

(19) World Intellectual Property  
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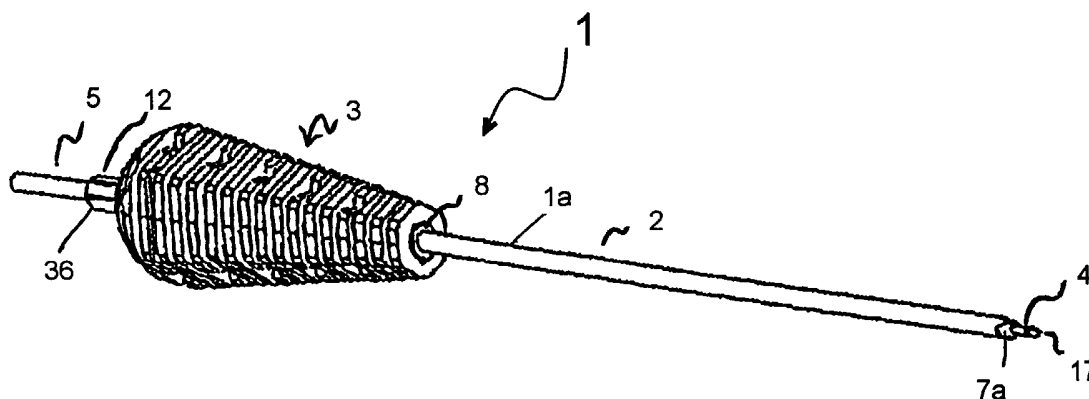
(43) International Publication Date  
8 January 2004 (08.01.2004)

PCT

(10) International Publication Number  
**WO 2004/002333 A1**

- (51) International Patent Classification<sup>7</sup>: **A61B 17/17**, 17/16
- (21) International Application Number:  
PCT/US2003/019098
- (22) International Filing Date: 19 June 2003 (19.06.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
10/184,829 28 June 2002 (28.06.2002) US
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: SOFT TISSUE REPAIR TOOL



(57) **Abstract:** A surgical tool includes a member, a guide wire received within the member by a friction fit, and a guide wire pusher for application of a force to the guide wire to overcome the friction fit and advance the guide wire relative to the member. The member includes a guide wire retainer that provides the friction fit and allows the guide wire to be held in such a way that it is pre-assembled and secure while the tool is being introduced to a surgical site. At the same time, once a hole is drilled into bone, the guide wire retainer allows the remainder of the tool to be removed leaving the guide wire in place at the site. The guide wire pusher allows the guide wire to be impacted into the bone before drilling and limits any possibility of drilling past the end of the guide wire.

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## SOFT TISSUE REPAIR TOOL

This invention relates to a soft tissue repair tool, and more particularly to a tool for preparing soft tissue and bone for implantation of a tissue fastener.

### BACKGROUND

When a tissue, or a portion of a tissue, is torn away from its bone attachment site, surgery to repair the detached soft tissue is often required. This is often currently done using push-in tack implants which are used to fix tendinous and ligamentous tissue to the bone at the re-attachment site. To prepare the tissue for the implant, a hole is made through the soft tissue and into the bone. The implant is subsequently passed through the soft tissue and into the bone with a portion of the implant remaining outside the hole to hold the soft tissue against the bone. Because of the need to pass the tack through the soft tissue to be re-attached, most instrument systems include a cannulated drill and guide wire. The drill and guide wire are passed through the tissue together and the drill is then used to make a hole in the bone. The guide wire is left in place in the bone hole to mark its location and provide alignment for placement of the implant. The implant is advanced over the guide wire, with a distal end of the implant passing through the soft tissue and into the bone.

### SUMMARY

According to an aspect of the invention, a surgical tool includes a member, a guide wire received within the member by a friction fit, and a guide wire pusher for application of a force to the guide wire to overcome the friction fit and advance the guide wire relative to the member.

Embodiments of this aspect of the invention may include one or more of the following features.

The member includes a guide wire retainer that receives the guide  
5 wire in the friction fit. The member includes a handle and a shaft coupled  
to the handle. The guide wire has a sharp distal end for penetrating soft  
tissue and bone. The member has a drill tip for forming a hole in bone.  
The guide wire pusher is arranged relative to the member to limit a depth  
to which the member can be advanced into bone. The member defines an  
10 internal shoulder which the guide wire pusher contacts to limit relative  
movement between the member and the guide wire pusher. The member  
is configured to provide the friction fit such that the guide wire is pre-  
assembled and secure within the member when the member is being  
introduced to a surgical site, and the friction fit is overcome when the guide  
15 wire is inserted into bone and the member is retracted relative to the guide  
wire.

