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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)

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

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(Continued)

Related U.S. Patent Documents

Reissue of:

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Primary Examiner — David O Reip

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U.S. Applications:

(60) Continuation of application No. 16/545,644, filed on Aug. 20, 2019, now Pat. No. Re. 48,250, which is an (Continued)

(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.

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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.

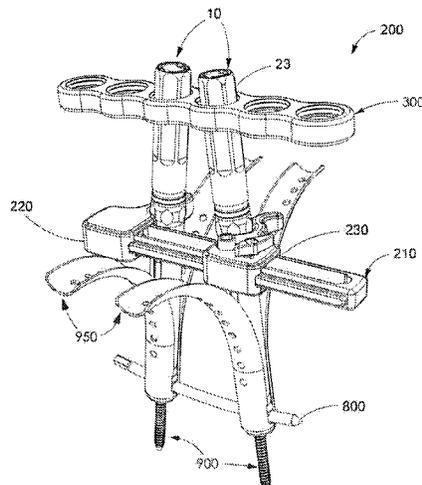
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21 Claims, 11 Drawing Sheets



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.

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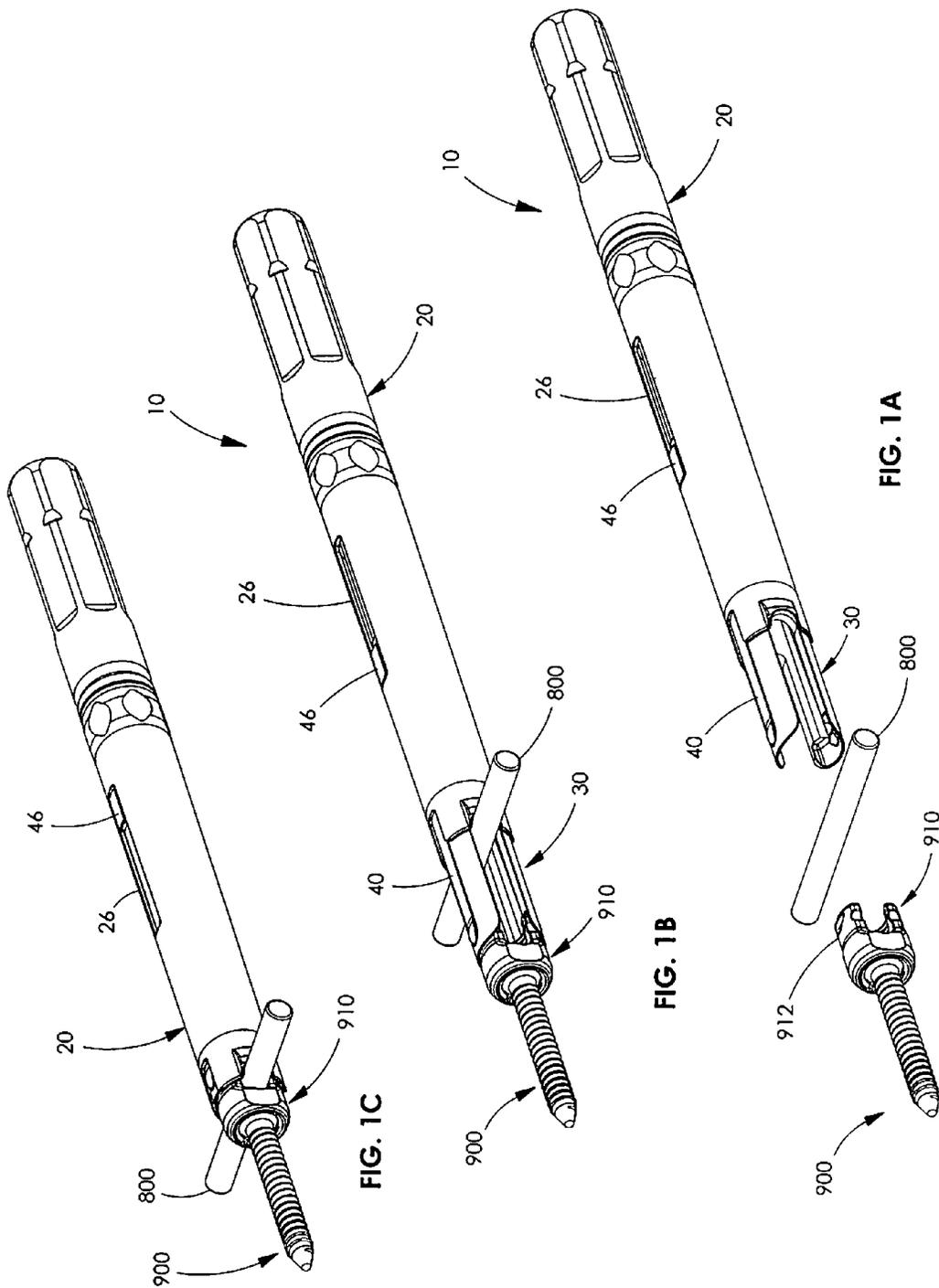
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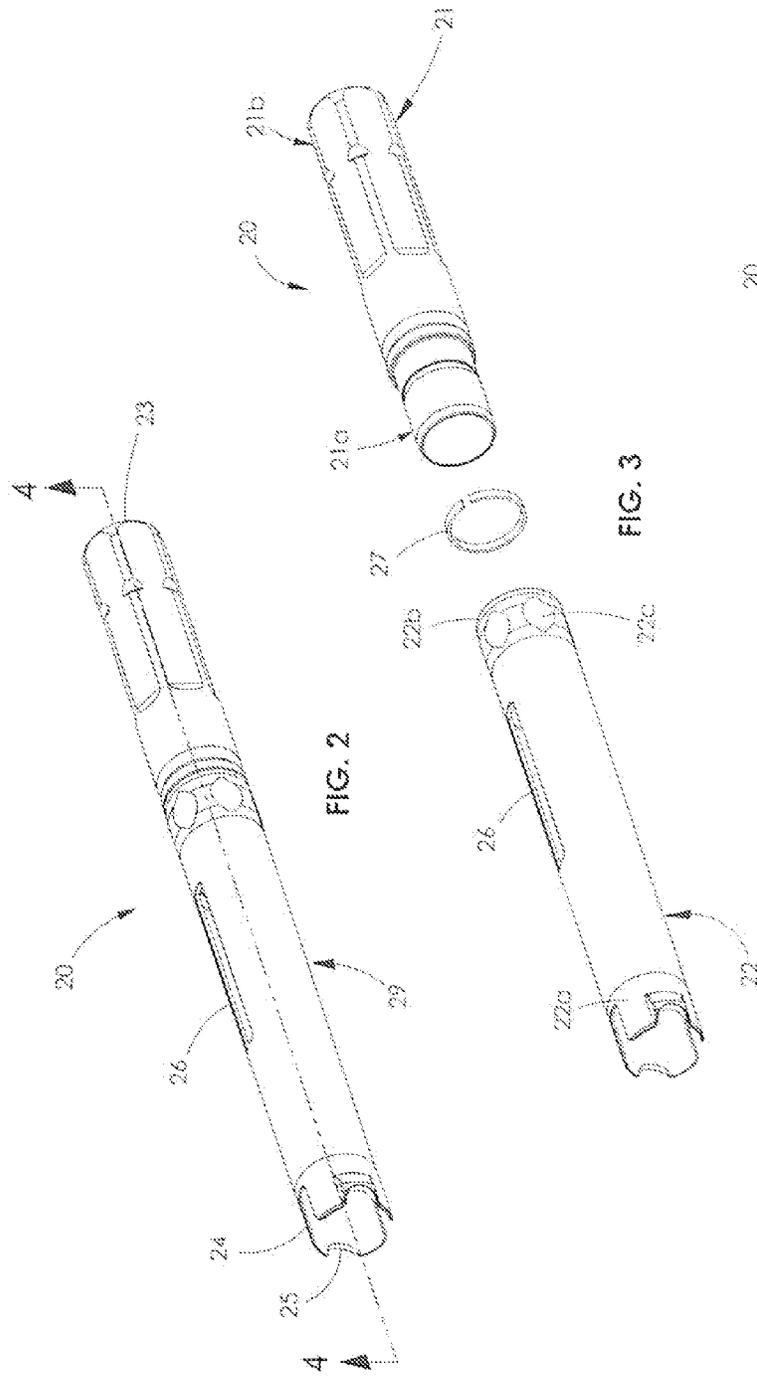


