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McClintock et al.

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(54) **ROD REDUCER, COMPRESSOR, DISTRACTOR SYSTEM**

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(73) Assignee: **K2M, Inc.**, Leesburg, VA (US)

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Related U.S. Patent Documents

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U.S. Applications:
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(51) **Int. Cl.**
A61B 17/88 (2006.01)
A61B 17/70 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 17/88*** (2013.01); ***A61B 17/708*** (2013.01); ***A61B 17/7079*** (2013.01); *A61B 17/7086* (2013.01)

(58) **Field of Classification Search**
CPC . A61B 2017/0256; A61B 17/60; A61B 17/88; A61B 17/708; A61B 17/7079
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,920,821 A * 8/1933 Wassenaar ..... A61B 17/6408 606/86 R
3,244,170 A * 4/1966 McElvenny A61B 17/7225 606/105
(Continued)

FOREIGN PATENT DOCUMENTS

DE 29710979 U1 8/1997
DE 19726754 A1 2/1999
(Continued)

OTHER PUBLICATIONS

Charles Hartjen; The Atavi System, Surgical Technique Brochure. Endius, p. 1-17, undated.

(Continued)

Primary Examiner — David O Reip
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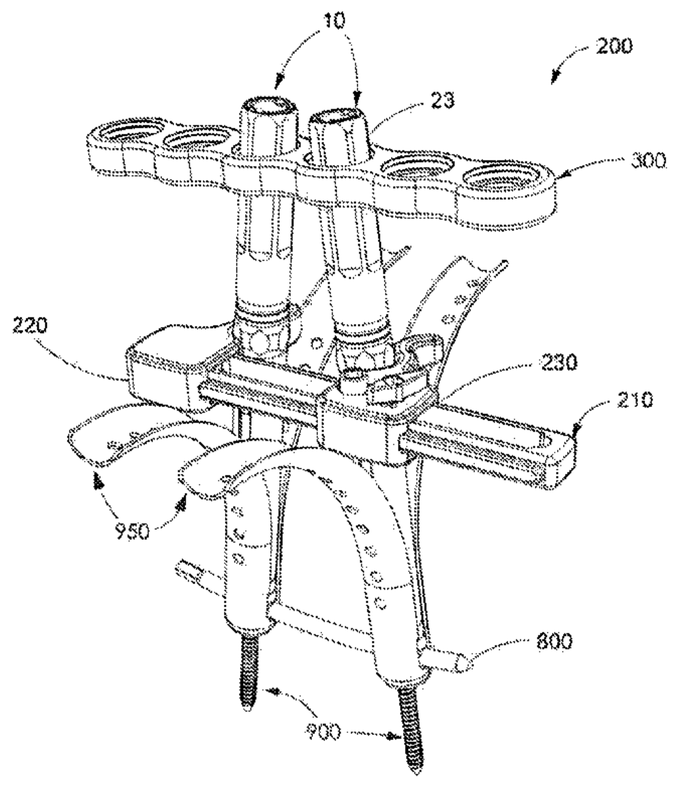
(57) **ABSTRACT**

A compressor/distractor system for operating on a spine is disclosed. The system includes two rod reducers which each advance a spinal rod into the shoulder portion of a pedicle screw. Each rod reducer includes an inner member, an outer member, and a pair of gripping members. Each outer member receives and advances the spinal rod into the pedicle screw. The outer member also includes a through slot which receives the proximal end of each of the pair of gripping members which may limit the longitudinal translation of the outer member with respect to the inner member. The compressor/distractor system may include a compressor/distractor device which has a compressing, a distracting, and a neutral configuration. A method for using the minimally invasive rod reducers with the compressor/distractor system to secure at least two pedicle screws in desired positions on a spinal rod is also disclosed.

21 Claims, 11 Drawing Sheets



Related U.S. Application Data

application for the reissue of Pat. No. 9,737,351, which is a division of application No. 13/741,934, filed on Jan. 15, 2013, now Pat. No. 9,125,703.

(60) Provisional application No. 61/586,928, filed on Jan. 16, 2012.

(56) References Cited

U.S. PATENT DOCUMENTS

3,997,138	A	12/1976	Crock et al.	
4,263,899	A	4/1981	Burgin	
4,382,438	A	5/1983	Jacobs	
4,409,968	A	10/1983	Drummond	
4,411,259	A	10/1983	Drummond	
4,957,495	A	9/1990	Kluger	
5,010,879	A	4/1991	Moriya et al.	
5,059,194	A	10/1991	Michelson	
5,167,662	A *	12/1992	Hayes	A61B 17/7076 606/151
5,242,443	A	9/1993	Kambin	
5,281,223	A	1/1994	Ray	
5,385,565	A	1/1995	Ray	
5,478,340	A	12/1995	Kluger	
5,487,743	A	1/1996	Laurain et al.	
5,529,571	A	6/1996	Daniel	
5,591,167	A	1/1997	Laurain et al.	
5,672,175	A *	9/1997	Martin	A61B 17/025 606/105
5,685,826	A	11/1997	Bonutti	
5,704,937	A *	1/1998	Martin	A61B 17/025 606/102
RE36,221	E	6/1999	Breard et al.	
5,944,658	A	8/1999	Koros et al.	
6,090,113	A	7/2000	Le Couedic et al.	
6,123,707	A	9/2000	Wagner	
6,146,386	A	11/2000	Blackman et al.	
6,200,322	B1	3/2001	Branch et al.	
6,485,518	B1	11/2002	Cornwall et al.	
6,506,151	B2	1/2003	Estes et al.	
6,530,929	B1	3/2003	Justis et al.	
6,616,605	B2	9/2003	Wright et al.	
6,616,666	B1	9/2003	Michelson	
6,616,667	B1	9/2003	Steiger et al.	
6,712,818	B1	3/2004	Michelson	
6,849,064	B2	2/2005	Hamada	
6,929,606	B2	8/2005	Ritland	
7,008,422	B2	3/2006	Foley et al.	
7,011,660	B2	3/2006	Sherman et al.	
7,083,621	B2	8/2006	Shaolian et al.	
7,160,300	B2	1/2007	Jackson	
7,179,261	B2	2/2007	Sicvol et al.	
7,188,626	B2	3/2007	Foley et al.	
7,250,052	B2	7/2007	Landry et al.	
7,462,182	B2	12/2008	Lim	
7,491,208	B2	2/2009	Pond, Jr. et al.	
7,591,836	B2	9/2009	Dick et al.	
7,625,379	B2	12/2009	Puno et al.	
7,651,502	B2	1/2010	Jackson	
7,655,008	B2	2/2010	Lenke et al.	
7,666,189	B2	2/2010	Gerber et al.	
7,794,464	B2	9/2010	Bridwell et al.	
7,846,093	B2	11/2010	Simonson et al.	
7,854,751	B2	12/2010	Sicvol et al.	
7,922,749	B2	4/2011	Dewey	
7,927,334	B2	4/2011	Miller et al.	
7,946,982	B2	5/2011	Hamada	
7,951,168	B2	5/2011	Chao et al.	
7,951,175	B2	5/2011	Chao et al.	
7,955,355	B2	6/2011	Chin	
7,981,115	B2 *	7/2011	Justis	A61B 90/06 606/102
7,988,694	B2	8/2011	Barrus et al.	
8,002,798	B2	8/2011	Chin et al.	
8,007,516	B2	8/2011	Chao et al.	
8,147,524	B2	4/2012	Piza Vallespir	
8,157,809	B2	4/2012	Butters et al.	
8,192,438	B2	6/2012	Garamszegi	
8,206,395	B2	6/2012	McLean et al.	
8,221,426	B2 *	7/2012	Justis	A61B 17/708 606/86 A
8,221,474	B2	7/2012	Bridwell et al.	
8,230,863	B2	7/2012	Ravikumar et al.	
8,277,453	B2	10/2012	Kave et al.	
8,298,138	B2	10/2012	Gorek et al.	
8,303,595	B2	11/2012	Jones	
8,308,729	B2	11/2012	Nunley et al.	
8,308,774	B2	11/2012	Hoffman et al.	
8,506,574	B2	8/2013	Butters et al.	
8,545,505	B2	10/2013	Sandstrom et al.	
8,702,713	B2	4/2014	Nayet et al.	
8,764,757	B1 *	7/2014	Tumialan	A61F 2/4455 600/210
8,784,424	B2 *	7/2014	Tsuang	A61B 17/1671 606/86 A
8,894,655	B2	11/2014	Fallin et al.	
8,915,925	B2	12/2014	Butters et al.	
9,125,703	B2	9/2015	McClintock et al.	
9,179,947	B2 *	11/2015	Bass	A61B 17/025
9,345,463	B2	5/2016	Butters et al.	
2002/0052603	A1	5/2002	Nichols et al.	
2003/0055430	A1	3/2003	Kim	
2003/0073998	A1	4/2003	Pagliuca et al.	
2003/0167059	A1 *	9/2003	Young	A61B 17/7014 606/258
2003/0187436	A1	10/2003	Bolger et al.	
2004/0034351	A1	2/2004	Sherman et al.	
2004/0138662	A1	7/2004	Landry et al.	
2004/0143265	A1	7/2004	Landry et al.	
2004/0147928	A1	7/2004	Landry et al.	
2004/0172022	A1	9/2004	Landry et al.	
2004/0215190	A1	10/2004	Nguyen et al.	
2004/0230191	A1	11/2004	Frey et al.	
2004/0260287	A1	12/2004	Ferree	
2004/0267275	A1	12/2004	Cournoyer et al.	
2005/0010220	A1	1/2005	Casutt et al.	
2005/0010221	A1	1/2005	Dalton	
2005/0021030	A1	1/2005	Pagliuca et al.	
2005/0021031	A1	1/2005	Foley et al.	
2005/0038436	A1	2/2005	Michelson	
2005/0070917	A1	3/2005	Justis	
2005/0090822	A1	4/2005	DiPoto	
2005/0090833	A1	4/2005	DiPoto	
2005/0131421	A1	6/2005	Anderson et al.	
2005/0131422	A1 *	6/2005	Anderson	A61B 17/7079 606/104
2005/0154389	A1	7/2005	Selover et al.	
2005/0245928	A1 *	11/2005	Colleran	A61B 17/708 606/90
2006/0004380	A1 *	1/2006	DiDomenico	A61B 17/8019 606/105
2006/0111714	A1	5/2006	Foley	
2006/0200132	A1 *	9/2006	Chao	A61B 17/708 606/86 A
2006/0200135	A1	9/2006	Sherman et al.	
2006/0247645	A1 *	11/2006	Wilcox	A61B 17/025 606/86 R
2006/0247649	A1 *	11/2006	Rezach	A61B 17/7077 606/90
2006/0264934	A1 *	11/2006	Fallin	A61B 17/8863 606/86 A
2007/0055247	A1	3/2007	Jahng	
2007/0162009	A1	7/2007	Chao et al.	
2007/0162010	A1	7/2007	Chao et al.	
2007/0213715	A1 *	9/2007	Bridwell	A61B 17/025 606/264
2007/0233079	A1 *	10/2007	Fallin	A61B 17/7085 606/86 A
2008/0015601	A1	1/2008	Castro et al.	
2008/0077155	A1 *	3/2008	Diederich	A61B 17/708 606/105
2008/0119862	A1 *	5/2008	Wicker	A61B 17/708 606/99

(56) **References Cited**

U.S. PATENT DOCUMENTS

2008/0125789 A1* 5/2008 Butters A61B 17/025 606/105
2008/0172062 A1* 7/2008 Donahue A61B 17/708 606/104
2009/0018593 A1 1/2009 Barrus et al.
2009/0062857 A1* 3/2009 Ramsay A61B 17/1735 606/246
2009/0082775 A1* 3/2009 Altarac A61B 17/025 606/90
2009/0138056 A1* 5/2009 Anderson ..... A61B 17/7074 606/86 A
2009/0143828 A1* 6/2009 Stad ..... A61B 17/7085 606/86 A
2009/0149892 A1* 6/2009 Stad ..... A61B 17/7077 606/86 A
2009/0157125 A1* 6/2009 Hoffman ..... A61B 17/7091 606/86 A
2009/0171391 A1* 7/2009 Hutton A61B 17/7032 606/246
2009/0228053 A1* 9/2009 Kolb ..... A61B 17/7076 606/86 A
2009/0259262 A1* 10/2009 Nayet ..... A61B 17/7079 606/86 A
2009/0326586 A1* 12/2009 Duarte A61B 17/7089 606/264
2010/0024487 A1* 2/2010 Khoo A61B 17/708 66/90
2010/0030283 A1* 2/2010 King ..... A61B 17/7037 606/86 A
2010/0036443 A1* 2/2010 Hutton ..... A61B 17/7032 606/86 R
2010/0324610 A1 12/2010 Bridwell et al.
2010/0331849 A1* 12/2010 Riesinger A61B 17/7077 606/90
2011/0077690 A1* 3/2011 Shin A61B 17/7074 606/278
2011/0106082 A1* 5/2011 Kave A61B 17/708 606/70
2011/0130793 A1* 6/2011 Woolley A61B 17/0206 606/279
2011/0137358 A1* 6/2011 Manninen ..... A61B 17/7079 606/86 R
2011/0152940 A1* 6/2011 Frigg A61B 17/7002 606/264
2011/0172714 A1 7/2011 Boachie-Adjei et al.
2011/0172723 A1* 7/2011 Miller ..... A61B 17/7088 606/86 A
2011/0196426 A1* 8/2011 Peukert A61B 17/7083 606/279
2011/0257692 A1* 10/2011 Sandstrom ..... A61B 17/7085 606/86 A
2011/0282402 A1 11/2011 Chao et al.
2011/0295328 A1 12/2011 Woolley et al.
2011/0313477 A1* 12/2011 McLean ..... A61B 17/7011 606/86 A
2011/0319938 A1* 12/2011 Piza Vallespir A61B 17/7076 606/264
2012/0031792 A1* 2/2012 Petit A61B 17/708 206/438
2012/0035668 A1* 2/2012 Manninen A61B 17/7037 606/305
2012/0078308 A1* 3/2012 Dziedzic A61B 17/7086 606/264
2012/0083853 A1* 4/2012 Boachie-Adjei ... A61B 17/7038 606/86 A
2012/0116467 A1 5/2012 King et al.
2012/0191137 A1 7/2012 Butters et al.
2012/0191143 A1* 7/2012 Nayet ..... A61B 17/708 606/86 A
2012/0197297 A1* 8/2012 Bootwala A61B 17/7077 606/246
2012/0239096 A1* 9/2012 Gleeson ..... A61B 17/708 606/86 A
2012/0239097 A1* 9/2012 Garamszegi ..... A61B 17/7086 606/86 A
2012/0271365 A1* 10/2012 Daubs ..... A61B 17/7086 606/86 A
2012/0323279 A1* 12/2012 Tsuang A61B 17/7002 606/279
2013/0012999 A1* 1/2013 Petit A61B 17/7076 606/279
2013/0046345 A1* 2/2013 Jones A61B 17/7037 606/266
2013/0096635 A1* 4/2013 Wall A61B 17/7085 606/305
2013/0096637 A1* 4/2013 Richelsoph ..... A61B 17/7089 606/86 A
2013/0110184 A1* 5/2013 Wing ..... A61B 17/708 606/86 A
2013/0172947 A1* 7/2013 Greenberg ..... A61B 17/708 606/86 A
2013/0184763 A1* 7/2013 McClintock A61B 17/88 606/279
2013/0238037 A1* 9/2013 Stad ..... A61B 17/708 606/86 A
2013/0245692 A1* 9/2013 Hayes A61B 17/708 606/279
2013/0245694 A1* 9/2013 Choi A61B 17/708 606/279
2013/0274804 A1 10/2013 Hutton et al.
2013/0289633 A1* 10/2013 Gleeson ..... A61B 17/7074 606/86 A
2014/0018860 A1 1/2014 Butters et al.
2014/0031828 A1* 1/2014 Patel A61B 17/025 606/90
2014/0039557 A1 2/2014 Stad et al.
2014/0039567 A1* 2/2014 Hoefer ..... A61B 17/708 606/86 A
2014/0046372 A1* 2/2014 Ibrahim A61B 17/8605 606/250
2014/0052139 A1 2/2014 Manninen
2014/0074106 A1* 3/2014 Shin A61B 17/7079 606/104
2014/0074171 A1 3/2014 Hutton et al.
2014/0100617 A1 4/2014 Sandstrom et al.
2014/0100618 A1 4/2014 Kolb et al.
2014/0107707 A1* 4/2014 Rovner A61B 17/7034 606/264
2014/0114354 A1* 4/2014 May A61B 17/708 606/246
2014/0135855 A1* 5/2014 Jones ..... A61B 17/7091 606/86 A
2014/0163575 A1* 6/2014 Thoren A61B 17/7077 606/105
2014/0188182 A1 7/2014 Chao et al.
2014/0249591 A1* 9/2014 Peultier ..... A61B 17/7077 606/86 A
2014/0257312 A1* 9/2014 Solitario, Jr. A61B 17/7079 606/90
2014/0277151 A1* 9/2014 Fowler A61B 17/7074 606/265
2014/0277198 A1* 9/2014 Stad ..... A61B 17/7074 606/86 A
2014/0316475 A1* 10/2014 Parikh ..... A61B 17/7083 606/86 A
2015/0238235 A1* 8/2015 Tuten A61B 17/7077 606/279
2016/0106408 A1* 4/2016 Ponmudi A61B 17/025 606/90
2016/0262807 A1* 9/2016 Benson A61B 17/7077
2016/0338683 A1 11/2016 Butters et al.

