repair. An apparatus includes a rigid outer sheath, and a needle residing within the rigid outer sheath, the needle including a superelastic material having an angled tip portion and a lumen having a longitudinal slot, a distal end of the needle having a bend, a deflection angle of the bend dependent upon an extent to which the needle is advanced from the stiff outer sheath.



ARTHROSCOPIC MENISCAL TEAR REPAIR DEVICE

BACKGROUND OF THE INVENTION

[001] The present invention relates generally to arthroscopic surgery, and more particularly to an arthroscopic meniscal tear repair device.

[002] In general, a meniscus tear is a common injury to the cartilage that stabilizes and cushions the knee joint. Surgical repair may be done by open surgery, in which a small incision is made and the knee is opened up so that a surgeon can see inside the knee and the meniscus can be repaired. Increasingly, surgeons use arthroscopic surgery to repair the meniscus. The surgeon inserts a thin tube (arthroscope) containing a camera and a light through small incisions near the knee and is able to see inside the knee without making a large incision. Surgical instruments can be inserted through other small incisions. The surgeon repairs the meniscus using sutures (stitches) or anchors.

SUMMARY OF THE INVENTION

[003] The following presents a simplified summary of the innovation in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is intended to neither identify key or critical elements of the invention nor delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

[004] The present invention is directed towards an arthroscopic meniscal tear repair device.

[005] In an aspect, the invention features an apparatus including a rigid outer sheath, and a needle residing within the rigid outer sheath, the needle including a superelastic material having an angled tip portion, and a lumen having a longitudinal slot, a distal end of the needle having a bend, a deflection angle of the bend

dependent upon an extent to which the needle is advanced from the stiff outer sheath.

[006] One or more of the following features may also be included. The rigid outer sheath can include a hypodermic tubing.

[007] The rigid outer sheath can include a stainless steel tube having laser cuts at a desired curved region and the needle may include a pull wire to achieve a desired bend of the needle when advanced from the rigid outer sheath.

[008] The needle can include a distal implant residing in the distal end of the needle, a proximal implant residing in a proximal end of the needle, and an actuator releasably linked to the proximal implant. The distal implant and the proximal implant may be tied together.

[009] The actuator can include a body, and an arm spring loaded to the body, a distal end of the arm including a projection configured to mate with a corresponding groove in the proximal implant and lock the proximal implant when the needle is in the rigid outer sheath and release the proximal implant when the actuator is advanced from the rigid outer sheath, exposing the proximal implant.

[0010] In another aspect, the invention features a method including advancing a tissue repair device into the portion of the tissue so that a distal end of the device is disposed beyond the tear, the device including a rigid outer sheath and a needle residing within the rigid outer sheath, the needle including a superelastic material having an angled tip portion and a lumen with a longitudinal slot, a distal end of the needle having a bend, a deflection angle of the bend dependent upon an extent to which the needle is advanced from the stiff outer sheath, advancing the needle beyond a tip of the outer sheath, causing the needle to bend due to inherent properties of the needle, and advancing distally an actuator linked by a spring loaded arm to an implant within the needle beyond a tip of the needle, the spring loaded arm of the actuator releasing the implant.

[0011] One or more of the following features may also be included. The rigid outer sheath can include a hypodermic tubing.

[0012] The rigid outer sheath can include a stainless steel tube having laser cuts at a desired curved region and the needle may include a pull wire to achieve a desired bend of the needle when advanced from the rigid outer sheath.

[0013] The needle can include a distal implant residing in the distal end of the needle, a proximal implant residing in a proximal end of the needle, and an actuator releasably linked to the proximal implant. The distal implant and the proximal implant may be tied together.

[0014] The actuator can include a body, and an arm spring loaded to the body, a distal end of the arm including a projection configured to mate with a corresponding groove in the proximal implant and lock the proximal implant when the needle is in the rigid outer sheath and release the proximal implant when the actuator is advanced from the rigid outer sheath, exposing the proximal implant.

[0015] Embodiments of the invention may include one or more of the following advantages.

[0016] The arthroscopic meniscal tear repair device of the present invention device is capable of being articulated to repair/engage tears of all segments of the meniscus.

