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(54) **Title**: TISSUE GRAFT ANCHOR ASSEMBLY AND INSTRUMENTATION FOR USE THEREWITH

(57) **Abstract**: The present disclosure relates to a soft tissue graft anchor. The anchor includes a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end. A tissue graft anchor assembly, a method for tissue repair, and instrumentation for use therewith are also disclosed.

TISSUE GRAFT ANCHOR ASSEMBLY AND INSTRUMENTATION FOR USE THEREWITH

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a PCT International Application claiming priority to U.S. Patent Application No. 61/224,123, filed July 9, 2009; US Patent Application No. 61/225,240, filed July 14, 2009; US Patent Application No. 61/312,506, filed March 10, 2010; US Patent Application No. 61/315,521, filed March 19, 2010; and US Patent Application No. 61/332,998, filed May 10, 2010, the disclosures of which are incorporated by reference in their entireties.

BACKGROUND

FIELD OF TECHNOLOGY

[0002] The present disclosure relates to the fixation of soft tissue to bone.

RELATED ART

[0003] In many aspects of orthopedic surgery it is necessary to fix a soft tissue to bone. In one example, a ligament, such as an anterior cruciate ligament (ACL), that has ruptured and is non-repairable, may be replaced by a soft tissue graft. The tissue graft can be harvested from various sites including, without limitation, the patellar tendon, quadriceps tendon, semitendonosis tendon, gracilis tendon, or a combination thereof. Alternatively, the graft may be formed from synthetic materials or from a combination of synthetic and natural materials.

[0004] The replacement tissue graft is implanted by securing one end of the tissue graft through a passage formed in the femur, and the other end of the graft through a passage formed in the tibia. Generally, an anchor (e.g., an interference screw or a post) is used to affix each end of the tissue graft to the bone.

[0005] In another example, a soft tissue may be anchored to passages in the femur and patella to reconstruct the medial patellofemoral ligament. Other examples of ligament

reconstructions include, but are not limited to, elbow and ankle ligament reconstructions. Tendons not part of a ligament reconstruction may also be anchored into bone passages. An example is fixation of the proximal biceps tendon to the proximal humerus.

[0006] There remains a need for a soft tissue anchor and instrumentation for use with the anchor which is simple, easy to install, and inexpensive to manufacture, while providing secure, trouble-free anchoring of a soft tissue graft.

SUMMARY

[0007] In an aspect, the present disclosure relates to a soft tissue graft anchor. The anchor includes a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end. In an embodiment, at least one of the prongs includes at least one barb on at least one side surface of the prong. In another embodiment, the anchor includes a through hole, wherein the cavity extends into the through hole. In yet another embodiment, at least one of the prongs includes at least one groove.

[0008] In another aspect, the present disclosure relates to tissue graft anchor assembly. The anchor assembly includes a tissue graft anchor including a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and a fixation member configured to be disposed within the cavity.

[0009] In yet another aspect, the present disclosure relates to a method of tissue repair. The method includes creating a tunnel in bone; inserting a soft tissue graft within the tunnel;

inserting a tissue graft anchor within the tunnel, the tissue graft anchor comprising a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and inserting a fixation member within the cavity of the tissue graft anchor, whereby inserting the fixation member into the cavity causes the prongs to twist and expand, thereby causing ends of the grafts to engage a wall of the tunnel and fixate the grafts to the bone.

[0010] In a further aspect, the present disclosure relates to a tension device. The tension device includes a body including two sides, wherein each side includes one wheel and two guides, wherein the wheel is configured for longitudinal movement relative to the body and the guides are stationary; a shoulder assembly coupled to the body; and a shaft assembly coupled to the shoulder assembly, the shaft assembly comprising a shaft and a handle coupled to the shaft, the handle including a window.

[0011] In yet a further aspect, the present disclosure relates to a broach. The broach includes a handle; and a shaft coupled to the handle, the shaft including a member located at an end of the shaft, the member including prongs, grooves located between the prongs, and a fin on at least one of the prongs, the fin extending perpendicular to a longitudinal axis of the of the prong.

[0012] In an aspect, the present disclosure relates to a delivery device. The delivery device includes a handle; a shaft coupled to the handle; and a movable member coupled to the shaft, the member including a track, a nipple coupled to the shaft located within the track, wherein the nipple is located in a first area of the track when the movable member is located in a

first position and the nipple is located in a second area of the track when the movable member is located in a second position.

[0013] In another aspect, the present disclosure relates to a kit. The kit includes a tissue graft anchor including a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and a fixation member configured to be disposed within the cavity.

[0014] Further areas of applicability of the present disclosure will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the disclosure, are intended for purposes of illustration only and are not intended to limit the scope of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are incorporated in and form a part of the specification, illustrate the embodiments of the present disclosure and together with the written description serve to explain the principles, characteristics, and features of the disclosure. In the drawings:

[0016] Figs. 1 and 2 show side elevation views of the tissue graft anchor of the present disclosure.

[0017] Fig. 3 shows an isometric view of the tissue graft anchor of the present disclosure.

[0018] Fig. 4 shows an isometric view of the tissue graft anchor of the present disclosure.

[0019] Fig. 5 shows a side elevation view of the tissue anchor assembly of the present disclosure.

[0020] Fig. 6 shows the tissue graft anchor assembly of the present disclosure after insertion of the assembly into a bone tunnel.

[0021] Fig. 7 shows an isometric view of an alternative embodiment of the tissue graft anchor of the present disclosure.

[0022] Figs. 8-11 show the tension device of the present disclosure and its components.

[0023] Fig. 12 shows an isometric view of the broach of the present disclosure.

[0024] Figs. 13-15 show the delivery device of the present disclosure.

[0025] Figs. 16-19 show soft tissue reconstruction surgery via use of the tissue graft anchors of the present disclosure.

[0026] Fig. 20 shows an isometric view of another alternative embodiment of the tissue graft anchor of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0027] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the disclosure, its application, or uses.

[0028] Figs. 1-4 show the soft tissue graft anchor **10** of the present disclosure. The anchor **10** includes prongs **10a**, wherein each prong **10a** has a distal end **10b** and a proximal end **10c**. The prongs **10a** are coupled at their distal ends **10b** to form an inner cavity **10d** having an opening **10e** and at least one prong **10a** includes at least one barb **10i** on at least one side surface **10j** of the prong **10a**. As shown in Figs. 1-4, the number of prongs **10a** having barbs **10i** and the number of barbs **10i** may vary. It is also within the scope of this disclosure for the prongs **10a** to not have any barbs **10i**. In addition, at least one of the prongs **10a** includes a fin **10f**. The fin **10f**

extends perpendicular to a longitudinal axis **L** of prong **10a** and includes a pointed end **10g**. An anchor **10** having prongs **10a** wherein more than one prong **10a** has a fin **10f** and an anchor **10** without a fin **10f** are also within the scope of this disclosure. For the purposes of the present disclosure, the tissue graft anchor **10** includes a plurality of prongs **10a**, with the word plurality meaning at least two prongs **10a**. Additionally, the anchor **10** includes a through hole **10k**. However, it is within the scope of this disclosure for the anchor **10** to not include a through hole **10k**. As shown in Figs. 3 and 4, the inner cavity **10d** extends into the through hole **10k**.

[0029] Fig. 5 shows the tissue graft anchor assembly **20** of the present disclosure. The assembly **20** includes the tissue graft anchor **10** and a fixation member **11**, which is configured to be disposed within the cavity **10d** of the anchor **10**. The fixation member **11** includes a distal end **11a**, a proximal end **11b**, and an outer surface **11c** including threads **11d**. The proximal end **11b** includes a hole **(not shown)** that is configured for engagement with a delivery device **(not shown)** during surgery, as will be further described below. The hole may extend a partial length or a full length of the member **11**. At least one of the prongs **10a** also includes an inner surface **10h** having at least one groove **10L** that is configured for engagement with the threads **11d** of the fixation member **11** upon insertion of the fixation member **11** into the inner cavity **10d**, as will be further described below. As shown in Figs. 1-4, the number of prongs **10a** having grooves **10L** and the number of grooves **10L** may vary. For the purposes of this disclosure, the grooves **10L** are located at the proximal ends **10c** of the prongs **10a** and extend a partial length of the prongs **10a**, but may be located any where along the inner surface **10h**, including along the entire inner surface **10h** of the prongs **10a**. It is also within the scope of this disclosure for the prongs **10a** to not have any grooves **10L**. Also, the inner surfaces **10h** of proximal ends **10c** of the prongs **10a** are tapered along partial lengths of the inner surfaces **10h**.