According to another aspect of the invention, a method includes  
advancing a surgical tool to a surgical site, the surgical tool including a  
20 member, a guide wire received in the member, and a guide wire pusher,  
and applying a force to the guide wire pusher to advance the guide wire  
into bone moving the guide wire relative to the member to overcome a  
friction fit securing the guide wire to the member.

25 Embodiments of this aspect of the invention may include one or more  
of the following features.

The method includes advancing the member relative to the guide  
wire to form a hole in the bone for receiving an implant. The advancement  
30 of the member relative to the guide wire is limited by interaction of the  
guide wire pusher with the member. The method includes withdrawing the  
member from the surgical site while maintaining the guide wire at the

surgical site by overcoming the friction fit, and advancing an implant over the guide wire and into the bone hole.

5 The guide wire retainer provides the friction fit and allows the guide wire to be held in such a way that it is pre-assembled and secure while the tool is being introduced to a surgical site. At the same time, once a hole is drilled into bone, the guide wire retainer allows the remainder of the tool to be removed leaving the guide wire in place at the site. The guide wire  
10 pusher allows the guide wire to be impacted into the bone before drilling and limits any possibility of drilling past the end of the guide wire.

Advantages of the invention may include one or more of the following features.

15 A soft tissue repair tool for bone preparation and implant deployment is easy to use, is presented pre-assembled in a single-case, pre-sterilized format, does not require separate assembly and dis-assembly steps, controls the relative position between the guide wire and shaft both before, during, and after drilling, requires only two instrument components, a drill  
20 tool and an inserter, to deploy an implant, and can be used arthroscopically or in an open or mini-open procedure.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features,  
25 objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

### DESCRIPTION OF DRAWINGS

30 Fig. 1 is a perspective view of a drill tool according to the invention;  
Fig. 2 is a cross-sectional view of the drill tool;  
Fig. 3A is a cross-sectional view of a handle region of the drill tool;

Fig. 3B is a cross-sectional view of the handle region showing a guide wire pusher advanced distally;

Fig. 4 is an exploded view of the drill tool;

Fig. 5 is an exploded view of a packaged tissue preparation and  
5 implant deployment assembly; and

Figs. 6A - 6E show the drill tool in use.

### DETAILED DESCRIPTION

10 Referring to Figs. 1 and 2, a drill tool 1 for preparing tissue to receive an implant includes an elongate member 1a having a shaft 2 and a handle 3 attached to a proximal region 8 of shaft 2, e.g., by pressing, gluing or welding. Shaft 2 defines a lumen 30, and handle 3 defines a lumen 32. Lumens 30, 32 are aligned and create a through passage 34 from a  
15 proximal end 36 of handle 3 to a distal end 7 of shaft 2. Tool 1 includes a guide wire 4 received within lumen 30 of shaft 2 and axially translatable relative to shaft 2, a guide wire pusher 5 received within lumen 32 of handle 3 and axially translatable relative to handle 3, and a guide wire retainer 6 received within proximal region 8 of shaft 2 that frictionally  
20 engages guide wire 4, for purposes described below. Guide wire 4 has a distal, sharp point 17 for penetrating soft tissue and bone, and shaft distal end 7 is formed to a sharp drilling tip 7a for forming a hole in bone. Handle 3 has a proximal hex feature 12 that allows releasable attachment of tool 1 to a power drilling tool (not shown).

25

Referring to Fig. 3A, handle 3 has a first internal shoulder 10 extending into lumen 32, against which shaft 2 and guide wire retainer 6 are held, and a second internal shoulder 11 extending into lumen 32, which limits the proximal translation of the guide wire pusher 5 (arrow, A)  
30 by engagement of an enlarged, distal end 13 of guide wire pusher 5 with shoulder 11. Guide wire pusher distal end 13 defines an axially oriented blind hole 15 opening distally for removably receiving a proximal end 18 of

guide wire 4. As shown in Fig. 3B, guide wire pusher 5 is used to distally advance guide wire 4 relative to shaft 2.

