US 20090093820A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2009/0093820 A1

TRIEU et al. (43) Pub. Date: Apr. 9, 2009

(54) ADJUSTABLE SPINAL STABILIZATION SYSTEMS

(75) Inventors: **Hai H. TRIEU**, Cordova, TN (US); **Dimitri K. PROTOPSALTIS**, Memphis, TN (US)

Correspondence Address:
MEDTRONIC
Attn: Noreen Johnson - IP Legal Department
2600 Sofamor Danek Drive
MEMPHIS, TN 38132 (US)

(73) Assignee: **WARSAW ORTHOPEDIC, INC.**, Warsaw, IN (US)

(21) Appl. No.: **11/869,355**

(22) Filed: **Oct. 9, 2007**

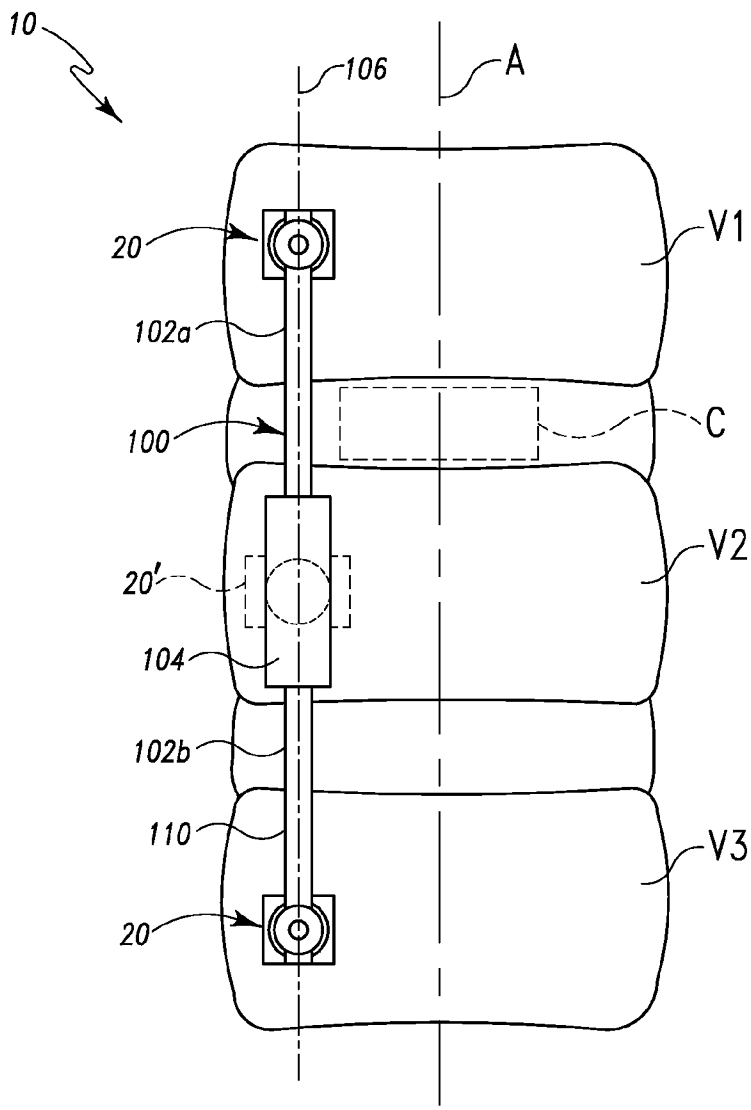
Publication Classification

(51) **Int. Cl.**
A61B 17/70 (2006.01)
A61B 17/58 (2006.01)
A61B 17/04 (2006.01)

(52) **U.S. Cl.** **606/103**; 606/246; 606/250; 606/251; 606/264; 606/301

(57) **ABSTRACT**

A spinal stabilization system includes a stabilization member with opposite end portions lying along a longitudinal axis and an adjustment mechanism between the end portions that allows the end portions to be moved toward and away from one another along the longitudinal axis.