[0017] The arthroscopic meniscal tear repair device of the present invention includes a needle having a groove and an implant having a complimentary groove wherein an actuator engages the implant when inside the needle and disengages the implant when the actuator has been advanced beyond the needle groove.

[0018] A curve of a needle can be altered depending on the distance advanced from the outer sheath due to the inherent properties of the needle.

[0019] These and other features and advantages will be apparent from a reading of the following detailed description and a review of the associated drawings. It is to be understood that both the foregoing general description and the following detailed description are explanatory only and are not restrictive of aspects as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The invention will be more fully understood by reference to the detailed description, in conjunction with the following figures, wherein:

[0021] FIG. 1 is an illustration of an exemplary arthroscopic meniscal tear repair device.

[0022] FIG. 2 is an illustration of a needle extended from an outer sheath.

[0023] FIG. 3 is an illustration of a needle of the exemplary arthroscopic meniscal tear repair device.

[0024] FIG. 4 is an illustration of pre-tied proximal and distal implants.

[0025] FIG. 5 is a diagram of an actuator in an unlocked position.

[0026] FIG. 6 is a diagram of the actuator in a locked position.

[0027] FIG. 7 is a flow diagram.

DETAILED DESCRIPTION

[0028] The subject Innovation is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It may be evident, however, that the present invention may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing the present invention.

[0029] As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or." That is, unless specified otherwise, or clear from context, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, if X employs A, X employs B, or X employs both A and B, then "X employs A or B" is satisfied under any of the foregoing instances. Moreover, articles "a" and "an" as used in the subject specification and annexed drawings should generally be construed to mean "one or more" unless specified otherwise or clear from context to be directed to a singular form.

[0030] The present description will be used with reference to arthroscopic meniscal tear repair, but it should be understood that the technology and methods of the present invention may have other applications for reconstruction and repair of other parts of body, such as, for example, hip capsule closure and repair.

[0031] As shown in FIG. 1, an exemplary arthroscopic meniscal tear repair device 10 includes an outer sheath 15 and a needle 20. The outer sheath 15 is a relatively rigid thick-walled stainless hypodermic tubing. In alternate embodiments, other materials may be used to form the outer sheath.

[0032] As shown in FIG. 2, the outer sheath 15 is designed to maintain a straight configuration throughout an entire surgical procedure, while the inherent properties of the needle 20, fully described below, cause it to bend as it is distally advanced from the outer sheath 15.

[0033] Referring again to FIG. 1, in the illustrated embodiment, the needle 20 is formed from a superelastic material, such as nickel titanium. In a preferred embodiment, the needle is formed from 17 gage (0.057) Nitinol. A distal end 25 of the needle 20 is manufactured with a bend. The inherent superelastic property of the nickel titanium needle 20 enables it to deform from its natural bended configuration to a straight configuration without yielding while recessed within the outer sheath 15. As the distal end 25 of the needle 20 is advanced from the outer sheath 15, the needle 20 bends. The extent to which the needle 20 is advanced from the outer sheath 15 determines the extent of the deflection angle of the needle 20. When the needle 20 is retracted into the outer sheath 15, the bend in the needle 20 straightens due to the physical constraints imposed by the rigid outer sheath 15. A curved needle 20 that has been advanced distally from the outer sheath 15 is illustrated in FIG. 1.

[0034] In one alternate embodiment, the arthroscopic meniscal tear repair device is manufactured using a stainless tube that has laser cuts at the desired curved region. In addition, there may be a pull wire to achieve the desired curvature in the needle.

[0035] In another alternate embodiment, the arthroscopic meniscal tear repair device uses a coil at the curved region to enable the device to curve upon applying force to the pull wire.

[0036] As shown in FIG. 3, the needle 20 includes an angled tip portion 50 and a lumen 55 having a longitudinal slot 57. The lumen 55 is exposed at the tip portion 50. The lumen 55 includes a distal implant 60, a proximal implant 65 and an actuator 70.

