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KR, KW, 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.

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(54) Title: K-WIRE DEPTH MEASUREMENT

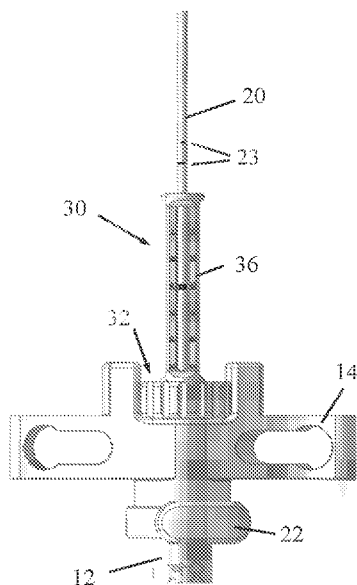


FIG. 2

(57) Abstract: An assembly includes a surgical device (10) including a distal interface member (12) and a proximal handle (14), the distal interface member (12) including a connecting element (16) for connecting to a surgical tool (18), and a K-wire (20) that passes through a central passageway of the surgical device (10) distally through the distal interface member (12) into a lumen of the surgical tool (18). A wire depth measurement tool (30) includes a handle interface member (32) that assembles to the handle (14) and one or more graduated scales (36) that extend proximally from the handle interface member (32). The graduated scales (36) include depth graduations for indicating an amount a tip of the K-wire (20) protrudes from a distal end of the surgical tool (18).



K-WIRE DEPTH MEASUREMENT FIELD OF THE INVENTION

The present invention relates generally to methods and apparatus for measuring depth of a Kirschner wire (K-wire) that passes through a surgical tool, such as but not limited to, screwdrivers, taps, bores, awls, probes, Jamshidi needles, and others.

BACKGROUND OF THE INVENTION

For example, in certain surgical procedures, a K-wire or similar guide wire (the terms being used interchangeably throughout) is used in combination with a cannulated surgical tool, such as a screwdriver, tap, bore, awl, probe, or Jamshidi needle, to name some. The K-wire is positioned through the pedicle and into the vertebral body to indicate or establish the position of subsequent screw placement. Once the proper positioning of the K-wire is confirmed by X-rays, the screw connected to the screwdriver is guided over the K-wire through the lumen (cannula) of the surgical tool and penetrates into the bone, which if not done properly can injure the patient, particularly if the K-wire encounters certain sensitive tissues. The procedures often require the use of force which can cause an otherwise properly positioned K-wire to move forward into the surgical site, which if excessive can move into contact where contact is to be avoided.

Measurement of the depth of the K-wire, that is, the amount the tip of the K-wire protrudes from the distal end of the surgical tool, is critical for patient safety. In a normal screw placement over a K-wire, the K-wire is placed to the desired depth, and then the screw is advanced over the K-wire. The surgeon must make sure the tip of the K-wire is not pushed further distally towards the anterior cortex of the vertebral body. If the K-wire tip were to puncture through the vertebra it could damage major blood vessels and cause major bleeding.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved device for measuring the depth of a K-wire, as described more in detail hereinbelow.

The term K-wire throughout the specification and claims encompasses any slender, elongated piece with a tip used for entering bone, such as a K-wire or Steinmann pin or guidewire.

There is thus provided in accordance with an embodiment of the present invention an assembly including a surgical device including a distal interface member and a proximal handle, the distal interface member including a connecting element for connecting to a surgical tool, and a K-wire that passes through a central passageway of

the surgical device distally through the distal interface member into a lumen of the surgical tool, and a wire depth measurement tool that includes a handle interface member that assembles to the handle and one or more graduated scales that extend proximally from the handle interface member, the one or more graduated scales including depth graduations for indicating an amount a tip of the K-wire protrudes from a distal end of the surgical tool.

In accordance with an embodiment of the present invention the handle interface member includes a threaded connection and a knob, wherein the threaded connection mates with the handle and is tightened or loosened by turning the knob.

In accordance with an embodiment of the present invention the K-wire is locked in place in the handle by means of a locking element.