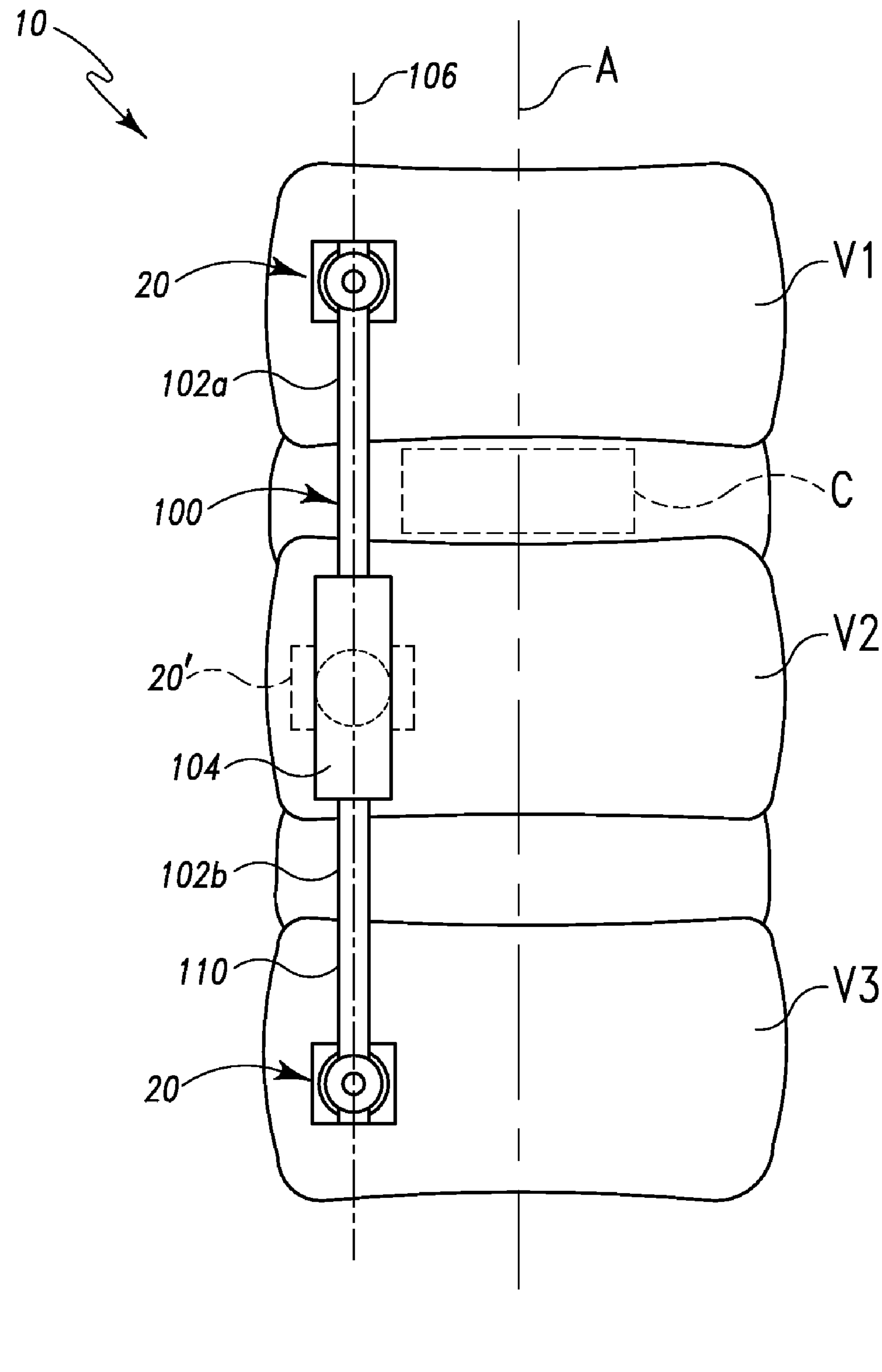


Fig. 1

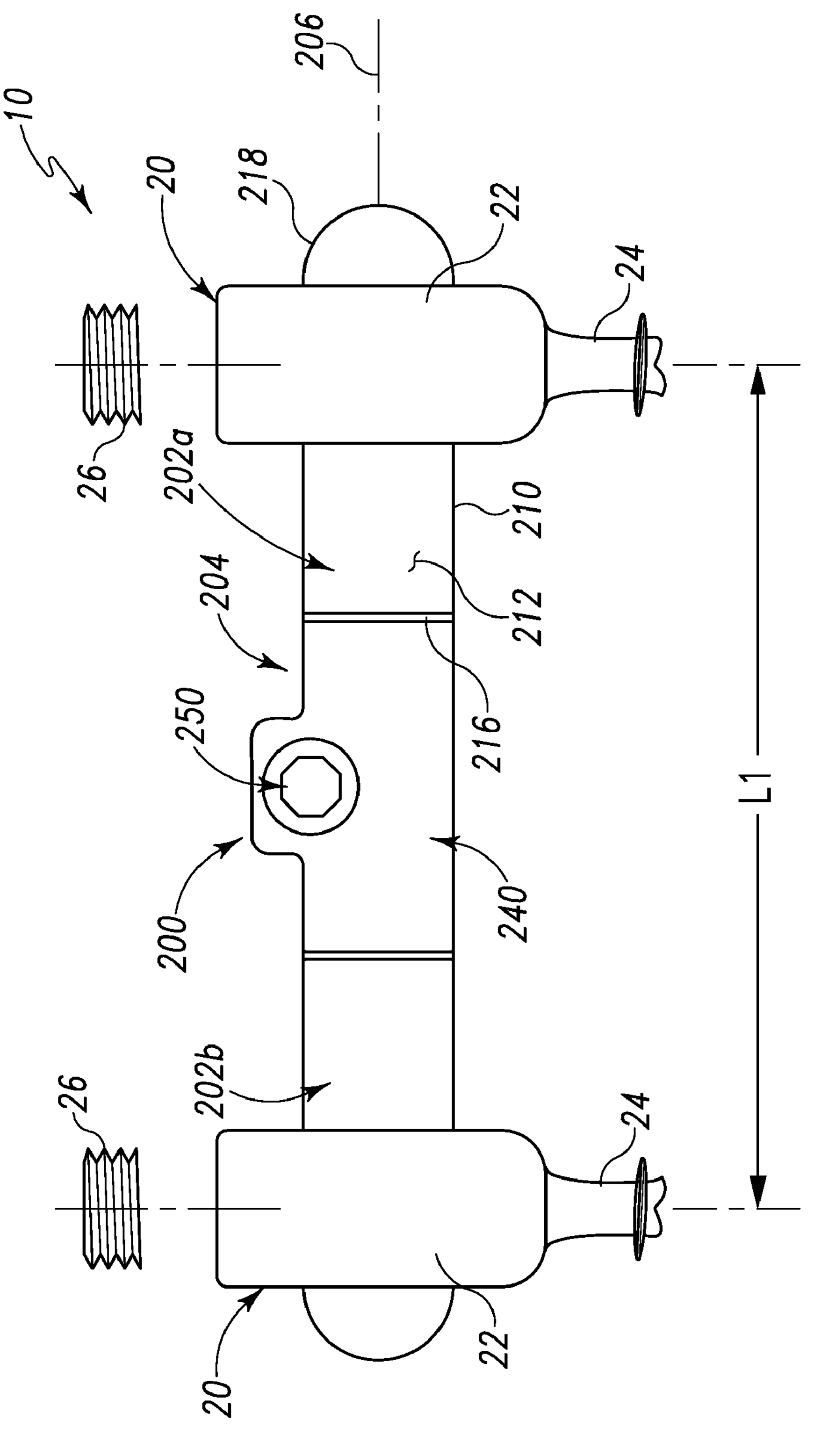

10
20
218
206
22
24
26
202a
210
204
212
216
250
200
240
L1
202b
26
24
22
20

Fig. 2

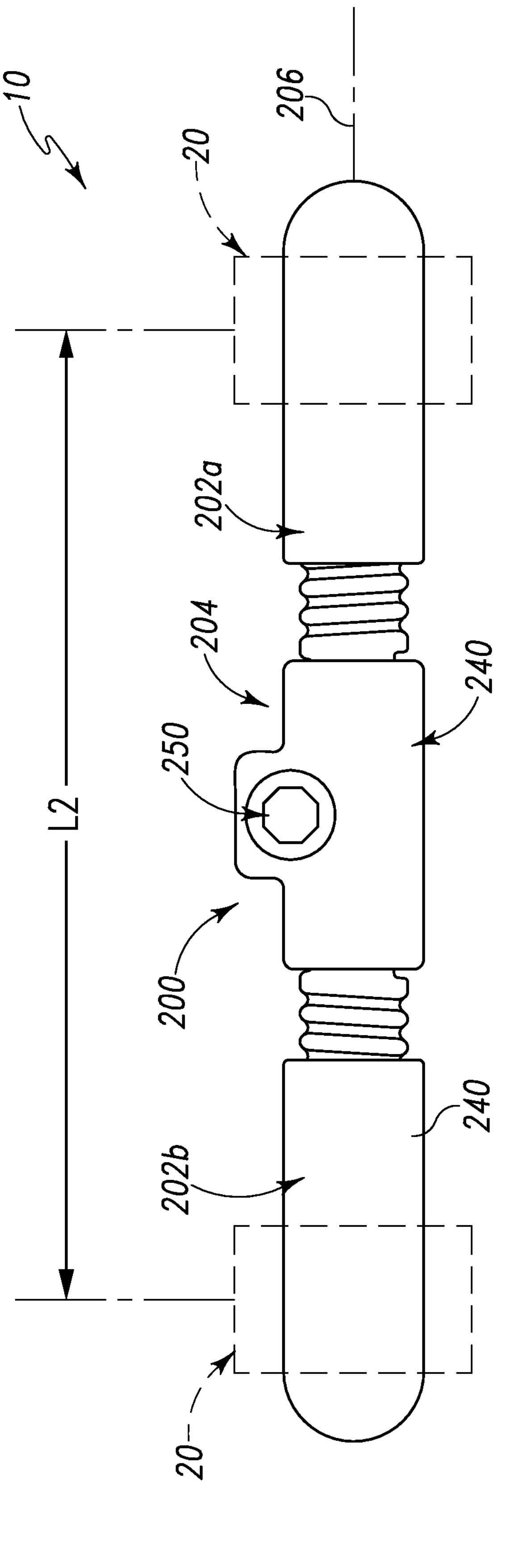


Fig. 3

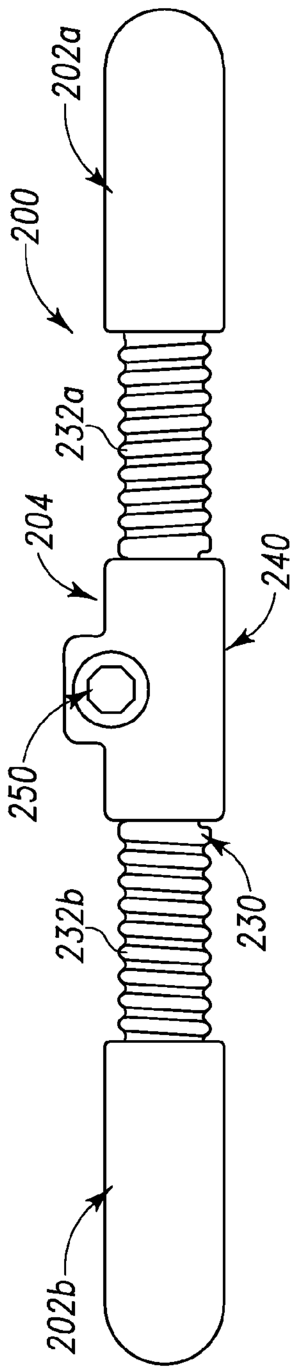

202a
200
232a
204
240
250
230
232b
202b

Fig. 4

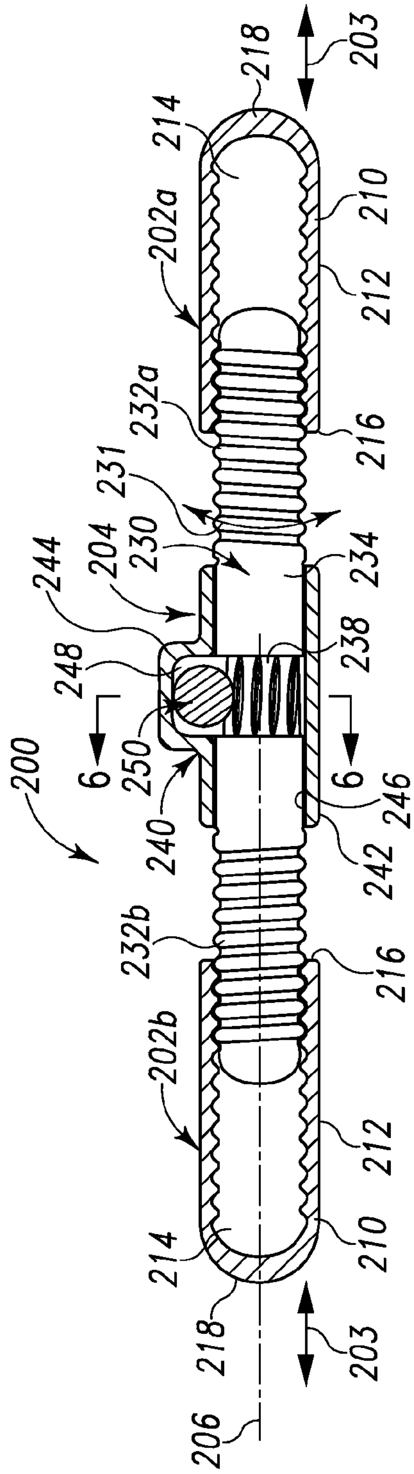

