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Donner

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(54) **SYSTEMS FOR AND METHODS OF FUSING A SACROILIAC JOINT**

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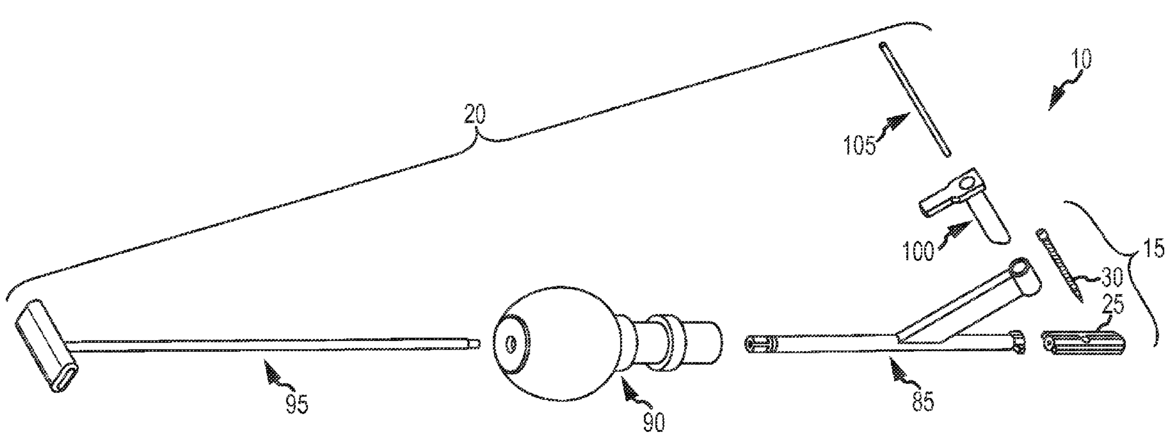
(57) **ABSTRACT**

One implementation of the present disclosure may take the form of a sacroiliac joint fusion system including a joint implant, an anchor element and a delivery tool. The join implant includes a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body. The anchor element includes a distal end and a proximal end and is configured to be received in the first bore. The delivery tool includes an implant arm and an anchor arm. The implant arm includes a proximal end and a distal end. The distal end of the implant arm is configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant. The anchor arm includes a proximal end and a distal end. The distal end of the anchor arm is configured to engage the proximal end of the anchor element. The anchor arm is operably coupled to the implant arm in an arrangement such that the longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element. The arrangement is fixed and nonadjustable.

131 Claims, 91 Drawing Sheets



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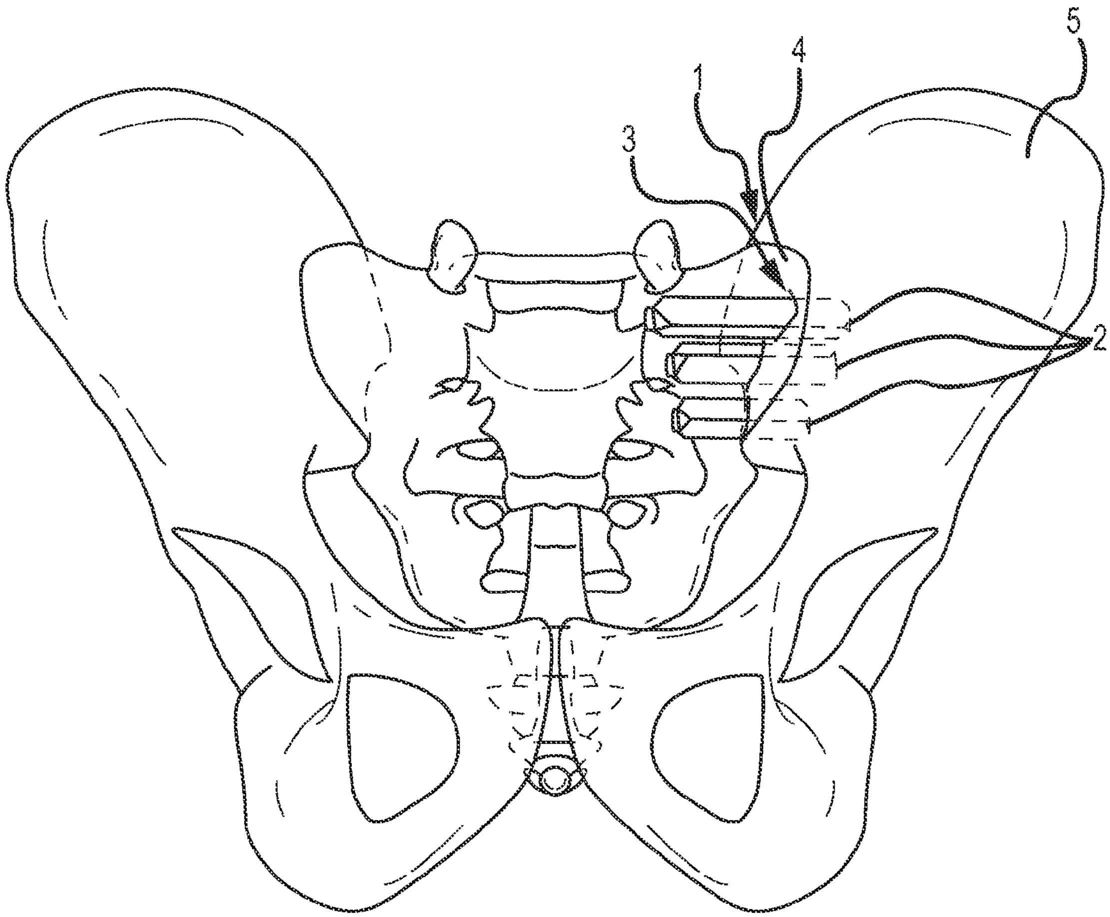


FIG.1
CONVENTIONAL ART

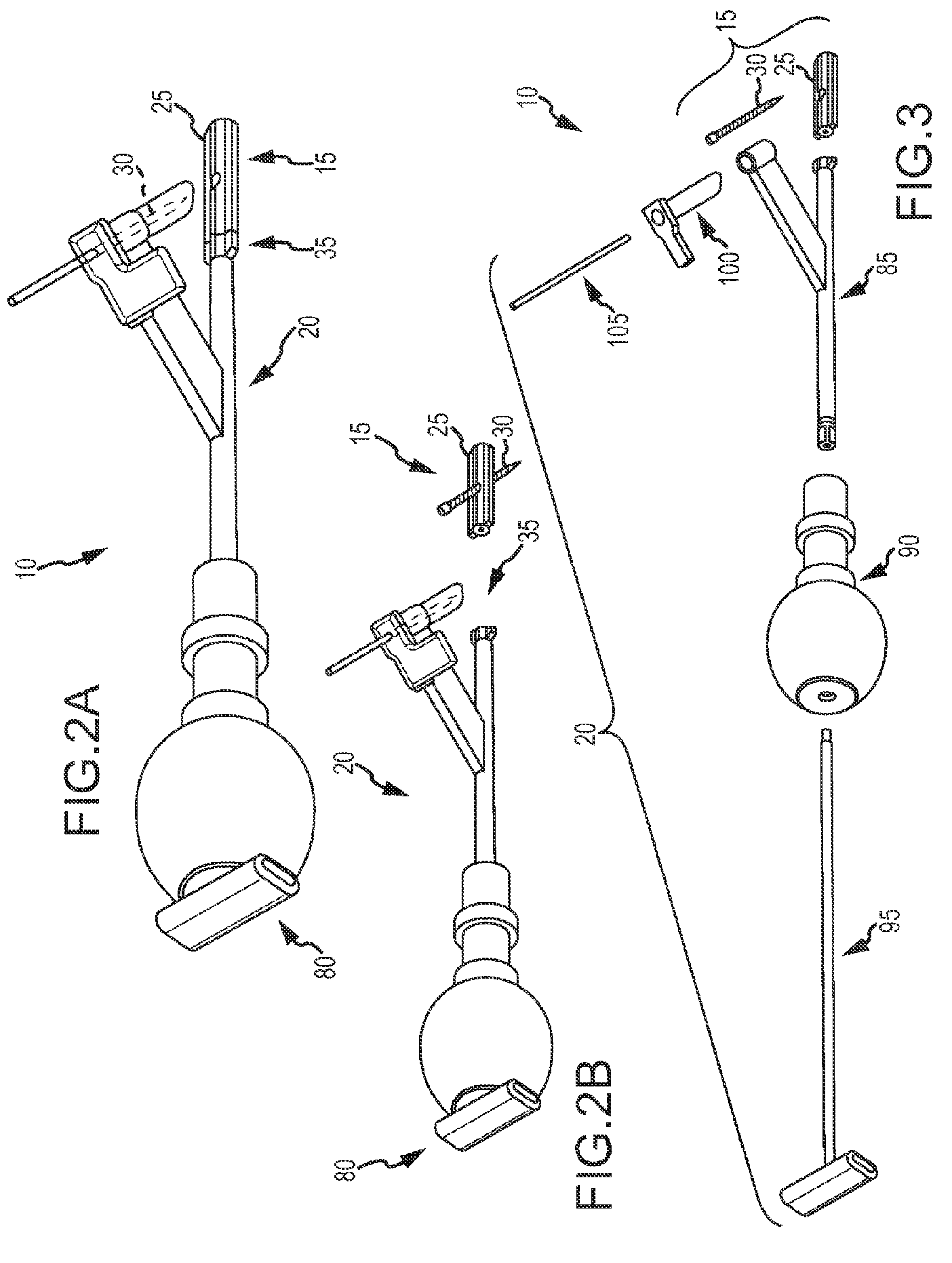


FIG.2A

FIG.2B

FIG.3

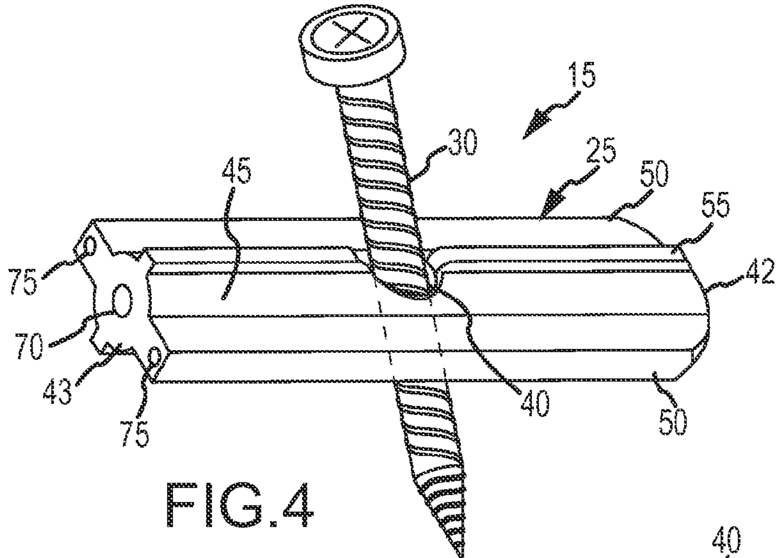


FIG.4

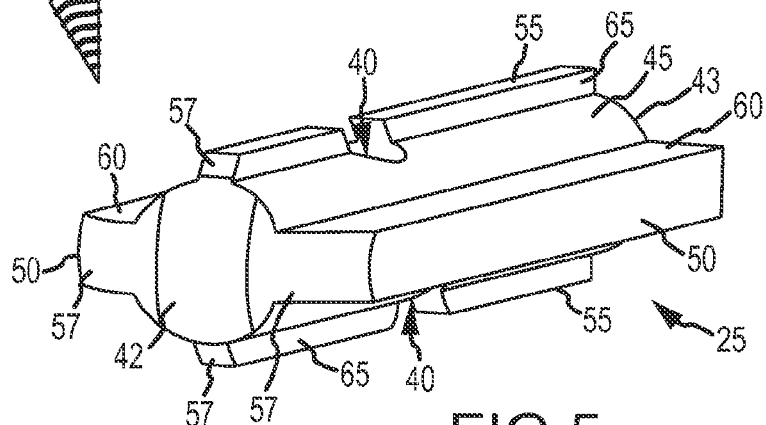


FIG.5

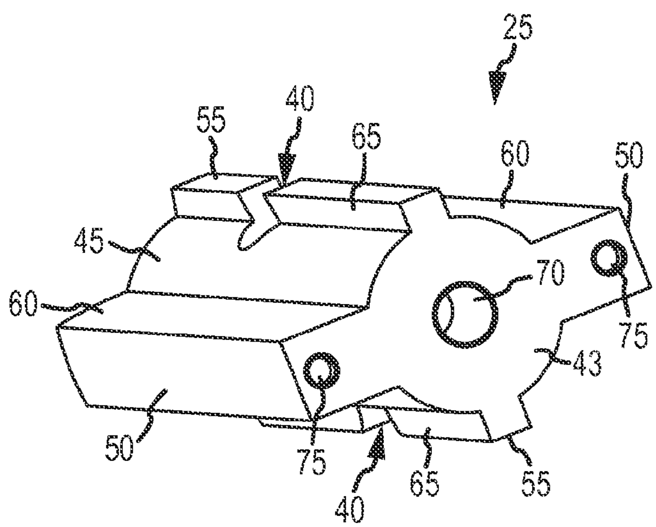


FIG.6

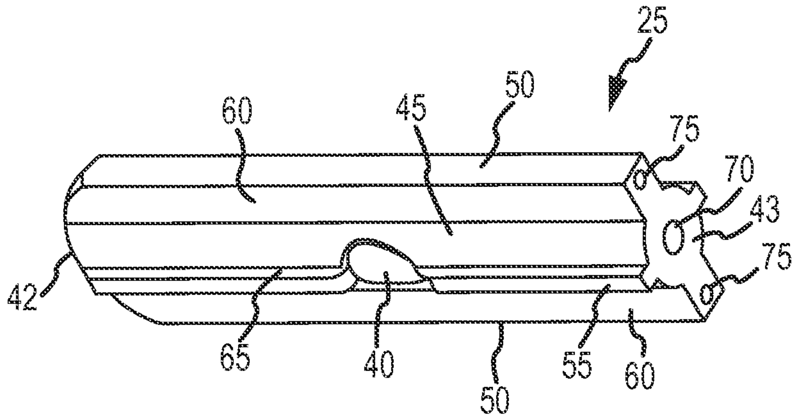


FIG.7

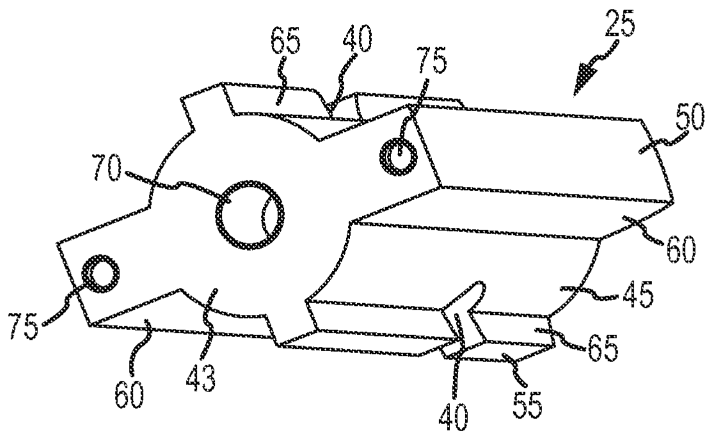


FIG.8

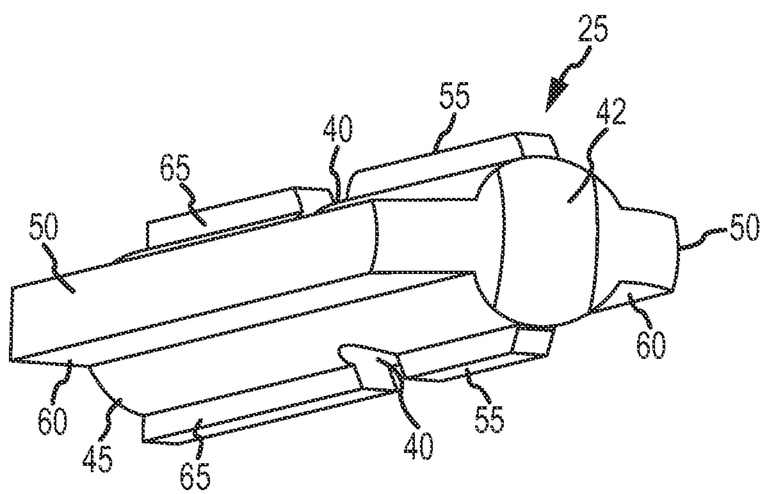


FIG.9

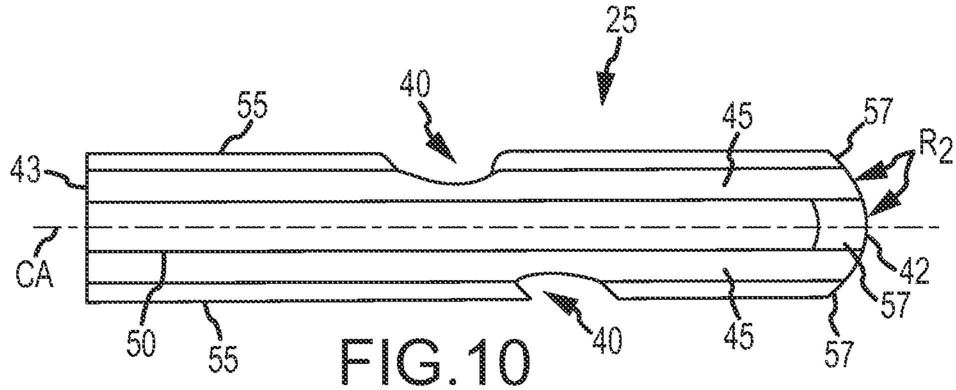


FIG.10

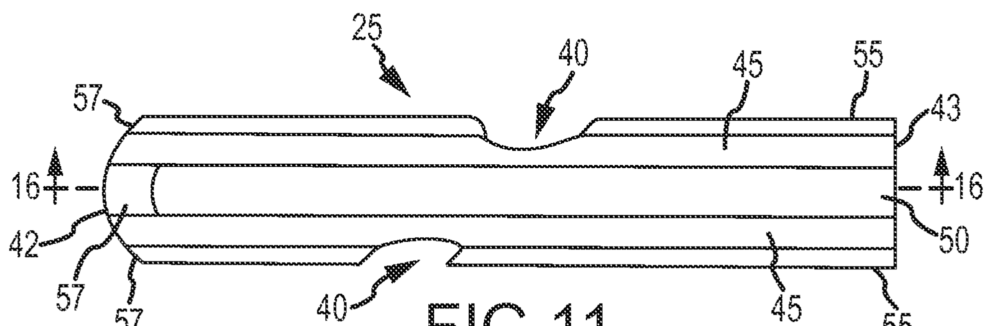


FIG.11

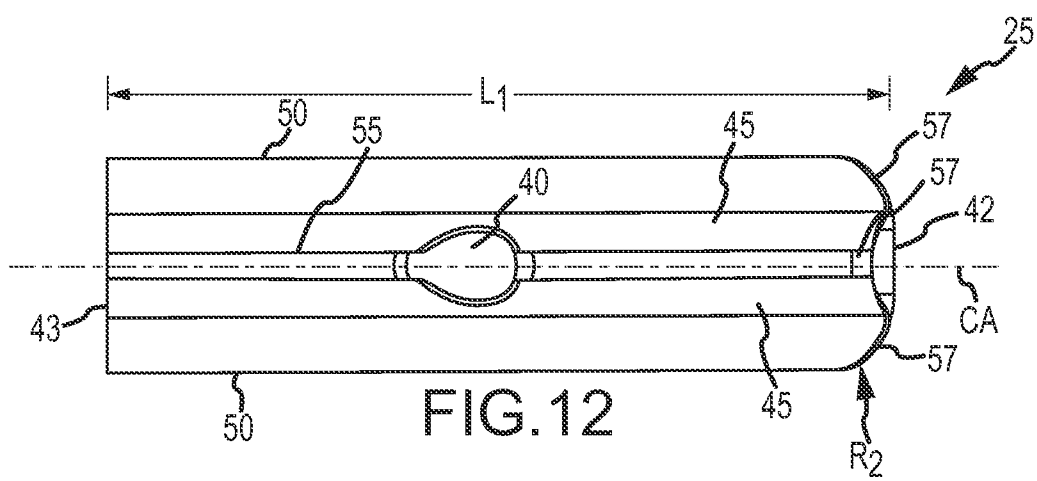


FIG.12

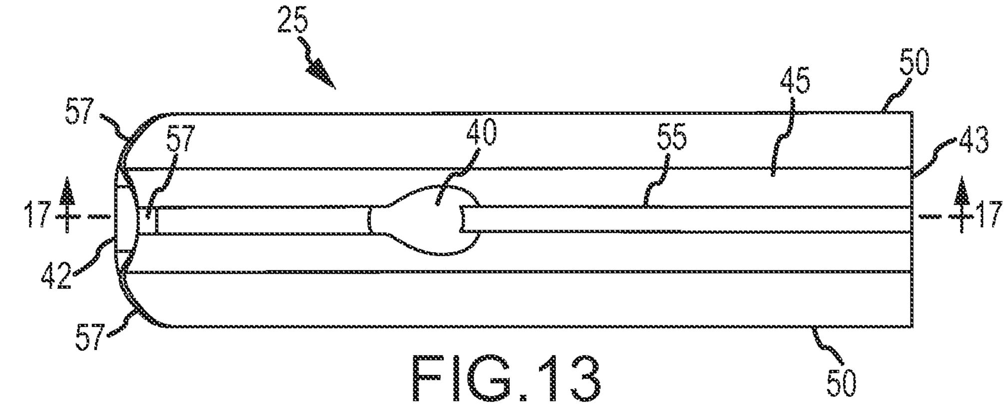


FIG.13

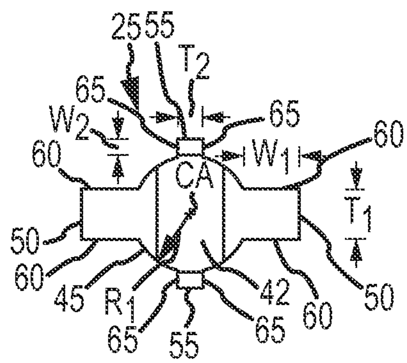


FIG.14

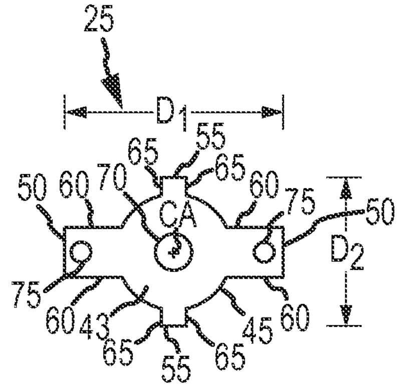


FIG.15

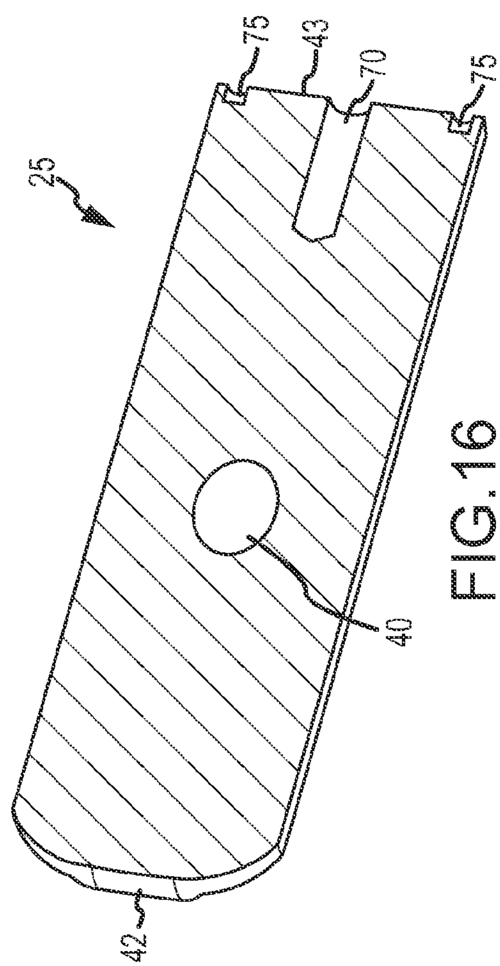


FIG.16

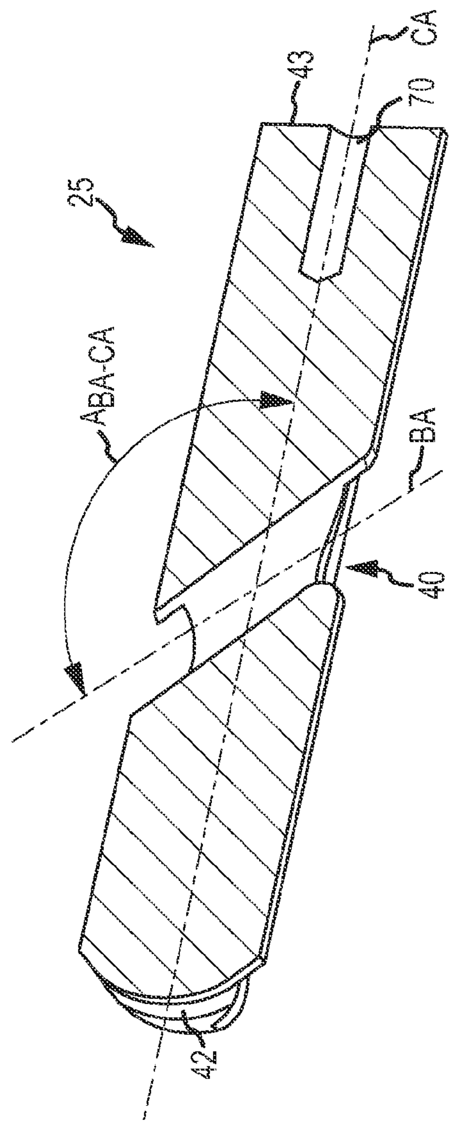


FIG.17

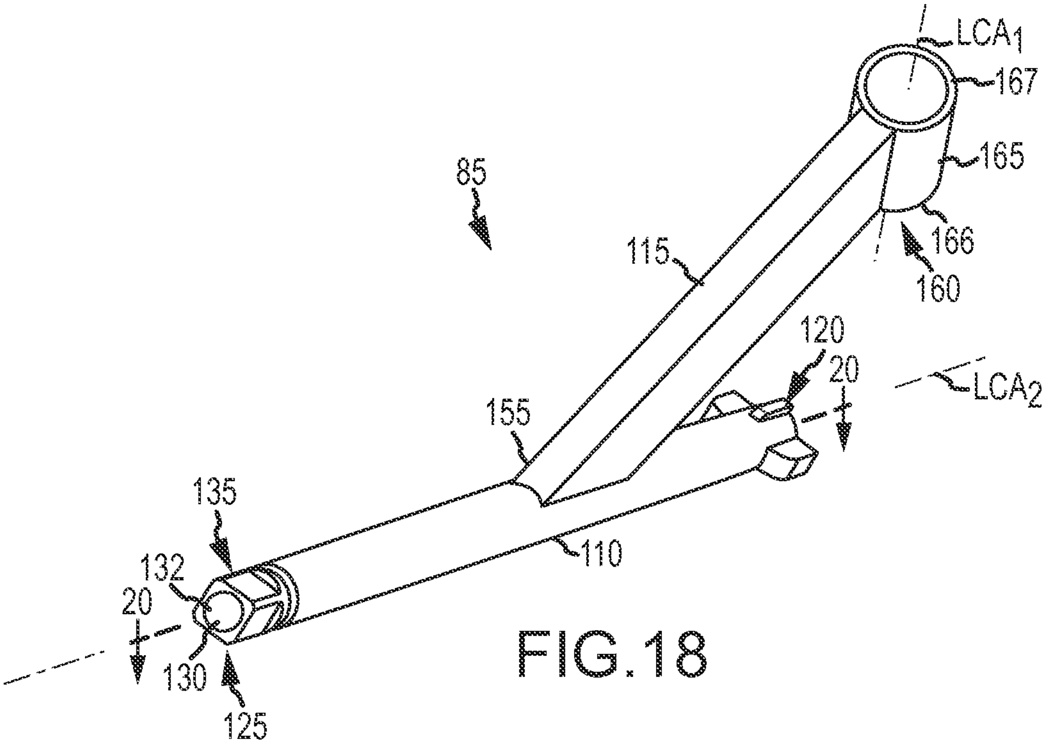

LCA1
167
165
85
166
115
160
120
20
LCA2
155
135
110
132
20
130
125

FIG.18

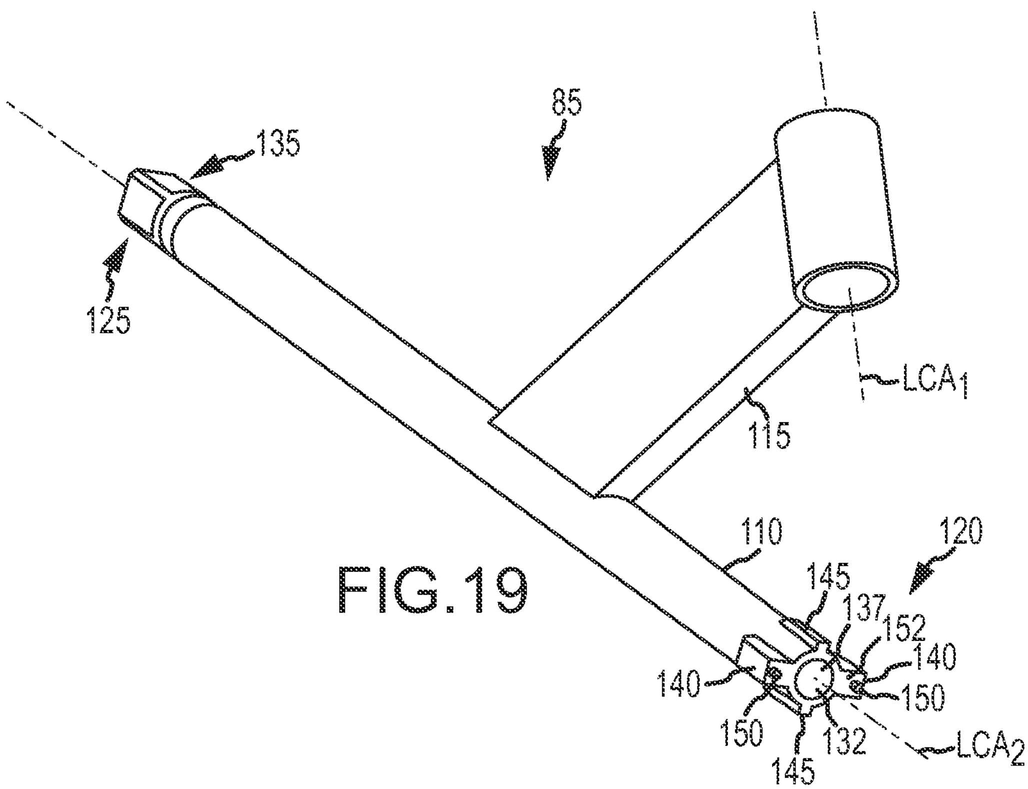

85
135
125
LCA1
115
110
120
145
137
152
140
140
150
150
132
145
LCA2

FIG.19

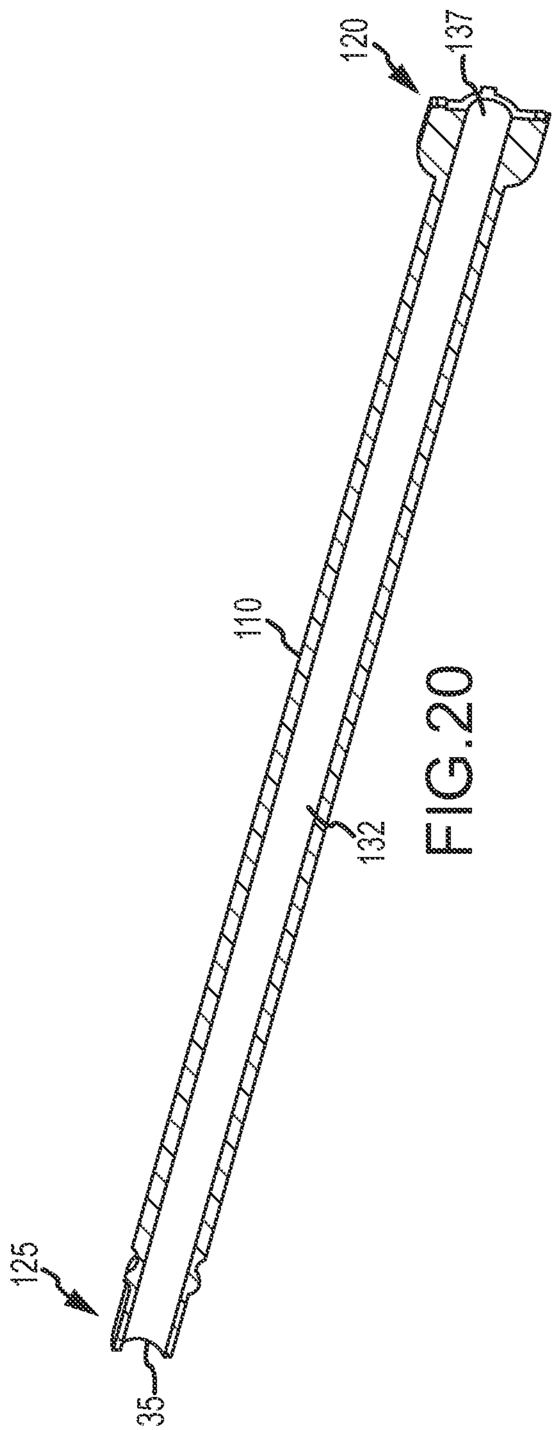


FIG.20

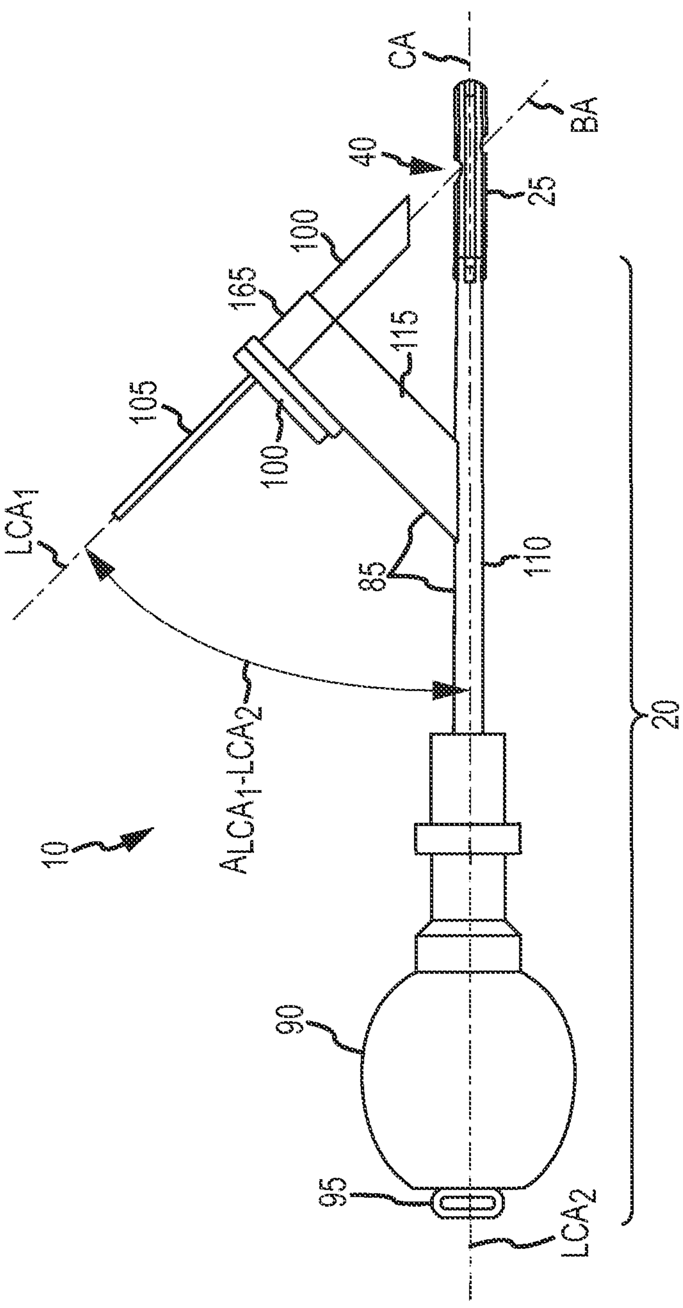

CA
BA
40
25
100
165
115
105
100
LCA_1
85
110
20
$A_{LCA_1\text{-}LCA_2}$
10
90
95
LCA_2

FIG.21A

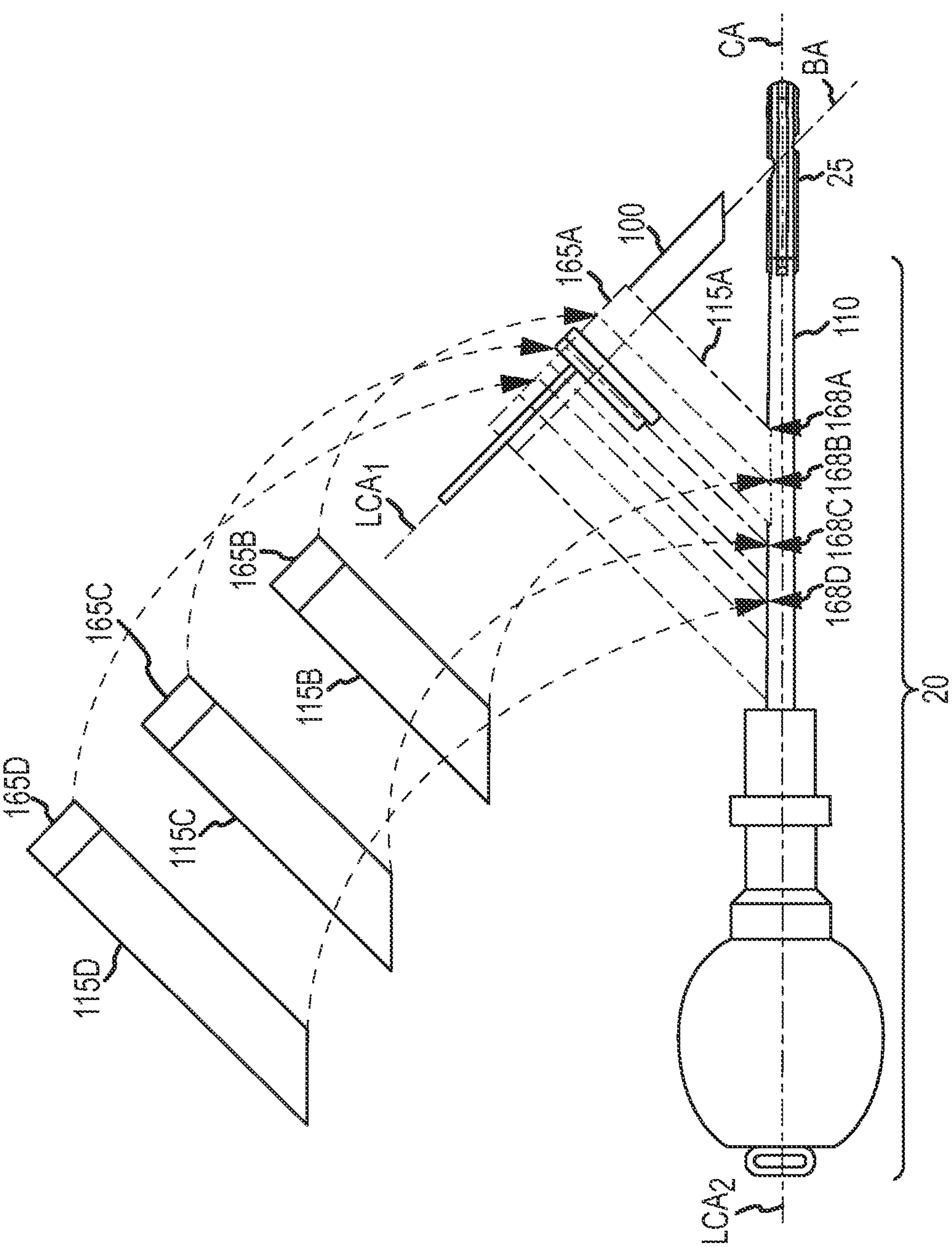

CA
BA
25
100
165A
115A
110
168A
168B
168C
168D
LCA1
165B
115B
165C
115C
165D
115D
20
LCA2

FIG.21B

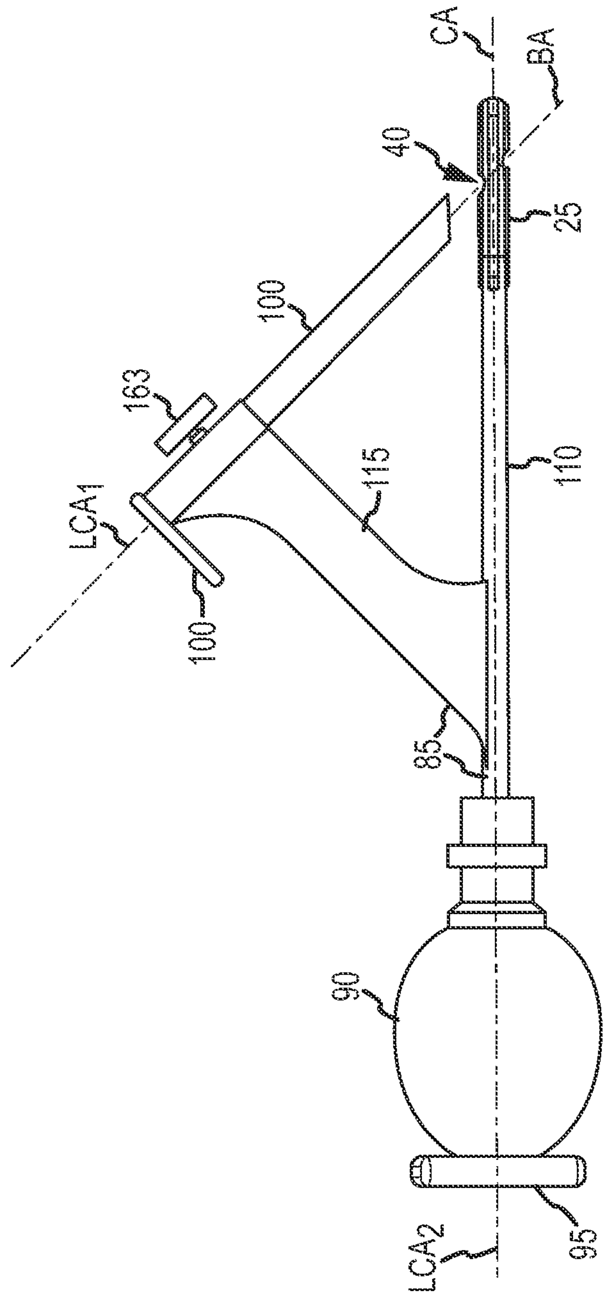


FIG.21C

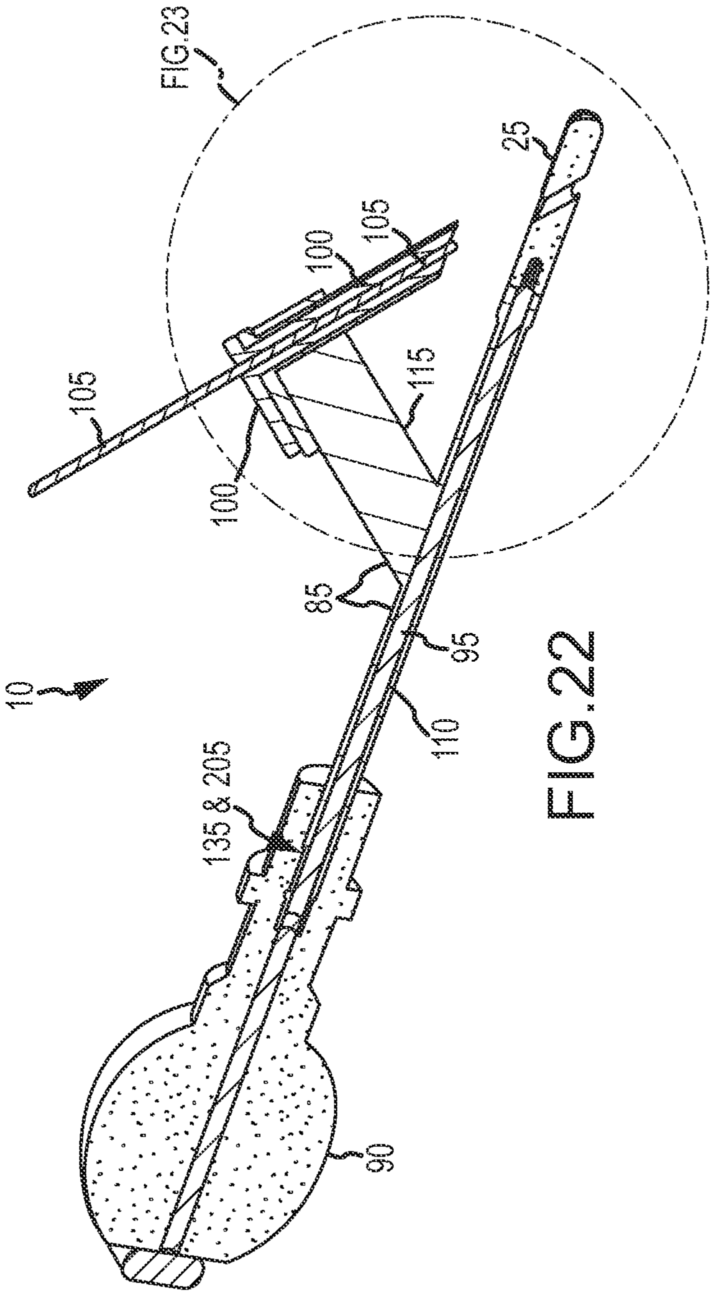


FIG.22

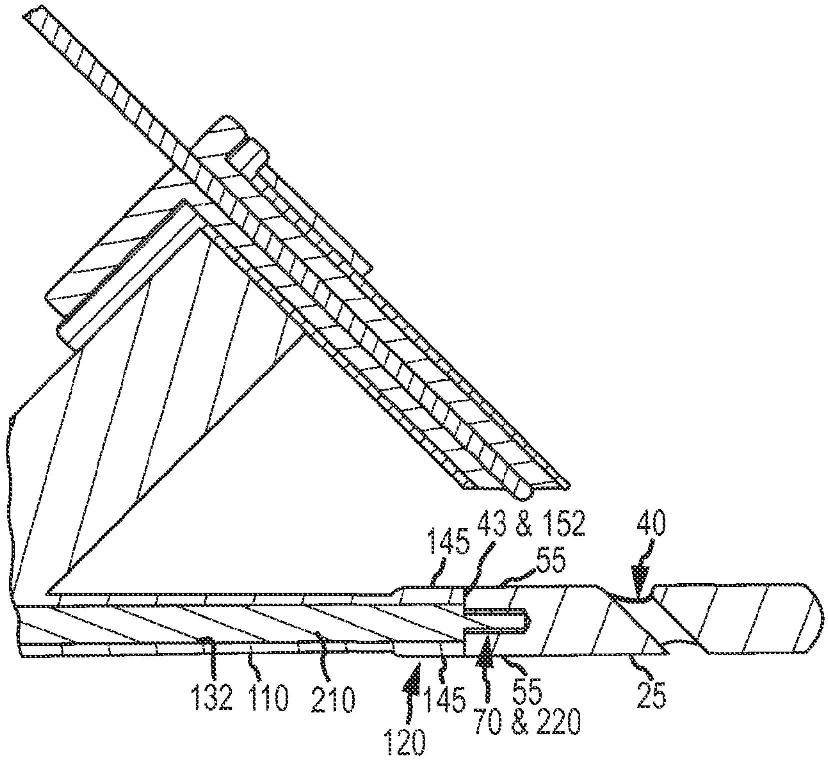
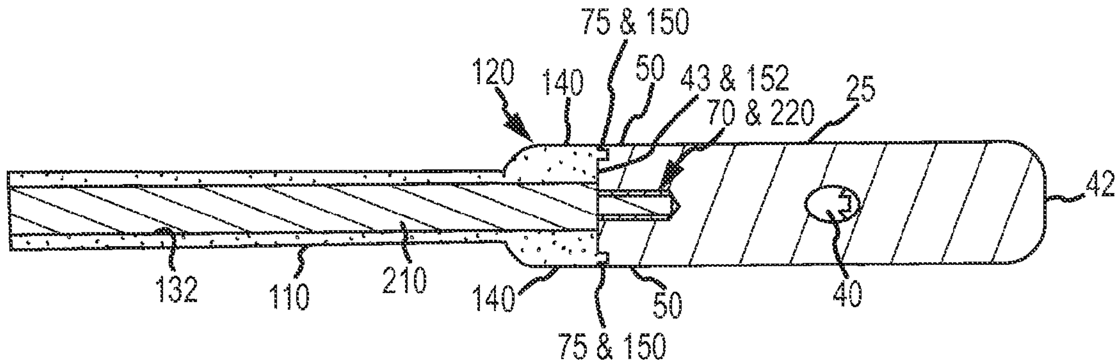

145
43 & 152
55
40
132
110
210
120
145
55
70 & 220
25

FIG.23


75 & 150
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140
50
43 & 152
70 & 220
25
42
132
110
210
140
75 & 150
50
40

FIG.24

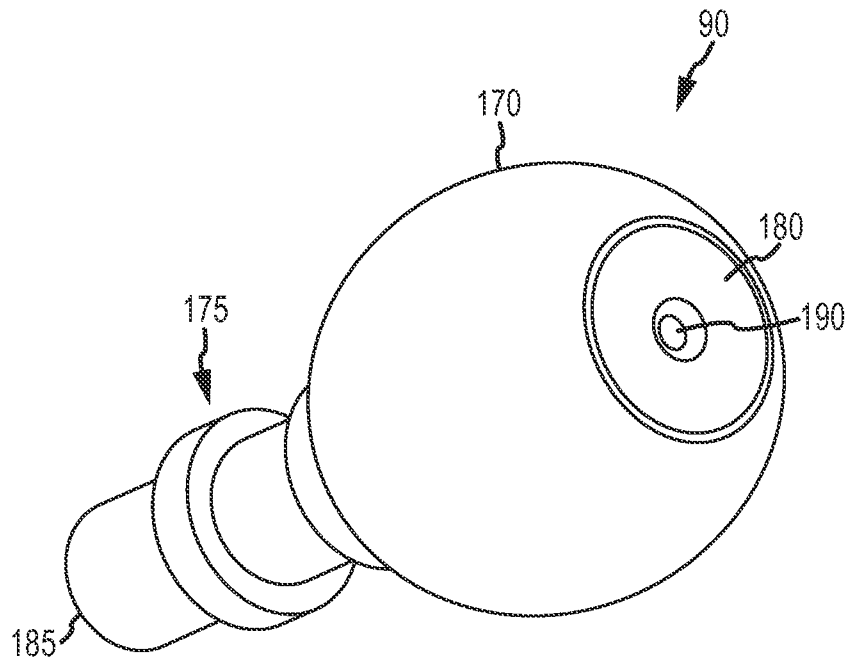


FIG.25

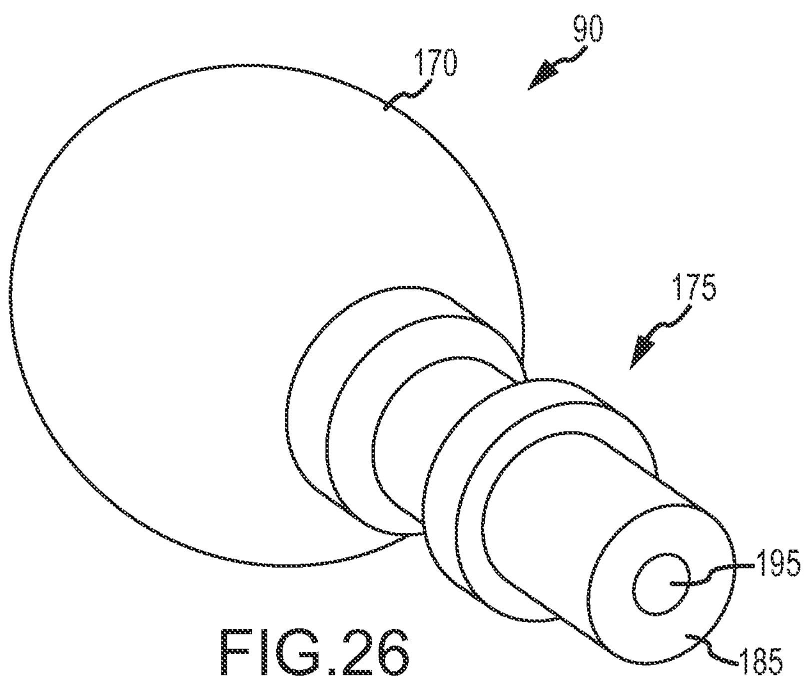


FIG.26

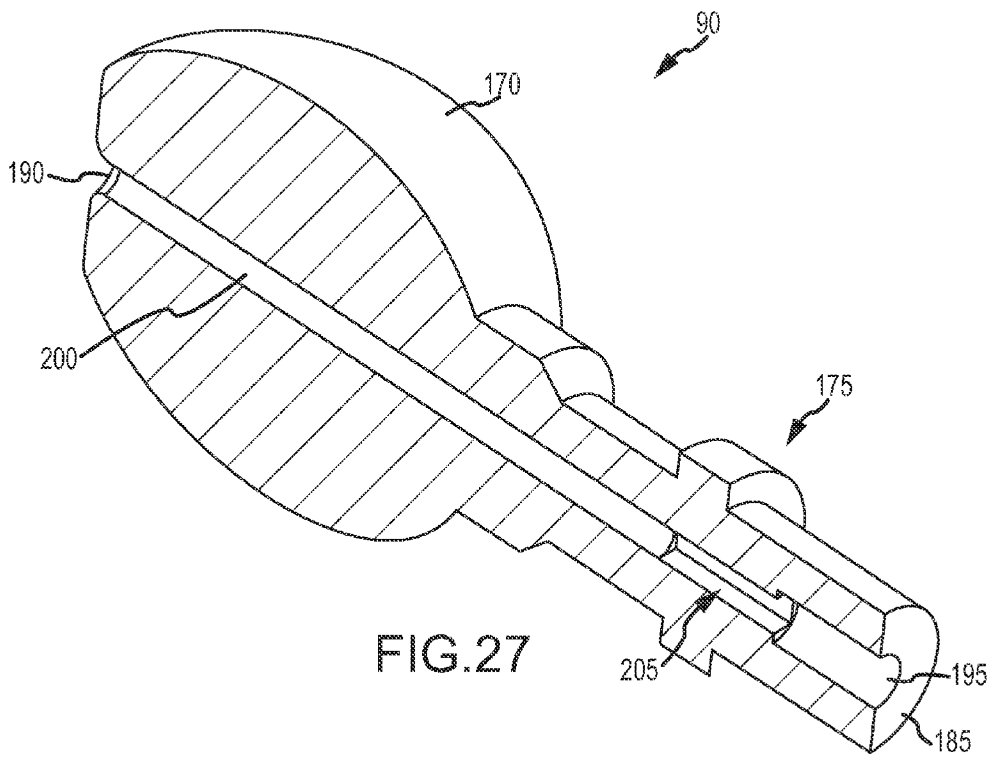


FIG.27

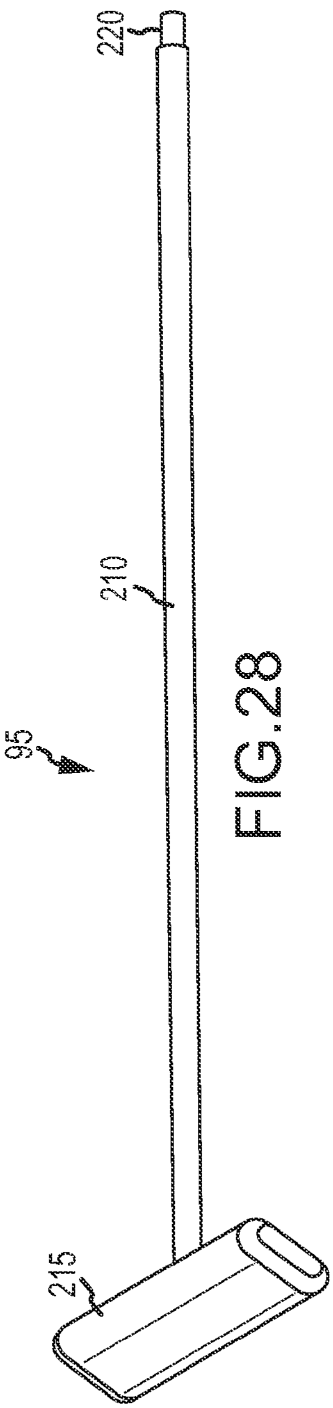


FIG.28

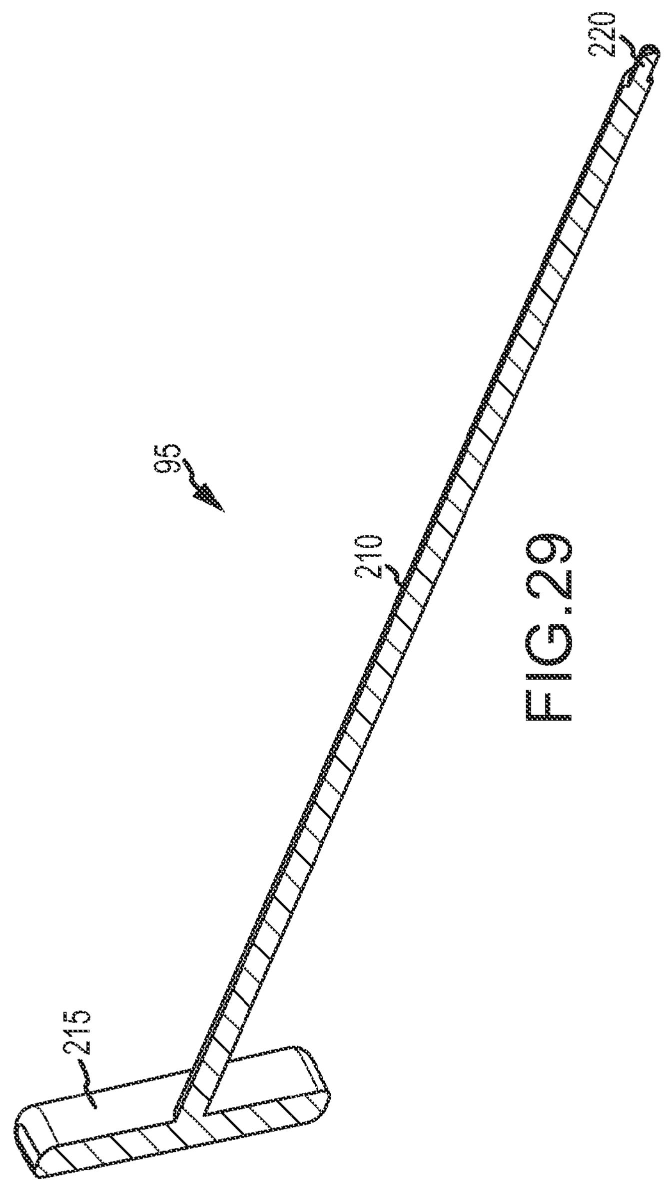


FIG.29

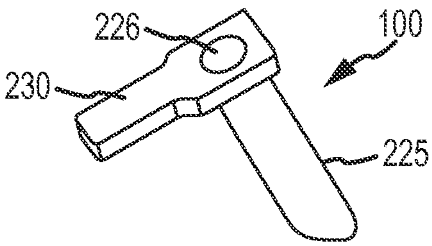


FIG.30A

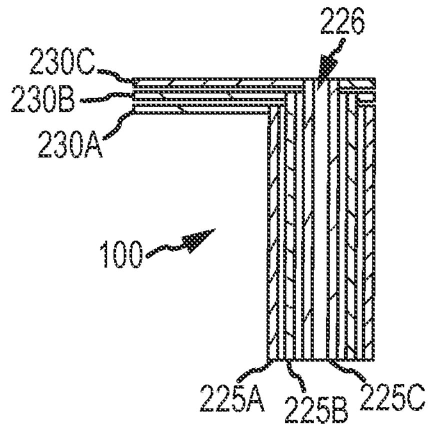


FIG.30B

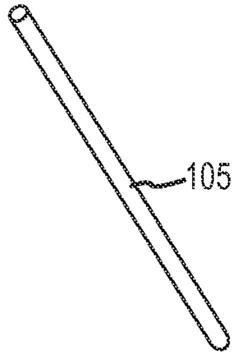
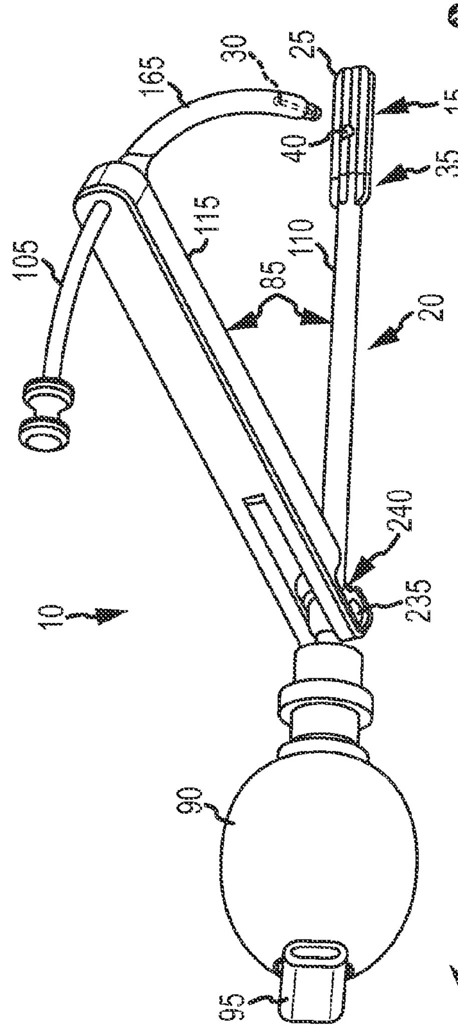