[0030] As mentioned above, during ligament reconstruction surgery, tunnels are created in the femur and tibia and the replacement tissue graft is implanted by securing one end of the tissue graft in the tunnel formed within the femur and the other end of the graft in the tunnel formed within the tibia. One or more replacement tissue grafts may be used. Fig. 6 illustrates use of the assembly **20** to secure the ends **31,41** of the replacement grafts **30,40** within the tibial tunnel **50**. Once the ends **31,41** are passed through the tunnel **50**, the tissue anchor **10** is inserted into the tunnel **50** such that the ends **31,41** are located between the prongs **10a**. The anchor **10** is seated within the tunnel **50** such that the prong **10a** with the fin **10f** is not completely inserted into the tunnel **50**. Rather, as shown in Fig. 6, the fin **10f** engages a portion of the tibia (outer surface of the tibia) outside of the tunnel and acts as a depth stop to substantially reduce over insertion of the anchor **10** into the tunnel **50**. In addition to acting as a depth stop, the fin **10f** engages the bone and allows for cortical fixation of the anchor **10**.

[0031] The fixation member **11** is then inserted within the cavity **10d** of the anchor **10** in a rotary manner. As mentioned above, the grooves **10i** are configured for engagement with the threads **11d** of the fixation member **11** to facilitate insertion of the fixation member **11** into the inner cavity **10d**. In addition, the tapered inner surfaces **10h** at the proximal ends **10c** of the prongs **10a** cooperate with the tapered distal portion **11a** of the fixation member **11** to allow for easier insertion of the fixation member **11**. During insertion of the fixation member **11** into the cavity **10d**, the prongs **10a** are caused to twist and expand, as shown in Fig. 6, thereby forcing the ends **31,41** of the grafts **30,40** against a wall **51** of the bone tunnel **50** and fixating the grafts **30,40** to the tibia. Additionally, upon insertion of the anchor **10** into the bone tunnel **50**, the barbs **10i** engage the ends **31,41** of the grafts **30,40** and apply compression to the ends **31,41**

when the fixation member **11** is inserted into the inner cavity **10d** so as to further fixate the grafts **30,40** to the tibia.

[0032] For the purposes of this disclosure, the fixation member **11** is not shown in Fig. 6. However, the illustration in Fig. 6 and the following corresponding description describes insertion of the fixation member **11** into the inner cavity **10d** and subsequent fixation of the grafts **30,40** to bone as if the member **11** was shown in Fig. 6. The anchor **10** is made from a non-metal material, including, but not limited to a polymer material. However, it may be made from a metal material. Also, the anchor **10** is made via an injection molding process, but may be made via another process known to one of skill in the art. The fixation member **11** is made from a non-metal material, including, but not limited to a polymer material and is made via an injection molding process. However, other materials and processes known to one of skill in the art are also possible.

[0033] For the purposes of this disclosure, the assembly **20** is used to fixate soft tissue within the tibial tunnel. However, the assembly **20** may be used to fixate soft tissue within the femoral tunnel or to bone in other parts of the body, such as described above in other types of ligament reconstructions and procedures. In addition, the assembly may be used to fixate soft tissue to bone in other areas of the body. The method described above may further include locating a guide wire within the femoral and tibial tunnels either before or after the tunnels are drilled for guiding the drill and/or guiding placement of the anchor **10** and/or the fixation member **11** within the tunnel.

[0034] Fig. 7 shows an alternative embodiment of the tissue graft anchor **60** of the present disclosure. Anchor **60** is similar to anchor **10**. However, anchor **60** differs from anchor **10** such that the distal ends **60b** of the prongs **60a** are substantially rounded, rather than tapered;

the barbs **60i** are wider and straight compared to barbs **10i**, and only two of the prongs **60a** have grooves **60L**, rather than four, as in anchor **10**.

[0035] Figs. 8-15 show instrumentation for use with anchors **10,60** during ligament reconstruction surgery. Figs. 8-11 show a tension device **70** for applying tension to a soft tissue graft prior to fixating the soft tissue graft to bone via use of one of anchors **10,60**. The device **70** includes a body **71** having suture wheels **71a** and guides **71b**. For the purposes of this disclosure, each side of the body **71** includes one wheel **71a** and two guides **71b**. However, the number of wheels **71a** and guides **71b** may vary. The guides **71b** are stationary, but the wheels **71a** are capable of being rotated and moved longitudinally relative to the body **71**. Each wheel **71a** has a central opening **71a'** through which is disposed a bearing pin **72**. A first end **72a** of each bearing pin **72** is coupled to a movable insert **73**, which is housed within a slot **74**.

[0036] Springs **74a** are also located within slots **74** to allow for longitudinal movement of the inserts **73**, and thus the wheels **71a**, when tension is applied via use of the tension device **70**, as will be further described later. The wheels **71a** are located on second ends **72b** of the bearing pins **72** such that first snap rings **75** are located between the wheels **71a** and the second ends **72b** of the bearing pins **72**. The snap rings **75** may be coupled to outer surfaces **72c** of the bearing pins **72** or inner surfaces **71a''** of the wheel openings **71a'**.

[0037] The device **70** also includes a central opening **71c** to which a shoulder assembly **76** is coupled. The assembly **76** includes a shoulder **76a** disposed within the opening **71c** and a bearing **76b** coupled to the shoulder **76a**. The shoulder **76a** has a central opening **76a'**, in which the bearing **76b** is disposed, and the bearing **76b** has a central opening **76b'**. A shaft assembly **77** is coupled to the shoulder assembly **76**. The shaft assembly **77** includes a shaft **77a** and a handle **77b** coupled to the shaft **77a**. The shaft **77a** includes a first end **77a'** and a second end

77a''. The first end **77a'** is coupled to the shoulder assembly **76** such that the first end **77a'** is disposed within the bearing central opening **76b'**. The second end **77a''** of the shaft **77a** includes a flange **77a'''**, the purposes of which will be described later.

[0038] Located on the shaft **77a** is a cannulated handle **77b**. Also disposed on the shaft **77a** is a spring **78** located between an end **77b'** of the handle **77b** and the flange **77a'''**. The handle **77b** includes pull members **77c**, grooves **77d**, a first window **77e** on a first side **77f** of the handle **77b**, and a second window **(not shown)** on a second side **77g** of the handle **77b**. Sets of reference numbers **77h** are located next to each window and a hash mark **77i** corresponds with each reference number. The reference numbers **77h** refer to the amount of tension applied by the user in Newtons (first side) or pounds (second side). During reconstruction surgery, force is applied to the handle **77b** by pulling the handle **77b** toward the user until a hash mark **77j**, located on the second end **77a''** and visible through the window **77e**, is in line with a hash mark **77i** that represents the amount of tension required by the user, as shown in Fig. 11 and as will be further described below. During this time, when the user is pulling on the handle **77b**, the spring **78** is in a compressed state.

[0039] For the purposes of this disclosure, the shoulder **76a** is press-fit into the opening **71c**, the bearing **76b** is press-fit into the opening **76a'** of the shoulder **76a**, the shaft **77a** is press-fit and welded into the opening **76b'** of the bearing **76b**, and the first end **72a** of the bearing pin **72** is press-fit into the insert **73**. However, other method of coupling may also be used.

[0040] Fig. 12 shows a cannulated broach **80** for use during reconstruction surgery. The broach **80** is used to divide the ends of the tissue grafts and create a seat for the anchor **10,60**, as will be further described below. The broach **80** includes a handle **81** and a shaft **82** coupled to the handle **81**. The handle **81** includes a removal tab **81a** extending perpendicular to a

longitudinal axis **L** of the handle **81**. The shaft **82** includes a member **84** located at an end **83** of the shaft **82**. The member **84** is similar to the anchors **10,60** in that the member **84** has prongs **84a** and grooves **84b** located between the prongs **84a**. Similarly, at least one of the prongs **84a** includes a fin **85** extending perpendicular to a longitudinal axis **L'** of the prong **84a**.

[0041] Figs. 13-15 show a cannulated delivery device **90** for use in delivering the anchors **10,60**. The device **90** includes a handle **91**, a shaft **92** coupled to the handle **91**, and a movable member **93** coupled to the shaft **92**. Also coupled to the shaft **92** and located between the movable member **93** and the shaft **92** are a fixed spring stop **94** and a spring **95**. The shaft **92** includes a proximal end **92a** and a distal end **92b**. The distal end **92b** includes a plurality of longitudinal grooves **92c** that extend a partial length of the shaft **92**. The movable member **93** includes a track **93a** through which a nipple **92d**, coupled to the shaft **92**, rides in. In a first position, the nipple **92d** is located, in a first area **93a'** of the track **93a**, as shown in Fig. 13, and in a second, retracted position the nipple **92d** is located in a second area **93a''** of the track **93a**. The movable member **93** also includes a distal portion **93b** and a proximal portion **93c**. The distal portion **93b** includes a fin **93d** and an opening **93e**. When the anchor **10,60** is located on the distal end **92b** of the shaft **92**, fin **10f,60f** is disposed within the opening **93e** and aligned with fin **93d**. In the first and second positions, as described above, the spring **95** is in a relaxed position and a compressed position, respectively. When the movable member is in the second position, the spring **95** is compressed between the proximal portion **93c** and the spring stop **94**.