In accordance with an embodiment of the present invention the one or more graduated scales include a plurality of scales that face different directions.

In accordance with an embodiment of the present invention the wire depth measurement tool is formed with a lumen for the K-wire to pass through.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Fig. 1 is a simplified illustration of a surgical tool assembled with a wire depth measurement tool, constructed and operative in accordance with an embodiment of the present invention;

Fig. 2 is a simplified illustration of the wire depth measurement tool assembled on a handle of the surgical tool;

Figs. 3 and 4 are simplified plan-view and perspective illustrations, respectively, of the wire depth measurement tool, in accordance with a non-limiting embodiment of the present invention; and

Fig. 5 is a simplified exploded illustration of the surgical tool, wire depth measurement tool and K-wire.

DETAILED DESCRIPTION OF EMBODIMENTS

Reference is now made to Figs. 1-2 and 5, which illustrate a surgical device 10 assembled with a wire depth measurement tool 30, constructed and operative in accordance with a non-limiting embodiment of the present invention.

Surgical device 10 may be, but not necessarily, constructed similarly to the tool described in PCT Patent Application PCT/IB2016/052074 (WO 2016/166662).

Surgical device 10 includes a distal interface member 12 and a proximal handle 14. Distal interface member 12 includes a connecting element 16 for connecting to a surgical tool 18, such as but not limited to, a cannulated pedicle awl, a screw, a screwdriver, a tap, a bore, a probe, or a jamshidi needle and the like. For example, connecting element 16 may be a quick-disconnect connector that secures to the proximal end of tool 18. Surgical device 10 is formed with a central passageway or lumen formed through distal interface member 12 and handle 14, and through surgical tool 18. Two or more surgical tools may be connected to each other, such as a screwdriver connected to a pedicle screw.

A K-wire 20 passes through the central passageway of surgical device 10 distally through distal interface member 12 into the lumen of surgical tool 18, and then can pass distally out the distal tip of surgical tool 18. The K-wire 20 may be locked in place in the handle 14 by means of a locking element 22 (such as, but not limited to, a screw or nut).

The wire depth measurement tool 30, shown particularly in Figs. 3 and 4, includes a handle interface member 32 that assembles to the handle 14. For example, handle interface member 32 may include a threaded connection 33 and a knob 34. The male (or female) threaded connection 33 mates with a corresponding (female or male) threaded portion of handle 14 and is tightened or loosened by turning knob 34 in the appropriate direction. Alternatively, handle interface member 32 may connect to handle 14 or even to surgical tool 18 by other means, such as but not limited to, quick disconnect connections, press fit, snap fit, bayonet connections and others.

One or more graduated scales 36 extend proximally from handle interface member 32. Each graduated scale 36 has depth graduations for indicating the depth of K-wire 20, that is, the amount the tip of K-wire 20 protrudes from the distal end of the surgical tool 18. There are preferably several graduate scales 36 that face different directions so the surgeon can easily see the depth graduations at any viewing angle. The wire depth measurement tool 30 is formed with a lumen 38 for the K-wire 20 to pass through. The wire depth measurement tool 30 is pre-calibrated such that when tool 30 is properly assembled on surgical device 10, the graduated scale 36 accurately indicates the depth of K-wire 20.

In another aspect of the invention, K-wire 20 includes one or more depth graduations 23, which may be laser marked, etched or otherwise disposed at least partially around the circumference of K-wire 20.

CLAIMS

What is claimed is:

1. An assembly comprising:

a surgical device (10) comprising a distal interface member (12) and a proximal handle (14), said distal interface member (12) comprising a connecting element (16) for connecting to a surgical tool (18), and a K-wire (20) that passes through a central passageway of said surgical device (10) distally through said distal interface member (12) into a lumen of said surgical tool (18); and

a wire depth measurement tool (30) that comprises a handle interface member (32) that assembles to said handle (14) and one or more graduated scales (36) that extend proximally from said handle interface member (32), said one or more graduated scales (36) comprising depth graduations for indicating an amount a tip of said K-wire (20) protrudes from a distal end of said surgical tool (18).