FIG. 2

FIG. 3

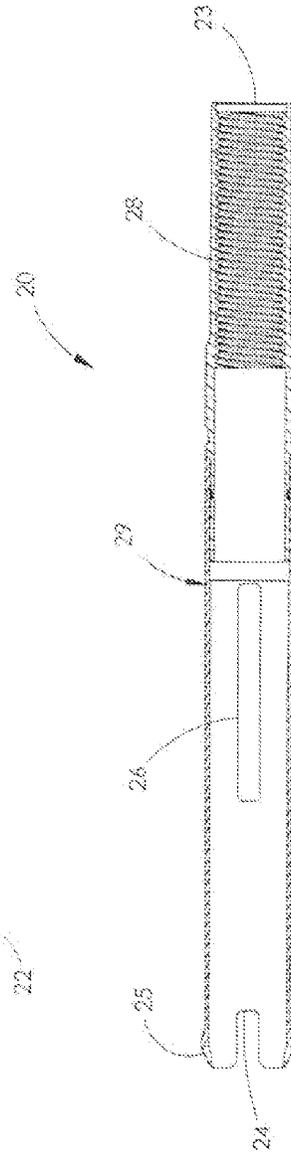


FIG. 4

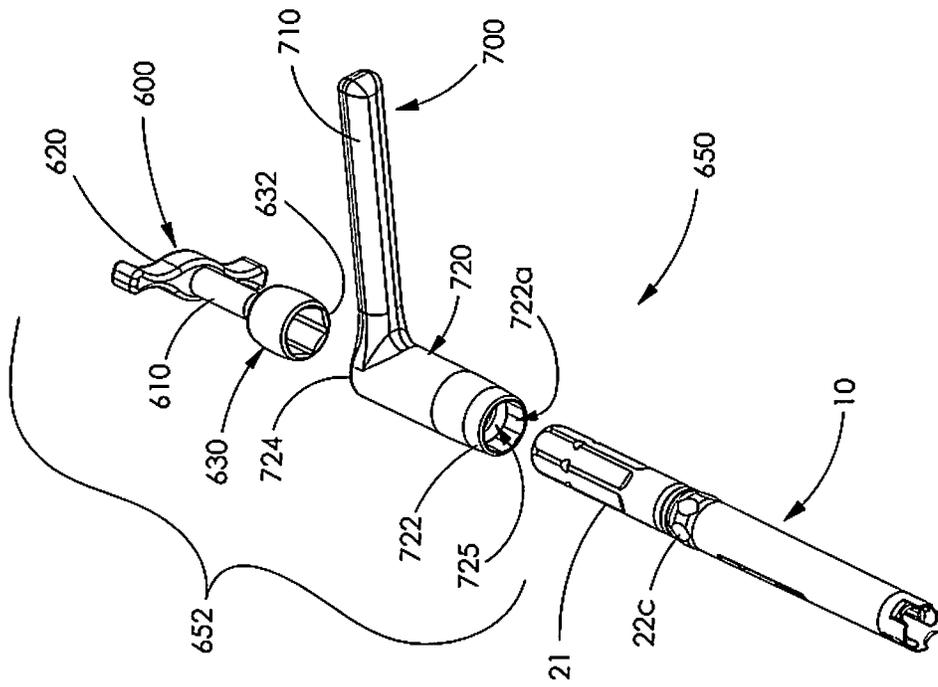


FIG. 7B

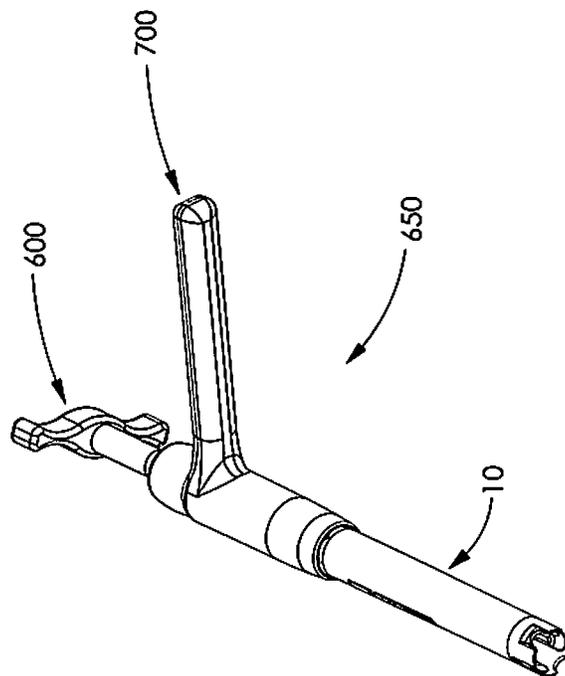


FIG. 7A

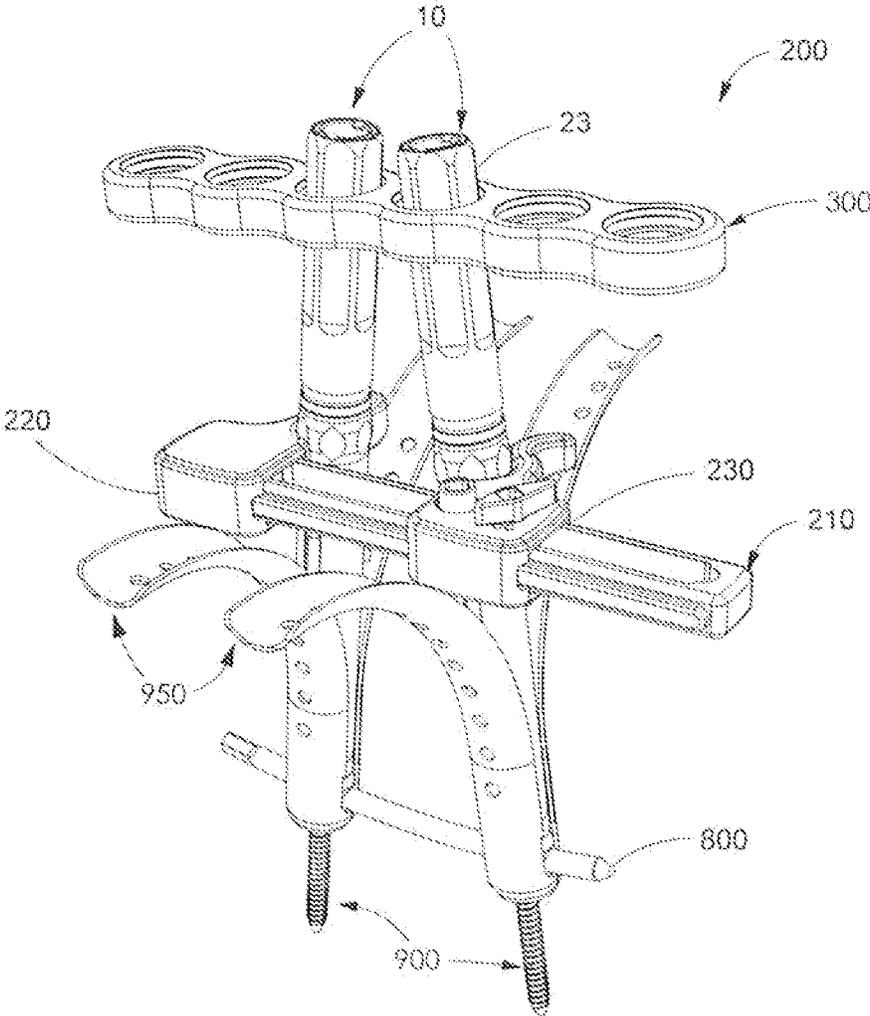


FIG. 8

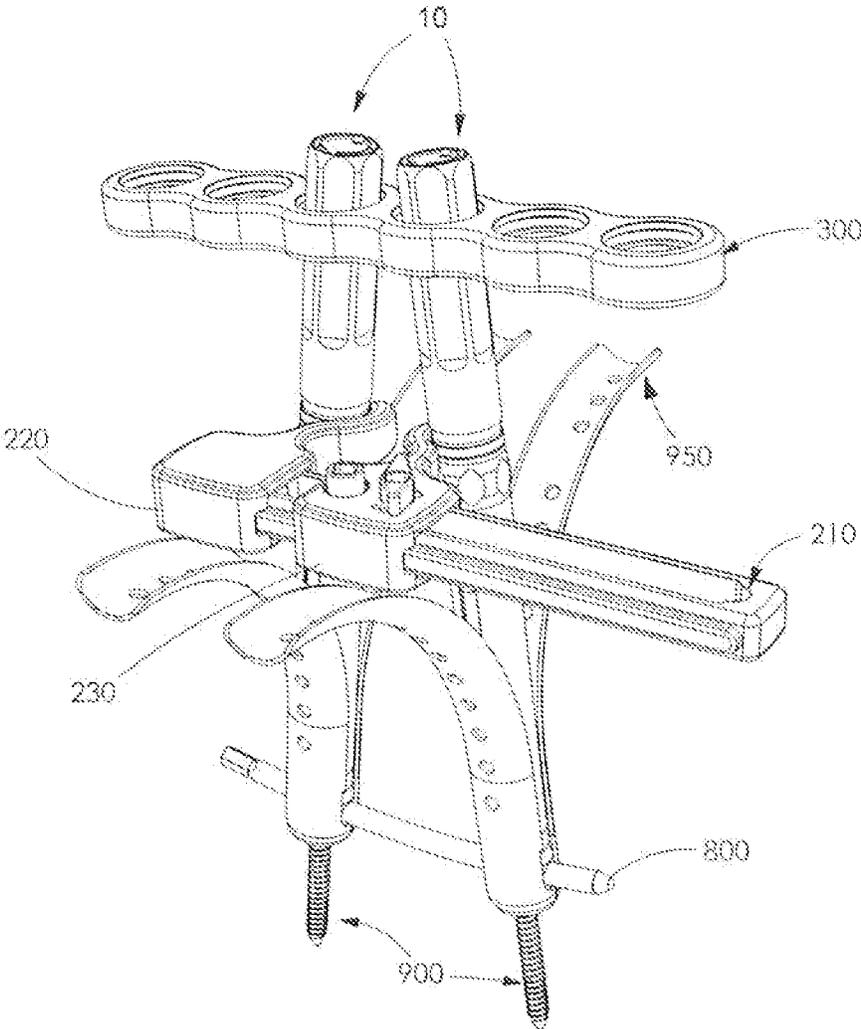


FIG. 9

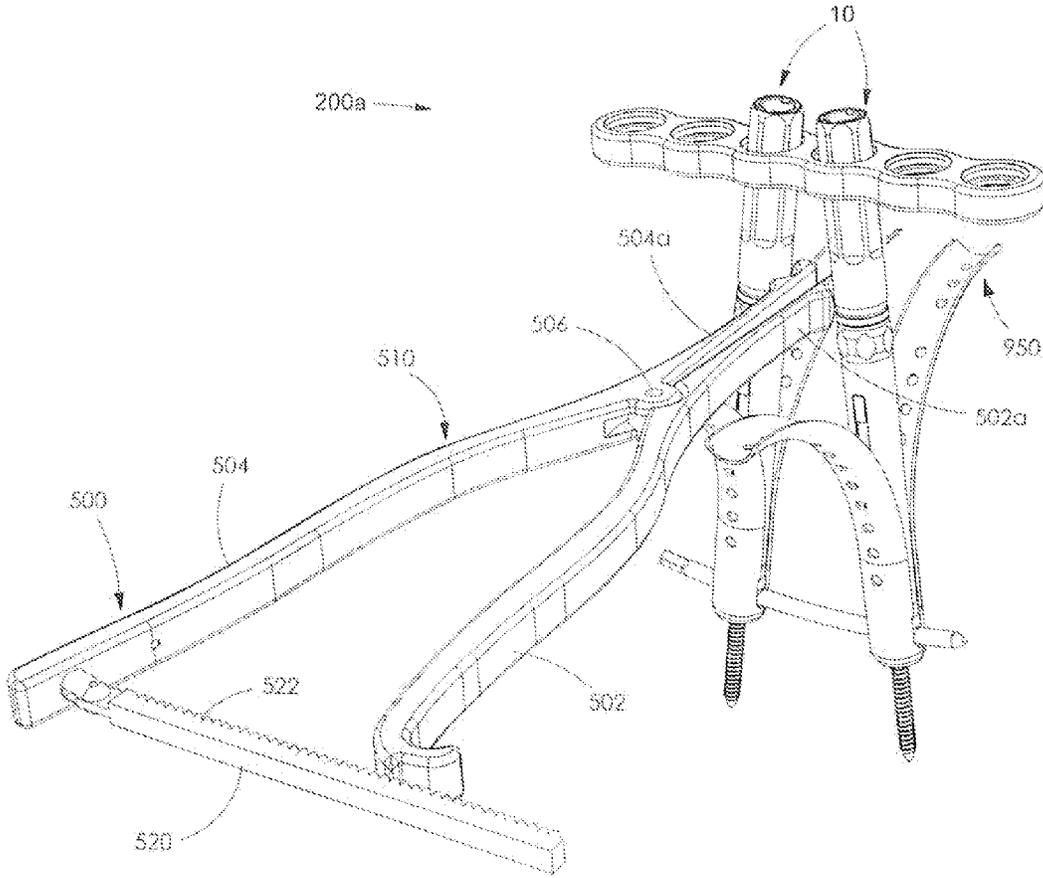


FIG. 10B

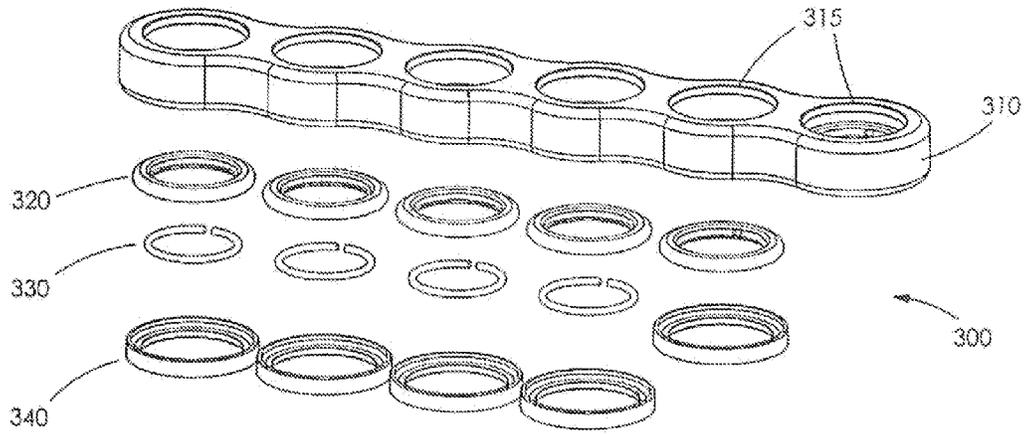


FIG. 11A

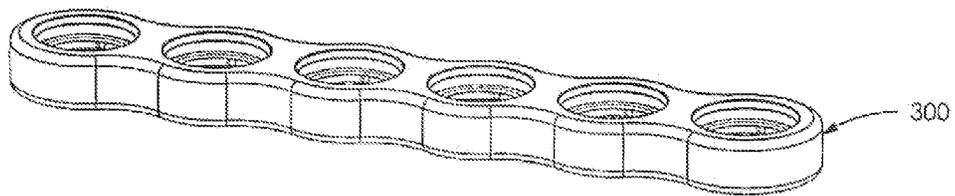


FIG. 11

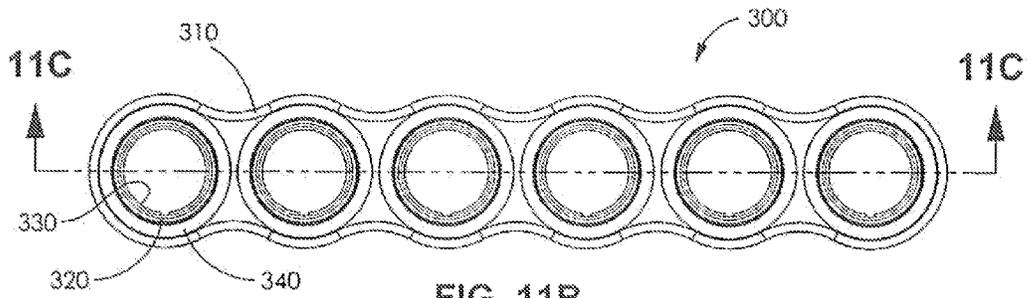


FIG. 11B

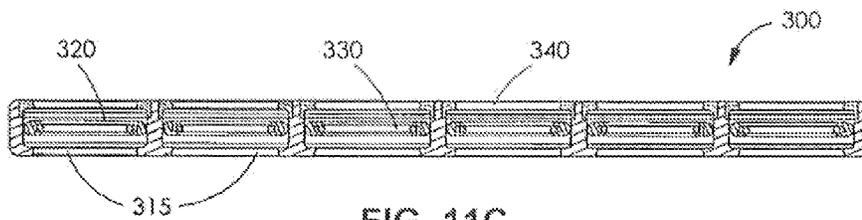


FIG. 11C

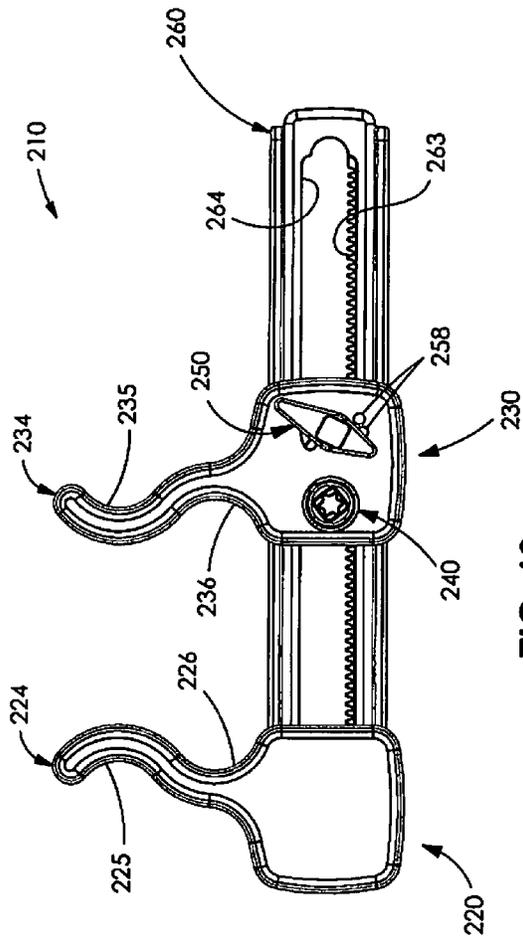


FIG. 13

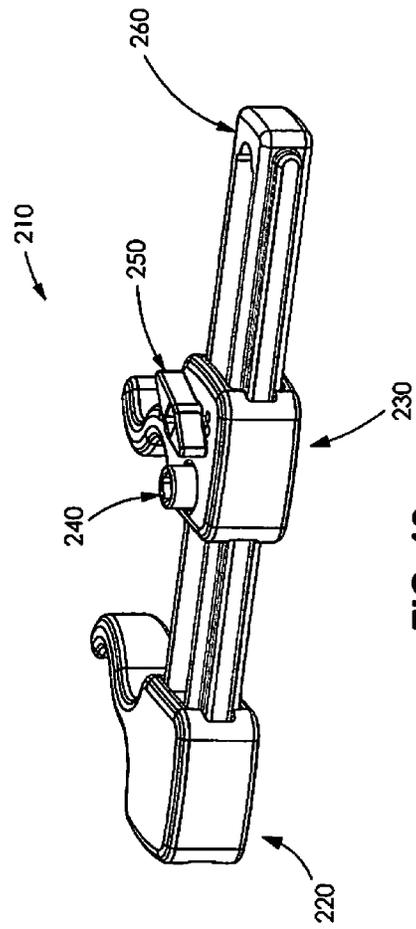


FIG. 12

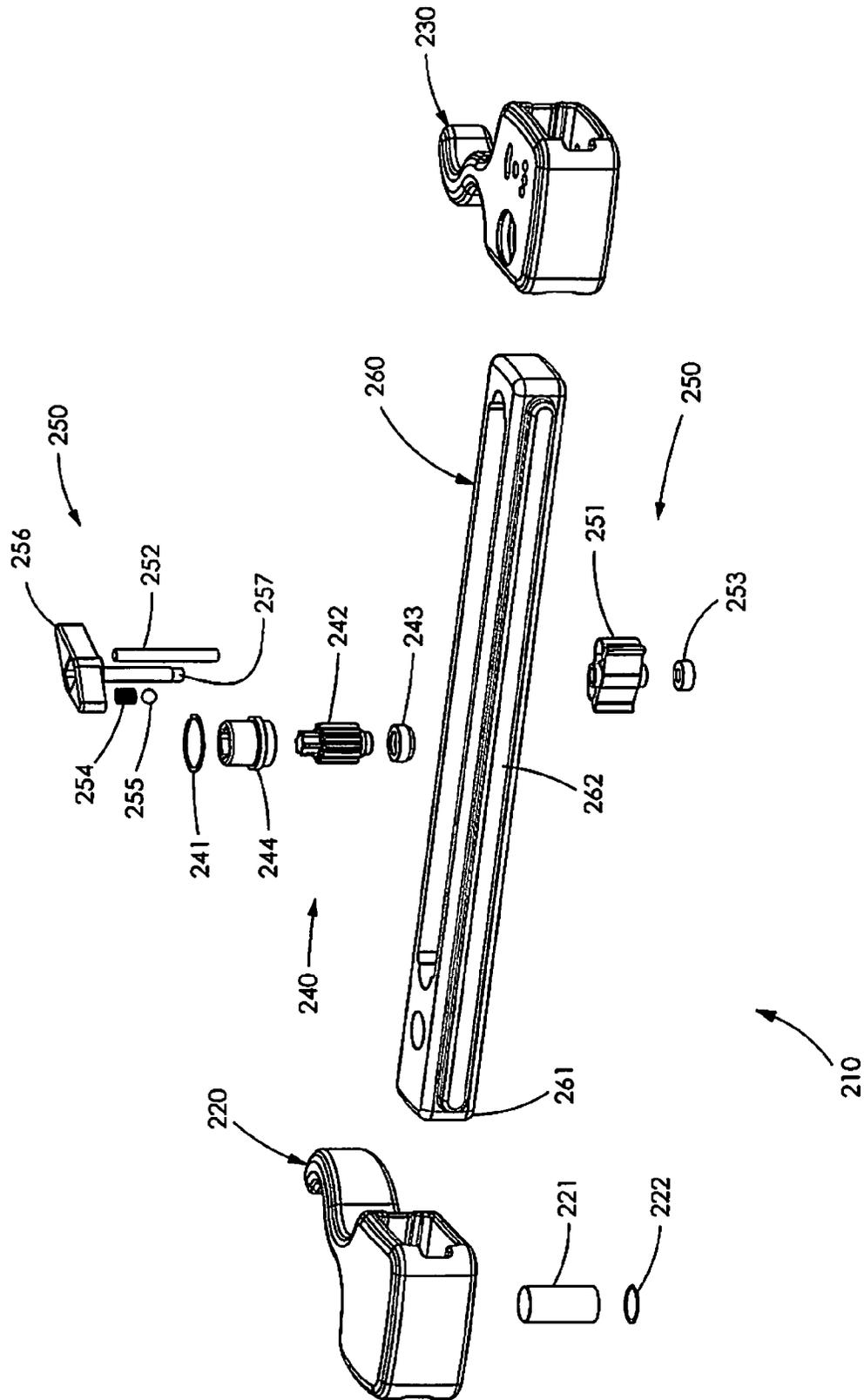


FIG. 14