[0042] As shown in Fig. 16, once the replacement tissue grafts **101,102** are secured in the femur **(not shown)** and the ends **101a-b,102a-b** of the grafts **101,102** are located in the tibial tunnel **301**, suture **401-404** coupled to the ends **101a-b,102a-b** are formed into two loops **405,406**. For the purposes of this disclosure, two grafts **101,102** are used. However, the use of

more or less than two grafts is also within the scope of this disclosure. Each graft **101,102** has two ends **101a-b,102a-b** and a suture **401-404** extends from each end **101a-b,102a-b**, such that two suture ends **401,403** are tied together to form a first loop **405** and the other two suture ends **402,404** are tied together to form a second loop **406**. Subsequently, the first loop **405** is placed around a wheel **71a** and two suture guides **71b** on one side of the tension device **70** and the second loop **406** is placed around a wheel **71a** and two suture guides **71b** on the other side of the tension device **70**. The handle **77b** is then pulled towards the user until the proper amount of tension is shown in the window **77e**, as shown in Fig. 16A.

[0043] A guide wire **(500, Fig. 19)** is then placed in the tunnel **301**. As shown in Fig. 17, the shaft **82** of the broach **80** is then placed over the guide wire **500**, through the tension device **70**, via the cannulated handle **77b** and shaft **77a**, and the end **83** is placed within the tibial tunnel **301** such that the prongs **84a** are inserted between the ends **101a-b,102a-b** of the soft tissue grafts **101,102** to divide the grafts **101,102**, as shown in Fig. 17A. As the prongs **84a** extend between the grafts **101,102**, they also extend into the wall of the tibial tunnel **301** to create a seat for the prongs **10a,60a** of the anchor **10,60** when the anchor **10,60** is inserted into the tunnel **301**. The fin **85** of the broach **80** engages a portion of the tibia **300** outside of the tunnel **301** and acts as a depth stop to substantially reduce over insertion of the end **83** of the broach **80** into the tunnel **301**, as also shown in Fig. 17A.

[0044] The anchor **10,60** is then loaded on the distal end **92b** of the delivery device **90**, while the delivery device is in the first position, as described above, by placing the distal end **92b** of the delivery device **90** into the cavity **10d,60d** of the anchor **10,60** such that the prongs **10a,60a** engage the grooves **92c** and the fin **10f,60f** of the anchor **10,60** aligns with the fin **93d** of the movable member **93** and is secured in the opening **93e**. The shaft **92** of the delivery

device **90** is inserted over the guide wire **500**, through the tension device **70**, via the cannulated handle **77b** and shaft **77a**, and the distal end **92b**, and therefore the anchor **10,60**, is placed into the tunnel **301** until the fin **10f,60f** engages a portion of the tunnel **301**, as described above and shown in Figs. 18 and 18A. The delivery device **90** is then removed and the movable member **93** is retracted to place the movable member **93** in the second position, as described above. The fixation member **600** is then loaded onto the distal end **92b** of the delivery device **90** and the device **90** is inserted through the tension device **70** and into the cavity **10d,60d** of the anchor **10,60**. The member **600** is inserted into the cavity **10d,60d** as described and shown above in Fig. 6 and as also shown in Figs. 19 and 19A. After the delivery device **90** is removed from the tunnel **301**, the suture loops **405,406** are removed from the tension device **70** and the ends **101a-b,102a-b** of the grafts **101,102** are cut.

[0045] Fig. 20 shows another alternative embodiment of the anchor **700**. Anchor **700** is similar to anchor **10**. However, anchor **700** differs from anchor **10** such that the distal ends **700b** of the prongs **700a** are extended, rather than tapered, and spaces **700m** exist between the extended portions. During use of the anchor **700** in surgery, one or more grafts may be extended over the anchor **700** such that the grafts are located within the spaces **700m** and the ends of the grafts are located between the prongs **700a**.

[0046] For the purposes of this disclosure, a guide wire is used during surgery. The guide wire is inserted into the tunnel and the instruments are inserted over the guide wire. However, it is possible for the guide wire to be inserted into the tunnel in other manners. It is also within the scope of this disclosure for the guide wire to not be used. In this instance, the anchor, fixation member, and instrumentation may be non-cannulated. Furthermore, it is within the scope of this disclosure for a tension device to not be used during surgery.

[0047] Additionally, it is within the scope of this disclosure for the anchors to have a varying number of prongs. Also, for the purposes of this disclosure the prongs are symmetric. However, the prongs may be asymmetric.

[0048] As various modifications could be made to the exemplary embodiments, as described above with reference to the corresponding illustrations, without departing from the scope of the disclosure, it is intended that all matter contained in the foregoing description and shown in the accompanying drawings shall be interpreted as illustrative rather than limiting. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims appended hereto and their equivalents.

CLAIMS

What is claimed is:

1. A soft tissue graft anchor comprising:

a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end.

2. The soft tissue graft anchor of claim 1 wherein at least one of the prongs includes at least one barb on at least one side surface of the prong.

3. The soft tissue graft anchor of claim 1 wherein the anchor includes a through hole, wherein the cavity extends into the through hole.

4. The soft tissue graft anchor of claim 1 wherein at least one of the prongs includes at least one groove.

5. A tissue graft anchor assembly comprising:

a tissue graft anchor comprising a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and

a fixation member configured to be disposed within the cavity.

6. A method of tissue repair comprising:

creating a tunnel in bone;

inserting a soft tissue graft within the tunnel;

inserting a tissue graft anchor within the tunnel, the tissue graft anchor comprising a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and

inserting a fixation member within the cavity of the tissue graft anchor, whereby inserting the fixation member into the cavity causes the prongs to twist and expand, thereby causing ends of the grafts to engage a wall of the tunnel and fixate the grafts to the bone.

7. A tension device comprising:

a body comprising two sides, wherein each side comprises one wheel and two guides, wherein the wheel is configured for longitudinal movement relative to the body and the guides are stationary;

a shoulder assembly coupled to the body; and

a shaft assembly coupled to the shoulder assembly, the shaft assembly comprising a shaft and a handle coupled to the shaft, the handle including a window.

8. A broach comprising:

a handle; and

a shaft coupled to the handle, the shaft including a member located at an end of the shaft, the member including prongs, grooves located between the prongs, and a fin on at least one of the prongs, the fin extending perpendicular to a longitudinal axis of the of the prong.

9. A delivery device comprising:

a handle;

a shaft coupled to the handle; and

a movable member coupled to the shaft, the member including a track, a nipple coupled to the shaft located within the track, wherein the nipple is located in a first area of the track when the movable member is located in a first position and the nipple is located in a second area of the track when the movable member is located in a second position.

10. A kit comprising:

a tissue graft anchor comprising a plurality of prongs, each prong including a distal end and a proximal end, wherein the prongs are coupled at their distal ends to form an inner cavity having an opening, at least one of the prongs including a fin, the fin extending perpendicular to a longitudinal axis of the prong and including a pointed end; and

a fixation member configured to be disposed within the cavity.