218
203
214
202a
210
212
232a
216
231
230
204
244
234
238
248
6
250
240
246
242
200
232b
202b
214
218
210
212
206

Fig. 5

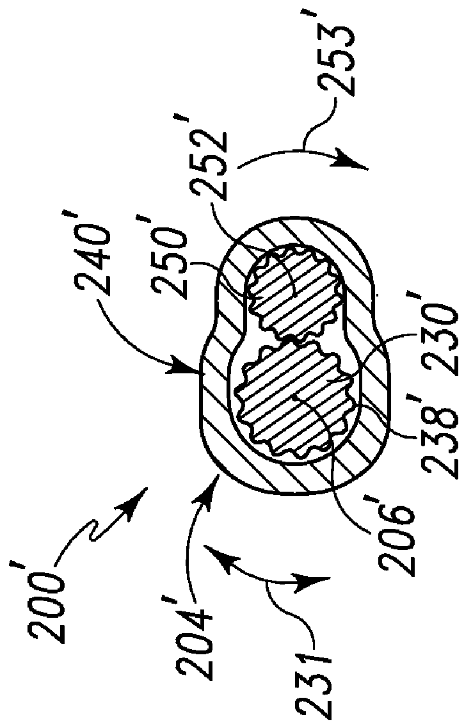

200'
204'
231
240'
250'
252'
253'
206'
238'
230'

Fig. 6A

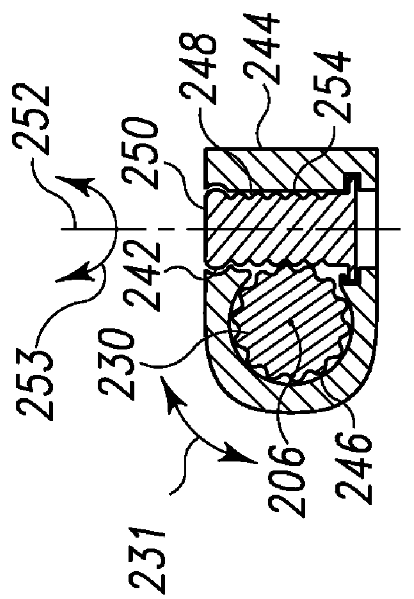
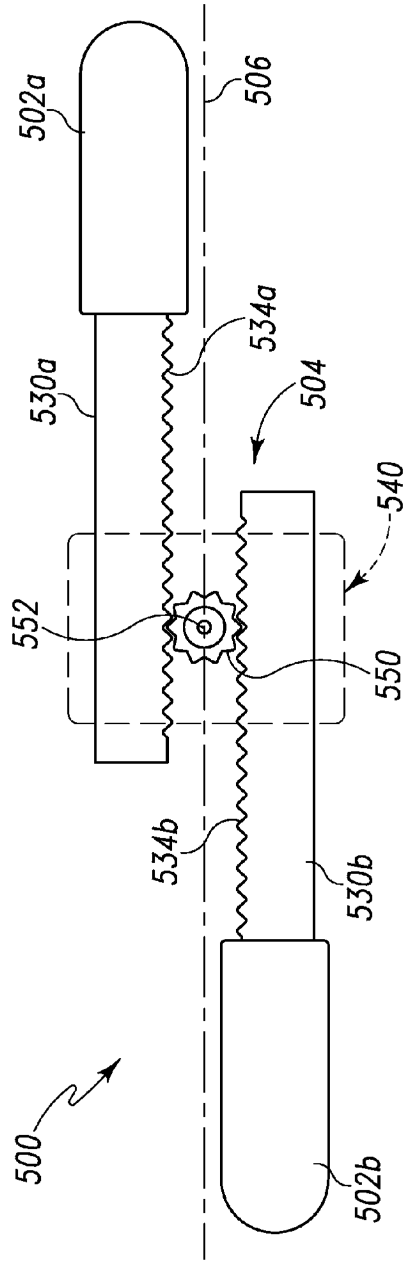
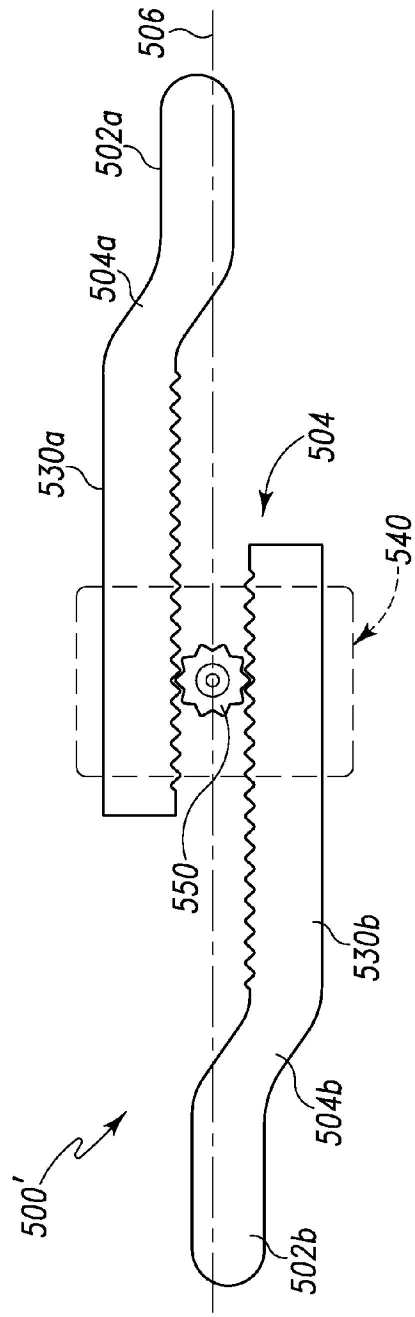