[0037] As shown in FIG. 4, the distal implant 60 and proximal implant 65 may be pre-tied by one or more sutures 68, such as with the sliding knot feature of the FAST-FIX™ 360 Meniscal Repair System manufactured by Smith & Nephew, Inc., of Andover, MA US. The longitudinal slot 57 of the lumen 55 (shown in FIG. 3) enables access to and/or manipulation of the sutures and/or sliding knot. Pre-tying the distal implant 60 and proximal implant 65 enable a release of the distal implant 60 during distal advancement of the actuator 70 from the needle 20 and prevents the proximal implant 65 from falling from the needle 20 prematurely as the actuator 70 is distally advanced from the needle 20.

[0038] As shown in FIG. 5, the actuator 70 includes a body 75 and a spring loaded arm 80. The spring loaded arm 80 includes a projection 85 located at a distal end of the arm 80. The projection 85 is configured to mate with a corresponding groove 90 in the proximal implant 65. When the proximal implant 65 is placed within the needle 20 and loaded proximally into the outer sheath 15, the spring loaded arm 80 compresses, causing the projection 85 to lock into the groove 90 of the proximal implant 65. When actuator 70 is advanced distally from the needle 20, the proximal implant 65 is exposed from the outer sheath 15, the spring loaded arm 80 unlocks from the groove 90, releasing the proximal implant 65. More specifically, as the actuator 70 is advanced distally from the needle 20, arm 80 of the actuator 70 springs open and disengages from the groove 90 to release the proximal implant 65 from the needle 20. In FIG. 3, the proximal implant 65 and the arm 80 are shown advanced beyond the angled tip portion 50 of the needle 20.

[0039] As shown in FIG. 6, the proximal implant 65 and actuator 70 are shown within the lumen 55 of the needle 20. In such a configuration, the arm 80 is locked into the groove 90 of the proximal implant 65, preventing the proximal implant 65 from being prematurely disengaged from the needle 20 until the actuator 70 is advanced from the needle 20.

[0040] As shown in FIG. 7, a process 100 for repairing a tear in a portion of tissue includes advancing (105) a tissue repair device into the portion of the tissue so that a distal end of the device is disposed beyond the tear. The device includes a rigid outer sheath and a needle residing within the rigid outer sheath, the needle including a superelastic material having an angled tip portion and a lumen, a distal end of the needle having a bend, a deflection angle of the bend adjustable on a distance the needle is advanced from the stiff outer sheath.

[0041] Process 100 advances (110) the needle beyond a tip of the outer sheath, causing the needle to bend due to the inherent properties of the needle.

[0042] Process 100 advances (115) distally an actuator linked by a spring loaded arm to an implant within the needle beyond a tip of the needle, the spring loaded arm of the actuator releasing the implant.

[0043] Although the above-described device was in the context of arthroscopic meniscal tear repair, it should be understood that the technology and methods of the present invention may have other applications for reconstruction and repair of other parts of body, such as, for example, hip capsule closure and repair. The illustrated and described embodiments should not be considered to be limiting in any way.

[0044] The fixation members, limiting elements, and flexible members of the above embodiments can be formed of a biodegradable material.

[0045] The devices and techniques described above can be applied to other anatomical regions to reattach tissue to bone or repair a tear in soft tissue, such as the biceps tendons, the lateral collateral ligament, the medial collateral ligament, the popliteal ligament, and the hip.

[0046] While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in

the art that various changes in form and details may be made therein without departing from the spirit and scope of the present application as defined by the appended claims. Such variations are intended to be covered by the scope of this present application. As such, the foregoing description of embodiments of the present application is not intended to be limiting. Rather, any limitations to the invention are presented in the following claims.

[0047] What is claimed is:

1. An apparatus comprising:
 - a rigid outer sheath; and
 - a needle residing within the rigid outer sheath, the needle comprising a superelastic material having an angled tip portion and a lumen having a longitudinal slot, a distal end of the needle having a bend, a deflection angle of the bend dependent upon an extent to which the needle is advanced from the stiff outer sheath.
2. The apparatus of claim 1 wherein the rigid outer sheath comprises a hypodermic tubing.
3. The apparatus of claim 1 wherein the rigid outer sheath comprises a stainless steel tube having laser cuts at a desired curved region.
4. The apparatus of claim 3 further comprising a pull wire to achieve a desired bend of the needle when advanced from the rigid outer sheath.
5. The apparatus of claim 1 wherein the needle comprises:
 - a distal implant residing in the distal end of the needle;
 - a proximal implant residing in a proximal end of the needle; and
 - an actuator releasably linked to the proximal implant.
6. The apparatus of claim 5 wherein the distal implant and the proximal implant are tied together.
7. The apparatus of claim 5 wherein the actuator comprises:
 - a body; and
 - an arm spring loaded to the body, a distal end of the arm comprising a projection configured to mate with a corresponding groove in the proximal implant and lock the proximal implant when the needle is in the rigid outer sheath and

release the proximal implant when the actuator is advanced from the rigid outer sheath, exposing the proximal implant.