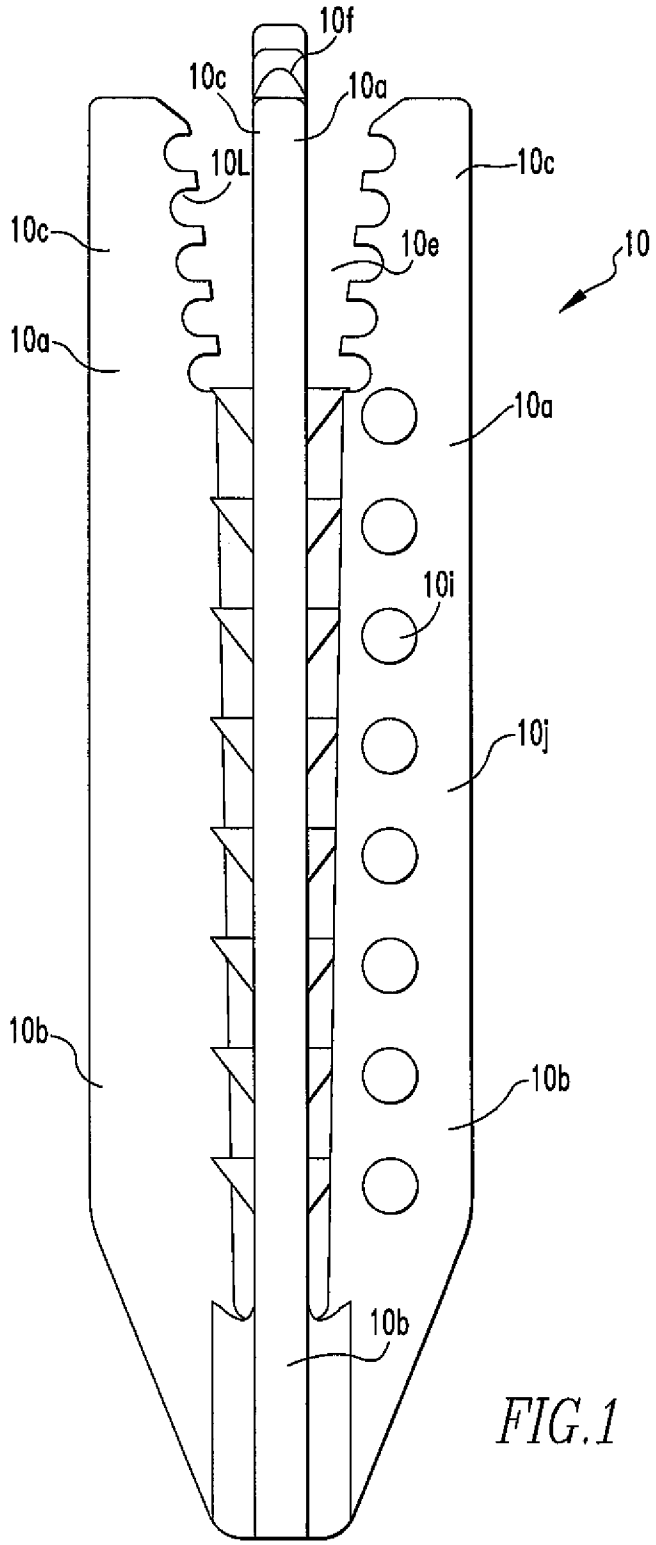


FIG.1

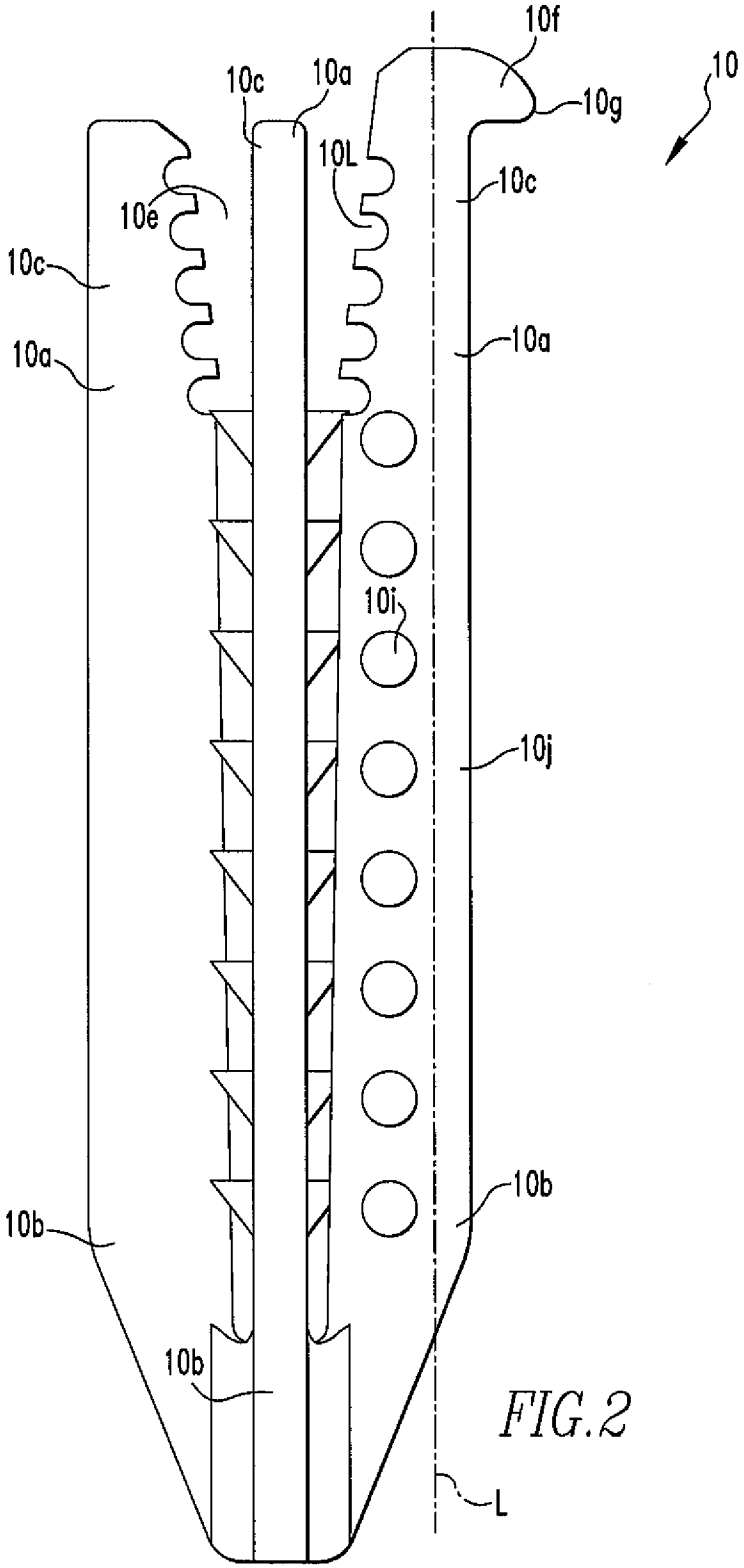
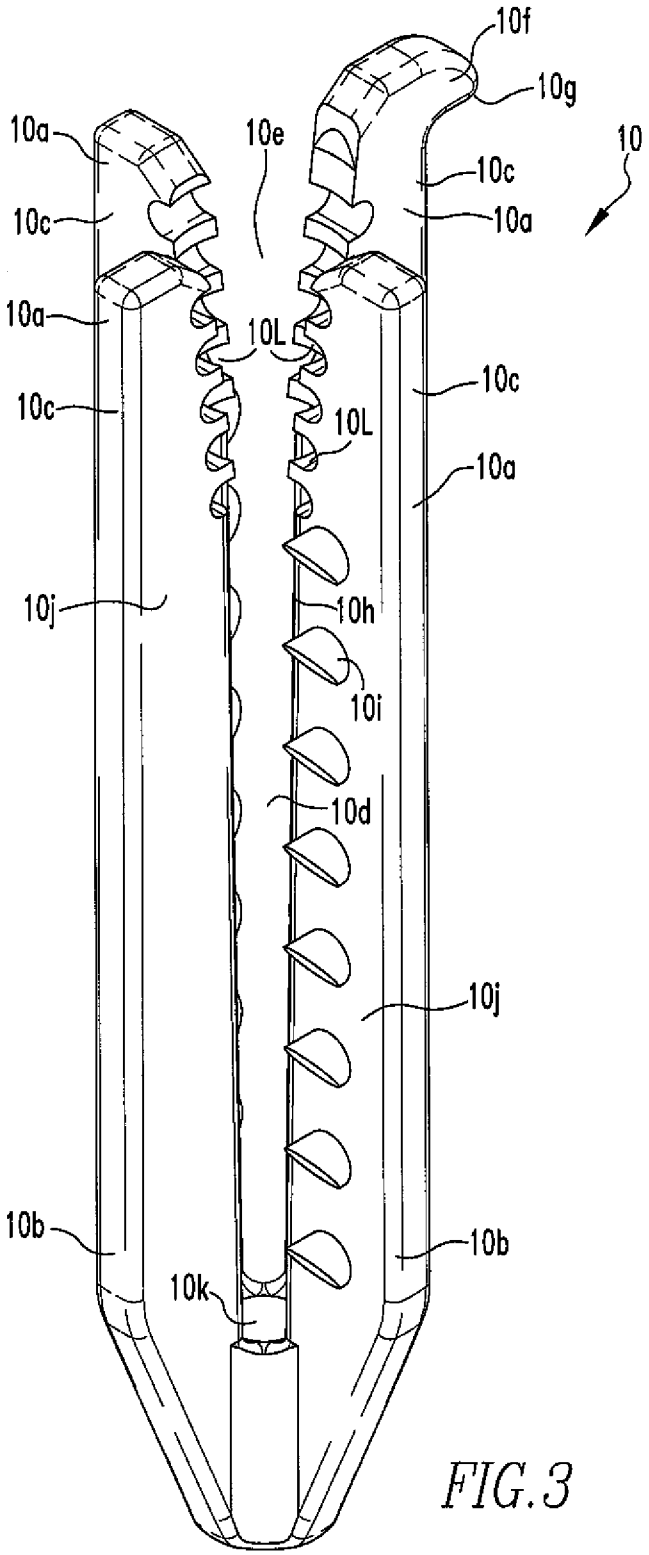


FIG.2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10g
10
10a
10e
10c
10a
10c
10a
10L
10c
10c
10L
10a
10j
10h
10i
10d
10j
10b
10b
10k