231
253
252
230
242
250
248
244
254
206
246

Fig. 6



500
502a
506
530a
534a
504
540
552
550
534b
530b
502b

Fig. 7



500'
506
502a
504a
530a
504
540
550
530b
504b
502b

Fig. 8

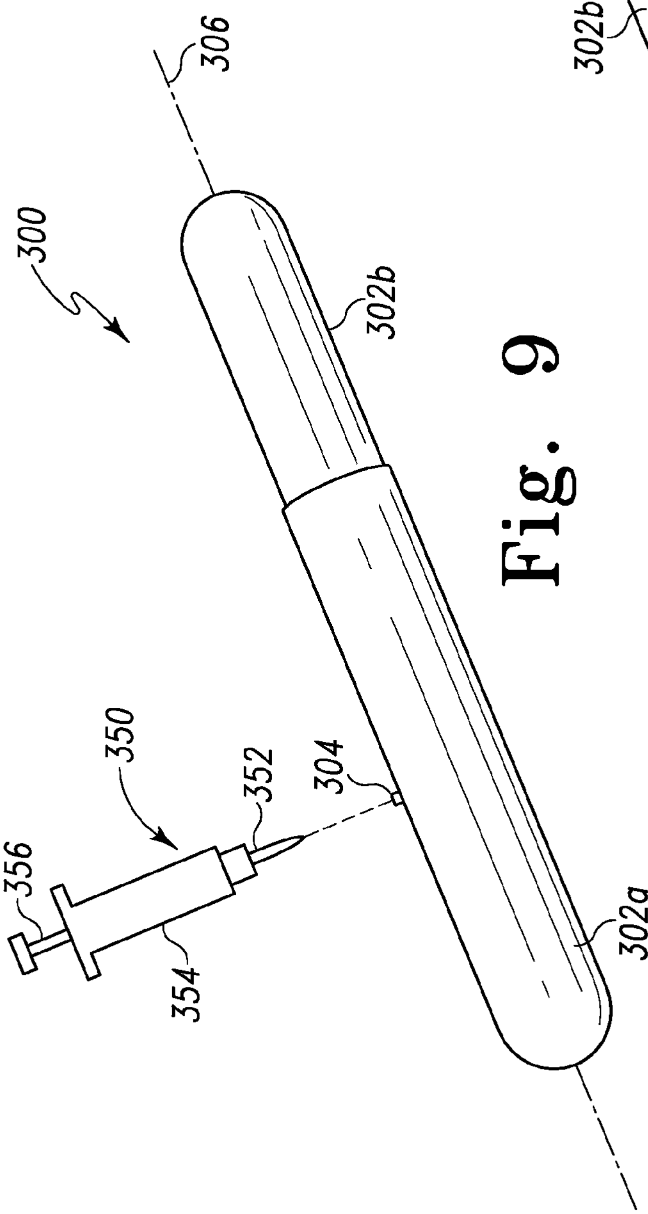

300
306
302b
304
350
352
354
356
302a

Fig. 9

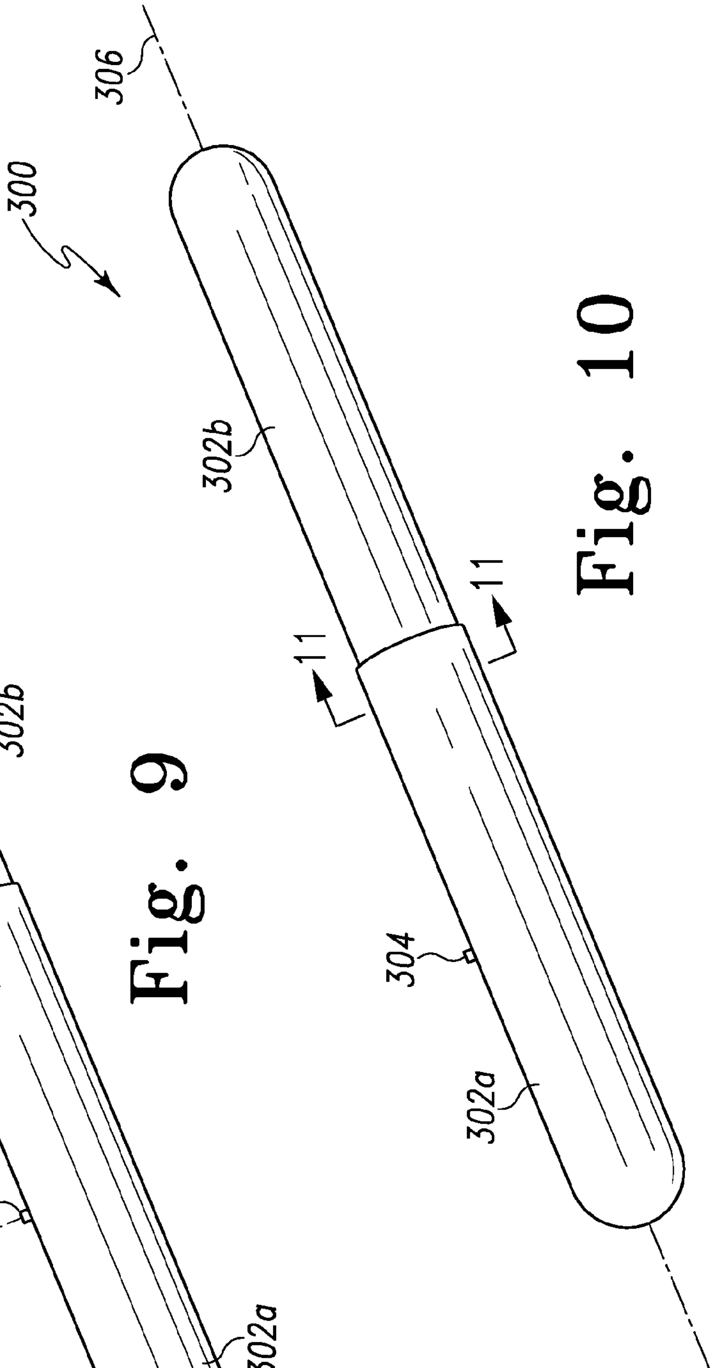

306
300
302b
11
11
304
302a

Fig. 10

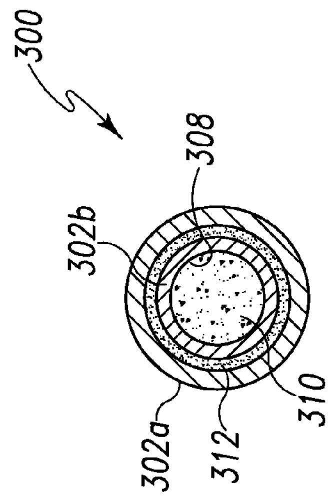


Fig. 11

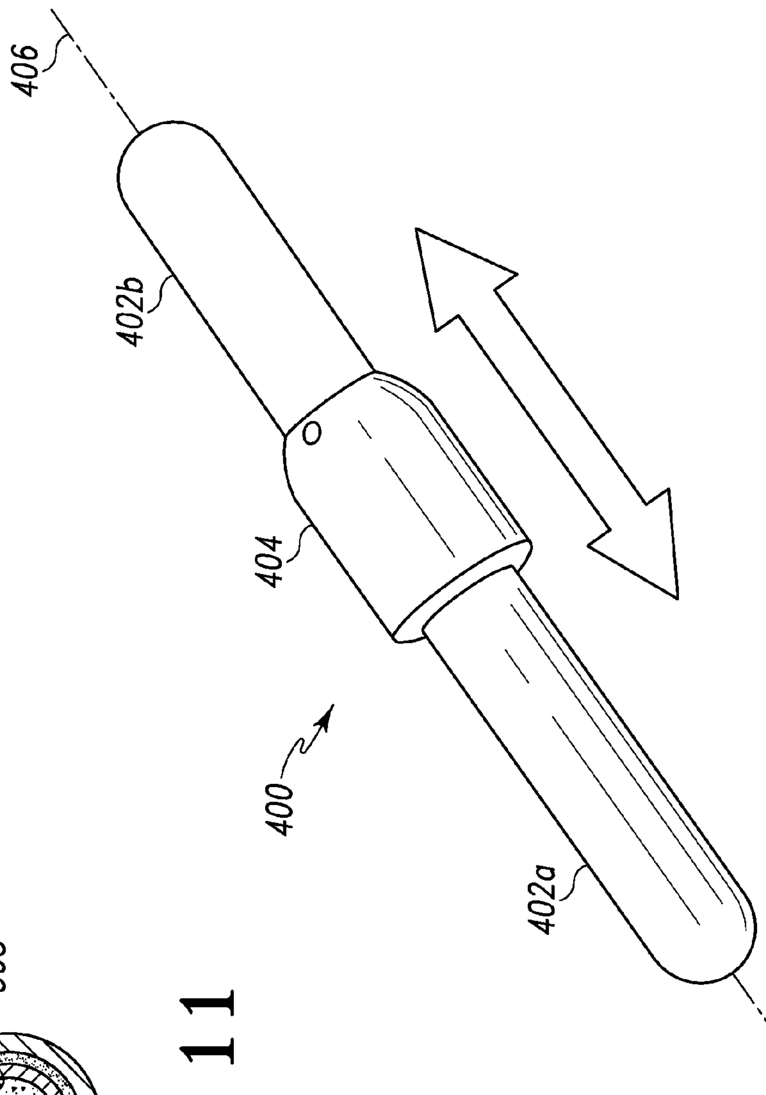


Fig. 12

ADJUSTABLE SPINAL STABILIZATION SYSTEMS

BACKGROUND

[0001] The spine is subject to various pathologies that compromise its load bearing and support capabilities. Such pathologies of the spine include, for example, degenerative diseases, the effects of tumors and, of course, fractures and dislocations attributable to physical trauma. In the treatment of diseases, malformations or injuries affecting spinal motion segments (which include two or more adjacent vertebrae and the disc tissue or disc space therebetween), and especially those affecting disc tissue, it has long been known to remove some or all of a degenerated, ruptured or otherwise failing disc. It is also known that artificial discs, fusion implants, or other interbody devices can be placed into the disc space after disc material removal. External stabilization of spinal segments alone or in combination with interbody devices also provides advantages. Elongated rigid plates, rods and other external stabilization devices have been helpful in the stabilization and fixation of a spinal motion segment, in correcting abnormal curvatures and alignments of the spinal column, and for treatment of other conditions.