FIG.31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105
165
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25
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115
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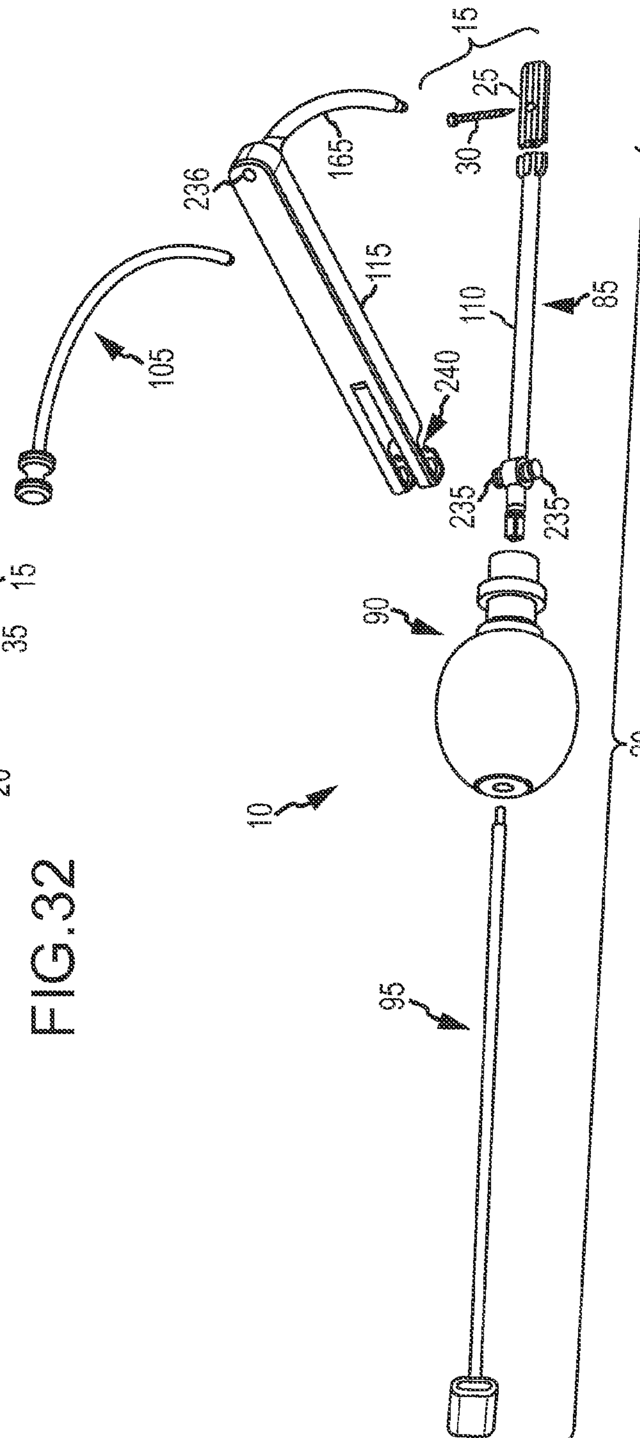
240
235
90
95
80

FIG.32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10
20
95

FIG.33

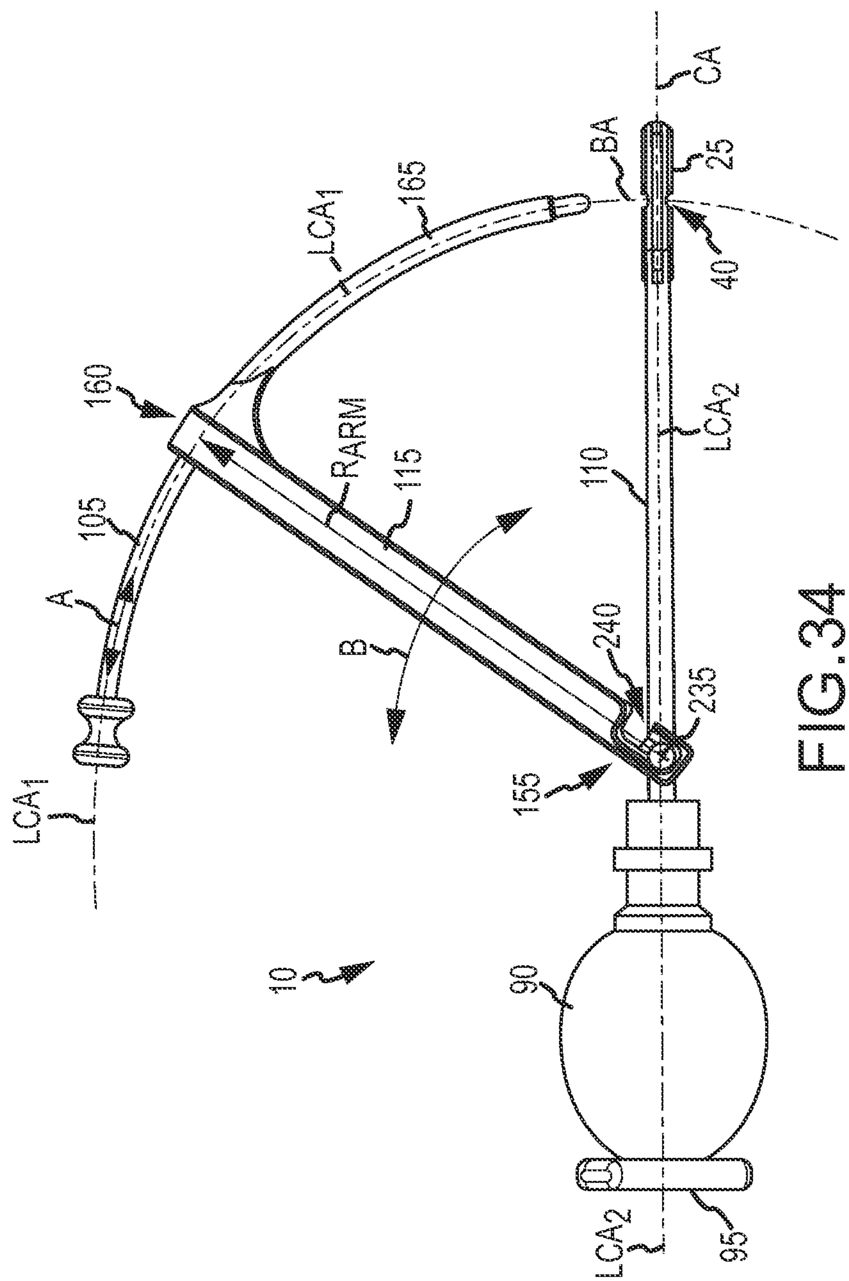

CA
BA
25
40
165
LCA1
160
RARM
115
LCA2
110
105
A
B
240
235
155
LCA1
10
90
LCA2
95

FIG. 34

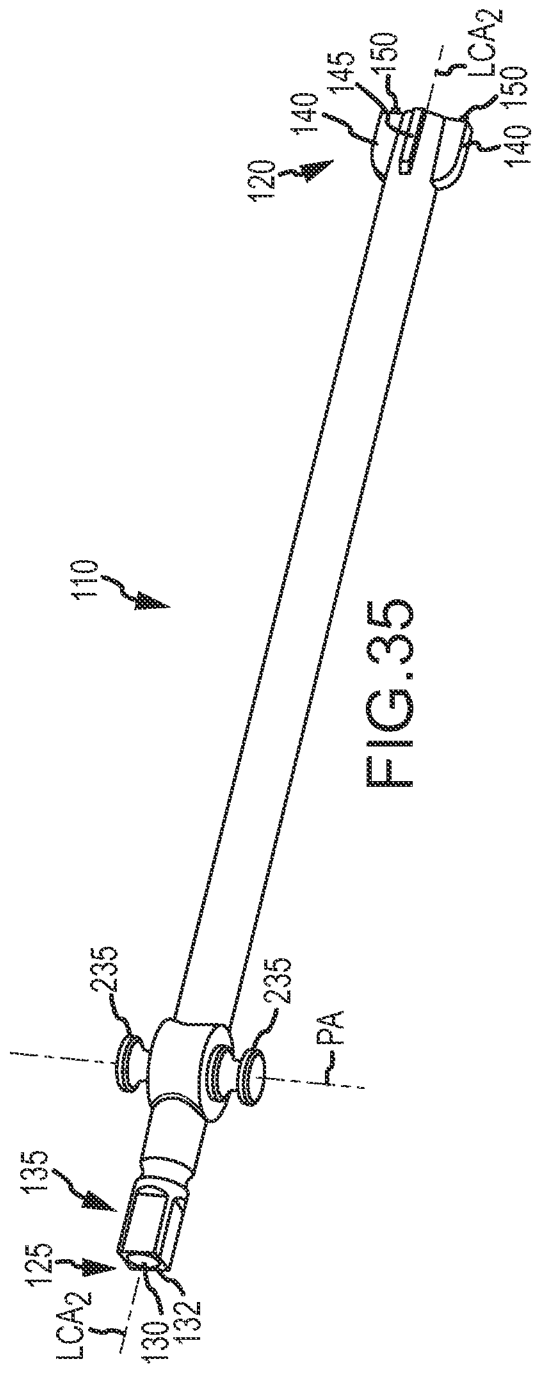


FIG.35

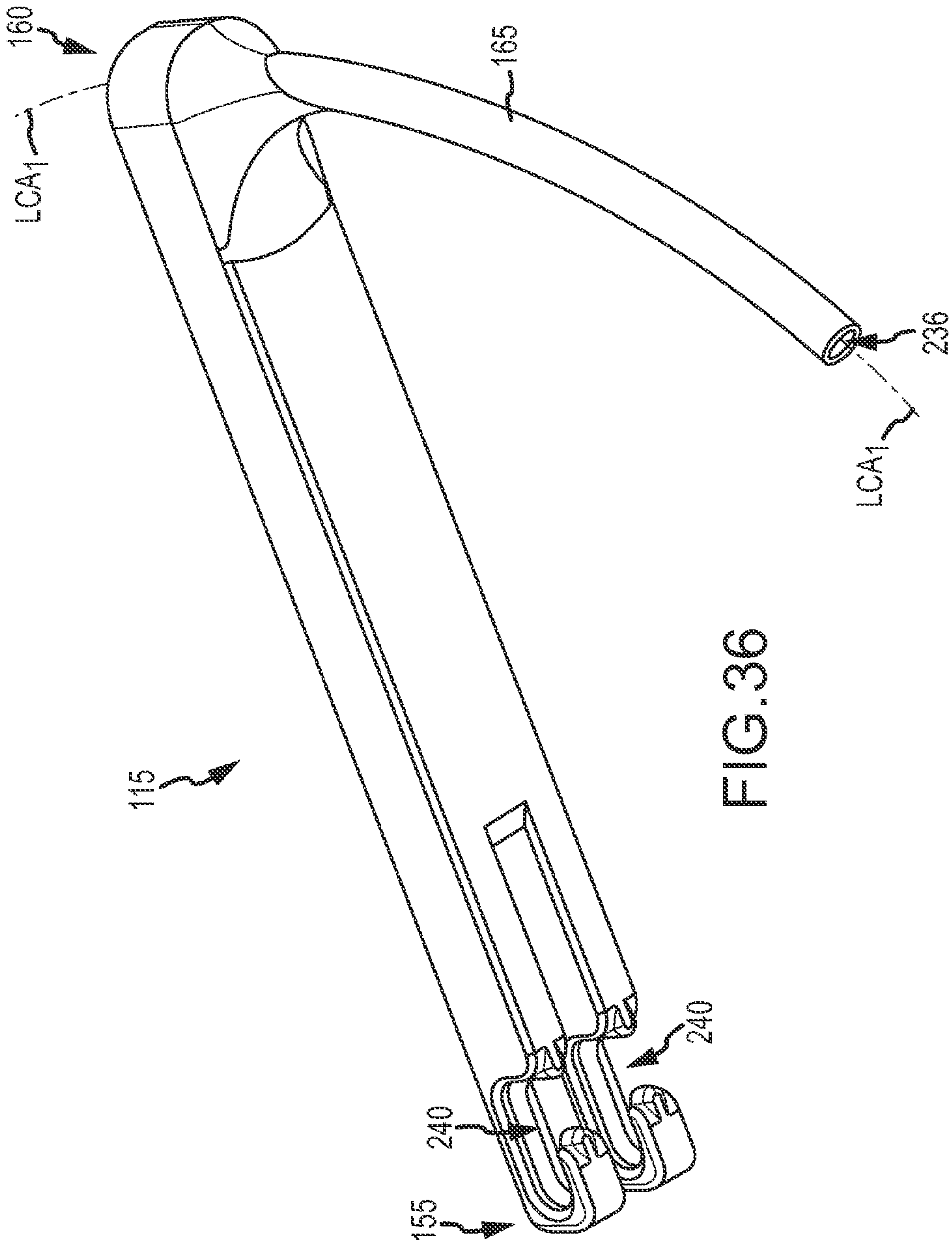


FIG. 36

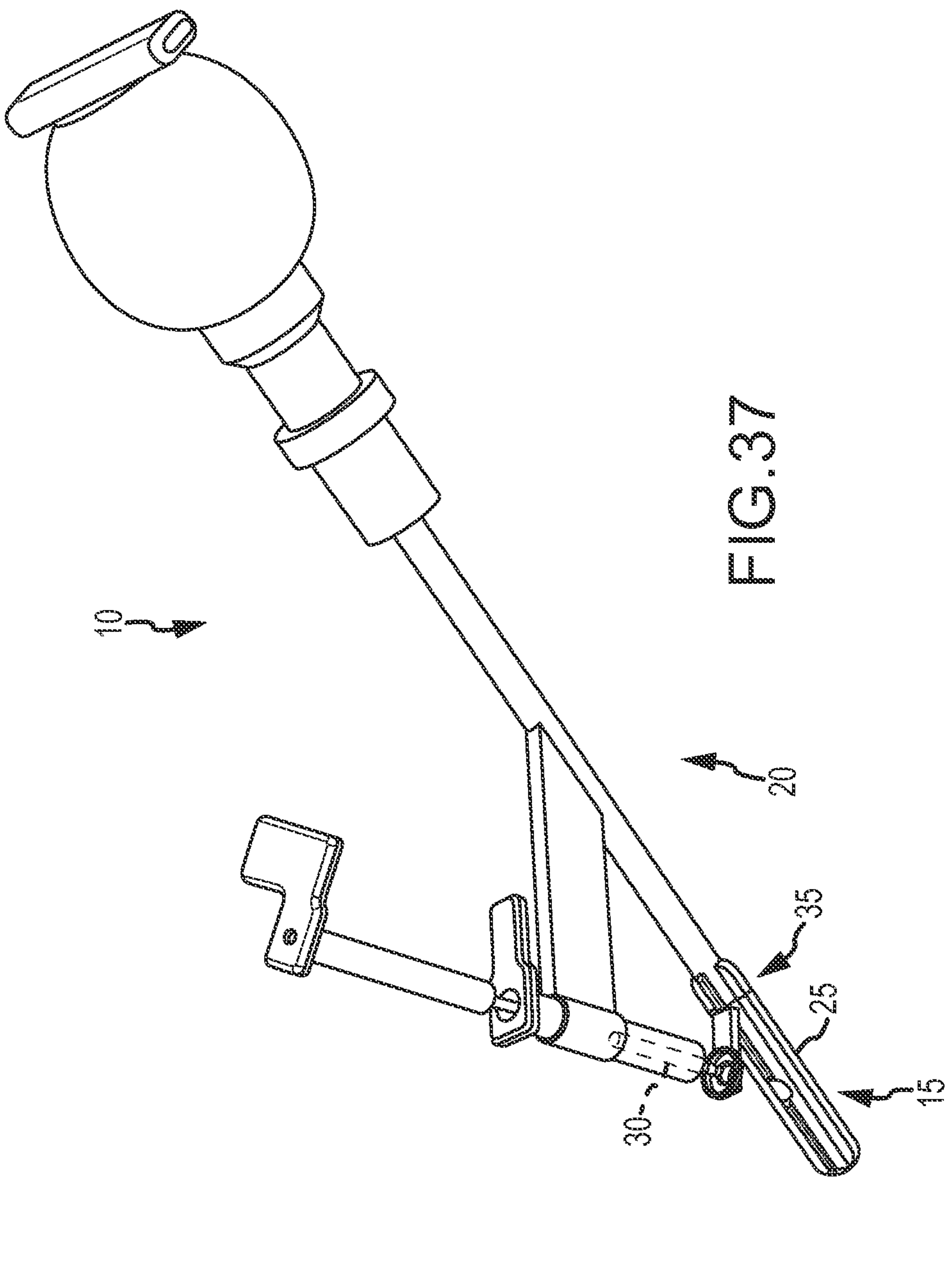


FIG.37

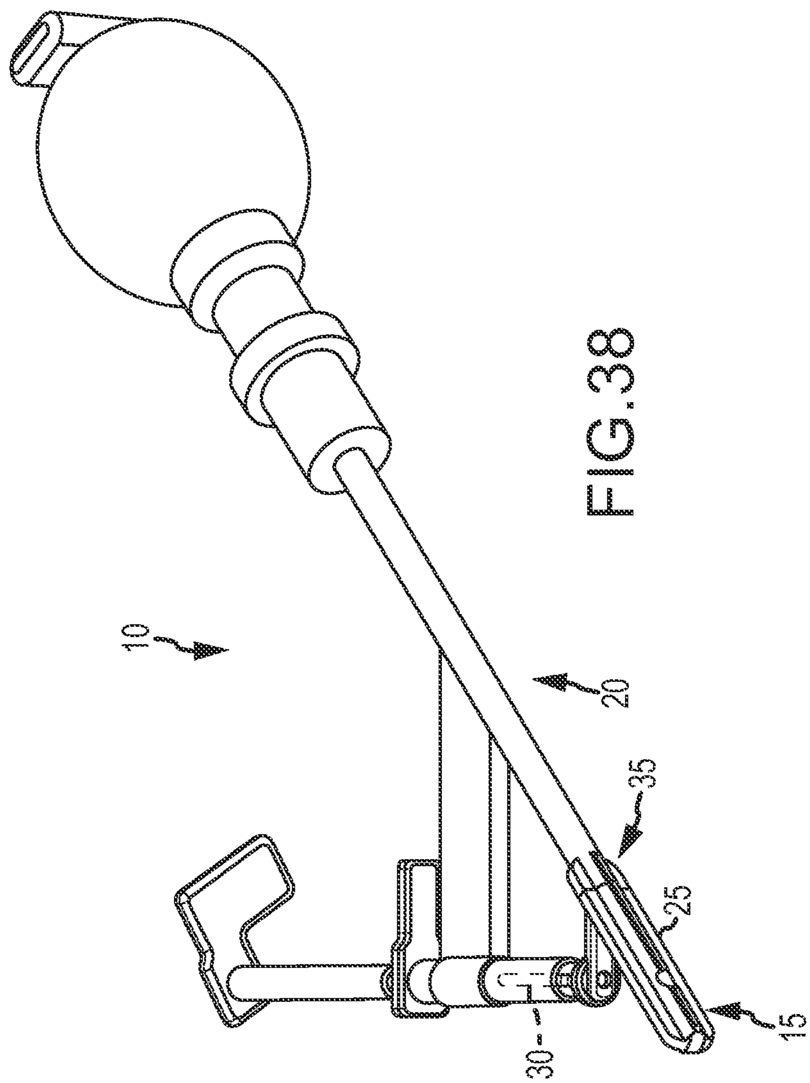


FIG. 38

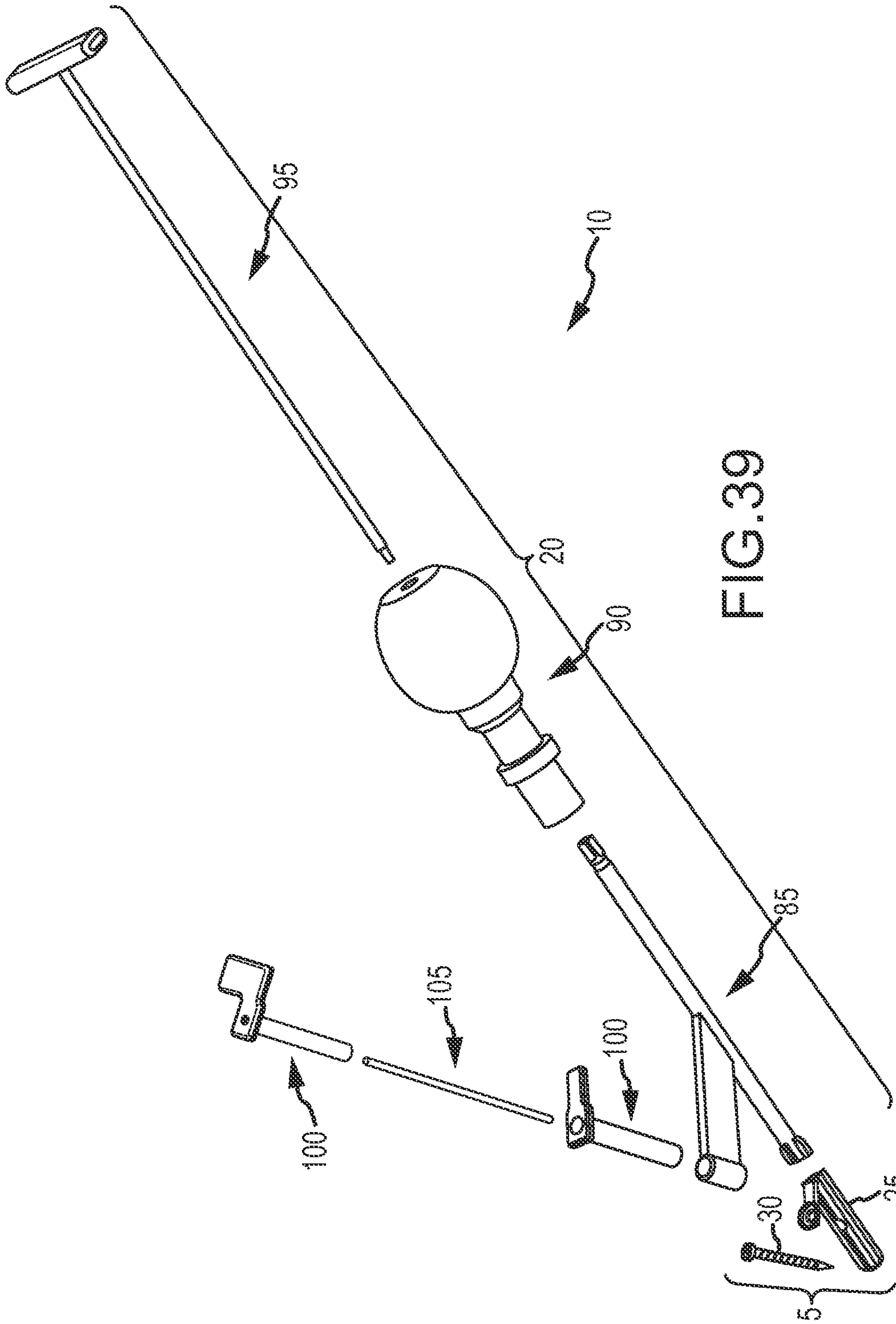
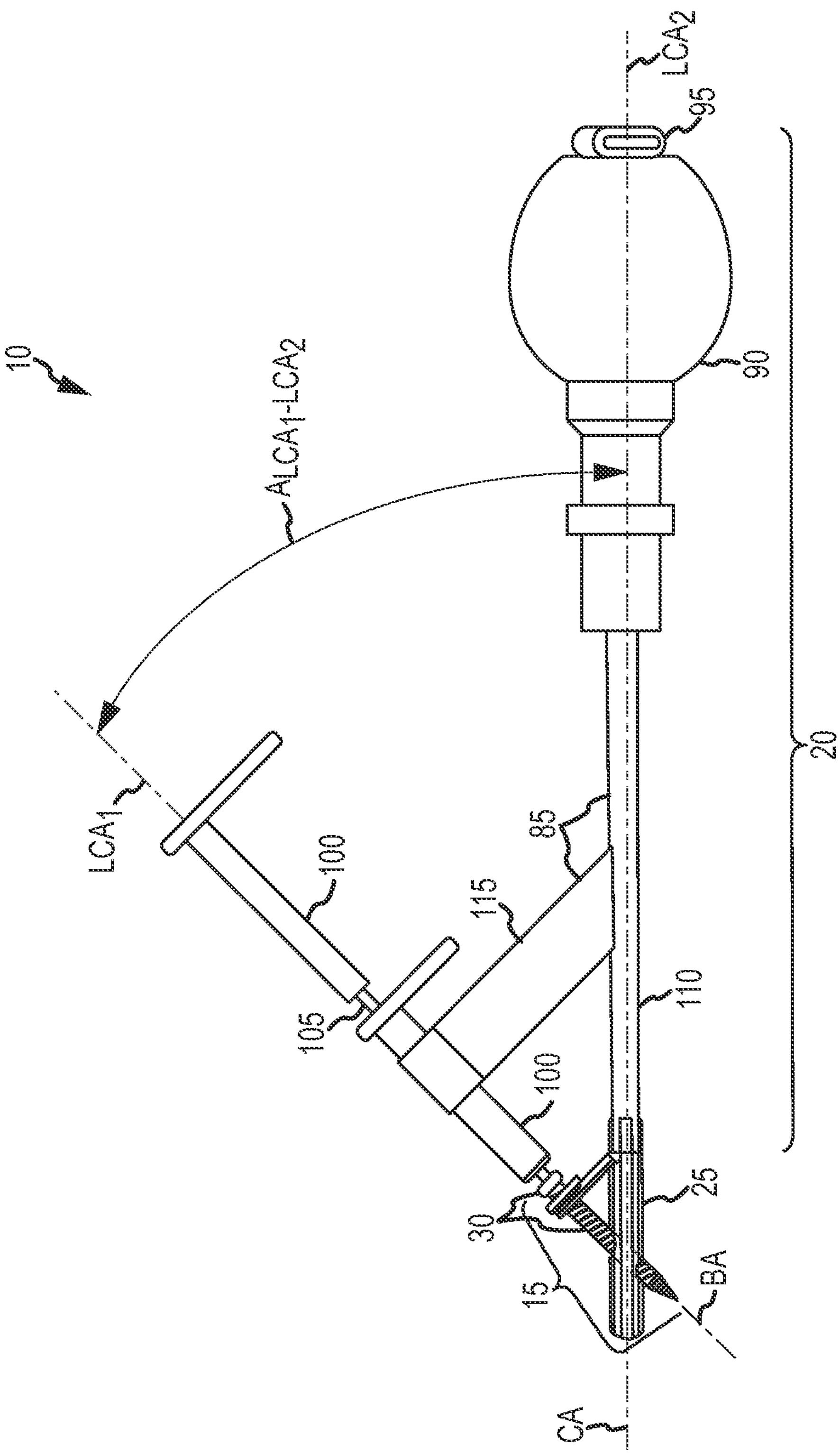


FIG.39


10
$A_{LCA1-LCA2}$
LCA2
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90
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LCA1
25
30
15
BA
CA

FIG. 40

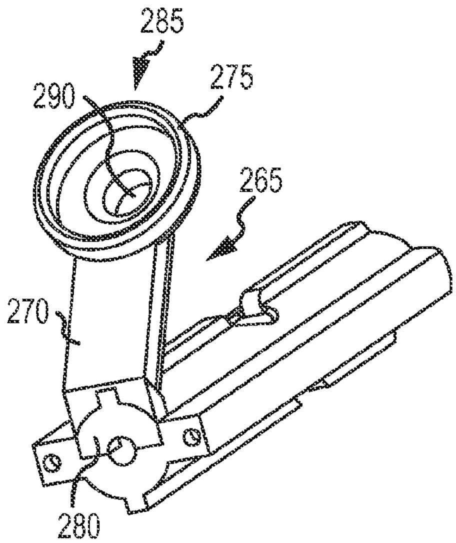

FIG.41

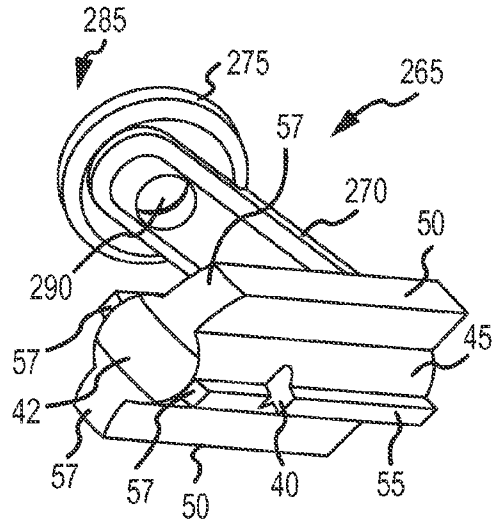

FIG.42

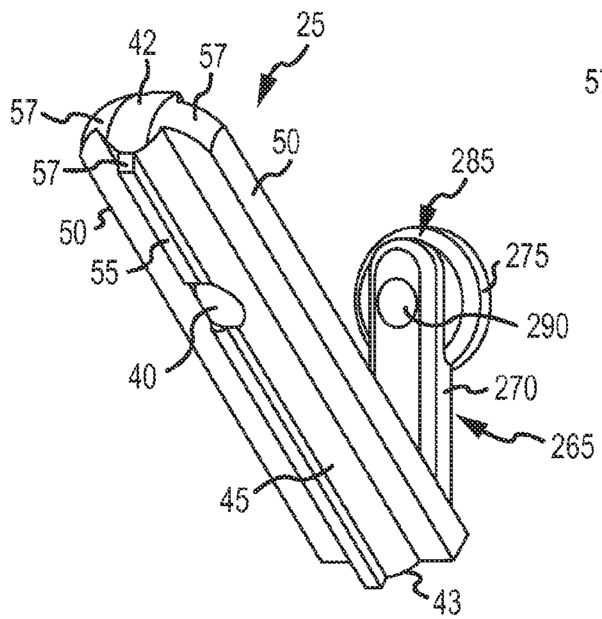

FIG.43

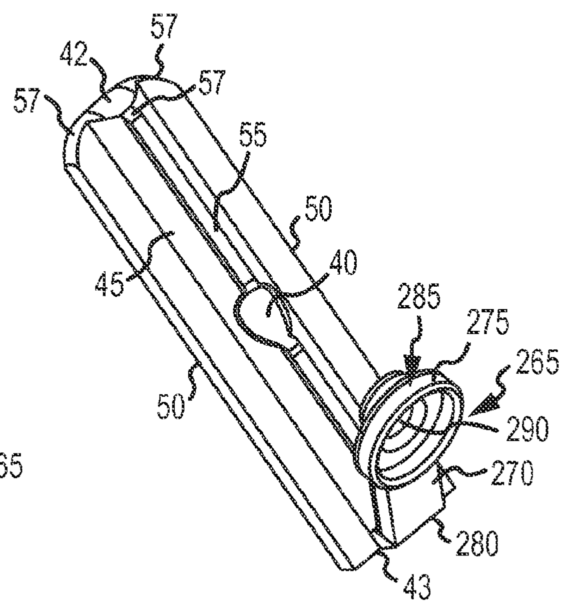

FIG.44

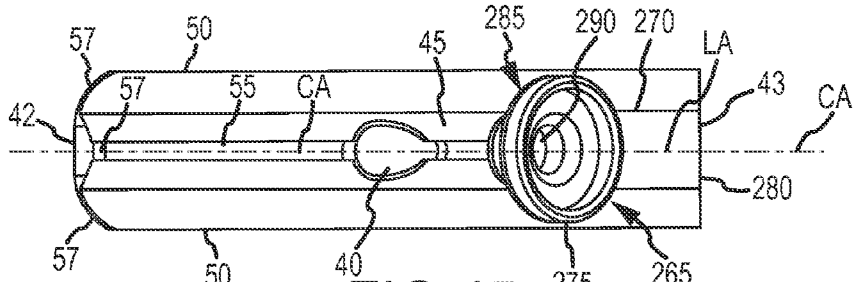

FIG.45

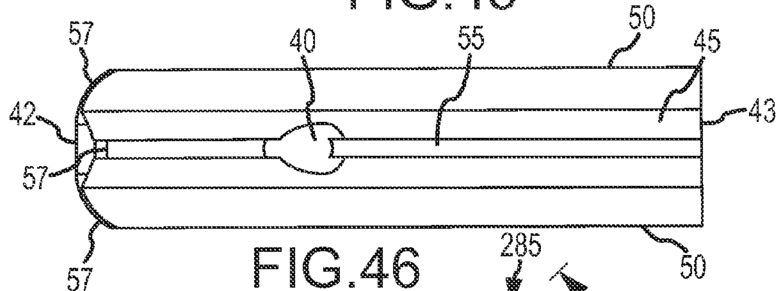

FIG.46

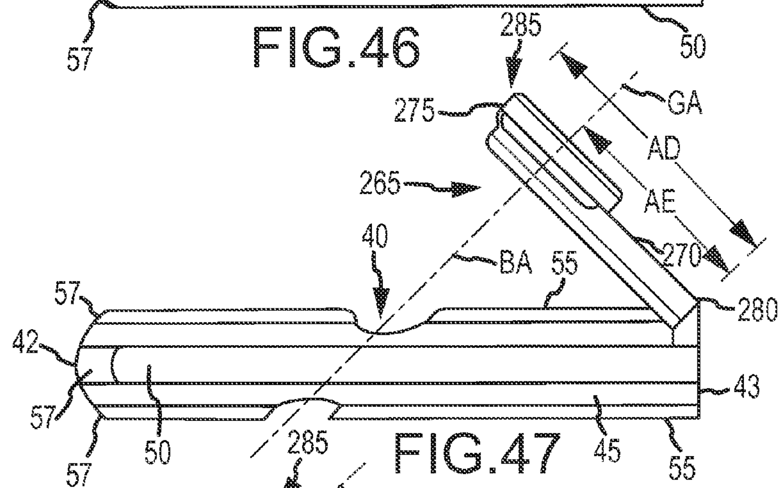

FIG.47

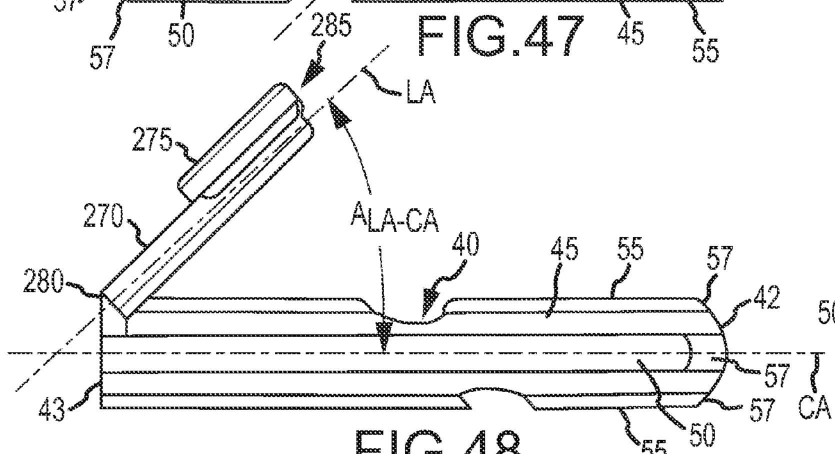

FIG.48

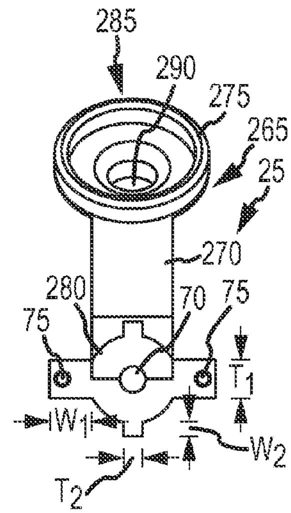

FIG.49

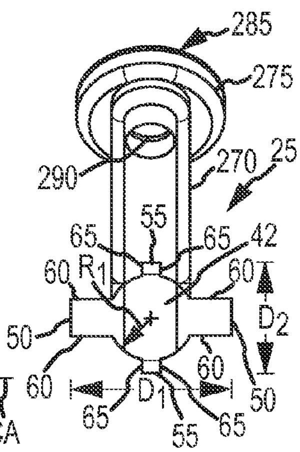

FIG.50

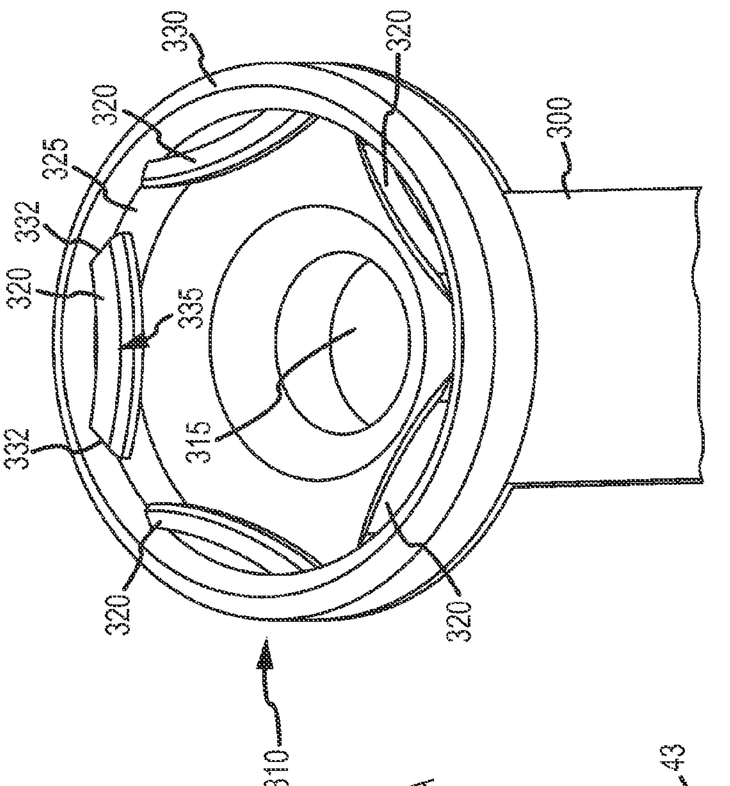

FIG.53

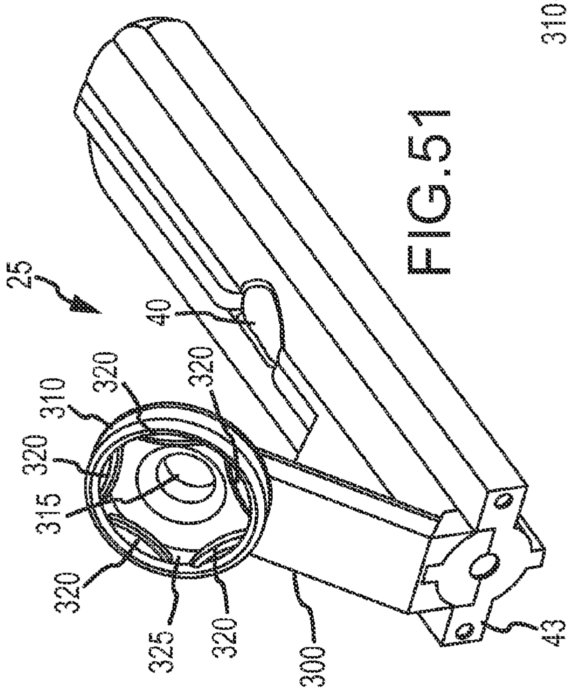

FIG.51

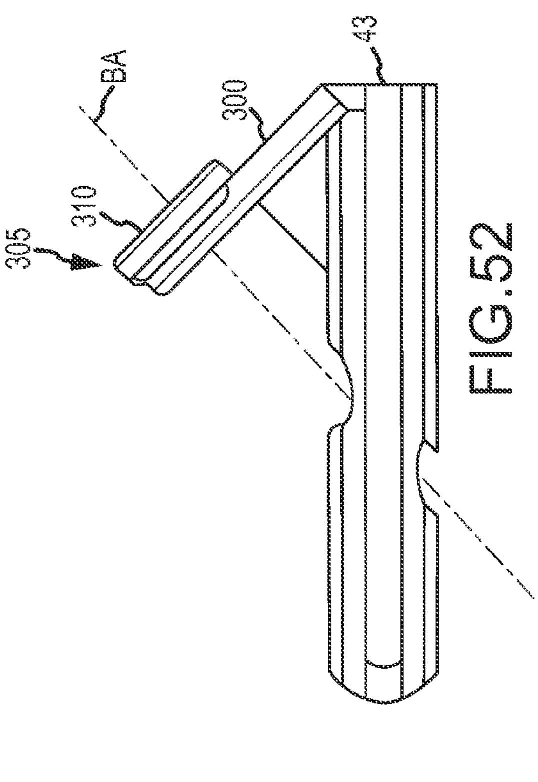

FIG.52

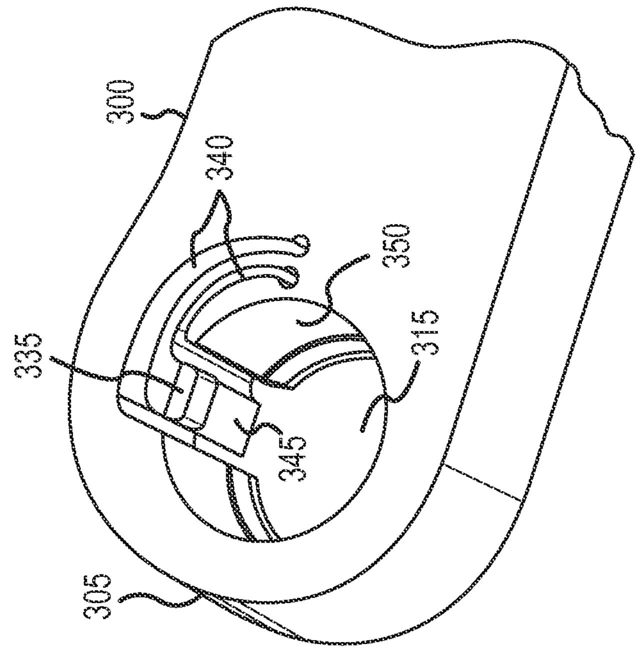

FIG.55

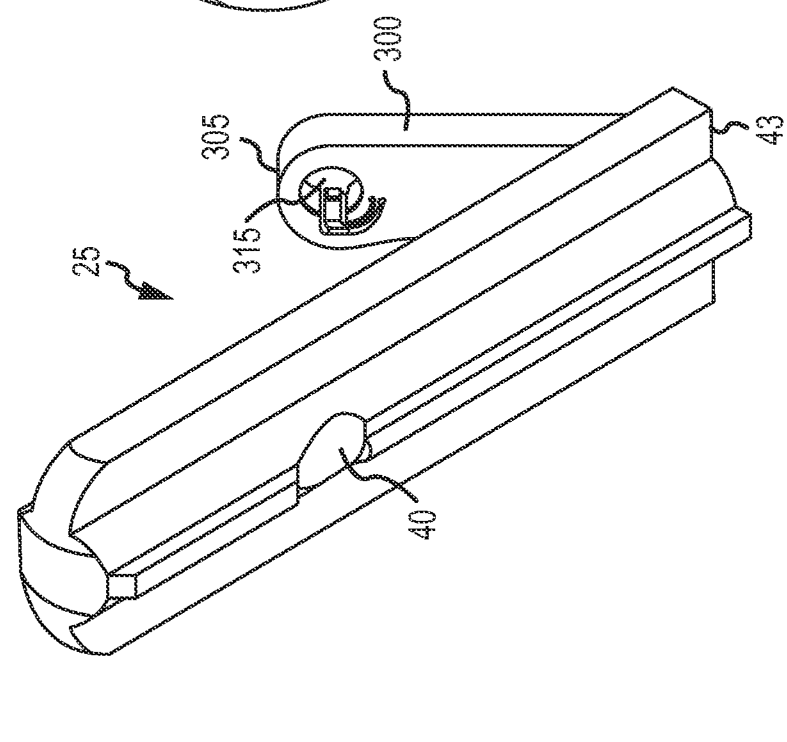

FIG.54

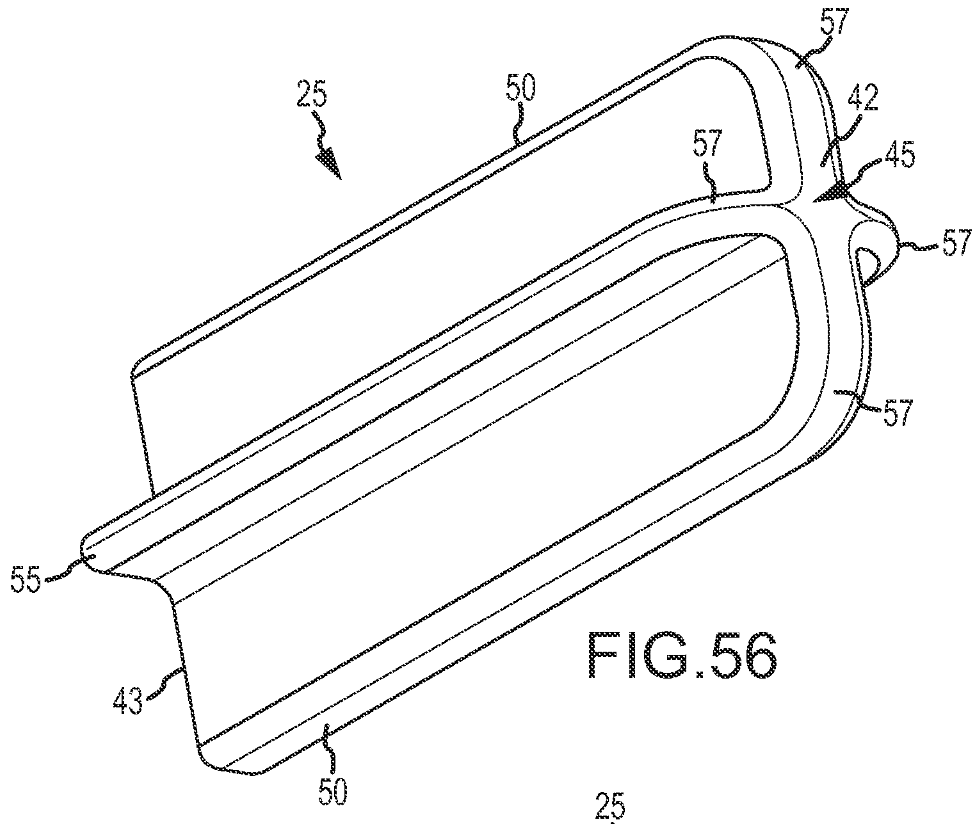

FIG.56

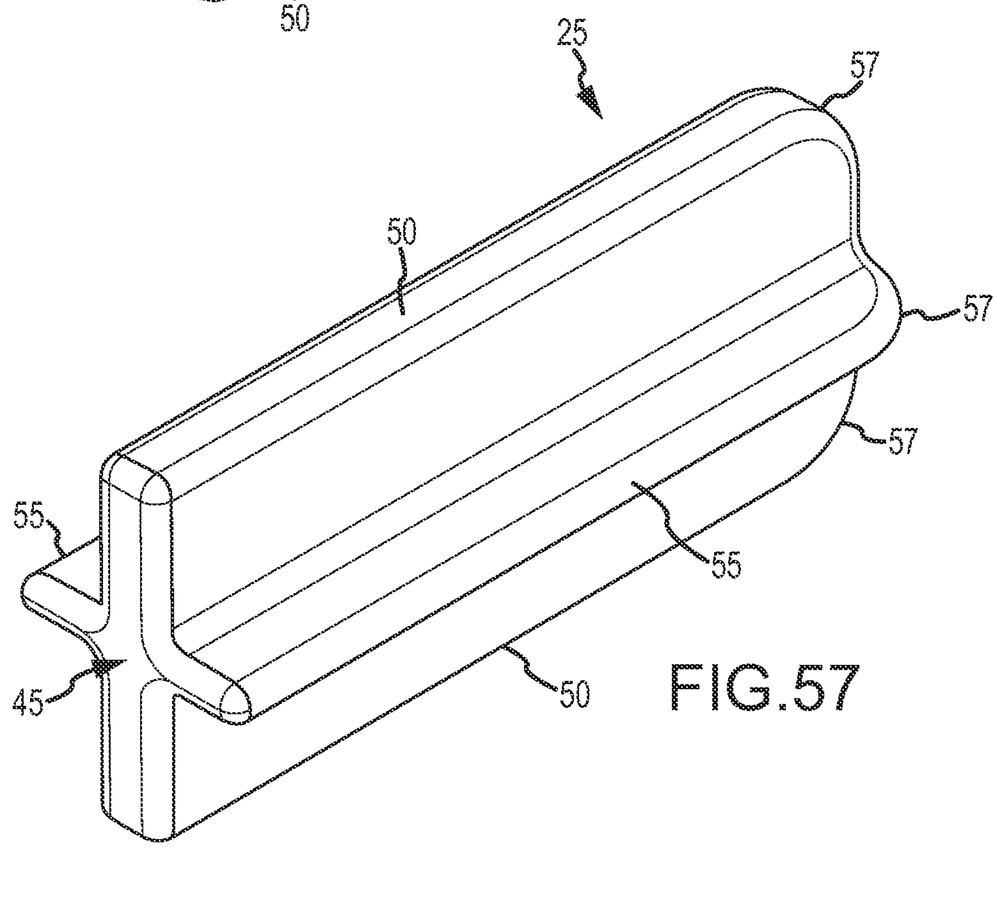

FIG.57

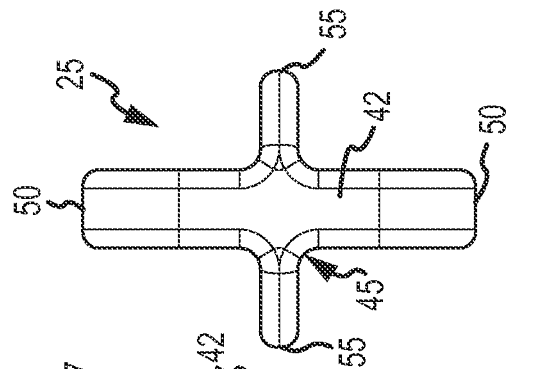

FIG.60

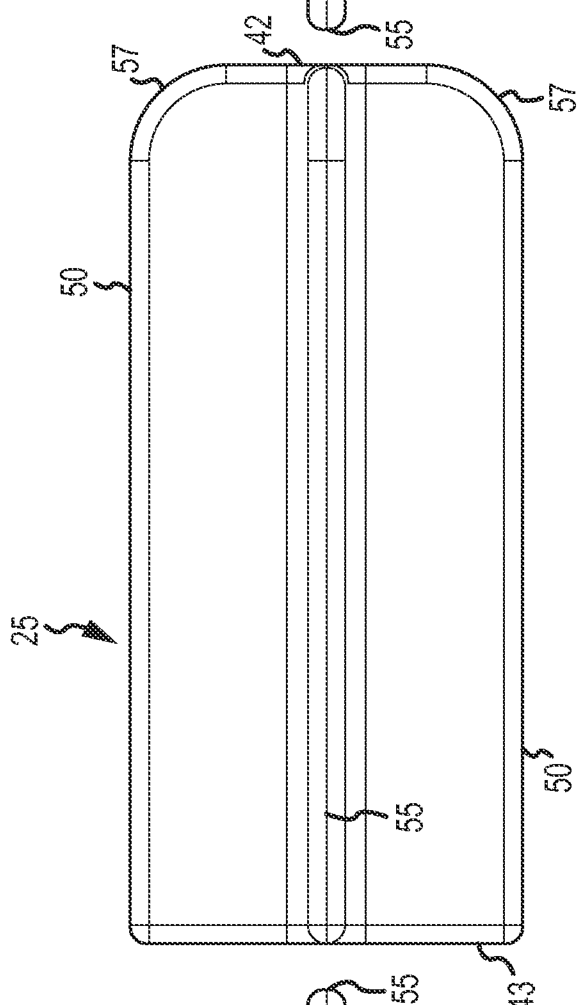

FIG.58

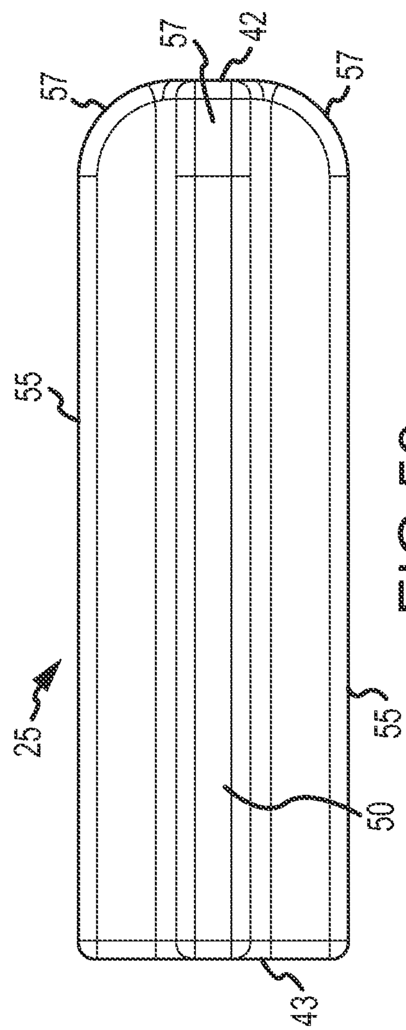

FIG.59

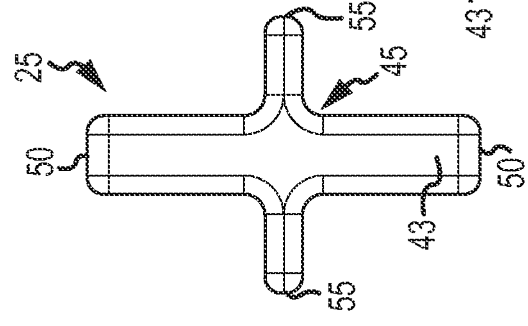

FIG.61

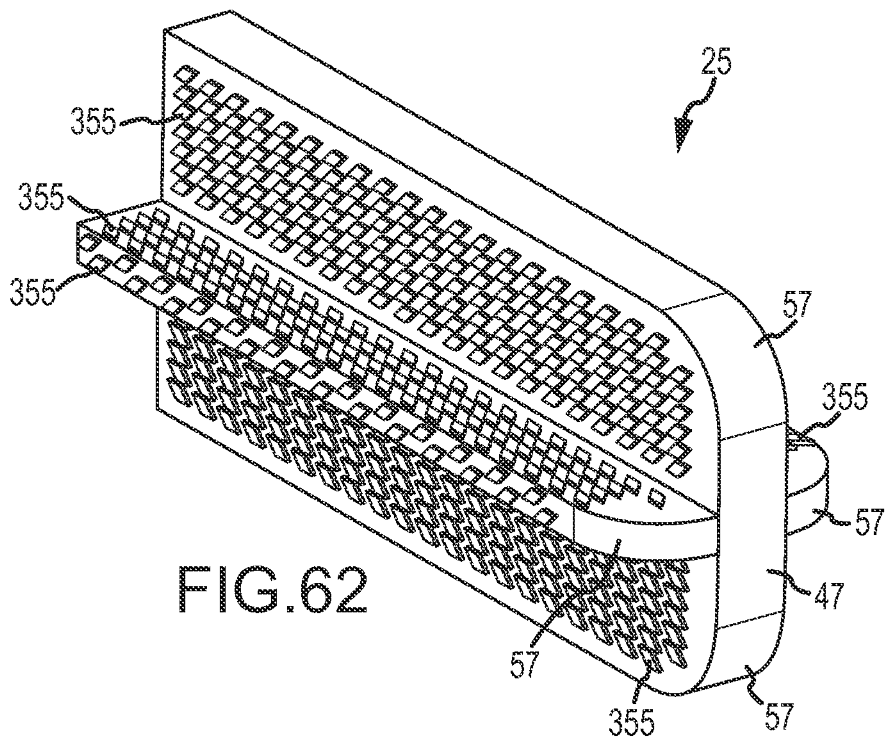
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FIG.62

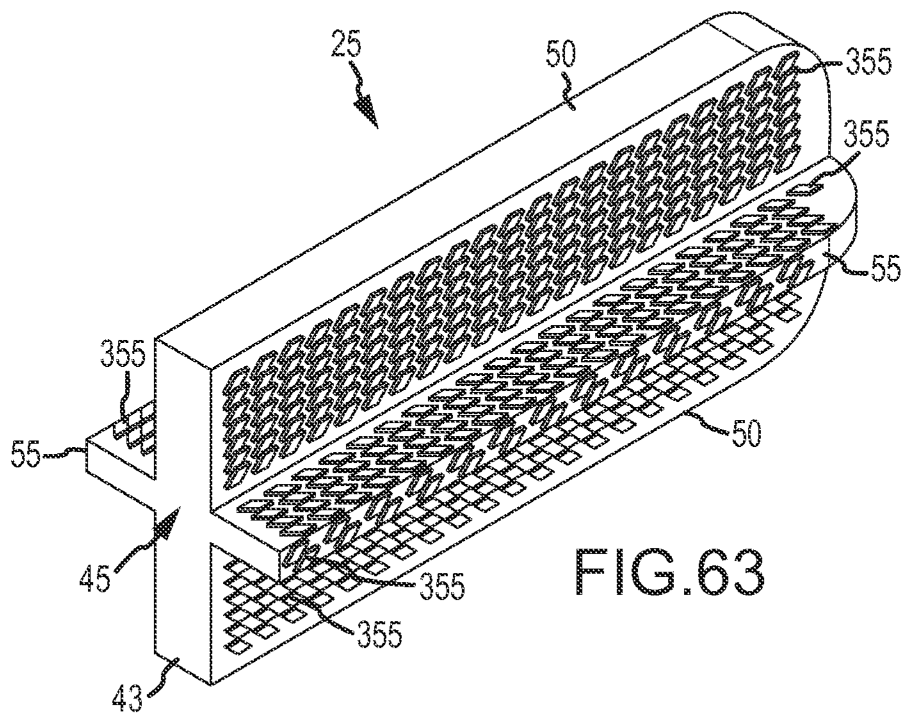
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FIG.63