8. A method for repairing a tear in a portion of tissue, the method comprising:

advancing a tissue repair device into the portion of the tissue so that a distal end of the device is disposed beyond the tear, the device comprising a rigid outer sheath and a needle residing within the rigid outer sheath, the needle comprising a superelastic material having an angled tip portion and a lumen with a longitudinal slot, a distal end of the needle having a bend, a deflection angle of the bend dependent upon an extent to which the needle is advanced from the stiff outer sheath;

advancing the needle beyond a tip of the outer sheath, causing the needle to bend due to inherent properties of the needle; and

advancing distally an actuator linked by a spring loaded arm to an implant within the needle beyond a tip of the needle, the spring loaded arm of the actuator releasing the implant.

9. The method of claim 8 wherein the rigid outer sheath comprises a hypodermic tubing.

10. The method of claim 8 wherein the rigid outer sheath comprises a stainless steel tube having laser cuts at a desired curved region.

11. The method of claim 10 wherein the needle further comprises a pull wire to achieve a desired bend of the needle when advanced from the rigid outer sheath.

12. The method of claim 8 wherein the implant is tied to a second implant.

13. The method of claim 8 wherein the actuator comprises:
a body; and

the arm spring loaded to the body, a distal end of the arm comprising a projection configured to mate with a corresponding groove in the implant and lock the implant when the needle is in the rigid outer sheath and release the implant when the actuator is advanced from the rigid outer sheath, exposing the implant.