FIG.3

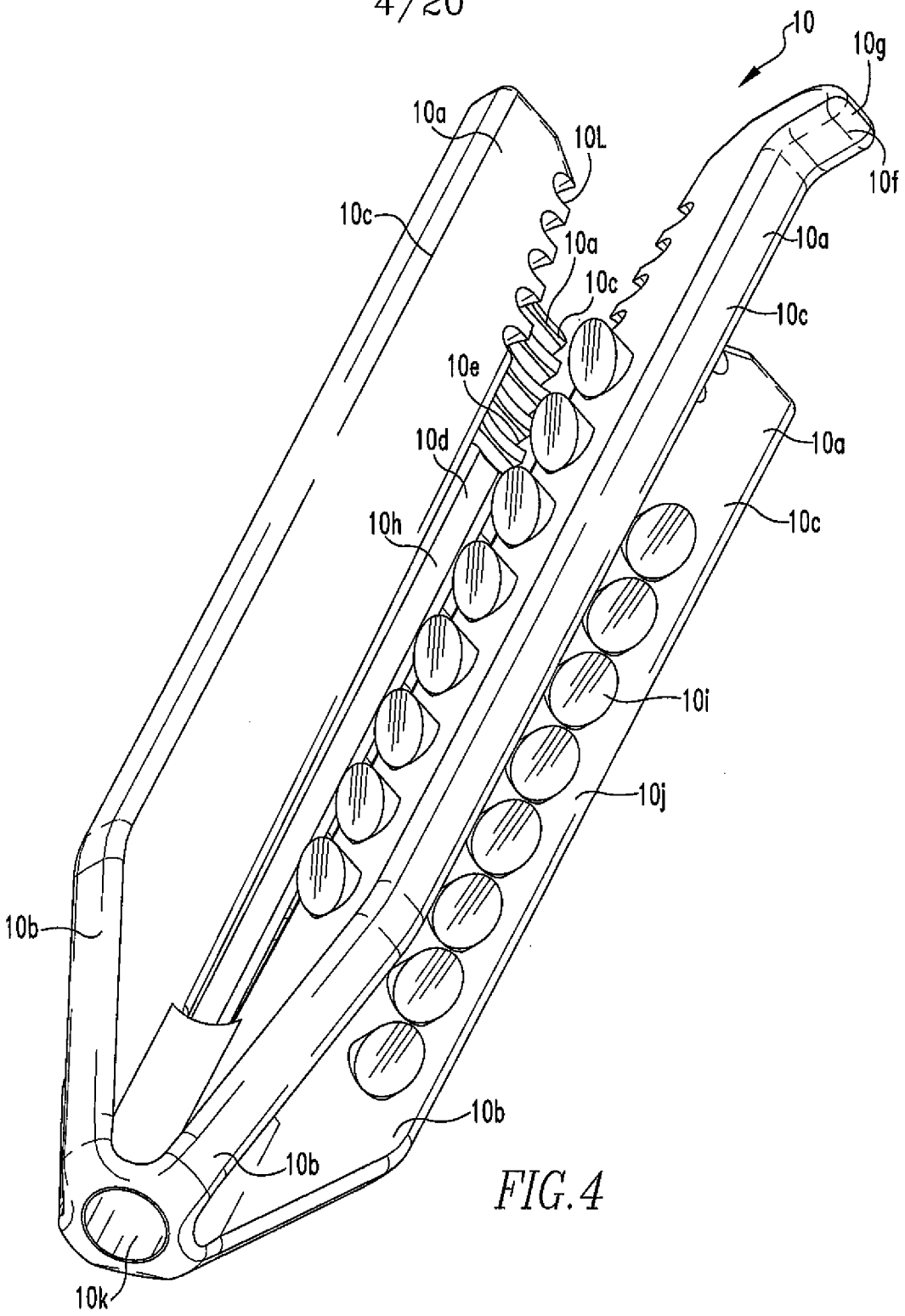

10
10g
10a
10L
10f
10c
10a
10a
10c
10c
10e
10a
10d
10h
10c
10i
10j
10b
10b
10b
10k