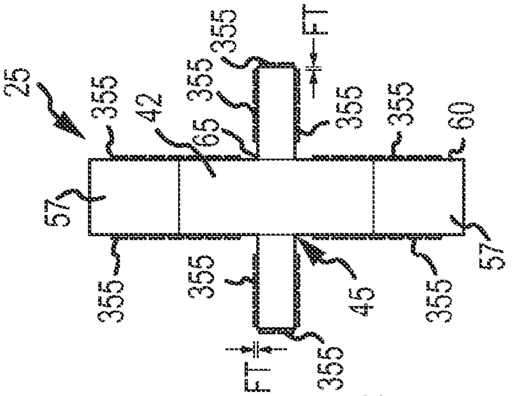

FIG.66

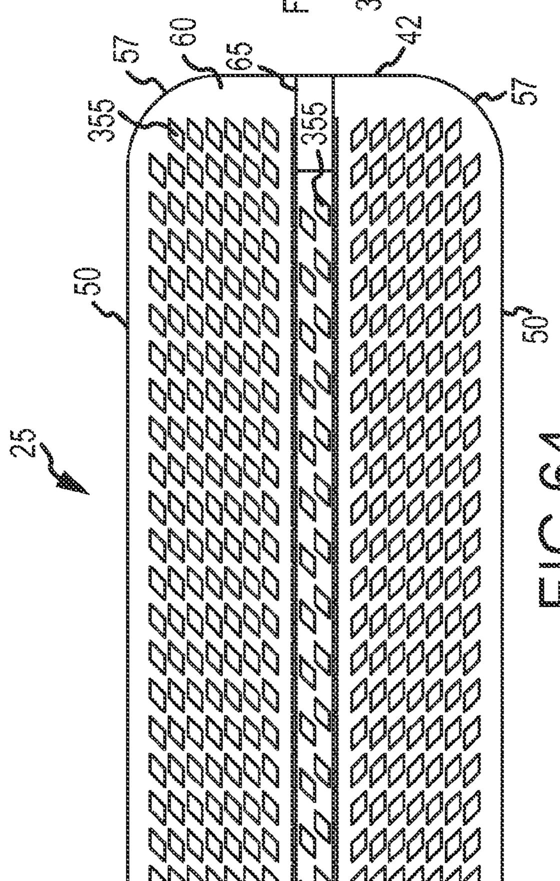

FIG.64

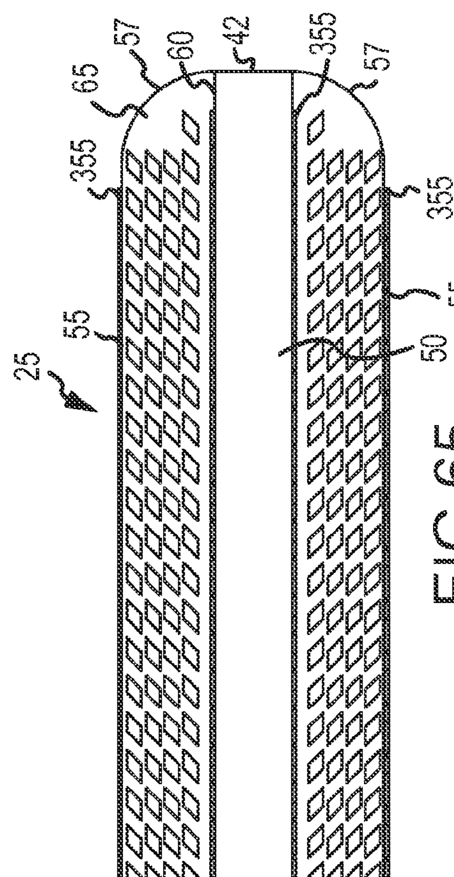

FIG.65

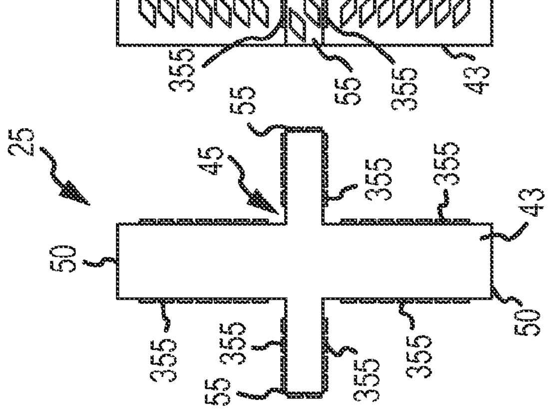

FIG.67

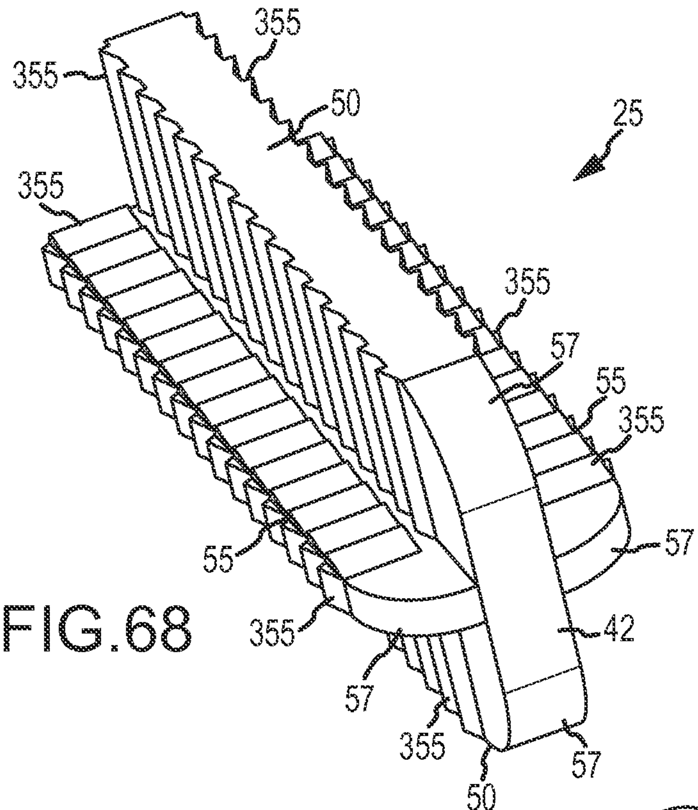
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FIG.68

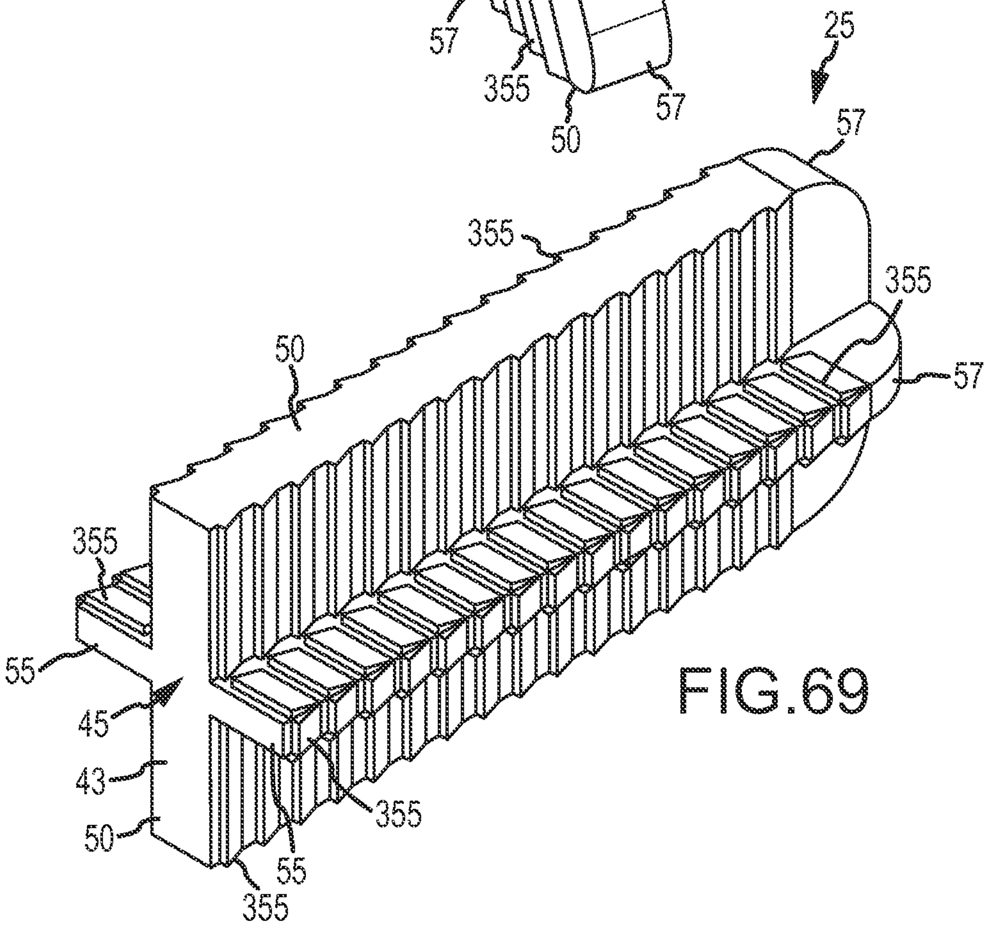
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FIG.69

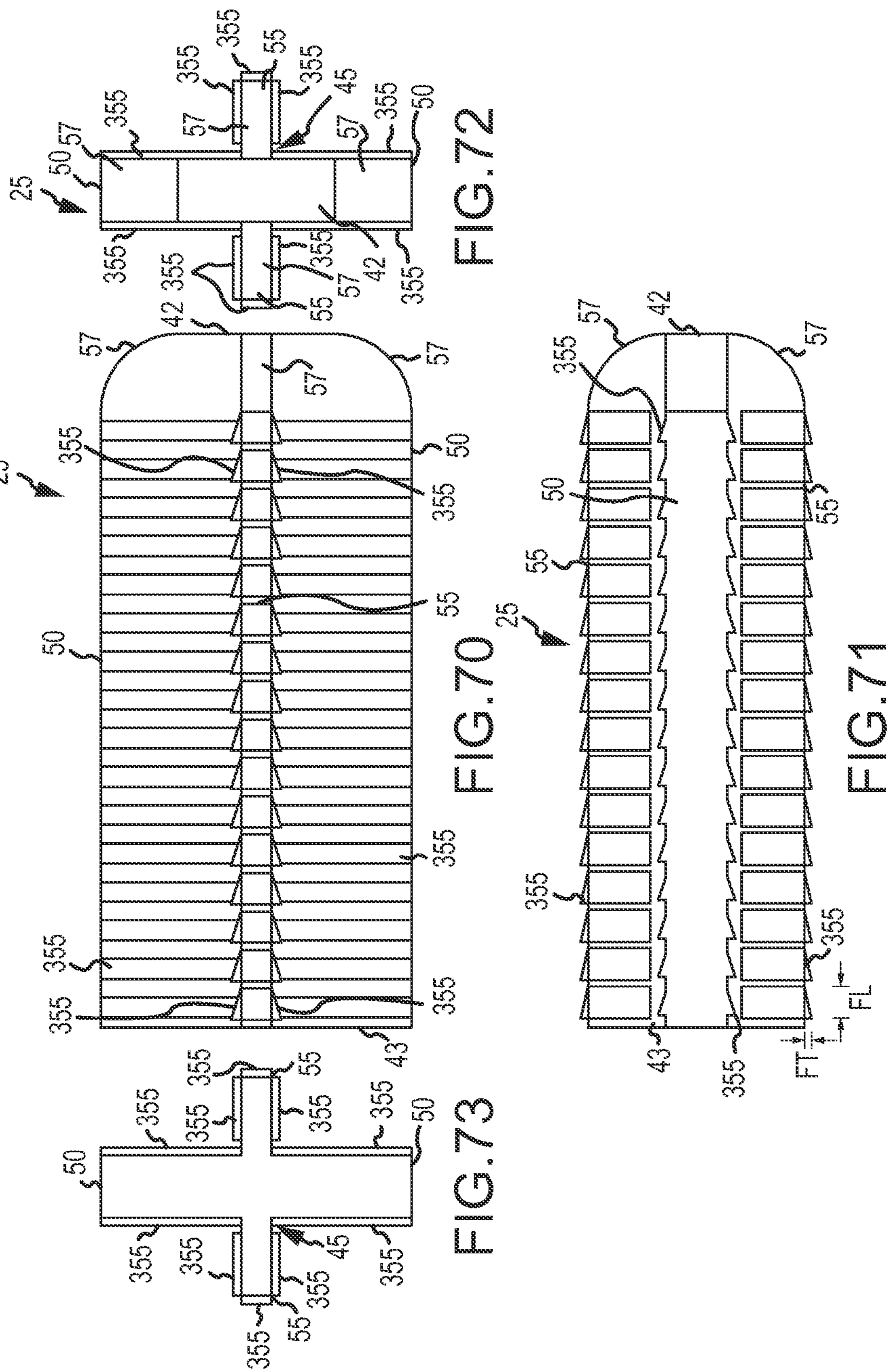

FIG. 72

FIG. 70

FIG. 71

FIG. 73

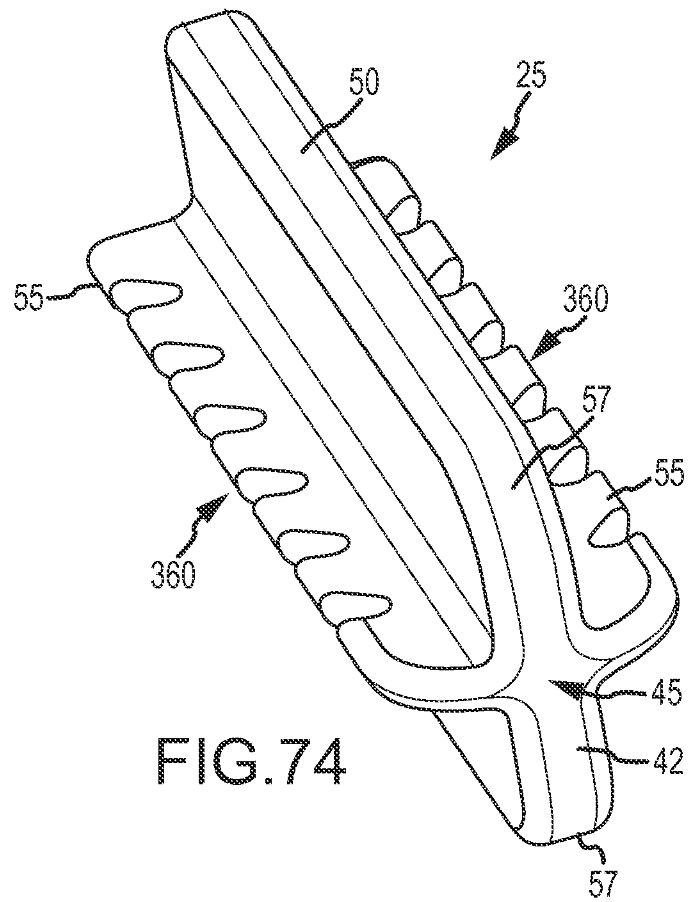

FIG.74

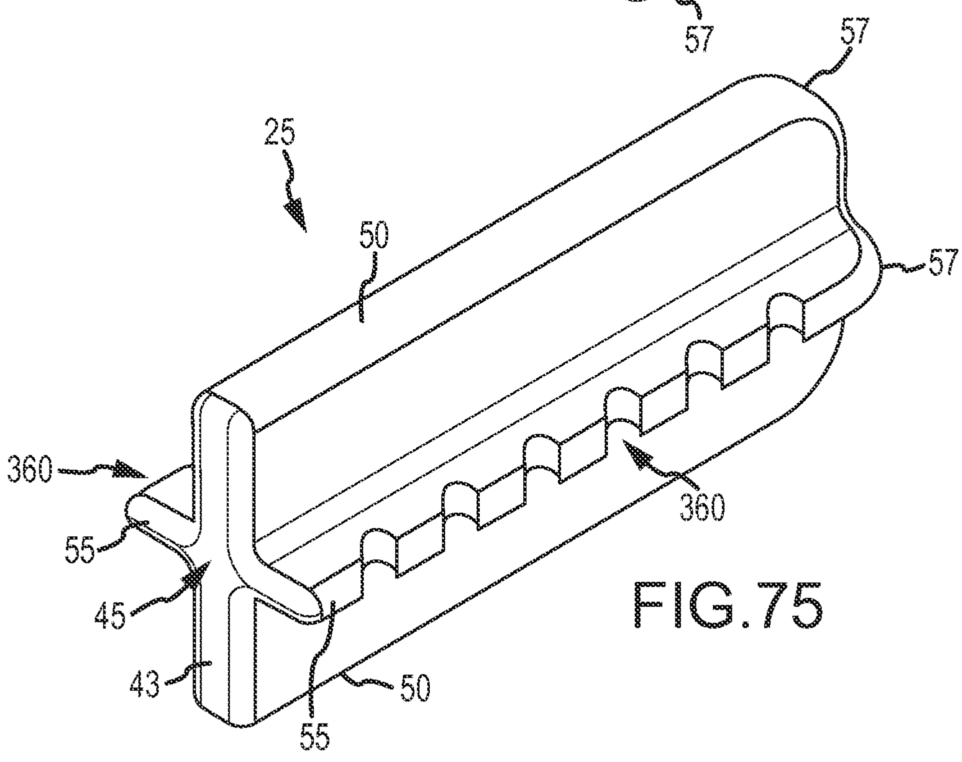

FIG.75

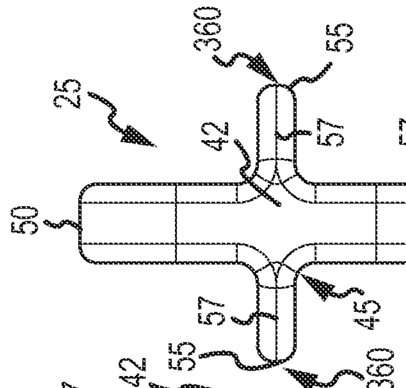

FIG.78

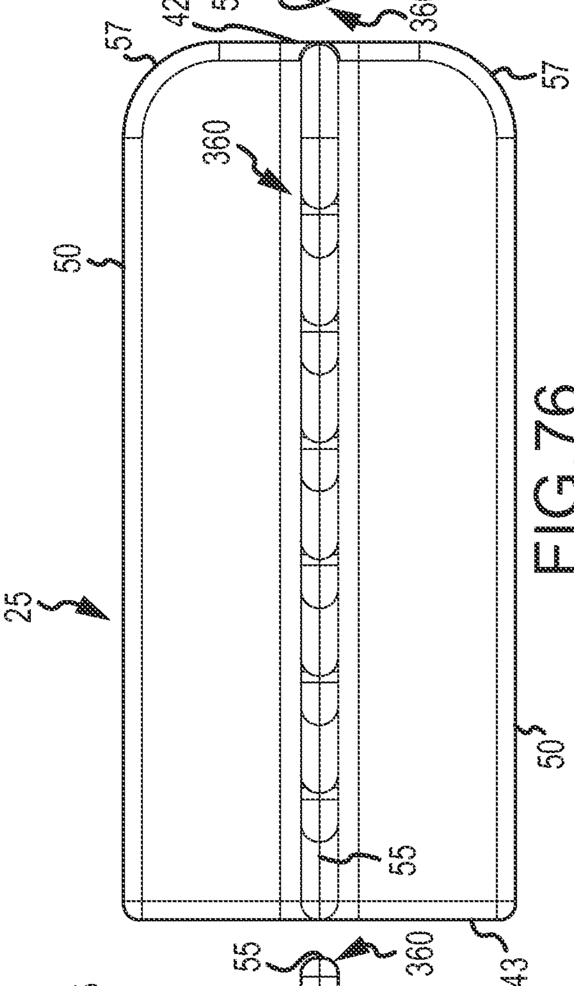

FIG.76

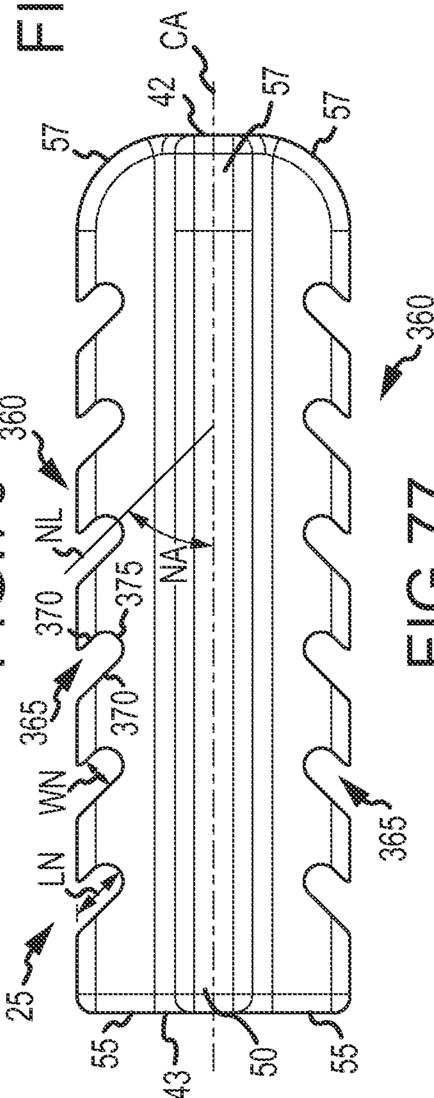

FIG.77

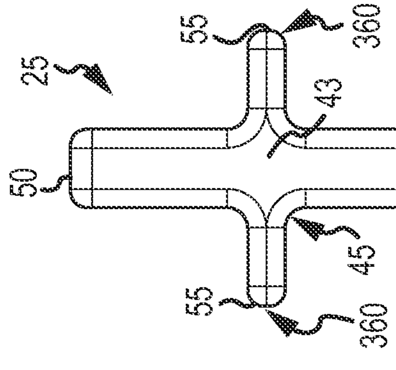

FIG.79

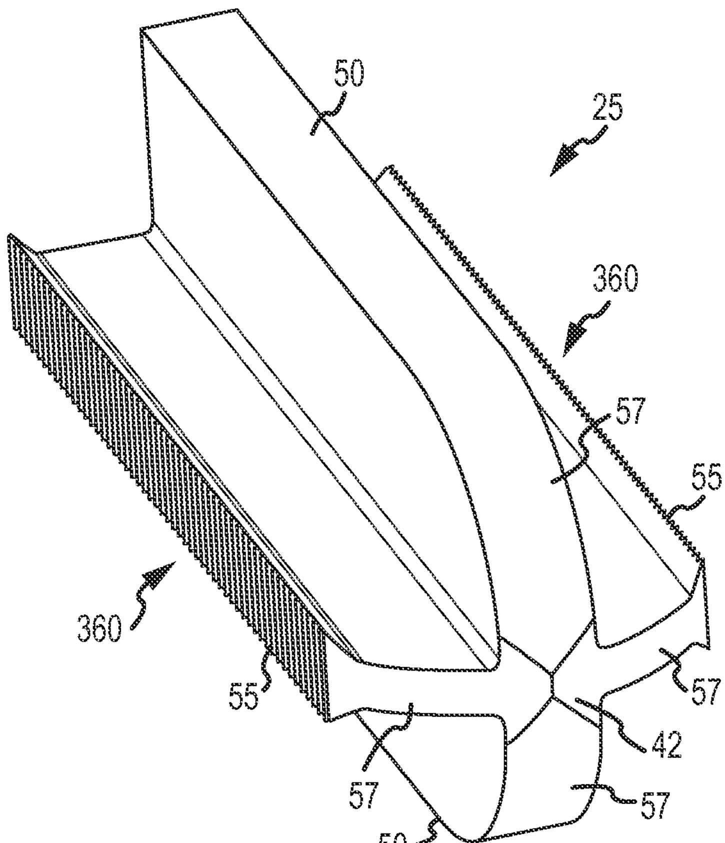

FIG.80

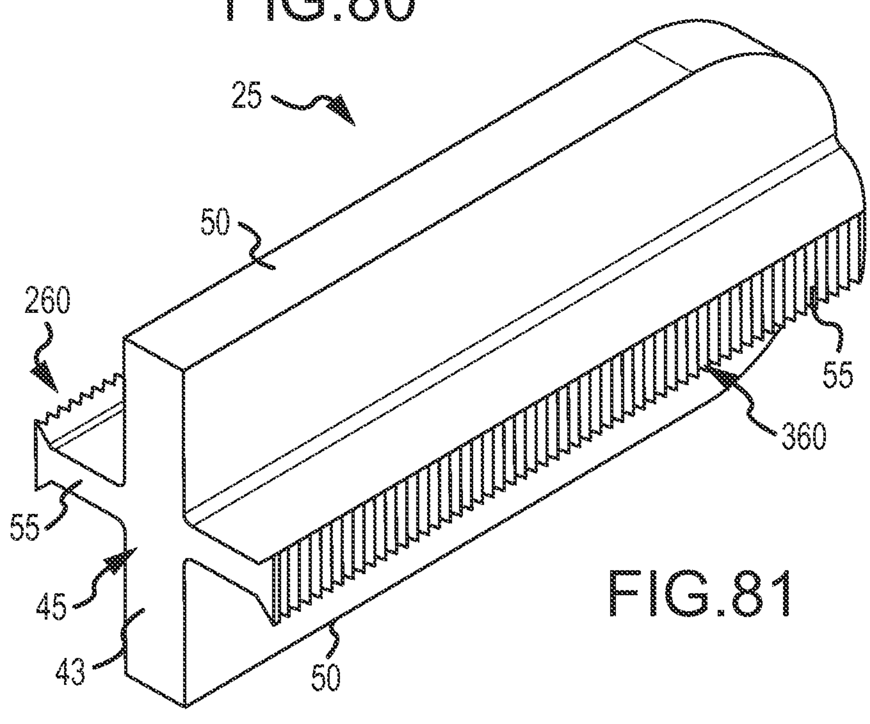

FIG.81

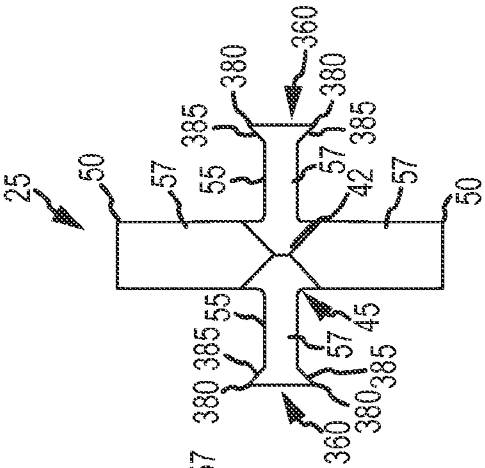

FIG.84

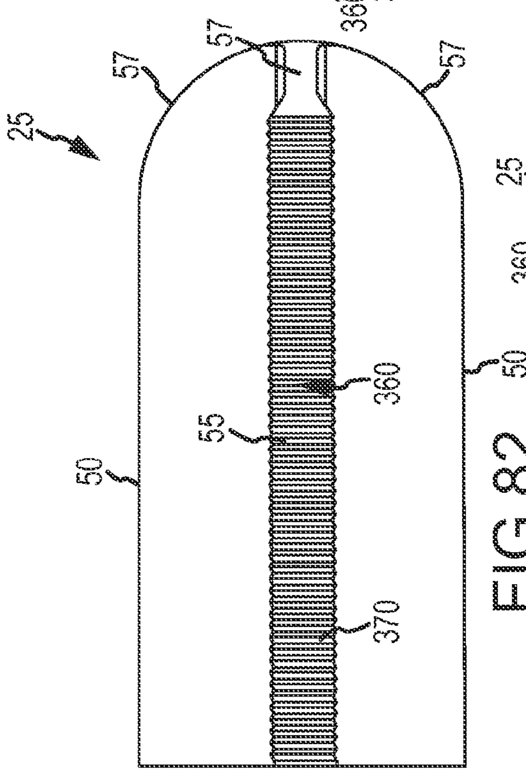

FIG.82

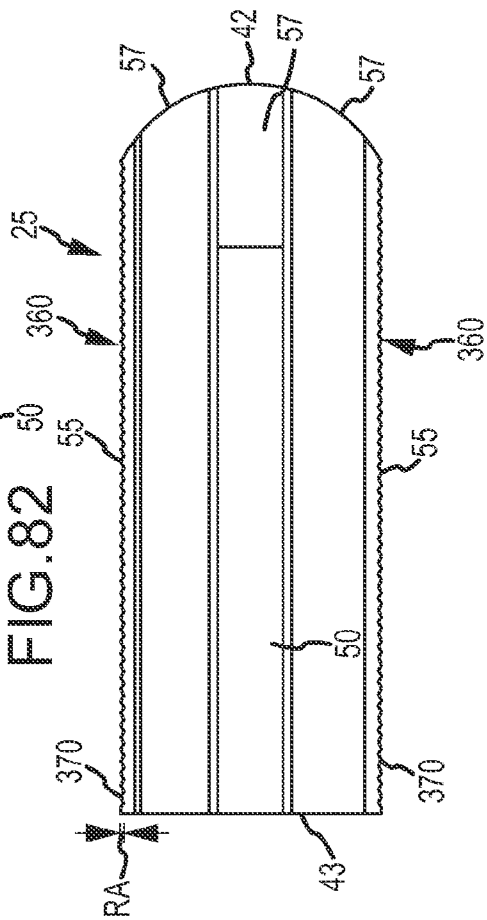

FIG.83

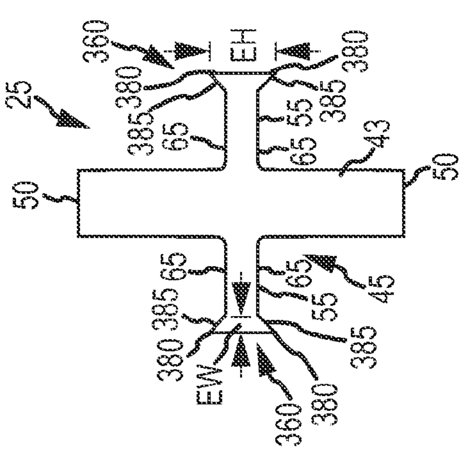

FIG.85

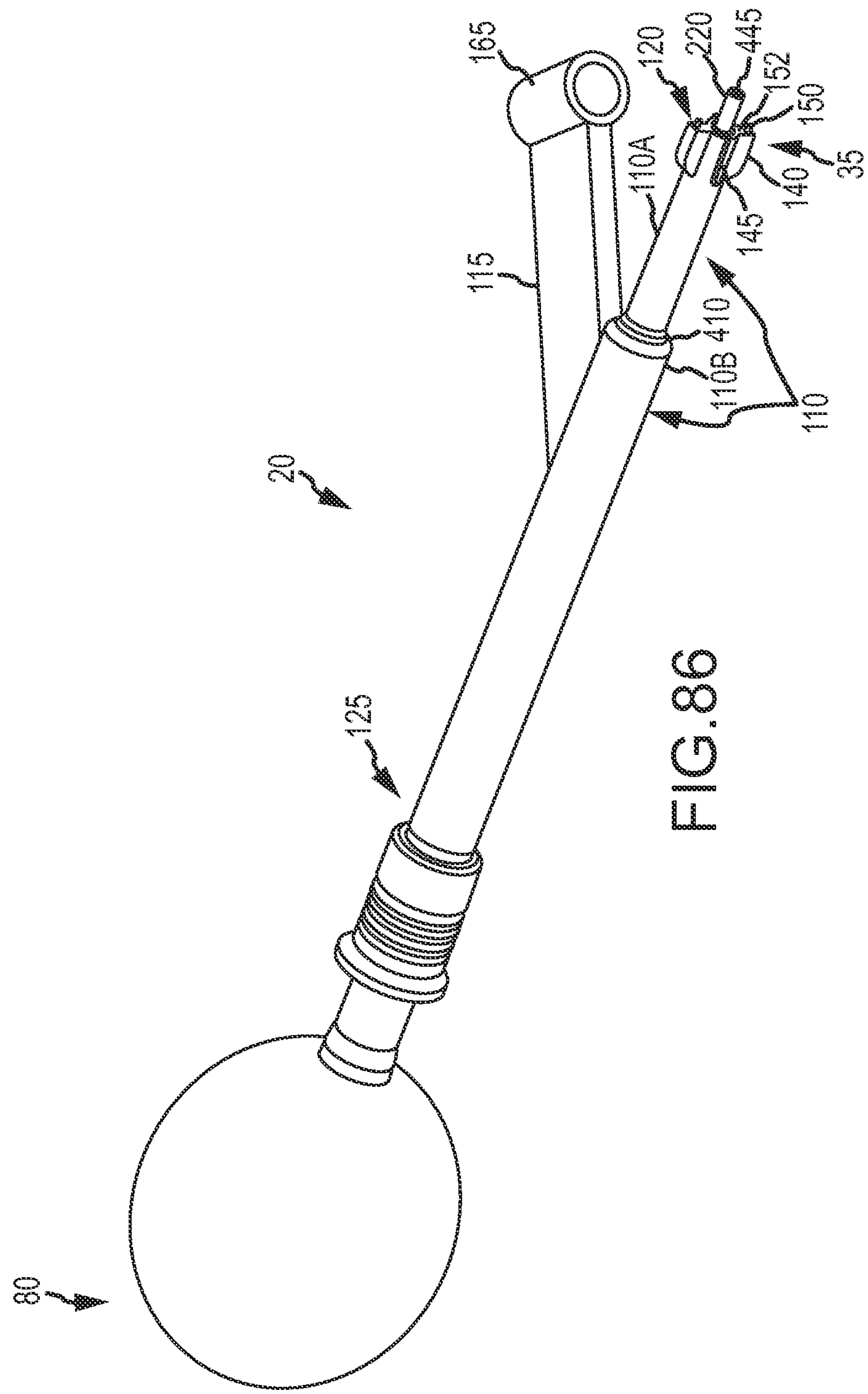
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FIG.86

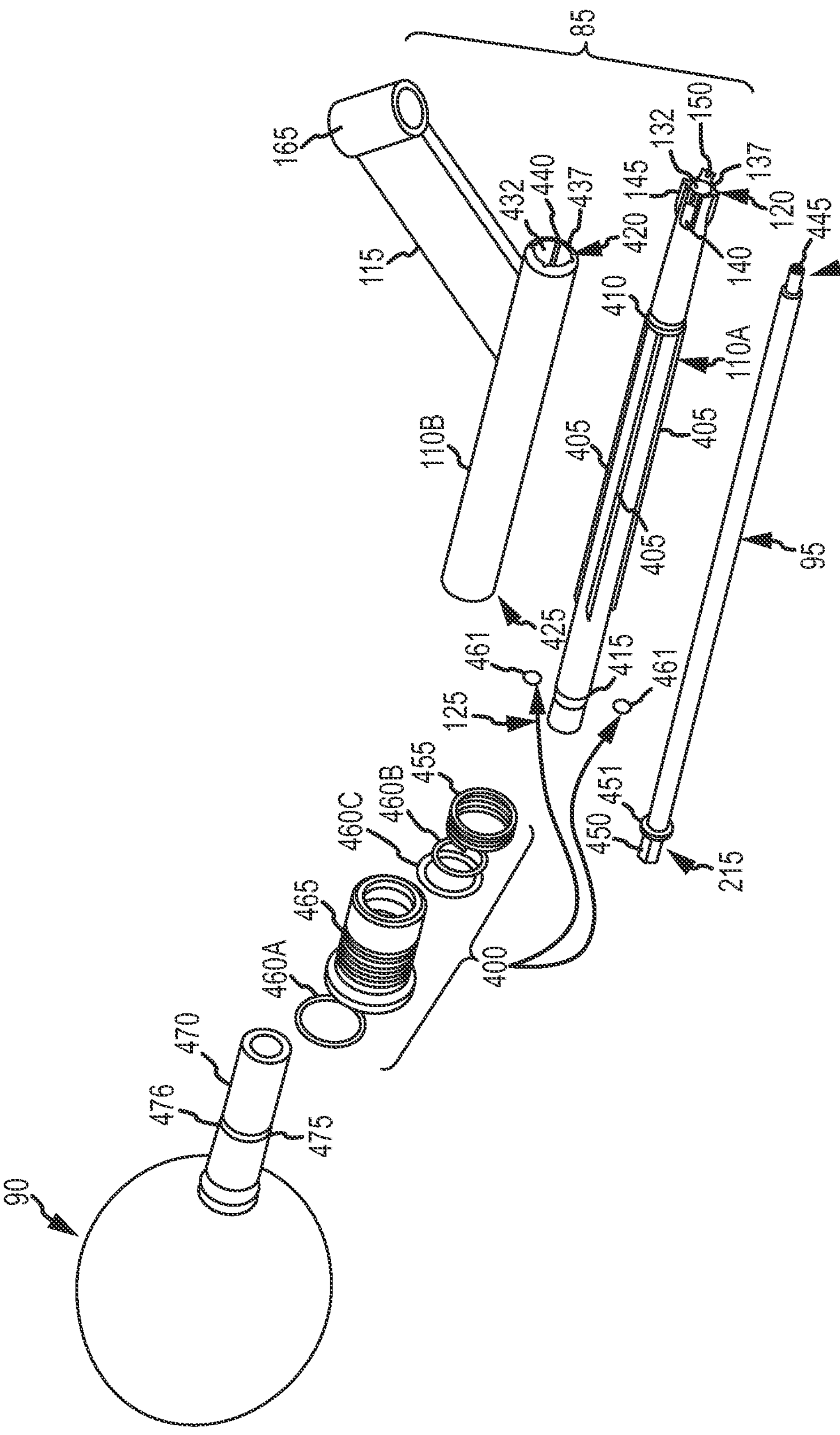
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FIG.87

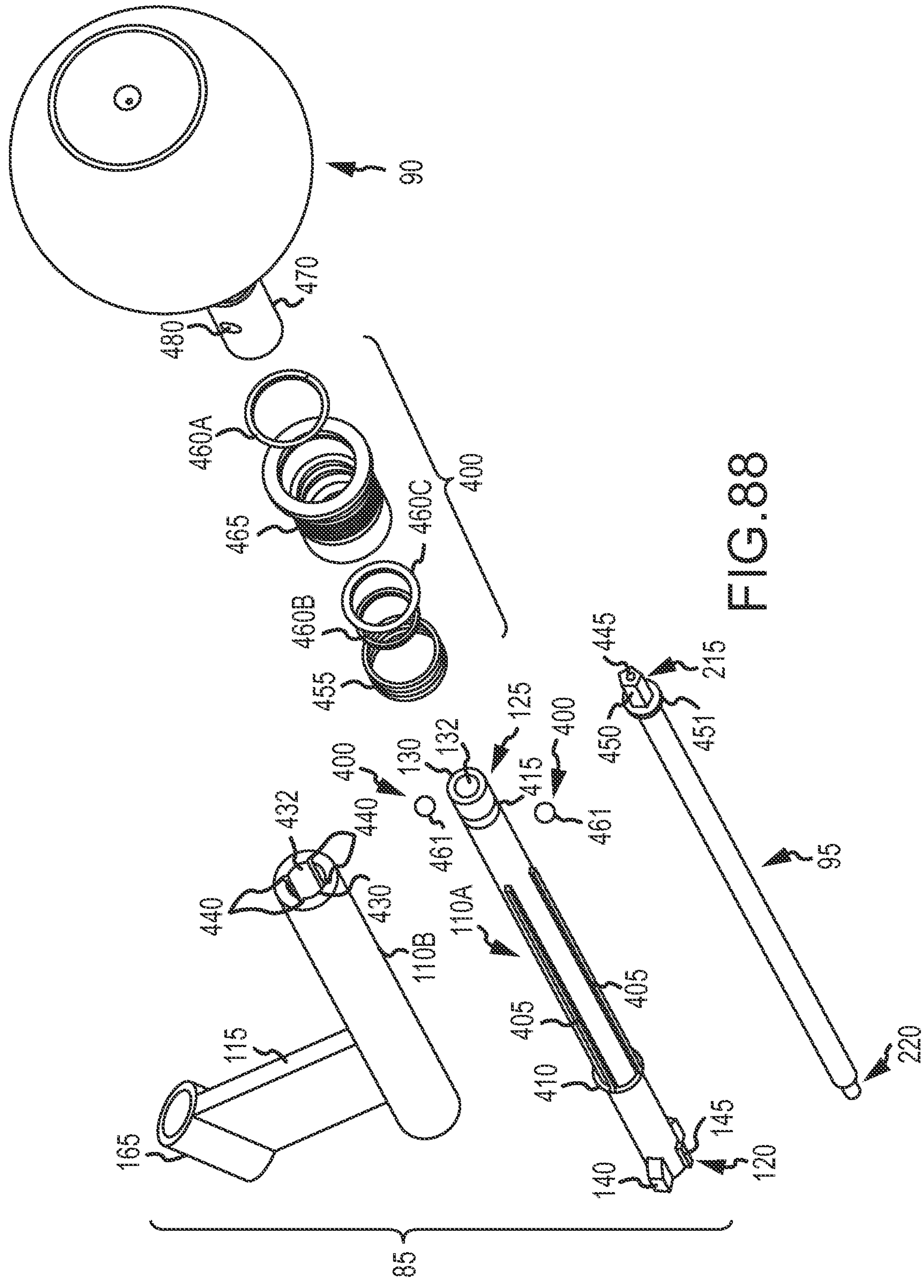
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FIG. 88

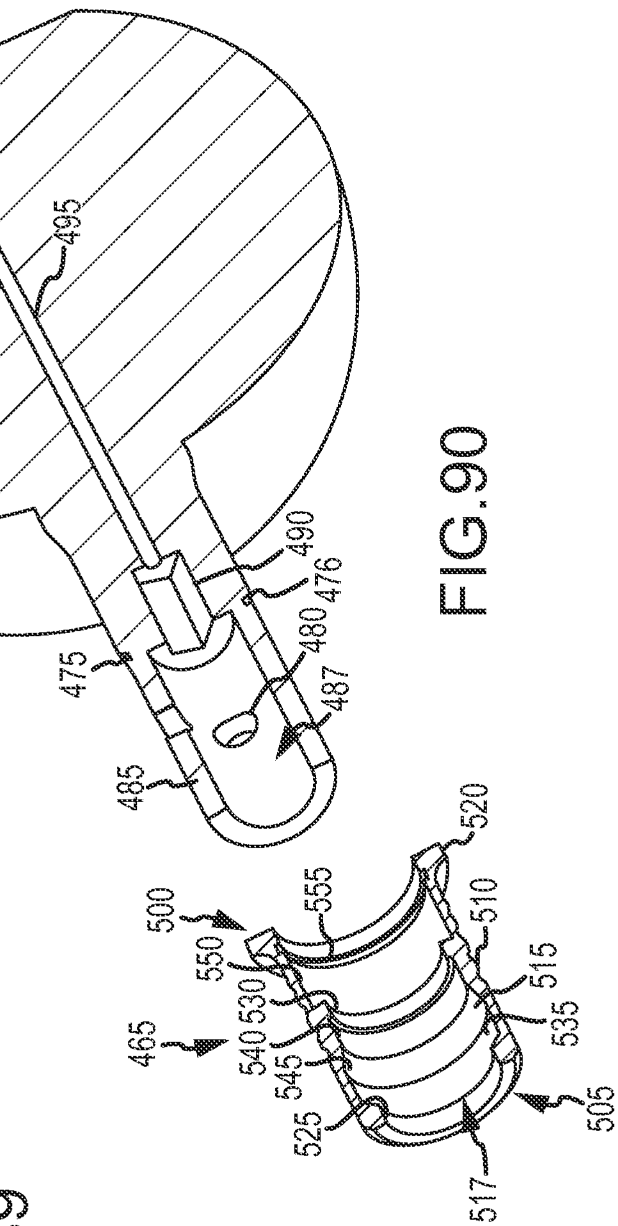
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FIG.90

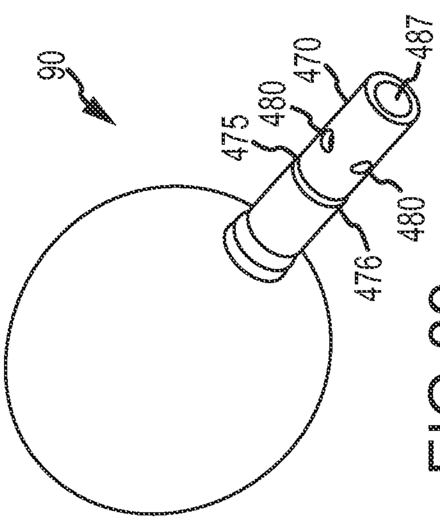
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FIG.89

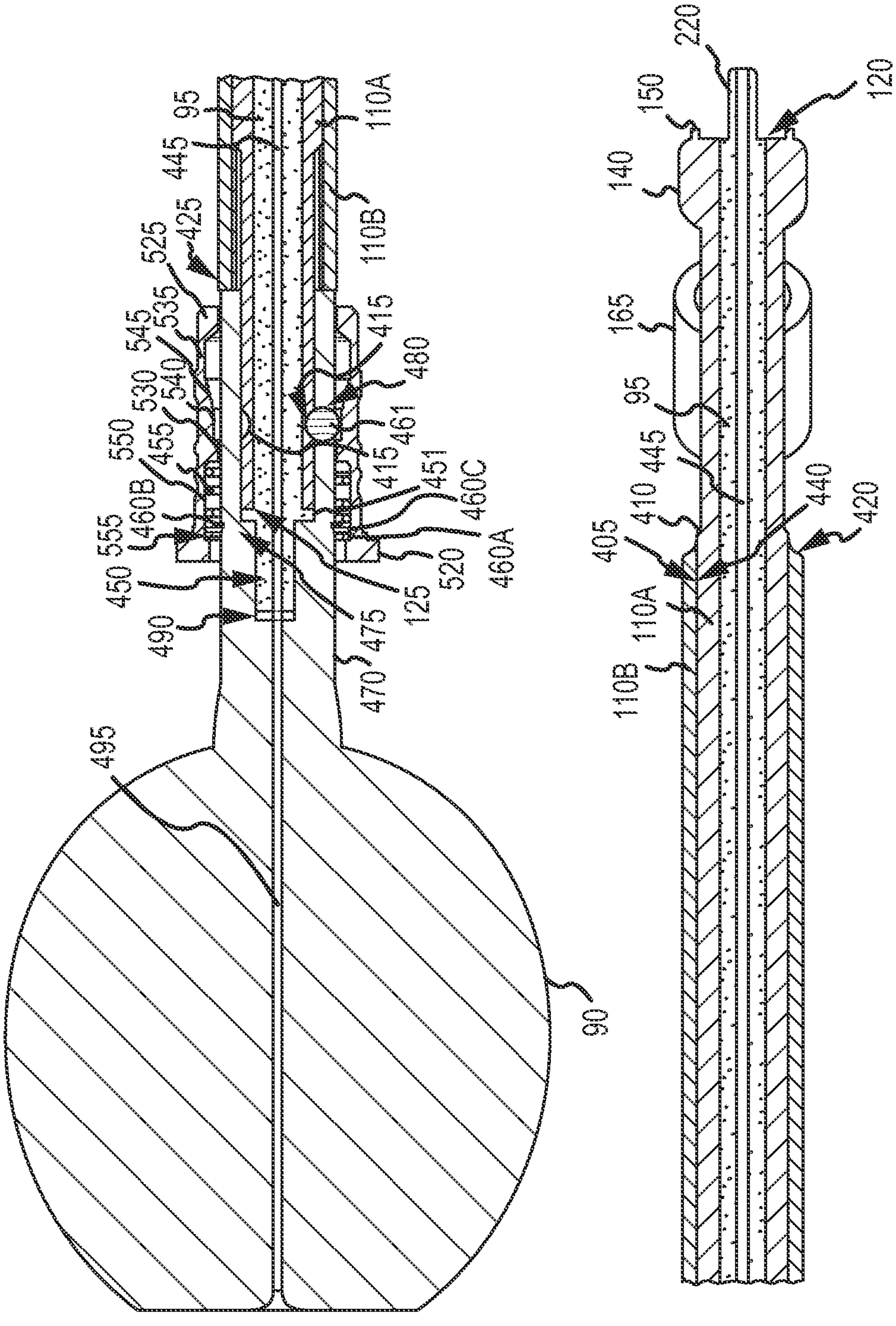
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FIG.91

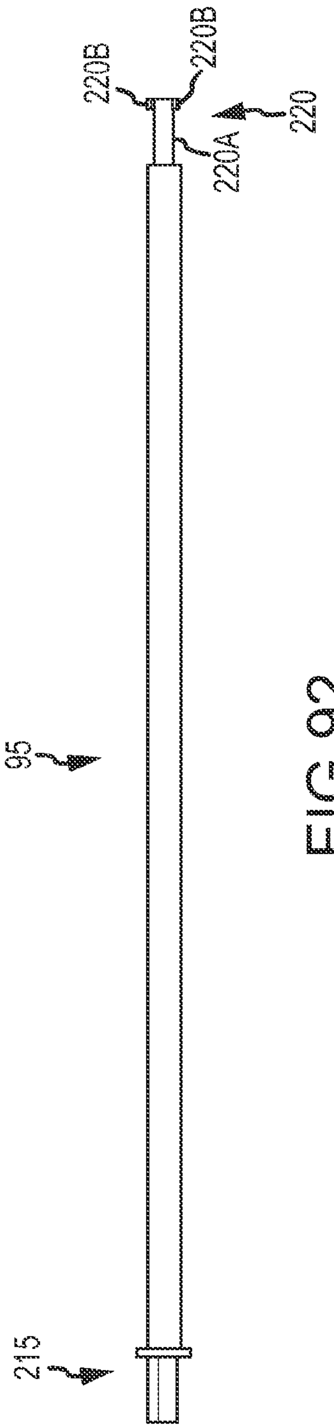

FIG.92

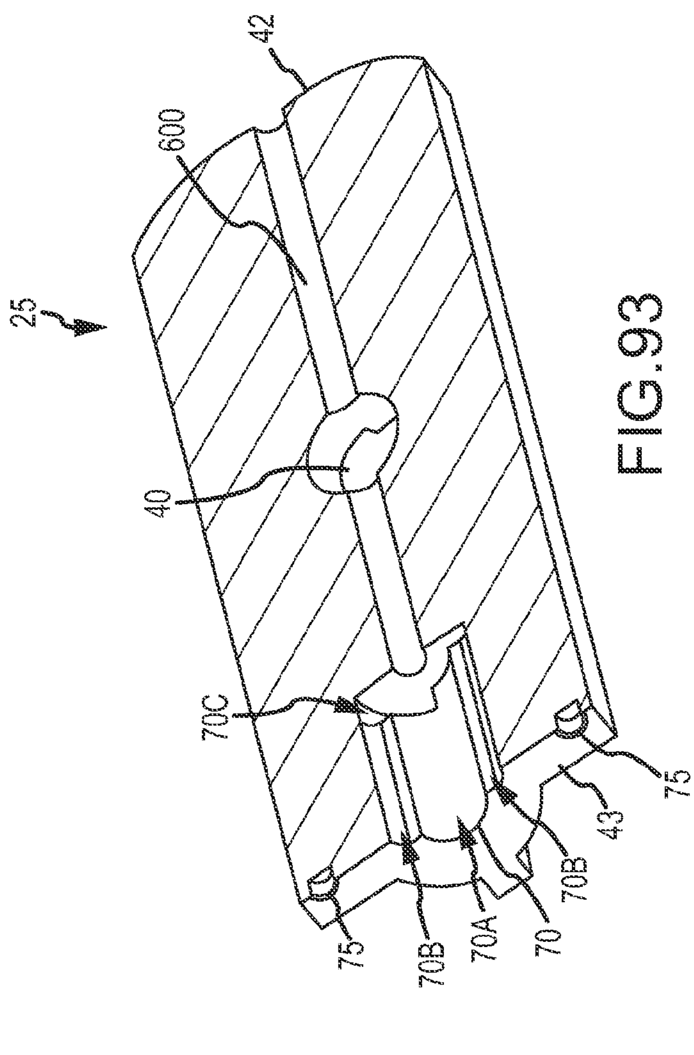

FIG.93

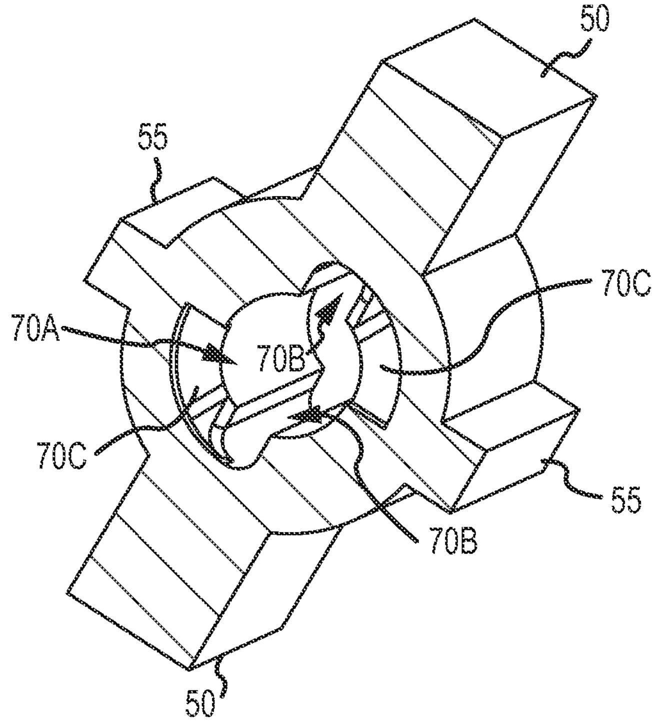

FIG.94

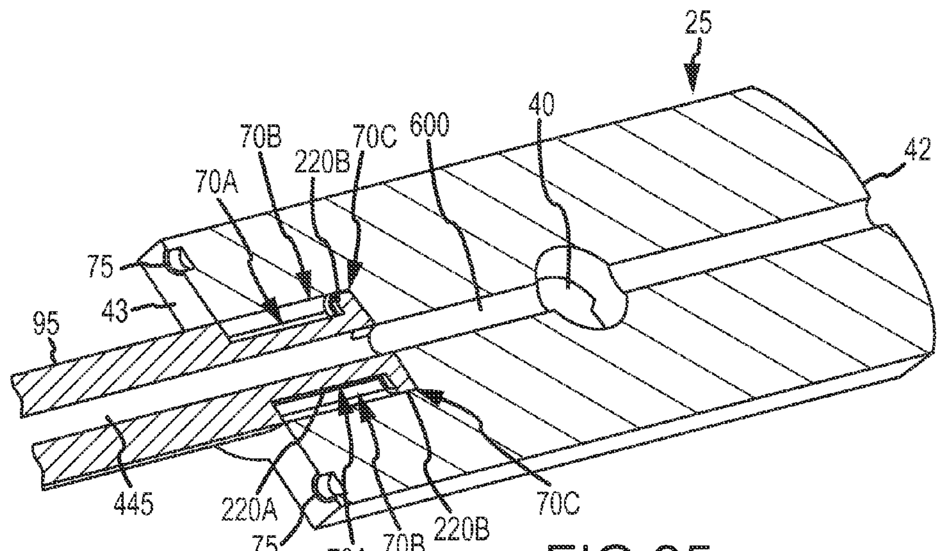
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FIG.95

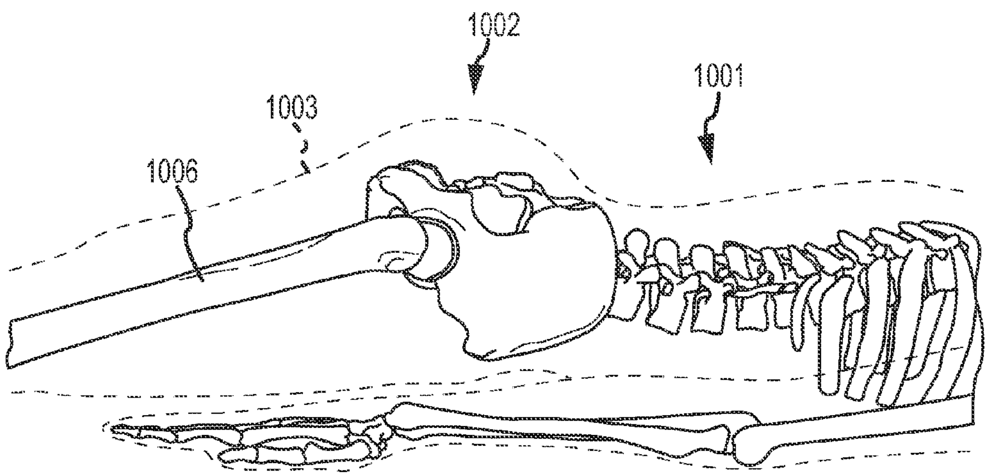

FIG.96A

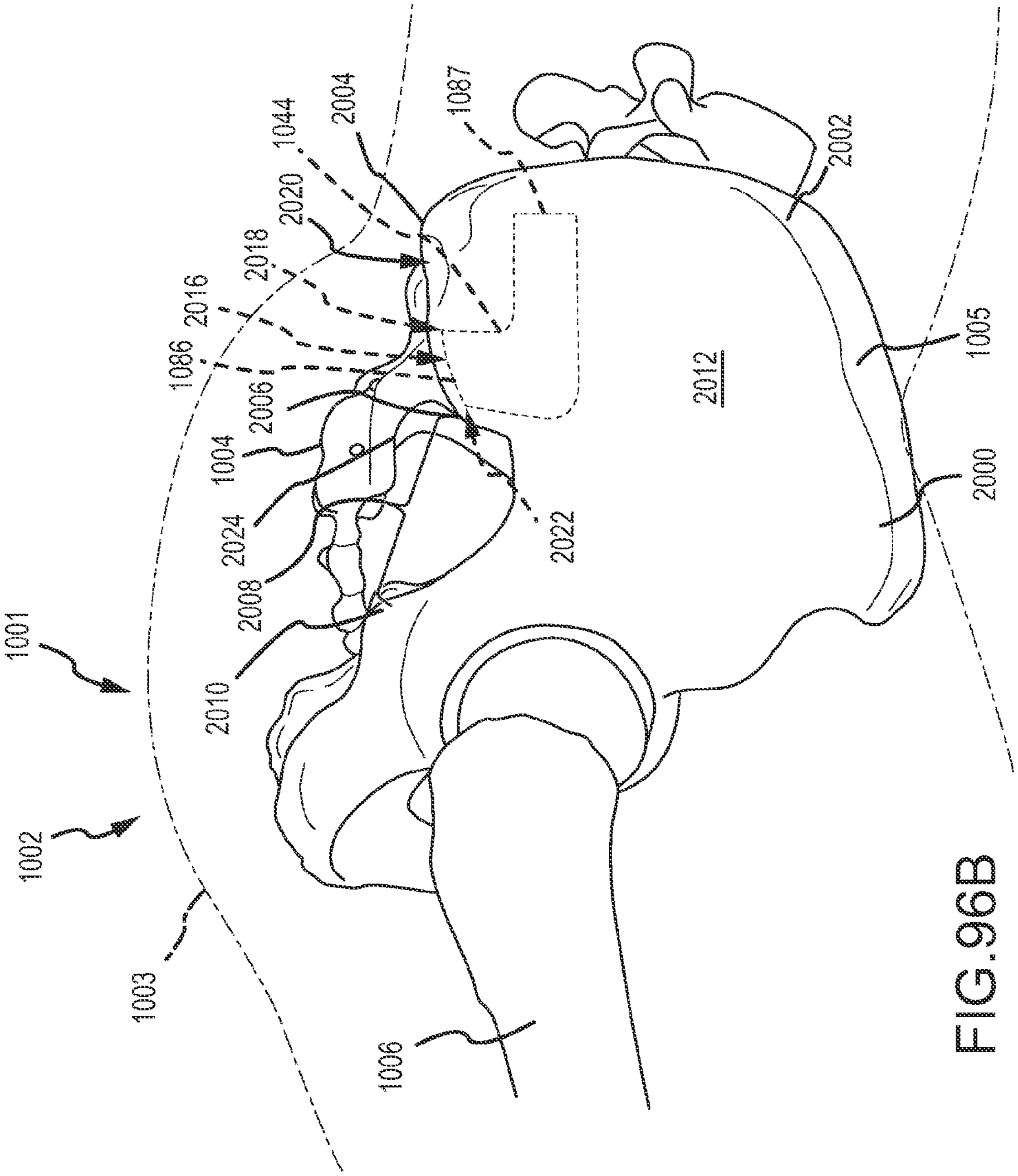
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FIG.96B