Referring also to Fig. 4, surrounding proximal region 8 of shaft 2 is an  
5 outer cylindrical member 38 having an enlarged inner diameter region 38a  
for receiving guide wire retainer 6. Shaft 2 has a proximal end 8a that  
abuts against guide wire retainer 6. Guide wire retainer 6 defines a  
channel 19 through which guide wire 4 passes. There is a frictional fit  
between guide wire 4 and guide wire retainer 6 such that guide wire 4 is  
10 retained within tool 1 until guide wire 4 is fixed in the bone and tool 1 is  
removed from the bone, as described below.

Referring to Fig. 5, tool 1 is preferably packaged sterile with an  
implant inserter 20 and extra guide wires 21 in a foam carrier 22 (in case  
15 the guide wire 4 supplied in tool 1 is damaged during a procedure before  
all implants for that procedure are implanted) in a disposable tray 23. The  
components of tool 1 are preferably manufactured by polymer molding  
processes and machining and pressed assembled, though other methods  
using biocompatible metal(s) and polymer(s) can be used.

20

Referring to Fig. 6A, in use, with guide wire 4 positioned relative to  
shaft 2 as shown in Fig. 1, i.e., with guide wire pusher 5 against internal  
shoulder 11, the operator passes distal point 17 of guide wire 4 and distal  
end 7 of shaft 2 through soft tissue 60 and against bone 62 at the  
25 reattachment site 64 on the bone. Referring also to Fig. 6B, the operator  
then impacts guide wire pusher 5 (arrow, B) with, e.g., a hammer,  
overcoming the friction fit between guide wire 4 and guide wire retainer 6  
to advance guide wire 4 relative to shaft 2, until a proximal end 14 of guide  
wire pusher 5 is flush with a proximal end 40 of handle hex feature 12.  
30 This action lodges the distal end of guide wire 4 in bone 62 a distance  
equal to the length,  $l$ , of guide wire pusher 5 that extends from proximal  
end 40 when guide wire pusher 5 is against internal shoulder 11.

Referring to Fig. 6C, the operator then advances (arrow, C) and rotates (arrow, D) handle 3 and shaft 2, either by hand or with a power drill coupled to hex feature 12, to form a hole 66 in bone 62 greater than or equal to the length of the portion of the implant to be deployed within the bone. This can be aided by length markings (not shown) on shaft 2. The advancement of shaft 2 moves shaft 2 relative to guide wire 4 such that guide wire pusher 5 again protrudes from proximal end 40 of handle 3, and guide wire 4 is retained within shaft 2 by the friction fit with retainer 6.

10 The operator then gives guide wire pusher 5 a few taps to dislodge any debris which may have become lodged in lumen 30 of shaft 2.

Referring to Fig. 6D, the operator then removes shaft 2, handle 3, pusher 5, and retainer 6 from the patient. The friction fit is selected such that the force to overcome the lodgement of guide wire 4 within the bone is greater than the force to overcome the friction fit, such that guide wire 4 remains in place in the bone when the remainder of tool 1 is removed. The operator then places an implant 50, such as a Suretac® tissue tack available from Smith & Nephew, Inc., Andover, MA, catalogue number 014567, on guide wire 4, and uses inserter 20 (Fig. 5) to push implant 50 into the bone. Impaction is usually necessary to aid in this step. The operator then removes guide wire 4 from the bone.

15  
20

Referring to Fig. 6E, implant 50 is preferably a tack with a shaft 52 and a head 54. Shaft 52 is implanted into hole 66 drilled in the bone, and head 54 captures and holds down the soft tissue 60 being re-attached to bone 62.

25

A number of embodiments of the invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention.