FIG.4

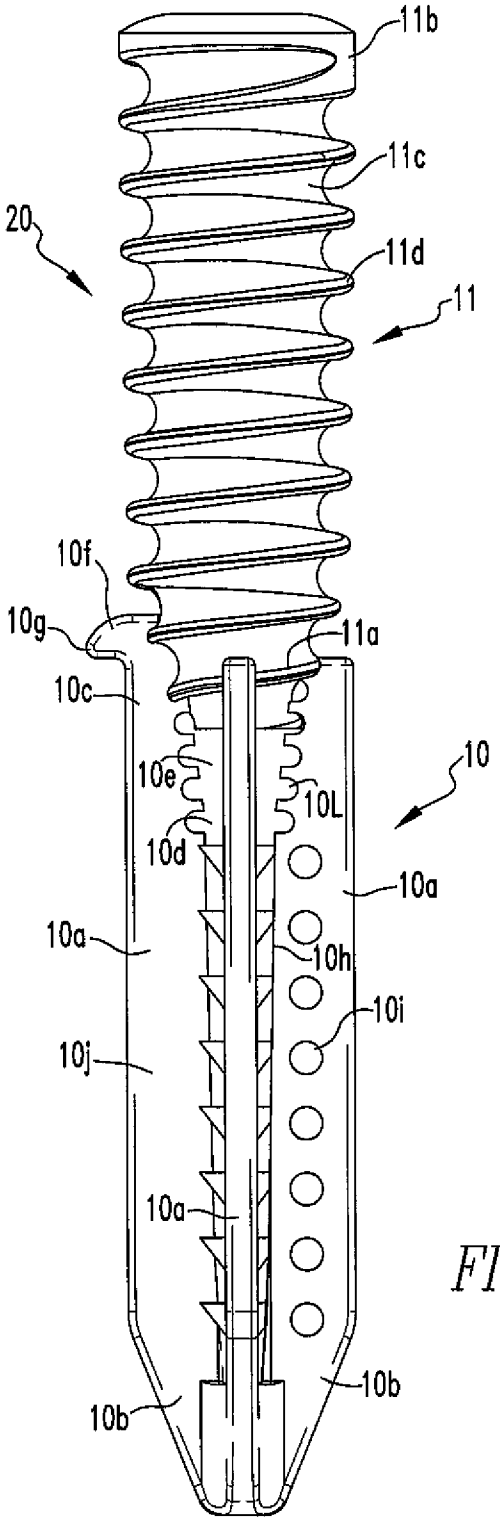

11b
11c
20
11d
11
10f
10g
11a
10c
10
10e
10L
10d
10a
10a
10h
10i
10j
10a
10b
10b

FIG.5

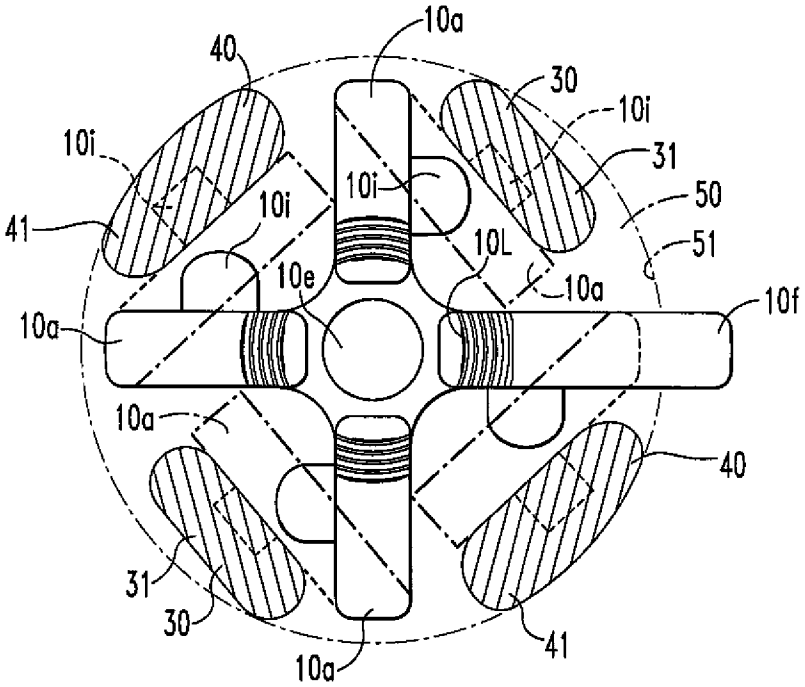

10a
40
30
10i
10i
31
10i
50
10i
41
10L
51
10e
10a
10f
10a
10a
40
31
30
41
10a

FIG.6

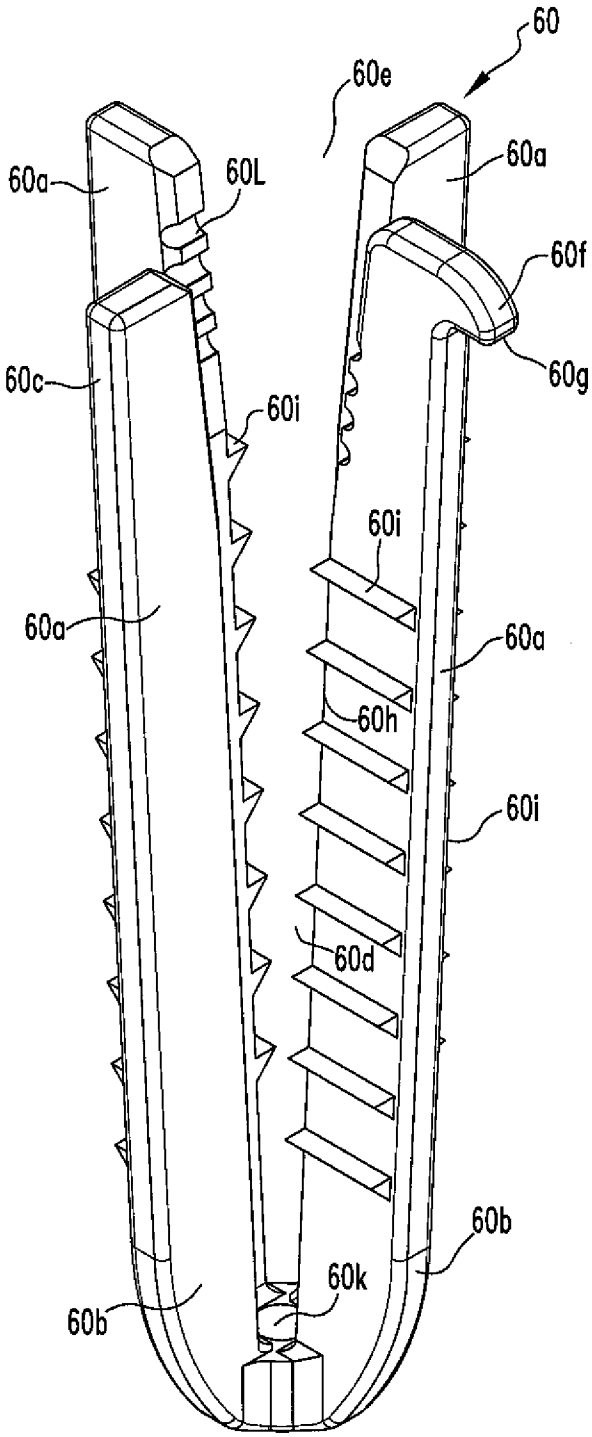

60
60e
60a
60L
60a
60f
60g
60c
60i
60i
60a
60a
60h
60i
60d
60b
60k
60b

FIG. 7

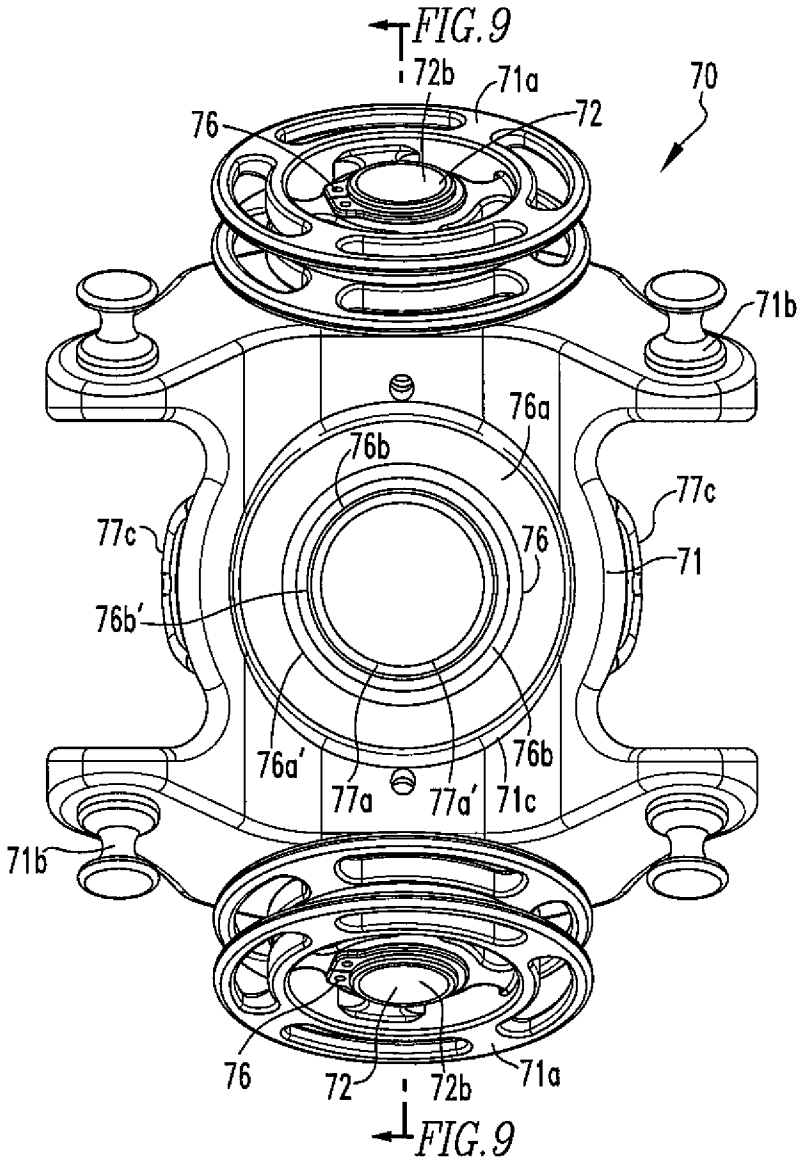


FIG.9
72b
71a
70
76
72
71b
76a
76b
77c
77c
76
71
76b'
76a'
77a
77a'
71c
76b
71b
76
72
72b
71a
FIG.9