[0002] While external stabilization systems have been employed along the vertebrae, the geometric and dimensional features of these systems and patient anatomy constrain the surgeon during surgery and prevent optimal placement and attachment along the spinal column. For example, elongated, one-piece spinal rods can be difficult to maneuver into position along the spinal column, and also provide the surgeon with only limited options in sizing and selection of the rod system to be placed during surgery. Furthermore, there remains a need to provide spinal stabilization systems which correct one or more targeted spinal deformities while also preserving the ability to adjust the systems for optimal fit during the surgical procedure and in subsequent surgical procedures.

SUMMARY

[0003] A spinal stabilization system includes a stabilization member with opposite end portions lying along a longitudinal axis and an adjustment mechanism between the end portions that allows the end portions to be moved toward and away from one another along the longitudinal axis to adjust the length of the stabilization member.

[0004] According to one aspect, a spinal stabilization system comprises a stabilization member extending along a longitudinal axis between a first end portion and a second end portion. The stabilization member also includes an adjustment mechanism connecting the first and second end portions along the longitudinal axis. The system also comprises first and second anchor members each including a bone engaging portion to engage a bony structure and a receiving portion extending from the bone engaging portion. The receiving portion is configured to receive a respective one of the first and second end portions. The first and second anchor members further each include an engaging member to fixedly secure the respective end portion to the receiving portion in the receptacle. The adjustment mechanism is operable to move the first and second end portions toward and away from one another along the longitudinal axis to shorten and lengthen the stabilization member along the longitudinal axis with the end portions fixedly secured to the first and second anchor members.

[0005] According to a further aspect, a spinal stabilization system comprises a stabilization member extending along a longitudinal axis between a first end portion and an opposite second end portion and an adjustment mechanism connecting the first and second end portions. The adjustment mechanism includes a housing including a sleeve portion defining a bore extending along the longitudinal axis and a mounting portion adjacent to the sleeve portion. The adjustment mechanism also includes an adjustment member extending through the bore between opposite first and second engaging end that are engaged to respective ones of the first and second end portions. The adjustment mechanism also includes a drive member in the mounting portion engaged to the adjustment member. The drive member is operable to manipulate the adjustment member to move the first and second end portions toward and away from one another along the longitudinal axis.

[0006] According to another aspect, a method for spinal stabilization comprises: engaging a first anchor to a first vertebra; engaging a second anchor to a second vertebra; engaging first and second end portions of a stabilization member to respective ones of the first and second anchors, the stabilization member including an adjustment member extending between and engaged to the first and second end portions; manipulating the adjustment mechanism to adjust a length of the stabilization member between the first and second end portions while the stabilization member is engaged to the first and second anchors; maintaining the stabilization member in the adjusted length; and manipulating the adjustment mechanism to adjust the adjusted length after maintaining the adjusted length for a period of time.

[0007] According to another aspect, a spinal stabilization system comprises a stabilization member extending along a longitudinal axis between a first end portion and an opposite second end portion. The stabilization member includes a length between the first and second end portions sized to extend between at least two vertebrae of a spinal column. The stabilization member includes an adjustment mechanism connecting the first and second end portions. The adjustment mechanism comprises a housing, a first adjustment member extending from the first end portion and to the housing along a first side of the longitudinal axis, a second adjustment member extending from the second end portion and to the housing along a second side of the longitudinal axis, and a drive member engaged to the housing between the first and second adjustment members. The drive member is engaged to the first and second adjustment members and is operable to manipulate the adjustment members to move the first and second end portions toward and away from one another along the longitudinal axis.

[0008] Related features, aspects, embodiments, objects and advantages will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a diagrammatic elevation view of a posterior portion of the spinal column with a stabilization system shown diagrammatically in attachment with the spinal column.

[0010] FIG. **2** is an elevation view of a stabilization member in a first, reduced length configuration and anchor members engageable to the stabilization member.

[0011] FIG. **3** is the stabilization member of FIG. **2** adjusted to increase the length thereof and with the anchor member engagement locations along the stabilization member shown diagrammatically.

[0012] FIG. **4** is the stabilization member of FIG. **2** in another adjusted configuration to increase the length thereof.

[0013] FIG. **5** is an elevation view in partial section of the stabilization member of FIG. **4**.

[0014] FIG. **6** is a cross-sectional view of the stabilization member of FIG. **5** along line **6-6** of FIG. **5**.

[0015] FIG. **6**A is a cross-sectional view of another embodiment stabilization member taken along a location thereof corresponding to the location of line **6-6** of the stabilization member of FIG. **5**.

[0016] FIG. **7** is an elevation view of another embodiment stabilization member.

[0017] FIG. **8** is an elevation view of another embodiment stabilization member.

[0018] FIG. **9** is a perspective view of another embodiment stabilization member in a reduced length configuration and a diagrammatic view of one embodiment adjustment device.

[0019] FIG. **10** is a perspective view of the stabilization member of FIG. **9** adjusted to increase the length thereof.

[0020] FIG. **11** is a cross-sectional view of the stabilization member of FIG. **10** along line **11-11** of FIG. **10**.

[0021] FIG. **12** is a perspective view of another embodiment stabilization member.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0022] For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any such alterations and further modifications in the illustrated devices, and such further applications of the principles of the invention as illustrated herein are contemplated as would normally occur to one skilled in the art to which the invention relates.

[0023] FIG. **1** illustrates posterior spinal stabilization system **10** located along a spinal column of a patient. More specifically, stabilization system **10** can be affixed to vertebrae V**1**, V**2**, V**3** of the spinal column segment from a posterior approach. Applications along two vertebrae or four or more vertebrae are also contemplated. Stabilization system **10** generally includes one or more anchor members **20** (shown diagrammatically in FIG. **1** and discussed further below) and at least one elongated stabilization member **100** extending generally along central spinal column axis A with a length sized to extend between anchor members **20**.

[0024] Stabilization member **100** includes an elongated body **110** that extends along longitudinal axis **106**. Body **110** of stabilization member **100** includes opposite end portions **102***a*, **102***b* extending along longitudinal axis **106** and an adjustment mechanism **104** between end portions **102***a*, **102***b*. Adjustment mechanism **104** is operable to selectively move end portions **102***a*, **102***b* toward or away from one another along longitudinal axis **106** to increase or decrease the length of body **110** of stabilization member **100**. The ability to adjust the length of stabilization member **100** along longitudinal axis is desirable for many applications in spinal surgical procedure, including, but not limited to, applying distraction or compression forces to one or more vertebrae through anchor members **10**, applying corrective forces to provide a desired alignment of one or more vertebrae, accommodating growth or other changes in the anatomy of the patient over time, facilitating revision surgery in minimally invasive surgical approaches without replacement of the stabilization member, and maintaining the position or orientation of one or more vertebrae during the implantation procedure and over time. Spinal stabilization system **10** may be used for, but is not limited to, treatment of degenerative spondylolisthesis, fracture, dislocation, scoliosis, kyphosis, spinal tumor, herniation, stenosis, and/or a failed previous fusion.

[0025] In one embodiment, adjustment mechanism is located along one of the vertebrae, such as vertebra V**2**, and is unconstrained relative to vertebra V**2**. In another embodiment, adjustment mechanism **104** is located along a spinal disc space or other structure between adjacent vertebrae of single level or multiple level procedures. In yet another embodiment, adjustment mechanism **104** is constrained or fixed relative to vertebra V**2** with an anchor member **20'**, as shown in FIG. **1**. In another embodiment, adjustment mechanism **104** is constrained or fixed relative to one of the adjacent vertebrae of a single level procedure. In still another embodiment, adjustment mechanism **104** is semi-constrained so that translation and/or rotation is permitted in or more degrees of freedom relative to the adjacent vertebral structure.