FOREIGN PATENT DOCUMENTS

DE 10027988 1/2002
EP 0528177 A2 2/1993
EP 0611116 A1 8/1994

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

EP	665731		8/1995
SU	839513	A1	6/1981
WO	9409726	A1	5/1994
WO	0141681	A1	6/2001
WO	04021899	A1	3/2004
WO	04037074	A2	5/2004
WO	04041100	A1	5/2004
WO	04080318	A1	9/2004
WO	05018466	A2	3/2005
WO	05023123	A1	3/2005
WO	05032358	A2	4/2005
WO	05060534	A2	7/2005
WO	2006060430	A1	6/2006

OTHER PUBLICATIONS

Diapason, Surgical Texchnique Catalog, Diapasan Spinal System, Jan. 2002.

Kambin, Minimally Invasive Techniques in Spinal Surgery Current Practice, Neurosurgical Focus, wwwspineuniversecom, 16 pages, printed Aug. 24, 2005.

Kambin et al., "Percutaneous Posterolateral Lumbar Discectomy and Decompression with a 6.9-millimeter cannula", The Journal of Bone and Joint Surgery, pp. 822-831, Jul. 1991.

Leu et al., Percutaneous Fusion of the Lumbar Spine, State of the Art Reviews, vol. 6, No. 3, pp. 593-604, Sep. 1992.

Pathfinder; Minimally Invasive Pedicie Fixation System. Spinal Concepts Product Brochure p. 1-4, May 2003.

* cited by examiner

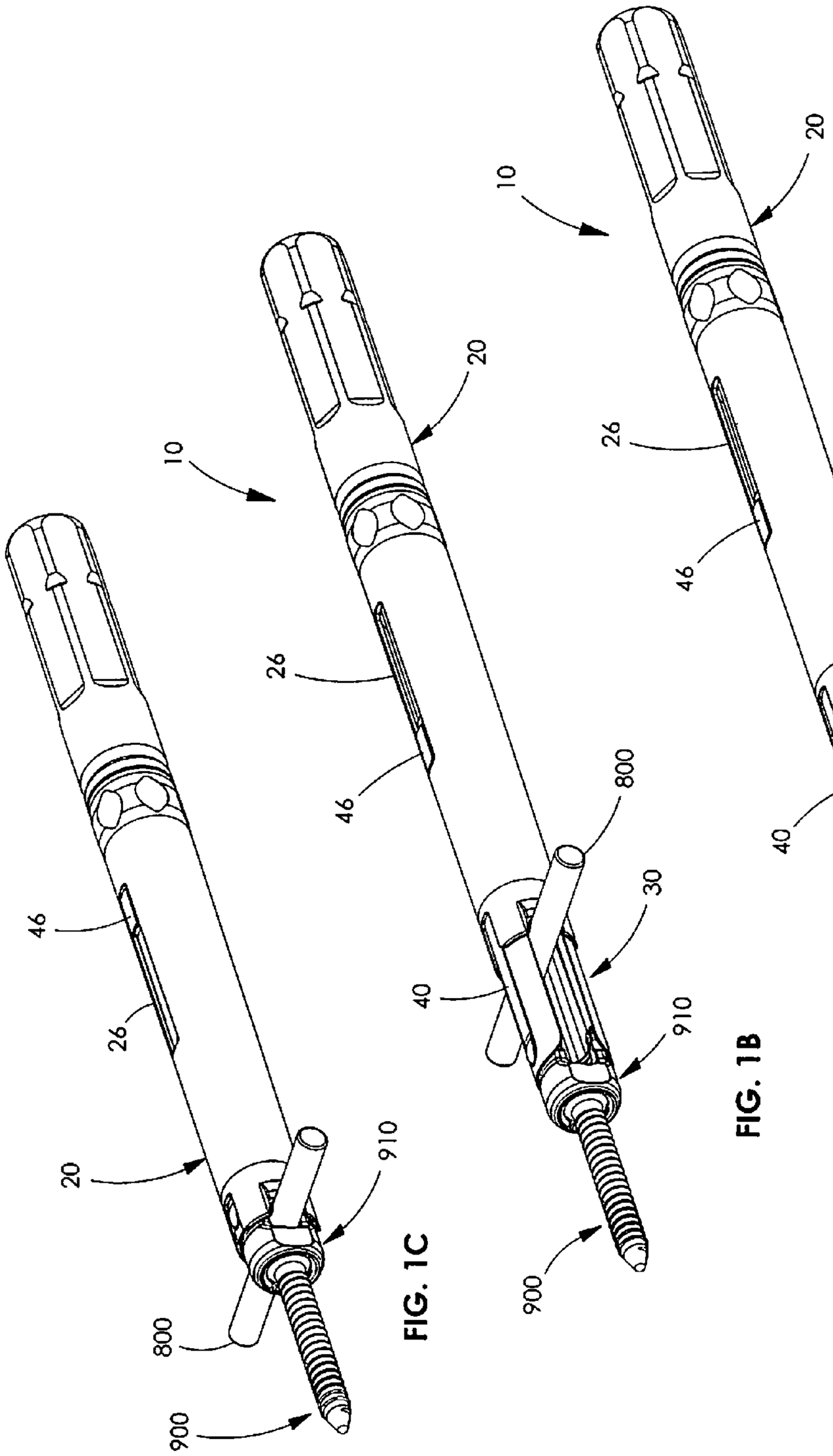


FIG. 1A

FIG. 1B

FIG. 1C

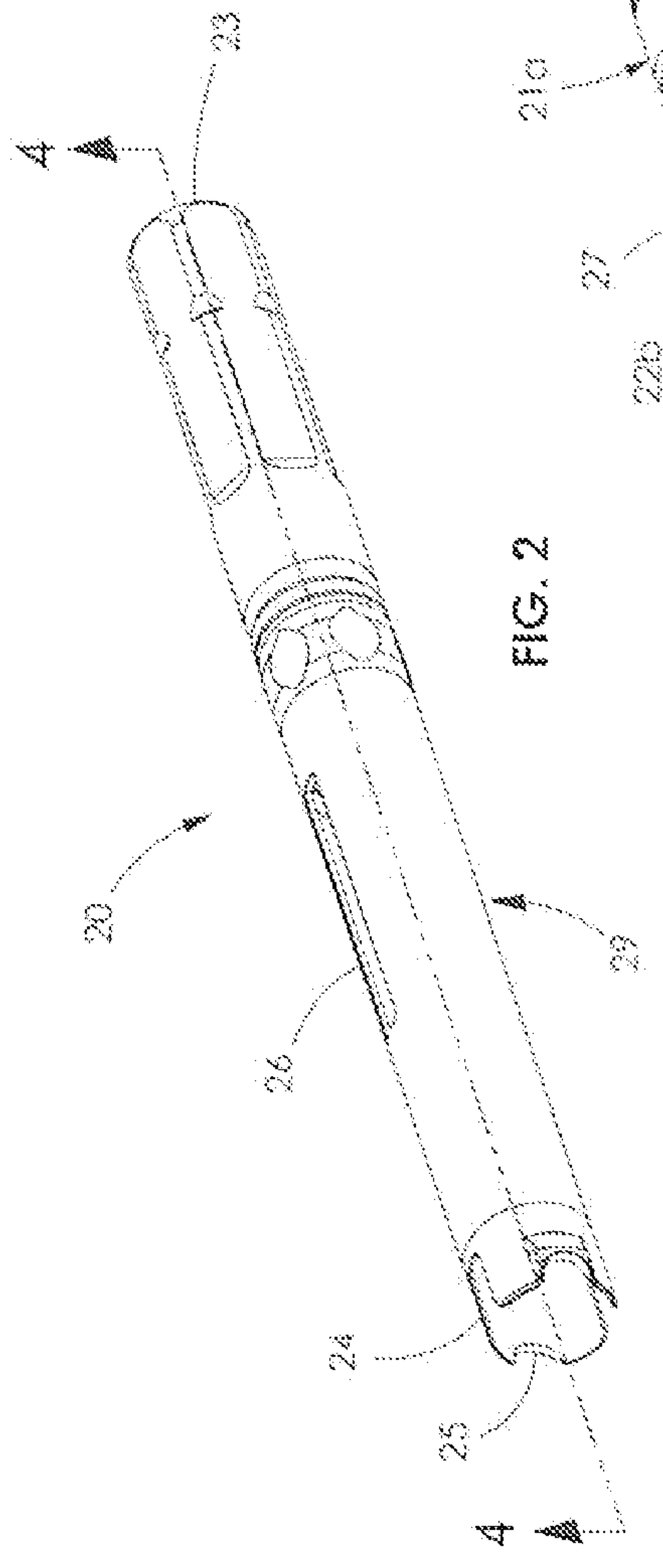


FIG. 2

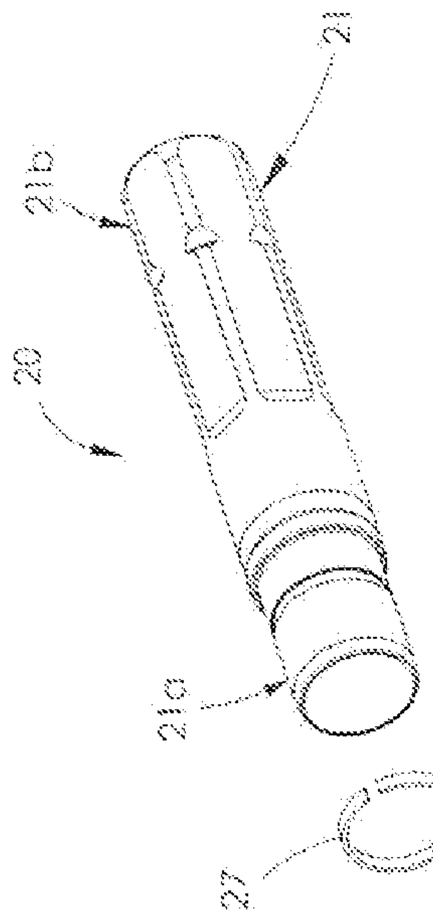
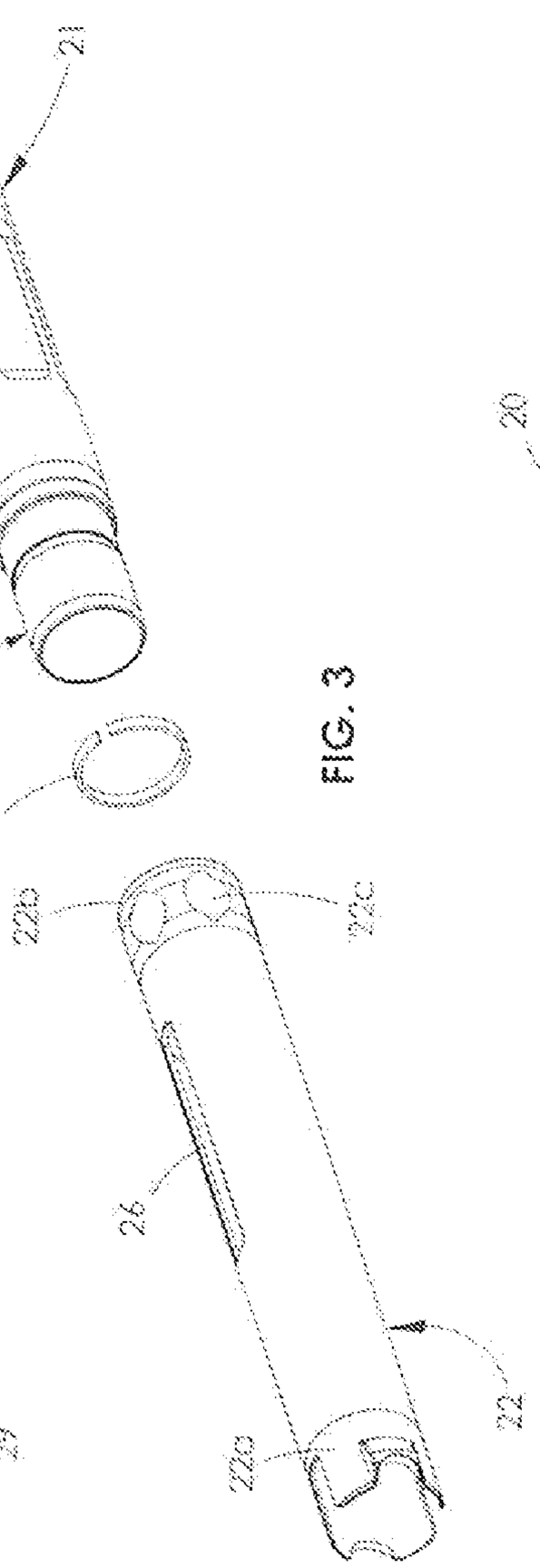