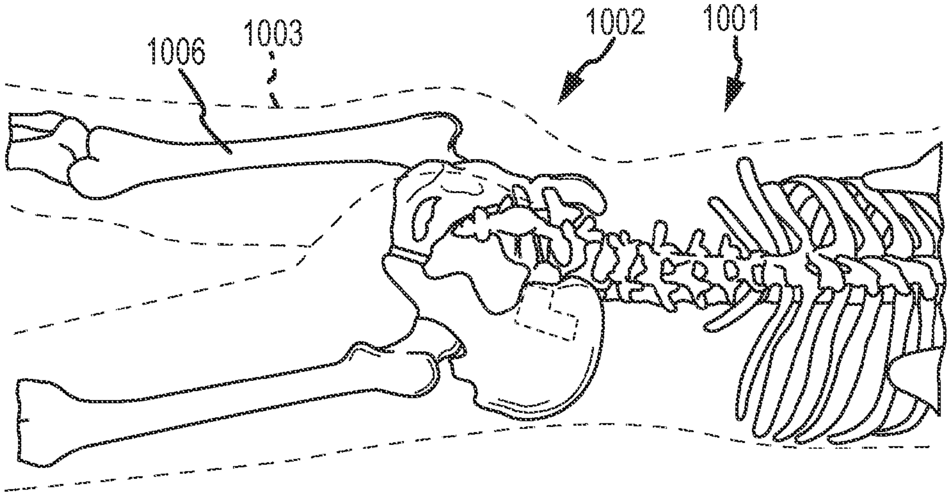

FIG.97A

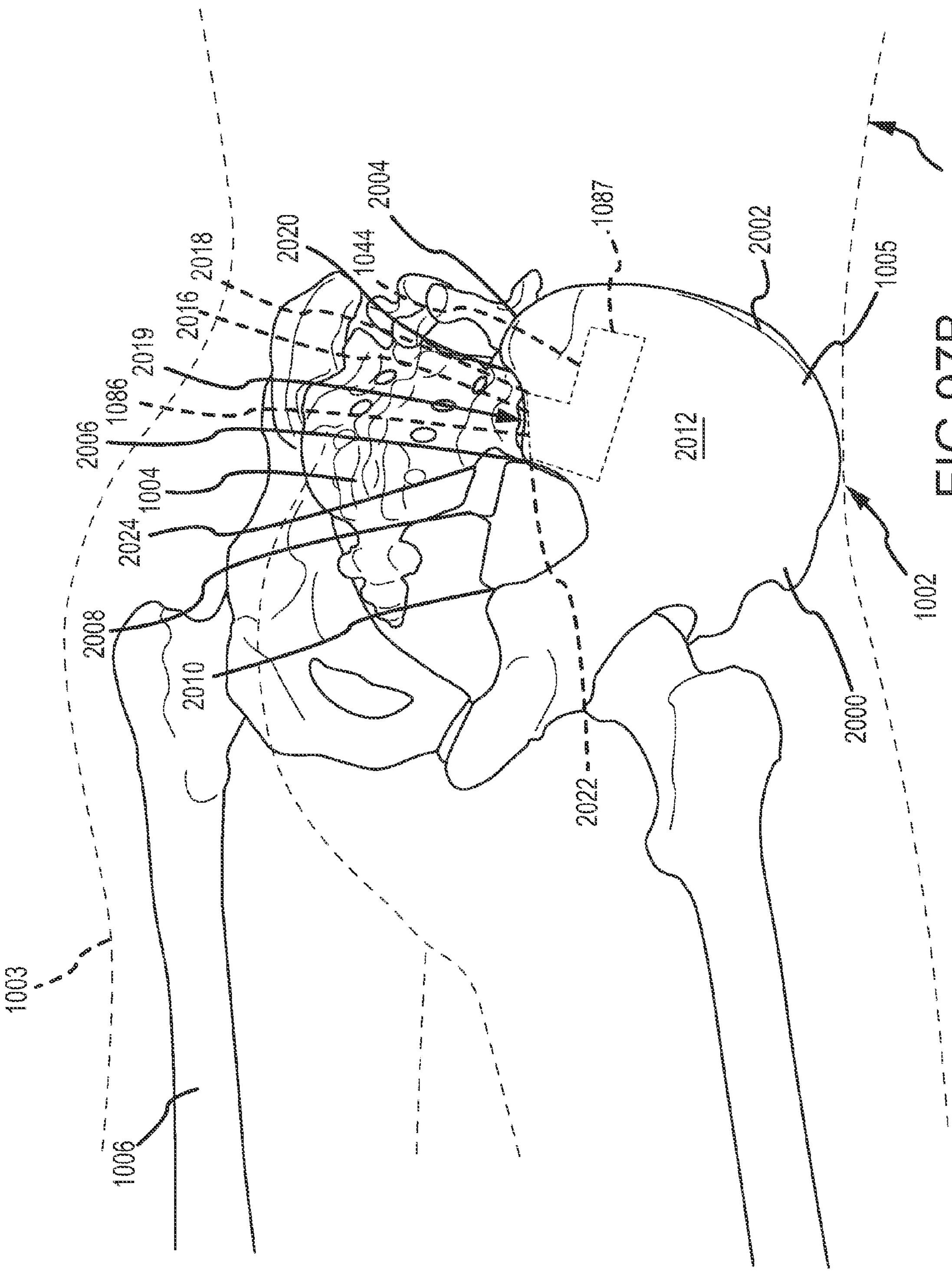
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FIG.97B

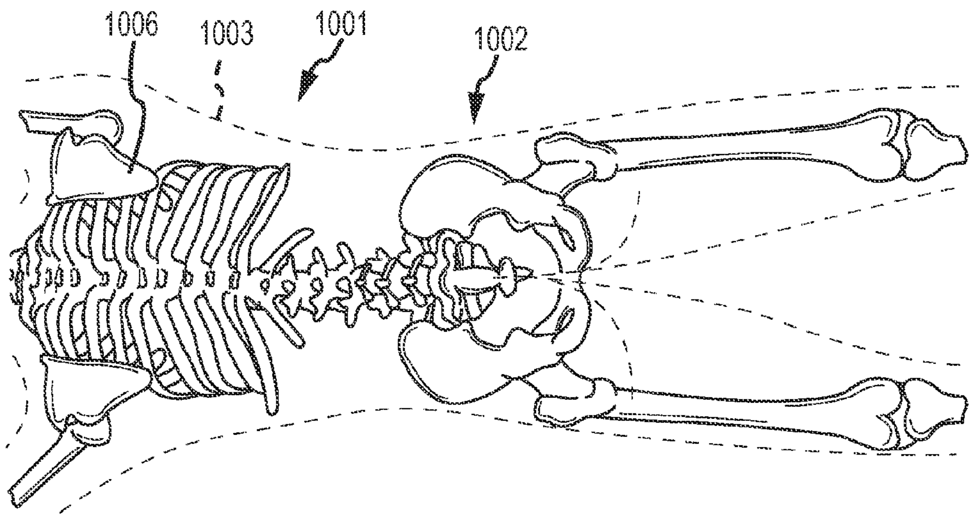

FIG.98A

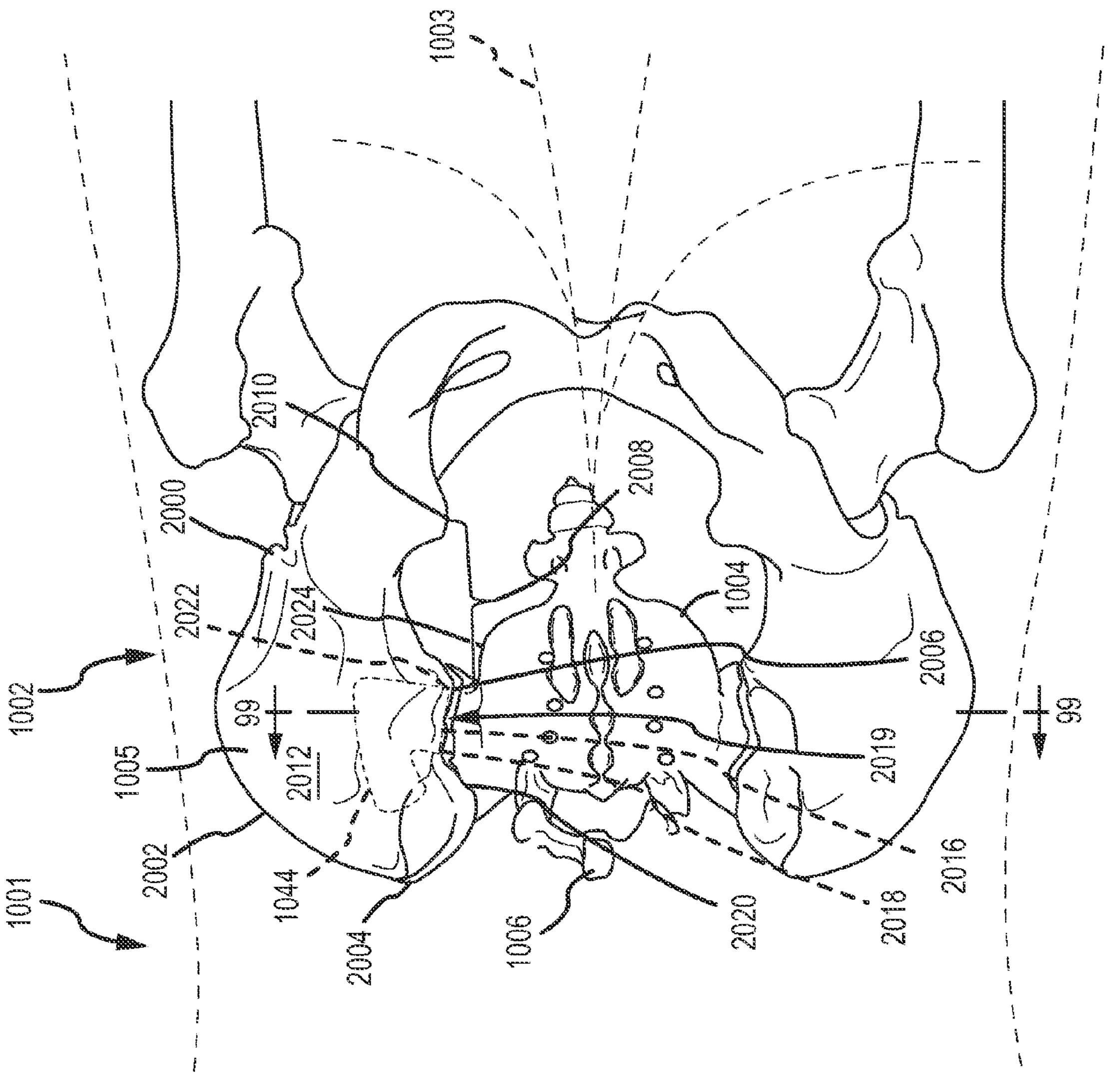
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FIG. 98B