1/4

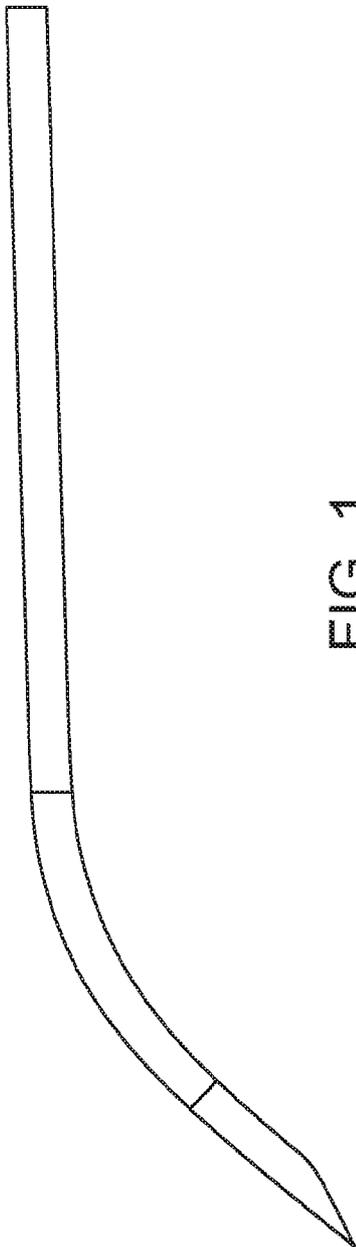


FIG. 1

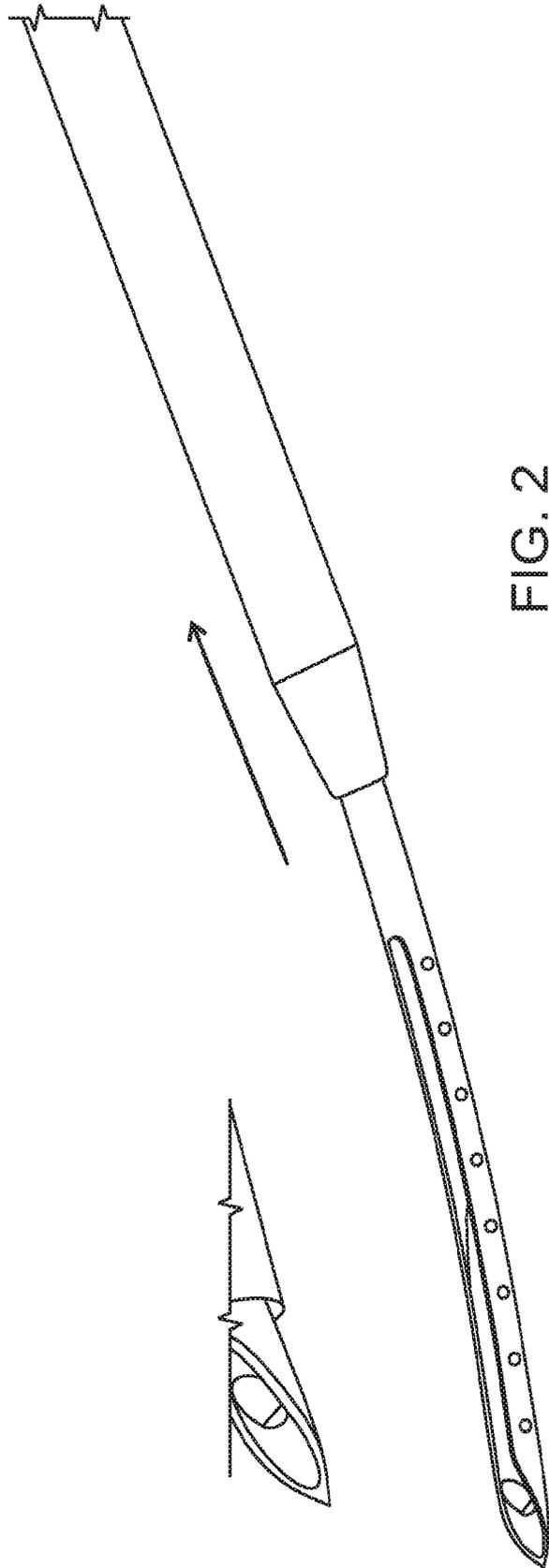


FIG. 2

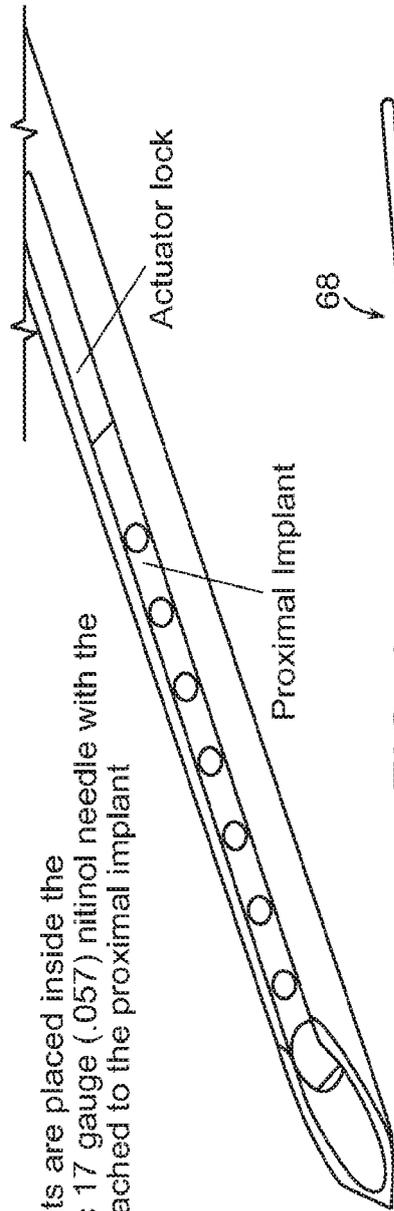