FIG. 3



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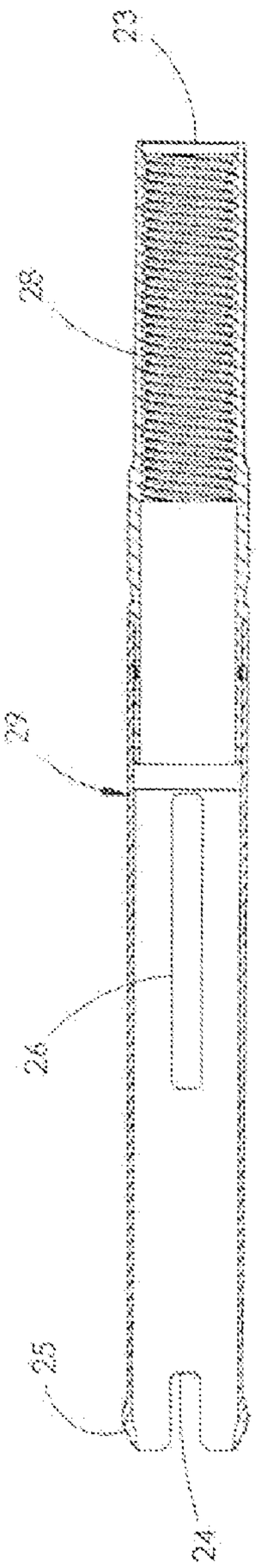

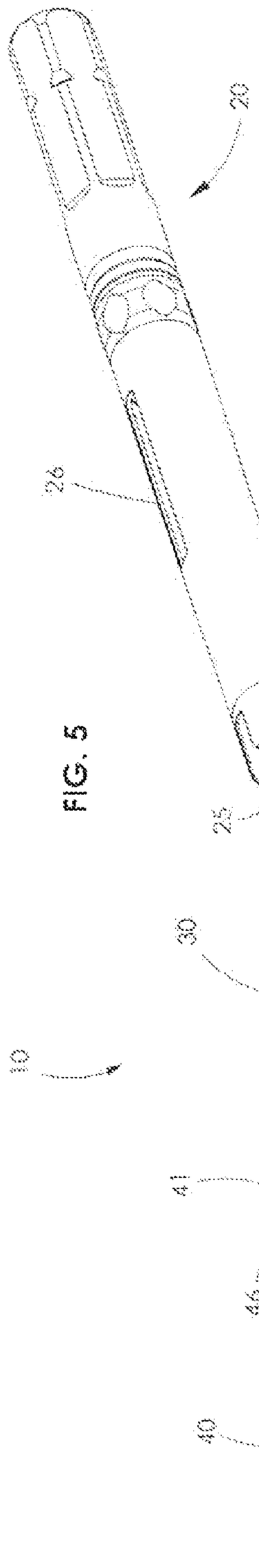

FIG. 5

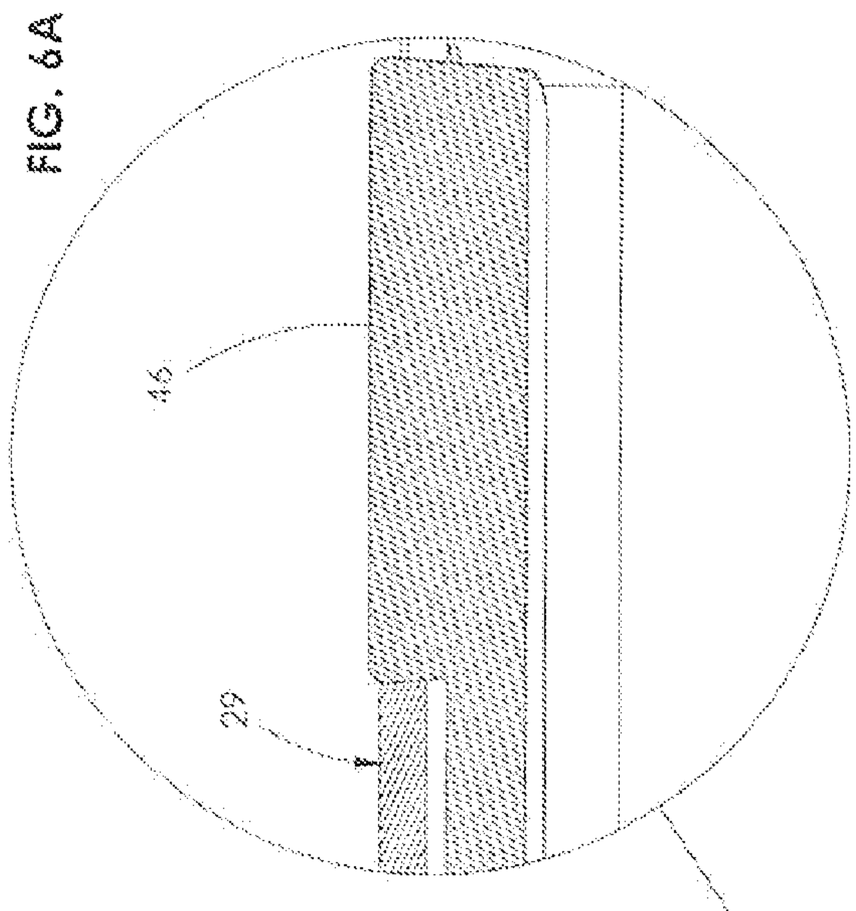

FIG. 6A

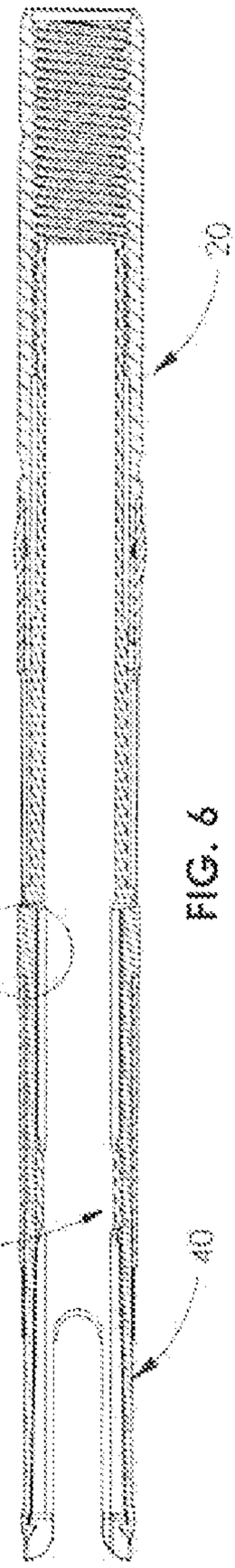

FIG. 6

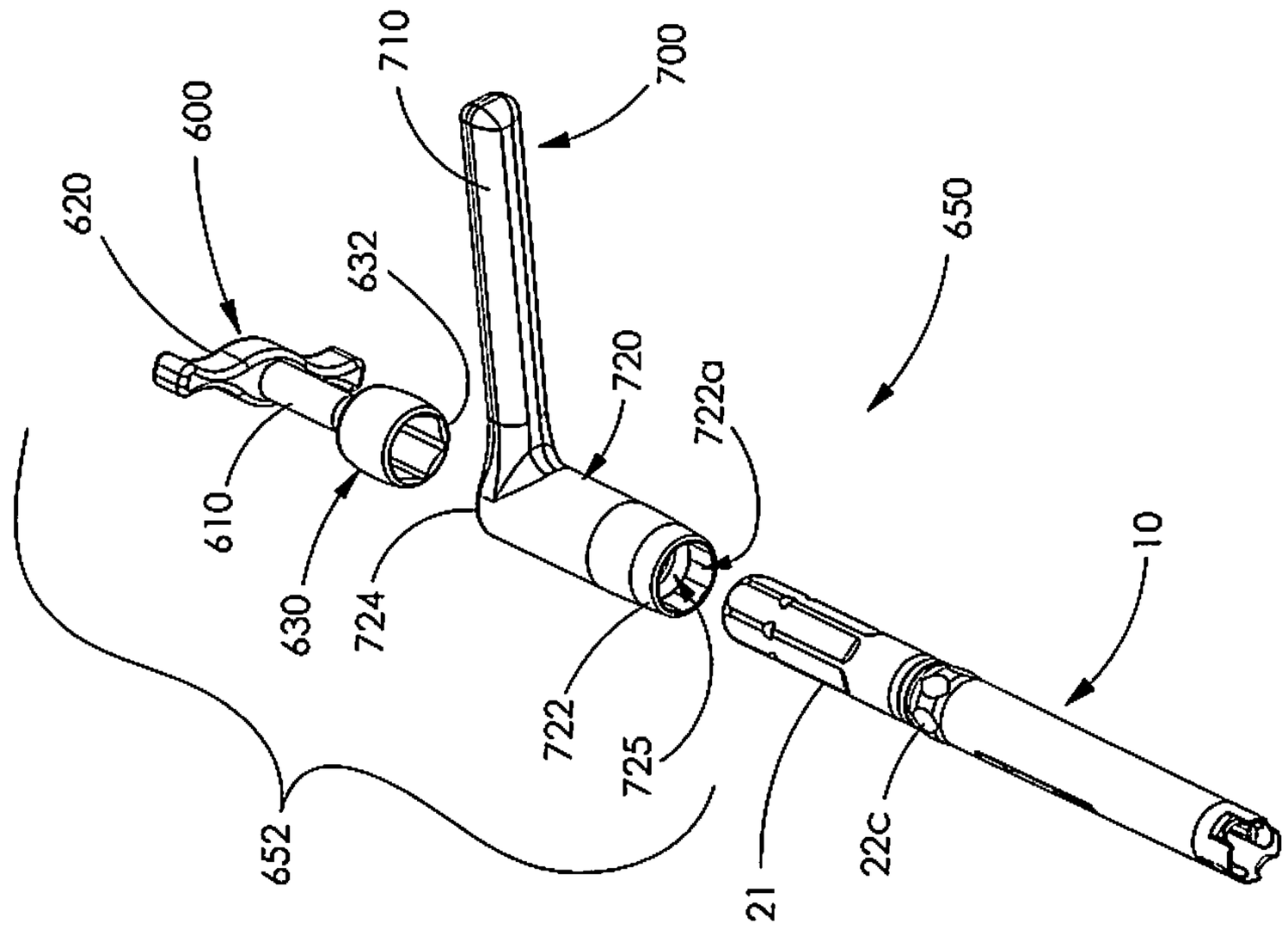
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FIG. 7B

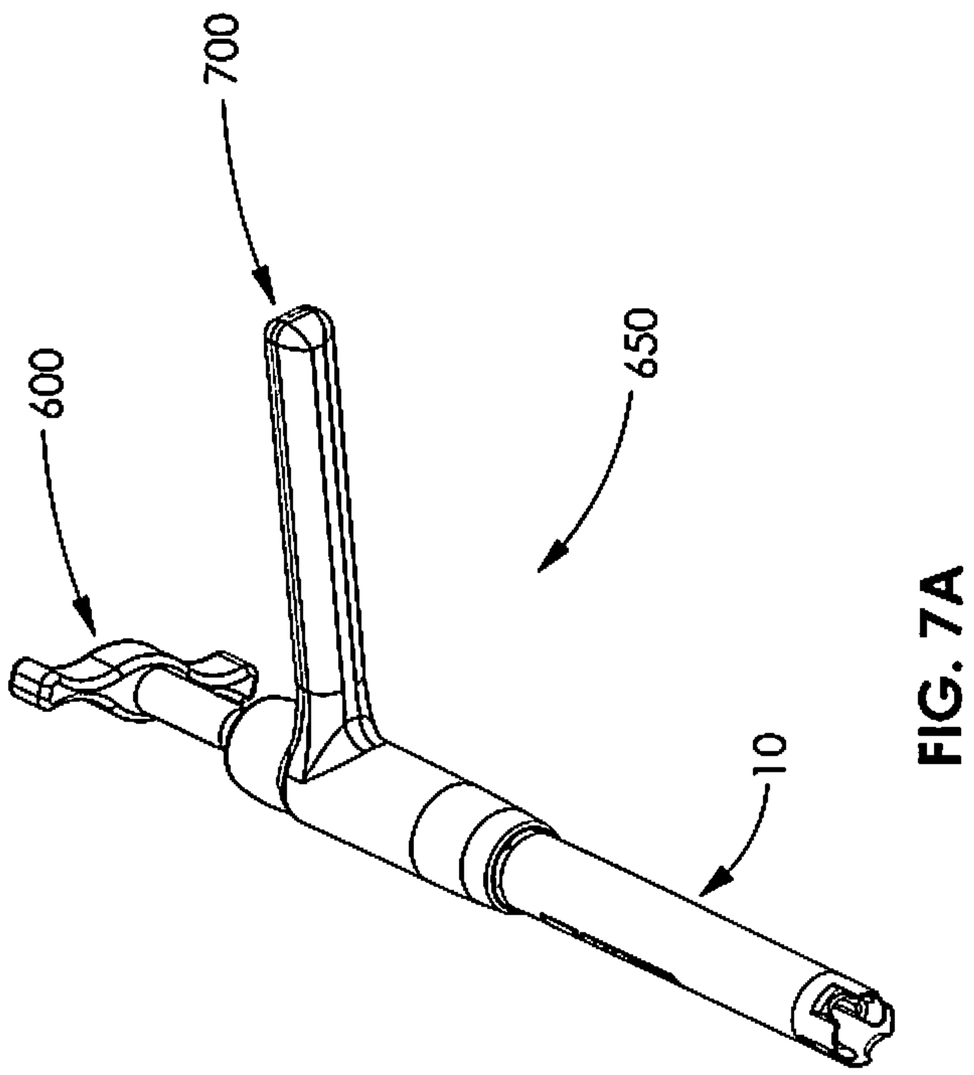
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FIG. 7A