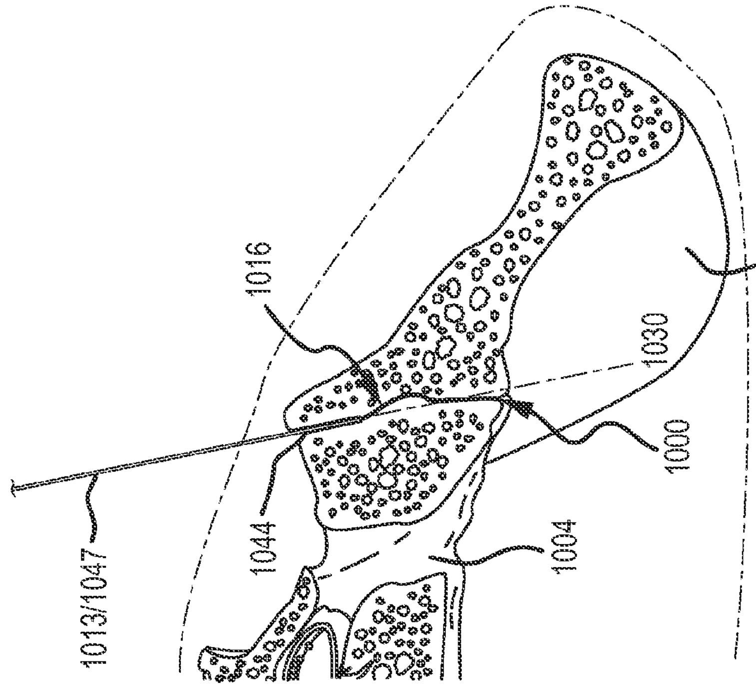


FIG.99B

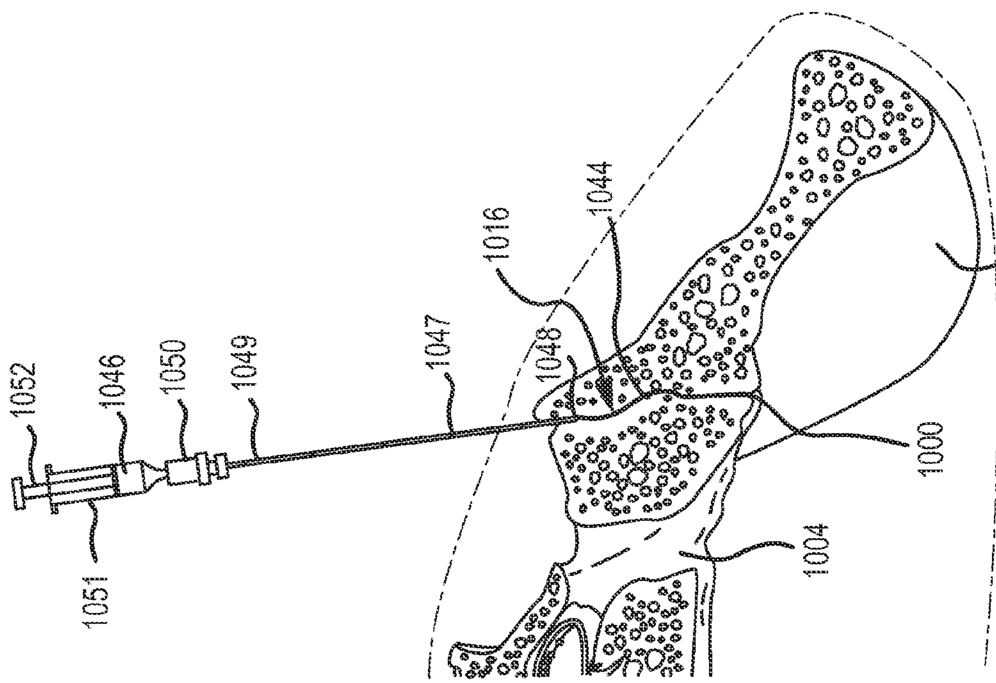


FIG.99A

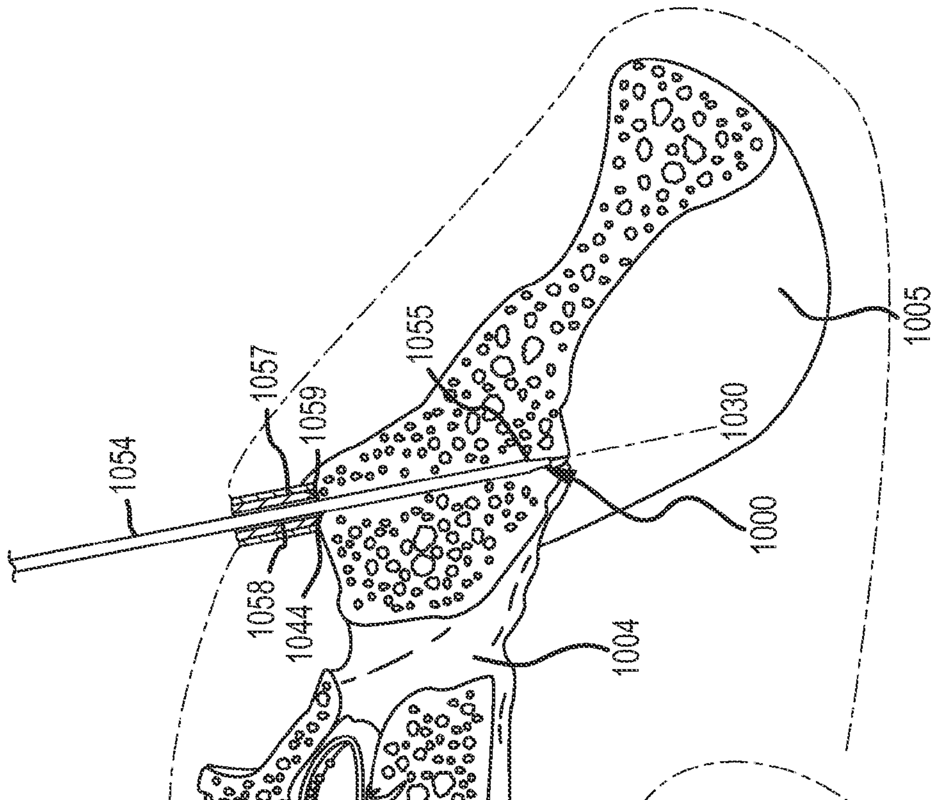


FIG.99D

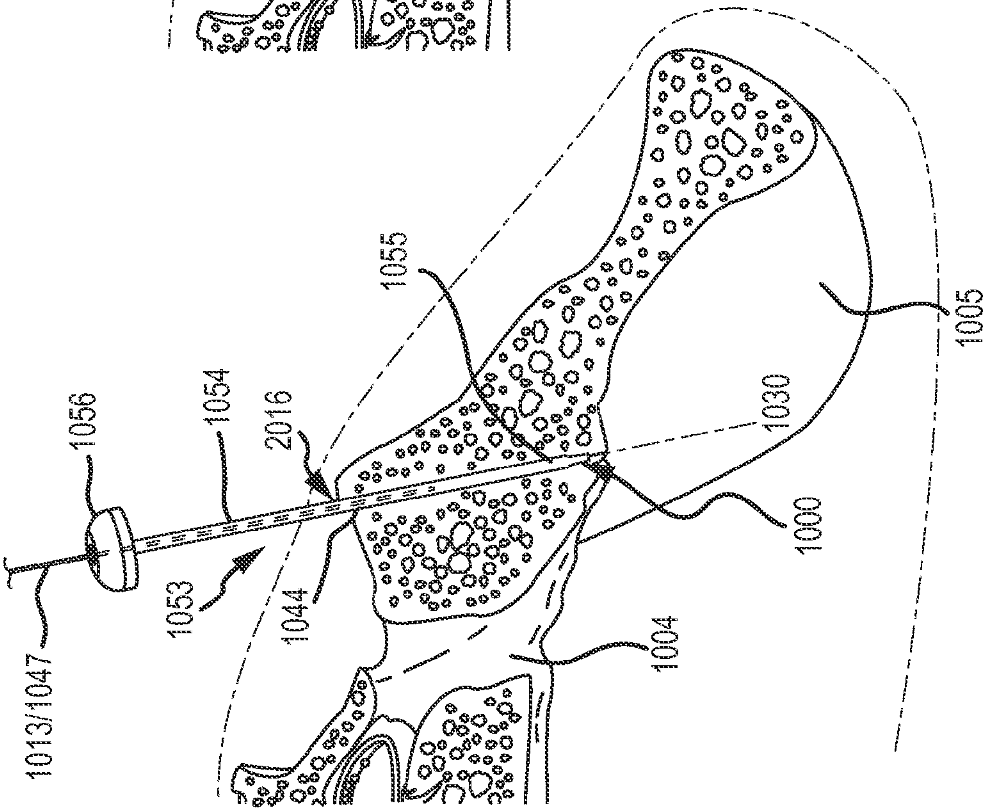


FIG.99C

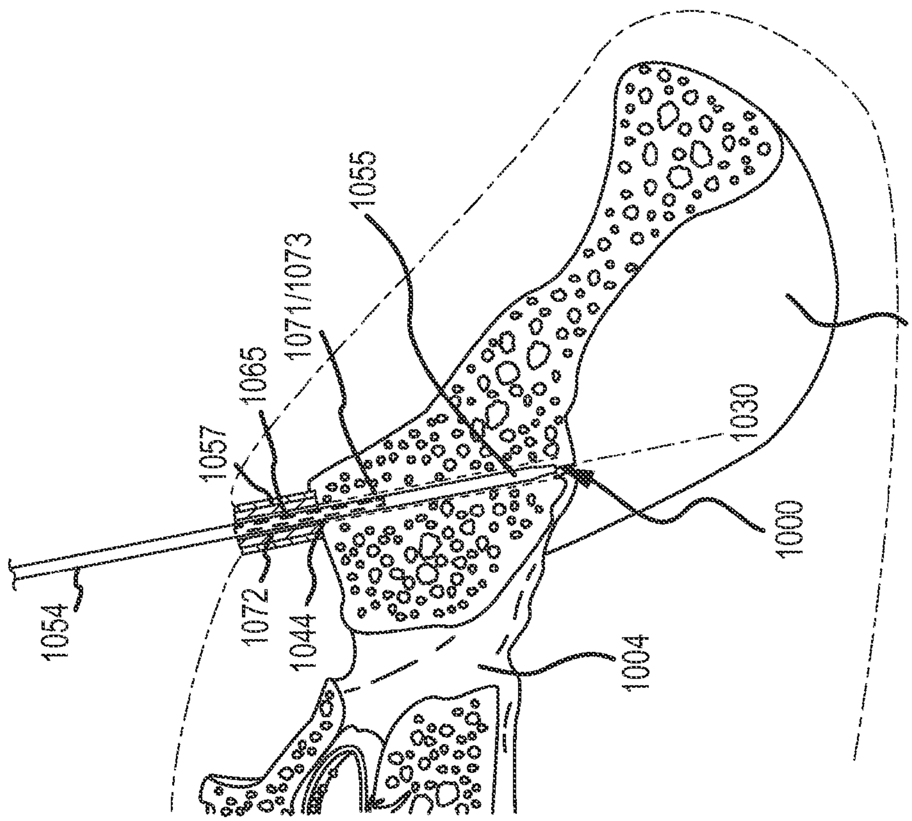


FIG.99F

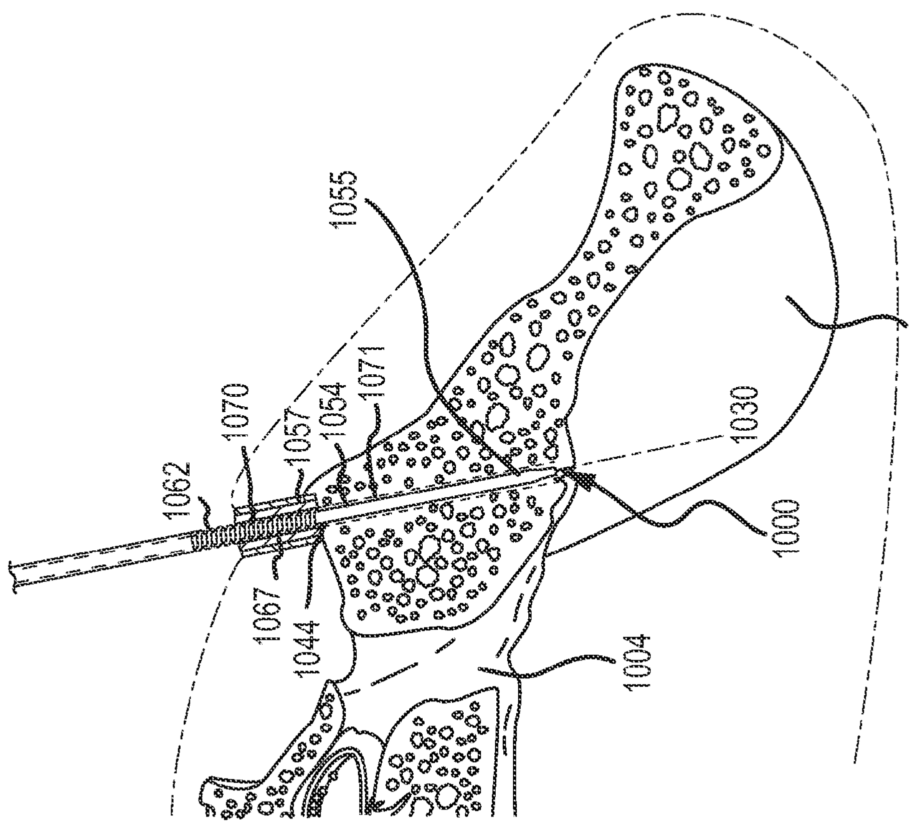


FIG.99E

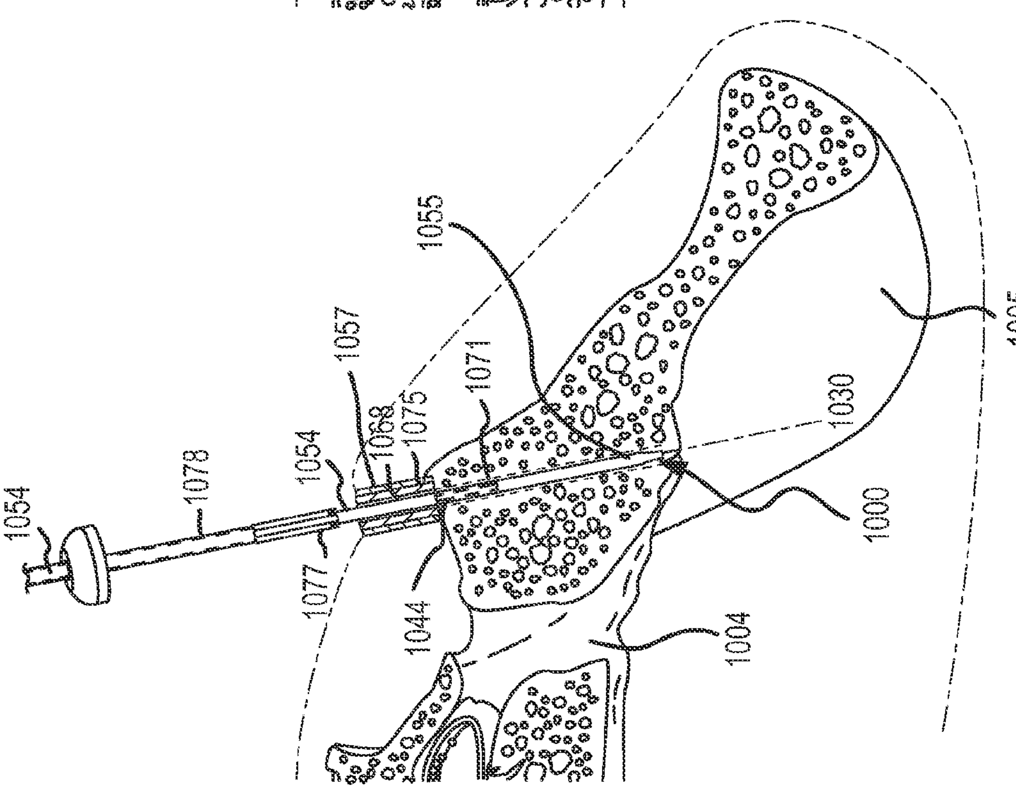


FIG.99G

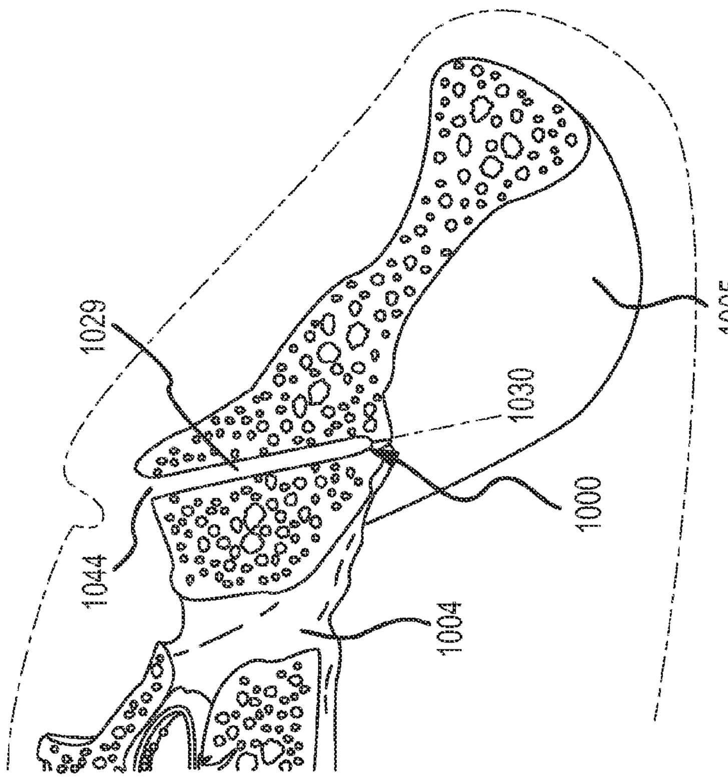


FIG.99H

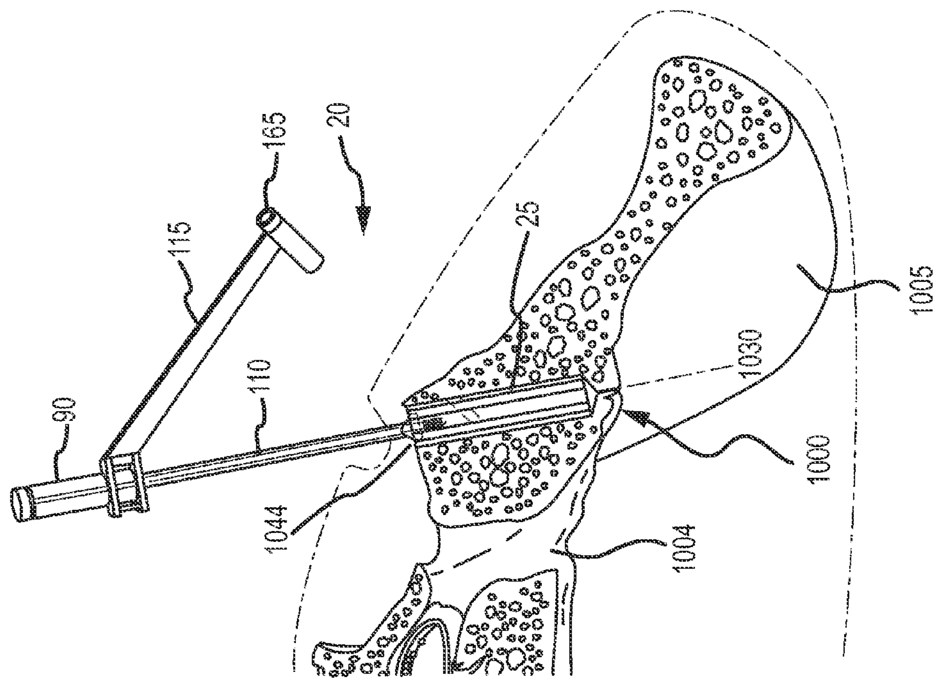


FIG.99J

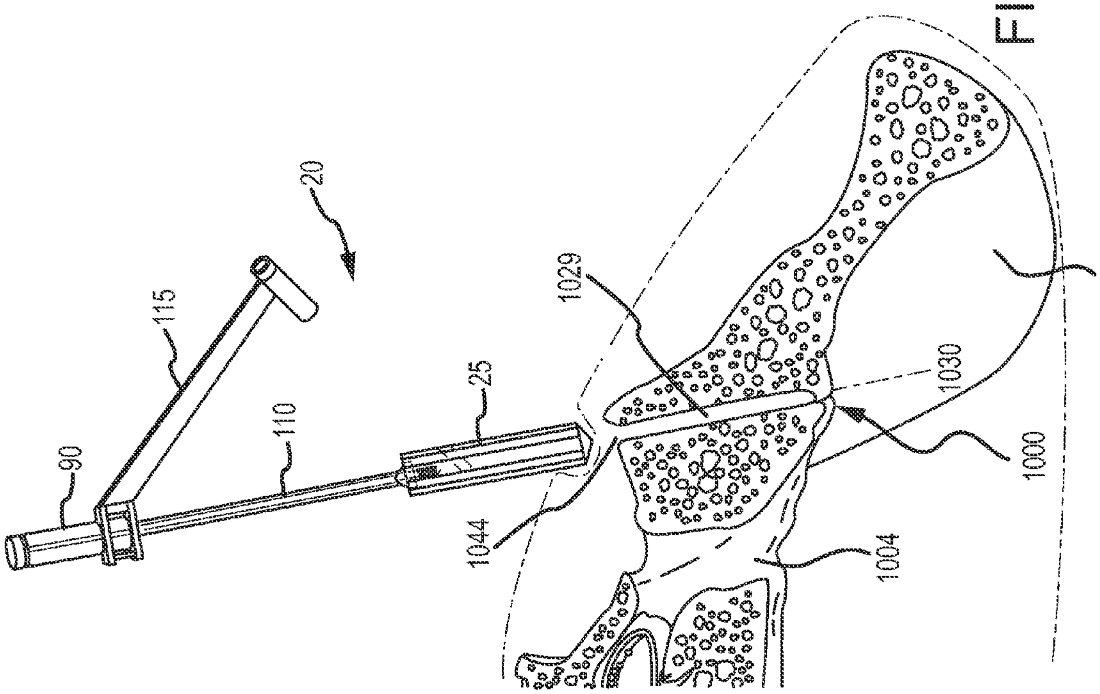


FIG.99I

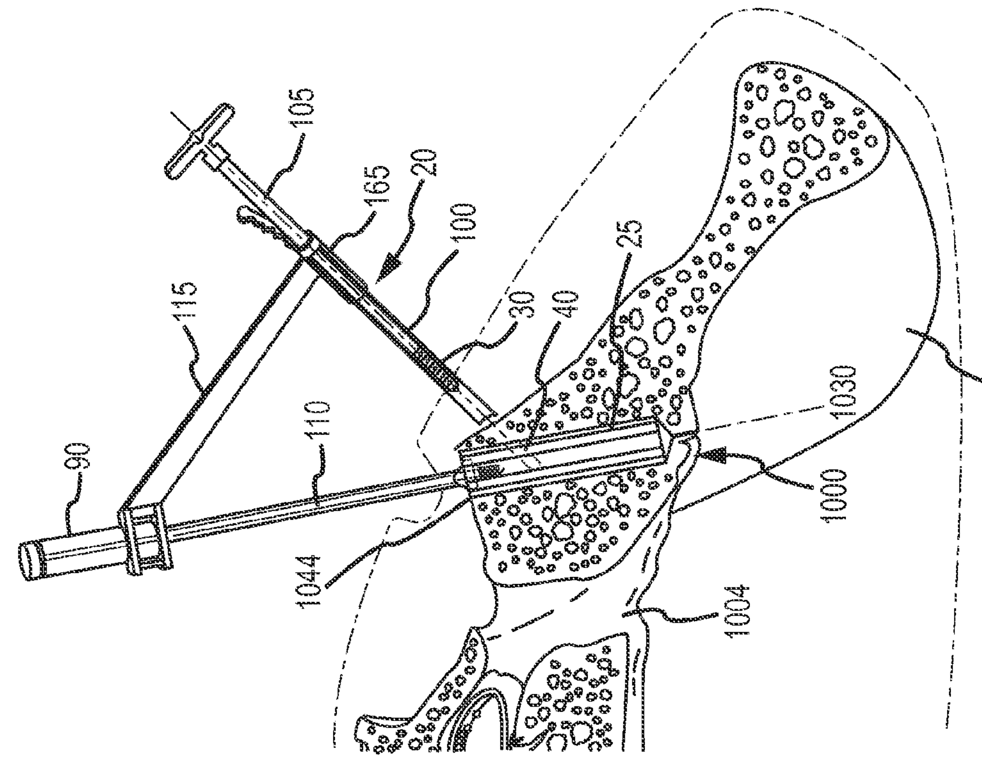


FIG.99L

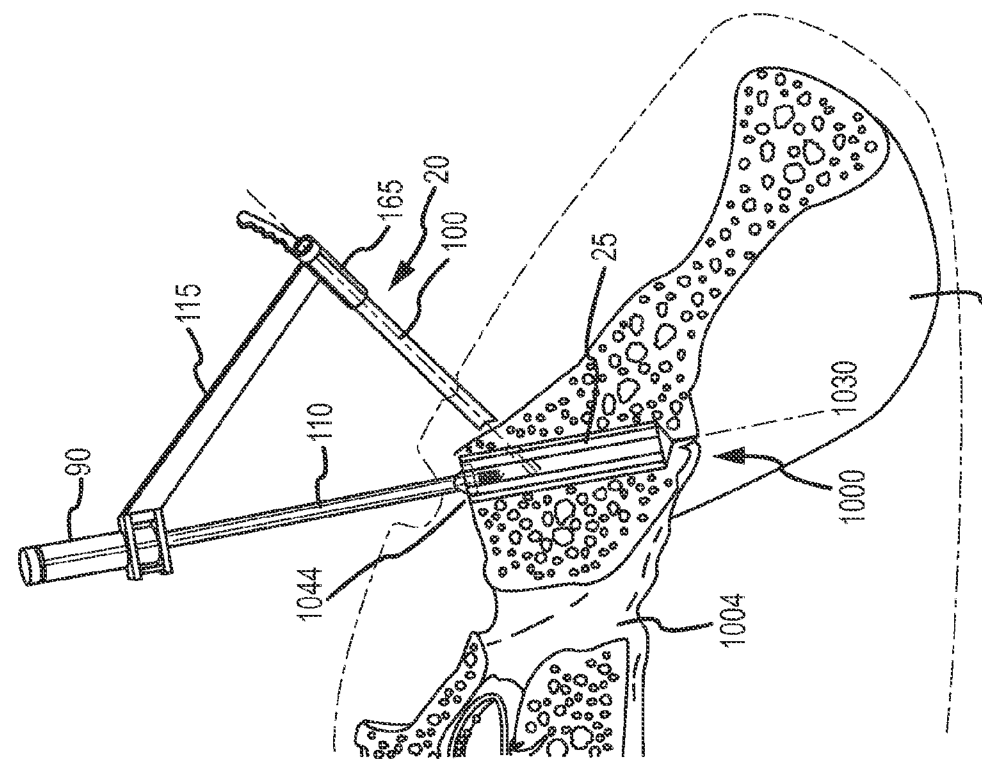


FIG.99K

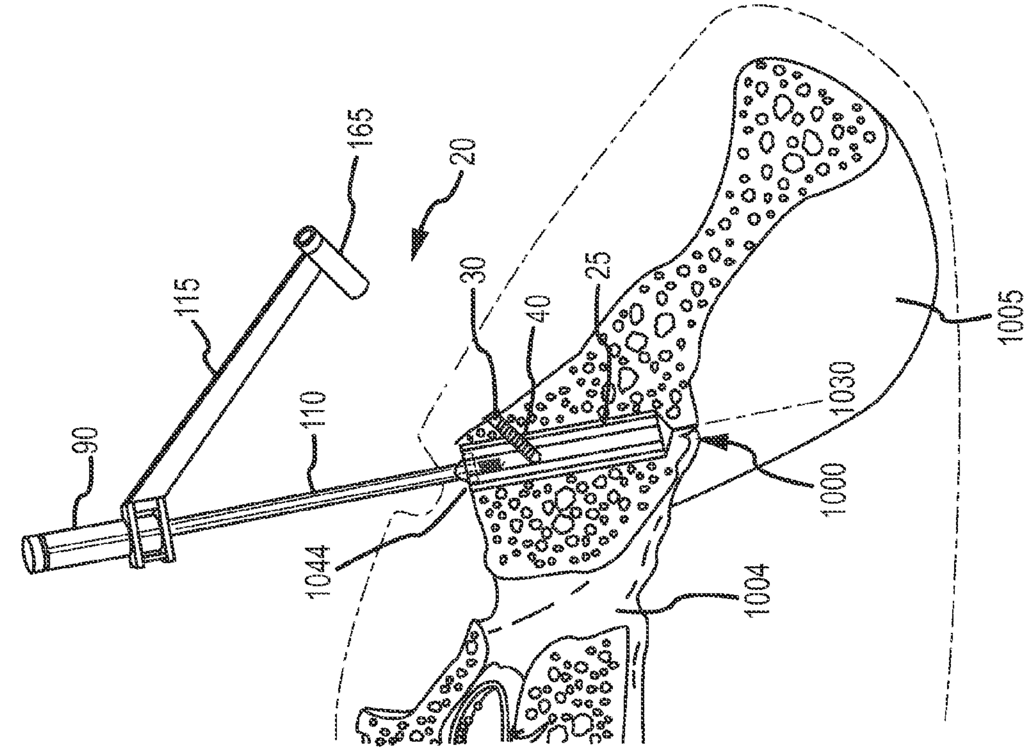


FIG.99N

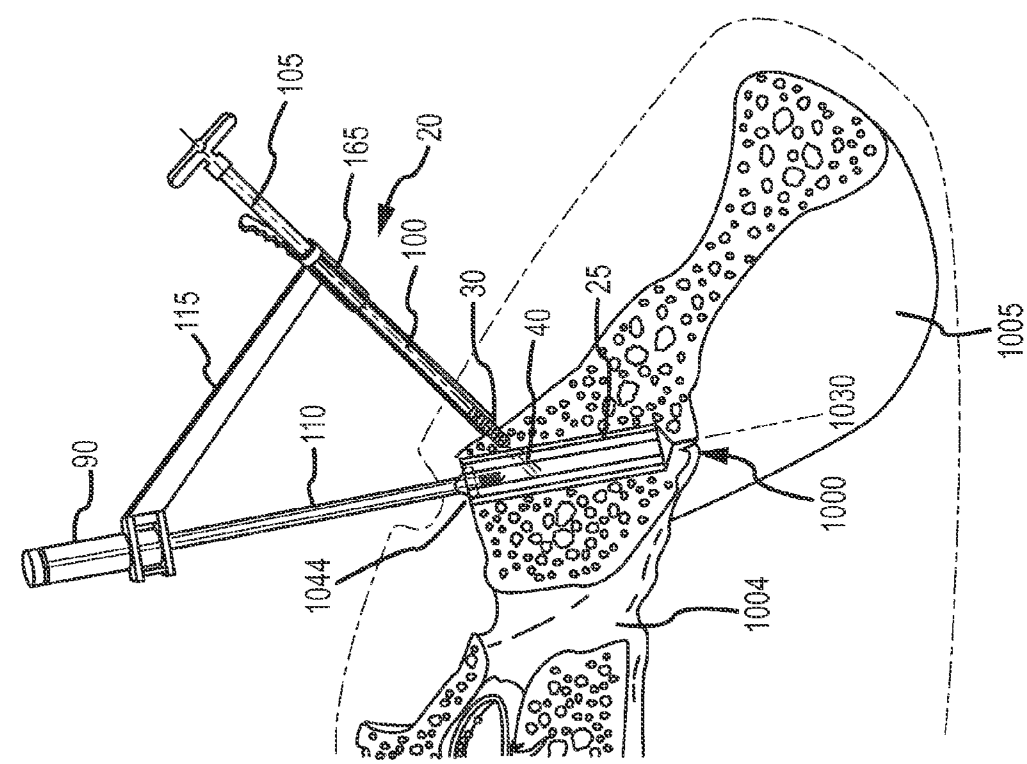


FIG.99M

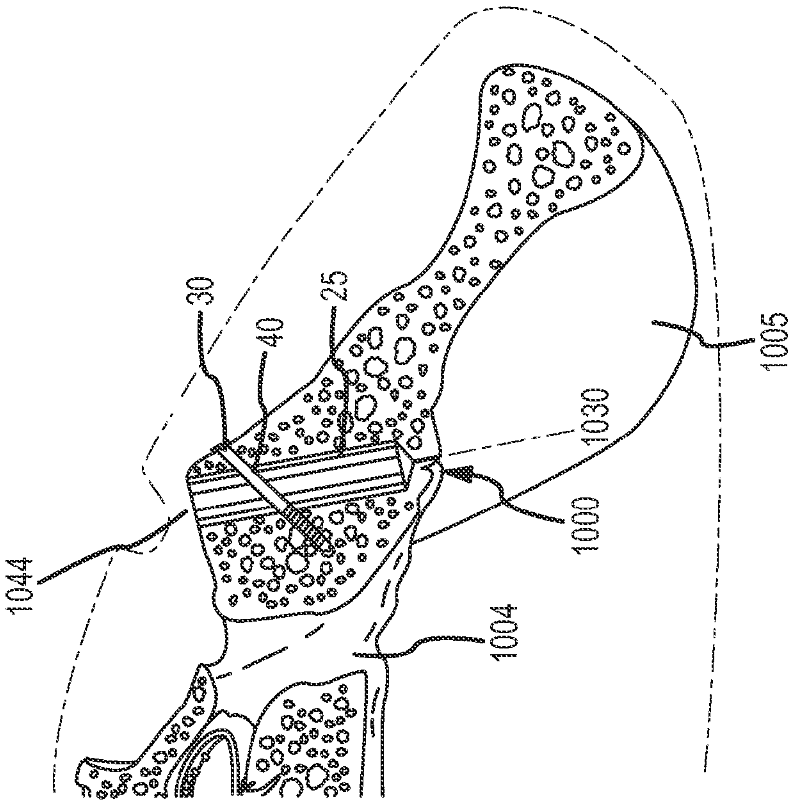


FIG.99P

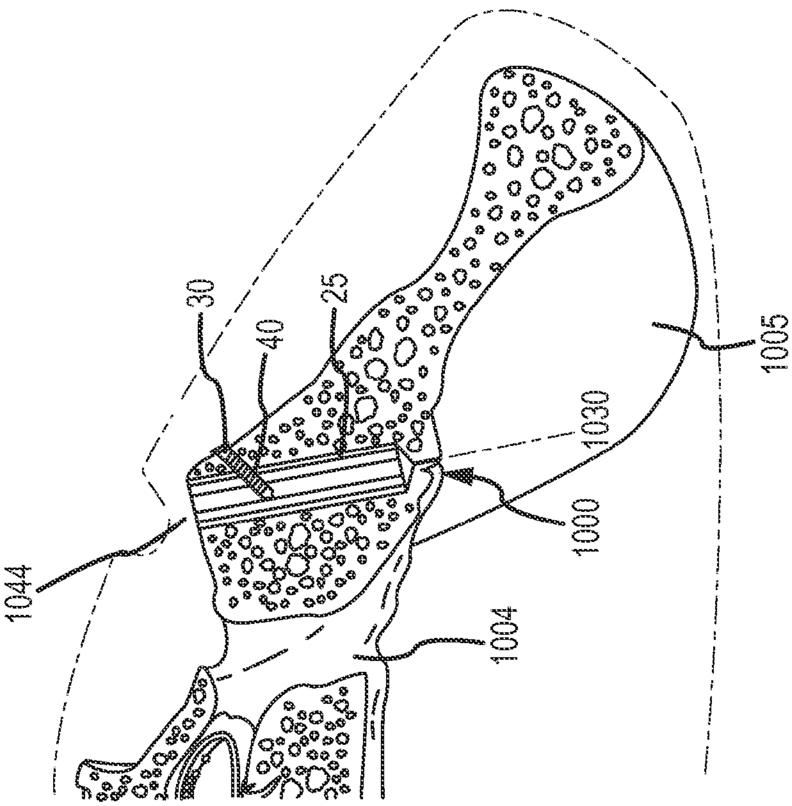


FIG.99O

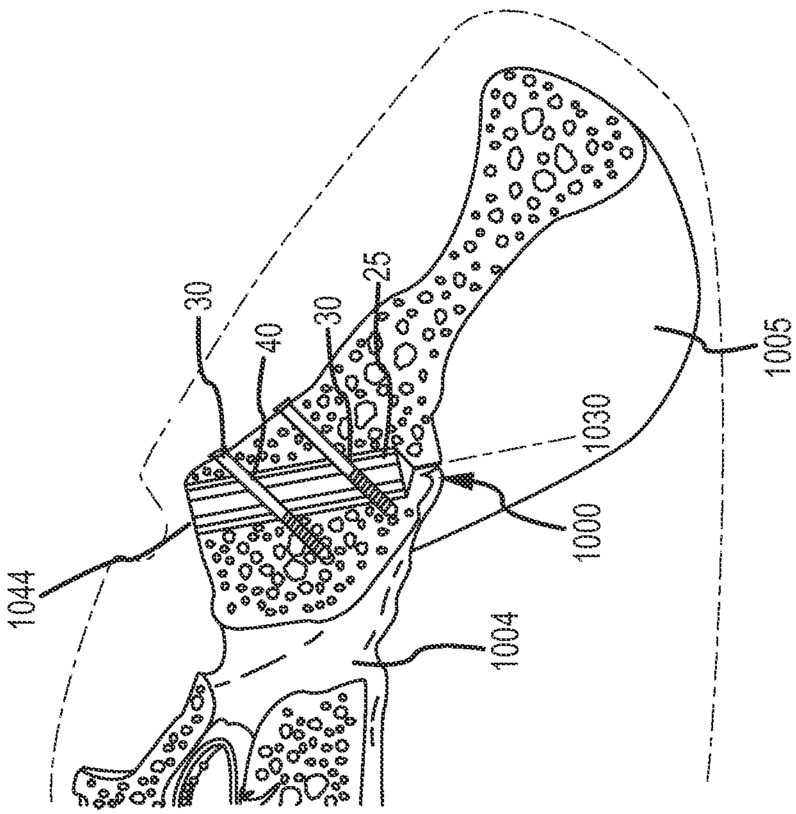


FIG.99Q

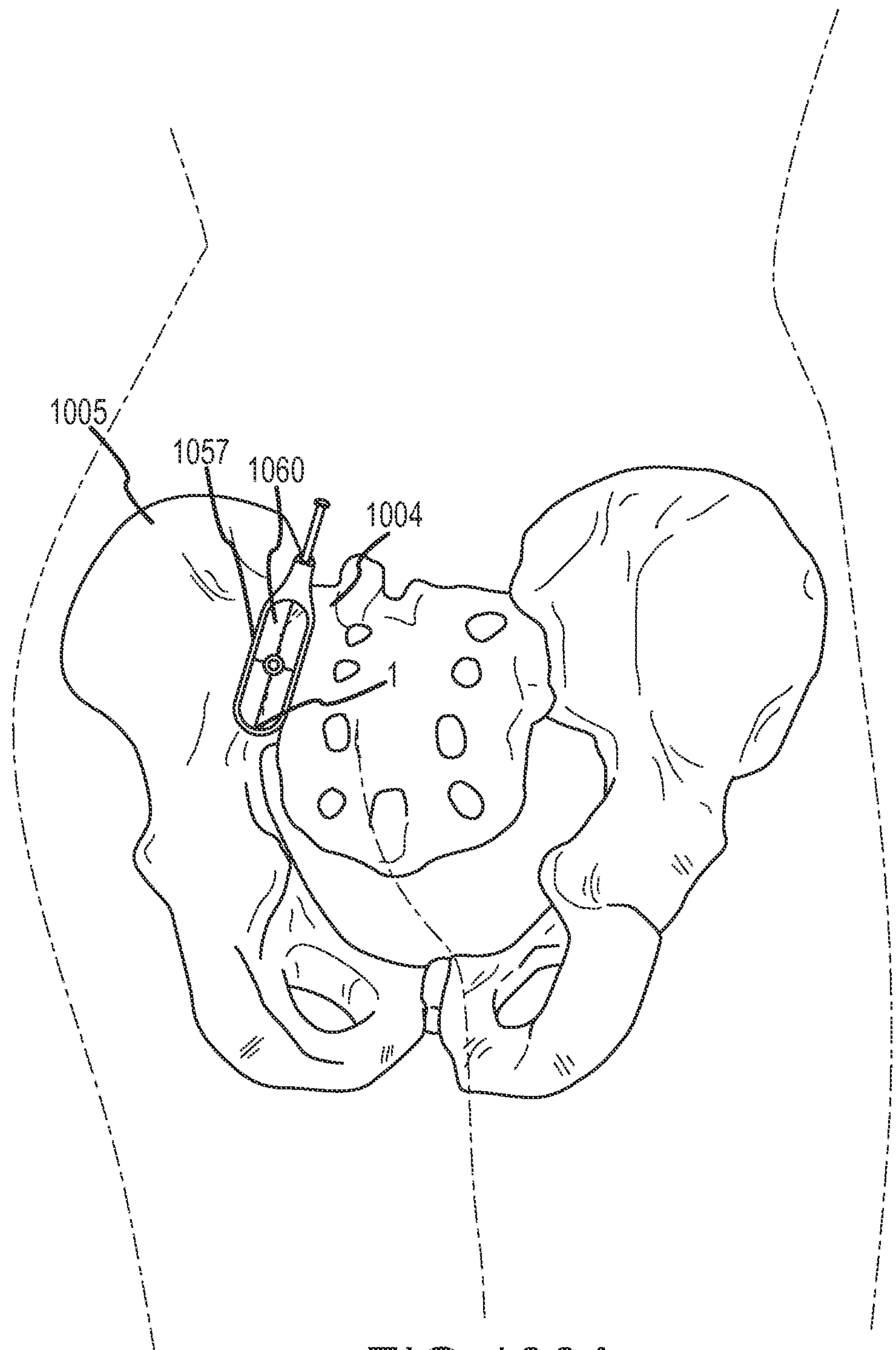


FIG.100A

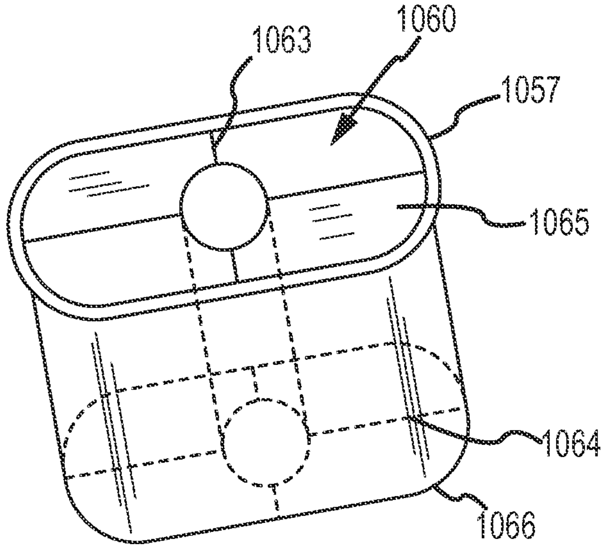


FIG.100B

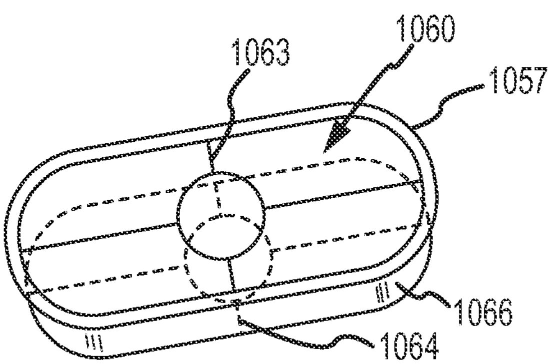


FIG.100C

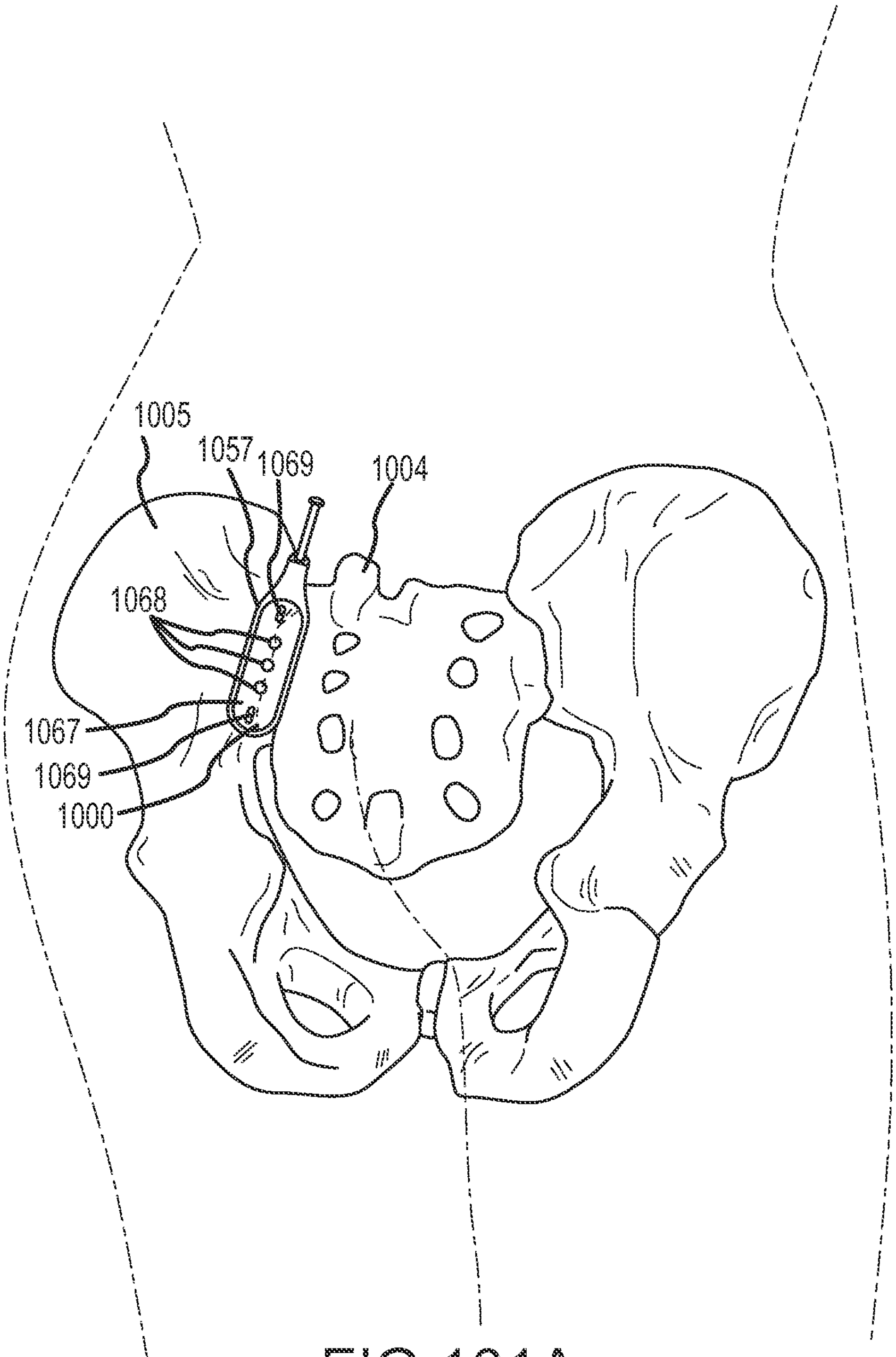


FIG.101A

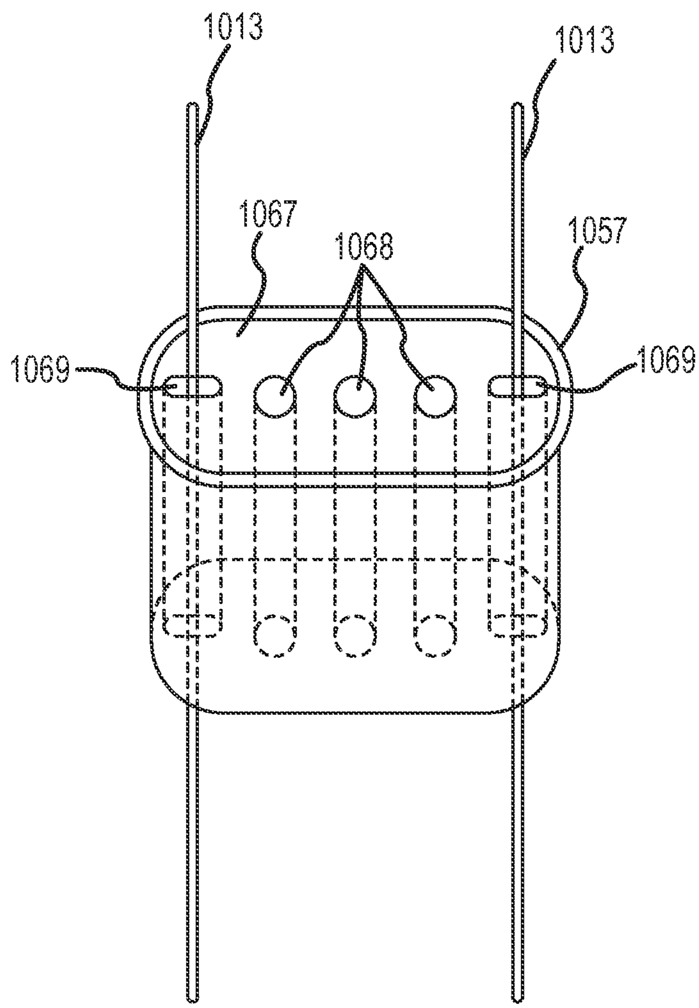


FIG.101B

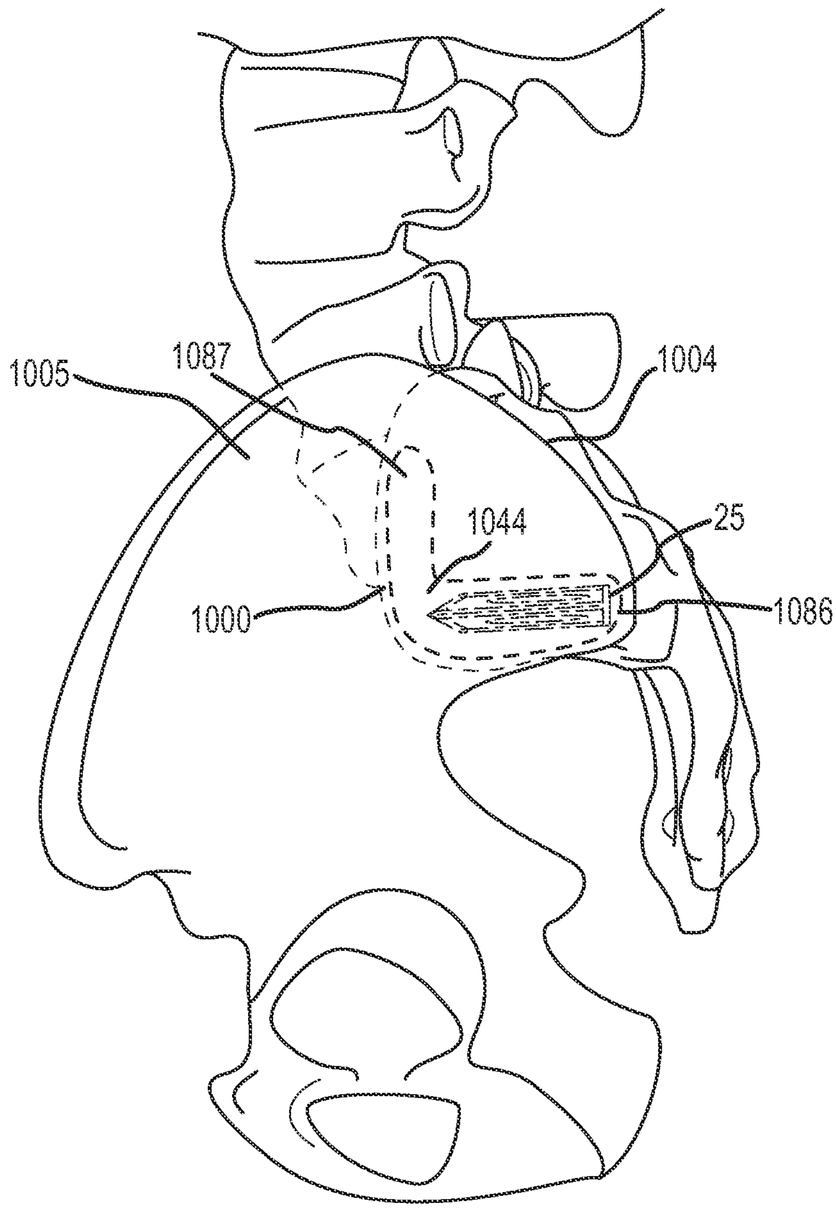


FIG.102A

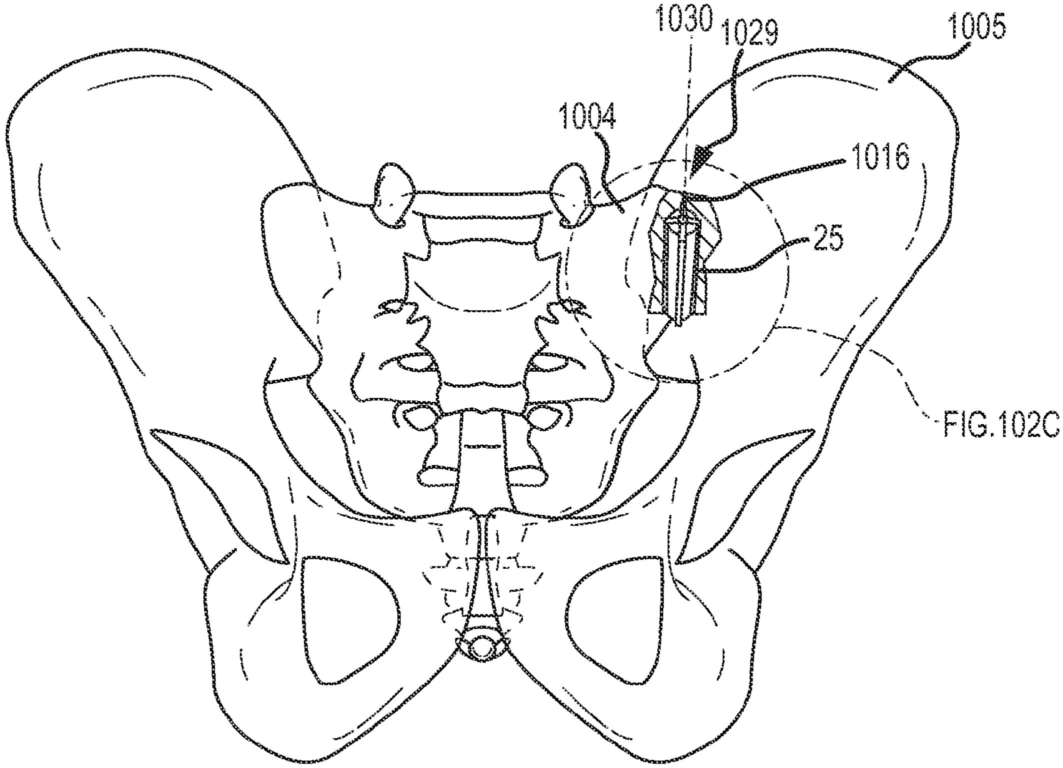


FIG.102B

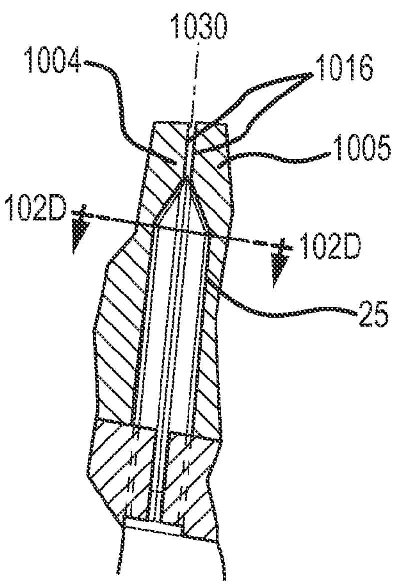


FIG.102C

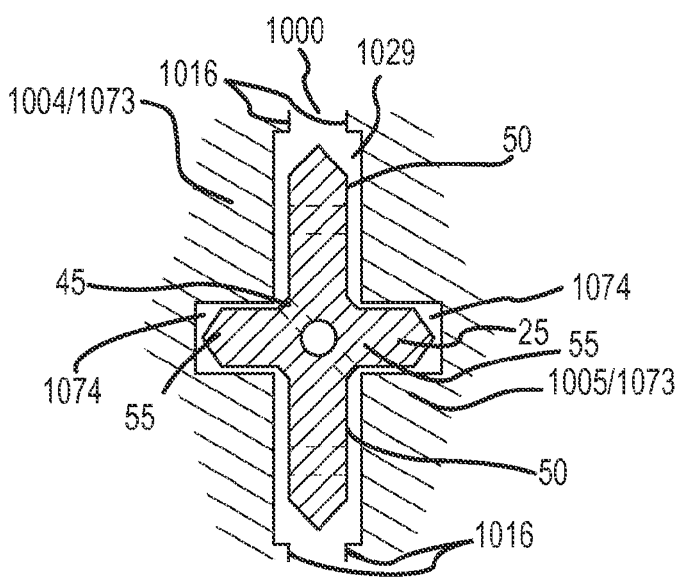


FIG.102D

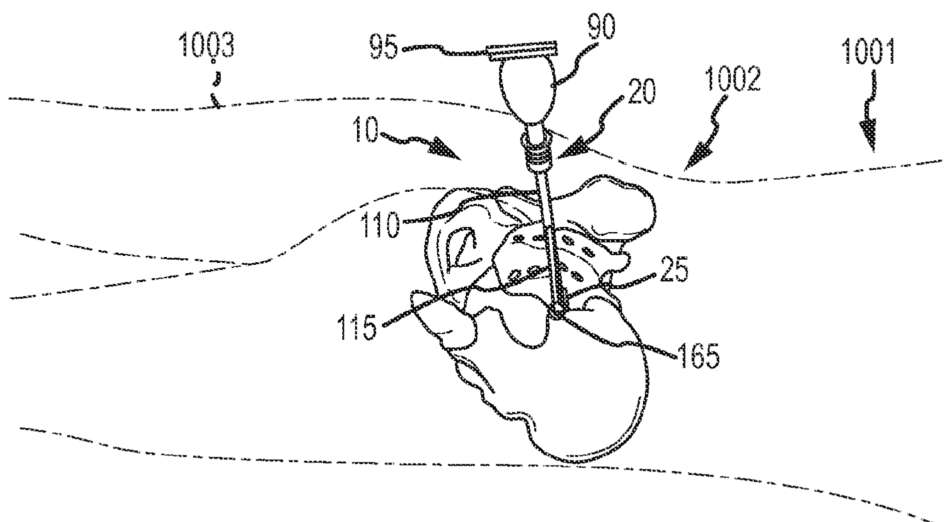


FIG.103A

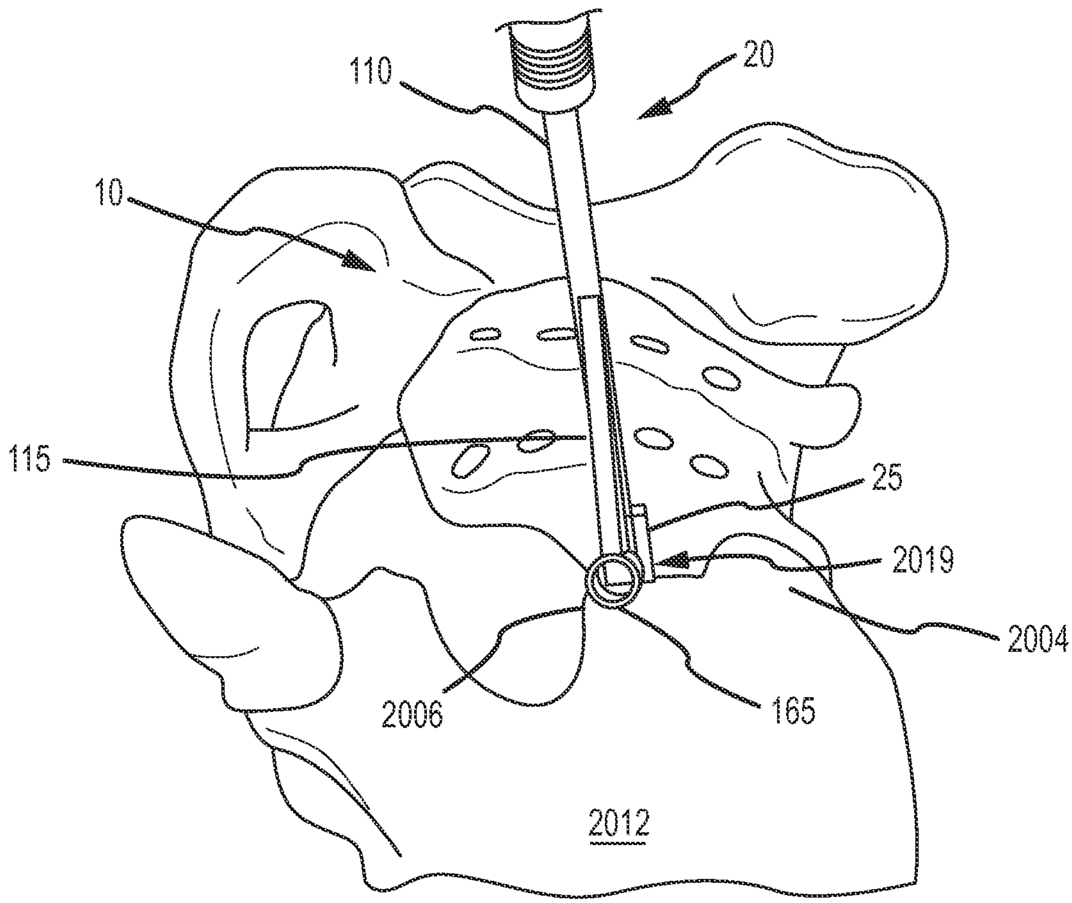


FIG.103B

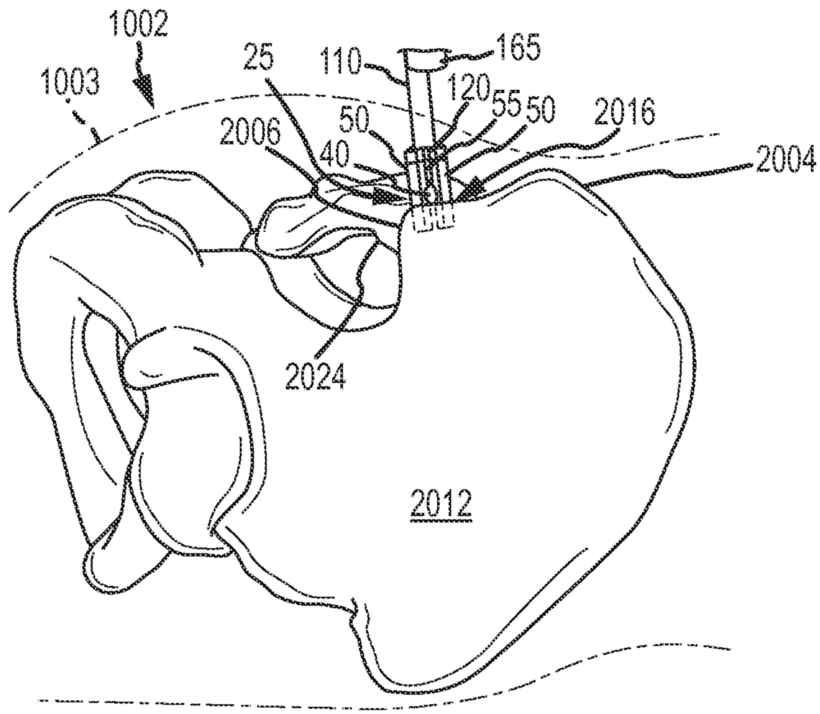


FIG.104

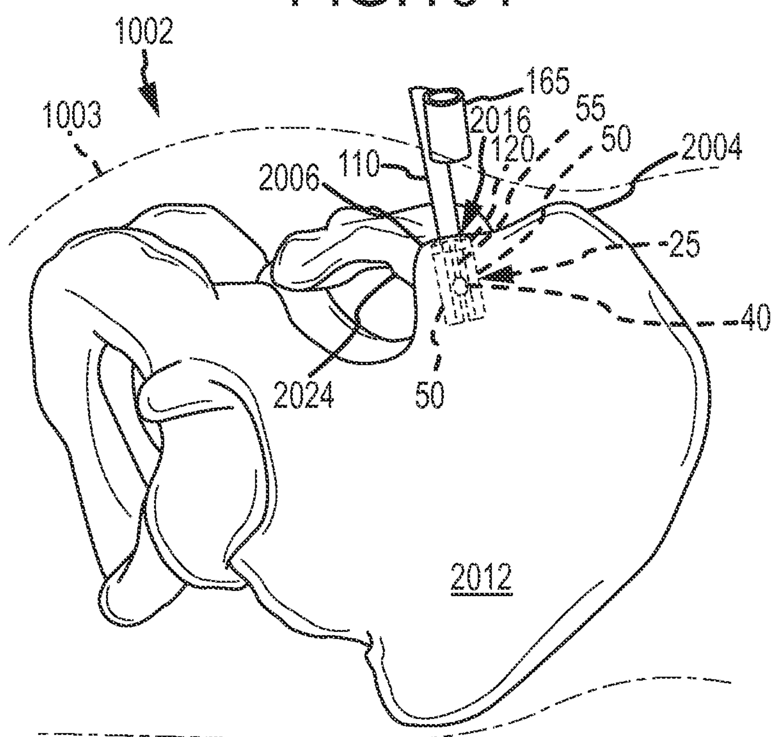
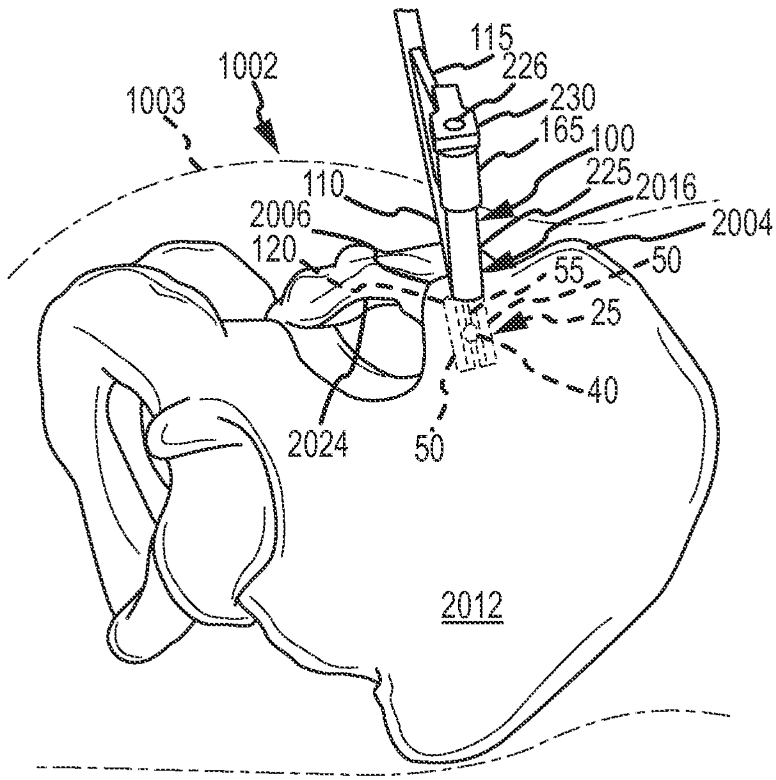


FIG.105


115
226
230
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2016
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FIG.106A

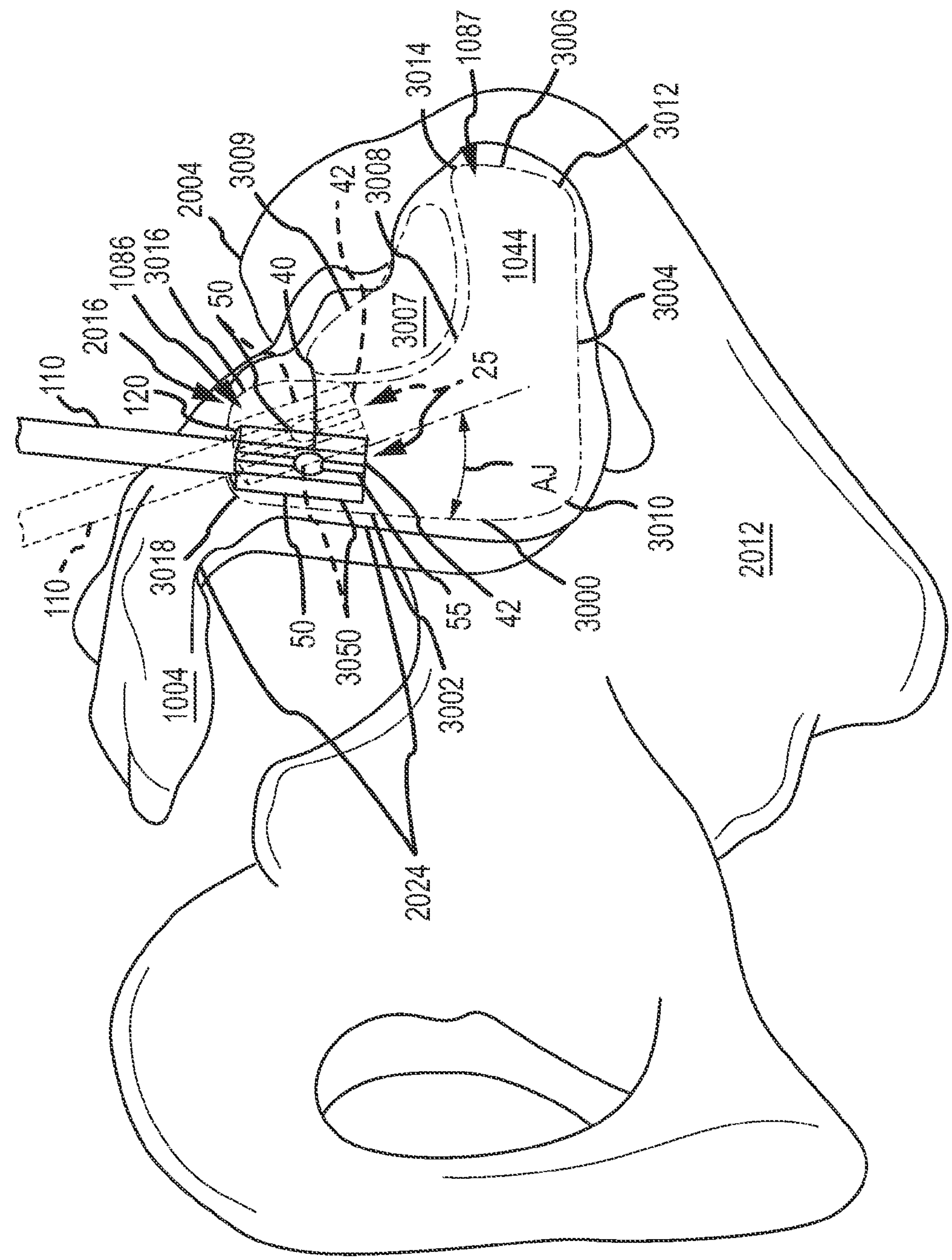
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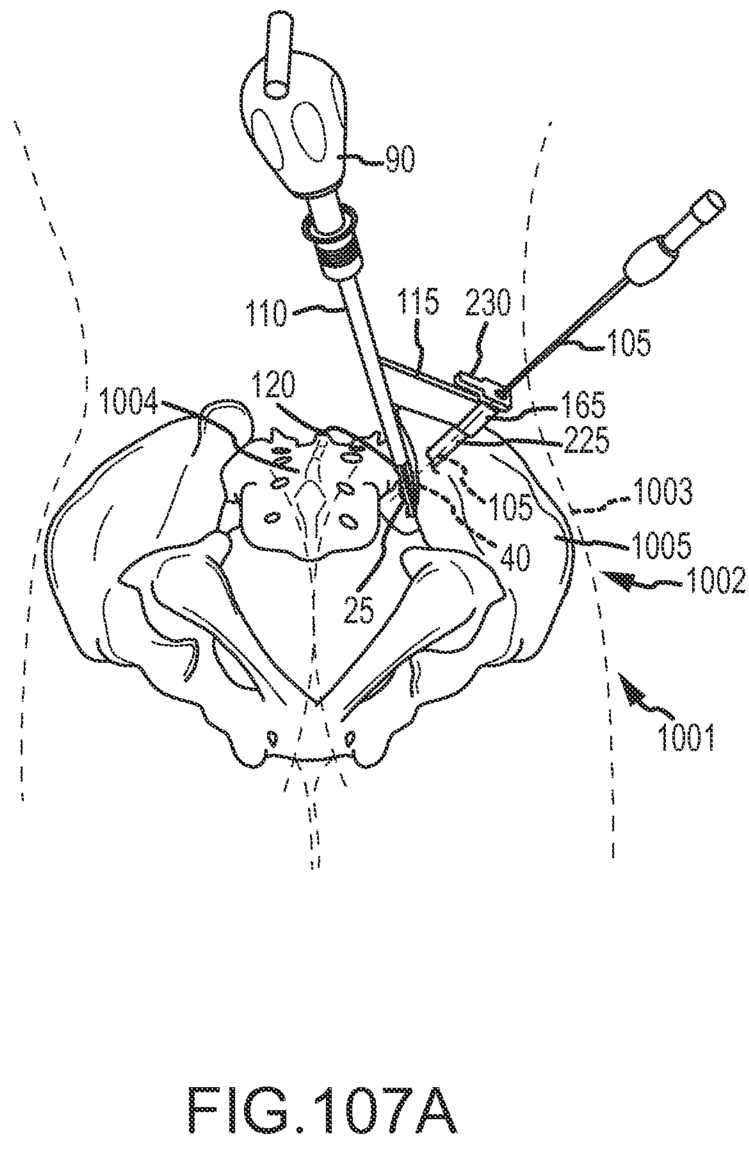
FIG.106B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1001

FIG.107A

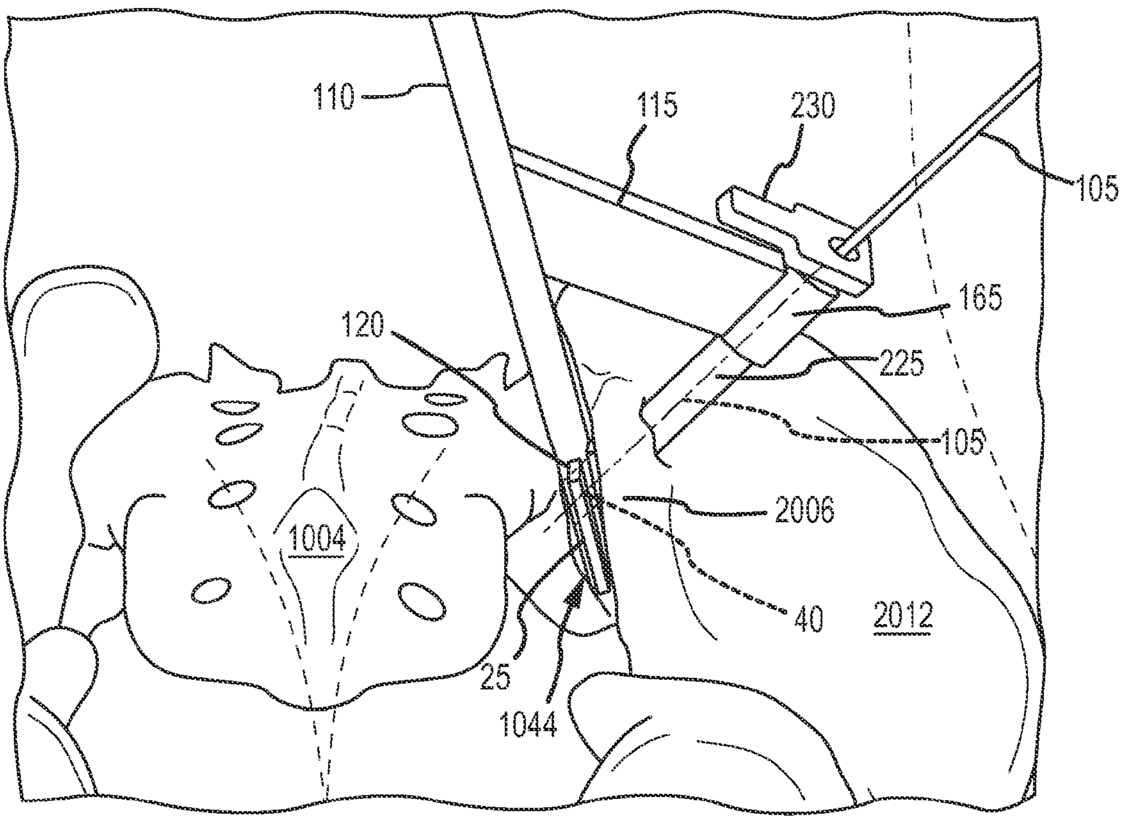
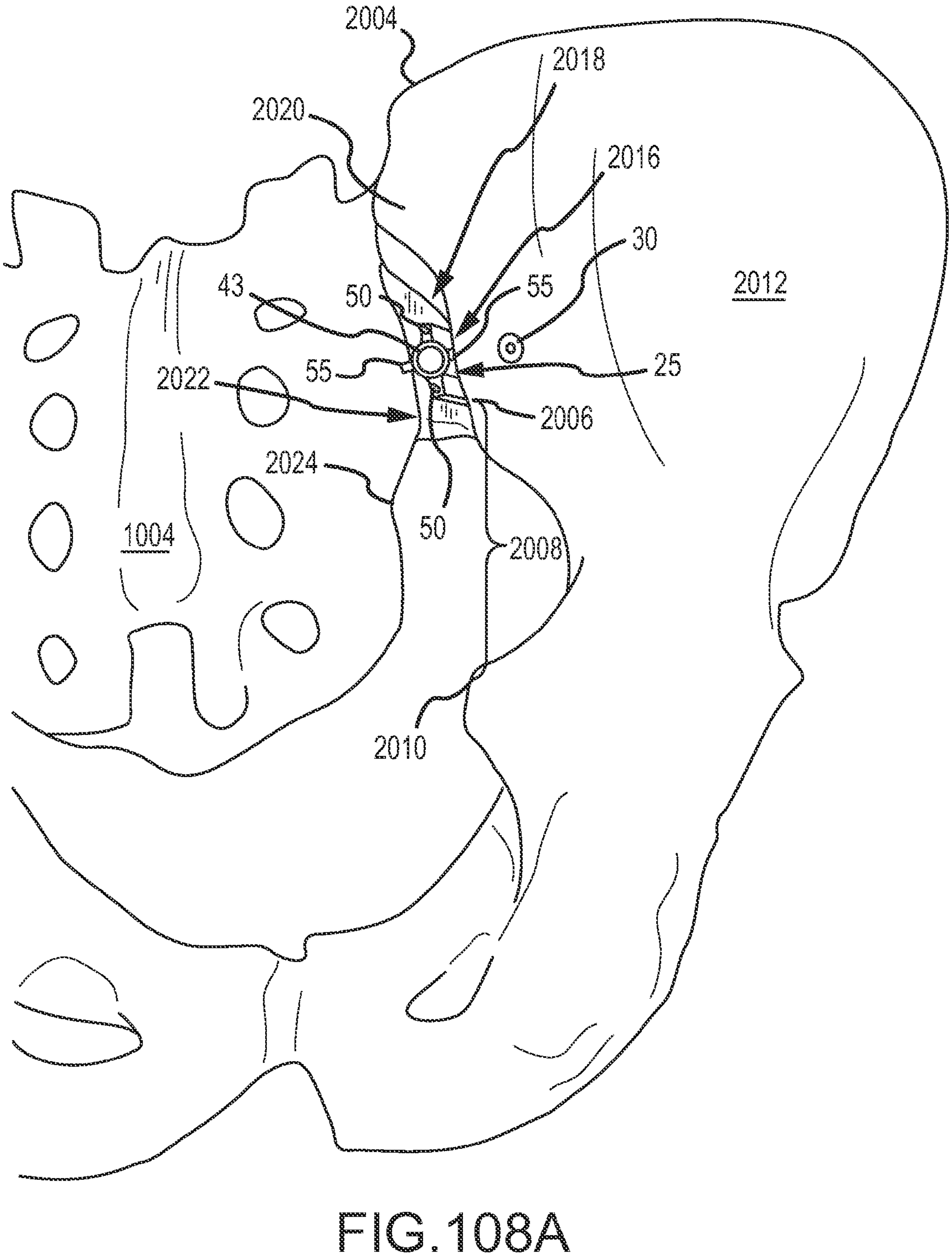


FIG.107B



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43
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55
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2022
2006
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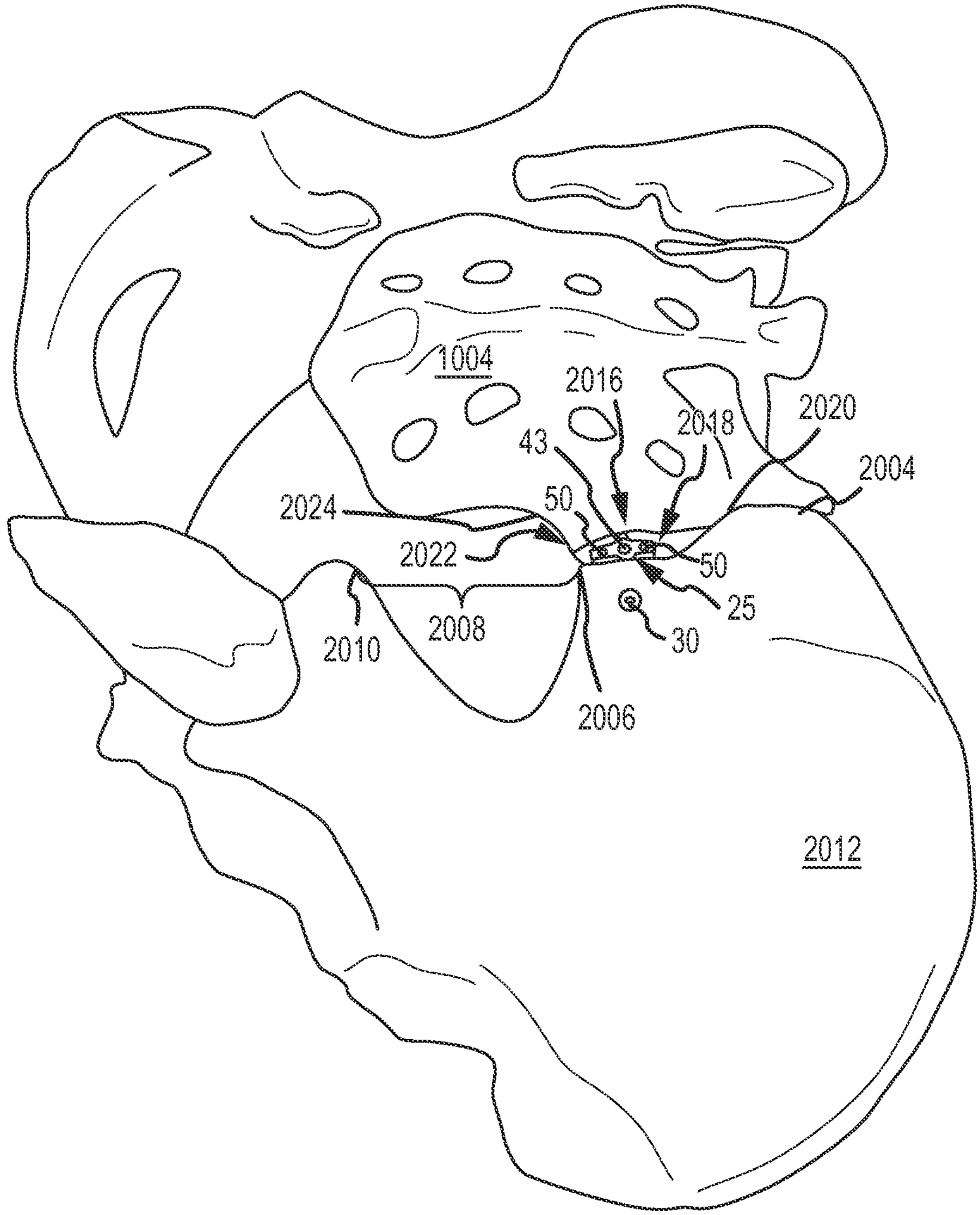
2008
2010

FIG.108A



1004
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FIG.108B

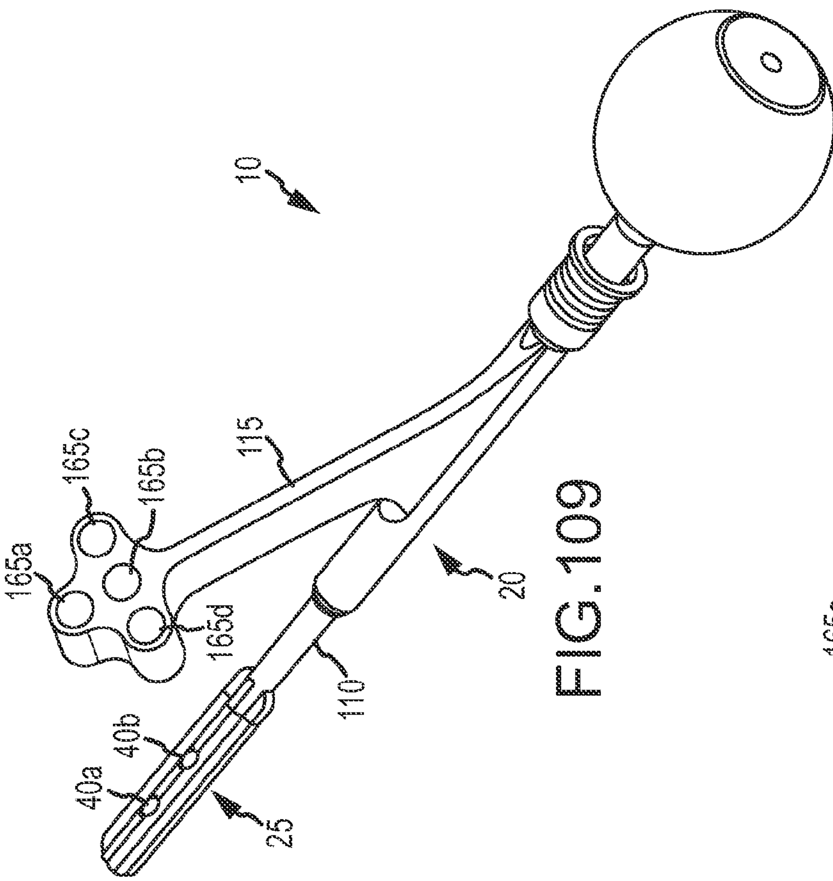

FIG. 109

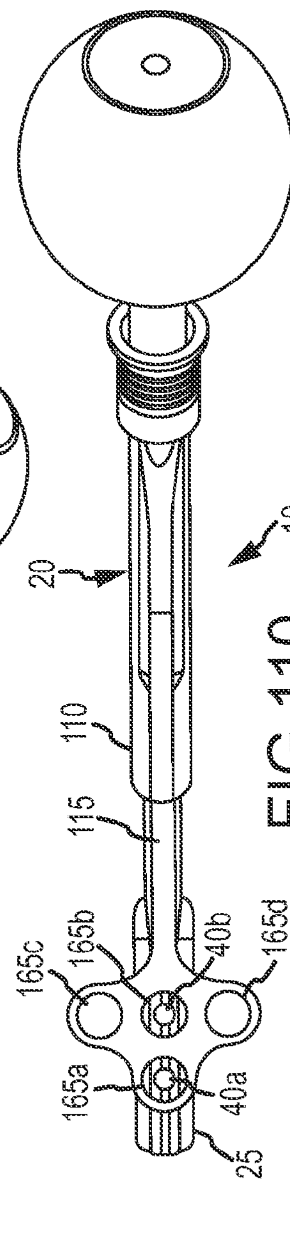

FIG. 110

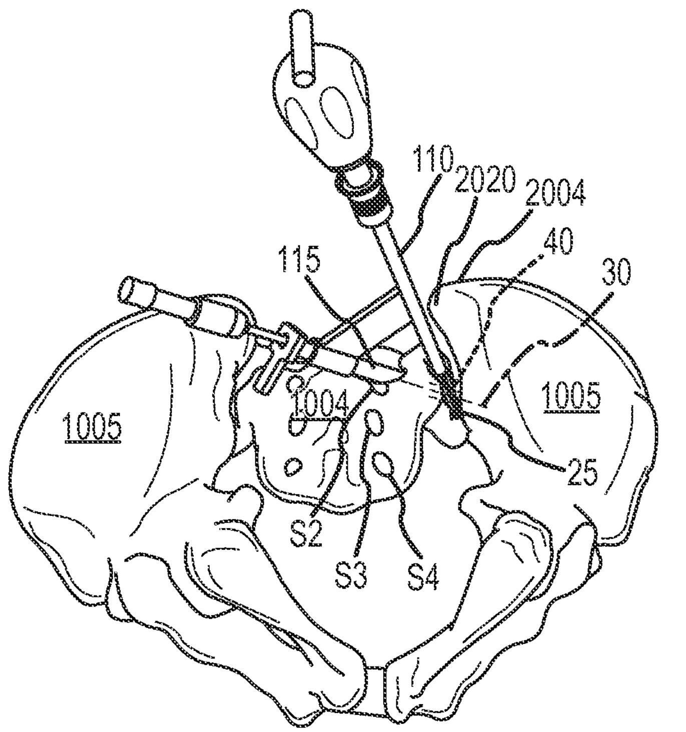

FIG.111A

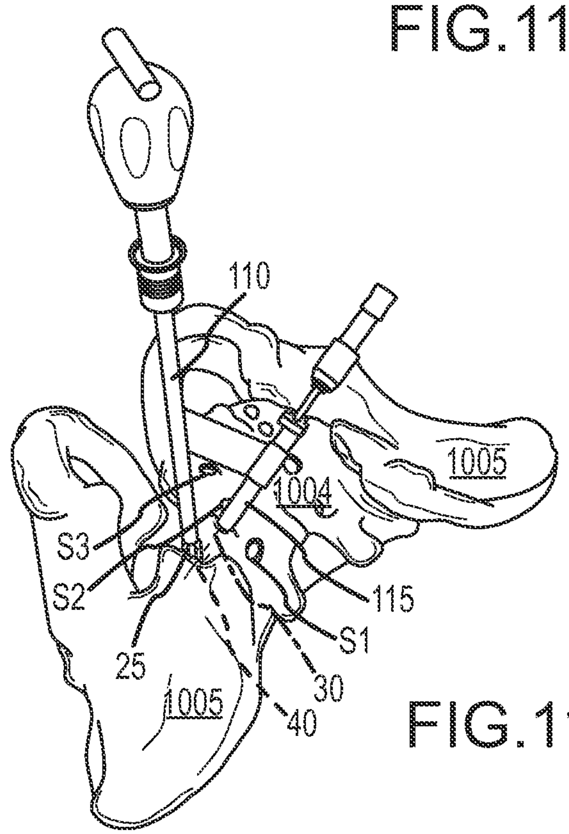

FIG.111B

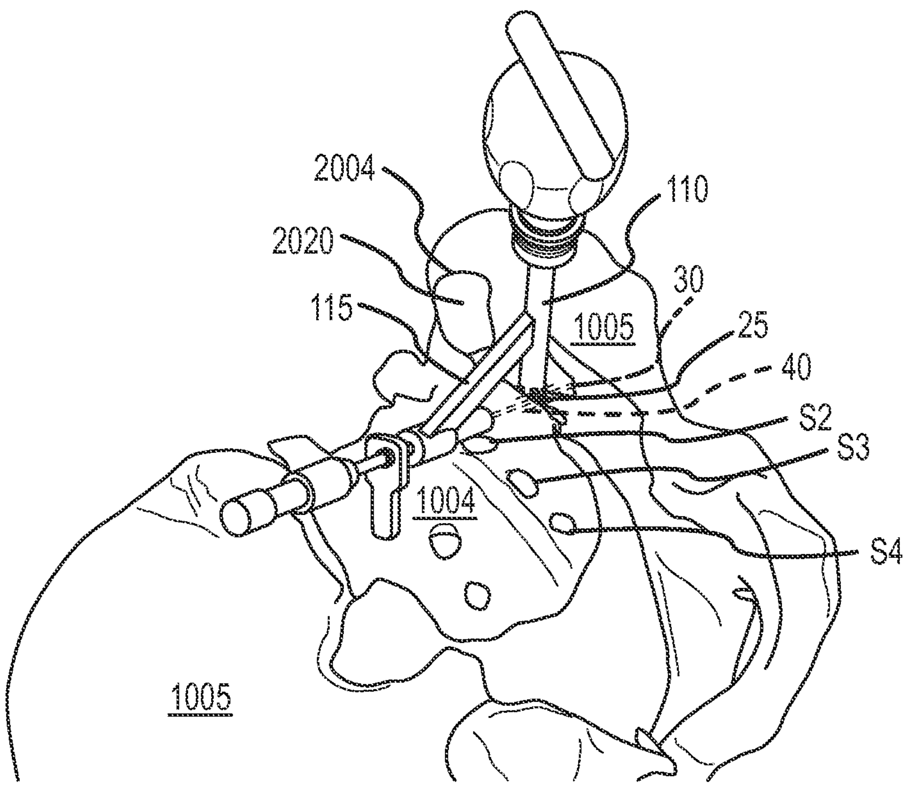

FIG.111C

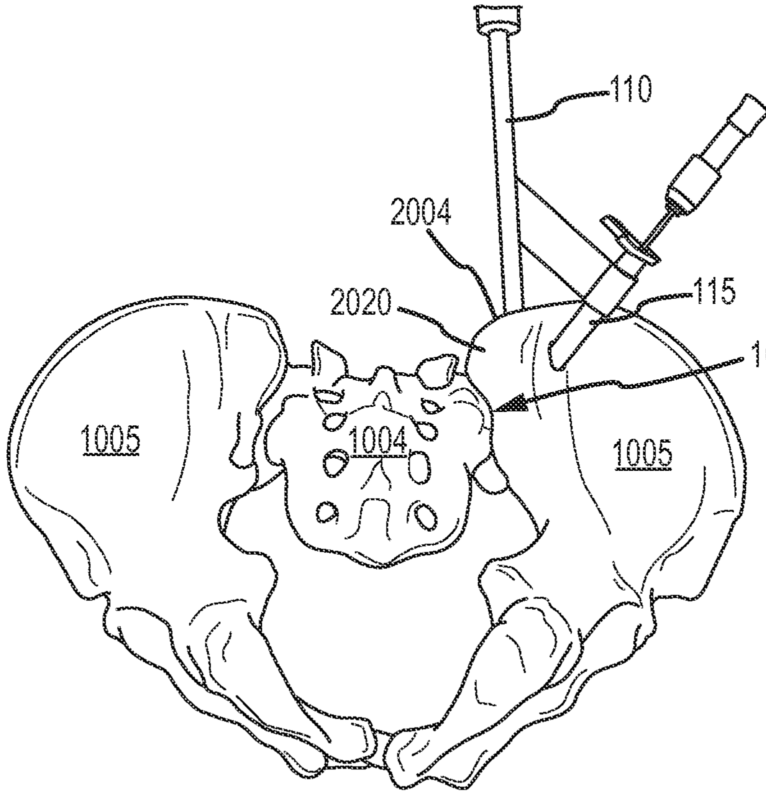

FIG.112A

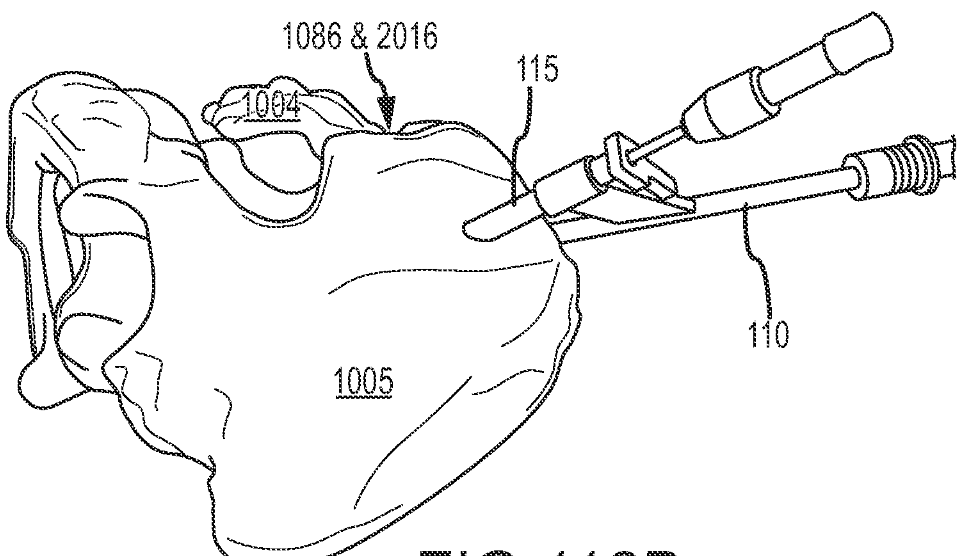

FIG.112B

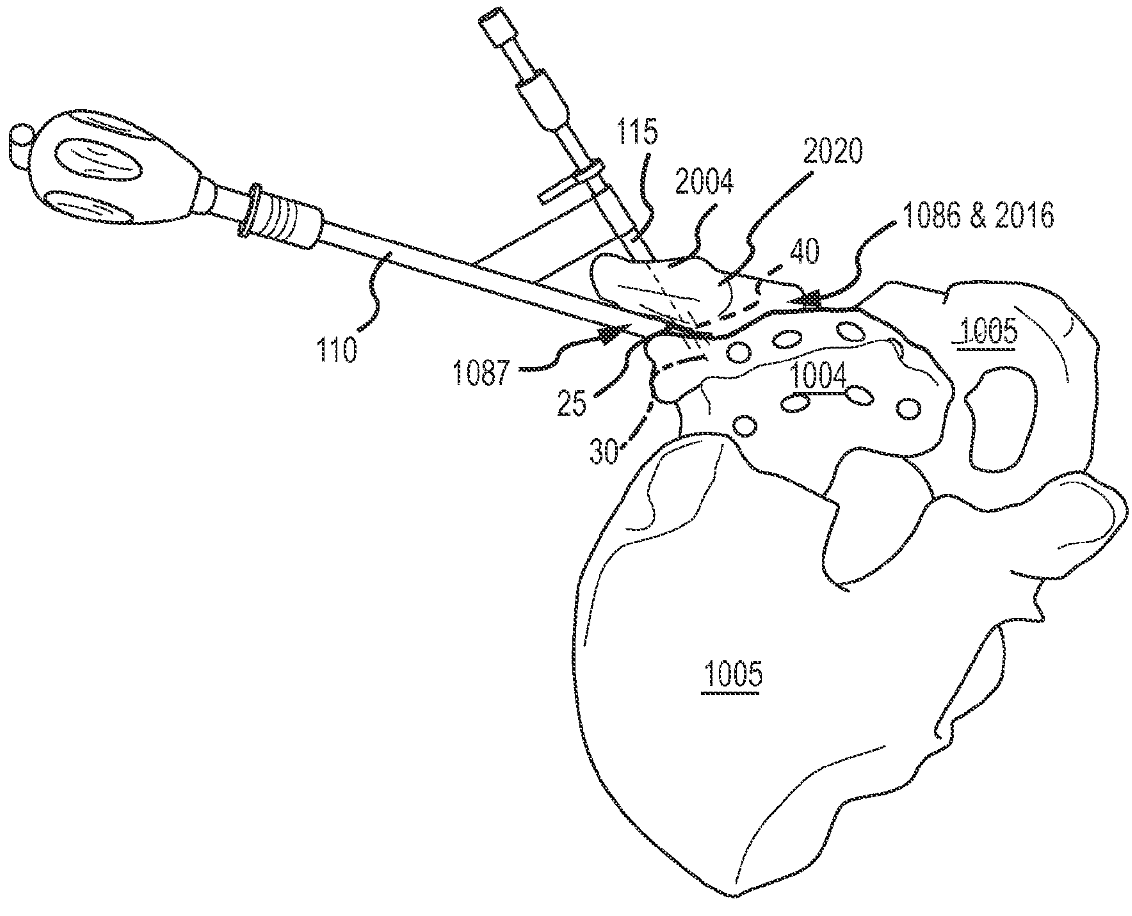

FIG.112C

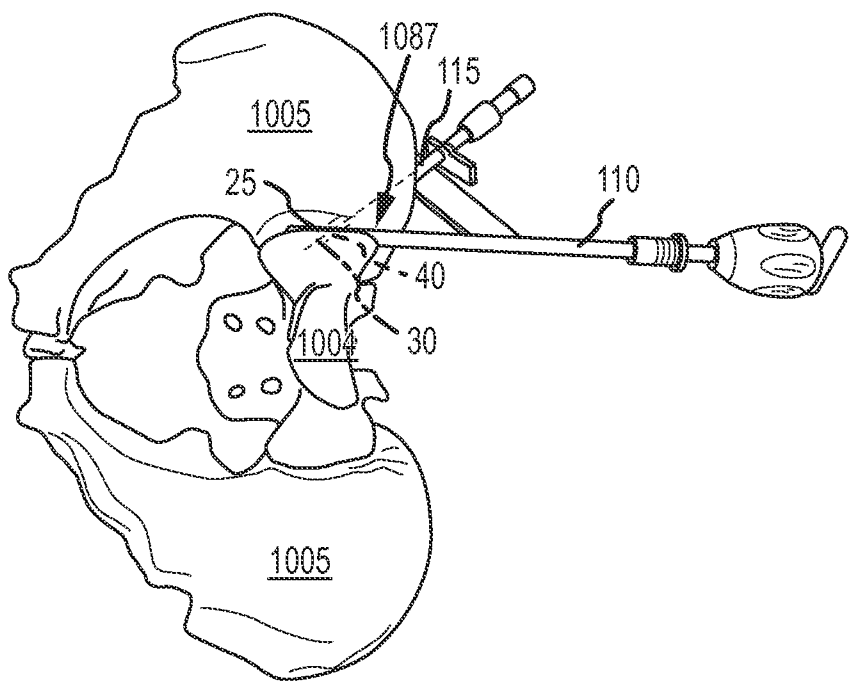

FIG.112D

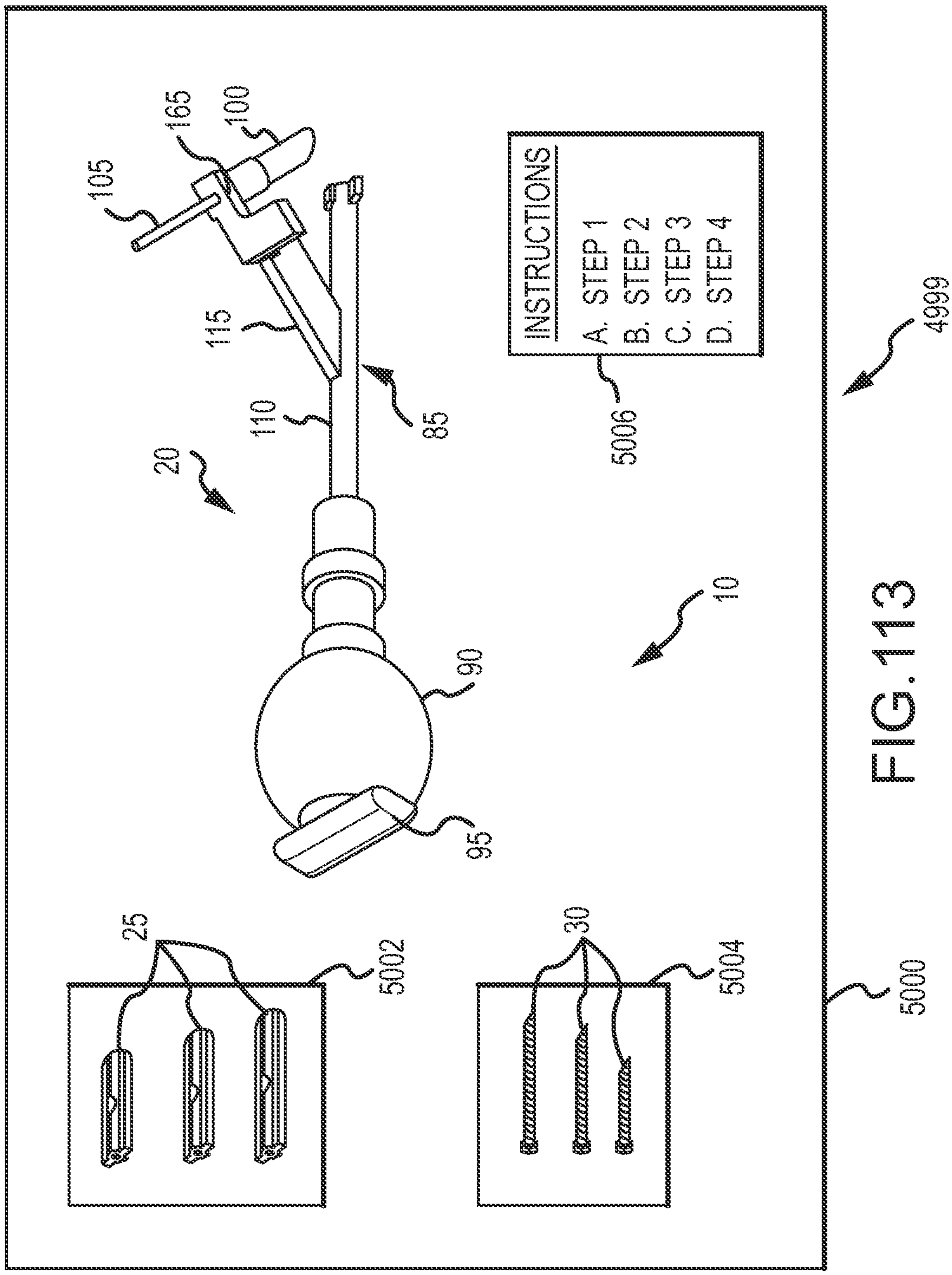
INSTRUCTIONS
A. STEP 1
B. STEP 2
C. STEP 3
D. STEP 4
105
165
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FIG.113

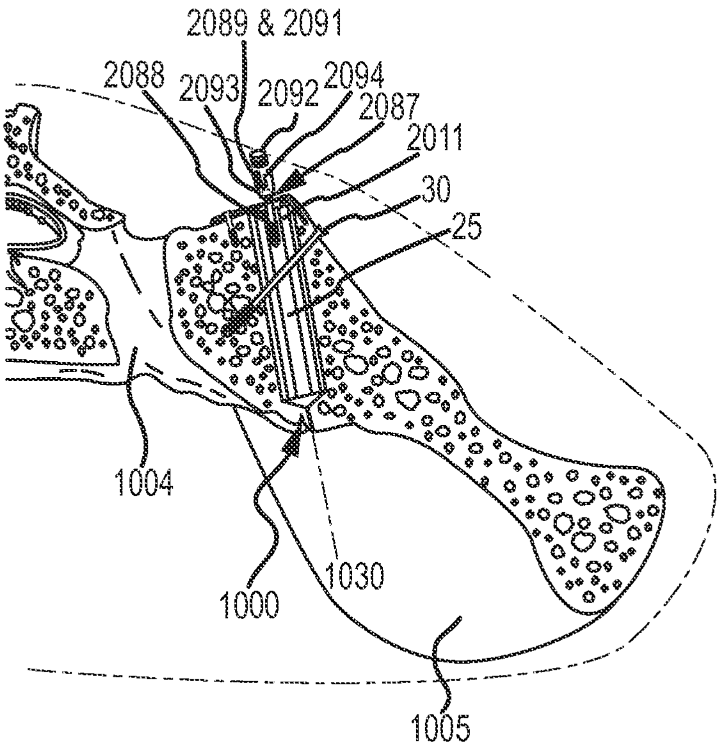
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FIG.114

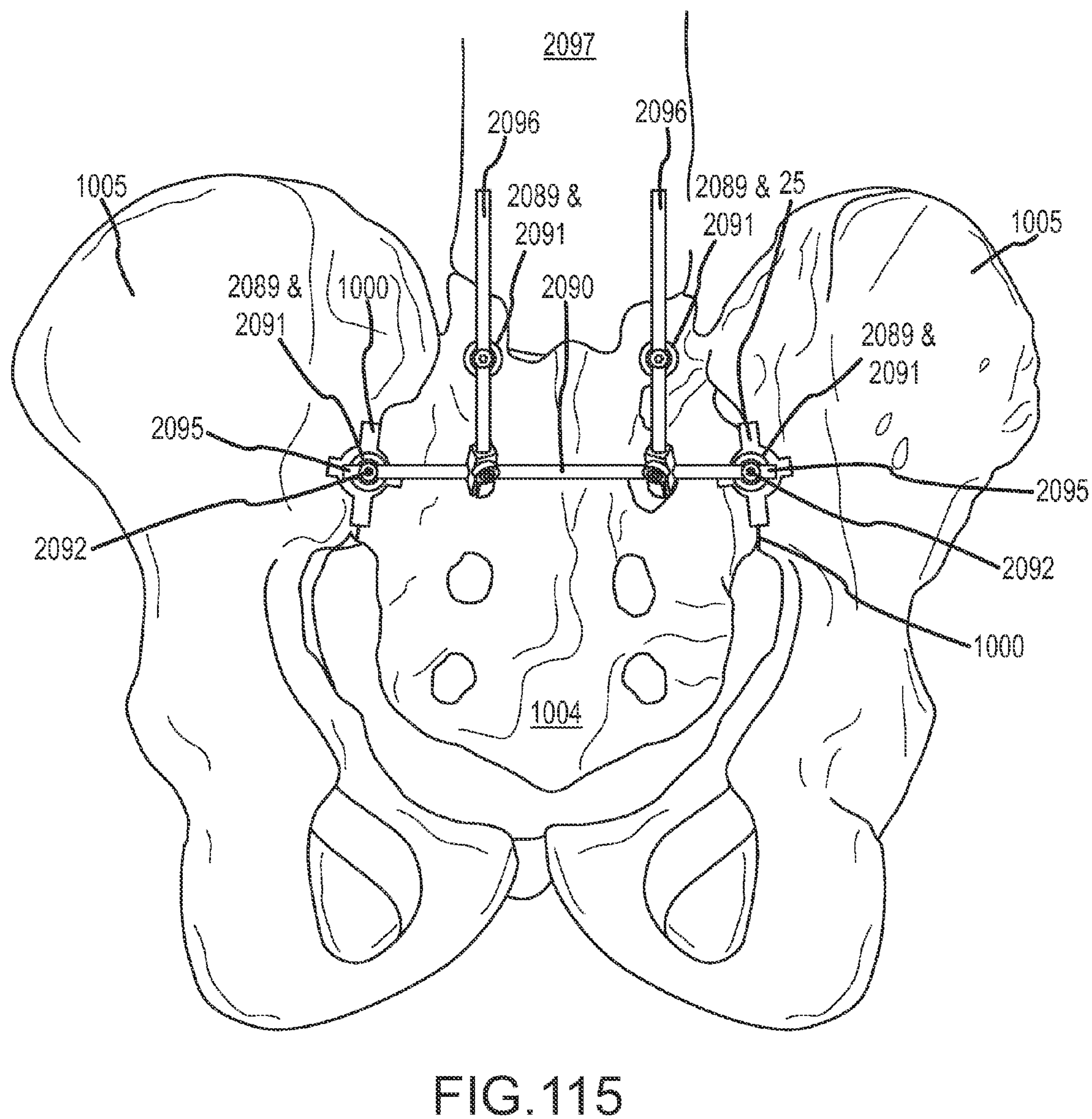
2097
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FIG.115