FIG. 3

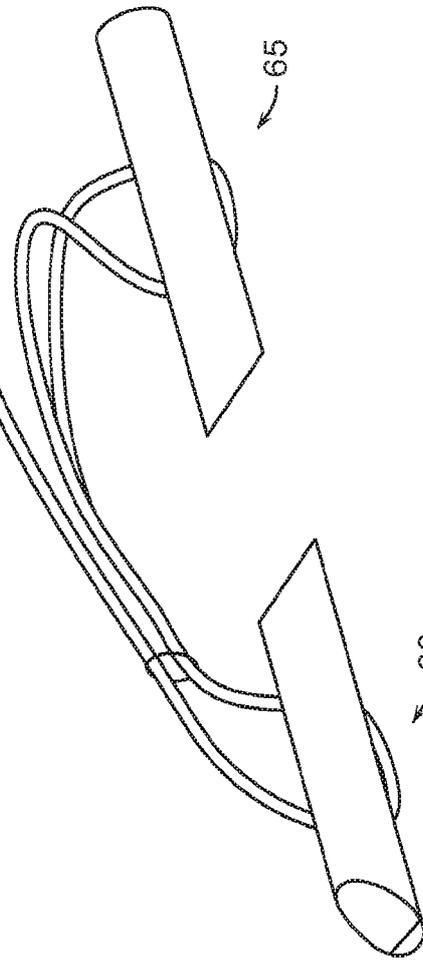
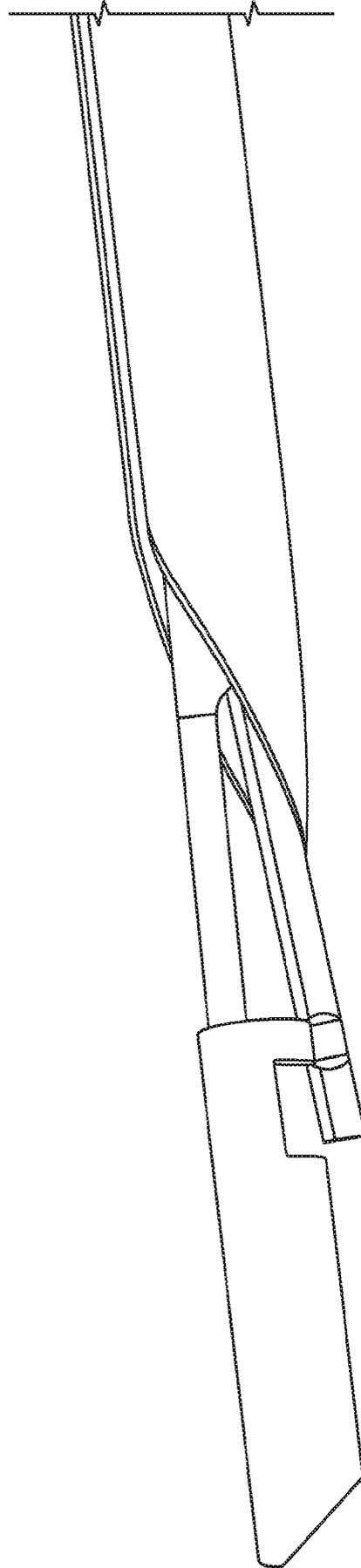
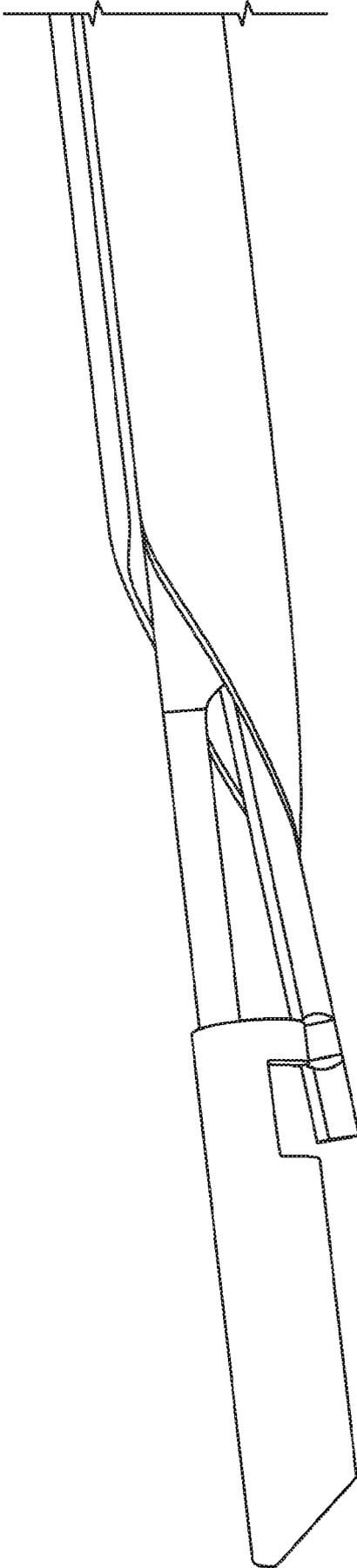