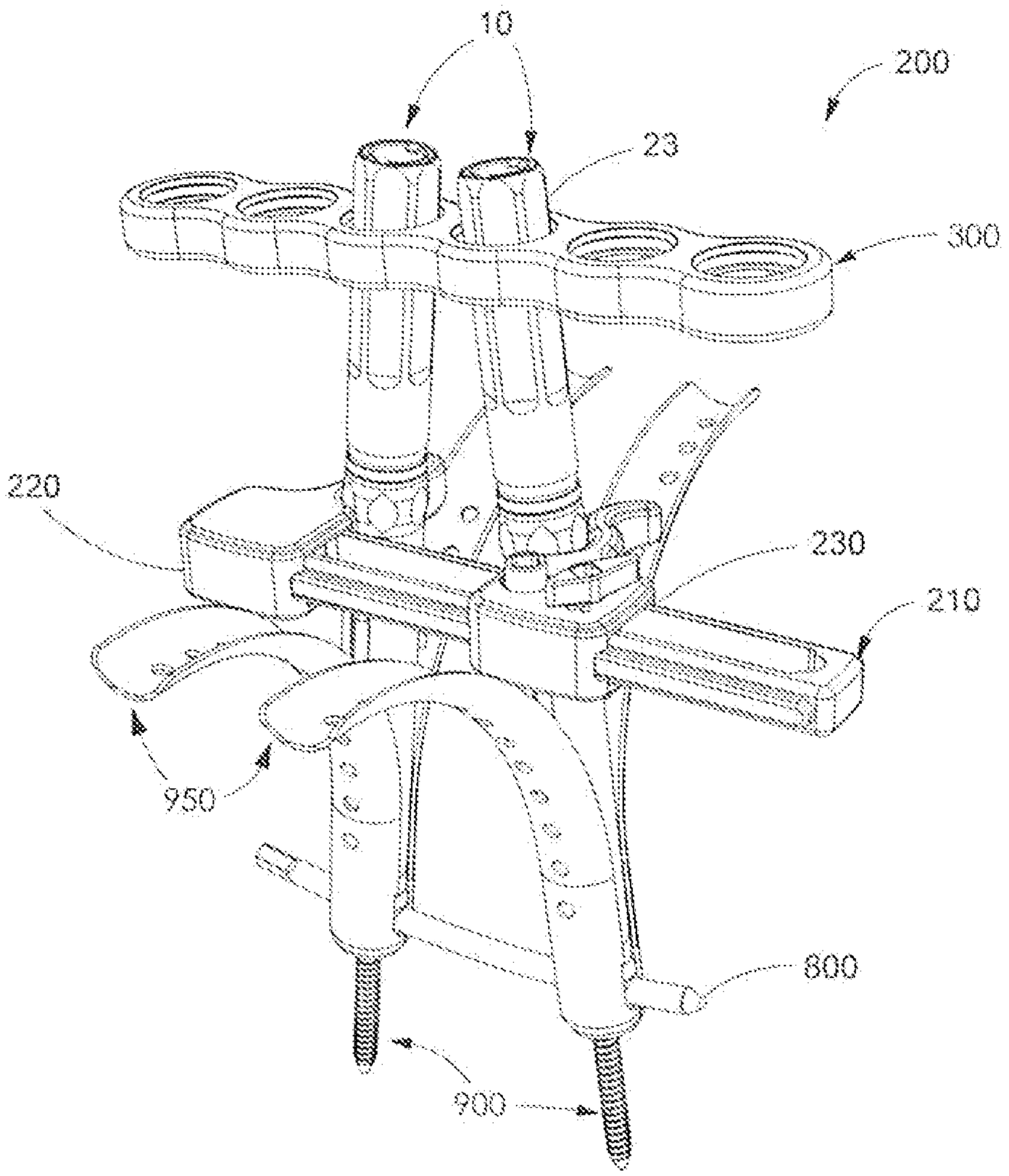

FIG. 8

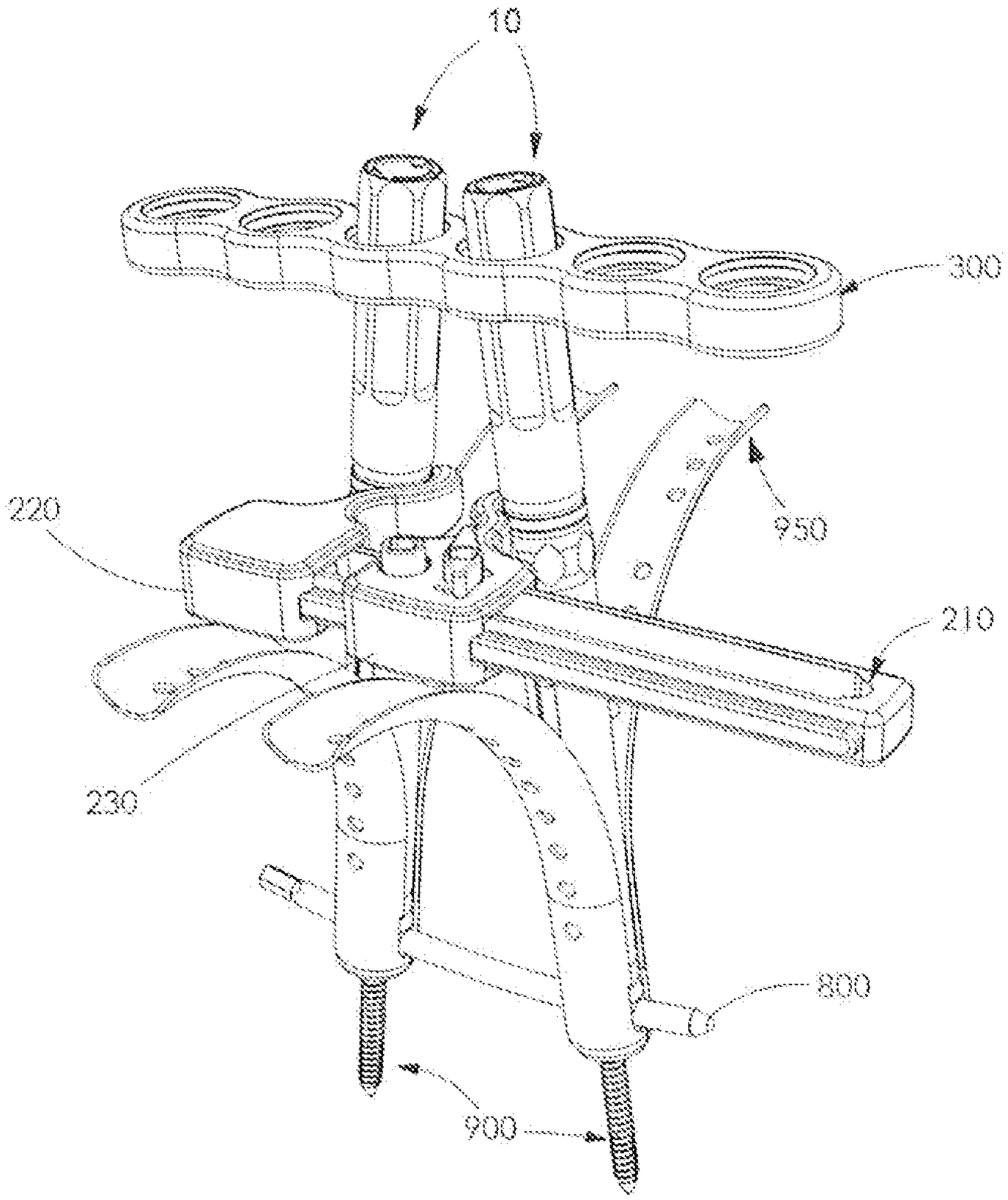

FIG. 9

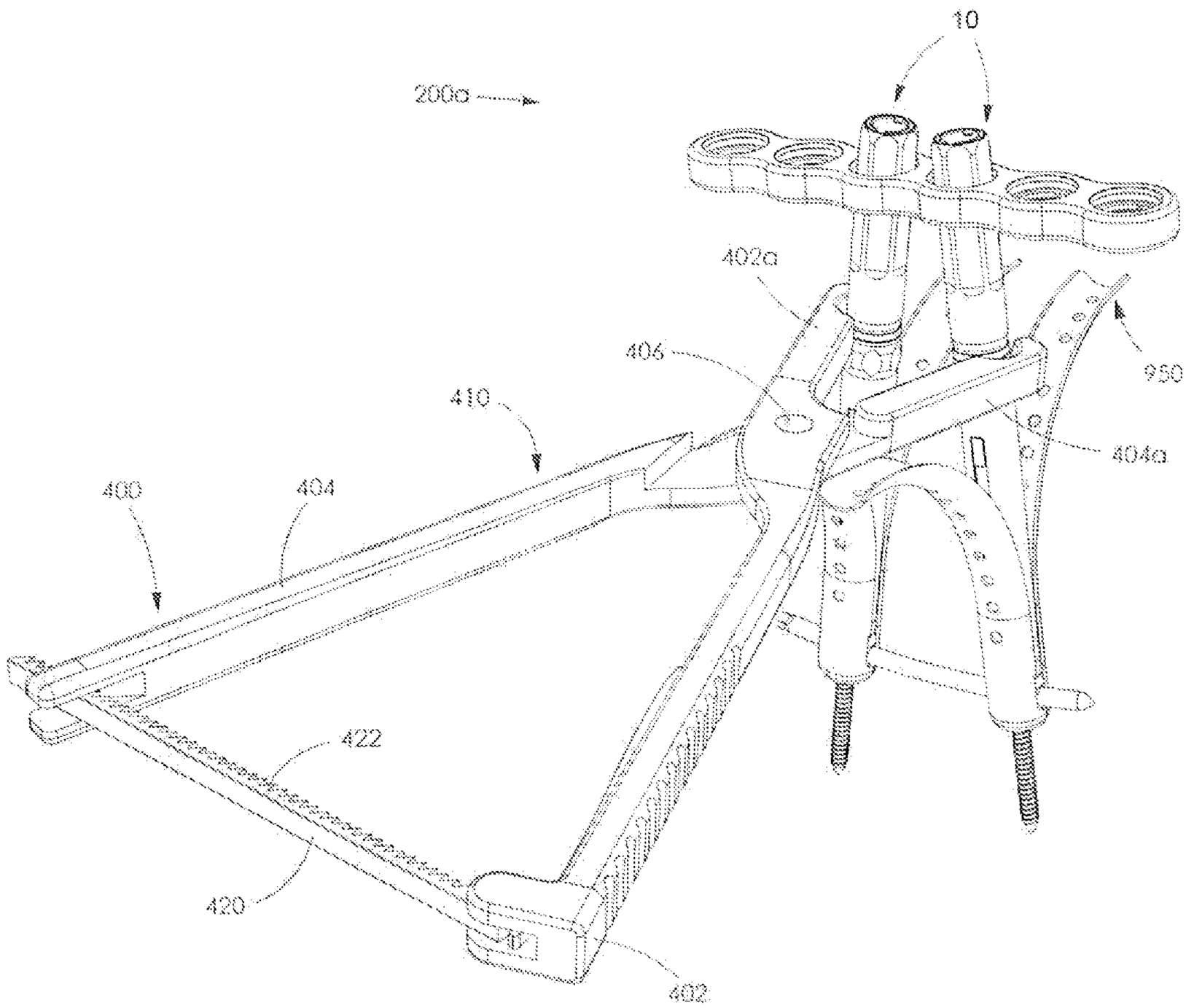

FIG. 10A

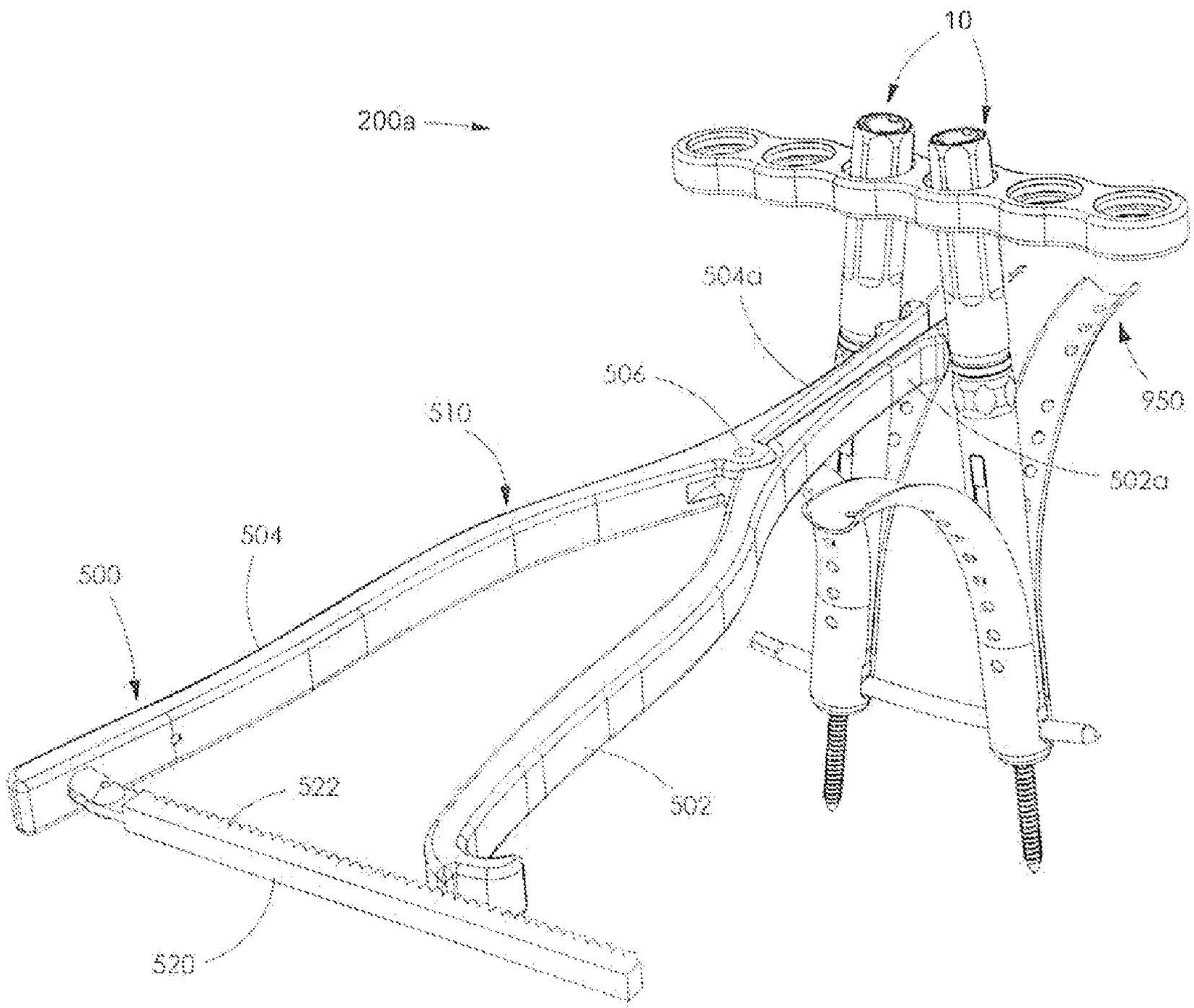

FIG. 10B

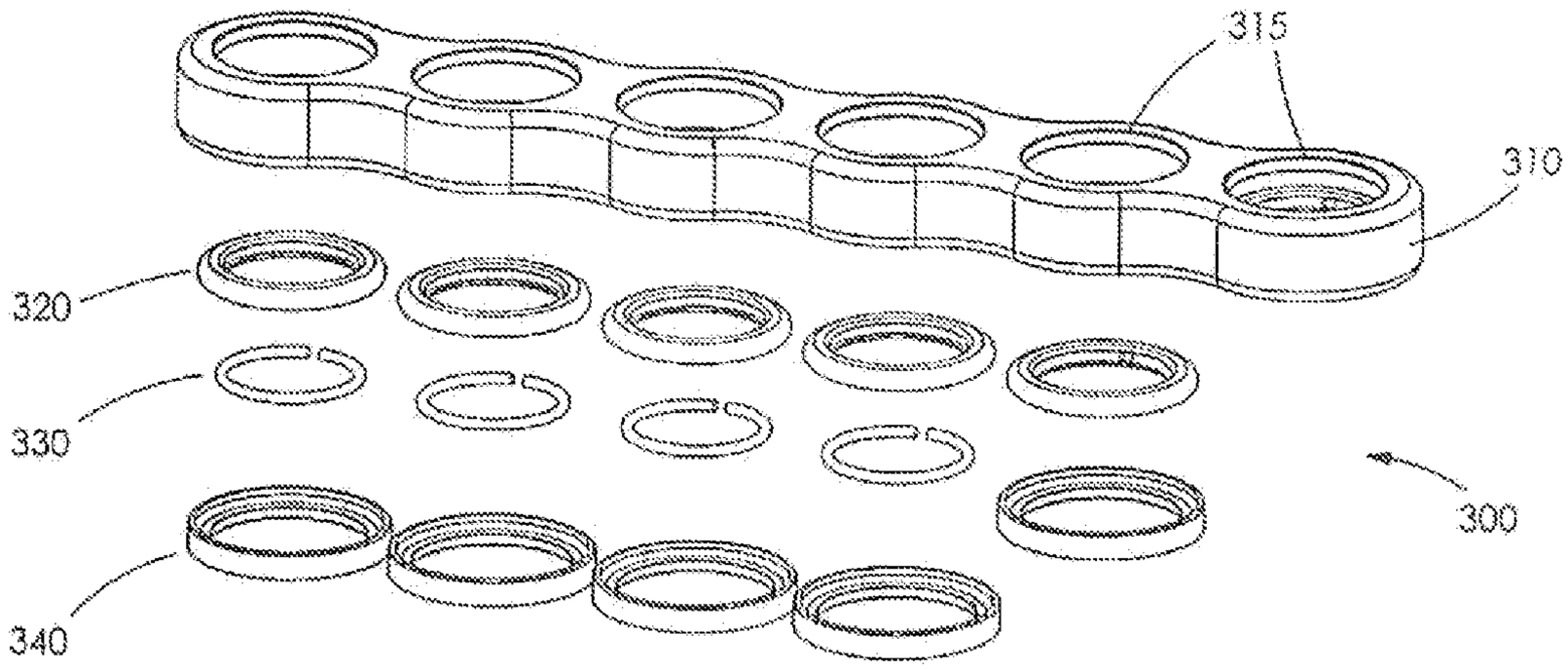

FIG. 11A