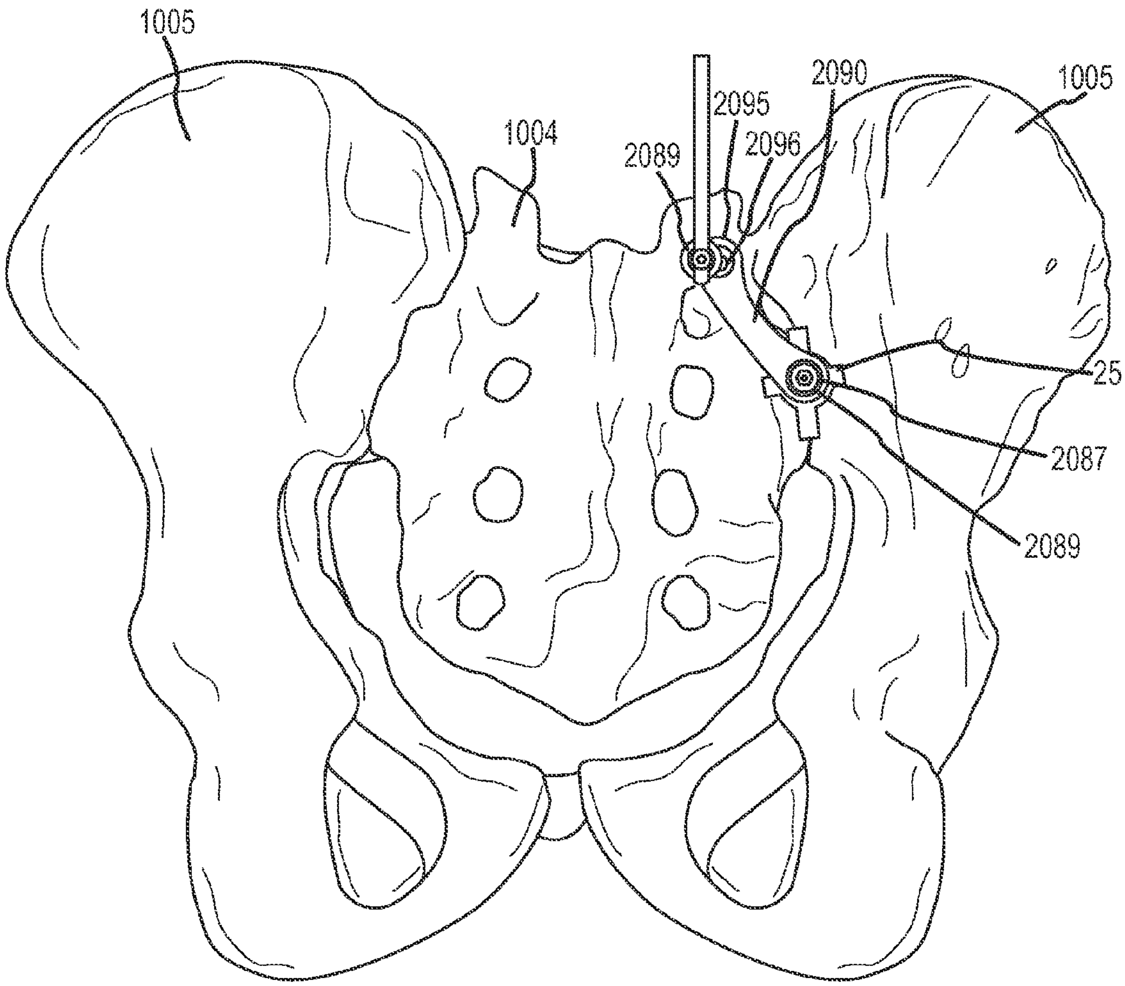

FIG.116

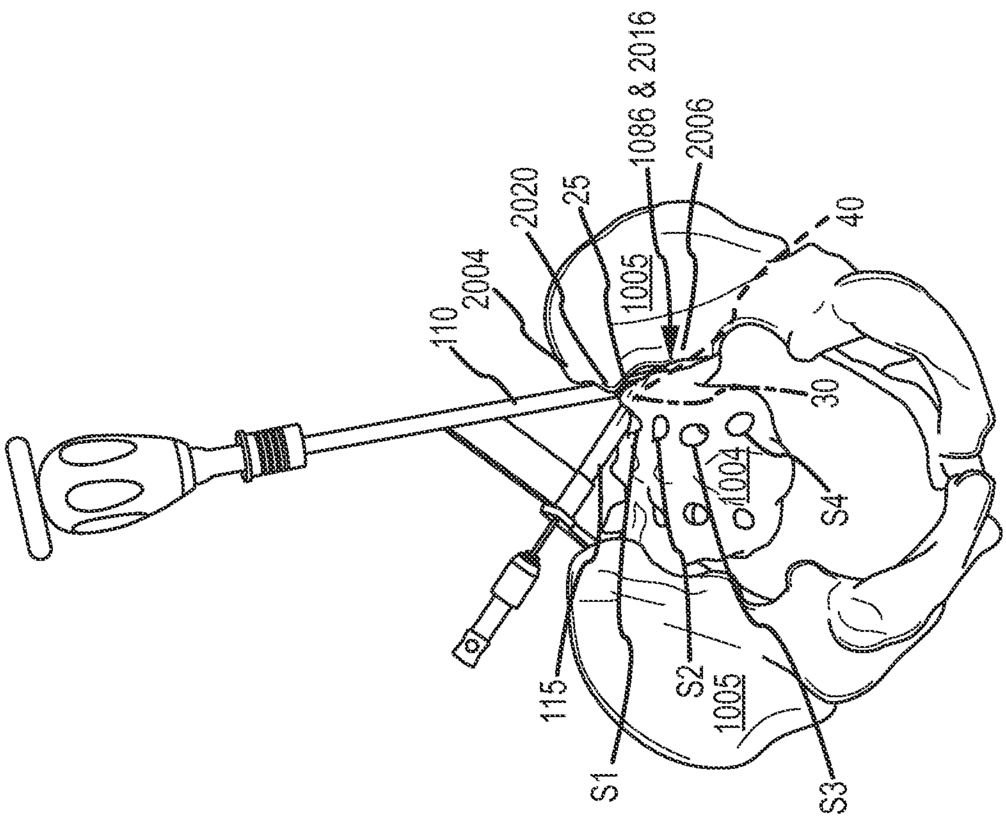

FIG.117B

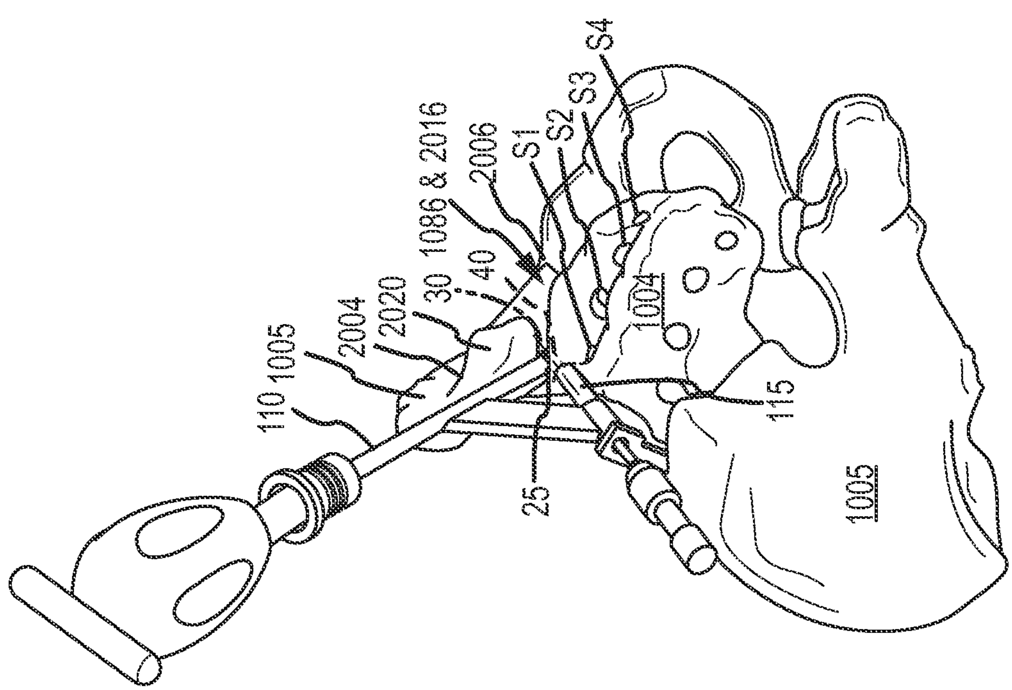

FIG.117A

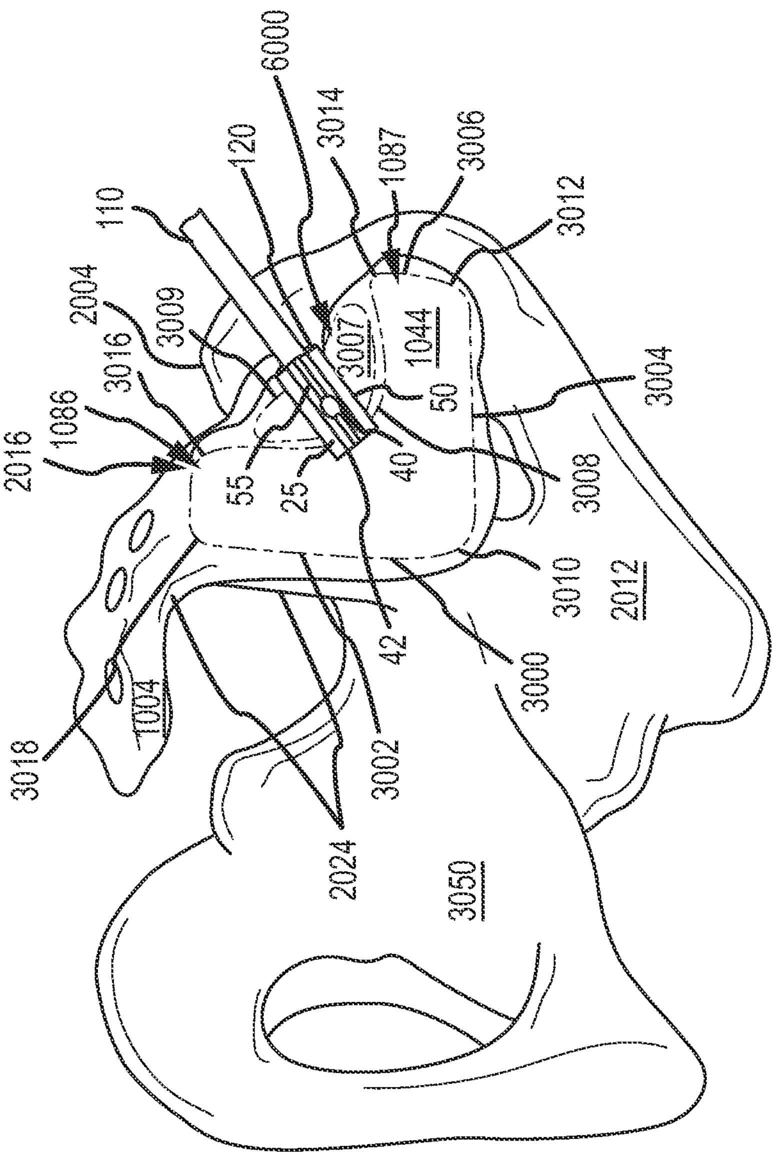
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FIG.117C

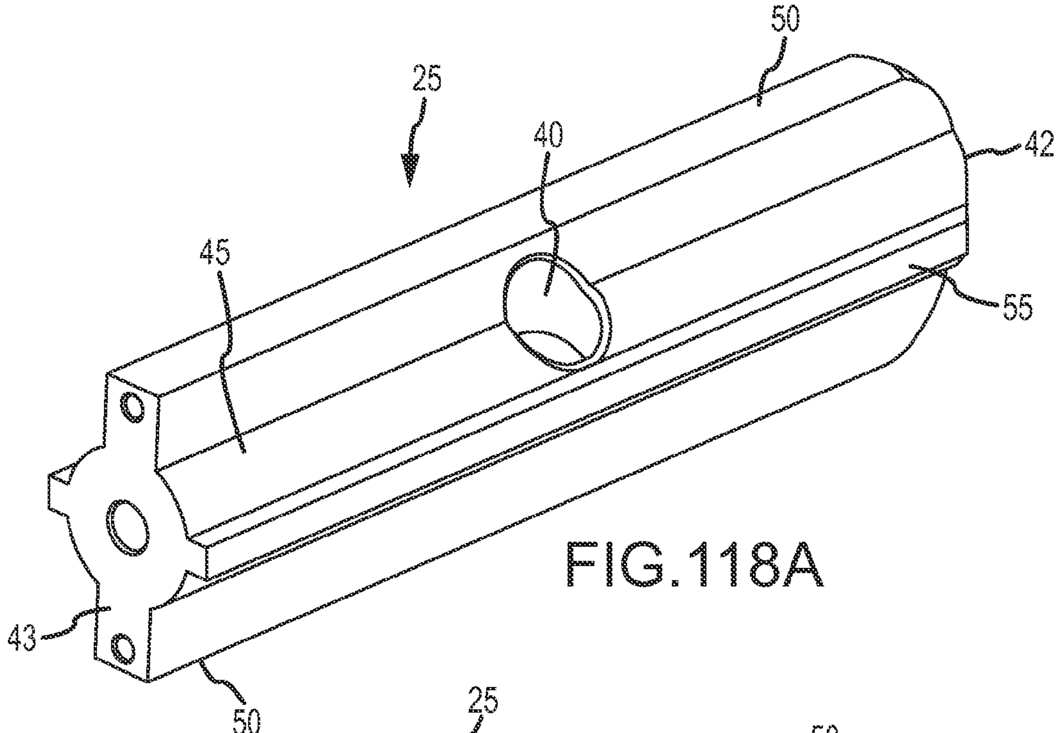

FIG.118A

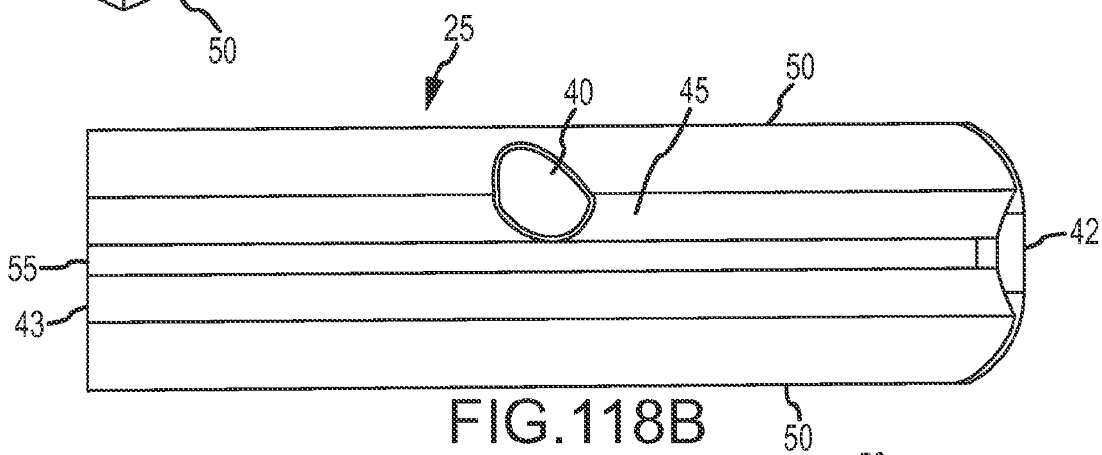

FIG.118B

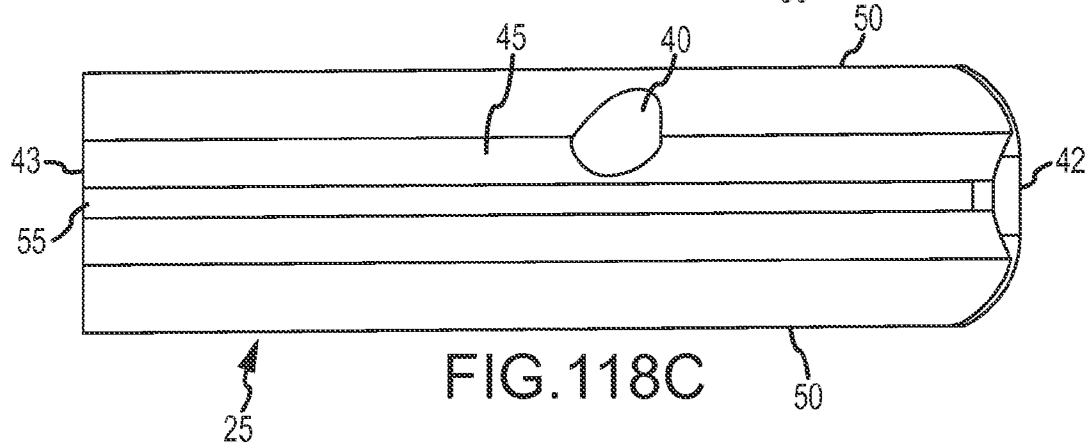

FIG.118C

SYSTEMS FOR AND METHODS OF FUSING A SACROILIAC JOINT

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part (CIP) application of U.S. patent application Ser. No. 12/998,712 ("the '712 application"), which was filed May 23, 2011. The 712 application is the National Stage of International Patent Cooperation Treaty Patent Application PCT/US2011/000070 (the 'PCT application"), which was filed Jan. 13, 2011. The PCT application claims the benefit of U.S. Provisional Patent Application 61/335,947, which was filed Jan. 13, 2010. All of the aforementioned applications are hereby incorporated by reference in their entireties into the present application.

FIELD OF THE INVENTION

Aspects of the present invention relate to medical apparatus and methods. More specifically, the present invention relates to devices and methods for fusing a sacroiliac joint.

BACKGROUND OF THE INVENTION

The sacroiliac joint is the joint between the sacrum and the ilium of the pelvis, which are joined by ligaments. In humans, the sacrum supports the spine and is supported in turn by an ilium on each side. The sacroiliac joint is a synovial joint with articular cartilage and irregular elevations and depressions that produce interlocking of the two bones.

Pain associated with the sacroiliac joint can be caused by traumatic fracture dislocation of the pelvis, degenerative arthritis, sacroiliitis an inflammation or degenerative condition of the sacroiliac joint, osteitis condensans ilii, or other degenerative conditions of the sacroiliac joint. Currently, sacroiliac joint fusion is most commonly advocated as a surgical treatment for these conditions. Fusion of the sacroiliac joint can be accomplished by several different conventional methods encompassing an anterior approach, a posterior approach, and a lateral approach with or without percutaneous screw or other type implant fixation. However, while each of these methods has been utilized for fixation and fusion of the sacroiliac joint over the past several decades, substantial problems with respect to the fixation and fusion of the sacroiliac joint remain unresolved.

A significant problem with certain conventional methods for fixation and fusion of the sacroiliac joint including the anterior approach, posterior approach, or lateral approach may be that the surgeon has to make a substantial incision in the skin and tissues for direct access to the sacroiliac joint involved. These invasive approaches allow the sacroiliac joint to be seen and touched directly by the surgeon. Often referred to as an "open surgery", these procedures have the attendant disadvantages of requiring general anesthesia and can involve increased operative time, hospitalization, pain, and recovery time due to the extensive soft tissue damage resulting from the open surgery.

A danger to open surgery using the anterior approach can be damage to the L5 nerve root, which lies approximately two centimeters medial to the sacroiliac joint or damage to the major blood vessels. Additionally, these procedures typically involve fixation of the sacroiliac joint (immobilization of the articular surfaces of the sacroiliac joint in relation to one another) by placement of one or more screws or one or more

trans-sacroiliac implants (as shown by the non-limiting example of FIG. **1**) or by placement of implants into the S1 pedicle and iliac bone.

Use of trans-sacroiliac and S1 pedicle-iliac bone implants can also involve the risk, of damage to the lumbosacral neurovascular elements. Damage to the lumbosacral neurovascular elements as well as delayed union or non-union of the sacroiliac joint by use of these procedures may require revision surgery to remove all or a portion of the implants or repeat surgery as to these complications.

Another significant problem with conventional procedures utilizing minimally invasive small opening procedures can be that the procedures are technically difficult, requiring biplanar fluoroscopy of the articular surfaces of the sacroiliac joint and extensive surgical training and experience. Despite the level of surgical training and experience, there is a substantial incidence of damage to the lumbosacral neurovascular elements. Additionally, sacral anomalies can further lead to malplacement of implants leading to damage of surrounding structures. Additionally, these procedures are often performed without fusion of the sacroiliac joint, which does not remove the degenerative joint surface and thereby does not address the degenerative condition of the sacroiliac joint, which may lead to continued or recurrent sacroiliac joint pain.

Another significant problem with conventional procedures can be the utilization of multiple trans-sacroiliac elongate implants, which do not include a threaded surface. This approach requires the creation of trans-sacroiliac bores in the pelvis and nearby sacral foramen, which can be of relatively large dimension and which are subsequently broached with instruments, which can result in bone being impacted into the pelvis and neuroforamen.

The creation of the trans-sacroiliac bores and subsequent broaching of the bores requires a guide pin, which may be inadvertently advanced into the pelvis or sacral foramen, resulting in damage to other structures. Additionally, producing the trans-sacroiliac bores, broaching, or placement of the elongate implants may result in damage to the lumbosacral neurovascular elements, as above discussed. Additionally, there may be no actual fusion of the articular portion of the sacroiliac joint, which may result in continued or recurrent pain requiring additional surgery.

Another substantial problem with conventional procedures can be that placement of posterior extra-articular distracting fusion implants and bone grafts may be inadequate with respect to removal of the articular surface or preparation of cortical bone, the implant structure and fixation of the sacroiliac joint. The conventional procedures may not remove sufficient amounts of the articular surfaces or cortical surfaces of the sacroiliac joint to relieve pain in the sacroiliac joint. The conventional implant structures may have insufficient or avoid engagement with the articular surfaces or cortical bone of the sacroiliac joint for adequate fixation or fusion. The failure to sufficiently stabilize and fuse the sacroiliac joint with the conventional implant structures and methods may result in a failure to relieve the condition of sacroiliac joint being treated. Additionally, conventional methods of driving apart a sacrum and ilium may lead to mal-alignment of the sacroiliac joint and increased pain.

The inventive sacroiliac fusion system described herein addresses the problems associated with conventional methods and apparatuses used in fixation and fusion of the sacroiliac joint.

BRIEF SUMMARY OF THE INVENTION

One implementation of the present disclosure may take the form of a sacroiliac joint fusion system including a joint implant, an anchor element and a delivery tool. The joint implant includes a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body. The anchor element includes a distal end and a proximal end and is configured to be received in the first bore. The delivery tool includes an implant arm and an anchor arm. The implant arm includes a proximal end and a distal end. The distal end of the implant arm is configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant. The anchor arm includes a proximal end and a distal end. The distal end of the anchor arm is configured to engage the proximal end of the anchor element. The anchor arm is operably coupled to the implant arm in an arrangement such that the longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element. The arrangement is fixed and nonadjustable.

Another implementation of the present disclosure may take the form of a sacroiliac joint fusion system including a joint implant, an anchor element and a delivery tool. The joint implant includes a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body. The anchor element includes a distal end and a proximal end and is configured to be received in the first bore. The delivery tool includes an implant arm and an anchor arm. The implant arm includes a proximal end and a distal end. The distal end of the implant arm is configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant. The anchor arm includes a proximal end and a distal end. The distal end of the anchor arm includes a guide. The anchor arm is pivotally coupled to the implant arm and configured such that a center of the guide moves along an arc that extends through generally the center of the first bore of the implant when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant. The anchor arm is configured to deliver the anchor element to the first bore.

Yet another implementation of the present disclosure may take the form of a sacroiliac joint fusion system including a joint implant and a tool. In one embodiment, the joint implant includes a longitudinal axis and a first bore extending non-parallel to the longitudinal axis. The anchor element is configured to be received in the first bore. The delivery tool includes an implant arm and an anchor arm. The implant arm is configured to releasably couple to the joint implant. The anchor arm is coupled to the implant arm and configured to deliver the anchor element to the first bore. The final manufactured configuration of the tool and final manufactured configuration of the joint implant are such that, when the system is assembled such that the implant arm is releasably coupled to the joint implant, a delivery arrangement automatically exists such that the anchor arm is correctly oriented to deliver the anchor element to the first bore.

Another implementation of the present disclosure may take the form of a method of sacroiliac joint fusion. In one embodiment, the method includes: a) approaching a sacroiliac joint space with a joint implant comprising at least first and second planar members radially extending generally coplanar with each other from opposite sides of a body of the joint implant; b) delivering the joint implant into a sacroiliac joint space, the joint implant being oriented in the sacroiliac joint space such that the first and second planar members are generally coplanar with a joint plane of the sacroiliac joint space; and c) causing an anchor element to be driven generally transverse to the joint plane through bone material defining at least a portion of the sacroiliac joint space and into a bore of the joint implant that extends generally transverse to the body of the joint implant.

Yet another implementation of the present disclosure may take the form of a medical kit for the fusion of a sacroiliac joint including a caudal access region and a joint plane. In one embodiment, the kit includes: a) a delivery tool comprising an implant arm and an anchor arm coupled to the implant arm; b) a joint implant comprising a bore defined therein that extends generally transverse to a longitudinal length of the joint implant; and c) an anchor element configured to be received in the bore of the joint implant. The bore of the implant, the implant, the implant arm and the anchor arm have an as-manufactured configuration that allows the anchor arm to properly align the anchor element to be received in the bore of the implant when the implant is coupled to the implant arm.

While multiple embodiments are disclosed, still other embodiments of the present disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the disclosure. As will be realized, the invention is capable of modifications in various aspects, all without departing from the spirit and scope of the present disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an anterior view of the pelvic region and a conventional method and device for stabilizing the sacroiliac joint.

FIG. **2**A is an isometric view of a first embodiment of a system for fusing a sacroiliac joint.

FIG. **2**B is the same view as FIG. **2**A, except the delivery tool and implant assembly are decoupled from each other.

FIG. **3** is the same view as FIG. **2**A, except the system is exploded to better illustrate its components.

FIG. **4** is a top-side isometric view of the implant assembly.

FIG. **5** is a distal end isometric view of the implant of the implant assembly of FIG. **4**.

FIG. **6** is a proximal end isometric view of the implant.

FIG. **7** is a bottom-side isometric view of the implant assembly.

FIG. **8** is another proximal end isometric view of the implant.

FIG. **9** is another distal end isometric view of the implant.

FIGS. **10** and **11** are opposite side elevation views of the implant.

FIGS. **12** and **13** are opposite plan views of the implant.

FIG. **14** is a distal end elevation of the implant.

FIG. **15** is a proximal end elevation of the implant.

FIG. **16** is an isometric longitudinal cross section of the implant as taken along section line **16-16** of FIG. **11**.

FIG. **17** is an isometric longitudinal cross section of the implant as taken along section line **17-17** of FIG. **13**.

FIG. **18** is a proximal isometric view of the arm assembly.

FIG. **19** is a distal isometric view of the arm assembly **85**.

FIG. **20** is a longitudinal cross section of the implant arm as taken along section line **20-20** in FIG. **18**.

FIG. **21**A is a side elevation of the system wherein the tool is attached to the implant assembly for delivery of the implant assembly to the sacroiliac joint.

FIG. **21**B is the same view as FIG. **21**A, except illustrating a series of interchangeable anchor arms that may be coupled to the implant arm to adjust the tool for the patient, but maintain the angular relationship between the components of system that allows the anchor member to be delivered into the implant bore without adjustment to the delivery tool.

FIG. **21**C is the same view of FIG. **21**A, except illustrating a version of the same embodiment wherein the anchor arm is more proximally located along the implant arm.

FIG. **22** is the same view as FIG. **21**A, except shown as a longitudinal cross section.

FIG. **23** is an enlarged view of the distal region of the system circled in FIG. **22**.

FIG. **24** is an enlarged cross sectional plan view taken in a plane 90 degrees from the section plane of FIG. **23**.

FIG. **25** is a proximal isometric view of the handle.

FIG. **26** is a distal isometric view of the handle.

FIG. **27** is a cross sectional distal isometric view of the handle.

FIG. **28** is an isometric view of the implant retainer.

FIG. **29** is a longitudinal cross sectional isometric view of the implant retainer.

FIG. **30**A is an isometric view of the sleeve.

FIG. **30**B is a longitudinal cross section of an embodiment of the sleeve having multiple sleeve portions.

FIG. **31** is an isometric view of a trocar, guidewire, drill, screwdriver, etc. for insertion through the lumen of the sleeve.

FIG. **32** is an isometric view of a second embodiment of a system for fusing a sacroiliac joint.

FIG. **33** is the same view as FIG. **32**, except the system is exploded to better illustrate its components.

FIG. **34** is a side elevation of the system embodiment of FIG. **32**.

As shown in FIG. **35** is a proximal isometric view of the implant arm of the embodiment of FIG. **32**.

FIG. **36** is an isometric view of the anchor arm.

FIGS. **37** and **38** are different isometric views of a third embodiment of the system.

FIG. **39** is the same view as FIG. **37**, except the system is shown exploded to better illustrate the components of the system.

FIG. **40** is a side elevation of the system of FIG. **37**, wherein the tool is attached to the implant assembly for delivery of the implant assembly to the sacroiliac joint.

FIGS. **41-44** are various isometric views of the implant of the third embodiment of the system.

FIGS. **45-46** are opposite plan views of the implant.

FIGS. **47-50** are various elevation views of the implant.

FIGS. **51-52** are, respectively, isometric and side elevation views of an implant having an anchor member receiving arm.

FIG. **53** is an enlarged view of the disk-shaped seat of the implant arm of FIG. **51**.

FIG. **54** is an isometric view of an implant with another type of anchor member locking mechanism.

FIG. **55** is an enlarged view of the free end of the anchor member locking mechanism of FIG. **54**.

FIGS. **56-61** are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of another embodiment of the implant.

FIGS. **62-67** are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of yet another embodiment of the implant.

FIGS. **68-73** are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of still another embodiment of the implant.

FIGS. **74-79** are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of yet another embodiment of the implant.

FIGS. **80-85** are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of still yet another embodiment of the implant.

FIG. **86** is an isometric view of the delivery tool.

FIGS. **87-88** are generally opposite isometric views of the delivery tool in an exploded state.

FIG. **89** is an isometric view of the handle.

FIG. **90** is an exploded isometric view of the retaining collar and handle shown in longitudinal cross section.

FIG. **91** is a longitudinal cross section of the delivery tool **20** when assembled as shown in FIG. **86**.

FIG. **92** is a side view of an implant retainer similar to that described with respect to FIGS. **86-91**, except having a modified distal end.

FIGS. **93-94** are, respectively, longitudinal and transverse cross sectional views of an implant with an engagement hole configured to complementarily engage with the T-shaped distal end of the retainer of FIG. **92**.

FIG. **95** is the same view as FIG. **93**, except with the retainer received in the hole.

FIG. **96**A is a right lateral side view of a hip region of a patient lying prone, wherein the soft tissue surrounding the skeletal structure of the patient is shown in dashed lines.

FIG. **96**B is an enlarged view of the hip region of FIG. **96**A.

FIG. **97**A is a lateral-posterior view of the hip region of the patient of FIG. **96**A, wherein the patient is lying prone and the soft tissue surrounding the skeletal structure of the patient is shown in dashed lines.

FIG. **97**B is an enlarged view of the hip region of FIG. **97**A.

FIG. **98**A is a posterior view of the hip region of the patient of FIG. **96**A, wherein the patient is lying prone and the soft tissue surrounding the skeletal structure of the patient is shown in dashed lines.

FIG. **98**B is an enlarged view of the hip region of FIG. **98**A.

FIGS. **99**A-**99**Q are each a step in the methodology and illustrated as the same transverse cross section taken along a plane extending medial-lateral and anterior posterior along section line **99-99** in FIG. **98**B.

FIG. **100**A is a posterior-lateral view of the hip region of the patient, illustrating the placement of a cannula alignment jig.

FIGS. **100**B-**100**C are different isometric views of the cannula alignment jig.

FIG. **101**A is a posterior-lateral view of the hip region of the patient, illustrating the placement of a drill jig.

FIG. **101**B is an isometric view of the drill jig.

FIG. **102**A is a lateral view of the hip region of the patient, illustrating the implant implanted in the caudal region of the sacroiliac join space.

FIG. **102**B is an anterior view of the hip region of the patient, illustrating the implant implanted in the caudal region of the sacroiliac join space.

FIG. **102**C is an enlarged view of the implant taken along the plane of the sacroiliac joint.

FIG. **102**D is a transverse cross section of the implant and joint plane taken along section line **102**D-**102**D of FIG. **102**C.

FIG. **103**A is generally the same view as FIG. **97**A, except illustrating the delivery tool being used to deliver the implant to the sacroiliac joint space.

FIG. **103**B is an enlarged view of the hip region of FIG. **103**A.

FIG. **104** is generally the same enlarged view as FIG. **96**B, except illustrating the delivery tool being used to deliver the implant to the sacroiliac joint space.

FIG. **105** is the same view as FIG. **104**, except the implant has now been fully inserted into the prepared space in the sacroiliac joint.

FIG. **106**A is the same view as FIG. **104**, except the sleeve is now received in the collar of the anchor arm.

FIG. **106**B is generally the same view as FIG. **106**A, except the ilium is removed to show the sacroiliac joint space boundary defined along the sacrum and the implant positioned for implantation within the joint space.

FIG. **107**A is a posterior-inferior view of the hip region of the patient, wherein the soft tissue surrounding the skeletal hip bones is shown in dashed lines.

FIG. **107**B is an enlarged view of the implant region of FIG. **107**A.

FIGS. **108**A and **108**B are, respectively, posterior and posterior-lateral views of the implantation area and the implant assembly implanted there.

FIG. **109** is an isometric view of the system wherein the tool is attached to the implant for delivery of the implant to the sacroiliac joint.

FIG. **110** is a view of the system wherein the implant and anchor arm are shown in plan view.

FIG. **111**A is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **107**A.

FIG. **111**B is a lateral-superior-posterior view of the patient's hip skeletal structure.

FIG. **111**C is an inferior-posterior view of the patient's hip skeletal structure taken from a perspective laterally opposite the view depicted in FIG. **111**B.

FIG. **112**A is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **107**A.

FIG. **112**B is a side view of the patient's hip skeletal structure similar to the view depicted in FIG. **106**A.

FIG. **112**C is a view of the patient's hip skeletal structure similar to the view depicted in FIG. **103**A, except from an opposite lateral perspective.

FIG. **112**D is a superior view of the patient's hip skeletal structure.

FIG. **113** is a plan view of a medical kit containing the components of the system, namely, the delivery tool, multiple implants of different sizes, and multiple anchor members of different sizes, wherein the system components are sealed within one or more sterile packages and provided with instructions for using the system.

FIG. **114** is the same transverse cross sectional view of the patient's hip as shown in FIGS. **99**A-**99**Q, except showing the implant having structure attached thereto that will allow the implant to serve as an attachment point for structural components of a spinal support system configured to support across the patient's hip structure and/or to support along the patient's spinal column.

FIG. **115** is a posterior view of the patient's sacrum and illiums, wherein structural components of a spinal support system extend medial-lateral across the patient's hip structure and superiorly to support along the patient's spinal column.

FIG. **116** is the same view as FIG. **117**, except having a different spanning member structure.

FIG. **117**A is a lateral-inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **111**C.

FIG. **117**B is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **111**A.

FIG. **117**C is the same view as FIG. **106**B, except showing the implant being implanted in the extra-articular space, as opposed to the sacroiliac joint articular region.

FIGS. **118**A-**118**C, which are, respectively, isometric and opposite plan views of an implant with a side-to-side deviated bore.

DETAILED DESCRIPTION

Implementations of the present disclosure involve a system **10** for fusing a sacroiliac joint. The system **10** includes a delivery tool **20** and an implant assembly **15** for delivery to a sacroiliac joint via the delivery tool **20**. The implant assembly **15**, which includes an implant **25** and anchor **30**, is configured to fuse a sacroiliac joint once implanted at the joint. The tool **20** is configured such that the anchor **30** can be quickly, accurately and reliably delivered to a bore **40** of an implant **25** supported off of the tool distal end in a sacroiliac joint.

To begin a detailed discussion of a first embodiment of the system **10**, reference is made to FIGS. **2**A-**3**. FIG. **2**A is an isometric view of the system **10**. FIG. **2**B is the same view as FIG. **2**A, except an implant assembly **15** of the system **10** is separated from a delivery tool **20** of the system **10**. FIG. **3** is the same view as FIG. **2**A, except the system **10** is shown exploded to better illustrate the components of the system **10**.

As can be understood from FIGS. **2**A and **2**B, the system **10** includes a delivery tool **20** and an implant assembly **15** for implanting at the sacroiliac joint via the delivery tool **20**, the implant assembly **15** being for fusing the sacroiliac joint. As indicated in FIG. **3**, the implant assembly **15** includes an implant **25** and an anchor element **30** (e.g., a bone screw or other elongated body). As discussed below in greater detail, during the implantation of the implant assembly **15** at the sacroiliac joint, the implant **25** and anchor element **30** are supported by a distal end **35** of the delivery tool **20**, as illustrated in FIG. **2**A. The delivery tool **20** is used to deliver the implant **25** into the sacroiliac joint space. The delivery tool **20** is then used to cause the anchor element **30** to extend through the ilium, sacrum and implant **25** generally transverse to the sacroiliac joint and implant **25**. The delivery tool **20** is then decoupled from the implanted implant assembly **15**, as can be understood from FIG. **2**B.

To begin a detailed discussion of components of an embodiment of the implant assembly **15**, reference is made to FIG. **4**, which is a side isometric view of the implant assembly **15**. As shown in FIG. **4**, the implant assembly **15** includes an implant **25** and an anchor element **30**. The anchor element **30** may be in the form of an elongated body such as, for example, a nail, rod, pin, threaded screw, expanding body, etc. The anchor element **30** is configured to be received in a bore **40** defined through the implant **25**. The bore **40** extends through the implant **25** and is sized such that the anchor element **30** can at least extend into or through the implant **25** as illustrated in FIG. **4**.

For a detailed discussion of the implant **25**, reference is made to FIGS. **5**-**17**. FIGS. **5**-**9** are various isometric views of the implant **25**. FIGS. **12** and **13** are opposite plan views of the implant **25**, and FIGS. **10**, **11**, **14** and **15** are various elevation views of the implant. FIGS. **16** and **17** are isometric longitudinal cross sections of the implant **25** as taken along corresponding section lines in FIGS. **11** and **13**, respectively.

As shown in FIGS. **5**-**15**, in one embodiment, the implant **25** includes a distal or leading end **42**, a proximal or trailing end **43**, a longitudinally extending body **45**, a bore **40** extending through the body, and keels, fins or planar members **50**, **55** that radially extend outwardly away from the body **45**. In one embodiment, the radially extending planar members **50**, **55** may be grouped into pairs of planar members **50**, **55** that are generally coplanar with each other. For example, planar members **50** that are opposite the body **45** from each other generally exist in the same plane. More specifically, as best understood from FIGS. **14** and **15**, the planar faces **60** of a first planar member **50** are generally coplanar with the planar faces **60** of a second planar member **50** opposite the body **45** from the first planar member **50**. Likewise, the planar faces **65** of a third planar member **55** are generally coplanar with the planar faces **65** of a fourth planar member **55** opposite the body **45** from the third planar member **50**.

As best understood from FIGS. **14** and **15**, one set of planar members **50** (i.e., the large planar members **50**) may extend radially a greater distance D_1 than the distance D_2 extended radially by the other set of planar members **55** (i.e., the small planar members **55**). Also, the width W_1 of a large planar member **50** from its outer edge to its intersection with the body **45** may be greater than the width W_2 of a small planar member **55** from its outer edge to its intersection with the body **45**. Also, the thickness T_1 of the large planar members **50** may be greater than the thickness T_2 of the small planar members **55**. Thus, one set of planar members **50** may be both wider and thicker than the other set of planar members **55**. In other words, one set of planar members **50** may be larger than the other set of planar members **55**.

In one embodiment, the distance D_1 spanned by the large planar members **50** is between approximately 5 mm and approximately 30 mm, with one embodiment having a distance D_1 of approximately 20 mm, and the distance D_2 spanned by the small planar members **55** is between approximately 5 mm and approximately 20 mm, with one embodiment having a distance D_2 of approximately 14 mm. The width W_1 of a large planar member **50** is between approximately 2.5 mm and approximately 15 mm, with one embodiment having a width W_1 of approximately 5 mm, and the width W_2 of a small planar member **55** is between approximately 1 mm and approximately 10 mm, with one embodiment having a width W_2 of approximately 3 mm. The thickness T_1 of a large planar member **50** is between approximately 2 mm and approximately 20 mm, with one embodiment having a thickness T_1 of approximately 4 mm, and the thickness T_2 of a small planar member **55** is between approximately 1 mm and approximately 10 mm, with one embodiment having a thickness T_2 of approximately 2 mm.

As indicated in FIGS. **5-15**, the first set of planar members **50** are generally perpendicular with the second set of planar members **55**. Since the sets of planar members **50**, **55** are perpendicular to each other, in one embodiment, the intersection of the planar members **50**, **55** at a central longitudinal axis of the implant **25** may form the body **45** of the implant **25**. In other embodiments, and as illustrated in FIGS. **5-14**, the body **45** may be of a distinct shape so as to have, for example, a cylindrical or other configuration. In one embodiment, as indicated in FIG. **14**, the cylindrical body **45** has a radius R_1 of between approximately 1 mm and approximately 20 mm, with one embodiment having a radius R_1 of approximately 10 mm.

As illustrated in FIG. **12**, in one embodiment, the implant **25** has a length L_1 of between approximately 5 mm and approximately 70 mm, with one embodiment having a length L_1 of approximately 45 mm.

As indicated in FIGS. **5** and **9-14**, the implant distal end **42** may have a bullnose or otherwise rounded configuration, wherein the rounded configuration extends outward away from the distal extremity of the body **45** and along the distal or leading edges of the planar members **50**, **55**. Thus, as can be understood from FIGS. **5** and **9-13**, the leading or distal edges **57** of the planar members **50**, **55** may be rounded in the radially extending length of the lead or distal edges and/or in a direction transverse to the radially extending length of the lead or distal edges. In one embodiment, the leading edges **57** of the planar members **50**, **55** each have a radius R_2 of between approximately 1 mm and approximately 15 mm, with one embodiment having a radius R_2 of approximately 10 mm. In one embodiment, the leading end **42** of the implant body **45** and the leading edges **57** of the planar members **50**, **55** have a generally conical point configuration.

As indicated in FIGS. **6-8**, **10-13**, and **15**, the implant proximal end **43** has a generally planar face that is generally perpendicular to a longitudinal center axis CA of the implant **25**. A center attachment bore **70** and two lateral attachment bores **75** on opposite sides of the center bore **70** are defined in the implant proximal end **43**. The center bore **70** is centered about the longitudinal center axis CA, and the lateral attachment bores **75** are near outer ends of the long planar members **50**, generally centered in the thickness of the larger planar members **50**. Alternatively, in particular embodiments, the implant proximal end **43** can be configured to have a face similarly configured to the implant distal end **42** (i.e. rounded, bullet nosed, etc.) to allow for a simplified removal of implant **25** during a revision surgery.

As indicated in FIGS. **16** and **17**, the center bore **70** may be a blind hole in that it only has a single opening. Alternatively, the center bore **70** may be configured as a hole that communicates between the implant proximal end **43** and implant bore **40**. A center bore so configured may be able to receive a fastener to permit interference with the anchor member **30** extending through the bore **40** after implantation to resist migration of said anchor member.

As illustrated in FIG. **16**, the lateral bores **75** are also blind holes and can be configured to not extend nearly as far into the body **45** as the center hole **70** and can be configured to be not nearly as great in diameter as the center hole **70**. In one embodiment, the center attachment bore **70** has a diameter of between approximately 2 mm and approximately 10 mm, with one embodiment having a diameter of approximately 5 mm. In one embodiment, the lateral attachment bores **75** can each have a diameter of between approximately 0.5 mm and approximately 3 mm, with one embodiment having a diameter of approximately 1.5 mm.

As can be understood from FIG. **17**, the implant bore **40**, which is configured to receive the anchor member **30**, has a longitudinal center axis BA that is generally transverse to the longitudinal center axis CA of the implant **25**. In one embodiment, the implant bore longitudinal center axis BA forms an angle $A_{BA\text{-}CA}$ with the implant longitudinal center axis CA. For example, the angle $A_{BA\text{-}CA}$ may be between approximately 15 degrees and approximately 135 degrees, with one embodiment being approximately 45 degrees.

As shown in FIGS. **4-17**, the bore **40** is generally located within a plane with which the small radial planar members **55** are located. That the bore **40** is located in the same plane as occupied by the small radial planar members **55** is also the case where the bore **40** angularly deviates from being perpendicular with the longitudinal axis of the implant body **45**.

In one embodiment, the implant **25** may be machined, molded, formed, or otherwise manufactured from stainless steel, titanium, ceramic, polymer, composite, bone or other biocompatible materials. The anchor member **30** may be machined, molded, formed or otherwise manufactured from similar biocompatible materials.

In some embodiments, the implant **25** may be substantially as described above with respect to FIGS. **4-17**, except the bore **40** of the implant **25** may be angled side-to-side relative to the longitudinal axis of the implant body **45** such that the bore **40** is not contained in the plane occupied by the small radial planar members **55**. For example, as shown in FIGS. **118**A-

118C, which are, respectively, isometric and opposite plan views of an implant **25** with such a side-to-side deviated bore **40**, the bore daylights in the body **45** and large radial planar members **50**. In doing so, the bore **40** deviates side-to-side from the plane in which the small planar members **55** are located. Since the bore daylights in the body **45** and large planar members **50**, the bore **40** of FIGS. **118**A-**118**C differs from that of FIGS. **4-17**, wherein the bore **40** daylights in the small radial members **55**.

Just like delivery tool **20** of FIG. **2**A has an as-manufactured configuration that allows the anchor arm **115** to deliver the anchor element **30** to the bore **40** of the implant **25** of FIGS. **4-17** without necessitating modification of the delivery tool **20** configuration subsequent to the tool **20** leaving its manufacturing facility, a delivery tool **20** can be configured to similarly interact with the bore **40** of the implant **25** of FIGS. **118**A-**118**C.

In some embodiments, the implant **25** may be substantially as described above with respect to FIGS. **4-17**, except the implant **25** may further include an anchor member receiving arm **300**. For example, as shown in FIGS. **51-52**, which are, respectively, isometric and side elevation views of an implant **25** having an anchor member receiving arm **300**, the arm **300** may be generally cantilevered off of the proximal end **43** of the implant **25**. The arm **300** includes a free end **305** with a disk-shaped seat **310** having a center hole **315** with a center axis that is coaxially aligned with the center axis BA of the bore **40**. As illustrated in FIG. **53**, which is an enlarged view of the disk-shaped seat **310**, the disk-shaped seat **310** has a plurality of arcuate members **320** distributed along an inner circumferential boundary **325** of a rim **330** of the disk-shaped seat **310**. There may be five or more or less arcuate members **320** distributed generally evenly about the inner circumferential surface **325** of the rim **330**.

In one embodiment, each arcuate member **320** has ends **332** that intersect the inner circumferential surface **325** of the rim **330**, with a center point **335** of the arcuate member **320** that is offset or spaced apart from inner circumferential surface **325** of the rim **330**. Thus, in one embodiment, the arcuate members **320** may be deflectable so as to allow the head of the anchor member **30** to pass between the center points **335** of the members **330** as the head of the anchor member **30** is seated in the seat **310**. As a result, the arcuate members **320** can act against the head of the anchor member **30** to prevent the anchor member from working its way out of the bore **40** and opening **315** of the implant **25**, thereby serving as an anchor member locking mechanism.

Other arms **300** may have an anchor member locking mechanism with a different configuration. For example, as illustrated in FIG. **54**, which is an isometric view of an implant **25** with another type of anchor member locking mechanism, the arm **300** may be generally cantilevered off of the proximal end **43** of the implant **25**. The arm **300** includes a free end **305** with a center hole **315** with a center axis that is coaxially aligned with the center axis BA of the bore **40**. As illustrated in FIG. **55**, which is an enlarged view of the free end **305**, the hole **315** has a cantilevered abutment arm **335** defined in the body of the arm **300** via a series of parallel arcuate slots **340**.

In one embodiment, a face **345** of the abutment arm **335** is deflectable and biased radially inward of the inner circumferential surface **350** of the hole **315** such that when the anchor member **30** is extended through the hole **315**, the face **345** abuts against the anchor member to prevent the anchor member from working its way out of the bore **40** and opening **315** of the implant **25**, thereby serving as an anchor member locking mechanism.

While in the implant embodiment discussed with respect to FIGS. **4-17** may have a cylindrical body **45** at which the planar members **50**, **55** intersect, in other embodiments the body **45** of the implant **25** may simply be the region **45** of the implant **25** where the planar members **50**, **55** intersect. For example, as shown in FIGS. **56-61**, which are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of an implant **25**, the body **45** of the implant **25** is simply the region **45** of the implant **25** where the planar members **50**, **55** intersect. Although not shown in FIGS. **56-61**, in one embodiment, the implant **25** has the bore **40** and holes **70**, **75** substantially as depicted and discussed with respect to the implant of FIGS. **4-17**. Also, the rest of the features of the implant **25** of FIGS. **56-61** are substantially as discussed with respect to the implant **25** of FIGS. **4-17**, a main difference being the lack of the cylindrical body **45** and the edges of adjacent intersecting surfaces of the implant **25** of FIGS. **56-61** being rounded or arcuate as opposed to sharp or well-defined edges, as is the case between adjacent intersecting surfaces of the implant embodiment of FIGS. **4-17**.

Depending on the embodiment, the implant **25** may have surface features or texture designed to prevent migration of the implant once implanted in the joint space. For example, as shown in FIGS. **62-67**, which are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of an implant **25** with anti-migration surface features **355**, the body **45** of the implant **25** is simply the region **45** of the implant **25** where the planar members **50**, **55** intersect. Although not shown in FIGS. **62-67**, in one embodiment, the implant **25** has the bore **40** and holes **70**, **75** substantially as depicted and discussed with respect to the implant of FIGS. **4-17**. Also, the rest of the features of the implant **25** of FIGS. **62-67** are substantially as discussed with respect to the implant **25** of FIGS. **56-61**, a main difference being the edges of adjacent intersecting surfaces the implant **25** of FIGS. **56-61** being sharp or well defined edges as opposed to round or arcuate edges, as is the case between adjacent intersecting surfaces of the implant embodiment of FIGS. **56-61**.

As to particular embodiments as shown in FIGS. **56-61**, and in other embodiments as disclosed throughout, the implants described herein can be configured to be used as trials during certain steps of the procedure to determine appropriate implant sizes and to allow a physician, who is presented with a kit containing the delivery system **20** and multiple sizes of the implant **20**, to evaluate particular embodiments of an implant as described herein that would be best suited to a particular patient, application or implant receiving space.

As shown in FIGS. **62-67**, the anti-migration features **355** are generally evenly distributed along the planar surfaces **60**, **65** of the planar members **50**, **55** in a rows and columns arrangement. The anti-migration features **355** are generally similarly distributed along the planar surfaces of the edges of the planar members **55**. The anti-migration features **355** may be in the form of trapezoids, squares, rectangles, etc. As indicated in FIG. **66**, the anti-migration features **355** may have a rectangular cross sectional elevation with a thickness FT of between approximately 0.2 mm and approximately 5 mm, with one embodiment having a thickness FT of approximately 1 mm.

As another example, as shown in FIGS. **68-73**, which are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of an implant **25** with another type of anti-migration surface features **355**, the body **45** of the implant **25** is simply the region **45** of the implant **25** where the planar members **50**, **55** intersect. Although not shown in FIGS. **68-73**, in one embodiment, the implant **25** has the bore **40** and holes **70**, **75** substantially as depicted and discussed with respect to the implant of FIGS. **4-17**. Also, the rest of the features of the implant **25** of FIGS. **68-73** are substantially as discussed with respect to the implant **25** of FIGS. **62-67**, including the sharp or well defined edges between adjacent intersecting surfaces of the implant **25**.

As shown in FIGS. **68-73**, the anti-migration features **355** are in the form of unidirectional serrated teeth or ridges **355**, wherein the ridges **355** have a triangular cross sectional elevation best understood from FIGS. **70** and **71**, wherein the rearward or trailing end of the features **355** are the truncated or vertical end of the triangle cross sectional elevation, and the front or leading end of the features **355** are the point end of the triangle cross sectional elevation. As indicated in FIG. **71**, the anti-migration features **355** with the triangular cross sectional elevations have a thickness FT of between approximately 0.2 mm and approximately 5 mm, with one embodiment having a thickness FT of approximately 1 mm, and a length FL of between approximately 0.5 mm and approximately 15 mm, with one embodiment having a thickness FT of approximately 2.5 mm. The triangular ridges **355** are generally evenly distributed along the planar surfaces **60**, **65** of the planar members **50**, **55** in ridges that run transverse to the length of the implant **25**. The anti-migration features **355** are generally similarly distributed along the planar surfaces of the edges of the planar members **55**.

In continuing reference to FIGS. **68-73**, although the anti-migration features **355** are depicted in the form of unidirectional serrated teeth or ridges **355** on each of the textured surfaces of the implant, the invention is not so limited and, as to particular embodiments, can be configured to have said features **355** arranged in multiple directions, unidirectional, or a combination of multiple direction on some surfaces of the implant and unidirectional on other surfaces of the implant. Accordingly, the features **355** can be so arranged on the various surfaces of the implant so as to prevent undesired migration in particular directions due to the forces present at the sacroiliac joint **1000**.

Depending on the embodiment, the implant **25** may have an edge configuration of the planar members **55** designed to prevent migration of the implant once implanted in the joint space. For example, as shown in FIGS. **74-79** which are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of an implant **25** with anti-migration edges or ends **360**, the body **45** of the implant **25** is simply the region **45** of the implant **25** where the planar members **50**, **55** intersect. Although not shown in FIGS. **74-79**, in one embodiment, the implant **25** has the bore **40** and holes **70**, **75** substantially as depicted and discussed with respect to the implant of FIGS. **4-17**. Also, the rest of the features of the implant **25** of FIGS. **74-79** are substantially as discussed with respect to the implant **25** of FIGS. **56-61**, with the exception of the anti-migration edges **360** of the implant embodiment of FIGS. **74-79**.

As shown in FIGS. **74-79**, the anti-migration edges **360** of the planar members **55** are in the form of notches **365** generally evenly distributed along longitudinally extending free edges or ends of the planar members **55**. As indicated in FIG. **77**, the notches **365** may have parallel sides **370** inwardly terminating as an arcuate end **375**. The orientation of each notch **365** may be such that the center line NL of the notch **365** forms an angle NA with the center axis CA of the implant **25** that is between approximately 90 degrees and approximately 15 degrees, with one embodiment having an angle NA of approximately 45 degrees. As indicated in FIG. **77**, each notch **365** may have a length LN between the extreme point on the arcuate end **375** and the outer edge boundary of the notch of between approximately 0.2 mm and approximately 10 mm, with one embodiment having a length LN of approximately 3 mm. Each notch **365** may have a width WN of between approximately 0.5 mm and approximately 20 mm, with one embodiment having a width WN of approximately 2 mm.

As another example, as shown in FIGS. **80-85**, which are, respectively, front isometric, rear isometric, side elevation, plan, front elevation, and rear elevation views of an implant **25** with another type of anti-migration edges or ends **360**, the body **45** of the implant **25** is simply the region **45** of the implant **25** where the planar members **50**, **55** intersect. Although not shown in FIGS. **80-85**, in one embodiment, the implant **25** has the bore **40** and holes **70**, **75** substantially as depicted and discussed with respect to the implant of FIGS. **4-17**. Also, with the exception of its anti-migration edges **360** and its more arcuate distal or leading end **42**, the rest of the features of the implant **25** of FIGS. **80-85** are substantially as discussed with respect to the implant **25** of FIGS. **62-67**, including the sharp or well defined edges between adjacent intersecting surfaces of the implant **25**.

As shown in FIGS. **80-85**, the anti-migration edges **360** are flared longitudinally extending free edges or ends of the planar members **55**. The edges **360** include a series of ridges **370** that are generally evenly distributed along the length of the edges **360** and oriented transverse to the length of the edges **360**.

As indicated in FIG. **83**, the ridges **370** have triangular cross sectional elevations with an overall height RA of between approximately 0.2 mm and approximately 8 mm, with one embodiment having a width RA of approximately 1 mm. As illustrated in FIG. **85**, the flared longitudinally extending free edges or ends of the planar members **55** have rim edges **380** defining the top and bottom edges of the anti-migration edges **360** of the planar members **55**, wherein the rim edges **380** have slopes **385** transitioning between the planar surfaces **65** of the planar members **55** and the rim edges **380**.

The edges **360** have a height EH between the edges **380** of between approximately 0.5 mm and approximately 15 mm, with one embodiment having a height EH of approximately 4 mm. The width EW of the flared edge **360** from the beginning of the sloped transition **385** to the face of the edge **360** is between approximately 0.2 mm and approximately 9 mm, with one embodiment having a width EW of approximately 1 mm.

In particular embodiments, the implants with features as described above with respect to FIGS. **62-83** can alternatively be configured to function as a broach or other surgical site preparation tool that can assist in the removal of certain tissues, for example, cartilage or bone, during certain steps of a procedure.

To begin a detailed discussion of components of an embodiment of the delivery tool **20**, reference is again made to FIGS. **2A-3**. As shown in FIG. **2A**, the delivery tool **20** includes a distal end **35** and a proximal end **80**. The distal end **35** supports the implant assembly **15** components **25**, **30**, and the proximal end **80** is configured to be grasped and manipulated to facilitate the implantation of the implant assembly **15** in the sacroiliac joint.

As illustrated in FIG. **3**, the delivery tool **20** further includes an arm assembly **85**, a handle **90**, an implant retainer **95**, a sleeve **100** and a trocar or guidewire **105**. As shown in FIG. **18**, which is a proximal isometric view of the arm assembly **85**, the arm assembly **85** includes an implant arm **110** and an anchor arm **115** supported off of the implant arm **110**. The implant arm **110** includes a distal end **120**, a proximal end **125** and a proximal cylindrical opening **130** of a cylindrical bore **132**. The proximal end **125** includes a squared outer surface configuration **135** that facilitates a mechanical engagement arrangement with the handle **90** such as the mechanical arrangement that exists between a wrench and nut.

As shown in FIG. **19**, which is a distal isometric view of the arm assembly **85**, the distal end **120** includes cylindrical opening **137** of a cylindrical bore **132**, large planar members, keels, or fins **140** and small planar members, keels, or fins **145**, pins **150**, and a planar extreme distal face **152**. As depicted in FIG. **20**, which is a longitudinal cross section of the implant arm **110** as taken along section line **20-20** in FIG. **18**, the cylindrical bore **132** extends the full length of the implant arm **110** between the proximal opening **135** and the distal opening **137**.