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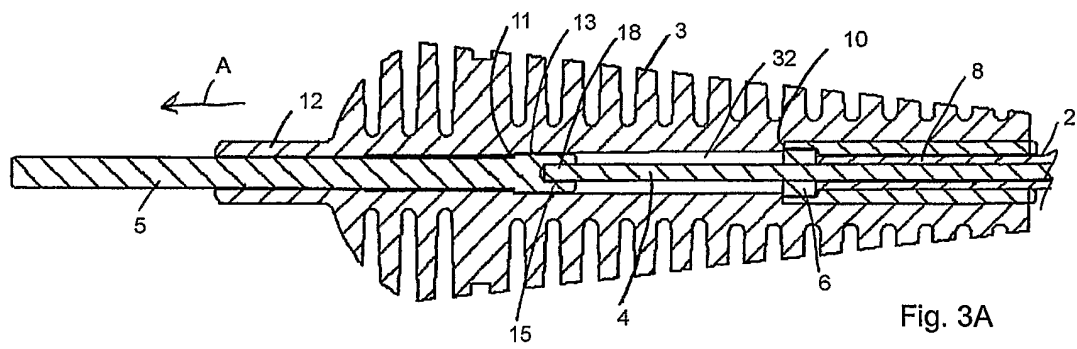
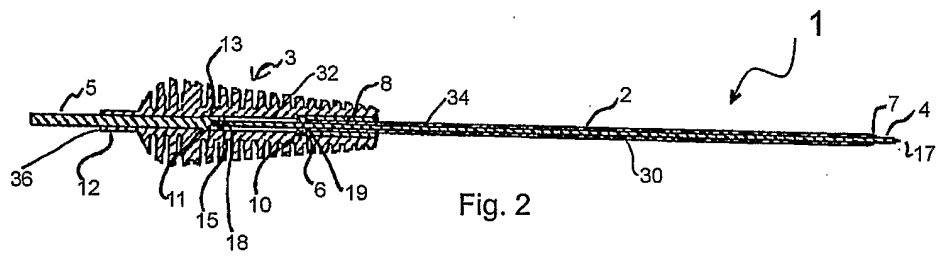
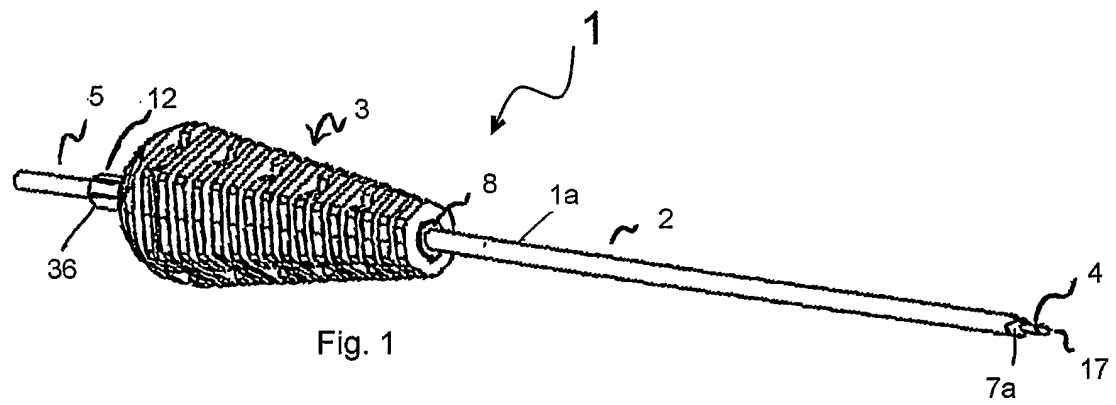
Accordingly, other embodiments are within the scope of the following claims.