[0026] Stabilization member **100** is provided in various embodiments made from any one of a number of materials and stiffness profiles along its length. Stabilization member **100** is provided in one embodiment with a profile that is completely rigid along its length so that minimal or no bending or flexing is provided in response to spinal loading and motion. Such rigid embodiments can be employed in conjunction with spinal fusion of one or more of the vertebrae with one or more spinal implants, bone growth material or other fusion construct, represented as construct C in FIG. **1**, between vertebrae of one or more levels of the spinal column. In another embodiment, stabilization member **100** is provided with one or more components that permit limited bending and/or flexing in response to loading and motion from the spinal column for dynamic stabilization procedures. In another embodiment, stabilization member **100** is substantially non-resistant to compression loading and collapsible so that little or no resistance is provided to movement of the vertebrae toward one another along the stabilization member, while the stabilization member provides tensile resistance in response to movement of vertebrae away from one another along the stabilization member **100**.

[0027] One or more components of stabilization member **100** can be provided with any suitable biocompatible material. Examples of suitable material include titanium and titanium alloys, stainless steel, and other suitable metals and metal alloys; polymers such as polyetheretherketone (PEEK); composites such as carbon-PEEK or titanium-PEEK composites; and any combination of these materials. The end portions of stabilization member **100** are configured to be anchored to bony structure along the spinal column, such as the pedicles, spinous processes, or other posterior elements. Anchoring of stabilization member **100** along the anterior portions of the vertebral bodies is also contemplated, including along the lateral, antero-lateral, and anterior sides of the anterior vertebral body structure.

[0028] Illustrative embodiments disclosed herein include spinal stabilization members with end portions in axially aligned relationships. Other embodiments contemplate axially offset relationships, and stabilization members that define one or more curved or arced segments along its longitudinal axis. The stabilization members are engaged to respective ones of first and second vertebrae with an anchor member, while the adjustment mechanism adjustably connects end portions of the stabilization member to one another between the anchor members. The adjustment mechanism permits the length of the stabilization member between the anchor members to be readily increased or decreased either by manual manipulation of the adjustment mechanism; minimally invasive access to the adjustment mechanism, by remote operation of the adjustment mechanism, or by preprogrammed operation or control of the adjustment mechanism.

[0029] Referring now to FIGS. **2-6**, an embodiment of stabilization member **100** will be described with reference to stabilization member **200**. Stabilization member **200** includes opposite end portions **202***a*, **202***b* extending along longitudinal axis **206** and an adjustment mechanism **204** axially connecting end portions **202***a*, **202***b*. End portions **202***a*, **202***b* are engageable to bony structure of the spinal column with respective ones of the anchor members **20** in the manner discussed above with respect to stabilization member **100**.

[0030] In the illustrated embodiment, anchor members **20** include a configuration having a proximal receiver portion **22** and a distal bone engaging portion **24**. Bone engaging portion **24** is shown with a threaded shaft in the form of a bone screw. Other embodiments contemplate other forms for bone engaging portions **24**, including hooks, staples, rivets, tacks, pins, intrabody devices, interbody devices, cross-link members, clamps, wires, tethers, cables, rods, plates, or any other bone engaging device. Receiver portion **22** can be fixed relative to bone engaging portion **22**, or can be movable to provide adjustment capabilities for the receiver portion when the bone engaging portion is engaged to the bony structure. Receiver portion **22** provides a structure for engagement with the respective end portion of stabilization member **200**. Some examples of suitable receiver portions include U-shaped saddles, top-loading saddles, side-loading saddles, bottom-loading saddles, and end-loading saddles. The saddles include a receptacle in which the end portion is positioned. Other examples of suitable receiver portions include posts about which the end portion is positioned, a clamp that clamps the end portion to a post or bone engaging portion of the anchor member, or any other suitable engagement structure. In one embodiment, anchor member **20** is a multi-axial screw, and in another embodiment anchor member **20** is a uni-axial screw. Engaging members **26** are provided that engage receiver portion **22** and secure the respective end portion **202***a*, **202***b* thereto. In the illustrated embodiment, engaging members **26** are set screws that include external thread profiles to engage internal threads of the respective receiver portion **22**. Other embodiments contemplate engaging members **26** in the form of nuts, caps, slide-locking members, washers, snap fit members, interference members, cerclages, clamps, and combinations thereof. In still other embodiments, the stabilization member is engaged to the anchor member without an engaging member.

[0031] End portions **202***a*, **202***b* are configured identically to one another in the illustrated embodiment, although embodiments with end portions having different configurations are also contemplated. End portions **202***a*, **202***b* include a tubular member **210** with a wall **212** extending around a central bore **214**. Central bore **214** is open at the inner end **216** of member **210**, and is enclosed at the opposite end by outer end wall **218**. Other embodiment contemplate that the outer end is open. Wall **212** includes an inner surface **220** extending around bore **214** that defines an internal thread profile along bore **214**.

[0032] Adjustment mechanism **204** includes an adjustment member **230** extending along longitudinal axis **206** between end portions **202***a*, **202***b*. Adjustment member **230** includes opposite engaging ends **232***a*, **232***b* that are received in bore **214** of the end portions **202***a*, **202***b*, respectively. Engaging ends **232***a*, **232***b* each include an external thread profile that threadingly engages the internal thread profile along bore **214** of the respective end portion **202***a*, **202***b*.

[0033] Adjustment member **230** includes an intermediate portion **234** between engaging ends **232***a*, **232***b*. Intermediate portion **234** extends through a housing **240** of adjustment mechanism **204**. Housing **240** includes an outer sleeve portion **242** defining a longitudinal bore **246** through which intermediate portion **234** extends, and a mounting portion **244** adjacent to sleeve portion **242**. Mounting portion **244** includes a chamber **248** housing a drive member **250** adjacent to and in engagement with intermediate portion **234** of adjustment member **230**. Drive member **250** is operable to rotate adjustment member **230** about longitudinal axis **206** in sleeve portion **242**. As adjustment member **230** rotates about longitudinal axis **206**, end portions **202***a*, **202***b* are maintained in rotational position about longitudinal axis **206** by engagement with the respective anchor member **20**. The axial rotation of adjustment member **230** rotates threaded engaging ends **232***a*, **232***b* along the thread profile of end portions **202***a*, **202***b*, causing the end portions **202***a*, **202***b* to move toward or away from one another along longitudinal axis **206** and the respective engaging end **232***a*, **232***b*, depending on the direction of axial rotation of adjustment member **230**.

[0034] In one embodiment shown in FIG. **6**, drive member **250** includes an outer profile **254** that engages a drive structure **238** around the periphery of adjustment member **230**. Rotation of drive member about its central axis **252** causes the outer profile **254** to push against the respective adjacent portion of drive structure **238**, resulting in adjustment member **230** rotating about longitudinal axis **206**. In the illustrated embodiment, drive structure **238** includes a series of spirally oriented teeth spaced circumferentially around intermediate portion **234** so that drive member **250** remains engaged thereto by a thread defining outer profile **254** of drive member **250**. The engagement between drive member **250** and drive structure **238** prevents or resists axial rotation of adjustment member **230** unless it is actively rotated by rotation of drive member **250**.

[0035] In one embodiment, drive member **250** and adjustment member **230** engage one another in a worm-gear type arrangement. In this type of arrangement, drive structure **238** provides a worm gear type of configuration in engagement with teeth or threads about the outer profile **254** of drive member **250**. The positioning of drive member **250** and adjustment member **230** relative to one another in this arrangement is infinitely variable to provide infinite number of lengths for stabilization member **200** along longitudinal axis **206**.

[0036] Drive member **250** extends along and is rotated about its central axis **252**, which is transversely oriented to longitudinal axis **206**. Rotation of drive member **250** about axis **252**, as indicated by arrow **253**, causes rotation of adjustment member **230** about longitudinal axis **206**, as indicated by arrow **231**, which in turn lengthens or shortens stabilization member **200** along longitudinal axis **206** by displacing end portions **202***a*, **202***b* away or toward one another, as indicated by arrows **203**. Accordingly, axial expansion and retraction of the length of stabilization member **200** is accomplished by manipulating drive member **250** along an axis that is transverse to longitudinal axis **206**. In one embodiment central axis **252** is orthogonally oriented to longitudinal axis **206**. The transverse and orthogonal orientations can minimize the intrusiveness into adjacent tissue when accessing stabilization member **200** to adjust the length thereof in subsequent procedures.