FIG.8

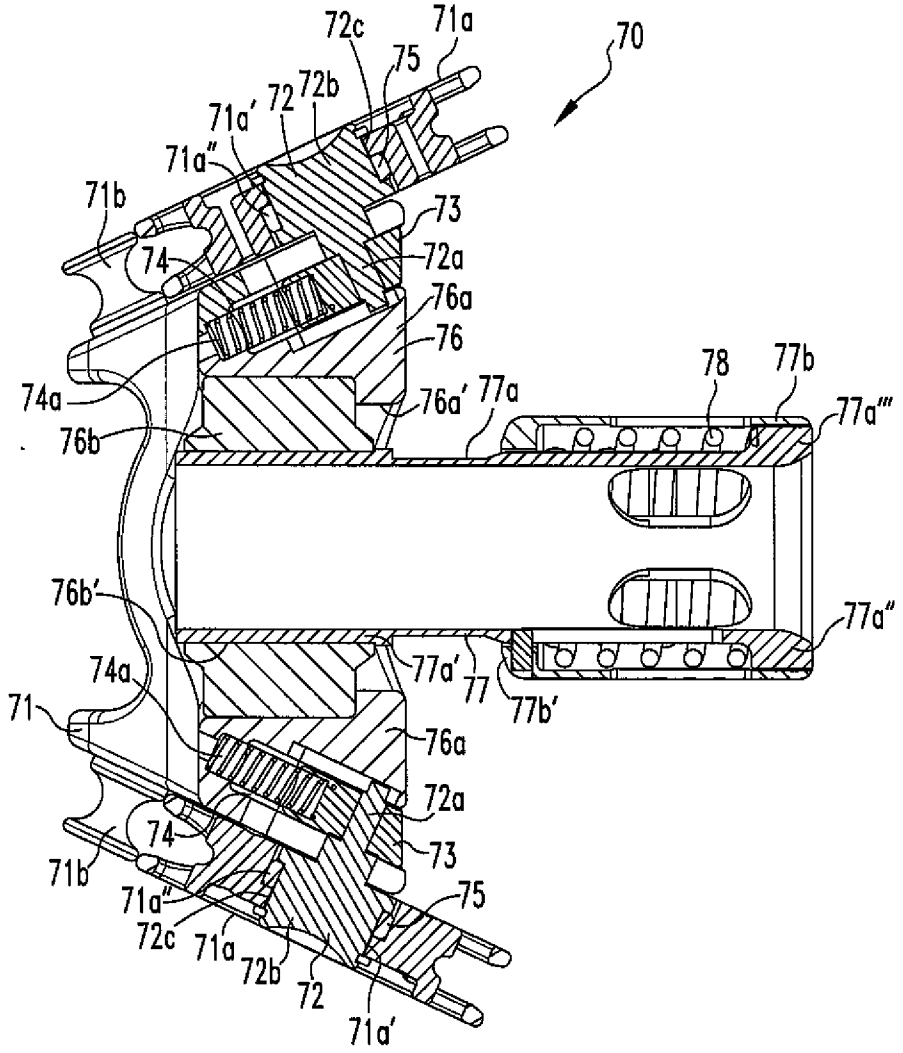
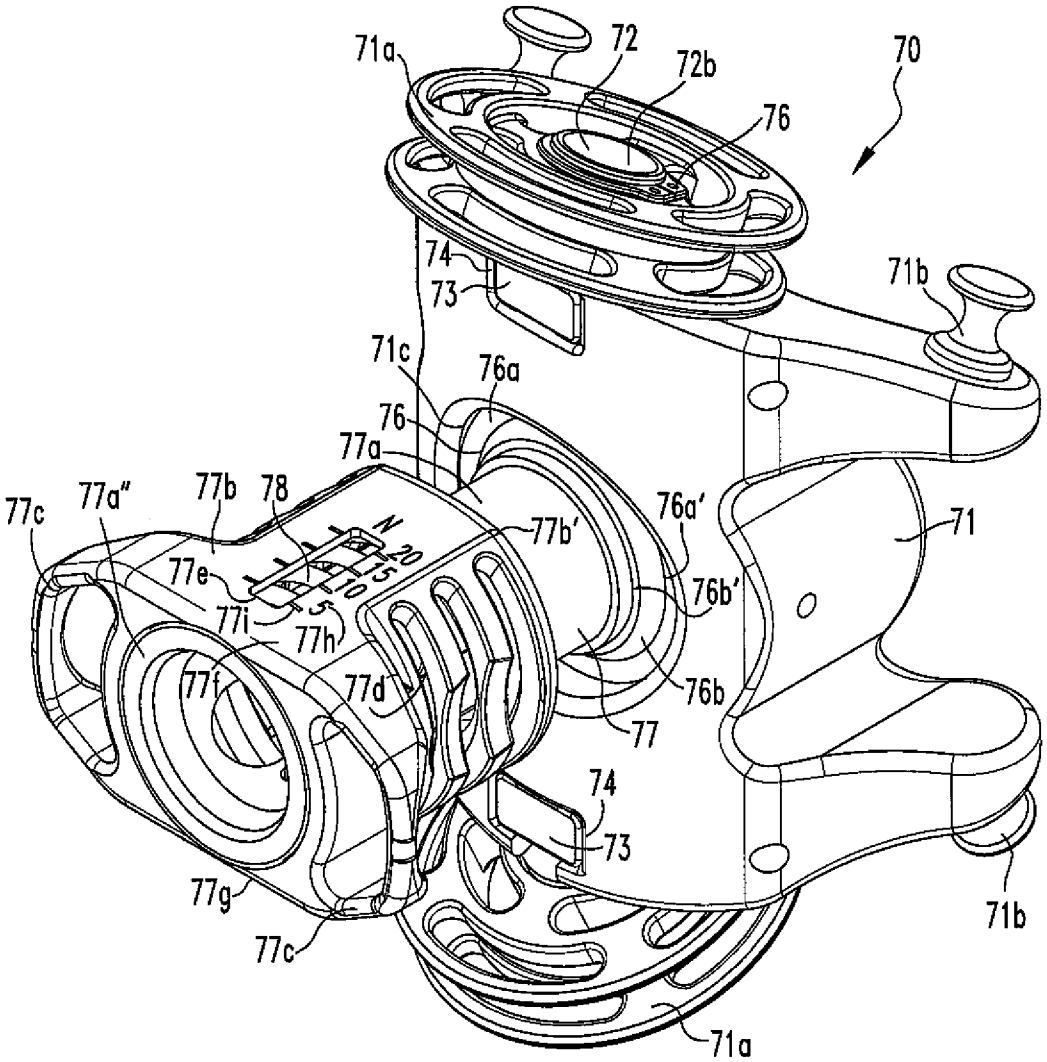

72c
71a
70
75
72b
72
71a'
71a"
71b
73
74
72a
76a
76
74a
76a'
77a
78
77b
77a'''
76b
76b'
77a"
74a
77a'
77
77b'
71
76a
72a
74
73
71b
71a"
75
72c
71a
72b
72
71a'

FIG.9


71a
72
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70
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74
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71c
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77a"
77b
78
77b'
76a'
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73
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77c
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71a