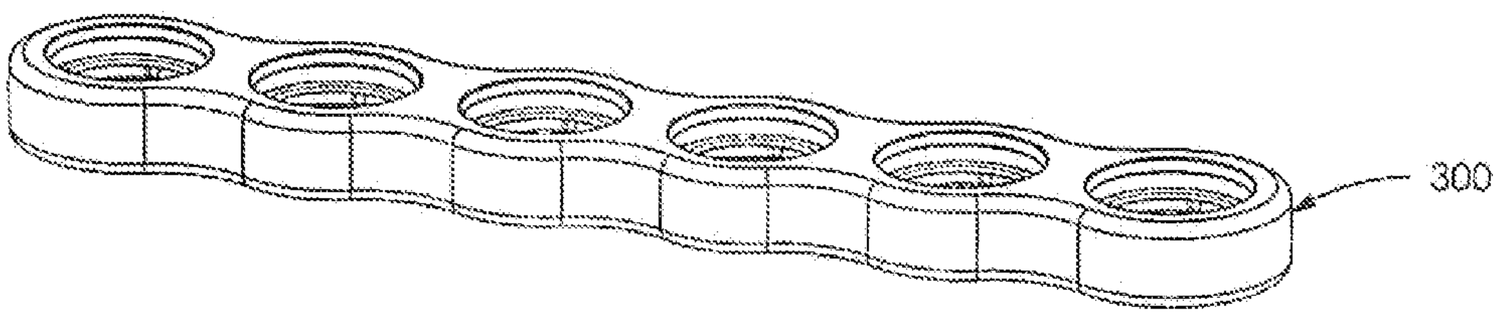

FIG. 11

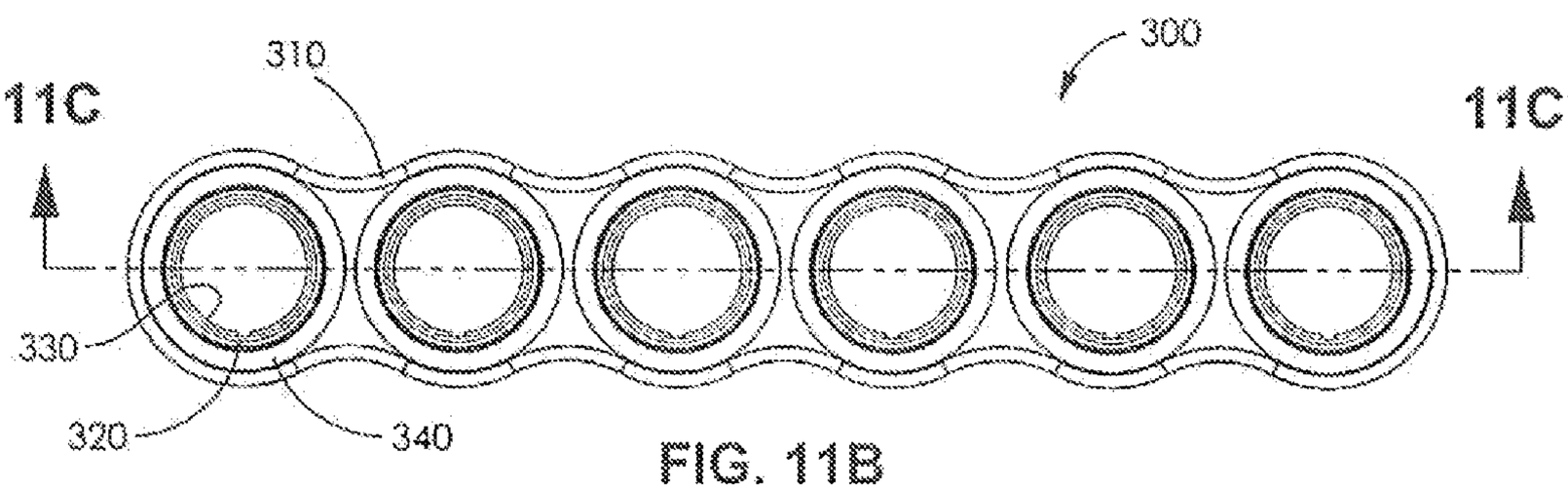

FIG. 11B

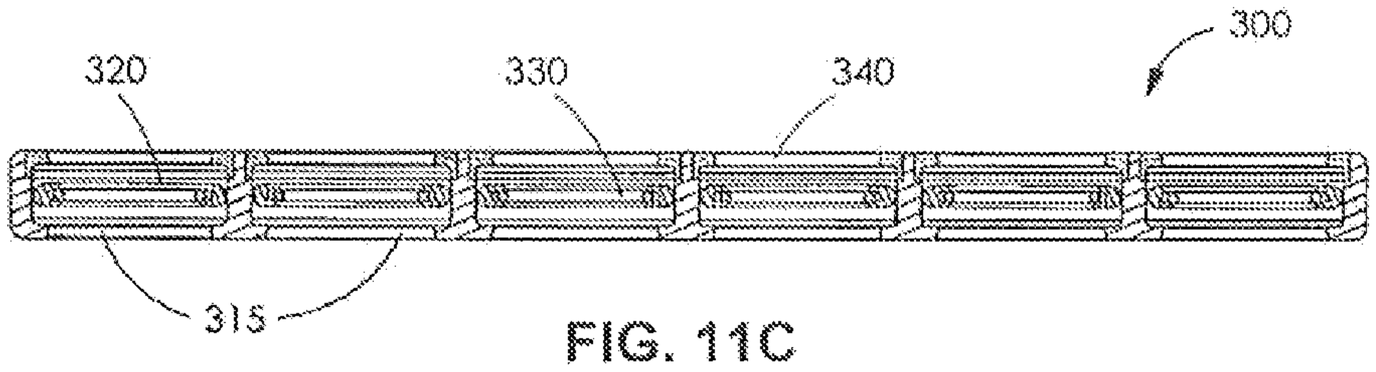

FIG. 11C

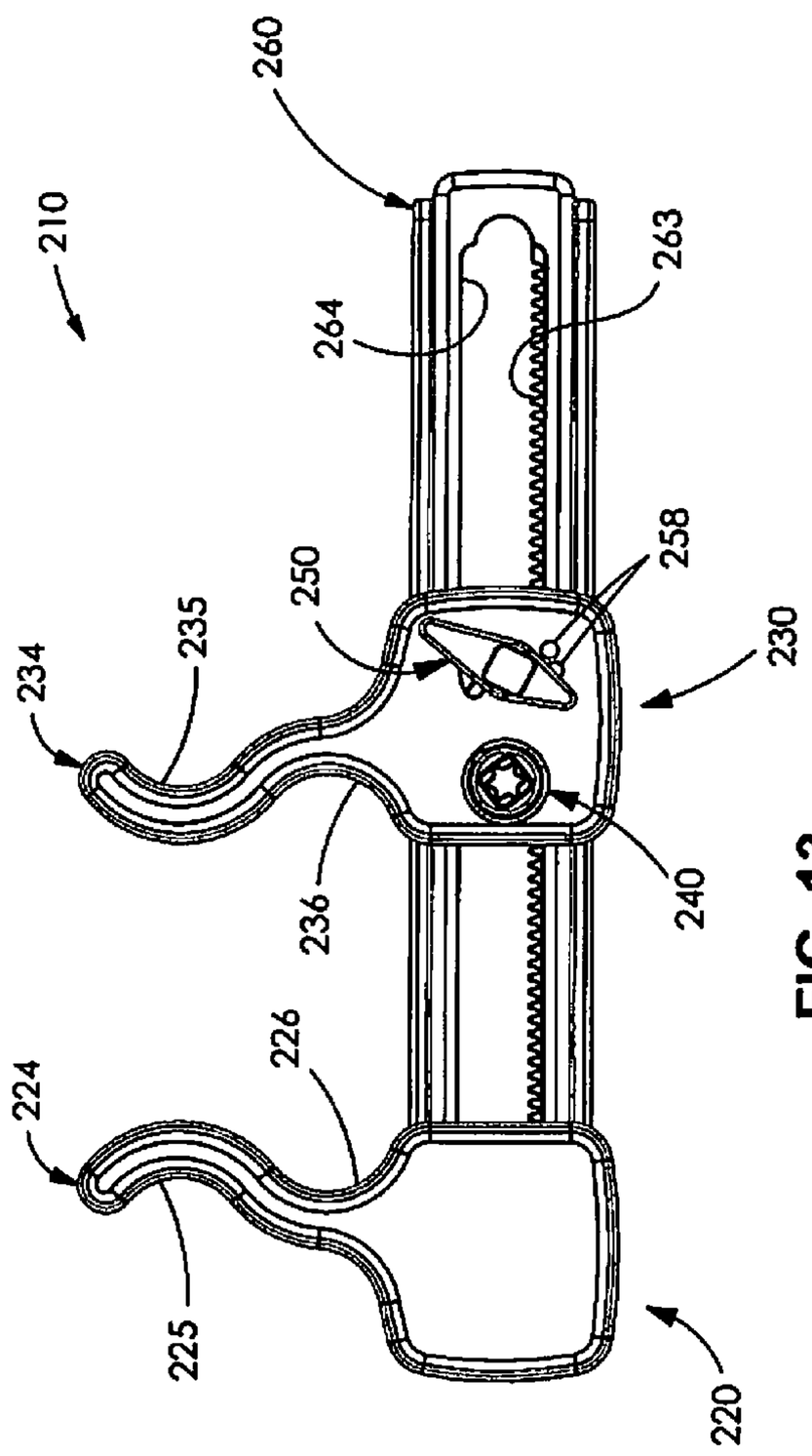
210
260
263
264
258
250
230
234
235
240
236
226
224
225
220