For a detailed discussion of the interaction between the features of the implant arm distal end **120** and the proximal end **43** of the implant **25**, reference is now made to FIGS. **2**A and **21**A and **22-24**. FIG. **21**A is a side elevation of the system **10** wherein the tool **20** is attached to the implant assembly **15** for delivery of the implant assembly **15** to the sacroiliac joint. FIG. **22** is the same view as FIG. **21**A, except shown as a longitudinal cross section. FIG. **23** is an enlarged view of the distal region of the system **10** circled in FIG. **22**. FIG. **24** is an enlarged cross sectional plan view taken in a plane 90 degrees from the section plane of FIG. **23**.

As can be understood from FIGS. **2**A and **21**A and **22-24**, when the system **10** is assembled for the delivery of the implant assembly **15** to the sacroiliac joint, the proximal end **43** of the implant **25** (see FIG. **6**) is supported off of the implant arm distal end **120** (see FIG. **19**). As can be understood from a comparison of FIGS. **6** and **19** and more clearly depicted in FIGS. **23** and **24**, the cylindrical body **45**, and planar members **50**, **55** of the implant **25** and the cylindrical implant arm **110** and planar members **140**, **145** of the implant arm **110** respectively correspond with respect to both shape and size such that when the implant **25** is supported off of the implant arm distal end **120** as depicted in FIGS. **2**A and **21**A and **22-24**, the respective outer surfaces of the implant **25** and implant arm distal end **120** transition smoothly moving from the implant **25** to the implant arm distal end **120**, and vice versa. Also, as shown in FIGS. **23** and **24**, when the system **10** is assembled for the delivery of the implant assembly **15** to the sacroiliac joint, the planar extreme proximal face **43** of the implant **25** abuts against the planar extreme distal face **152** of the implant arm distal end **120**, the pins **150** being received in a recessed fashion in the lateral bores **75**. The pins **150** being received in the lateral bores **75** prevents the implant **25** from pivoting relative to the implant arm **110**. The pins **150** can be configured to have a rectangular, circular or any other cross section and the corresponding lateral bores **75** can also be configured to have corresponding shapes in cross section.

Alternatively, in order to further restrict undesirable movement between components of a system **10**, namely between that of a delivery tool **20** and an implant **25**, the distal face **152** of the implant arm distal end **120** can be configured to rap around, and can also be recessed into or grappled to, the exterior surface of the elongate body **45**, or planar members **50**, or **55** of the implant **25** a distance DE, from about 0.2 mm to about 20 mm (e.g., 10 mm), in the direction of implant distal end **42**. According to particular embodiments, a recess can extend a distance DA from said exterior surfaces in the general direction of implant longitudinal axis CA, from about 0.25 mm to 5 mm (e.g., 1.25 mm). In a non-limiting example of a particular embodiment, the distal face **152** of the implant arm distal end **120** can be further configured to wrap completely or only a portion of the periphery of an implant by occupying only a portion, CAR, as defined by a number of degrees around implant longitudinal axis CA, from about 1 degree to about 180 degrees (e.g., 30 degrees). In particular embodiments, said features can be configured to be located in the area between the planar members **50** and **55**.

As shown in FIGS. **18** and **19**, the anchor arm **115** is supported off of the implant arm **110** at an angle and includes a proximal end **155** and a distal end **160** distally terminating in a sleeve or collar **165** having a longitudinal center axis LCA_1 that is generally transverse to the longitudinal axis of the anchor arm **115**. Collar **165** has a length of between approximately 10 mm and approximately 60 mm (e.g., 20 mm) disposed between collar ends **166** and **167** configured to permit and maintain accurate alignment of the first sleeve **100** along LCA_1 during the course of the procedure. The anchor arm proximal end **155** intersects the implant arm **110** at a location between the proximal and distal ends of the implant arm.

As indicated in FIGS. **18** and **19**, the implant arm **110** also includes a longitudinal center axis LCA_2. As shown in FIG. **21**A, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110**, the longitudinal center axis CA of the implant **25** is coaxially aligned with the longitudinal center axis LCA_2 of the implant arm **110**, and the longitudinal center axis BA of the implant bore **40** is coaxially aligned with the longitudinal center axis LCA_1 of the anchor arm collar **165**. Thus, the longitudinal center axis CA of the implant **25** and the longitudinal center axis LCA_2 of the implant arm **110** exist on a first common longitudinally extending axis, and the longitudinal center axis BA of the implant bore **40** and the longitudinal center axis LCA_1 of the anchor arm collar **165** exist on a second common longitudinally extending axis.

In one embodiment, the longitudinal center axis LCA_1 of the anchor arm collar **165** forms an angle $A_{LCA1-LCA2}$ with the longitudinal center axis LCA_2 of the implant arm **110**. For example, the angle $A_{LCA1-LCA2}$ may be between approximately 15 degrees and approximately 135 degrees, with one embodiment being approximately 45 degrees.

As can be understood from FIG. **21**A, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110**, the longitudinal center axis LCA_2 of the implant arm **110** is coaxial with the longitudinal center axis CA of the implant **25** and the longitudinal center axis of the handle **90**. Thus, the line of action for the insertion of the implant **25** into the sacroiliac joint is coaxial with the longitudinal center axes of the implant **25**, implant arm **110** and handle **90**.

As can be understood from the preceding discussion, in one embodiment, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110**, the angle A_{BA-CA} may be substantially the same as the angle $A_{LCA1-LCA2}$. Also, the longitudinal center axis BA of the implant bore **40** is coaxially aligned with the longitudinal center axis LCA_1 of the anchor arm collar **165**. Thus, as will be described in detail below, the anchor arm collar **165** is oriented so as to guide drills and other tools in creating a channel through tissue and bone leading to the implant bore **40** when the implant **25** is positioned in the sacroiliac joint while the implant **25** is still attached to the distal end of the implant arm **110**, as shown in FIG. **21**. Additionally, the anchor arm collar **165** is oriented so as to guide the anchor member **30** into the implant bore **40** when the implant **25** is positioned in the sacroiliac joint while the implant **25** is still attached to the distal end of the implant arm **110**, as shown in FIG. **21**A.

As can be understood from FIG. **21**A, in one embodiment, the above-described coaxial and angular relationships are rigidly maintained due to the anchor arm **115** and its collar **165** being in a fixed, non-adjustable configuration, and the interconnection between the proximal end of the anchor arm **115** and the implant arm **110** being a fixed, non-adjustable configuration at least with respect to the angle $A_{LCA1-LCA2}$ between the longitudinal center axis LCA_1 of the anchor arm collar **165** and the longitudinal center axis LCA_2 of the implant arm **110**. Thus, in one embodiment, the delivery tool **20** comes from the manufacture to the physician in a fixed, non-adjustable configuration having the coaxial and angular relationships articulated above with respect to FIG. **21**A.

FIG. **21**B is the same view as FIG. **21**A, except of another embodiment of the delivery tool **20** wherein the tool **20** includes multiple anchor arms **115**A-**115**D that can be coupled to specific respective locations **168**A-**168**D on the implant arm **110** to account for different patient sizes, yet still maintain the coaxial and angular relationships set out above. As shown in FIG. **21**B, the delivery tool **20** may include two or more, for example, four, anchor arms **115**A-**115**D, each anchor arm having a different overall length. Despite having different overall lengths, because each anchor arm **115**A-**115**D is configured to couple to a specific respective location **168**A-**168**D on the implant arm **110**, the longitudinal center axis LCA_1 of each anchor arm collar **165**A-**165**D is still coaxially aligned with the longitudinal center axis BA of the implant bore **40** when each anchor arm is mounted at its correct respective location **168**A-**168**D on the implant arm **110**. Thus, although the embodiment depicted in FIG. **21**B is adjustable with respect to patient size via the interchangeable anchor arms **115**A-**115**D, the above-described coaxial and angular relationships are rigidly maintained due to the anchor arms **115**A-**115**D and their collars **165** being in a fixed, non-adjustable configuration, and the interconnection between the proximal end of the anchor arms **115**A-**115**D and the implant arm **110** being a fixed, non-adjustable configuration at least with respect to the angle $A_{LCA1-LCA2}$ between the longitudinal center axis LCA_1 of the anchor arm collar **165** and the longitudinal center axis LCA_2 of the implant arm **110**. Thus, although the embodiment depicted in FIG. **21**B is adjustable with respect to the patient size via the interchangeable anchor arms **115**A-**115**D, the delivery tool **20** comes from the manufacture to the physician in a fixed, non-adjustable configuration with respect to the coaxial and angular relationships articulated above with respect to FIG. **21**A.

Although not shown in FIG. **21**B, in some embodiments, multiple sleeves **100** may be provided with the system **10**. For example, the system **10** may include four anchor arms **165**A-**165**D of different lengths, and the system may also include four sleeves **100** of different lengths, each sleeve **100** being configured for use with a specific anchor arm. For example, since anchor arm **165**D is the longest anchor arm, its corresponding sleeve **100** may be the longest of the sleeves. Similarly, since anchor arm **165**A is the shortest anchor arm, its corresponding sleeve **100** may be the shortest of the sleeves.

Because of the multiple interchangeable anchor arms **165**A-**165**D that are each configured for attachment to a specific respective location **168**A-**168**D on the implant arm **110**, the delivery tool **20** may be adjusted to accommodate patients of different sizes and still maintain the angular relationships between the components of system **10** that allows the anchor member **30** to be delivered into the implant bore **40** without any further adjustment to the delivery tool. Because the angular relationships are rigidly maintained between the arms **110**, **115**, the collar **165**, and the implant bore **40** despite the anchor arms **115**A-**115**B being interchangeable, the anchoring of the implant **25** in the sacroiliac joint via the anchor member **30** may be achieved quickly and safely. In other words, because the tool does not need to be adjusted with respect to angular relationships, the surgery is simplified, reduced in duration, and reduces the risk of the anchor member **30** being driven through a nerve, artery or vein.

In some embodiments, the system **10** may be provided with two or more tools **20**, each tool having a configuration for a specific size of patient. For example, the tool **20** depicted in FIG. **21**A may be provided for smaller patients in that there is reduced distance between the anchor arm collar **165** and the implant **25**. As depicted in FIG. **21**C, which is the same view of FIG. **21**A, except illustrating a version of the same tool **20** configured to accommodate larger patients, the distance between anchor arm collar **165** and implant **25** is greater due to the anchor arm **165** being more proximally located on the implant arm **110** as compared to the configuration depicted in FIG. **21**A. It should be noted that, although the version depicted in FIG. **21**C is configured to accommodate larger patients, the coaxial and angular relationships discussed above with respect to FIG. **21**A are the same for the version depicted in FIG. **21**C. For the version depicted in FIG. **21**C, the sleeve **100** is substantially elongated as compared to the sleeve **100** of FIG. **21**A. Depending on the size of the patient, the physician may select or be provided with one of the tool configurations shown in FIG. **21**A or **21**C.

Additionally, the sleeve **100** of FIG. **21**C can be prevented from undesired migration within the anchor arm collar **165** during a procedure by utilizing a locking mechanism **163** in close proximity to the collar **165**. As a non-limiting example, a locking mechanism can be configured as a fastener **163**, which, in certain embodiments, can be threaded and rotatably advanced into the collar **165** to cause a greater amount of friction upon the sleeve **100**.

As shown in FIGS. **25**-**27**, which are various isometric views of the handle **90**, the handle **90** includes a gripping portion **170**, a neck portion **175**, a proximal end **180**, a distal end **185**, a proximal opening **190**, a distal opening **195** and a bore **200** extending longitudinally through the handle **90** between the openings **190**, **195**. The proximal opening **190** is defined in the proximal end **180**, which forms the extreme proximal portion of the gripping portion **170**. The distal opening **195** is defined in the distal end **185**, which forms the extreme distal portion of the neck portion **175**. The neck portion **175** has multiple regions having different diameters, thereby forming a collared configuration. The gripping portion **170** may have a generally spherical or oval hemispheric shape.

As shown in FIG. **27**, a squared inner surface configuration **205** is defined in a segment of the bore **195** located in the neck portion **175**, the rest of the bore **195** having a cylindrical configuration. Thus, as can be understood from FIGS. **1**, **21**A and **22**, when the implant arm distal end **125** is received in the handle bore **200**, the squared inner surface configuration **205** facilitates a mechanical engagement arrangement with the squared outer surface configuration **135** of the implant arm distal end **125**. As a result, grasping the handle so as to cause the handle to pivot about its longitudinal center axis causes the implant arm to similarly pivot about its longitudinal center axis, which is generally coaxial with the longitudinal center axis of the handle. The fit between the squared surface configurations **135**, **205** may be such as to form an interference fit, thereby preventing the handle from being pulled off of the implant arm distal end without the intentional application of substantial separating force.

As illustrated in FIGS. **28** and **29**, which are full isometric and longitudinal cross sectional isometric views of the implant retainer **95**, the implant retainer **95** includes a longitudinal cylindrical member **210**, T-handle **215** on a proximal end of the longitudinal cylindrical member **210**, and an implant engagement feature **220** on a distal end the longitudinal cylindrical member **210**. As can be understood from FIGS. **2**A and **21**A and **22-24**, when the system **10** is assembled for the delivery of the implant assembly **15** to the sacroiliac joint, the longitudinal cylindrical member **210** extending through the handle bore **200** (see FIG. **27**) and implant arm bore **132** (FIG. **20**) such that a distal side of the T-handle **215** abuts or nearly abuts with the handle proximal face or end **180** (FIG. **25**) and the implant engagement feature **220** is received in the implant center bore **70** (FIG. **6**). In one embodiment, the implant engagement feature **220** is in the form of a threaded shaft for engaging complementary threads in the center bore **70**, thereby securing the implant proximal face against the implant arm distal face and the pins in the lateral bores, as depicted in FIGS. **22-24**. In other embodiments, the implant engagement feature **220** and the center bore **70** are configured so as to form an interference fit between the two such that an intentional separating force is required to remove the implant engagement feature from within the center bore and allow the release of the implant from the distal end of the implant arm, as indicated in FIG. **2**B.

FIG. **30**A is an isometric view of a sleeve **100** that is configured to be received in the anchor arm collar **165**, as can be understood from FIGS. **2**A, **21**A, and **22-23**. The sleeve **100** may have a tubular portion **225** that extends from a plate **230** and defines a lumen **226** extending the length of the tubular portion **225**. As indicated in FIG. **30**B, which is a longitudinal cross section of one embodiment of the sleeve **100**, the sleeve **100** is formed of multiple sleeve portions **100**A-**100**C nested together such that the tubular portions **225**A-**225**B are concentrically arranged and the plates **230**A-**230**B are stacked. As each sleeve portion **100**A-**100**C has a tubular portion **225**A-**225**B with a different diameter, the sleeve portions **100**A-**100**C can be employed as needed to dilate an incision opening or guide different diameter guidewires, trocars, drills, etc. in the direction of the implant bore **40**.

FIG. **31** is an isometric view of a trocar, guidewire, drill, screwdriver, etc. that may be inserted through the lumen **226** of the tubular portion **225** in gaining access to, or driving the anchor member **30** into, the implant bore **40** when the implant **25** is positioned in the sacroiliac joint via the distal end of the implant arm **110**.

To begin a detailed discussion of a second embodiment of the system **10**, reference is made to FIGS. **32-33**. FIG. **32** is an isometric view of the system **10**, and FIG. **33** is the same view as FIG. **32**, except the system **10** is shown exploded to better illustrate the components of the system **10**.

As can be understood from FIGS. **32** and **33**, the system **10** includes a delivery tool **20** and an implant assembly **15** for implanting at the sacroiliac joint via the delivery tool **20**, the implant assembly **15** being for fusing the sacroiliac joint. As indicated in FIG. **33**, the implant assembly **15** includes an implant **25** and an anchor element **30** (e.g., a bone screw or other elongated body). In one embodiment, the implant assembly **15** is the same as that described above with respect to FIGS. **4-17**. As discussed below in greater detail, during the implantation of the implant assembly **15** at the sacroiliac joint, the implant **25** and anchor element **30** are supported by a distal end **35** of the delivery tool **20**, as illustrated in FIG. **32**. The delivery tool **20** is used to deliver the implant **25** into the sacroiliac joint space. The delivery tool **20** is then used to cause the anchor element **30** to extend through the ilium, sacrum and implant **25** generally transverse to the sacroiliac joint and implant **25**. The delivery tool **20** is then decoupled from the implanted implant assembly **15**.

As shown in FIG. **32**, the delivery tool **20** includes a distal end **35** and a proximal end **80**. The distal end **35** supports the implant assembly **15** components **25**, **30**, and the proximal end **80** is configured to be grasped and manipulated to facilitate the implantation of the implant assembly **15** in the sacroiliac joint.

As illustrated in FIG. **33**, the delivery tool **20** further includes an arm assembly **85**, a handle **90**, an implant retainer **95**, and a trocar or guidewire **105**. As shown in FIG. **33** and also in FIG. **34**, which is a side elevation of the system **10**, the arm assembly **85** includes an implant arm **110** and an anchor arm **115**.

As shown in FIG. **35**, which is a proximal isometric view of the implant arm **110**, the implant arm **110** includes a distal end **120**, a proximal end **125** and a proximal cylindrical opening **130** of a cylindrical bore **132**. The proximal end **125** includes a squared outer surface configuration **135** that facilitates a mechanical engagement arrangement with the handle **90** such as the mechanical arrangement that exists between a wrench and nut. As the handle **90** is the same as described above with respect to FIGS. **25-27**, the handle **90** receives and mechanically interlocks with the distal region of the implant arm **110** as described above with respect to FIG. **22**.

As with the implant arm **110** discussed above with respect to FIG. **19** and as can be understood from FIG. **34**, the distal end **120** of the implant arm **110** includes a cylindrical opening **137** (see FIG. **19**) of a cylindrical bore **132**, large planar members, keels, or fins **140** and small planar members, keels, or fins **145**, pins **150**, and a planar extreme distal face **152** (see FIG. **19**). Just as explained with respect to FIG. **20** above, the cylindrical bore **132** of the embodiment depicted in FIG. **34** extends the full length of the implant arm **110** between the proximal opening **135** and the distal opening **137**.

As the retaining member **95** of the embodiment of FIG. **33** is the same as described above with respect to FIGS. **28-29**, the retainer member **95** extends through the handle **90** and implant arm **110** to mechanically interlock with the implant center bore **70** as described above with respect to FIGS. **22-24**. Also, the configuration of the distal end **120** of the implant arm **110** of FIG. **35** is the same as the configuration of the distal end **120** of the implant arm **110** of FIG. **19**. Accordingly, the distal end **120** of the implant arm **110** of FIG. **35** interacts with the proximal end of the implant **25** as describe above with respect to FIGS. **22-24**.

As indicated in FIG. **35**, the implant arm **110** includes pivot pins **235** on opposite sides of the implant arm **110**, the pivot pins **235** having a pivot axis PA that is perpendicular to the plane in which the implant bore **40** passes through the implant **25**. In other words, the pivot axis PA is perpendicular to the longitudinal center axis LCA_2 of the implant arm **110** and contained within the same plane as the longitudinal center axis LCA_2 of the implant arm **110**. The pivot pins **235** are located on the implant arm **110** near the distal end of the handle **90**.

As illustrated in FIG. **36**, which is an isometric view of the anchor arm **115**, the anchor arm **115** includes a proximal end **155** and a distal end **160** distally terminating in a sleeve or collar **165** that is arcuate and substantially extended as compared to the collar **165** of the embodiment depicted in FIG. **18**.

The arcuate and extended collar **165** has an arcuate longitudinal center axis LCA_1 that is generally transverse to the longitudinal axis of the anchor arm **115**. A lumen **236** extends the length of the collar **165** to daylight in openings at both ends of the collar **165**.

As shown in FIG. **36**, the anchor arm proximal end **155** includes notches **240**, which, as can be understood from FIGS. **32** and **34**, receive the respective pivot pins **235**. As a result, the anchor arm **115** is pivotally supported off of the implant arm **110** via the notches **240** at the anchor arm proximal end **155** pivotally receiving the pivot pins **235** of the implant arm **110**.

As can be understood from FIGS. **32-34**, an arcuate member **105** can be inserted in the lumen **236** of the arcuate extended collar **165**. The curvature of the arcuate member **105** matches the curvature of the lumen **236** of the arcuate collar **165**. The arcuate member **105** may be a trocar, guidewire, drill, screwdriver, etc. that may be inserted through the lumen **236** of the collar **165** in gaining access to, or driving the anchor member **30** into, the implant bore **40** when the implant **25** is positioned in the sacroiliac joint via the distal end of the implant arm **110**. As indicated by the arrow A in FIG. **34**, the arcuate member **105** is slideably displaceable through the arcuate length of the collar **165**. Also, as indicated by arrow B, the anchor arm **110** is pivotal about the pivot pins **235**.

As indicated in FIG. **35**, the implant arm **110** includes a longitudinal center axis LCA_2. As shown in FIG. **34**, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110**, the longitudinal center axis CA of the implant **25** is coaxially aligned with the longitudinal center axis LCA_2 of the implant arm **110**, and the longitudinal center axis BA of the implant bore **40** is coaxially aligned with the longitudinal center axis LCA_1 of the anchor arm collar **165**. In other words, in the context of the embodiment of FIG. **34**, the arcuate longitudinal center axis LCA_1 extends to be coaxially aligned with the longitudinal center axis BA of the implant bore **40**. In one embodiment, as indicated in FIG. **34**, the longitudinal center axis LCA_1 of the anchor arm collar **165** has an arm radius R_{ARM} that extends into coaxial alignment with the longitudinal center axis BA of the implant bore **40**. For example, the arm radius R_{ARM} may be between approximately 50 mm and approximately 300 mm, with one embodiment being approximately 160 mm.

As can be understood from FIG. **34**, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110**, the longitudinal center axis LCA_2 of the implant arm **110** is coaxial with the longitudinal center axis CA of the implant **25** and the longitudinal center axis of the handle **90**. Thus, the line of action for the insertion of the implant **25** into the sacroiliac joint is coaxial with the longitudinal center axes of the implant **25**, implant arm **110** and handle **90**. Thus, as will be described in detail below, the anchor arm collar **165** is oriented so as to guide drills and other tools in creating a channel through tissue and bone leading to the implant bore **40** when the implant **25** is positioned in the sacroiliac joint while the implant **25** is still attached to the distal end of the implant arm **110**, as shown in FIG. **34**. Additionally, the anchor arm collar **165** is oriented so as to guide the anchor member **30** into the implant bore **40** when the implant **25** is positioned in the sacroiliac joint while the implant **25** is still attached to the distal end of the implant arm **110**, as shown in FIG. **32**.

Because the tool embodiment depicted in FIG. **32** has an anchor arm **115** that is pivotally supported off of the implant arm **110** and the anchor arm collar **165** is arcuate and slideably receives an arcuate trocar, etc. **105**, the tool **20** is able to account for different patient sizes, yet still maintain the coaxial and angular relationships set out above. In other words, regardless of whether the anchor arm **115** is pivoted so as to move the anchor arm distal end **160** closer to or further away from the implant bore **40** to accommodate a smaller or larger patient, the trocar **105** can be withdrawn from or extended towards the implant bore **40** as needed to deliver the anchor **30** to the implant bore **40**, the trocar **105** being maintained in the necessary coaxial alignment of the longitudinal axis LCA_1 of the collar **165** with the longitudinal axis BA of the implant bore **40**.

Because the angular relationships are rigidly maintained between the trocar **105** and the implant bore **40** despite the anchor arm **115** being pivotal relative to the implant arm, the anchoring of the implant **25** in the sacroiliac joint via the anchor member **30** may be achieved quickly and safely. In other words, because the tool does not need to be adjusted with respect to angular relationships, the surgery is simplified, reduced in duration, and reduces the risk of the anchor member **30** being driven through a nerve, artery or vein.

To begin a detailed discussion of a third embodiment of the system **10**, reference is made to FIGS. **37-40**. FIGS. **37** and **38** are different isometric views of the system **10**. FIG. **39** is the same view as FIG. **37**, except the system **10** is shown exploded to better illustrate the components of the system **10**. FIG. **40** is a side elevation of the system wherein the tool is attached to the implant assembly for delivery of the implant assembly to the sacroiliac joint.

As can be understood from FIGS. **37-40**, the system **10** includes a delivery tool **20** and an implant assembly **15** for implanting at the sacroiliac joint via the delivery tool **20**, the implant assembly **15** being for fusing the sacroiliac joint. As indicated in FIG. **39**, the implant assembly **15** includes an implant **25** and an anchor element **30** (e.g., a bone screw or other elongated body).

As can be understood from a comparison of FIGS. **2A-3** to FIGS. **37-40**, the delivery tool **20** of FIGS. **2A-3** is the same as the delivery tool **20** of FIGS. **37-40**. Thus, for a complete description of the delivery tool **20** of FIGS. **37-40** and its components, namely, the arm assembly **85**, handle **90**, implant retainer **95**, a trocar or guidewire **105**, and multiple nested sleeves **100**, refer back to the corresponding discussion given above with respect to FIGS. **2A-3** and **18-31**.

As indicated in FIGS. **37-40**, the system **10** includes an implant assembly **15** with an implant **25** similar the implant **25** discussed above with respect to FIGS. **4-18**, except the implant **25** of FIGS. **37-40** also includes a guide arm **265**. To begin a detailed discussion of components of the embodiment of the implant **25** of FIGS. **37-40**, reference is made to FIGS. **41-50**. FIGS. **41-44** are various isometric views of the implant **25**. FIGS. **45-46** are opposite plan views of the implant **25**, and FIGS. **47-50** are various elevation views of the implant.

A comparison of FIGS. **41-50** to FIGS. **5-18** reveals that the two implant embodiments are the same, except the implant embodiment of FIGS. **41-50** has a guide arm **265**. Thus, for a complete description of the features of the implant **25** other than the guide arm **265**, which is discussed below, refer back to the corresponding discussion given above with respect to FIGS. **5-18**.

As shown in FIGS. **41-45** and **46-50**, the guide arm **265** includes a longitudinally extending member **270** and a guide portion **275**. The guide arm **265** is cantilevered off of a side of the implant near the proximal or trailing end **43** of the implant **25**. Thus, the guide arm **265** includes an attached end **280**, which is attached to, or extends from, the implant proximal end **43**, and a free end **285**, which defines the guide portion **275**.

The longitudinally extending member **270** may be in the form of a planar member or other shaped member. As illustrated in FIG. **45**, the longitudinal axis LA of the member **270** is generally coplanar with the longitudinal axis CA of the implant body **45**. However, as indicated in FIG. **48**, the longitudinal axis LA of the member **270** forms an angle A_{LA-CA} with the longitudinal axis CA of the implant body **45**. For example, the angle A_{LA-CA} may be between approximately 5 degrees and approximately 60 degrees, with one embodiment being approximately 40 degrees.

As illustrated in FIGS. **41-45** and **47-50**, the guide portion **275** is in the form of a collar defining a central hole **290**. As indicated in FIG. **47**, the member **270** has an overall length AD from its intersection with the rest of the implant to the tip of the free end **285** of between approximately 5 mm and approximately 60 mm, with one embodiment being approximately 20 mm. Also, the center axis GA of the hole **290** is coaxially aligned with the center axis BA of the bore **40**. The overall length AE from the intersection of the member **270** with the rest of the implant to the center axis GA is between approximately 2 mm and approximately 58 mm, with one embodiment being approximately 17 mm.

Since the center axis GA of the hole **290** is coaxially aligned with the center axis BA of the bore **40**, when the system **10** is assembled such that the implant **25** is mounted on the distal end of the implant arm **110** with the longitudinal center axis LCA_2 of the implant arm **110** coaxial with the longitudinal center axis CA of the implant **25**, the respective longitudinal axes LCA_1, BA and GA of the anchor arm collar **165**, the bore **40** and the guide hole **290** are coaxially aligned, as can be understood from FIG. **40**. Thus, when the implant body **45** is located in the sacroiliac joint and the guide collar **275** of the implant **25** is located near or against bone adjacent to the sacroiliac joint, the anchor member **30** may be accurately driven through the guide hole **290**, through the bone and through the implant bore **40** to anchor the implant at the sacroiliac joint in such a manner to allow the implant to fuse the joint.

In one embodiment, the implant **25** may be machined, molded, formed, or otherwise manufactured from stainless steel, titanium, ceramic, polymer, composite or other biocompatible materials. The anchor member **30** may be machined, molded, formed or otherwise manufactured from similar biocompatible materials.

For the delivery tools **20** depicted in FIGS. **2**A, **21**A, **21**C, **32**, **37**, and **40**, the handle **90** and arm assembly **85** are coupled together so as to not allow rotational movement relative to each other, and the implant retainer **95** is rotationally displaceable within the handle **90** and arm assembly **85**. In other embodiments of the tool **20**, the handle **90** and implant retainer **95** are coupled together so as to rotate as a unit relative to the arm assembly **85**. An example of such an embodiment is illustrated in FIG. **86**, which is an isometric view of the delivery tool **20**.

As shown in FIG. **86**, the delivery tool **20** includes a distal end **35** and a proximal end **80**. As shown in FIGS. **87-88**, which are generally opposite isometric views of the delivery tool **20** in an exploded state, the tool **20** further includes an arm assembly **85**, a handle **90**, an implant retainer **95**, and a collar assembly **400**. The tool **20** may also include a sleeve **100** and a trocar or guidewire **105** as discussed above with respect to the embodiment of FIG. **3**.

As can be understood from FIGS. **86-88**, the arm assembly **85** includes an implant arm **110** and an anchor arm **115** supported off of the implant arm **110**. The implant arm **110** has a two-piece construction of an inner sleeve **110**A and an outer sleeve **110**B. The implant arm inner sleeve **110**A includes a distal end **120**, a proximal end **125**, a proximal cylindrical opening **130** of a cylindrical bore **132**, and a distal cylindrical opening **137** of the bore **132**. The cylindrical bore **132** extends the full length of the implant arm inner portion **110**A between the proximal opening **135** and the distal opening **137**. Longitudinally extending raised ribs **405** are radially distributed about the outer circumferential surface of the implant arm inner portion **110**A. The longitudinal ribs **405** distally terminate by intersecting a raised circumferential ring **410** on the outer circumferential surface of the inner implant arm portion **110**A. A groove **415** is circumferentially extends about the outer circumference of the implant arms inner portion **110**A. The distal end **120** of the implant arm inner portion **110**A also includes large planar members, keels, or fins **140** and small planar members, keels, or fins **145**, pins **150**, and a planar extreme distal face **152** similar to that discussed above with respect to the embodiment of FIG. **2**A.

As illustrated in FIGS. **87-88**, the implant arm outer portion **110**B includes a distal end **420**, a proximal end **425**, a proximal cylindrical opening **430** of a cylindrical bore **432**, and a distal cylindrical opening **437** of the bore **432**. The cylindrical bore **432** extends the full length of the implant arm outer portion **110**B between the proximal opening **435** and the distal opening **437**. Longitudinally extending grooves **440** are radially distributed about the inner circumferential surface of the bore **432** in an arrangement that matches the longitudinal raised ribs **405** of the implant arm inner portion **110**A such that the ribs **405** are received in the grooves **440** in a mated arrangement when the inner portion **110**A is received in the bore **432** of the outer portion **110**B. The anchor arm **115** extends off the implant arm outer portion **110**B at an angle as described above with respect to the previously discussed embodiments. The anchor arm **115** terminates at its free end in a collar **165** similar to those already discussed above.

As shown in FIGS. **87** and **88**, the implant retainer **95** includes a proximal end **215**, a distal end **220**, and a lumen **445** extending the full length of the implant retainer **95**. The proximal end **215** includes a squared, pentagonal or hexagonal outer surface configuration **450** that facilitates a mechanical engagement arrangement with the handle **90** such as the mechanical arrangement that exists between a wrench and nut. A ring **451** radial extends from the retainer **95** at the distal edge of the squared, pentagonal or hexigonal configuration **450**. The distal end **220** may be threaded or otherwise configured to engage a proximal end of anyone of the implants **25** disclosed herein.

As illustrated in FIGS. **87** and **88**, the collar assembly **400** includes a helical spring **455**, rings **460**A and **460**B, washer **460**C, retainer balls **461**, and a retaining collar **465**. As shown in FIG. **89**, which is an isometric view of the handle **90**, a cylindrical neck portion **470** of the handle **90** includes a shoulder **476** which slopes down to a circumferential groove **475** and a pair of holes **480** defined in the outer circumferential surface of the neck **470**.

As indicated in FIG. **90**, which is an exploded isometric view of the retaining collar **465** and handle **90** shown in longitudinal cross section, the holes **480** extend through the cylindrical wall **485** that defines the neck **470** and a cylindrical void **487** within the neck. A squared, pentagonal or hexagonal inner surface configuration **490** is defined in the handle **90** distal the cylindrical void **487** to receive in a mating arrangement the complementarily shaped outer configuration **450** of the proximal end of the implant retainer **95**. A lumen **495** extends from a proximal end of the handle to open into the squared, pentagonal or hexagonal inner surface configuration **490**.

As shown in FIG. **90**, the retaining collar **465** includes a proximal end **500**, a distal end **505**, an outer circumferential surface **510** and an inner circumferential surface **515** that defines the hollow interior of the collar **517**. The outer circumferential surface **510** extends radially outward to form a rim **520** near the proximal end **500**. The inner circumferential surface **515** has a stepped and ramped configuration. Specifically, working distal to proximal, the inner circumferential surface **515** includes a proximal inner ring **525** separated from an intermediate inner ring **530** by a proximal large diameter region **535** separated from a small diameter region **540** by a ramped surface **545**. Proximal the intermediate inner ring **530** is another large diameter region **550** bordered on its proximal boundary by a groove **555**.

As can be understood from FIG. **91**, which is a longitudinal cross section of the delivery tool **20** when assembled as shown in FIG. **86**, the implant arm inner portion **110**A is received in the implant arm outer portion **110**B such that the ribs **405** are matingly received in the corresponding slots **440** and the ring **410** abuts against the distal end **420** of the outer portion **110**B. The implant retainer **95** extends through the inner portion **110**A such that the distal end **220** of the implant retainer distally extends from the distal end **120** of the inner portion **110**A and the ring **451** abuts against the proximal end **125** of the inner portion **110**A. The proximal ends of the inner portion **110**A and retainer **95** are received in the volume **487** (see FIG. **90**) of the neck **470**, the squared, pentagonal, or hexagonal portion **450** of the retainer **95** matingly received in the complementarily shaped volume **490** of the neck such that the ring **451** abuts against the step in the neck between the volume **490** of the neck and the rest of the volume of the neck distal thereto. The distal end of the neck **470** abuts against the proximal end **425** of the outer portion **110**B.

As illustrated in FIG. **91**, a first lock ring **460**A is received in the groove **555** in the collar **465**. A second lock ring **460**B is received in the circumferential groove **475**. A washer **460**C is received on the neck **470** and abuts shoulder **476**, which prevents washer **460**C from advancing proximally beyond shoulder **476**, and washer **460**C is held in place distally by second lock ring **460**B. Helical spring **455** circumferentially extends about the neck **470** between the washer **460**C and the intermediate inner ring **530** of the collar **465**. Thus, the spring biases the collar **465** distally on the neck **470**. First lock ring **460**A prevents collar **465** from distal disengagement from neck **470**; the ring **460**A, due to the forces exerted by a compressed spring **455** abuts washer **460**C under normal conditions until manipulation by a medical person acting to move collar **465** proximally which in turn moves first lock ring **460**A proximally thereby creating a further distance between first lock ring **460**A and washer **460**C.

As depicted in FIG. **91**, neck holes **480** can be configured to have a sufficient diameter to allow the retaining balls **461** to enter from the opening nearest the outer circumferential surface of the neck **470** and to be seated within holes **480**, the configuration further allowing a portion of the retaining balls **461** to extend into the cylindrical void **487** such to allow sufficient engagement with groove **415** as further described below. The neck holes **480** can be further configured, as depicted in FIG. **91**, to have a slight reduction in their diameter, the reduction of diameter occupying a small portion of the holes **480** nearest the cylindrical void **487**, thereby allowing for a configuration between neck **470**, neck holes **480** and retaining balls **461** such that the retaining balls **461** are resistant to completely entering cylindrical void **487** after the removal of inner portion of the implant retainer **95** and implant arm inner portion **110**A. The balls **461** are each held in their respective holes **480** in the neck **470** by the balls **461** being trapped between the neck holes **480** and inner circumferential surface of the collar **465**. Therefore, when the collar **465** is biased distally on the neck, the balls **461** are inwardly forced by the reduced diameter region **540** to lock into the groove **415** of the inner portion **110**A, retaining the proximal end of the anchor arm **110** in the handle/collar assembly. When the collar **465** is pulled proximally by a medical person using the tool **20**, the balls **461** are exposed to the large diameter region **535**, allowing the balls **461** sufficient play to radially outwardly move in the holes **480** to allow the balls to escape the groove **415**, thereby allowing the proximal end of the anchor arm **110** to be removed from the handle/collar assembly.

As shown in FIG. **91**, the lumens **495** and **445** are aligned to make one continuous lumen through the assembled tool **20**. Thus, the tool **20** can be fed over a guidewire, stylet, needle or etc., or such implements can be fed through the lumen. Also, a bone paste, in situ curable biocompatible material, or similar material can be fed through the lumen to an implant **25** positioned in the joint via the tool.

As can be understood from FIGS. **86-91**, the collar assembly **400** retains the proximal end of the implant arm **110** in the neck of the handle **90**. The collar assembly **400** can be displaced proximally on the neck of the handle **90** to allow the proximal end of the implant arm **110** to be removed from the neck of the handle. When the implant arm **110** is coupled to the handle **90**, the portions **110**A and **110**B of the implant arm **110** are locked together and prevented from displacing relative to each other, but the handle **90** and retainer **95** can be caused to rotate as a unit relative to the implant arm **110** to cause the distal end **220** of the retainer **95** engage or disengage the implant **25** as desired. Accordingly, the configuration allows for the removal of a handle **90** during the course of a procedure while allowing the retainer **95** to maintain engagement with implant **25** as desired.

Additionally, as a non-limiting example, according to particular embodiments, a reversible locking ratcheting mechanism can be employed to prevent undesired rotation of the handle and other components which could loosen the connection between implant **25** and retainer **95**.

As illustrated in FIG. **92**, which is a side view of an implant retainer **95** similar to that described with respect to FIGS. **86-91**, except having a modified distal end **220**. Specifically, the embodiment of FIG. **92** has T-shaped distal end **220**. In one embodiment, the T-shaped distal end **220** includes a cylindrical center portion **220**A and ears or tabs **220**B oppositely positioned on the center portion **220**A from each other.

FIGS. **93-94** are, respectively, longitudinal and transverse cross sectional views of an implant **25** with an engagement hole **70** configured to complementarily engage with the T-shaped distal end **220** of the retainer **95** of FIG. **92**. As illustrated in FIGS. **93-94**, the hole **70** includes a cylindrical longitudinally extending center portion **70**A with longitudinally extending grooves **70**B located oppositely from each other. Inner radially extending grooves **70**C intersect the distal ends of the grooves **70**B.

As shown in FIG. **95**, which is the same view as FIG. **93**, except with the retainer **95** received in the hole **70**, the cylindrical retainer portion **220**A is received in the cylindrical hole portion **70**A, and the retainer tab portions **220**B are received in the hole grooves **70**B. Once the distal end **220** of the retainer **95** is sufficiently received in the hole **70** such that the retainer tab portions **220**B are aligned with the associated radially extending grooves **70**C as illustrated in FIG. **95**, the retainer **95** can be rotated within the hole **70** to cause the tab portions **220**B to move into the radially extending grooves **70**C, thereby locking the distal end **220** of the retainer **95** in the hole **70** of the implant **25**. Grooves **70**C can be configured such as to form an interference fit, thereby preventing retainer **95** from being separated from the implant **25** without the intentional application of substantial rotational separating force. Reversing the rotation of the retainer can cause the tab portions **220**B to exit the radial grooves **70**C, thereby unlocking the retainer distal end from the implant hole. Alternatively, according to particular embodiments, as a non-limiting example, radially extending grooves **70**C can be configured to have at least one ramped surface, which upon rotation of retainer **95** into the grooves **70**C, urges the distal end **220** a distance further in the direction of distal end **42** of implant **25** thereby creating increased friction between ring **45** of retainer **95** and proximal end **125** of **110**A thereby preventing undesirable reverse rotation of the retainer without the intentional application of substantial rotational separating force, which otherwise could lead to an unlocking of the retainer distal end from the implant hole.

As illustrated in FIG. **93**, in one embodiment, the implant **25** may include a lumen **600** extending the length of the implant through the anchor hole **40** and the retainer engagement hole **70**. Such a lumen **600** may serve to receive a guidewire or stylet there through. Such a lumen **600** may serve to receive an injection of bone paste material, or other biocompatible material.

To begin a detailed discussion of a fourth embodiment of the system **10**, reference is made to FIGS. **109** and **110**. FIG. **109** is an isometric view of the system **10** wherein the tool **20** is attached to the implant **25** for delivery of the implant to the sacroiliac joint. FIG. **110** is a view of the system **10** wherein the implant **25** and anchor arm **115** are shown in plan view.

As can be understood from FIGS. **109-110**, the system **10** includes a delivery tool **20** and an implant **25** for implanting at the sacroiliac joint via the delivery tool **20**, the implant **25** being for fusing the sacroiliac joint. As can be understood from a comparison of FIGS. **109** and **86**, the tool embodiment of FIG. **109** is substantially similar to the tool embodiment of FIG. **86**, except the tool embodiment of FIG. **109** has an anchor arm **115** that distally ends in multiple anchor collars **165***a*-**165***d*.

As can be understood from a comparison of FIGS. **109** and **7**, the implant embodiment of FIG. **109** is substantially similar to the implant embodiment of FIG. **7**, except the implant embodiment of FIG. **109** has multiple bores **40***a*-**40***b*.

As illustrated in FIGS. **109-110**, the anchor collars **165** may include two linearly aligned center collars **165***a* and **165***b*, and a lateral anchor collar **165***c* and **165***d* may be located on either side of the most proximal center collar **165***b*. As indicated in FIG. **110**, the two center collars **165***a* and **165***b* may be axially aligned with the respective bores **40***a* and **40***b* of the implant **25** when the implant **25** is supported off of the distal end of the implant arm **110** of the tool **20**. As a result, an anchor member **30** (see, for example, FIG. **4**) may be delivered into each of the bores **40***a* and **40***b* via the respective anchor collars **165***a* and **165***b*. The lateral anchor collars **165***c* and **165***d* may be employed to deliver yet additional anchor members **30** to additional anchor member receiving features (e.g., bores, etc.) existing on, or extending from the sides of, the implant **25**, where such additional anchor member receiving features are present on the implant **25**. Alternatively, lateral collars **165***c* and **165***d* can be configured to deliver additional anchor members **30** into the bone of the ilium and sacrum while not passing through a bore **40** (i.e., preconfigured to place anchor members **30** immediately adjacent the longitudinal side edges of the implant **25**.

To begin a discussion regarding the methodology associated with employing any of the above-described delivery tools **20** in implanting any of the above-described implants **25** in the sacroiliac joint **1000** of a patient **1001**, reference is first made to FIGS. **96**A-**98**B to identify the bone landmarks adjacent, and defining, the sacroiliac joint **1000**. FIG. **96**A is a right lateral side view of a hip region **1002** of a patient **1001** lying prone, wherein the soft tissue **1003** surrounding the skeletal structure **1006** of the patient **1001** is shown in dashed lines. FIG. **96**B is an enlarged view of the hip region **1002** of FIG. **96**A. As illustrated in FIGS. **96**A and **96**B, a lateral view of the patient's hip region **1002** reveals certain features of the ilium **1005**, including the anterior superior iliac spine **2000**, the iliac crest **2002**, the posterior superior iliac spine **2004**, the posterior inferior iliac spine **2006**, the greater sciatic notch **2008** extending from the posterior inferior iliac spine **2006** to the ischial spine **2010**, and the tubercle of iliac crest **2012**. The sacroiliac joint articular region **1044** is shown in dashed lines. A posterior inferior access region **2016** of the sacroiliac joint articular region **1044** has a superior end **2018** on the sacroiliac joint line **2019** that is between approximately 0 mm and approximately 40 mm inferior the posterior inferior overhang **2020** of the posterior superior iliac spine **2004**. The posterior inferior access region **2016** of the sacroiliac joint articular region **1044** has an inferior end **2022** on the sacroiliac joint line that is at approximately the intersection of the posterior inferior iliac spine **2006** with the lateral anterior curved boundary **2024** of the sacrum **1004**. In other words, the posterior inferior access region **2016** of the sacroiliac joint articular region **1044** has an inferior end **2022** on the sacroiliac joint line that is at approximately the superior beginning of the greater sciatic notch **2008**.

FIG. **97**A is a lateral-posterior view of the hip region **1002** of the patient **1001** of FIG. **96**A, wherein the patient **1001** is lying prone and the soft tissue **1003** surrounding the skeletal structure **1006** of the patient **1001** is shown in dashed lines. FIG. **97**B is an enlarged view of the hip region **1002** of FIG. **97**A. As shown in FIGS. **97**A and **97**B, a lateral-posterior view of the patient's hip region **1002** reveals the same features of the sacrum **1004** and ilium **1005** as discussed above with respect to FIGS. **96**A and **96**B, except from another vantage point. The vantage point provided via FIGS. **97**A and **97**B provides further understanding regarding the posterior inferior access region **2016** of the sacroiliac joint articular region **1044** and superior end **2018** and inferior end **2022** of the posterior inferior access region **2016** relative to nearby anatomical features, such as, for example, the posterior inferior overhang **2020** of the posterior superior iliac spine **2004**, the intersection of the posterior inferior iliac spine **2006** with the lateral anterior curved boundary **2024** of the sacrum **1004**, and the superior beginning of the greater sciatic notch **2008**.

FIG. **98**A is a posterior view of the hip region **1002** of the patient **1001** of FIG. **96**A, wherein the patient **1001** is lying prone and the soft tissue **1003** surrounding the skeletal structure **1006** of the patient **1001** is shown in dashed lines. FIG. **98**B is an enlarged view of the hip region **1002** of FIG. **98**A. As shown in FIGS. **98**A and **98**B, a posterior view of the patient's hip region **1002** reveals the same features of the sacrum **1004** and ilium **1005** as discussed above with respect to FIGS. **96**A and **96**B, except from yet another vantage point. The vantage point provided via FIGS. **98**A and **98**B provides yet further understanding regarding the posterior inferior access region **2016** of the sacroiliac joint articular region **1044** and superior end **2018** and inferior end **2022** of the posterior inferior access region **2016** relative to nearby anatomical features, such as, for example, the posterior inferior overhang **2020** of the posterior superior iliac spine **2004**, the intersection of the posterior inferior iliac spine **2006** with the lateral anterior curved boundary **2024** of the sacrum **1004**, and the superior beginning of greater sciatic notch **2008**.

Now that the relevant anatomical landmarks have been identified with respect to FIGS. **96**A-**98**B, the methodology associated with employing any of the above-described delivery tools **20** in implanting any of the above-described implants **25** in the sacroiliac joint **1000** of a patient **1001** can be discussed. In doing so, reference will be made to FIGS. **99**A-**99**P, which are each a step in the methodology and illustrated as the same transverse cross section taken in along a plane extending medial-lateral and anterior posterior along section line **99**-**99** in FIG. **98**B. In this cross section, articular surfaces **1016** are covered by a thick layer of articular cartilage with a joint space existing between them, the FIGS. **99**A-**99**P are simplified for illustrative purposes and do not show these features to scale. Now referring primarily to FIG. **99**A, an embodiment of the method can include the step of placing a patient under sedation prone on a translucent operating table (or other suitable surface). The sacroiliac joint **1000** can be locally anesthetized to allow for injecting a radiographic contrast **1046** (as a non-limiting example, Isoview **300** radiographic contrast) under fluoroscopic guidance into the inferior aspect of the sacroiliac joint **1000** to outline the articular surfaces **1016** of the sacroiliac joint **1000**) defined between the sacrum **1004** and ilium **1005**, the sacroiliac joint **1000** having an interarticular region **1044**. Injection of the radiographic contrast **1046** within the sacroiliac joint **1000** can be accomplished utilizing a tubular member **1047**) (such as a syringe needle) having first tubular member end **1048** which can be advanced between the articulating surfaces **1016** of the sacroiliac joint **1000** and having a second tubular member end **1049** which removably couples to a hub **1050**. The hub **1050** can be configured to removably couple to a syringe barrel **1051** (or other device to contain and deliver an amount of radiographic contrast **1046**). In the example of a syringe barrel **1051**, the syringe barrel **1051** can have an internal volume capable of receiving an amount of the radiographic contrast **1046** sufficient for outlining the articular surfaces **1016** of the sacroiliac joint **1000**, for example, under lateral fluoroscopy. A plunger **1052** can be slidingly received within the barrel **1051** to deliver the radiographic contrast **1046** through the tubular member **1047** into the sacroiliac joint **1000**. The tubular member **1047** can have a gauge in the range of about 16 gauge and about 20 gauge and can further be incrementally marked on the external surface to allow determination of the depth at which the first needle end **1048** has advanced within the sacroiliac joint **1000**. As the first needle end **1048** advances into the sacroiliac joint **1000** the radiographic dye **1046** can be delivered from within the syringe barrel **1051** into the sacroiliac joint **1000** to allow visualization of the sacroiliac joint **1000** and location of the tubular needle **1047** within the sacroiliac joint **1000**.

Now referring primarily to FIG. **99**B, once the first tubular member end **1048** has been sufficiently advanced into the sacroiliac joint **1000** and the articular surfaces **1016** of the sacroiliac joint **1000** have been sufficiently visualized, the hub **1050** can be removed from the tubular member **1047** leaving the tubular member **1047** fixed within the sacroiliac joint **1000** as a initial guide for tools subsequently used to locate or place the sacroiliac joint implant **25** non-transversely between the articulating surfaces **1016** of the sacroiliac joint **1000** (e.g., locate the implant **25** non-transversely to the joint plane **1030** generally defined by the articulating surfaces **1016** of the interarticular region **1044** of the sacroiliac joint **1000**) or in removal of a portion of the sacroiliac joint **1000** within the region defined by the articular surfaces **1016** to generate an implant receiving space **1029** (see FIG. **99**H). Alternately, one or more guide pins **1013** can be inserted along substantially the same path of the tubular member **1047** for fixed engagement within the sacroiliac joint **1000** and used in subsequent steps as a guide(s).

Now referring primarily to FIG. **99**C, a small incision **1053** can be made in the skin at the posterior superior (or as to certain embodiments inferior) aspect of the sacroiliac joint **1000**, extending proximal and distal to the tubular member **1047** along the line of the sacroiliac joint **1000** to provide a passage to access the interarticular space between the articulating surfaces **1016** (see FIG. **99**B) of the sacroiliac joint **1000**. More specifically, as can be understood from FIGS. **96**A-**98**B, in one embodiment, the small incision **1053** can be made along the joint line **2019** of the sacroiliac joint **1000** in the tissue covering the posterior inferior access region **2016** of the sacroiliac joint articular region **1044**. A cannulated probe **1054** can be slidingly engaged with the tubular member **1047** (or guide pin **1013**) extending outwardly from the sacroiliac joint **1000** (while the sacroiliac joint may be shown in the figures as being substantially linear for illustrative purposes, it is to be understood that the normal irregular features of the sacroiliac joint have not been removed). The cannulated probe **1054** can have a probe body **1054** of generally cylindrical shape terminating in a spatulate tip **1055** at the end advanced into the sacroiliac joint **1000**. A removable cannulated probe handle **1056** couples to the opposed end of the probe body **1054**. The spatulate tip **1055** can be guided along the tubular needle **1047** or guide wire **1013** into the posterior portion of the sacroiliac joint **1000** and advanced to the anterior portion of the sacroiliac joint **1000** under lateral fluoroscopic visualization. The cannulated probe handle **1056** can then be removed providing the generally cylindrical probe body **1054** extending outwardly from the sacroiliac joint **1000** through the incision **1053** made in the skin.

Alternatively, probe **1054** can be used to guide, advance or place a needle, guide wire or other instrument up to, near, or into the joint.

Additionally, in particular embodiments, probe handle **1056** or the opposed end of the probe body **1054**, or both, can be configured to have an interference fit or a luer lock hub to communicate with a syringe barrel **1051** in order to advance contrast, in situ curable biocompatible materials, stem cells, or etc through the cannulated probe **1054** or cannulated probe handle **1056**.

Now referring primarily to FIG. **99**D, a passage from the incision **1053** (see FIG. **99**C) to the sacroiliac joint **1000** can be generated by inserting a cannula **1057** into the incision. A soft tissue dilator **1058** having a blunt end **1059** can be advanced over the probe body **1054**, or a plurality of soft tissue dilators of increasing size, until the blunt end **1059** of the soft tissue dilator **1058** and the corresponding cannula end contact the posterior aspect of the sacroiliac joint **1000**. More specifically, as can be understood from FIGS. **96**A-**98**B, in one embodiment, the ends of the dilator **1058** and cannula **1057** contact the joint line **2019** of the sacroiliac joint **1000** at the posterior inferior access region **2016** of the sacroiliac joint articular region **1044**. The soft tissue dilator **1058** can be removed from within the cannula **1057**. The external surface of the cannula **1057** can be sufficiently engaged with the surrounding tissue to avoid having the tissue locate with in the hollow inside of the cannula **1057**. A non-limiting embodiment of the cannula **1057** provides a tubular body having substantially parallel opposed side walls which terminate in a radius at both ends (lozenge shape) into which a plurality of different jigs can be inserted. Alternatively, as a non-limiting example, according to particular embodiments, cannula **1057** and corresponding dilators **1058** and alignment jigs **1060** can be configured to have tubular bodies with an elliptical or circular cross section.

Now referring primarily to FIGS. **100**A-**100**C, a cannula alignment jig **1060** can be advanced over the probe body **1054** (or guide pins **1013**) and received within the cannula **1057**. Substantially, identical cross hairs **1063**, **1064** can be disposed on the upper jig surface **1065** and the lower jig surface **1066**. Alignment of the cross hairs **1063**, **1064** under x-ray with the sacroiliac joint **1000** can confirm that the cannula **1057** has proper orientation in relation to the paired articular surfaces **1016** of the sacroiliac joint **1000**. The cannula **1057** properly oriented with the paired articular surfaces **1016** can then be disposed in fixed relation to the sacroiliac joint by placement of fasteners through the cannula **1057** into the sacrum **1004** or the ilium **1005**.

Now referring to FIGS. **101**A and **101**B, a first drill jig **1067** can be advanced over the probe body **1054** (or guide pins **1013**) and received within the cannula **1057**. The probe body **1054** (or guide pins **1013**) extending outwardly from the sacroiliac joint **1000** passes through a drill guide hole **1068** of the first drill jig **1067** (or a plurality of guide pins **1013** can extend through a corresponding plurality of guide pin holes **1069**). The drill guide hole **1068** can take the form of a circular hole as shown in the Figures, a slot, or other configuration to restrict the movement of the drill bit **1062** (see FIG. **99**E) within the drill jig **1060** and provide a guide for a drill bit **1062** in relation to the sacroiliac joint **1000**. Guide pin holes **1069** can receive guide pins which can be positioned between the articular surfaces **1016** of the sacroiliac joint **1000** to demarcate the zone of desired treatment or safe working zones while using, for example, lateral fluoroscopy. As a non-limiting example, a first guide pin **1013** can be advanced through a first guide pin hole **1069**, or alternatively a guide pin **1013** is first inserted into the sacroiliac joint **1000** and subsequently a guide jig **1067** is advanced over the guide pin **1013**, the first guide pin **1013** can enter near inferior end **2022** of the posterior inferior access region **2016** of the sacroiliac joint articular region **1044** via the sacroiliac joint line **2019** to border a portion of the greater sciatic notch **2008** thereby allowing a medical person, computer guided surgical system, or other observer to more easily highlight under xray a border which should not be crossed during the procedure due to the presence of nerve and other structures. Similarly, a second guide pin **1013** can be placed in another guide pin hole **1069** to demarcate a second limit to a desired zone of treatment, or safe working zone. For example, a second guide pin **1013** can enter near the superior end **2018** of the posterior inferior access region **2016** of the sacroiliac joint articular region **1044** via the sacroiliac joint line **2019** to be positioned to border an area of the sacroiliac joint **1000** such as a transition zone between the extraarticular **3007** (see FIG. **106**B) and the interarticular region **1044** which, for example, has been highlighted by contrast material as above described.

Now referring to FIG. **99**E, a cannulated drill bit **1070** can be advanced over the probe body **1054** and within a drill guide hole **1068** (see FIGS. **101**A and **101**B) of the first drill jig **1067**. The cannulated drill bit **1070** under fluoroscopic guidance can be advanced into the interarticular region **1044** between the articulating surfaces **1016** of the sacroiliac joint **1000** to produce a first bore **1071** (shown in broken line) to a determined depth. As to certain embodiments of the method, an amount of articular cartilage or other tissues from between the articular surfaces **1016** of the sacroiliac joint **1000** can be removed sufficient to allow embodiments of the sacroiliac joint implant **25** to be implanted in replacement of the removed articular cartilage or tissue. Because the method removes the degenerative articular cartilage or tissue between the articular surfaces **1016** of the sacroiliac joint **1000**, the articular surfaces **1016** of the sacroiliac joint **1000** can remain intact or substantially intact allowing the sacroiliac joint implant **25** to be non-transversely located between the articular surfaces **1016** of the sacroiliac joint **1000**. Understandably, other instruments can be utilized separately or in combination with a cannulated drill bit **1062** for the removal of articular cartilage or tissue between articular surfaces **1016** such as: box chisels, side cutting router bits, burs, flexible burs and bits, hole saws, curettes, lasers (such as C02, Neodymium/YAG (yttrium-aluminum-garnet), argon, and ruby), electrosurgical equipment employing electromagnetic energy (the cutting electrode can be a fine micro-needle, a lancet, a knife, a wire or band loop, a snare, an energized scalpel, or the like) where the energy transmitted can be either monopolar or bipolar and operate with high frequency currents, for example, in the range of about 300 kHz and about 1000 kHz whether as pure sinusoidal current waveform where the "crest factor" can be constant at about 1.4 for every sinus waveform, and a voltage peak of approximately 300 V to enable a "pure" cutting effect with the smallest possible coagulation effect or as amplitude modulated current waveforms where the crest factor varies between 1.5 and 8, with decreasing crest factors providing less of a coagulation effect. Electrosurgical waveforms may be set to promote two types of tissue effects, namely coagulation (temperature rises within cells, which then dehydrate and shrink) or cut (heating of cellular water occurs so rapidly that cells burst). The proportion of cells coagulated to those cut can be varied, resulting in a "blended" or "mixed" effect. Additionally, a fully rectified current, or a partially rectified current, or a fulguration current where a greater amount or lateral heat is produced can be employed to find the articular surfaces of the joint and aid in advancing a probe or guide wire into a position in between the articulating surfaces. These currents can effectively degrade the cartilage and allow advance into the joint without grossly penetrating much beyond the cartilage.

Now referring to FIG. **99**F, as to certain embodiments of the invention, the first drill jig **1067** can be removed from within the cannula **1057** and a second drill jig **1072** can be advanced over the probe body **1054** and received within the cannula **1057**; however, the invention is not limited to any particular number of drill jigs and as to certain embodiments of the method the first drill jig **1067** can include all the required drill guide hole(s) **1068** (or slots or other configurations of the drill guide) and as to other embodiments of the method a plurality of drill jigs can be utilized in serial order to provide all the drill guide holes **1068**. As to the particular embodiment of the invention shown by the Figures, the first drill jig **1067** can provide one or more additional drill guide holes **1068** which guide in relation to the first bore **1071***a* second or more cannulated drills **1062** of the same or different configuration to be inserted within and advanced into the sacroiliac joint **1000** to produce a second bore **1073** (generally shown in broken line as **1071**/**1073**) or a plurality of bores within the sacroiliac joint **1000** spaced apart in predetermined pattern to allow removal of sufficient articular cartilage **1016** or other tissue from the interarticular space of sacroiliac joint **1000** for placement of embodiments of the sacroiliac joint implant **25** within the region defined by and between the paired articular surfaces **1016** of the sacroiliac joint **1000**. As to certain methods of the invention, the first drill jig **1067** or the second drill jig **1072** or a plurality of drill jigs can be utilized in serial order to remove a portion of the sacroiliac joint **1000** for generation of an implant receiving space **1029** (see, for example, FIG. **99**H). As these embodiments of the method, articular cartilage or other tissues and sufficient subchondral bone can be removed from between the articular surfaces **1016** of the sacroiliac joint **1000** sufficient to allow placement of certain embodiments of the sacroiliac joint implant **25** and one or more radial member receiving channels **1074** can be cut into at least one of the articular surfaces **1016** of said sacroiliac joint **1000** sufficient to receive other embodiments of the sacroiliac implant **25**. The one or more radial member receiving channels **1074** can be cut a depth into the subchondral, cortical bone or cancellous bone of the sacrum **1004** or ilium **1005**.