2. The assembly according to claim 1, wherein said handle interface member (32) comprises a threaded connection (33) and a knob (34), wherein said threaded connection (33) mates with said handle (14) and is tightened or loosened by turning said knob (34).

3. The assembly according to claim 1, wherein said K-wire (20) is locked in place in said handle (14) by means of a locking element (22).

4. The assembly according to claim 1, wherein said one or more graduated scales (36) comprise a plurality of scales (36) that face different directions.

5. The assembly according to claim 1, wherein said wire depth measurement tool (30) is formed with a lumen (38) for said K-wire (20) to pass through.

6. The assembly according to claim 1, wherein said K-wire (20) comprises one or more depth graduations (23) disposed at least partially around a circumference of said K-wire (20).

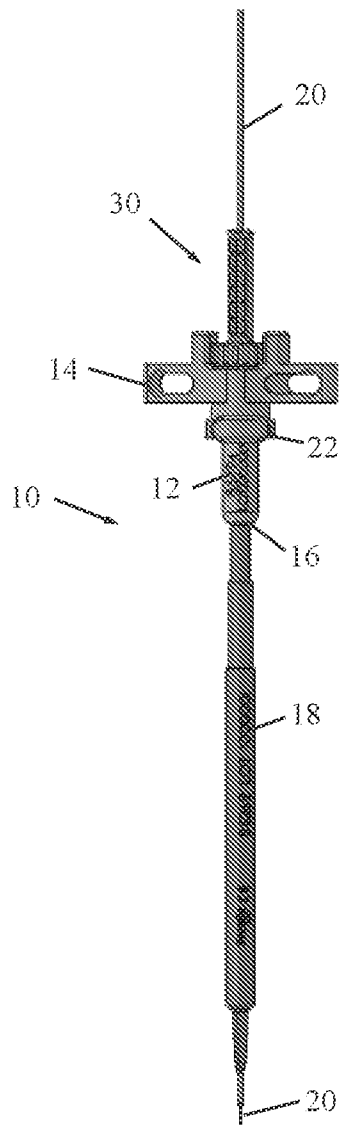


FIG. 1

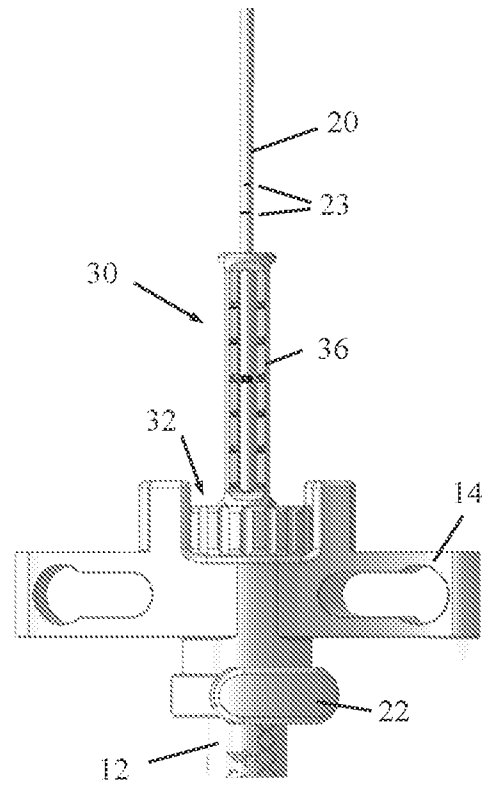


FIG. 2

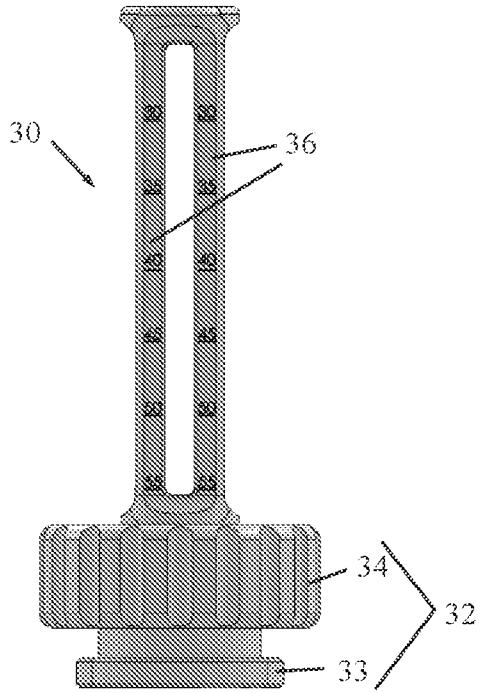


FIG. 3

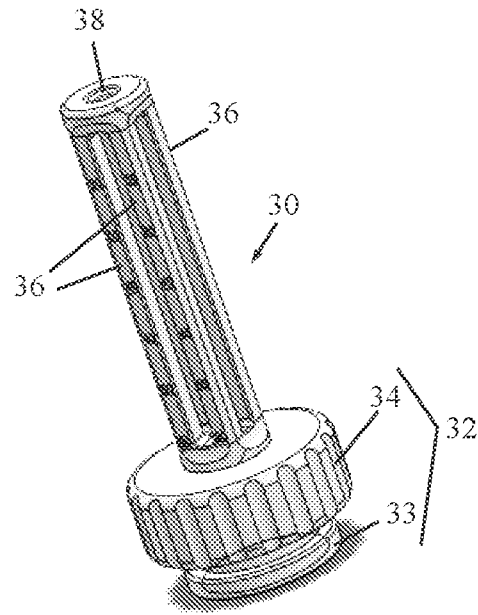


FIG. 4

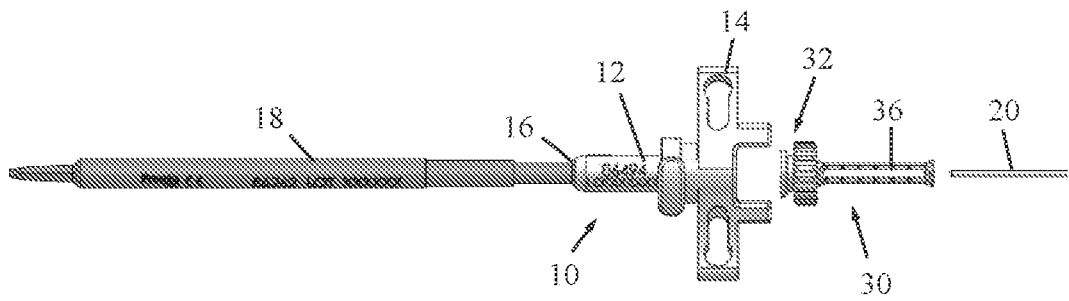


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/052849

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/84 A61B17/34 A61B90/00 A61B17/88
ADD.
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 2009/157077 A1 (LARSEN SCOTT [US] ET AL) 18 June 2009 (2009-06-18) paragraph [0075]; figures 1, 34-36 -----	1-6
X	US 2016/250039 A1 (CHOW JAMES [US]) 1 September 2016 (2016-09-01) paragraph [0128] - paragraph [0131]; figures 54-58 -----	1-6
X	US 2016/030106 A1 (CARTER ROBERT D [US] ET AL) 4 February 2016 (2016-02-04) paragraph [0128] - paragraph [0129]; figures 10a,b -----	1-6
A	US 2009/228015 A1 (ELLIS DANIEL B [US] ET AL) 10 September 2009 (2009-09-10) paragraph [0019]; figures 1-5 ----- -/--	1,6

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
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- "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

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"&" document member of the same patent family

Date of the actual completion of the international search 15 July 2019	Date of mailing of the international search report 19/07/2019
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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 Moers, Roelof
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/052849

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 895 389 A (SCHENK BEAT SIMON [US] ET AL) 20 April 1999 (1999-04-20) column 4, line 13 - column 5, line 25; figure 1	1
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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