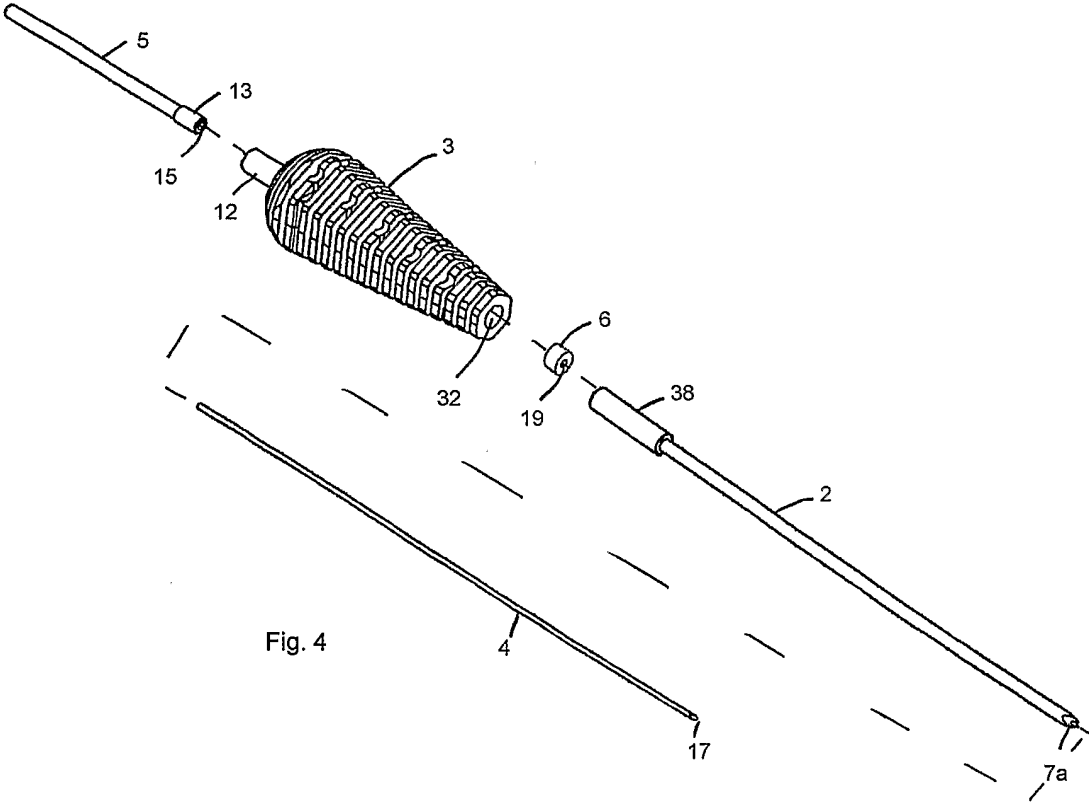
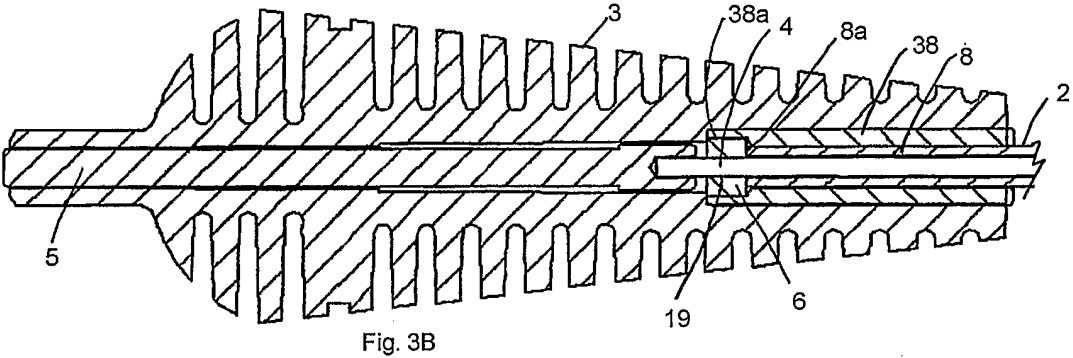
**WHAT IS CLAIMED IS:**

1. A surgical tool, comprising:  
a member,  
5 a guide wire received within the member by a friction fit, and  
a guide wire pusher for application of a force to the guide wire to  
overcome the friction fit and advance the guide wire relative to the  
member.
- 10 2. The surgical tool of claim 1 wherein the member includes a guide  
wire retainer that receives the guide wire in the friction fit.
3. The surgical tool of claim 1 wherein the member includes a handle  
and a shaft coupled to the handle.
4. The surgical tool of claim 1 wherein the guide wire has a sharp distal  
end for penetrating soft tissue and bone.
- 15 5. The surgical tool of claim 1 wherein the member has a drill tip for  
forming a hole in bone.
6. The surgical tool of claim 1 wherein the guide wire pusher is  
arranged relative to the member to limit a depth to which the member  
can be advanced into bone.
- 20 7. The surgical tool of claim 6 wherein the member defines an internal  
shoulder which the guide wire pusher contacts to limit relative  
movement between the member and the guide wire pusher.
- 25 8. The surgical tool of claim 1 wherein the member is configured to  
provide the friction fit such that the guide wire is pre-assembled and  
secure within the member when the member is being introduced to a  
surgical site, and the friction fit is overcome when the guide wire is  
inserted into bone and the member is retracted relative to the guide  
wire.

9. A method comprising:  
advancing a surgical tool to a surgical site, the surgical tool including  
a member, a guide wire received in the member, and a guide wire  
pusher, and  
5 applying a force to the guide wire pusher to advance the guide wire  
into bone moving the guide wire relative to the member to overcome  
a friction fit securing the guide wire to the member.
10. The method of claim 9 further comprising advancing the member  
relative to the guide wire to form a hole in the bone for receiving an  
10 implant.
11. The method of claim 10 wherein the advancement of the member  
relative to the guide wire is limited.
12. The method of claim 11 wherein the advancement of the member is  
limited by interaction of the guide wire pusher with the member.
- 15 13. The method of claim 10 further comprising withdrawing the member  
from the surgical site while maintaining the guide wire at the surgical  
site by overcoming the friction fit.
14. The method of claim 13 further comprising advancing an implant over  
the guide wire and into the bone hole.