[0037] In another embodiment, a ratcheting type arrangement is provided such as shown in FIG. **6**A. In this alternate embodiment, the stabilization member **200'** is identical to stabilization member **200** unless otherwise noted. Stabilization member **200'** includes an adjustment mechanism **204'** with an adjustment member **230'** having drive structure **238'** about its periphery. Drive structure **238'** is in the form of ratchet teeth in the illustrated embodiment. Adjustment mechanism **204'** also includes a drive member **250'** that is oriented to extend along adjustment member **230'** in housing **240'**. Drive member **250'** provides a pinion that includes teeth extending around the periphery thereof that engage drive structure **238'** in interdigitating relation. Rotation of drive member **250'** about its central axis **252'**, as indicate by arrow **253'**, causes adjustment member **230'** to rotate axially about longitudinal axis **206** and lengthen or shorten stabilization member **200'** depending on the direction of rotation. A locking arrangement can be provided to maintain the relative rotational positions of adjustment member **230'** and drive member **250'**. In this embodiment, central axis **252'** is oriented parallel to longitudinal axis **206**.

[0038] Various arrangements for engaging drive member **250**, **250'** are contemplated. The drive members **250**, **250'** can be provided with a head recessed to receive and engage a driver instrument, or with an external configuration around which the driver instrument is positioned. In still other embodiments, driver members **250**, **250'** are rotated via magnetic or electric signals or forces from a source external to the patient or implanted with the stabilization member.

[0039] One example of using stabilization members **200**, **200'** in a spinal stabilization procedure will be discussed. In FIG. **2** stabilization member **200** includes a length L**1** between anchor members **20**, and end portions **202***a*, **202***b* are engaged to anchor members **20** with engaging members **26**. During the surgical procedure, adjustment mechanism **204** is manipulated to move end portions **202***a*, **202***b* away from one another, increasing length L**1** to length L**2** as shown in FIG. **3**. When end portions **202***a*, **202***b* are engaged to anchor members **20**, a distraction force is applied to the vertebrae through anchor members **20** by the elongated, expanded stabilization member **20**.

[0040] In another example of using stabilization members **200**, **200'** in a spinal stabilization procedure, stabilization member **200** includes a length L**1** between anchor members **20**, and end portions **202***a*, **202***b* are engaged to anchor members **20** with engaging members **26**. Sometime after the surgical procedure, the length of stabilization member **200** along longitudinal axis requires post-operative adjustment to accommodate growth of the patient, to provide a different stabilization effect, or for some other reason. Adjustment mechanism **204** is accessed in a second procedure and manipulated to move end portions **202***a*, **202***b* away from one another, increasing length L**1** to length L**2** as shown in FIG. **3**. Adjustments of the length of stabilization member **200** can further be accomplished from the length L**2** in FIG. **3** to a maximum length where the end portions **202***a*, **202***b* are separated by a maximum distance to the ends of adjustment member **230**, such as shown in FIG. **4**, to a minimum length where end portions **202***a*, **202***b* are positioned adjacent to sleeve portion **242**, such as shown in FIG. **2**. The various length adjustments can be conducted in the same surgical procedure or after lapse of a period of time in one or more post-operative follow up procedures where revision surgery is deemed advisable.

[0041] In another example of using stabilization member **200** in a spinal stabilization procedure, stabilization member **200** includes a length L**1** between anchor members **20**. Stabilization member **200** is positioned between anchor members **20**. During the surgical procedure, either before or after placement into the patient, adjustment mechanism **204** is manipulated to move end portions **202***a*, **202***b* away from one another, increasing length L**1** to length L**2** as shown in FIG. **3**. End portions **202***a*, **202***b* are then engaged to anchor members **20** with engaging members **26** to provide an optimal length for stabilization member **200** between anchor members **20**. Adjustment mechanism **204** can then be further manipulated to move end portions **202***a*, **202***b* away from one another to apply a distraction force between the vertebrae through anchor members **20**, or end portions **202***a*, **202***b* are moved toward one another to apply a compression force between the vertebrae through anchor members **20**. Alternatively or additionally, post-operative length adjustment is possible as deemed advisable.

[0042] Referring now to FIG. **7**, an embodiment of stabilization member **100** will be described with reference to stabilization member **500**. Stabilization member **500** includes opposite end portions **502***a*, **502***b* extending along longitudinal axis **506** and an adjustment mechanism **504** axially connecting end portions **502***a*, **502***b*. End portions **502***a*, **502***b* are engageable to bony structure of the spinal column with respective ones of the anchor members **20** in the manner discussed above with respect to stabilization member **100**.

[0043] End portions **502***a*, **502***b* are configured identically to one another in the illustrated embodiment, although embodiments with end portions having different configurations are also contemplated. End portions **502***a*, **502***b* can be configured with a two piece construction with a rack portion in a tubular end portion, like that discussed above for end portions **202***a*, **202***b*, or as a single, unitary piece. Adjustment mechanism **504** includes a pair of adjustment members **530***a*, **530***b* extending along longitudinal axis **506** between end portions **502***a*, **502***b*. Adjustment members **230** can include opposite engaging ends that are received in a bore of the respective end portions **502***a*, **502***b*, respectively. Alternatively, adjustment members **230***a*, **230***b* can be formed as a integral, single unit with the respective end portion **502***a*, **502***b*.

[0044] Adjustment members **530***a*, **530***b* extend through a housing **540** of adjustment mechanism **504**. Housing **540** is shown in phantom lines for clarity, and can include an outer sleeve portion defining one or more longitudinal bores through which adjustment members **230***a*, **230***b* extend. Housing **540** houses a drive member **550** adjacent to and in engagement with adjustment members **530***a*, **530***b*. Drive member **550** includes a wheel like arrangement with outer teeth that interdigitate with teeth **534***a*, **534***b* along adjustment members **530***a*, **530***b*, respectively.

[0045] Drive member **550** is operable to rotate about a rotation axis **552** that is orthogonal to longitudinal axis **506** to axially translation adjustment members **530***a*, **530***b* along longitudinal axis **506** to increases or decrease the length of stabilization member **500**, depending on the direction of axial rotation of adjustment member **230**. End portions **502***a*, **502***b* are offset from and extend generally parallel to longitudinal axis **506**. In another embodiment shown in FIG. **8**, a stabilization member **500'** is shown that is generally the same as stabilization member **500**. However, stabilization member **500'** includes intermediate bends **504***a*, **504***b* that connect adjustment members **530***a*, **530***b* with the respective end portions **502***a*, **502***b* so that end portions **502***a*, **502***b* are aligned with and extend along longitudinal axis **506**. In another embodiment, only one bend is provided of sufficient length so that end portions **502***a*, **502***b* are aligned along a common longitudinal axis that is offset from longitudinal axis **506**.

[0046] Referring now to FIGS. **9-11**, there is shown another embodiment of stabilization member **100** in the form of stabilization member **300**. Stabilization member **300** includes an elongated body extending along longitudinal axis **306** between a first end portion **302***a* and a second end portion **302***b*. End portions **302***a*, **302***b* overlap one another along longitudinal axis **306** in telescoping fashion. End portions **302***a*, **302***b* each include an interior bore **308** and an adjustment mechanism **304** extends from at least one of the end portions, such as end portion **302***a* in the illustrated embodiment. End portions **302***a*, **302***b* are movable toward and away from one another along longitudinal axis **306** to allow the length of stabilization member **300** to be adjusted. End portions **302***a*, **302***b* are engaged to bony structure of the spinal column with anchor members, such as anchor members **20** discussed above.

[0047] Adjustment mechanism **304** provides a port in communication with bores **308**. Adjustment mechanism **304** includes a valve or other sealing structure in one embodiment. In another embodiment, no sealing structure is provided. A delivery device **350** includes an introducer **352** engageable to adjustment mechanism **304** to deliver an adjustment member **310** to bore **308**. Adjustment member **310** is housed in chamber **354** in a flowable form, and delivered through introducer **352** by depressing a plunger **356** to force it from chamber **356**. Any other suitable material delivery or dispensing system is contemplated for delivery device **350**.