FIG. 4



4/4

100

Advance a tissue repair device into a portion of a tissue so that a distal end of the device is disposed beyond the tear.

105

Advance the needle beyond a tip of the outer sheath, causing the needle to bend due to inherent properties of the needle

110

Advance an actuator linked by a spring loaded arm to an implant within the needle beyond a tip of the needle, the spring loaded arm of the actuator releasing the implant

115

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/055241

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B17/06
ADD. A61B17/04 A61B17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 071 292 A (MAKOWER JOSHUA [US] ET AL) 6 June 2000 (2000-06-06) col umn 19, line 42 - col umn 21, line 32; figure 27 -----	1,2,5-7
X	US 2010/113873 AI (SUZUKI TAKAYUKI [JP] ET AL) 6 May 2010 (2010-05-06) paragraphs [0105] - [0108] ; figures 16-22 -----	1-6
Y	US 2009/157099 AI (SURTI VIHAR C [US]) 18 June 2009 (2009-06-18) paragraphs [0018] - [0024] ; figures 1,3-5 ,9 -----	7
X	US 2004/133124 AI (BATES BRIAN L [US] ET AL) 8 July 2004 (2004-07-08) paragraphs [0035] - [0047] ; figures 7,8, 10, 11 -----	1-4
X	----- -/- .	1-3

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 January 2016

Date of mailing of the international search report

02/02/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Mai er, Chri sti an

INTERNATIONAL SEARCH REPORT

International application No PCT/US2015/055241

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/163934 A1 (RASCHDORF JR ALFRED H [US] ET AL) 25 June 2009 (2009-06-25) paragraphs [0107] - [0110]; figures 5A, 5B, 6A-D <p style="text-align: center;">-----</p>	7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/055241

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claims Nos.: 8-13
because they relate to subject matter not required to be searched by this Authority, namely:
Pursuant to Article 17(2)(a)(i) PCT, this Authority is not required to search the subject-matter of claims 8-13, since a method for repairing a tear in a portion of tissue as defined in claim 8 represents a method for treatment of the human or animal body by surgery (Rule 39.1(iv) and Rule 43bis PCT).
- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
- 3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
- 2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
- 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos. :
- 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos. :

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2015/055241
--

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6071292	A	06-06-2000	AT 492221 T 15-01-2011
			AU 8171298 A 17-05-1999
			CA 2295133 AI 06-05-1999
			EP 1047341 AI 02-11-2000
			JP 4097045 B2 04-06-2008
			JP 2002512550 A 23-04-2002
			US 6071292 A 06-06-2000
			US 6287317 BI 11-09-2001
			US 7056325 BI 06-06-2006
			US 2001039426 AI 08-11-2001
			Wo 9921490 AI 06-05-1999

US 2010113873	AI	06-05 -2010	CN 102164548 A 24-08-2011
			EP 2316346 AI 04-05-2011
			JP 4624485 B2 02-02-2011
			US 2010113873 AI 06-05-2010
			Wo 2010053118 AI 14-05-2010

US 2009157099	AI	18-06 -2009	US 2009157099 AI 18-06-2009
			wo 2009082596 AI 02-07-2009

US 2004133124	AI	08-07 -2004	US 2004133124 AI 08-07-2004
			wo 2004062505 AI 29-07-2004

US 2009163934	AI	25-06 -2009	CN 102395331 A 28-03-2012
			EP 2400922 AI 04-01-2012
			US 2009163934 AI 25-06-2009
			wo 2010098804 AI 02-09-2010