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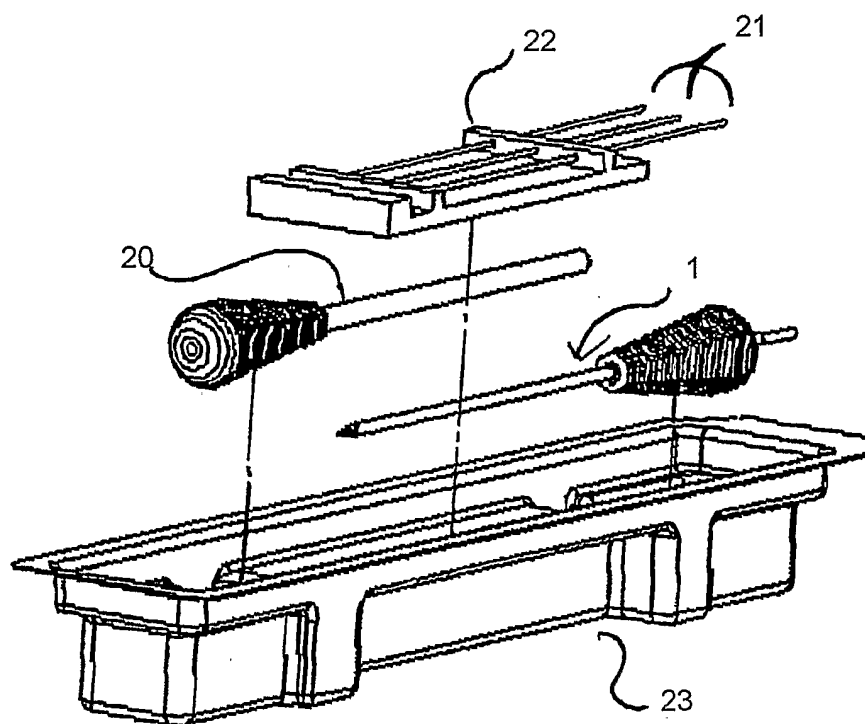