Now referring primarily to FIG. **99**G, in a subsequent step, the last in the serial presentation of drill jigs **1067**, **1072** can be removed from within the cannula **1057** and a broach jig **1075** can be advanced over the probe body **1054** to locate within the cannula **1057**. The broach jig **1075** can include a broach guide hole **1076** which receives a first broach end **1077** of a cannulated broach **1078** advanced over the probe body **1054**. The first broach end **1077** can have a configuration which can be advanced into the sacroiliac joint **1000**. As to certain embodiments of the method, the first broach end **1077** can be adapted to remove an amount of articular cartilage and other tissue from between the articular surfaces **1016** within the articular region **1044** of the sacroiliac joint **1000** for non-transverse placement of a sacroiliac joint implant **25** having an elongate body **45**, or having an elongate body **45** and a first radial member **50**, or an elongate body **45** having a first and second radial members **50** between the articular surfaces **1016** of the sacroiliac joint **1000**. As to other embodiments of the method, the cannulated broach **1078** can remove a sufficient portion of the sacroiliac joint **1000** to generate an implant receiving space **1029** to receive embodiments of the sacroiliac joint implant **25** having an elongate body **45**, an elongate body **45** and at least one radial member **50** adapted for non-transverse placement between the articular surfaces **1016** or at least one radial member **55** adapted to extend into the bone of the sacrum **1004** or the ilium **1005**.

As a non-limiting example, FIG. **99**G shows a broach **1078** configured to remove a portion of the sacroiliac joint **1000** to produce a implant receiving space **1029** (shown in FIG. **99**H) to receive embodiments of the sacroiliac joint implant **25** having an elongate body **45** to which a first radial member **50** and a second radial member **50** extend along the longitudinal axis CA of the elongate body **45** in substantially opposed relation adapted to locate between the articular surfaces **1016** of the sacroiliac joint **1000** and further having a third radial member **55** and a fourth radial member **55** which extend along the longitudinal axis CA of the elongate body **45** in substantially opposed relation adapted to correspondingly extend correspondingly into the bone of the sacrum **1004** and the ilium **1005**.

Now referring primarily to FIGS. **102**A-**102**D, the implant receiving space **1029** and the sacroiliac joint implant **25** can be configured having related dimension relations such that placement of the sacroiliac joint implant **25** within the implant receiving space **1029** disposes the sacrum **1004** and the ilium **1005** in substantially immobilized relation and substantially avoids alteration of the positional relation of the sacrum **1004** and the ilium **1005** from the normal condition, or avoids driving together or driving apart the sacrum **1004** from the ilium **1005** outside of or substantially outside of the normal positional relation. An intention in selecting configurations of the sacroiliac joint implant **25** and the implant receiving space **1029** being immobilization of the sacrum **1004** in relation to the ilium **1005** while maintaining the sacroiliac joint **1000** in, substantially normal or substantially normal positional relation, or returning the sacroiliac joint **1000** to a substantially normal positional relation to correct a degenerative condition of the sacroiliac joint **1000**.

As a non-limiting example, configurations of an implant receiving space **1029** allow embodiments of the sacroiliac joint implant **25** to be placed non-transversely between the caudal portion **1086** of the articular surfaces **1016** of the sacroiliac joint **1000**. While certain embodiments of the sacroiliac joint implant **25** may only provide an elongate body **45** which locates within a correspondingly configured implant receiving space **1029** to engage at least a portion of the bone of the ilium **1005** or sacrum **1004**, the invention is not so limited, and can further include at least a first radial member or a first and a second radial member at least a portion of the external surface of the first radial member **50** engaging a portion of the bone **1073** of the sacrum **1004** and the ilium **1005**. As to those embodiments of the sacroiliac joint implant **25** which have a third radial member **55** and a fourth radial member **55**, the implant receiving space **1029** can further include one or more radial member receiving channels **1074**, which correspondingly allow the third and fourth radial members **55**, **55** to extend into the bone **1073** of the sacrum **1004** or the ilium **1005** (whether subchondral, cortical, cancellous, or the like), or impact of the sacroiliac joint implant **25** into the implant receiving space **1029** without the radial member receiving channels **1074** can forcibly urge the radial members **55**, **55** into the bone **1073** of the sacrum **1004** and the ilium **1005**. An anchor member **30** (such as treaded members) can be inserted through the bore **40** in the implant **25** and into the sacrum **1004** and ilium **1005** to fix the location of the fixation fusion implant **25** within the implant receiving space **1029**.

While the preceding discussion is given in the context of the implant **25** being implanted non-transversely in the caudal portion **1086** of the sacroiliac joint **1000**, in other embodiments, the implant **25** may be implanted in other locations within the sacroiliac joint. For example, as disclosed in U.S. patent application Ser. No. 12/998,712, which is incorporated herein by reference, in some embodiments, the implant **25** may be implanted non-transversely in the cranial portion **1087** (see FIG. **102**A) of the sacroiliac joint **1000** by the similar procedures or steps as above described with the incision and generation of the passage to the superior articular portion of the sacroiliac joint **1000**. The implant may also be implanted in the sacroiliac joint in such a manner so as to extend between the cranial and caudal portions, as also disclosed in U.S. patent application Ser. No. 12/998,712.

To begin a discussion of employing the delivery tool **20** to implant the implant **25** in the sacroiliac joint **1000** once the implant receiving space **1029** has been created, reference is made to FIGS. **99**I, **103**A, **103**B and **104**. FIG. **103**A is generally the same view as FIG. **97**A, and FIG. **103**B is an enlarged view of the hip region of FIG. **103**A. FIG. **104** is generally the same enlarged view as FIG. **96**B. As shown in FIGS. FIGS. **99**I, **103**A, **103**B and **104**, once the implant receiving space **1029** has been created as discussed above with respect to FIGS. **99**A-**99**H, the implant **25** can be supported off of the distal end **120** of the implant arm **110** of the delivery tool **20** and positioned such that the distal end **42** of the implant **25** begins to enter the sacroiliac joint articular region **1044** via the posterior inferior access region **2016**, which is described in detail above with respect to FIGS. **96**A-**98**B. As can be understood from FIGS. **103**A-**104**, in entering the sacroiliac joint space, the implant **25** is oriented such that its wide planar members **50** are oriented generally parallel to, and aligned with, the sacroiliac joint line **2019** (i.e., the wide planar members **50** are generally located within the joint plane **1030**), and the implant's narrow planar members **55** are generally transverse to the joint plane **1030** (see, e.g., FIGS. **102**C and **102**D). The longitudinal axis LCA_2 of the implant arm **110** of the delivery tool **20** has a generally anterior trajectory that is located within the joint plane **1030**. Alternatively, according to particular embodiments, as a non-limiting example, the longitudinal axis LCA_2 of the implant arm **110** of the delivery tool **20** can have a trajectory which can be defined as being generally lateral or, in particular embodiments, generally posterior. In some embodiments, when the implant **25** is being delivered into the joint space, the implant arm **110** can be said to be at least one of generally superior or cephald the sciatic notch.

FIG. **105** is the same view as FIG. **104**, except the implant **25** has now been fully inserted into the prepared space **1029** in the sacroiliac joint **1000**. As illustrated in FIGS. **99**J and **105**, the implant **25** is fully received in the prepared sacroiliac space **1029** such that the wide planar members **50** are oriented generally parallel to, and aligned with, the sacroiliac joint line **2019** (i.e., the wide planar members **50** are generally located within the joint plane **1030**), and the implant's narrow planar members **55** are generally transverse to the joint plane **1030** and, in some embodiments, have even entered the bone material forming the sacrum and ilium articular surfaces of the sacroiliac joint (see, e.g., FIGS. **102**C and **102**D). As can be understood from FIG. **99**J, the longitudinal axis of the implant **25** and the longitudinal axis of the implant arm **110** may be coaxially aligned with each other and generally located in the sacroiliac joint plane **1030**.

FIG. **106**A is the same view as FIG. **104**, except the sleeve **100** is now received in the collar **165** of the anchor arm **115**. As can be understood from FIGS. **99**K and **106**A, the distal end of the sleeve **100** may extend through an incision in the patient's soft tissue such that the distal end of the sleeve **100** is positioned generally against the lateral surface of the ilium **1005**. The longitudinal axis of the sleeve and collar of the anchor arm can be understood to be generally coaxially aligned with the longitudinal axis of the bore **40** of the implant **25**.

FIG. **106**B is generally the same view as FIG. **106**A, except the ilium **1005** is removed to show the sacroiliac joint space boundary **3000** defined along the sacrum **1004** and outlining the sacroiliac joint articular region **1044**, the implant **25** positioned for implantation within the sacroiliac joint articular region **1044**. As shown in FIG. **106**B, the sacroiliac joint space boundary includes an inferior boundary segment **3002**, an anterior boundary segment **3004**, a superior boundary segment **3006**, and a posterior boundary segment **3008**. The inferior boundary segment **3002** is immediately adjacent, and extends along, the sciatic notch **2024**.

The inferior boundary segment **3002** and anterior boundary segment **3004** intersect to form an anterior-inferior corner **3010**. The anterior boundary segment **3004** and superior boundary segment **3006** intersect to form an anterior-superior corner **3012**. The superior boundary segment **3006** and posterior boundary segment **3008** intersect to form a superior-posterior corner **3014**. The posterior boundary segment **3008** and posterior inferior access region **2016** intersect to form a superior-posterior corner **3016** of the posterior inferior access region **2016**. The inferior boundary segment **3002** and posterior inferior access region **2016** intersect to form an inferior-posterior corner **3018** of the posterior inferior access region **2016**.

The inferior boundary segment **3002** extends between corners **3010** and **3018**. The anterior boundary segment **3004** extends between corners **3010** and **3012**. The superior boundary segment **3006** extends between corners **3012** and **3014** and provides an access into the cranial portion **1087** of the sacroiliac joint. The posterior boundary segment **3008** extends between corners **3014** and **3016**. The posterior inferior access region **2016** extends between corners **3016** and **3018** and provides an access into the caudal region **1086** of the sacroiliac joint. The posterior boundary segment **3008** separates articular region **1044** and extra-articular region **3007**, which includes the sacral fossa on the sacrum **1004** and the corresponding iliac tuberosity on the ilium **1005** and defined by the extra-articular region boundary **3009**.

As shown in FIG. **106**B, the implant **25** is inserted via the implant arm **110** of the delivery tool **20** into the caudal region **1086** of the sacroiliac joint articular region **1044**. As shown via the implant **25** and implant arm **110** shown in solid lines, in one embodiment, the implant **25** enters the posterior inferior access region **2016**, and is further advanced into the caudal region **1086** of the sacroiliac joint articular region **1044**, in an orientation such that the implant arm **110** and wide planar members **50** are in the joint plane **1030** (see, for example, FIGS. **99**I-**99**J) and the longitudinally extending edge **3050** of the wide planar member **50** next to the inferior boundary segment **3002** is generally parallel to, and immediately adjacent to, the inferior boundary segment **3002**. Thus, the distal end **42** of the implant is heading generally perpendicular to, and towards, the anterior boundary segment **3004**.

As shown in FIG. **106**B via the implant **25** and implant arm **110** shown in dashed lines, in one embodiment, the implant **25** enters the posterior inferior access region **2016**, and is further advanced into the caudal region **1086** of the sacroiliac joint articular region **1044**, in an orientation such that the implant arm **110** and wide planar members **50** are in the joint plane **1030** (see, for example, FIGS. **99**I-**99**J) and the longitudinally extending edge **3050** of the wide planar member **50** next to the inferior boundary segment **3002** is somewhere between being generally parallel to the inferior boundary segment **3002** (as illustrated by the solid-lined implant **25** in FIG. **106**B) or forming an angle AJ with the inferior boundary segment **3002** of up to approximately 50 degrees. Thus, the distal end **42** of the implant shown in dashed lines can be said to head anywhere from generally perpendicular to, and towards, the anterior boundary segment **3004** to heading generally towards the superior-anterior corner **3012**, or points in between.

In one embodiment, the implant **25** may be first directed into the joint space as illustrated by the solid-lined implant **25** in FIG. **106**B after which the implant **25** is rotated within the joint space to be positioned somewhere between, and including, angled position depicted by the dashed-lined implant **25**. In other embodiments, the implant **25** may be first directed into the joint space as illustrated by the dashed-lined implant **25** in FIG. **106**B after which the implant **25** is rotated within the joint space to be positioned somewhere between, and including, the parallel position depicted by the solid-lined implant **25**.

FIG. **107**A is a posterior-inferior view of the hip region **1002** of the patient **1001**, wherein the soft tissue **1003** surrounding the skeletal hip bones is shown in dashed lines. FIG. **107**B is an enlarged view of the implant region of FIG. **107**A. As can be understood from FIGS. **99**L, **107**A and **107**B, the anchor member **30** is positioned in the lumen of the sleeve **100**. A driving tool **105** (e.g., screw driver) is extended through the lumen of the sleeve **100** so the distal end of the tool **105** is engaged with a proximal end of the anchor member **30** (e.g., screw). As shown in FIG. **99**M, the tool **105** is used to drive the anchor member **30** distally through the bone of the ilium **1005** and into the bore **40** of the implant **25** generally transverse to the joint line plane **1030**. As a result, as indicated in FIG. **99**N, the implant assembly formed of the implant **25** and anchor member **30** is secured at the implantation site such that the implant **25** is located in the prepared space **1029** of the sacroiliac joint space, and the anchor member **30** extends through the bone of the ilium **1005** and into the implant bore **40** generally transverse to the joint space plane **1030**. The tool **105** and sleeve **100** can be removed from the anchor arm collar **165**, and the incision associated with the sleeve **100** can be closed. Additionally, tool **105** can be a cutting tool **105** (e.g., drill bit, hole punch, or etc) which can used in similar steps as above describe to remove bone or other tissues in the path where anchor member **30** is to be placed.

As indicated in FIG. **99**O, the distal end of the implant arm is decoupled from the proximal end of the implant **25** and removed. The incision associated with the implant arm can be closed. In some embodiments, the anchor member **30** will only be long enough to span bone of the ilium **1005** and enter the implant bore **40**. In other embodiments, as illustrated in FIG. **99**P, the anchor member **30** will be sufficiently long to extend through the bone of the ilium, completely through the implant bore **40**, and into the bone of the sacrum **1004**. As illustrated in FIG. **99**Q, in certain embodiments, implant **25** can be configured to have more than one implant bore **40** which can also receive an anchor member **30**. The anchor member **30** prevents migration of the implant **25** within the joint space. The anchor member **30** also can draw the ilium and sacrum together about the implant **25**, increasing the sturdiness of the fixation of the implant in the joint space. Where the anchor member extends through the implant bore and into the bone of both the sacrum and ilium, the anchor member **30** can be used to drawn the articular surfaces **1016** of the sacroiliac joint **1000** against the external surfaces of the sacroiliac joint implant **25**. With the implant implanted in the sacroiliac joint, the body will cause the joint surfaces to fuse together about the implant **25**.

As can be understood from FIGS. **108**A and **108**B, which are, respectively, posterior and posterior-lateral views the implantation area and the implant assembly implanted there, proximal end **43** of the implant **25** can be seen positioned in the posterior inferior access region **2016**, the implant being implanted in the caudal area of the sacroiliac joint space. The anchor member **30** can be understood to have been driven into the implant bore **40** transversely to the joint plane **1030** via a route in the ilium **1005** that avoids contact with vascular and neurological structures, thereby avoiding potentially life threatening injury to such structures. The ability to blindly, yet safely, drive the anchor member **30** into the implant bore **40** while the implant **25** is hidden in the joint space is made possible by the cooperating configurations of the implant **25** and the delivery tool **20**. Specifically, the longitudinal axis LCA_1 of the anchor arm collar **165** being coaxially aligned with the longitudinal axis BA of the implant bore **40** when the proximal end **43** of the implant **25** is supported off of the implant arm **115** of the delivery tool **20** makes it possible to safely drive the anchor member **30** through the ilium **1005** bone and into the implant bore **40** when the implant is hidden in the joint space on account of being delivered to the joint space via the delivery tool **20**.

To begin a detailed discussion of another method of employing the system **10** to fuse the sacroiliac joint, reference is made to FIGS. **111**A-**111**C. FIG. **111**A is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **107**A. FIG. **111**B is a lateral-superior-posterior view of the patient's hip skeletal structure. FIG. **111**C is an inferior-posterior view of the patient's hip skeletal structure taken from a perspective laterally opposite the view depicted in FIG. **111**B. The S1 through S4 foramina can be seen at the respective indicators S1, S2, S3 and S4 in FIGS. **111**A-**111**C.

As can be understood from a comparison of FIGS. **111**A to **107**A, the delivery tool **20** has been reversed such that the anchor collar **165** is oriented so as to deliver the anchor member **30** through the sacrum **1004** first and then into the bore **40** of the implant **25** and optionally further into the ilium **1005**. In other words, unlike the method depicted in FIG. **107**A, wherein the anchor member **30** is driven lateral to medial through the ilium **1005** first and then into the implant followed by the sacrum **1004** (optional), the method depicted in FIG. **111**A shows the anchor member **30** being driven medial to lateral through the sacrum **1004** first and then into the implant followed by the ilium **1005** (optional). As can be understood from a comparison of FIGS. **111**A to **107**A, the implant **25** of FIG. **111**A is located in the sacroiliac joint with its wide radial members **50**, narrow radial members **55** and body **45** oriented as explained above with respect to FIGS. **102**A-**107**B, the only difference being the direction the bore **40** is oriented and the way the anchor member **30** penetrates the surrounding bone structures.

In the embodiment of FIG. **111**A, the anchor member **30** may be an S2 alar iliac (S2AI) screw. Such a screw may penetrate the sacrum **1004** just lateral the lateral edge of the S2 foramen and, in some instances, generally superiorly-inferiorly even with the superior edge of the S2 foramen so as to mimic an S2 alar iliac pelvic fixation.

To begin a detailed discussion of another method of employing the system **10** to fuse the sacroiliac joint, reference is made to FIGS. **112**A-**112**D. FIG. **112**A is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **107**A. FIG. **112**B is a side view of the patient's hip skeletal structure similar to the view depicted in FIG. **106**A. FIG. **112**C is a view of the patient's hip skeletal structure similar to the view depicted in FIG. **103**A, except from an opposite lateral perspective. FIG. **112**D is a superior view of the patient's hip skeletal structure.

As can be understood from a comparison of FIGS. **112**A and **112**B to FIGS. **107**A and **106**A, respectively, in the embodiment depicted in FIGS. **112**A-**112**D, the delivery tool **20** has a trajectory that is generally superior-to-inferior as opposed to posterior-to-anterior. Further, unlike the embodiments described above wherein the implant **25** gains access to the sacroiliac joint space **1044** via the caudal access **2016** to be implanted in the caudal region **1086** of the sacroiliac joint space **1044** (see, for example, FIG. **106**B and related figures and discussion), the embodiment of FIGS. **112**A-**112**D gains access to gains access to the sacroiliac joint space **1044** via the cranial access **2017** (e.g., at the superior boarder **3006** shown in FIG. **106**B) to be implanted in the cranial region **1087** of the sacroiliac joint space **1044** (see, for example, FIG. **112**C-**112**D).

As indicated in FIGS. **112**A-**112**D, the delivery tool **20** is oriented such that the anchor collar **165** is positioned so as to deliver the anchor member **30** through the ilium **1005** first and then into the bore **40** of the implant **25** and optionally further into the sacrum **1004**. In other words, the method depicted in FIGS. **112**A-**112**D shows the anchor member **30** being driven lateral to medial through the ilium **1005** first and then into the implant followed by the sacrum **1004** (optional). Other than being delivered via a different trajectory and access location and being implanted in a different region of the sacroiliac joint, the implant **25** of FIGS. **112**C-**112**D is located in the sacroiliac joint with its wide radial members **50**, narrow radial members **55** and body **45** oriented as explained above with respect to FIGS. **102**A-**102**D, the only difference being the implant **25** being accessed via, and implanted in, the cranial region **1087** as opposed to the caudal region **1086**.

To begin a detailed discussion of another method of employing the system **10** to fuse the sacroiliac joint, reference is made to FIGS. **117**A-**117**C. FIG. **117**A is a lateral-inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **111**C. FIG. **117**B is an inferior-posterior view of the patient's hip skeletal structure similar to the view depicted in FIG. **111**A. FIG. **117**C is the same view as FIG. **106**B, except showing the implant **25** being implanted in the extra-articular space **3007**, as opposed to the sacroiliac joint articular region **1044**, and accessing the extra-articular space **3007** via an extra-articular recess access region **6000**. The S1 through S4 foramina can be seen at the respective indicators S1, S2, S3 and S4 in FIGS. **117**A-**117**B.

As can be understood from a comparison of FIGS. **117**A to **107**A, the delivery tool **20** has been reversed such that the anchor collar **165** is oriented so as to deliver the anchor member **30** through the sacrum **1004** first and then into the bore **40** of the implant **25** and optionally further into the ilium **1005**. In other words, unlike the method depicted in FIG. **107**A, wherein the anchor member **30** is driven lateral to medial through the ilium **1005** first and then into the implant followed by the sacrum **1004** (optional), the method depicted in FIG. **117**A shows the anchor member **30** being driven medial to lateral through the sacrum **1004** first and then into the implant followed by the ilium **1005** (optional). In the embodiment of FIG. **117**A, the anchor member **30** may be a bone screw the same as or similar to an S2 alar iliac (S2AI) screw. Such a screw may penetrate the sacrum **1004** just lateral the lateral edge of the S1 foramen and just superior the superior edge of the S1 foramen. Thus, the anchor element **30** can enter the bone of sacrum near the first sacral foramen (S1AI trajectory) then into or through implant bore **40** and can further enter the bone of the ilium. The implant **25**, as with any of the implantation locations and implants **25** discussed herein can optionally be employed to be configured to serve as an attachment point for structural components of a spinal support system with a spanning element as discussed below with respect to FIGS. **115** and **116** or with a coupling element as discussed below with respect to FIG. **114**.

As can be understood from a comparison of FIGS. **117**A to **107**A, FIGS. **117**B to **111**C, and FIGS. **117**C to **106**B, the implant **25** of FIG. **117**C is located in the extra-articular region **3007** as opposed to the sacroiliac joint articular region **1044**. Further, the implant **25** of FIGS. **117**A-C has entered the extra-articular region **3007** via an extra-articular recess access region **6000**, which, is on the opposite side of the posterior inferior overhang **2020** of the posterior superior iliac spine **2004** from the caudal portion **1086** of the sacroiliac joint articular region **1014** and posterior inferior access region **2016** leading to the sacroiliac joint articular region **1044** employed to implant the implant **25** in the caudal portion **1086** of the sacroiliac joint articular region **1044**, as discussed above with respect to FIGS. **103**A-**108**B or FIGS. **111**A-**111**C.

As can be understood from FIG. **117**C, the implant **25** is oriented in the extra-articular region **3007** with its wide radial members **50** generally coplanar with the plane of the extra-articular region **3007** and the narrow radial members **55** extending into the sacrum and ilium bone defining each side of the extra-articular region **3007**.

As illustrated in FIG. **117**C, in some embodiments, the implant **25** is oriented within the extra-articular region **3007** such that the longitudinal axis of the body **45** is generally perpendicular to the posterior boundary segment **3008** of the boundary **3000** of the sacroiliac joint articular region **1014**. Also, the distal end **42** of the implant **25**, when implanted in the extra-articular region **3007**, points towards the anterior-inferior corner **3010** of the boundary **3000** of the sacroiliac joint articular region **1014**. The distal end **42** of the implant **25** may extend across the posterior boundary segment **3008** of the boundary **3000** of the sacroiliac joint articular region **1014** and into the sacroiliac joint articular region **1014**. Thus, when implanting the implant **25** via the extra-articular recess access region **6000**, the general direction of travel for the implant distal end **42** is towards the anterior-inferior corner **3010**, and the implant **25** can be positioned substantially within the extra-articular region **3007** or, alternatively, the implant **25** can be further advanced to also occupy a portion of the sacroiliac joint articular region **1044**.

As discussed above with respect to FIGS. **117**A-**117**B, in implanting the implant **25** in the extra-articular region **3007**, the delivery tool **20** is configured to drive the anchor element **30** medial to lateral through the sacrum **1004** into the implant bore **40** and, optionally, further into the ilium **1005**. However, in some embodiments, the delivery tool **20** and implant bore **40** may have as-manufactured configurations that allow the anchor element **30** to be driven lateral to medial through the ilium **1005** into the implant bore **40** and, optionally, further into the sacrum **1004**.

In some embodiments, the system **10** may be provided in the form of a kit **4999**. Such a kit **4999** is shown in FIG. **113**. The kit **4999** may include the system **10** enclosed in a sterile main package **5000**. For example, the delivery tool **20**, the implant **25** and anchor member **30** may be sealed within the sterile main package **5000**. The delivery tool **20** may be any of the tool embodiments disclosed herein and may include all of its components. Also, the implant **25** may be any of the implant embodiments disclosed herein.

As illustrated in FIG. **113**, in some embodiments, the kit **4999** may include multiple sizes of the implant **25** and/or multiple sizes of the anchor member **30**. The multiple implants **25** may be contained in a sterile individual package **5002** within the sterile main package **5000**, and the multiple anchor members **30** may be contained in another sterile individual package **5004** within the sterile main package **5000**. By providing the multiple sizes of implants **25** and anchor members **30**, the implants and anchor members can be used as trials during certain steps of the procedure to determine appropriate implant sizes and to allow a physician, who is presented with the kit **4999** containing the delivery system **20** and multiple sizes of the implant and anchor members, to evaluate particular embodiments of an implant and anchor member as described herein that would be best suited to a particular patient, application or implant receiving space. The kit **4999** may also or alternatively contain multiple implants **25** with different angles of bore **40** to provide various desirable trajectories for an anchor member **30** and multiple delivery systems **20** with as-manufactured angular relations corresponding to the different angles of the bore. The kit **4999** may also include color coded, numeric or other indicators corresponding between delivery systems **20** and the corresponding implants **25**.

In some embodiments, the kit **4999** may include instructions **5006** that lay out the steps of using the system **10**. The instructions **5006** may be contained within one of the sterile packages such as, for example, the sterile main package **5000**. Alternatively, the instructions **5006** may be adhered or otherwise attached to an exterior surface of one of the sterile packages such as, for example, the sterile main package **5000**. Alternatively, the instructions **5006** may be simply provided separately such as, for example, via simply shipped loose with the rest of the kit **4999**, emailed, available for download at a manufacturer website, or provided via a manufacture offered training seminar program.

In some embodiments, the kit **4999** may have any one or more of the tool **20**, implants **25** and anchor members **30** contained in individual sterile packages that are not held within a sterile main package. Alternatively, the tool **20**, implants **25** and anchor members **30** may be contained in a single common package or in any combination of packages and combination of tool, implants and anchor members.

As can be understood from FIG. **114**, which is the same transverse cross sectional view of the patient's hip as shown in FIGS. **99**A-**99**Q, once the implant **25** and anchor(s) **30** are secured at the sacroiliac joint **1000** in any of the manners depicted in FIGS. **99**O-**99**Q, the implant **25** can be used as an attachment point for structural components of a spinal support system configured to support across the patient's hip structure and/or to support along the patient's spinal column. To serve as an attachment point for structural components of a spinal support system, a coupling element **2087** is connected to the proximal end **2011** of the sacroiliac joint implant **25**. As a non-limiting example, the coupling element **2087** can be disposed in fixed relation to the proximal end **2011** of the sacroiliac joint implant **25** by threaded engagement of a fastener portion **2088**; however, the invention is not so limited and the fastener portion **2088** can be connected to the first end **2011** of the sacroiliac joint implant **25** by any method such as welding, spin welding, adhesive, or the like. The coupling element **2087** can further provide a coupling portion **2089** configured to join with a numerous and wide variety of cross sectional geometries of spanning members **2090**. As a non-limiting example, the coupling portion **2089** can be configured as cylindrical cup **2091** pivotally coupled to the fastener portion **2088**. A spiral thread can be coupled to the internal surface of the cylindrical cup **2091** to rotationally receive a spirally threaded body **2092**. The side wall **2093** of the cylindrical cup **2091** can include a pass through element **2094** in which part of a spanning member **2090** can be received. The part of the spanning member **2090** received within the pass through element **2094** can be placed in fixed relation to the cylindrical cup **2091** by rotational engagement of the spirally threaded body **2092**.

FIG. **115** is a posterior view of the patient's sacrum **1004** and illiums **1005**, wherein structural components of a spinal support system extend medial-lateral across the patient's hip structure and superiorly to support along the patient's spinal column. As shown in FIG. **115**, in one embodiment, each of a pair of sacroiliac joints **1000** can receive an embodiment of the sacroiliac joint implants **25**, above-described, each having a coupling element **2087** coupled to the first end **2011**. Each of the coupling elements **2087** can receive the opposed ends **2095** of a spanning member **2090**. Additionally, the spanning member **2090** in fixed relation to the sacroiliac joint implants **25** can be connected to a plurality of additional spanning members **2096** which can as a non-limiting example be placed in positional relation to the vertebral column **2097** to allow support of additional implants which can be anchored between vertebrae.

FIG. **116** is the same view as FIG. **117**, except having a different spanning member structure. As illustrated in FIG. **116**, a first coupling element **2087** can be joined to the first end **2011** of an embodiment of a sacroiliac joint implant **25** as above described and the fastener portion **2088** of a second coupling element **2087** can be disposed directly into the bone of the sacrum **1004** or the ilium **1005**, or both. The opposed ends **2095** of a spanning element **2090** in the form of a flat plate can be can provide apertures **2096** through which the fastener portion **2088** of the coupling element **2087** can pass. The corresponding parts of the external surface of the coupling portion **2089** and the spanning member **2090** can be engaged to fix the location of the spanning member **2090** allowing for coupling of the lumbar spine to the stabilized pelvis by a plurality of fixation elements to further increase stability.

As can be understood from FIG. **116** and with continuing reference to FIGS. **111**A-C, according to particular embodiments, the spanning element **2090** can be configured to receive an S2AI screw positioned and directed in a trajectory as substantially shown in FIGS. **111**A-C. As a non-limiting example, an S2AI screw or other elongate fixation body can pass through an aperture **2096**, which can be located on an opposed end **2095** of the spanning element **2090** and can be disposed directly into the bone of the sacrum **1004**, pass through or engage the bore **40** of an implant **25**, and into the bone of the ilium **1005**. According to certain embodiments, an engagement between an S2AI screw and the bore **40** can be configured, for example, as having a bore **40** which can have threads or other surface that are generally complementary to those of a fastener **2088**. Said complementary surfaces can be configured to provide a virtual cold weld between components to further resist undesirable movement."

As can be understood from the foregoing, various embodiments of the delivery tools or system configurations as described herein can be similarly configured to operate with various embodiments of the sacroiliac joint implants disclosed in U.S. Provisional 61/520,956.

In summary and as can be understood from the preceding discussion, the sacroiliac joint fusion systems **10** disclosed herein include a joint implant **25**, an anchor element **30** and a delivery tool **20**. The joint implant **25** includes a longitudinal axis CA (e.g., see FIG. **10**) and a bore **40** extending non-parallel to the longitudinal axis CA. The anchor element **30** is configured to be received in the bore **40**.

The delivery tool **20** includes an implant arm **110** and an anchor arm **115**. The implant arm **110** is configured to releasably couple to the joint implant **25**. The anchor arm **115** is coupled to the implant arm and configured to deliver the anchor element **30** to the bore **40**.

The final manufactured configuration of the tool **20** and final manufactured configuration of the joint implant **25** are such that, when the system **10** is assembled such that the implant arm **110** is releasably coupled to the joint implant **25** (e.g., as shown in FIGS. **2**A, **21**A, **21**C, **32**, **37** and **109**), a delivery arrangement automatically exists such that the anchor arm **115** is correctly oriented to deliver the anchor element **30** to the bore **40**. Thus, when the system **10** is shipped from the manufacturer to the medical facility where the sacroiliac joint fusion will take place, the components **20**, **25**, **30**, **40**, **110**, **115** are each configured such that simply plugging them together such that the tool **20** is fully assembled and the implant **25** is supported off of the distal end of the tool **20** is all that is required to employ the tool **20** to both deliver the implant **25** into the sacroiliac joint **1000** and deliver the anchor element **30** into the bore **40** so as to anchor the implant **25** in the sacroiliac joint. In other words, once the components of the system **10** are coupled together, the cumulative result of the as-manufactured three dimensional configurations of each component of the system **10** is that the system **10** has a delivery arrangement such that the anchor arm **115** is correctly oriented to deliver the anchor element **30** to the bore **40** without having to adjust the as-manufactured three dimensional configurations of any of the components of the system **10**. This automatically arrived-at delivery arrangement is even the case wherein the anchor arm **115** being employed is part of a plurality of anchor arms (as discussed with respect to FIG. **21**B) or where the anchor arm **115** is pivotally coupled to the implant arm **110** and further equipped with an arcuate slider **105** at a free distal end of the anchor arm, the arcuate radius of the anchor arm **115** at the arcuate slider **105** being such that the radius extends through the bore **40** (as discussed with respect to FIG. **34**).

The foregoing merely illustrates the principles of the invention. Various modifications and alterations to the described embodiments will be apparent to those skilled in the art in view of the teachings herein. It will thus be appreciated that those skilled in the art will be able to devise numerous systems, arrangements and methods which, although not explicitly shown or described herein, embody the principles of the invention and are thus within the spirit and scope of the present invention. From the above description and drawings, it will be understood by those of ordinary skill in the art that the particular embodiments shown and described are for purposes of illustrations only and are not intended to limit the scope of the present invention. References to details of particular embodiments are not intended to limit the scope of the invention.

What is claimed is:

1. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, a first bore extending non-parallel to a longitudinal axis of the body, and a second bore generally coaxial with a center longitudinal axis of the joint implant, the second bore receiving a feature of the distal end of an implant arm when the distal end of the implant arm is releasably coupled to the proximal end of the joint implant;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) the implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant;

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable, and

iii) an implant retainer that extends through the implant arm, a distal end of the implant retainer defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore.

2. The system of claim **1**, wherein at least a portion of the implant retainer is in the form of an elongated body that is at least one of longitudinally displaceable or rotationally displaceable within the implant arm in the course of the at least a portion of the feature of the distal end of the implant arm being received in the second bore so as to releasably couple with the proximal end of the joint implant.

3. The system of claim **1**, wherein the anchor arm comprises a plurality of specific sized anchor arms, each specific sized anchor arm being configured to couple with the implant arm at a respective specific location, wherein when a specific sized anchor arm is coupled to the implant arm at the respective specific location on the implant arm, the specific sized anchor arm is operably coupled to the implant arm in a manner that results in the arrangement.

4. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable;

iii) a handle coupled to a proximal end of the implant arm, a center longitudinal axis of the handle is substantially at least one of coaxial or parallel with a longitudinal axis of the implant arm; and

iv) an implant retainer that extends through the implant arm, a distal end of the implant retainer defining at least a portion of a feature of the distal end of the implant arm that is received in the second bore, wherein the handle is coupled to the implant retainer such that the handle and implant retainer can rotate relative to the implant arm.

5. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the Point implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable; and

iii) a handle coupled to a proximal end of the implant arm via a spring-biased retaining ball and groove interlocking arrangement, a center longitudinal axis of the handle is substantially at least one of coaxial or parallel with a longitudinal axis of the implant arm.

6. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, a first bore extending non-parallel to a longitudinal axis of the body, at least one pair of planar members radially extending from the body of the joint implant, and a guide member cantilevered off of the body of the joint implant and including a guide hole coaxially aligned with the first bore of the joint implant;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable.

7. The system of claim **6**, wherein the guide member includes an anchor element retaining feature.

8. The system of claim **7**, wherein the anchor element retaining feature includes a series of arcuate members that are configured to bias against the anchor element when the anchor element is extended through the guide hole and first bore.

9. The system of claim **7**, wherein the anchor element retaining feature includes an arm defined in the guide member and configured to bias against the anchor element when the anchor element is extended through the guide hole and first bore.

10. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, a first bore extending non-parallel to a longitudinal axis of the body, and first, second, third and fourth radially extending members, wherein each of the radially extending members extends lengthwise along the joint implant, the first and second radially extending members are substantially coplanar with each other, and the third and fourth radially extending members are substantially coplanar with each other and generally perpendicular to the first and second radially extending members;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable.

11. The system of claim **10**, wherein the first and second radially extending members extend over a wider radial extent than the third and fourth radially extending members.

12. A system for fusing a sacroiliac joint including a sacrum and an ilium, the system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body of the joint implant;

b) an anchor element configured to be received in the first bore; and

c) a delivery tool comprising:

i) an implant arm configured to releasably couple to the joint implant; and

ii) an anchor arm coupled to the implant arm and configured to deliver the anchor element to the first bore,

wherein a final manufactured configuration of the tool and a final manufactured configuration of the joint implant are such that, when the system is assembled such that the implant arm is releasably coupled to the joint implant, a delivery arrangement automatically exists such that the anchor arm is correctly oriented to deliver the anchor element to the first bore.

13. The system of claim **12**, wherein the delivery tool further includes a handle coupled to a proximal end of the implant arm, and a center longitudinal axis of the handle is substantially at least one of coaxial or parallel with a longitudinal axis of the implant arm.

14. The system of claim **12**, wherein the joint implant further comprises at least one pair of planar members radially extending from the body of the joint implant.

15. The system of claim **12**, wherein the first bore extends substantially transverse to the longitudinal axis of the body of the implant.

16. The system of claim **12**, wherein in being coupled together, the implant arm and anchor arm form an angle relative to each other, and the angle is non-adjustable.

17. The system of claim **16**, wherein the anchor arm is specific sized anchor arms, each specific sized anchor arm being configured to couple with the implant arm at a respective specific location, wherein when a specific sized anchor arm is coupled to the implant arm at the respective specific location on the implant arm, the angle is the same regardless of which specific sized anchor arm is coupled to the implant arm.

18. The system of claim **12**, wherein in being coupled together, the implant arm and anchor arm intersect at an angle, and the angle is non-adjustable.

19. The system of claim **12**, wherein the joint implant further comprises a second bore generally extending distally from the proximal end of the joint implant, the second bore receiving a feature of a distal end of the implant arm when the distal end of the implant arm is releasably coupled to the proximal end of the joint implant, wherein the feature of the distal end of the implant arm actively retains the joint implant when releasably coupled and is configured to actively release the joint implant when actuated by the delivery tool.

20. The system of claim **19**, wherein the delivery tool further includes an implant retainer including a distal end defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore, wherein the implant retainer is configured to decouple with the second bore via movement of the implant retainer relative to a shaft of the implant arm.

21. The system of claim **20**, wherein the movement of the implant retainer is rotational movement.

22. The system of claim **20**, wherein the movement of the implant retainer is longitudinal displacement.

23. The system of claim **19**, wherein the delivery tool further includes an implant retainer including a distal end defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore, wherein the implant retainer is configured to decouple from the second bore via a separating force applied only to the implant retainer.

24. The system of claim **23**, wherein the separating force is rotational movement of the implant retainer relative to a shaft of the implant arm.

25. The system of claim **23**, wherein the separating force is longitudinal displacement of the implant retainer relative to a shaft of the implant arm.

26. The system as in any of claim **12** or **19**, in which the body of the joint implant further comprises a top planar surface, a bottom planar surface opposite the top planar surface, a distal end member extending between the top and bottom planar surfaces and positioned distal of the first bore, a proximal end member extending between the top and bottom planar surfaces and positioned proximal of the first bore, and at least one planar member extending generally perpendicularly off of the distal and proximal end members.

27. The system of claim **26**, wherein the body of the joint implant extends a length between the distal and proximal ends, and wherein the at least one planar member extends the length.

28. The system of claim **27**, wherein the at least one planar member comprises a first planar member and a second planar member, wherein the first and the second planar members are generally parallel to each other.

29. The system of claim **28**, wherein the first bore extends between the first and the second planar members.

30. The system of claim **28**, wherein the first planar member and the second planar member are generally coplanar.

31. The system of claim **26**, wherein the top planar surface includes a width that is greater than a thickness between opposite side surfaces of the distal and proximal end members, wherein the width and the thickness are defined generally perpendicular to the longitudinal axis of the body of the joint implant.

32. The system of claim **31**, wherein a junction of the top planar surface and the opposite side surfaces includes a sloped transition.

33. The system of claim **32**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

34. The system of claim **26**, wherein the distal and proximal end members include opposite side surfaces, and wherein the top planar surface includes a pair of top side edges that extend lengthwise along the body of the joint implant and define a juncture of the top planar surface and the opposite side surfaces, wherein a width between the pair of top side edges is greater than a thickness between the opposite side surfaces.

35. The system of claim **34**, wherein the juncture includes a sloped transition.

36. The system of claim **35**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

37. The system as in any of claim **12** or **19**, in which the body of the joint implant further comprises a first surface, a second surface generally opposite the first surface, the first and second surfaces extending a length between the distal and proximal ends, and a first outwardly projecting member extending outwardly from the first surface, the first outwardly projecting member extending a portion of the length of the body of the joint implant and including a third surface, a fourth surface generally opposite the third surface, and a first thickness defined between the third and fourth surfaces, the third and the fourth surfaces outwardly extending a first height from the first surface.

38. The system of claim **37**, wherein the first thickness is variable along the first height.

39. The system of claim **38**, wherein the first thickness is least at an outward edge of the first outwardly projecting member.

40. The system of claim **38**, wherein the first thickness is greatest at an outward edge of the first outwardly projecting member.

41. The system of claim **37**, wherein the first thickness is different than a second thickness defined between the first and second surfaces.

42. The system of claim **41**, wherein the first thickness is less than the second thickness.

43. The system of claim **41**, wherein the first thickness is greater than the second thickness.

44. The system of claim **37**, wherein the first height is variable along the portion of the length of the body of the joint implant.

45. The system of claim **44**, wherein the first height tapers towards a distal tip of the body of the joint implant.

46. The system of claim **37**, wherein the first outwardly projecting member extends the length of the body of the implant.

47. The system of claim **37**, wherein: the first and second surfaces are generally parallel; the third and fourth surfaces are generally parallel; and the first and second surfaces are generally perpendicular to the third and fourth surfaces.

48. The system of claim **37**, further comprising a second outwardly projecting member extending outwardly from the second surface, the second outwardly projecting member extending a portion of the length of the body of the joint implant and including a fifth surface and a sixth surface generally opposite the fifth surface.

49. The system of claim **48**, wherein the first and second outwardly projecting members are generally parallel to each other.

50. The system of claim 48, wherein the first and second outwardly projecting members are generally coplanar to each other.

51. The system of claim 37, further comprising a second outwardly projecting member extending outwardly from the second surface, the second outwardly projecting member extending a portion of the length of the body of the joint implant and including a fifth surface and a sixth surface generally opposite the fifth surface, the fifth and surfaces outwardly extending a second height from the second surface; wherein, when implant in the sacoliac jiont, each of the first and second outwardly projecting members are oriented non-parallel to the joint plane of the sacroiliac joint so as to extend into one of the sacrum or the ilium.

52. The medical kit of claim 51, wherein a disposition of the second outwardly projecting member is a substantial a mirror of a disposition of the first outwardly projecting member when mirrored over a plane which extends along and is coincident with a longitudinal axis of the joint implant.

53. The system of claim 12, wherein the anchor arm comprises a first anchor arm guide configured to deliver the anchor element to the first bore according to the delivery arrangement, and wherein the anchor arm comprises a second anchor arm guide configured to deliver another anchor element adjacent the joint implant and not in the bore of the joint implant in another delivery arrangement that automatically exists such that the second anchor arm guide is correctly oriented to deliver the another anchor element adjacent the joint implant and not in the bore of the joint implant when the system is assembled such that the implant arm is releasably coupled to the joint implant.

54. The system of claim 12, wherein the joint implant further comprises a guide member cantilevered off of the body of the joint implant, the guide member including a guide hole aligned with the bore of the joint implant such that the delivery arrangement includes correctly orienting the anchor element with both the implant bore and the guide hole such that the anchor is to be delivered to both the bore of the joint implant and the guide hole.

55. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, a first bore extending non-parallel to a longitudinal axis of the body, and a second bore generally coaxial with a center longitudinal axis of the joint implant, the second bore receiving a feature of the distal end of an implant arm when the distal end of the implant arm is releasably coupled to the proximal end of the joint implant;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) a delivery tool comprising:

i) the implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant, wherein the feature of the distal end of the implant arm actively retains the joint implant when releasably coupled and is configured to actively release the joint implant when actuated by the delivery tool; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable.

56. The system of claim 55, wherein the delivery tool further includes an implant retainer including a distal end defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore, wherein the implant retainer is configured to decouple with the second bore via movement of the implant retainer relative to a shaft of the implant arm.

57. The system of claim 56, wherein the movement of the implant retainer is rotational movement.

58. The system of claim 56, wherein the movement of the implant retainer is longitudinal displacement.

59. The system of claim 55, wherein the delivery tool further includes an implant retainer including a distal end defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore, wherein the implant retainer is configured to decouple from the second bore via a separating force applied only to the implant retainer.

60. The system of claim 59, wherein the separating force is rotational movement of the implant retainer relative to a shaft of the implant arm.

61. The system of claim 59, wherein the separating force is longitudinal displacement of the implant retainer relative to a shaft of the implant arm.

62. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body, the body of the joint implant further comprises a first surface, a second surface generally opposite the first surface, the first and second surfaces extending a length between the distal and proximal ends, and a first outwardly projecting member extending outwardly from the first surface, the first outwardly projecting member extending a portion of the length of the body of the joint implant and including a third surface, a fourth surface generally opposite the third surface, and a first thickness defined between the third and fourth surfaces, the third and the fourth surfaces outwardly extending a first height from the first surface;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and)

a delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable.

63. The system of claim **62**, wherein the first thickness is variable along the first height.

64. The system of claim **63**, wherein the first thickness is least at an outward edge of the first outwardly projecting member.

65. The system of claim **63**, wherein the first thickness is greatest at an outward edge of the first outwardly projecting member.

66. The system of claim **65**, wherein the first thickness is less than the second thickness.

67. The system of claim **65**, wherein the first thickness is greater than the second thickness.

68. The system of claim **62**, wherein the first thickness is different than a second thickness defined between the first and second surfaces.

69. The system of claim **62**, wherein the first height is variable along the portion of the length of the body of the joint implant.

70. The system of claim **69**, wherein the first height tapers towards a distal tip of the body of the joint implant.

71. The system of claim **62**, wherein the first outwardly projecting member extends the length of the body of the implant.

72. The system of claim **62**, wherein: the first and second surfaces are generally parallel; the third and fourth surfaces are generally parallel; and the first and second surfaces are generally perpendicular to the third and fourth surfaces.

73. The system of claim **62**, further comprising a second outwardly projecting member extending outwardly from the second surface, the second outwardly projecting member extending a portion of the length of the body of the joint implant and including a fifth surface and a sixth surface generally opposite the fifth surface.

74. The system of claim **73**, wherein the first and second outwardly projecting members are generally parallel to each other.

75. The system of claim **73**, wherein the first and second outwardly projecting members are generally coplanar to each other.

76. A medical kit for the fusion of a sacroiliac joint including a sacrum, an ilium, a caudal access region and a joint plane, the kit comprising:

a) a delivery tool comprising an anchor arm coupled to an implant arm, the anchor arm comprising a first anchor arm guide;

b) a joint implant comprising a bore defined therein that extends generally transverse to a longitudinal length of the joint implant; and

c) an anchor element configured to be received in the bore of the joint implant,

wherein the bore of the implant, the implant, the implant arm and the anchor arm have an as-manufactured configuration that limits the first anchor arm guide to properly align the anchor element in only a single orientation relative to the bore of the implant such that the anchor element is to be received in the bore of the implant when the implant is coupled to the implant arm.

77. The medical kit of claim **76**, wherein the anchor element comprises a plurality of multiple anchor elements of different sizes.

78. The medical kit of claim **76**, wherein the joint implant is multiple joint implants of different sizes, each of the multiple joint implants having the as-manufactured configuration.

79. The medical kit of claim **76**, further comprising sterile packaging.

80. The medical kit of claim **79**, further comprising instructions directing: 1) the implant to be delivered into the sacroiliac joint via the caudal access region of the sacroiliac joint; and 2) the anchor element to be driven generally transverse to the joint plane of the sacroiliac joint when the anchor element is caused to be received in the bore.

81. The medical kit of claim **80**, wherein the instructions are at least one of provided with the sterile packaging, via an internet source, or via physician seminar.

82. The medical kit of claim **76**, wherein the joint implant further comprises a second bore extending distally from a proximal end of the joint implant, the second bore receiving a feature of a distal end of the implant arm when the distal end of the implant arm is releasably coupled to the proximal end of the joint implant.

83. The medical kit of claim **82**, wherein the delivery tool further includes an implant retainer that extends through the implant arm, a distal end of the implant retainer defining at least a portion of the feature of the distal end of the implant arm that is received in the second bore.

84. The medical kit of claim **83** wherein the feature of the distal end of the implant arm actively retains the joint implant when releasably coupled and is configured to actively release the joint implant when actuated by the delivery tool.

85. The medical kit of claim **84**, wherein the implant retainer is configured to decouple with the second bore via movement of the implant retainer relative to a shaft of the implant arm.

86. The medical kit of claim **85**, wherein the movement of the implant retainer is rotational movement.

87. The medical kit of claim **85**, wherein the movement of the implant retainer is longitudinal displacement.

88. The medical kit of claim **76**, wherein a body of the joint implant comprises a top planar surface, a bottom planar surface opposite the top planar surface, a distal end member extending between the top and bottom planar surfaces and positioned distal of the bore, a proximal end member extending between the top and bottom planar surfaces and positioned proximal of the bore, and at least one planar member extending generally perpendicularly off of the distal and proximal end members.

89. The medical kit of claim **88**, wherein the body of the joint implant extends the longitudinal length of the joint implant between a distal end and a proximal end, and wherein the at least one planar member extends the longitudinal length.

90. The medical kit of claim **89**, wherein the at least one planar member comprises a first planar member and a second planar member, wherein the second planar member is generally a mirrored copy of the first planar member and mirrored over a plane which extends along and is coincident with an implant longitudinal length.

91. The medical kit of claim **89**, wherein the at least one planar member comprises a first planar member and a second planar member, wherein the first and the second planar members are generally parallel to each other.

92. The medical kit of claim **91**, wherein the bore extends between the first and the second planar members.

93. The medical kit of claim **88**, wherein the top planar surface includes a width that is greater than a thickness between opposite side surfaces of the distal and proximal end members, wherein the width and the thickness are defined generally perpendicular to the longitudinal length of the body of the joint implant.

94. The medical kit of claim **93**, wherein a junction of the top planar surface and the opposite side surfaces includes a sloped transition.

95. The medical kit of claim **94**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

96. The medical kit of claim **88**, wherein the distal and proximal end members include opposite side surfaces, and wherein the top planar surface includes a pair of top side edges that extend lengthwise along the body of the joint implant and define a juncture of the top planar surface and the opposite side surfaces, wherein a width between the pair of top side edges is greater than a thickness between the opposite side surfaces.

97. The medical kit of claim **96**, wherein the juncture includes a sloped transition.

98. The medical kit of claim **97**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

99. The medical kit as in any of claim **76** or **88**, in which the anchor arm comprises a plurality of specific sized anchor arms, each specific sized anchor arm being configured to couple with the implant arm at a respective specific location, wherein when a specific sized anchor arm is coupled to the implant arm at the respective specific location on the implant arm, the specific sized anchor arm is operably coupled to the implant arm in a manner that results in an arrangement such that the anchor is aligned to be received in the bore of the joint implant when the joint implant is coupled to the implant arm.

100. The medical kit of claim **99**, wherein the joint implant is multiple joint implants of different sizes, each of the multiple joint implants having the as-manufactured configuration and result in the arrangement.

101. The medical kit of claim **99**, wherein the joint implant is multiple joint implants of different configurations, each of the multiple joint implants having the as-manufactured configuration and result in the arrangement.

102. The medical kit of claim **101**, wherein the different configurations include different angles of the bore relative to a longitudinal axis of the joint implant.

103. The medical kit as in any of claim **76** or **88**, in which an interface arrangement between the joint implant and a distal end of the implant arm comprises a complementary configuration including a projection and a recess configured to receive the projection such that the joint implant is prevented from pivoting relative to the implant arm when the joint implant is coupled to the implant arm and an extreme distal face of the implant arm distal end abuts the implant.

104. The medical kit of claim **103**, wherein a proximal end of the joint implant comprises an opening defining a passageway which extends distally and communicates with the bore of the joint implant, the opening and passageway configured to receive at least one of a) an injection of biocompatible material or b) a fastener, wherein the receipt of the fastener allows, interference with the anchor extending through the bore such that after implantation the fastener interfering with the anchor resists migration of the anchor.

105. The medical kit of claim **103**, wherein the distal end of the implant arm corresponds with respect to both a size and shape of a portion of the joint implant which comprises a respective portion of the interface arrangement such that when the joint implant is supported off the implant arm respective outer surfaces of the joint implant and implant arm distal end transition smoothly moving from the joint implant to the implant arm distal end.

106. The medical kit of claim **103**, wherein the joint implant further comprises a guide member cantilevered off of the joint implant and including a guide hole aligned with'the bore of the joint implant such that the as-manufactured configuration includes allowing the anchor element to align with both the implant bore and the guide hole such that the anchor is to be received in both the bore of the joint implant and the guide hole.

107. The medical kit of claim **103**, wherein the anchor arm further comprises a second guide configured to deliver the anchor adjacent the joint implant and not through the bore.

108. The medical kit of claim **76**, wherein the joint implant is multiple joint implants having different dispositions of the bore of the joint implant, each of the multiple joint implants having the as-manufactured configuration and wherein the medical kit further comprises a corresponding anchor arm guide which properly aligns the anchor relative to the bore such that the anchor is to be received in the bore of the joint implant when the implant is coupled to the implant arm,

109. The medical kit of claim **108**, wherein the different dispositions of the bore comprise different angles defined between a longitudinal axis of the bore of the joint implant relative to a longitudinal axis of the joint implant extending along the longitudinal length of the joint implant.

110. The medical kit of claim **109**, wherein the different angles of the bore of the joint implant comprise an angular difference defined in a reference plane that is coincident with and extending along the longitudinal axis of the joint implant.

111. The medical kit of claim **109**, wherein the different angles of the implant bore comprise an angular difference defined in a reference plane that is normal to the longitudinal axis of the joint implant.

112. The medical kit of claim **109**, wherein the different angles of the implant bore comprise an angular difference defined in a first reference plane that is normal to the longitudinal axis of the joint implant and in a second reference plane that is coincident with and extending along the longitudinal axis of the joint implant.

113. The medical kit of claim **108**, wherein the different dispositions of the bore comprise different positions of the bore relative to a proximal most surface of the joint implant.

114. The medical kit as in any of claim **76** or **108**, in which the joint implant further comprises a first surface, a second surface generally opposite the first surface, the first and second surfaces extending the longitudinal length between an implant distal end and an implant proximal end, and a first outwardly projecting member extending outwardly from the first surface, the first outwardly projecting member extending a portion of the longitudinal length and including a third surface, a fourth surface generally opposite the third surface, and a first thickness defined between the third and fourth surfaces, the third and the fourth surfaces outwardly extending a first height from the first surface.

115. The medical kit of claim **114**, further comprising a second outwardly projecting member extending outwardly from the second surface, the second outwardly projecting member extending a portion of the longitudinal length of the joint implant and including a fifth surface and a sixth surface generally opposite the fifth surface, the fifth and the sixth surfaces outwardly extending a second height from the second surface.

116. The medical kit of claim **115**, wherein a disposition of the second outwardly projecting member is a substantial mirror of a disposition of the first outwardly projecting member when mirrored over a plane which extends along and is coincident with the longitudinal length of the joint implant.

117. The medical kit of claim **115**, wherein, when implanted in the sacroiliac joint, the first outwardly projecting member is oriented non-parallel to the joint plane of the sacroiliac joint so as to extend into one of the sacrum or the ilium.

118. The medical kit of claim **76**, wherein the joint implant further comprises a guide member cantilevered off of the joint implant and including a guide hole aligned with the bore of the joint implant such that the as-manufactured configuration includes allowing the anchor element to align with both the implant bore and the guide hole such that the anchor is to be received in both the implant bore and the guide hole. and a sixth surface generally opposite the fifth surface, the fifth and the sixth surfaces outwardly extending a second height from the second surface; wherein, when implanted in the sacroiliac joint, each of the first and second outwardly projecting members are oriented non-parallel to the joint plane of the sacroiliac joint so as to extend into one of the sacrum or the ilium.

119. The medical kit of claim **76**, wherein the first anchor arm guide is a collar that is configured to guide a surgical tool in delivering the anchor element in the bore of the joint implant.

120. The medical kit of claim **91**, wherein the first planar member and the second planar member are generally coplanar.

121. A sacroiliac joint fusion system comprising:

a) a joint implant comprising a distal end, a proximal end, a body extending between the proximal and distal ends, and a first bore extending non-parallel to a longitudinal axis of the body, the body of the joint implant further comprises a top planar surface, a bottom planar surface opposite the top planar surface, a distal end member extending between the top and bottom planar surfaces and positioned distal of the first bore, a proximal end member extending between the top and bottom planar surfaces and positioned proximal of the first bore, and at least one planar member extending generally perpendicularly off of the distal and proximal end members;

b) an anchor element comprising a distal end and a proximal end and being configured to be received in the first bore; and

c) delivery tool comprising:

i) an implant arm comprising a proximal end and a distal end, the distal end of the implant arm configured to releasably couple to the proximal end of the joint implant such that a longitudinal axis of the implant arm is substantially at least one of coaxial or parallel with the longitudinal axis of the body of the joint implant; and

ii) an anchor arm comprising a proximal end and a distal end, the distal end of the anchor arm configured to engage the proximal end of the anchor element, the anchor arm operably coupled to the implant arm in an arrangement such that a longitudinal axis of the anchor element is generally coaxially aligned with a longitudinal axis of the first bore when the distal end of the implant arm is releasably coupled with the proximal end of the joint implant and the distal end of the anchor arm is engaged with the proximal end of the anchor element, wherein the arrangement is fixed and nonadjustable.

122. The system of claim **121**, wherein the body of the joint implant extends a length between the distal and proximal ends, and wherein the at least one planar member extends the length.

123. The system of claim **122**, wherein the at least one planar member comprises a first planar member and a second planar member, wherein the first and the second planar members are generally parallel to each other.

124. The system of claim **123**, wherein the first bore extends between the first and the second planar members.

125. The system of claim **123**, wherein the first planar member and the second planar member are generally coplanar.

126. The system of claim **121**, wherein the top planar surface includes a width that is greater than a thickness between opposite side surfaces of the distal and proximal end members, wherein the width and the thickness are defined generally perpendicular to the longitudinal axis of the body of the joint implant.

127. The system of claim **126**, wherein a junction of the top planar surface and the opposite side surfaces includes a sloped transition.

128. The system of claim **127**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

129. The system of claim **121**, wherein the distal and proximal end members include opposite side surfaces, and wherein the top planar surface includes a pair of top side edges that extend lengthwise along the body of the joint implant and define a juncture of the top planar surface and the opposite side surfaces, wherein a width between the pair of top side edges is greater than a thickness between the opposite side surfaces.

130. The system of claim **129**, wherein the juncture includes a sloped transition.

131. The system of claim **130**, wherein the sloped transition includes an outward flaring of the opposite side surfaces.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,017,407 B2
APPLICATION NO. : 13/236411
DATED : April 28, 2015
INVENTOR(S) : Edward Jeffrey Donner

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

- In claim 5, column 44, line 57, delete “Point” and replace with -- joint --.
- In claim 51, column 49, line 9, after “and” insert -- the sixth --.
- In claim 51, column 49, line 11, delete “implant in the sacoliac jiont” and replace with -- implanted in the sacroiliac joint --.
- In claim 52, column 49, line 15, replace “medical kit” with -- system --; and in line 16, after “substantial” delete “a”.
- In claim 104, column 53, line 60, delete the “,” after -- allows --.
- In claim 106, column 54, line 6, delete “with’the” and replace with -- with the --.
- In claim 108, column 54, line 22, replace the “,” at the end of the paragraph with a -- . --.
- In claim 118, column 55, beginning at line 14, after “hole.” delete the remaining text to the end of the paragraph on line 20.
- In claim 121, column 55, line 44, after “c)” insert -- a --.

Signed and Sealed this
Twenty-sixth Day of April, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office