FIG. 13

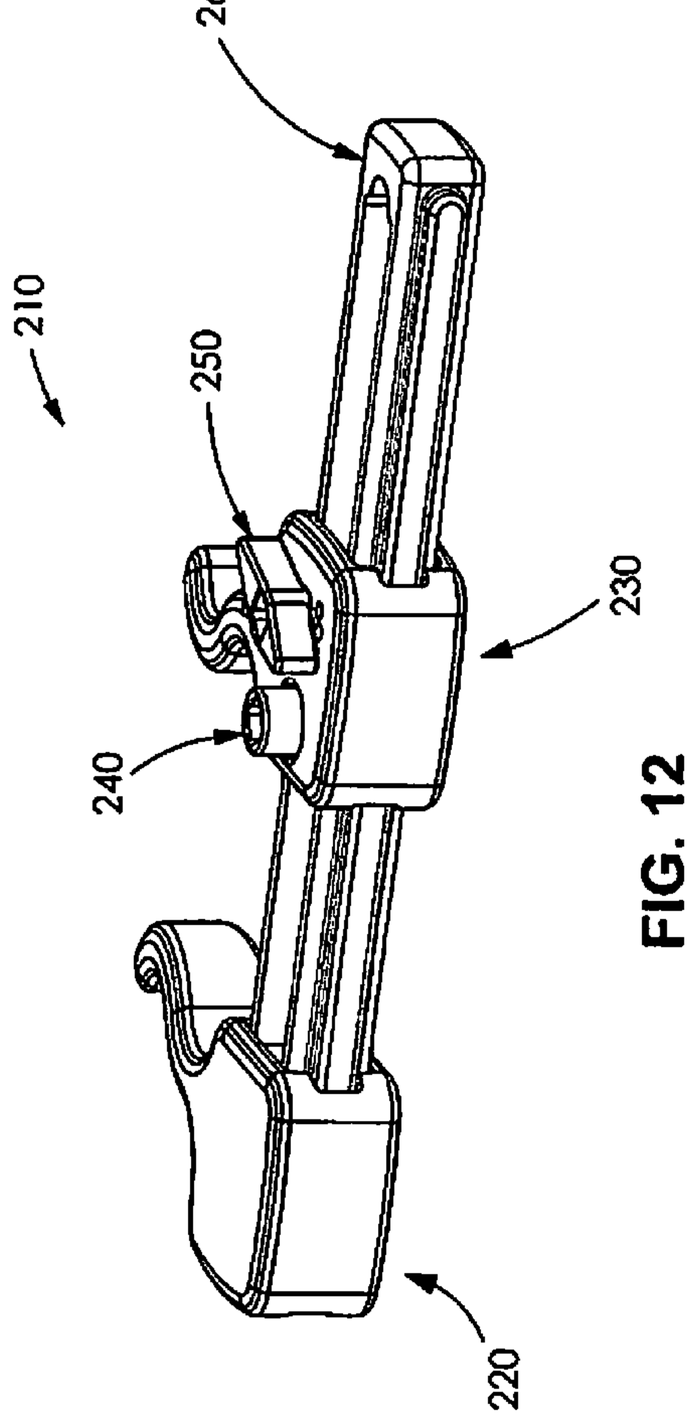
210
250
230
240
220

FIG. 12

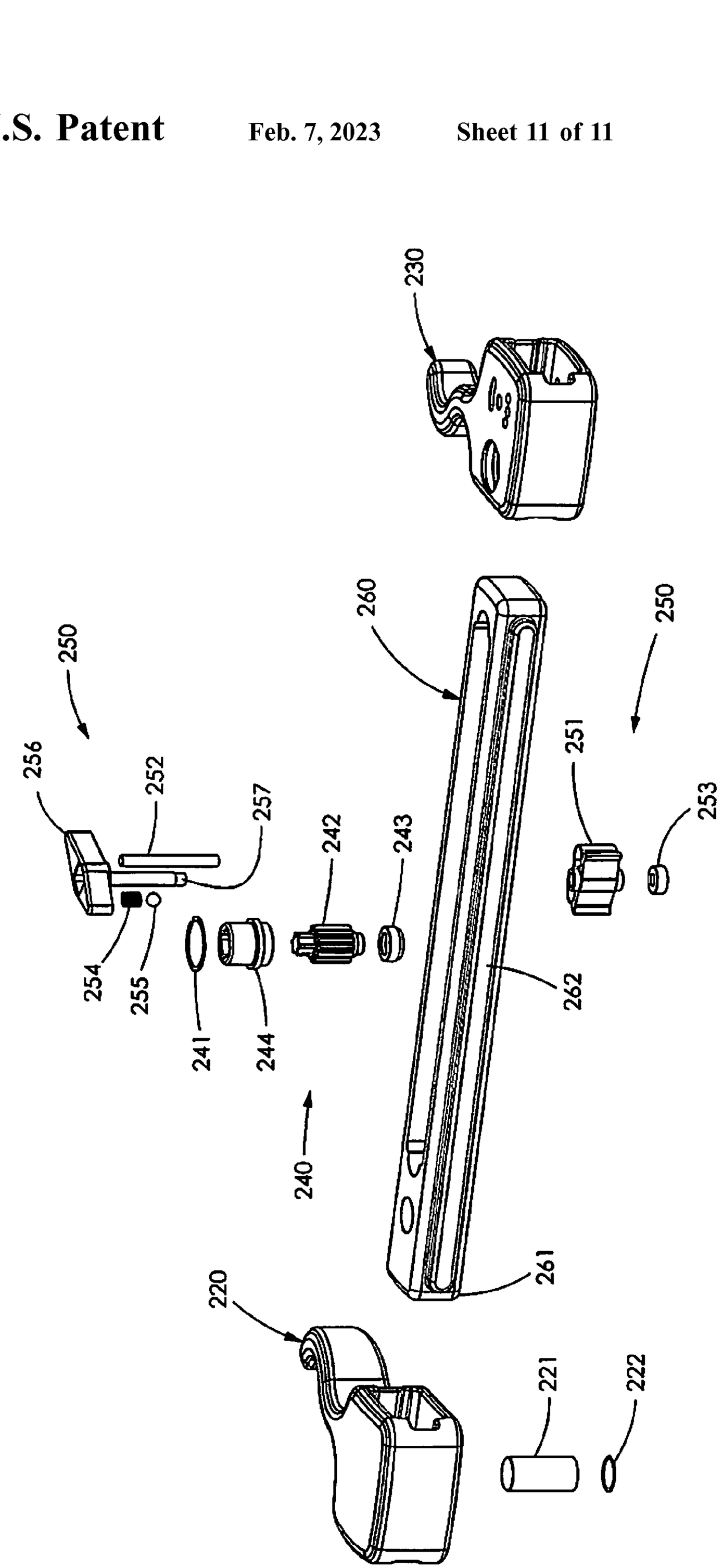
230
260
250
256
252
257
242
243
251
253
254
255
241
244
262
240
261
220
221
222
210

FIG. 14

ROD REDUCER, COMPRESSOR, DISTRACTOR SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

NOTICE: More than one reissue application has been filed for the reissue of U.S. Pat. No. 9,737,351 B2. The reissue applications are U.S. Reissue patent application Ser. No. 16/545,644 and the present application. The present application is *a continuation reissue application of U.S. Reissue patent application Ser. No. 16/545,644, filed on Aug. 20, 2019, which is an application for the reissue of U.S. Pat. No. 9,737,351, which is* a divisional of U.S. patent application Ser. No. 13/741,934, filed Jun. 15, 2013, which claims the benefit of, and priority to, U.S. Provisional Application Ser. No. 61/586,928, filed on Jan. 16, 2012. The entire contents of each of the above applications are incorporated herein by reference.

BACKGROUND

Technical Field

The present disclosure relates to a system and method for operating on the spine. More particularly, the present disclosure relates to a minimally invasive rod reducer, compressor/distractor system, and a method for using the compressor/distractor system to deliver a spinal rod to the head of a pedicle screw.

Background of Related Art

The spinal column is a complex system of bones and connective tissues that provide support for the human body and protection for the spinal cord and nerves. The adult spine is comprised of an upper and lower portion. The upper portion contains 24 discrete bones, which are subdivided into three areas including 7 cervical vertebrae, 12 thoracic vertebrae and 5 lumbar vertebrae. The lower portion is comprised of the sacral and coccygeal bones. The cylindrical shaped bones, called vertebral bodies, progressively increase in size from the upper portion downwards to the lower portion.

An intervertebral disc along with two posterior facet joints cushion and dampen the various translational and rotational forces exerted upon the spinal column. The intervertebral disc is a spacer located between two vertebral bodies. The facets provide stability to the posterior portion of adjacent vertebrae. The spinal cord is housed in the canal of the vertebral bodies. It is protected posteriorly by the lamina. The lamina is a curved surface with three main protrusions. Two transverse processes extend laterally from the lamina, while the spinous process extends caudally and posteriorly. The vertebral bodies and lamina are connected by a bone bridge called the pedicle.

The spine is a flexible structure capable of a large range of motion. There are various disorders, diseases, and types of injury which restrict the range of motion of the spine or interfere with important elements of the nervous system. The problems include, but are not limited to scoliosis, kyphosis, excessive lordosis, spondylolisthesis, slipped or ruptured

discs, degenerative disc disease, vertebral body fracture, and tumors. Persons suffering from any of the above conditions typically experience extreme or debilitating pain and often times diminished nerve function. These conditions and their treatments can be further complicated if the patient is suffering from osteoporosis, or bone tissue thinning and loss of bone density.

Spinal fixation apparatuses are widely employed in surgical processes for correcting spinal injuries and diseases. When the disc has degenerated to the point of requiring removal, there are a variety of interbody implants that are utilized to take the place of the disc. These include polyetheretherketone ("PEEK") interbody spacers, metal cages, and cadaver and human bone implants. In order to facilitate stabilizing the spine and keeping the interbody in position, other implants are commonly employed, including longitudinally linked rods secured to coupling elements, which in turn are secured to the bone by spinal bone fixation fasteners such as pedicle screws, hooks, and others. The opposing pair of longitudinally linked rods is commonly disposed along the long axis of the spine via a posterior approach. Pedicle screws are utilized to capture these rods and can be manufactured from any biocompatible material, including cobalt chrome, stainless steel, titanium, and PEEK. It is desired to perform these procedures in a minimally invasive manner to minimize pain and reduce recovery time for the patient. Therefore, a need exists for a minimally invasive rod reducer, compressor, distractor system that can deliver the rod into the head of the pedicle screw or bone anchor while maintaining the proper screw and rod construct alignment.

A rod reducer that is small enough in diameter to work with a minimally invasive retractor, such as the rod reducer disclosed in U.S. Patent Publication No. 2013/0046345, the contents of which are hereby incorporated by reference in their entirety and a minimally invasive retractor, such as the minimally invasive retractor disclosed in U.S. Pat. No. 7,846,093, the contents of which are hereby incorporated by reference in their entirety, are also disclosed.

SUMMARY

The present disclosure is directed towards a system for operating on the spine. The system includes pedicle screws, rod reducers, and a force applying device.

According to one aspect, the rod reducers include a proximal end and a distal end and define a longitudinal axis between the proximal and distal ends. The rod reducer includes an outer member and an inner member. The inner member is selectively attachable to the housing of the pedicle screw. The outer member is axially movable relative to the inner member when the inner member is secured to the housing of the pedicle screw to secure the spinal rod within the saddle of the housing of the pedicle screw. The outer member includes a proximal segment and a distal segment. The proximal segment is rotatable for axially translating the distal segment. The distal segment is engageable with the spinal rod to secure the spinal rod within the saddle upon the axial translation of the distal segment. The proximal segment independently rotates relative to the distal segment. The rod reducer includes a pair of gripping members configured to engage the housing of the pedicle screw. The pair of gripping members is positioned between the inner and outer members of the rod reducer.

The handle assembly is selectively engageable with the rod reducer to move the outer member of the rod reducer axially relative to the inner member of the rod reducer. The

handle assembly is configured to rotate the outer member so that the rotational movement of the outer member axially moves the outer member relative to the inner member. The handle assembly includes a turning handle and an anti-torque handle. The anti-torque handle is selectively engageable with the proximal end of the rod reducer and the turning handle is selectively engageable with a proximal end of the anti-torque handle.

In another aspect, an embodiment of the system includes two rod reducers, a force applying device, and a fulcrum. The force applying device is configured for selectively engaging each rod reducer. The system may also include at least one minimally invasive retraction device.

In yet another aspect, the force applying device is a compressor/distractor device including a first hook member, a second hook member, and a body portion. The body portion has a first end and a track extending from the first end. The first end includes the first hook member in a fixed position. The first end may slidably receive the first hook member in a fixed position. The track includes a set of teeth and is configured for slidably receiving the second hook member.

The second hook member includes a switch assembly and a gear assembly. The second hook member traverses the track when the gear assembly is rotated. The gear assembly may also retain the second hook member within the track. The switch assembly permits the second hook member to traverse the track in a desired direction, towards the first hook member or away from the first hook member. The switch assembly may also restrain the second hook member from traversing the track in an undesired direction.

The first and second hook members may be configured in a compressing configuration to engage the two rod reducers such that rod reducers are between the hook members. The first and second hook members may also be configured in a distracting configuration to engage the rod reducers such that the hook members are between the rod reducers.

The fulcrum is configured to receive the proximal segment of the outer member of each rod reducer and remain in a fixed position on the longitudinal axis of each rod reducer.

According to still another aspect, a method for compressing or distracting vertebrae including two minimally invasive rod reducers, a compressor/distractor system, a spinal rod, and two pedicle screws. The method includes the steps of accessing the spinal area of a patient having at least two pedicle screws secured to respective vertebrae, engaging each pedicle screw with a rod reducer, advancing the spinal rod into the head of each pedicle screw, attaching a compressor/distractor device to each rod reducer, inserting a set screw through each rod reducer, manipulating the compressor/distractor device, and securing the spinal rod to each pedicle screw.