Fig. 5

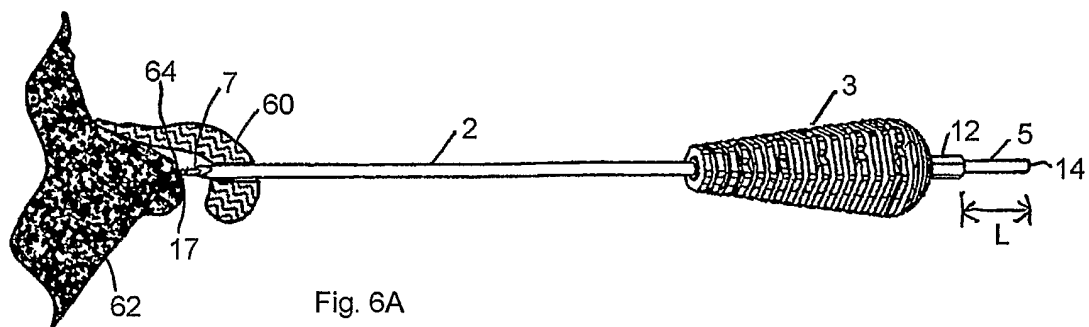
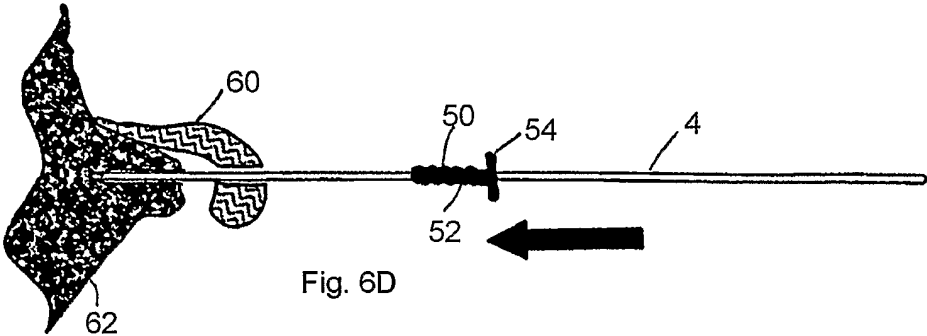
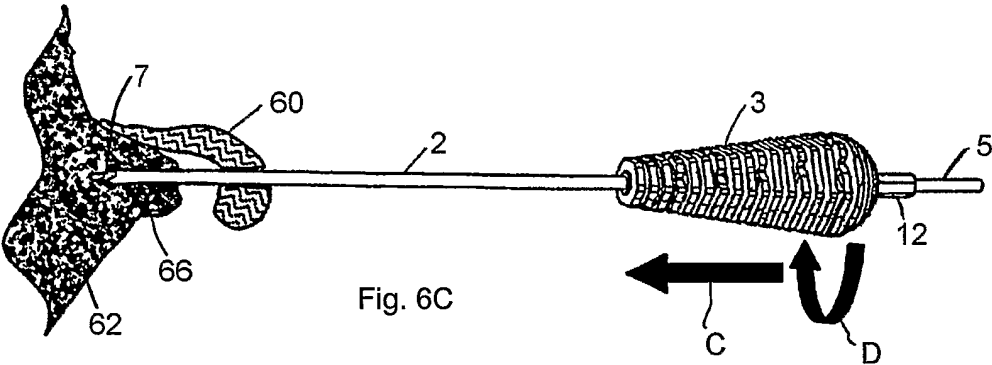
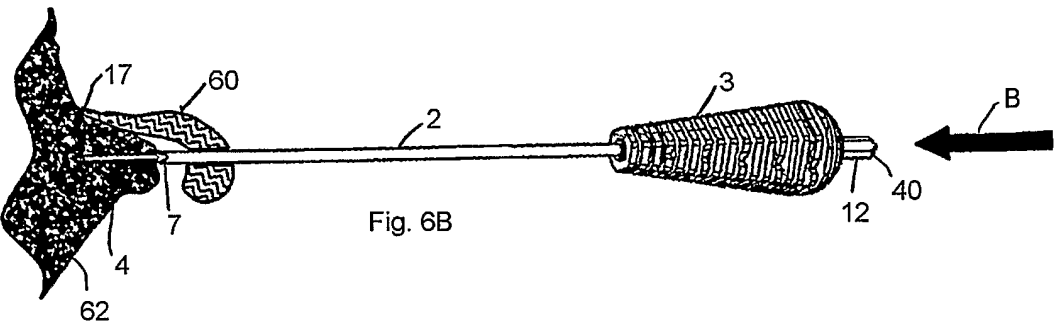


Fig. 6A



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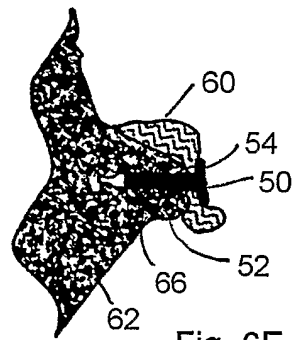


Fig. 6E

# INTERNATIONAL SEARCH REPORT

Internat	Application No
PCT/US	03/19098

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 A61B17/17 A61B17/16

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)

IPC 7 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 practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 450 835 A (ASNIS STANLEY E ET AL) 29 May 1984 (1984-05-29) column 5, line 36 -column 6, line 12; figures 5,6 ----	1,4,5
A	US 2001/044633 A1 (KLINT HENRIK SONDERSKOV) 22 November 2001 (2001-11-22) paragraph '0093!; figure 13 ----	1
A	US 5 374 270 A (HENDRICKS STEPHEN D ET AL) 20 December 1994 (1994-12-20) the whole document ----	1,4,5
A	EP 0 556 570 A (ARTHREX MED INSTR GMBH) 25 August 1993 (1993-08-25) column 3, line 55 - line 58; figure 2 -----	1



Further documents are listed in the continuation of box C.



Patent family members are listed in 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 document 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.

\*Z\* document member of the same patent family

Date of the actual completion of the international search

8 October 2003

Date of mailing of the international search report

16/10/2003

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 03/19098

### Box I Observations where certain claims were found unsearchable (Continuation of item 1 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.: 9-14  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.
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.

☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internet Application No  
PCT/US 03/19098

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