[0048] Adjustment member **310**, as shown in FIG. **11**, is delivered to bore **308** to expand the length of stabilization member **300** and move end portions **302***a*, **302***b* away from one another, as shown in FIG. **10**. Additional material can be delivered to bore **308** in the same or in subsequent procedures to further adjust the length of stabilization member **300**. In one embodiment, adjustment member **310** is removable to allow end portions **302***a*, **302***b* to move toward one another and decrease the length of stabilization member.

[0049] Adjustment member **310** can be any suitable biomaterial deliverable to bore **308**. Examples include material that readily flows or is made flowable. Examples further include material that hardens after delivery to provide a rigid stabilization member **300**. Still other embodiments contemplate material that remains in fluid form after delivery. Specific examples of suitable material for adjustment member **310** include saline, PMMA bone cement, hydrogels, and polymers, to name a few.

[0050] Referring now to FIG. **12**, there is shown another embodiment of stabilization member **100** in the form of stabilization member **400**. Stabilization member **400** includes an elongated body extending along longitudinal axis **406** between a first end portion **402***a* and a second end portion **402***b*. End portions **402***a*, **402***b* overlap one another along longitudinal axis **406** in telescoping fashion. An adjustment mechanism **404** is situated between end portions **402***a*, **402***b*, and includes an electrical mechanism that allows the length of stabilization member **400** to be adjusted along longitudinal axis **406** by electrical means. Adjustment mechanism **404** includes a servo motor in one embodiment. In another embodiment, adjustment mechanism **404** includes a piezoelectric motor.

[0051] Adjustment mechanism **404** employs electro or piezo action that articulates one of the end portions **402***a*, **402***b* to increase the overall length of stabilization member **400**. In one embodiment, end portion **402***a* is threadingly engaged to end portion **402***b*, and rotation of one of the end portions **402***a*, **402***b* threadingly and axially displaces the end portions **402***a*, **402***b* relative to one another. In another embodiment, one or both of the end portions **402***a*, **402***b* is axially translated relative to the other without rotation to adjust the length of stabilization member **400**. End portions **402***a*, **402***b* are engaged to bony structure of the spinal column with anchor members, such as anchor members **20** discussed above. End portions **402***a*, **402***b* are movable toward and away from one another along longitudinal axis **406** to allow the length of stabilization member **400** to be adjusted either prior to engagement to the anchors to provide optimal fit, or after engagement to the anchors to provide distraction, compression, or revision of length.

[0052] Stabilization members **300**, **400** may be employed in surgical procedures such as those discussed above with respect to stabilization members **100**, **200**, and **200'**. The surgical procedures can distract or compress vertebrae by adjusting the length of the stabilization member when engaged to anchor members, adjust the length of the stabilization member to provide an optimum fit between anchor members before engagement with the anchor member, and to provide post-operative adjustment in subsequent procedures to accommodate growth of the patient or other anatomical changes or conditions.

[0053] While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered illustrative and not restrictive in character, it being understood that only selected embodiments have been shown and described and that all changes, equivalents, and modifications that come within the scope of the inventions described herein or defined by the following claims are desired to be protected.

What is claimed is:

1. A spinal stabilization system, comprising:

a stabilization member extending along a longitudinal axis between a first end portion and a second end portion, said stabilization member including an adjustment mechanism connecting said first and second end portions along said longitudinal axis; and

first and second anchor members each including a bone engaging portion to engage a bony structure and a receiving portion extending from said bone engaging portion, said receiving portions each being configured to receive a respective one of said first and second end portions, said first and second anchor members further each including an engaging member to fixedly secure said respective end portion to said receiving portion in said receptacle, wherein said adjustment mechanism is operable to move said first and second end portions toward and away from one another along said longitudinal axis to shorten and lengthen said stabilization member along said longitudinal axis with said end portions fixedly secured to said first and second anchor members.

2. The spinal stabilization system of claim **1**, wherein said first and second end portions of said stabilization member are cylindrical.

3. The spinal stabilization system of claim **1**, wherein said adjustment mechanism includes:

a sleeve portion including a bore extending along said longitudinal axis;

an adjustment member in said bore of said sleeve portion, said adjustment member including first and second engaging ends extending from opposite ends of said sleeve portion;

said first and second end portions each include an internal bore receiving respective ones of said first and second engaging ends therein; and

a drive member in contact with said adjustment member, said drive member being operable to rotate said adjustment member about said longitudinal axis to selectively move said first and second end portions toward and away from one another along said longitudinal axis.

4. The spinal stabilization system of claim **3**, wherein said first and second end portions each define an internal thread profile along said internal bore thereof and said first and second engaging ends of said adjustment member each include an external thread profile threadingly engaged to said internal thread profile of said respective one of said first and second end portions.

5. The spinal stabilization system of claim **4**, wherein said drive member includes teeth engaging a drive structure on said adjustment member.

6. The spinal stabilization system of claim **5**, wherein said drive member extends along and is rotatable about a central axis that is orthogonally oriented to said longitudinal axis.

7. The spinal stabilization system of claim **4**, wherein said drive member includes teeth engaging a ratchet tooth arrangement on said drive member.

8. The spinal stabilization system of claim **7**, wherein said drive member extends along and is rotatable about a central axis that is oriented parallel to said longitudinal axis.

9. The spinal stabilization system of claim **1**, wherein:

said first and second end portions each define an internal bore;

said first and second end portions overlap one another along said longitudinal axis in a telescoping arrangement;

said adjustment mechanism includes a port in at least one of said first and second end portions in communication with said internal bores; and

said adjustment mechanism includes an adjustment member introduced into said internal bores through said port, wherein prior to introduction of said adjustment member said stabilization member includes a first length along said longitudinal axis and after introduction of said adjustment member said stabilization member includes a second length along said longitudinal axis, said second length being greater than said first length.

10. The spinal stabilization system of claim **9**, wherein said adjustment member is comprised of a material that is flowable for introduction through said port.

11. The spinal stabilization system of claim **10**, wherein said material is hardenable to a second form after introduction into said internal bores.

12. The spinal stabilization system of claim **1**, wherein said adjustment mechanism includes an electric motor coupled to said first and second end portions.

13. The spinal stabilization system of claim **1**, wherein said adjustment mechanism includes:

a housing including a sleeve portion defining a bore extending along a longitudinal axis and a mounting portion adjacent to said sleeve portion;

an adjustment member extending through said bore between opposite first and second engaging ends, said first and second engaging ends engaged to respective ones of said first and second end portions; and

a drive member in said mounting portion engaged to said adjustment member, said drive member being operable to manipulate said adjustment member and move said first and second end portions toward and away from one another along said longitudinal axis.

14. The spinal stabilization system of claim **13**, wherein said drive member is operable to rotate said adjustment member about said longitudinal axis.

15. A method for spinal stabilization, comprising:

engaging a first anchor to a first vertebra;

engaging a second anchor to a second vertebra;

engaging first and second end portions of a stabilization member to respective ones of the first and second anchors, the stabilization member including an adjustment member extending between and engaged to the first and second end portions;

manipulating the adjustment mechanism to adjust a length of the stabilization member between the first and second end portions while the stabilization member is engaged to the first and second anchors;

maintaining the stabilization member in the adjusted length; and

manipulating the adjustment mechanism to adjust the adjusted length after maintaining the adjusted length for a period of time.

16. The method of claim **15**, where the first and second anchors are engaged to pedicles of the first and second vertebrae.

17. The method of claim **15**, wherein the adjustment member is rotated about a longitudinal axis of the stabilization member to adjust the length of the stabilization member.

18. The method of claim **17**, wherein the adjustment member is engaged to a drive member, and the drive member is rotated about its central axis to rotate the adjustment member.

19. The method of claim **18**, wherein the central axis of the drive member is orthogonally oriented to the longitudinal axis of the stabilization member.

20. The method of claim **18**, wherein the central axis of the drive member is oriented parallel to the longitudinal axis of the stabilization member.

21. The method of claim **15**, wherein the adjustment member is introduced through a port of the stabilization member into the first and second end portions to adjust the length of the stabilization member.

22. The method of claim **21**, wherein the adjustment member is comprised of a flowable material.

23. The method of claim **22**, wherein the flowable material hardens after the period of time.

24. The method of claim **18**, wherein the adjustment member includes an electric motor coupled to the first and second end portions of the stabilization member.

25. The method of claim **18**, further comprising accessing the stabilization member in a second surgical procedure before manipulating the adjustment mechanism to adjust the adjusted length.

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