The method may also include the step of attaching a fulcrum to the proximal segment of each outer member before rotating the gear assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the disclosure and, together with a general description of the disclosure given above, and the detailed description of the embodiments given below, serve to explain the principles of the disclosure, wherein:

FIG. **1**A is a perspective view of a minimally invasive rod reducer in accordance with the principles of the present disclosure before engagement with a rod and a pedicle screw;

FIG. **1**B is a perspective view of the rod reducer of FIG. **1**A after initial engagement of the rod and pedicle screw;

FIG. **1**C is a perspective view of the rod reducer of FIG. **1**B after the rod has been received by the shoulder portion of the pedicle screw

FIG. **2** is a perspective view of the outer member of FIG. **1**A;

FIG. **3** is a exploded view of the outer member of FIG. **2**;

FIG. **4** is a bottom cross-sectional view of the outer member of FIG. **2** taken along the section line **4**-**4**;

FIG. **5** is an exploded view of the rod reducer of FIG. **1**A;

FIG. **6** is a side cross-sectional view of the of the rod reducer of FIG. **1**A;

FIG. **6**A is an enlarged view of the detail area **6**A of FIG. **6**;

FIG. **7**A is a perspective view of the outer member of FIG. **2** engaged with a turning handle and an anti-torque handle;

FIG. **7**B is an exploded view of FIG. **7**A;

FIG. **8** is a perspective view of an embodiment of a compressor/distractor system in accordance with the principles of the present disclosure in a compressing configuration;

FIG. **9** is a perspective view of the compressor/distractor system of FIG. **8** in a distracting configuration;

FIG. **10**A is a perspective view of another embodiment of a compressor/distractor system in accordance with the principles of the present disclosure in a compressing configuration;

FIG. **10**B is a perspective view of the compressor/distractor system of FIG. **10**A in a distracting configuration;

FIG. **11** is a perspective view of the fulcrum of FIG. **9**;

FIG. **11**A is an exploded view of the fulcrum of FIG. **11**;

FIG. **11**B is a top view of the fulcrum of FIG. **11**;

FIG. **11**C is a side cross-sectional view of the fulcrum taken along the section line **11**C-**11**C in FIG. **11**B;

FIG. **12** is an enlarged view of the compressor/distractor device of FIG. **9**;

FIG. **13** is a top view of the compressor/distractor device of FIG. **12**; and

FIG. **14** is an exploded view of the compressor/distractor device of FIG. **12**.

DETAILED DESCRIPTION OF THE DRAWINGS

Particular embodiments of the present disclosure will be described herein with reference to the accompanying drawings. As shown in the drawings and as described throughout the following description, and as is traditional when referring to relative positioning on an object, the terms "proximal" and "trailing" may be employed interchangeably, and should be understood as referring to the portion of a structure that is closer to a clinician during proper use. The terms "distal" and "leading" may also be employed interchangeably, and should be understood as referring to the portion of a structure that is farther from the clinician during proper use. In addition, the term "cephalad" or "cranial" is used in this application to indicate a direction toward a patient's head, whereas the term "caudad" indicates a direction toward the patient's feet. Further still, the term "medial" indicates a direction toward the middle of the body of the patient, whilst the term "lateral" indicates a direction toward a side of the body of the patient (i.e., away from the middle of the body of the patient). The term "posterior" indicates a

direction toward the patient's back, and the term "anterior" indicates a direction toward the patient's front. In the following description, well-known functions or constructions are not described in detail to avoid obscuring the present disclosure in unnecessary detail.

Turning now to FIGS. **2-6**A, a rod reducer **10** includes an outer member **20**, an inner member **30**, and a pair of gripping members **40**, such as the rod reducer disclosed in U.S. patent application Ser. No. 13/595,533 which is incorporated by reference. Outer member **20** includes a proximal segment **21**, a distal segment **22**, and a ring member **27** that is disposed between proximal and distal segments **21**, **22**. Proximal segment **21** includes an engaging portion **21**a at a distal end of proximal segment **21** and a gripping portion **21**b at a proximal end of proximal segment **21**. An inner surface **28** of proximal segment **21** is threaded. Distal segment **22** defines a slot **26** therethrough and includes a reducing portion **22**a at a distal end of distal segment **22** and a receiving portion **22**b at a proximal end of distal segment **22**. Receiving portion **22**b includes a plurality of gripping features **22**c on an outer surface of receiving portion **22**b. A pair of rod engaging slots **25** and a pair of gripping member receiving slots **24** are defined through reducing portion **22**a. Receiving portion **22**b of distal segment **22** is configured to receive engaging portion **21**a of proximal segment **21** so that ring member **27** is disposed between proximal and distal segments **21**, **22**. The components of outer member **20** may be integrally formed or assembled.

Inner member **30** includes an elongate body member **39** that defines an annular recess **33** configured to receive the pair of gripping members **40** so that the gripping members **40** are disposed in opposition on the elongate body member **39**. Inner member **30** includes a pair of arms **32** supported on a distal end of elongate body member **39**. A proximal end of elongate body member **39** has a threaded arrangement **38** that mates with threaded inner surface **28** of proximal segment **21** of outer member **20** to axially advance outer member **20** relative to inner member **30** as will be described in greater detail below.

Each gripping member **40** includes a body **47** having a supporting member **43**, a proximal finger **46**, and a distal finger **45**. Supporting member **43** is configured to engage annular recess **33** of inner member **30** to support body **47** of each gripping member **40** on inner member **30**. Proximal finger **46** extends proximally from supporting member **43** and is slidably positionable within slot **26** of outer member **20**. Distal finger **45** extends distally from supporting member **43** and is positionable between an arm **32** of inner member **30** and reducing portion **22**a of outer member **20** so that distal finger **45** is substantially aligned with a gripping member receiving slot **24** of reducing portion **22**a.

As illustrated in FIGS. **1**A-**1**C, outer member **20** of rod reducer **10** is disposed in a proximal position relative to inner member **30** of rod reducer **10**, distal fingers **45** of gripping member **40** of rod reducer **10** are secured to an outer surface of pedicle screw head **910**. Proximal segment **21** of outer member **20** may then be rotated by virtue of the threaded arrangement between outer member **20** and inner member **30** for axially advancing distal segment **22** of outer member **20** relative to inner member **30** and proximal segment **21**. Proximal segment **21** remains axially fixed when rotated. Notably, as proximal segment **21** rotates, distal segment **22** remains radially fixed as distal segment **22** axially translates relative to inner member **30** and proximal segment **21**. Outer member **20** approximates a spinal rod **800** positioned between rod reducer **10** and pedicle screw **900** as outer member **20** is advanced toward pedicle screw **900** to secure spinal rod **800** within a saddle **912** of pedicle screw **900**. As outer member **20** advances distally, a proximal end of slot **26** of outer member **20** approximates a proximal end of proximal fingers **46** of gripping member **40**.

Turning now to FIGS. **7**A and **7**B, a rod reducer and handle assembly **650** includes the rod reducer **10** and a handle assembly **652**. Handle assembly **652** includes a turning handle **600** and an anti-torque handle **700** that are selectively connectable to gripping portion **21**b and gripping features **22**c respectively on rod reducer **10**. Turning handle **600** includes a shaft **610**, a handle **620**, and a socket **630** that defines an opening **632**. Opening **632** is configured to receive a proximal end of gripping portion **21**b of rod reducer **10**. Handle **620** is secured to a proximal end of shaft **610** and a socket **630** that may be integrally formed is secured to a distal end of shaft **610**. Anti-torque handle **700** includes a shaft **720** and a handle **710** that may be integrally formed. Shaft **720** includes a socket **722** that defines an opening **722**a at a distal end of socket **722**. Opening **722**a is disposed in communication with a lumen **725** defined within shaft **720** and another opening **724** disposed at a proximal end of shaft **720** so that anti-torque handle **700** may slide over gripping portion **21**b of rod reducer **10** and engage with gripping feature **22**c of rod reducer **10** to prevent rotational movement of distal segment **22** of outer member **20** of rod reducer **10**.

Thus, if needed, either or both the turning handle **600** and the anti-torque handle **700** may be used to facilitate the rotational movement of outer member **20** relative to inner member **30**. In particular, rotation of turning handle **600** imparts rotational movement to proximal segment **21** of outer member **20** and anti-torque handle **700** imparts counter rotational movement to distal segment **22** of outer member **20** so that proximal segment **21** rotates and distal segment **22** axially translates without rotating. As appreciated, anti-torque handle **700** is configured to limit the amount of torque imparted from the rotational movement imparted by turning handle **600** to prevent undesirable torquing of the outer member **20**. More particularly, anti-torque handle **700** slides down over the outer surface of outer member **20** of rod reducer **10** so that a distal end of anti-torque handle **700** engages distal segment **22** of outer member **20** and a proximal end of proximal segment **21** of outer member **20** is exposed for engagement with turning handle **600**. Meanwhile, since gripping member **40** is secured within annular recess **33** of inner member **30** such that proximal finger **46** of gripping member **40** is supported in slot **26** of distal segment **22** of outer member **20**, the engagement of anti-torque handle **700** with gripping feature **22**c of distal segment **22** of outer member **20** prevents rotation of both distal segment **22** of outer member **20** and inner member **30** as proximal segment **21** of outer member **20** is rotated with turning handle **600**. After spinal rod **800** is fully reduced into the saddle **910** of pedicle screw **900**, turning handle **600** and anti-torque handle **700** may be removed and a set screw (not shown) may be inserted down an inner diameter of rod reducer **10** to lock spinal rod **800** into place. Alternatively, anti-torque handle **700** may also be used to prevent rotation when tightening the set screw after spinal rod **800** has been fully reduced. Rod reducer **10** may then be removed.

Referring now to FIGS. **8** and **9**, a compressor/distractor system **200** includes rod reducers **10**, a compressor/distractor device **210**, and a fulcrum **300**. System **200** may further include one or more minimally invasive retraction devices **950**, such as the retractor disclosed in U.S. Pat. No. 7,846,093, the entire contents of which is incorporated by reference. Each of the two rod reducers **10** engages a respective

pedicle screw **900**. Each pedicle screw **900** is inserted into a respective vertebra and is configured to receive spinal rod **800** in saddle portion **912** as shown in FIG. **1**C. Compressor/distractor device **210** is configured for selective engagement with each rod reducer **10** when each rod reducer **10** is attached to pedicle screw **900**.

FIGS. **10**A and **10**B illustrate other embodiments of compressor/distractor system **200**a using compressor **400** and distractor **500** respectively as the force applying device. As shown in FIG. **10**A, the compressor **400** has a handle assembly **410** with handles **402**, **404** that are pivotably coupled together by pivot pin **406**. Distal portions of handles **402**, **404** have respective grippers **402**a, **404**a for engaging rod reducers **10**. Each gripper **402**a, **404**a includes an arcuate recess configured for engaging an outer surface of rod reducer **10**. Compressor **400** also includes an arm **420** having teeth **422** disposed thereon. Teeth **422** releasably engage a distal portion of handle **404** for maintaining a predetermined distance or spacing between handles **402**, **404** during a compression stroke that moves rod reducers **10** towards each other. The arm **420** is pivotably coupled to a distal end of arm **402** such that it can be repositioned and allow handles **402**, **404** to be moved away from each other once the desired amount of compression is achieved. Similarly, as shown in FIG. **10**B, the distractor **500** has a handle assembly **510** with handles **502**, **504** that are pivotably coupled together by pivot pin **506**. Distal portions of handles **502**, **504** have respective grippers **502**a, **504**a for engaging rod reducers **10**. Each gripper **502**a, **504**a includes an arcuate recess configured for engaging an outer surface of rod reducer **10**. Distractor **500** also includes an arm **520** having teeth **522** disposed thereon. Teeth **522** releasably engage a distal portion of handle **502** for maintaining a predetermined distance or spacing between handles **502**, **504** during a distraction stroke that moves rod reducers **10** away from each other. The arm **520** is pivotably coupled to a distal end of arm **504** such that it can be repositioned and allow handles **502**, **504** to be moved away from each other once the desired amount of distraction is achieved.

Now referring to FIGS. **11**-**11**C illustrating fulcrum **300** including through holes **315** which receive inner bearing rings **320** which house retaining rings **330** that are prevented from falling out of fulcrum **300** by caps **340**. Fulcrum **300** is an elongate structure and each through hole **315** includes an annular groove for retaining inner bearing rings **320** and their respective retaining rings **330**.

Referring now to FIGS. **12**-**14**, compressor/distractor device **210** has a first hook member **220**, a second hook member **230**, and a body portion **260**. Body portion **260** includes first end **261** and track **262** extending from first end **261** along a length of body portion **260**. Track **262** includes a set of teeth **263** and sidewall **264**. First end **261** is insertable into a recess of the first hook member **220** and is fixed in position at first end **261** of body portion **260** by the cooperation of retaining pin **221** and first end retaining ring **222**.

First and second hook members **220**, **230** may each include hook portions **224**, **234** for engaging rod reducers **10**. Hook portions **224**, **234** have respective distracting hooks **225**, **235** and compressing hooks **226**, **236**. When rod reducers **10** are between first and second hook members **220**, **230**, each compressing hook **226**, **236** engages a rod reducer **10** in a compressing configuration of compressor/distractor device **210** (FIG. **8**). When first and second hook members **220**, **230** are between rod reducers **10**, each distracting hook **225**, **235** engages a rod reducer **10** in a distracting configuration of compressor/distractor device **210** (FIG. **9**). Compressor/distractor device **210** may also have a neutral configuration. Each hook member **220**, **230** may engage gripping features **22**c of each rod reducer **10**.

Second hook member **230** may include a switch assembly **250** and a gear assembly **240**. Switch assembly **250** may include a pawl **251**, a pawl switch pin **252**, a switch cap **253**, a spring **254**, a ball **255**, ball detents **258**, a switch **256**, and a switch shaft **257**. Switch assembly **250** is selectable amongst a first condition, a second condition, and a third condition. Each condition may correspond to a configuration of the compressor/distractor device **210**. In the first condition, switch assembly **250** restrains second hook member **230** from traversing track **262** towards the first hook member **220**, while permitting second hook member **230** to traverse track **262** away from the first hook member **220** (i.e., a distracting configuration). In the second condition, switch assembly **250** restrains second hook member **230** from traversing track **262** away from the first hook member **220**, while permitting second hook member **230** to traverse track **262** towards the first hook member **220** (i.e., a compressing configuration). In the third condition, switch assembly **250** allows the second hook member **230** to freely move along track **262** in either direction (i.e., a neutral configuration), which allows for quick adjustment of compressor/distractor device **210**.

Switch **256** rotates about switch shaft **257** causing pawl pivot pin **252** to rotate pawl **251** about switch shaft **257**.

Pawl pivot pin **252** acts on pawl **251** causing pawl **251** to engage set of teeth **263** which restrains second hook member from traversing in the undesired direction.

Second hook member **230** may include ball detents **258**. Each ball detent **258** corresponds to a position of switch **256**. Switch **256** may be retained in each position by spring **254** pressing ball **255** into a corresponding ball detent **258**. Ball **255** selectively engages each ball detent **258** when the switch is in one of the positions corresponding to the compressing, distracting, and neutral configurations of the compressor/distractor device **210**.