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

FIG. 1C is a perspective view of the rod reducer of FIG. 1B 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. 1A;

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. 1A;

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

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

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

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

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

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

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

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

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

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. 2-6A, 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 21a at a distal end of proximal segment 21 and a gripping portion 21b 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 22a at a distal end of distal segment 22 and a receiving portion 22b at a proximal end of distal segment 22. Receiving portion 22b includes a plurality of gripping features 22c on an outer surface of receiving portion 22b. A pair of rod engaging slots 25 and a pair of gripping member receiving slots 24 are defined through reducing portion 22a. Receiving portion 22b of distal segment 22 is configured to receive engaging portion 21a 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 22a of outer member 20 so that distal finger 45 is substantially aligned with a gripping member receiving slot 24 of reducing portion 22a.

As illustrated in FIGS. 1A-1C, 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. 7A and 7B, 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 21b and gripping features 22c 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 21b 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 722a at a distal end of socket 722. Opening 722a 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 21b of rod reducer 10 and engage with gripping feature 22c 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 22c 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. 1C. 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. 10A and 10B illustrate other embodiments of compressor/distractor system **200a** using compressor **400** and distractor **500** respectively as the force applying device. As shown in FIG. 10A, 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 **402a**, **404a** for engaging rod reducers **10**. Each gripper **402a**, **404a** 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. 10B, 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 **502a**, **504a** for engaging rod reducers **10**. Each gripper **502a**, **504a** 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. 11-11C 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). Com-

pressor/distractor device **210** may also have a neutral configuration. Each hook member **220**, **230** may engage gripping features **22c** 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. 1B. 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. 1B and 1C. Once each outer member **20** is fully advanced with respect to each inner member **30** as shown in FIG. 1C, the surgeon engages each outer member **20** with a force applying device **210**, **400**, **500** as shown in FIGS. 8-10B. 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 **21b** 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 between 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.