Gear assembly **240** engages set of teeth **263** causing second hook member **230** to traverse track **262**. Rotation of traversing screw **244** rotates pinion **242**. The cooperation of pinion **242** with set of teeth **263** induces the second hook member **230** to traverse track **262**. A drive tool (not shown) may engage and rotate traversing screw **244**.

A method for using system **200** to manipulate a vertebra into a desired position with respect to a second vertebra is discussed below. First, a surgeon accesses the spinal area of a patient having at least two pedicle screws **900** secured to adjacent vertebrae (not shown). Each pedicle screw **900** may be engaged by a minimally invasive retraction device **950**. The surgeon then engages each pedicle screw **900** with a rod reducer **10** by attaching inner member **30** to pedicle screw head **910** as shown in FIG. **1**B. Each inner member **30** receives a respective pedicle screw head **910** between arms **32**. Next, the surgeon advances an outer member **20** along each inner member **30** by rotating the distal segment **21** of the outer member **20**. The surgeon may use handle assembly **650** to rotate distal segment **21**.

Rod engaging slots **25** of proximal segment **22** of each outer member **20** receives a portion of rod **800** and advances rod **800** into saddle portion **912** of each pedicle screw **900** as shown in FIGS. **1**B and **1**C. Once each outer member **20** is fully advanced with respect to each inner member **30** as shown in FIG. **1**C, the surgeon engages each outer member **20** with a force applying device **210**, **400**, **500** as shown in FIGS. **8**-**10**B. The force applying device may include gear assembly **240**. Then the surgeon inserts a set screw (not

shown) through each rod reducer **10** for securing the rod **800** to each pedicle screw **900**. The surgeon may rotate at least one of the set screws to either partially or fully secure rod **800** to at least one of the pedicle screws **900**.

Then the surgeon manipulates gear assembly **240** until each pedicle screw **900** is in a desired position on rod **800**. Manipulation of gear assembly **240** may include rotating traversing screw **244**. The surgeon may use a drive tool to manipulate gear assembly **240**.

Then the surgeon rotates each set screw to fully secure rod **800** to each pedicle screw **900** in the desired position. Then the surgeon may remove compressor/distractor device **210** and each rod reducer **10**.

The surgeon may also attach fulcrum **300** to gripping portion **21**b of proximal segment **21** of each outer member **20** before manipulating gear assembly **240**. Fulcrum **300** may then be removed with the compressor/distractor device **210** and each of the rod reducers **10**.

While several embodiments of the disclosure have been shown in the drawings, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

What is claimed:

[1. A method for manipulating vertebrae comprising:
accessing the spinal area of a patient having a pedicle screw secured to each of at least two vertebrae;
engaging each pedicle screw with an inner member having distal and proximal ends defining a longitudinal axis therebetween, the distal end of each inner member receiving a head of the pedicle screw;
advancing an outer member having distal and proximal ends distally along each of the inner members by rotating the proximal end of each of the outer members relative to each inner member, a pair of receiving slots on the distal end of each outer member receiving a portion of a spinal rod, each pair of receiving slots advancing the spinal rod into a saddle portion of the head of each pedicle screw;
attaching a force applying device and a fulcrum to an outer surface of each outer member, the force applying device including first and second hook members and having a compressing configuration when the first and second hook members are attached to each outer member with each of the outer members between the first and second hook members and a distracting configuration when the first and second hook members are attached to each outer member with the first and second hook members between each of the outer members;
manipulating each outer member with the force applying device until each of the pedicle screws is in a desired position with respect to the spinal rod; and
securing each pedicle screw to the spinal rod with a set screw.**]**

[2. The method of claim **1**, wherein the force applying device further includes a neutral configuration and the second hook member includes a switch assembly having a first, a second, and a third position, each position corresponding to a configuration of the force applying device.**]**

[3. The method of claim **1**, wherein the first and second hook members each include a hook portion, each hook portion having a compressing hook and a distracting hook.**]**

[4. The method of claim **1**, wherein the fulcrum is attached to a gripping portion of each outer member.**]**

[5. The method of claim **1**, wherein the step of advancing further includes attaching an anti-torque handle to a distal segment of each outer member and attaching a turning handle to a proximal segment of each outer member.**]**

[6. The method of claim **1**, wherein the method further includes the step of inserting at least one set screw through an inner member and at least partially locking the rod to at least one of the pedicle screws before the step of manipulating the each outer member.**]**

[7. A method for manipulating vertebrae comprising:
securing a first elongate member to a first pedicle screw that is secured in a first vertebra;
securing a second elongate member to a second pedicle screw that is secured in a second vertebra; and
manipulating the first and second elongate members with a force applying device until the first and second pedicle screws are in a desired position, the force applying device having first and second hook members, each hook member having a distracting hook and a compressing hook.**]**

[8. The method according of claim **7**, wherein manipulating the first and second elongate members with the force applying device includes positioning the first and second elongate members between the first and second hook members of the force applying device to compress the first and second elongate members towards one another.**]**

[9. The method according of claim **7**, wherein manipulating the first and second elongate members with the force applying device includes positioning the first and second hook members of the force applying device between the first and second elongate members to distract the first and second elongate members away from one another.**]**

[10. The method according of claim **7**, further comprising positioning a fulcrum over a distal end of each of the first and second elongate members before manipulating the first and second elongate members with the force applying device.**]**

[11. The method according to claim **10**, wherein manipulating the elongate members with the force applying device includes engaging the first elongate member with the first hook member between the fulcrum and the pedicle screw and engaging the second elongate member with the second hook member between the fulcrum and the pedicle screw.**]**

[12. The method according of claim **7**, further comprising:
reducing a spinal rod into a head of the first pedicle screw with the first elongate member; and
reducing the spinal rod into a head of the second pedicle screw with the second elongate member.**]**

[13. A method for manipulating vertebrae comprising:
securing a first elongate member to a first pedicle screw that is secured in a first vertebra;
securing a second elongate member to a second pedicle screw that is secured in a second vertebra; and
manipulating the first and second elongate members with a force applying device until the first and second pedicle screws are in a desired position, the force applying device having a compressing configuration, a distracting configuration, and a neutral configuration and including two hook members, at least one of the two hook members including switch assembly for selecting a respective one of the compressing, distracting, and neutral configurations, the switch assembly defining detents which each correspond to a respective one of the compressing, distracting, and neutral configurations of the force applying device.**]**

14. A compression/distraction system, comprising:

a pair of elongate members, including:

a first elongate member having a distal end removably securable to a first bone anchor such that the first elongate member extends away from the first bone anchor along a first longitudinal axis, the first elongate member having a lateral outer surface extending along the first longitudinal axis;

a second elongate member having a distal end removably securable to a second bone anchor such that the second elongate member extends away from the second bone anchor along a second longitudinal axis, the second elongate member having a lateral outer surface extending along the second longitudinal axis; and

a force applying device, including:

a body portion defining a compression/distraction dimension;

a first engagement member having a longitudinal dimension projecting outwardly from the body portion transverse to the compression/distraction dimension, the first engagement member having an inner side and an outer side extending along the longitudinal dimension of the first engagement member on opposing sides of the first engagement member in the compression/distraction dimension; and

a second engagement member having a longitudinal dimension projecting outwardly from the body portion transverse to the compression/distraction dimension, the second engagement member having an inner side and an outer side extending along the longitudinal dimension of the second engagement member on opposing sides of the second engagement member in the compression/distraction dimension, the inner sides of the first and second engagement members facing towards one another, and the outer sides of the first and second engagement members facing away from one another;

wherein the first and second engagement members are movable relative to one another along the compression/distraction dimension to change a distance defined between the first and second engagement members;

wherein the first and second engagement members of the force applying device are selectively engageable to the pair of elongate members such that the force applying device can apply compression and distraction forces to the first and second bone anchors via the respective first and second elongate members, the force applying device being engageable to the pair of elongate members in a compressing configuration for applying the compression forces and in a distracting configuration for applying the distraction forces; wherein the inner sides of the first and second engagement members are configured to engage the lateral outer surfaces of the respective first and second elongate members with the pair of elongate members positioned between the first and second engagement members in the compressing configuration; and wherein the outer sides of the first and second engagement members are configured to engage the lateral outer surfaces of the respective first and second elongate members with the first and second engagement members positioned between the pair of elongate members in the distracting configuration.

15. The compression/distraction system of claim 14, wherein each of the first and second engagement members includes a first receiver and a second receiver, the first receiver of each of the first and second engagement members being configured to receive a respective one of the pair of elongate members in the compressing configuration, and the second receiver of each of the first and second engagement members being configured to receive a respective one of the pair of elongate members in the distracting configuration.

16. The compression/distraction system of claim 15, wherein the first receiver of each one of the first and second engagement members is a respective first concave portion facing towards the other of the first and second engagement members, and wherein the second receiver of each one of the first and second engagement members is a respective second concave portion facing away from the other of the first and second engagement members.

17. The compression/distraction system of claim 14, wherein the body portion includes a track along which the second engagement member is movable along the longitudinal dimension.

18. The compression/distraction system of claim 17, wherein the second engagement member is movable along the longitudinal dimension by rotation of a toothed pinion to advance the pinion along a set of teeth positioned along at least a portion of the track.

19. The compression/distraction system of claim 14, wherein the force applying device is transitionable between the compressing configuration and the distracting configuration by moving a switch assembly between a first position and a second position, respectively.

20. The compression/distraction system of claim 19, wherein the switch assembly is movable to a third position corresponding to a neutral configuration of the force applying device, the neutral configuration permitting the second engagement member to freely move along the longitudinal dimension both towards and away from the first engagement member.

21. The compression/distraction system of claim 20, wherein the first and second engagement members are respective first and second hook members, the second hook member including ball detents each corresponding to a respective one of the first, second, and third positions of the switch assembly.

22. The compression/distraction system of claim 19, wherein moving the switch assembly between the first position and the second position causes a pawl to rotate between a first angular position and a second angular position, respectively, the pawl engaging a set of teeth of the force applying device in both the first and second angular positions, such that the engagement between the pawl and the set of teeth in the first angular position prevents relative movement of the first and second engagement members away from one another along the longitudinal dimension, and such that the engagement between the pawl and the set of teeth in the second angular position prevents relative movement of the first and second engagement members towards one another along the longitudinal dimension.

23. A force applying device for a compression/distraction system, comprising:

a first engagement member;

a second engagement member;

a body portion coupling the first and second engagement members together along a longitudinal dimension; and

a switch assembly;

wherein the first and second engagement members are movable relative to one another along the longitudinal dimension to change a distance defined between the first and second engagement members;

wherein the first and second engagement members of the force applying device are selectively engageable to a pair of elongate members each securable to a respective bone anchor such that the force applying device can apply compression and distraction forces to the bone anchors via the elongate members; wherein the force applying device has a compressing configuration and a distracting configuration, the compressing configuration restraining relative movement of the first and second engagement members away from one another along the longitudinal dimension while permitting relative movement of the first and second engagement members towards one another along the longitudinal dimension, and the distracting configuration restraining relative movement of the first and second engagement members towards one another along the longitudinal dimension while permitting relative movement of the first and second engagement members away from one another along the longitudinal dimension; and wherein the force applying device is transitionable between the compressing and distracting configurations by moving the switch assembly between a first position and a second position, respectively.

24. The force applying device of claim 23, wherein each of the first and second engagement members includes a first receiver and a second receiver, the first receiver of each of the first and second engagement members being configured to receive a respective one of the pair of elongate members in the compressing configuration, and the second receiver of each of the first and second engagement members being configured to receive a respective one of the pair of elongate members in the distracting configuration.

25. The force applying device of claim 24, wherein the first receiver of each one of the first and second engagement members is a respective first concave portion facing towards the other of the first and second engagement members, and wherein the second receiver of each one of the first and second engagement members is a respective second concave portion facing away from the other of the first and second engagement members.

26. The force applying device of claim 23, wherein the body portion includes a track along which the second engagement member is movable along the longitudinal dimension.

27. The force applying device of claim 26, wherein the second engagement member is movable along the longitudinal dimension by rotation of a toothed pinion to advance the pinion along a set of teeth positioned along at least a portion of the track.

28. The force applying device of claim 23, wherein the switch assembly is movable to a third position corresponding to a neutral configuration of the force applying device, the neutral configuration permitting the second engagement member to freely move along the longitudinal dimension both towards and away from the first engagement member.

29. The force applying device of claim 28, wherein the first and second engagement members are respective first and second hook members, the second hook member including ball detents each corresponding to a respective one of the first, second, and third positions of the switch assembly.

30. The force applying device of claim 23, wherein moving the switch assembly between the first position and the second position causes a pawl to rotate between a first angular position and a second angular position, respectively, the pawl engaging a set of teeth of the force applying device in both the first and second angular positions, such that the engagement between the pawl and the set of teeth in the first angular position prevents relative movement of the first and second engagement members away from one another along the longitudinal dimension, and such that the engagement between the pawl and the set of teeth in the second angular position prevents relative movement of the first and second engagement members towards one another along the longitudinal dimension.

31. The force applying device of claim 23, wherein the first and second engagement members are configured to engage the pair of elongate members with the elongate members positioned between the first and second engagement members in the compressing configuration; and wherein the first and second engagement members are configured to engage the pair of elongate members with the first and second engagement members positioned between the elongate members in the distracting configuration.

32. A force applying device for a compression/distraction system, comprising:

a first engagement member having a portion including a distracting hook and a compressing hook;

a second engagement member having a portion including a distracting hook and a compressing hook; and

a body portion coupling the first and second engagement members together along a longitudinal dimension;

wherein the first and second engagement members are movable relative to one another along the longitudinal dimension to change a distance defined between the first and second engagement members; and

wherein the first and second engagement members of the force applying device are selectively engageable to a pair of elongate members each securable to a respective bone anchor such that the force applying device can apply compression and distraction forces to the bone anchors via the elongate members, the force applying device being engageable to the pair of elongate members in a compressing configuration for applying the compression forces and in a distracting configuration for applying the distraction forces.

33. The force applying device of claim 32, wherein the compressing hook of each of the first and second engagement members is configured to receive a respective one of the pair of elongate members in the compressing configuration, and wherein the distracting hook of each of the first and second engagement members is configured to receive a respective one of the pair of elongate members in the distracting configuration.

34. The force applying device of claim 32, wherein the compressing hook of each one of the first and second engagement members includes a respective first concave portion facing towards the other of the first and second engagement members, and wherein the distracting hook of each one of the first and second engagement members includes a respective second concave portion facing away from the other of the first and second engagement members.

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