FIG.10

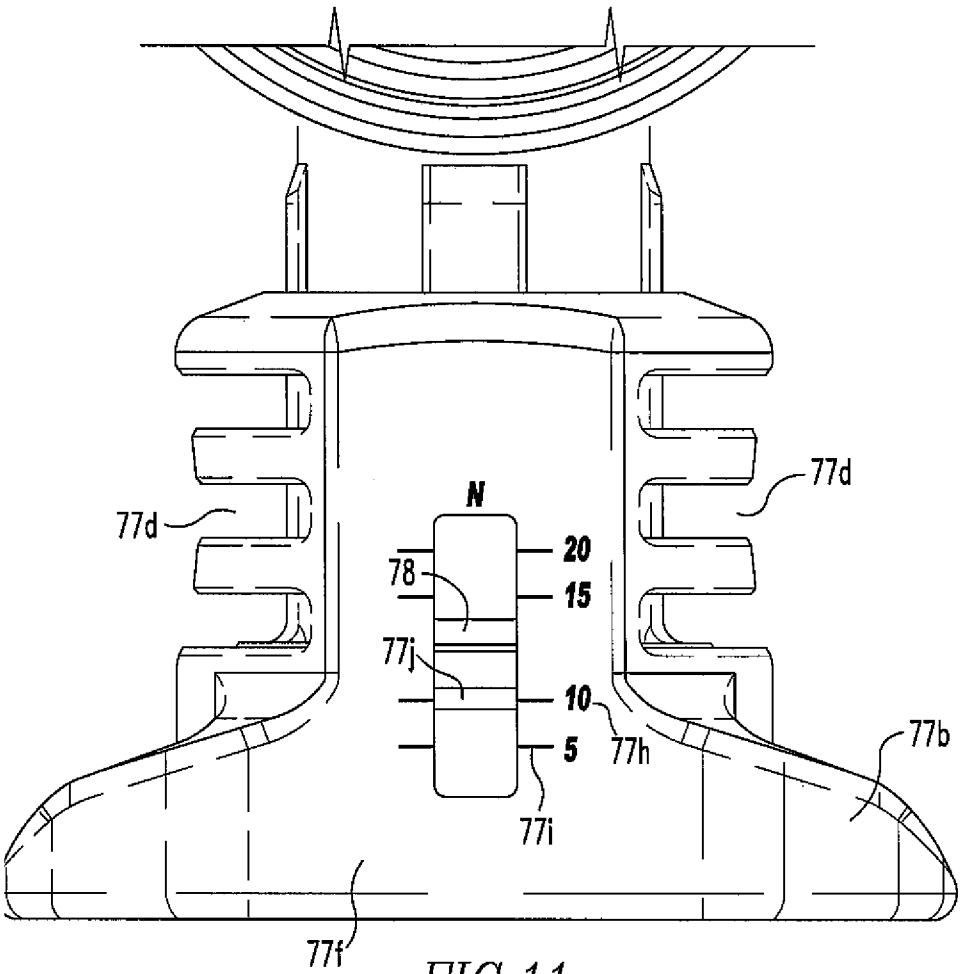

FIG.11

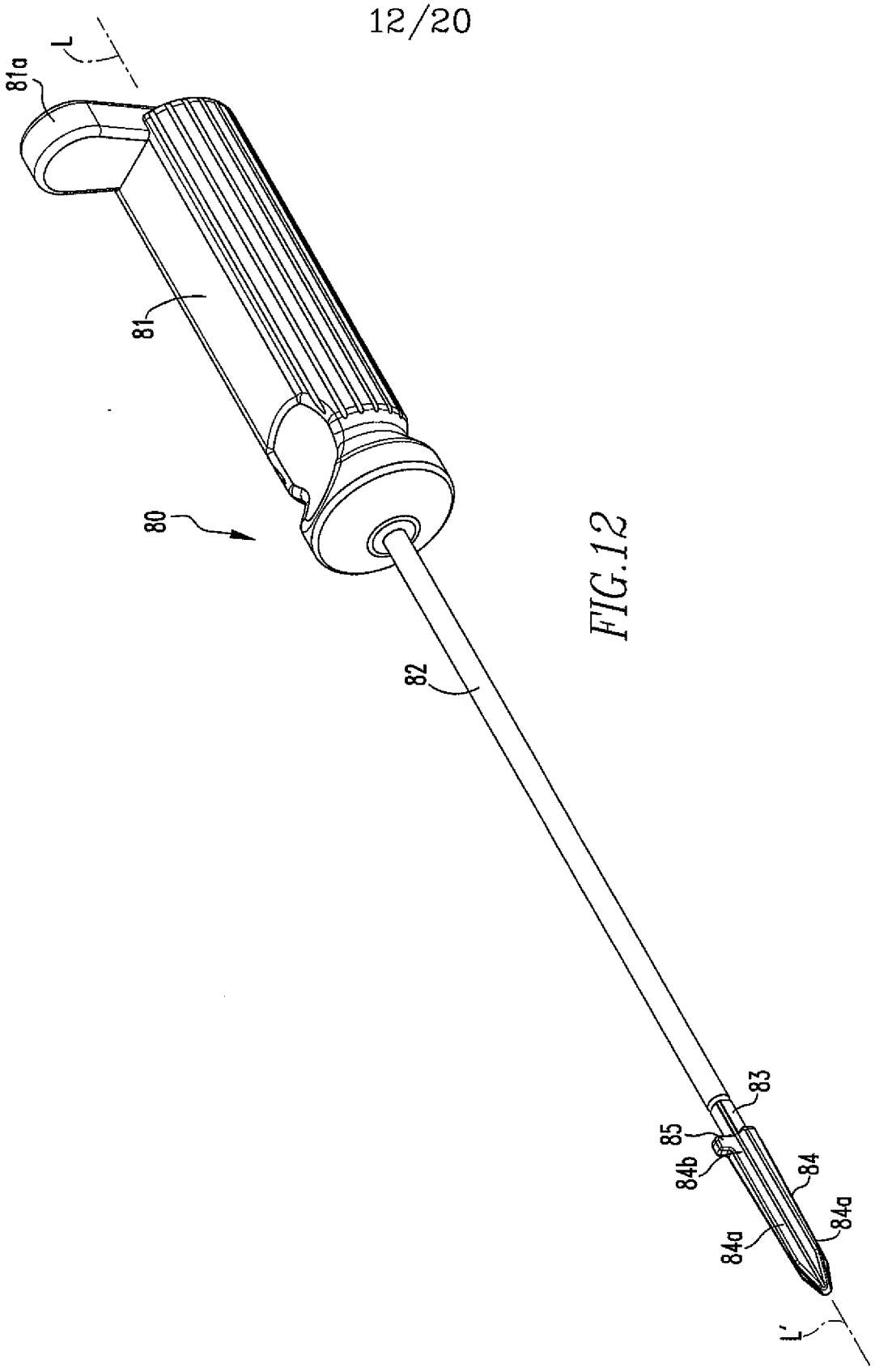

FIG.12

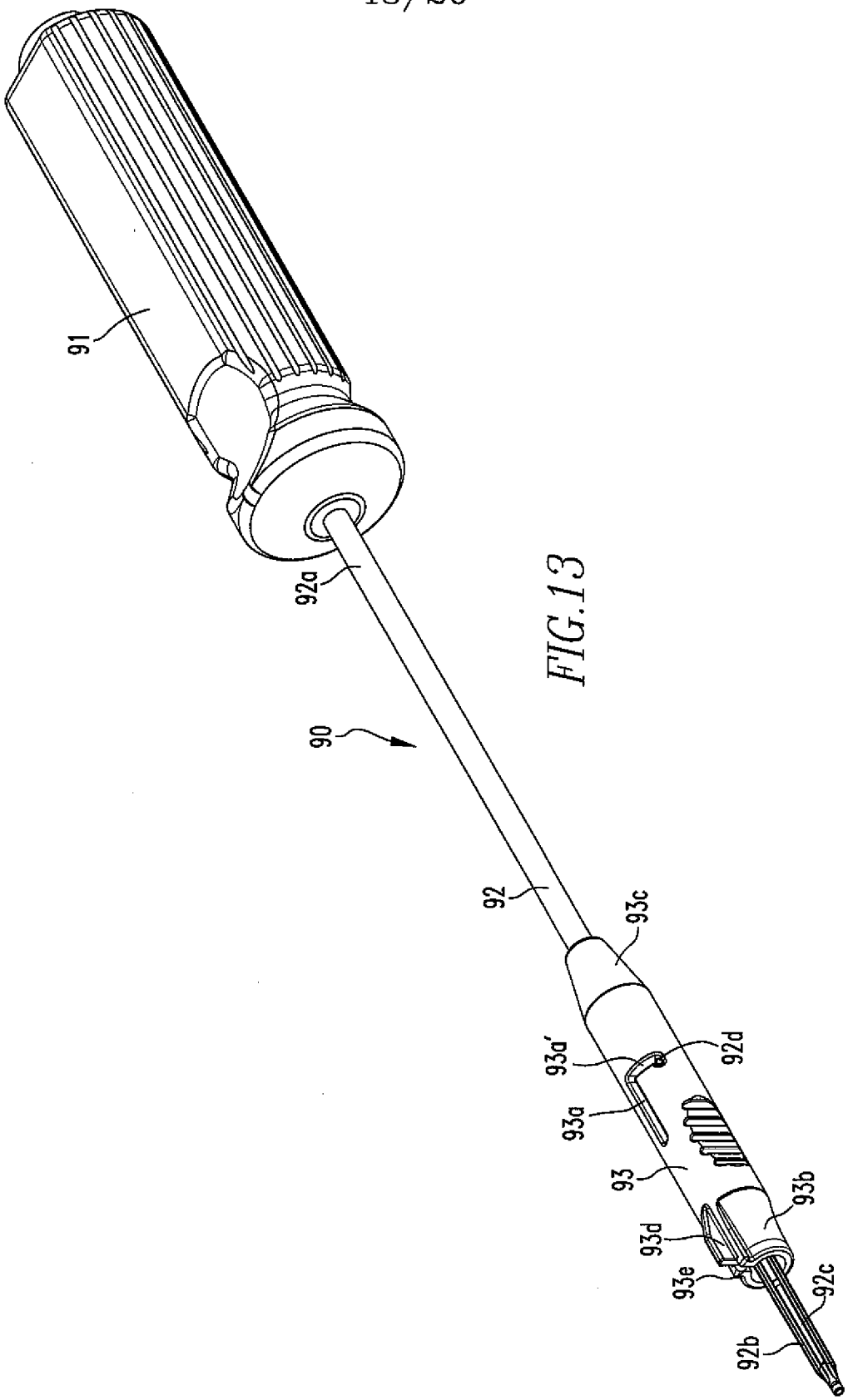

FIG.13

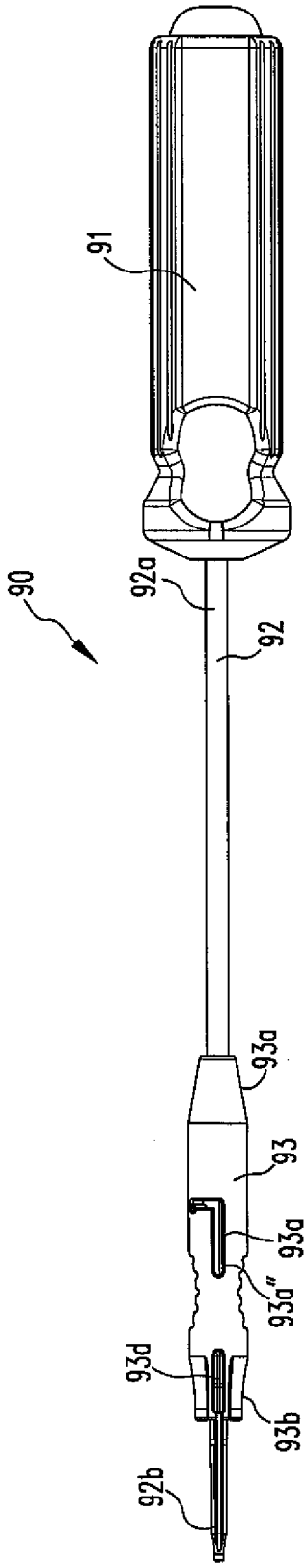

FIG.14

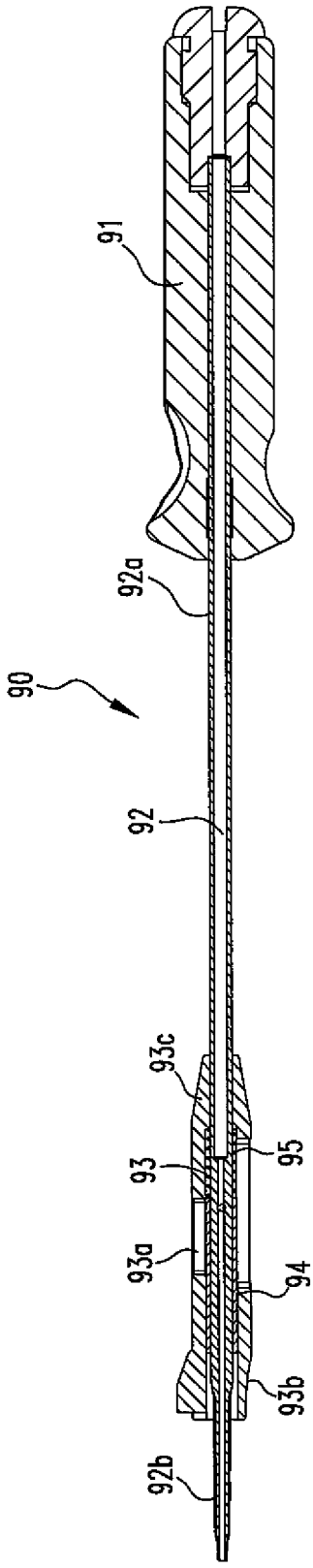

FIG.15

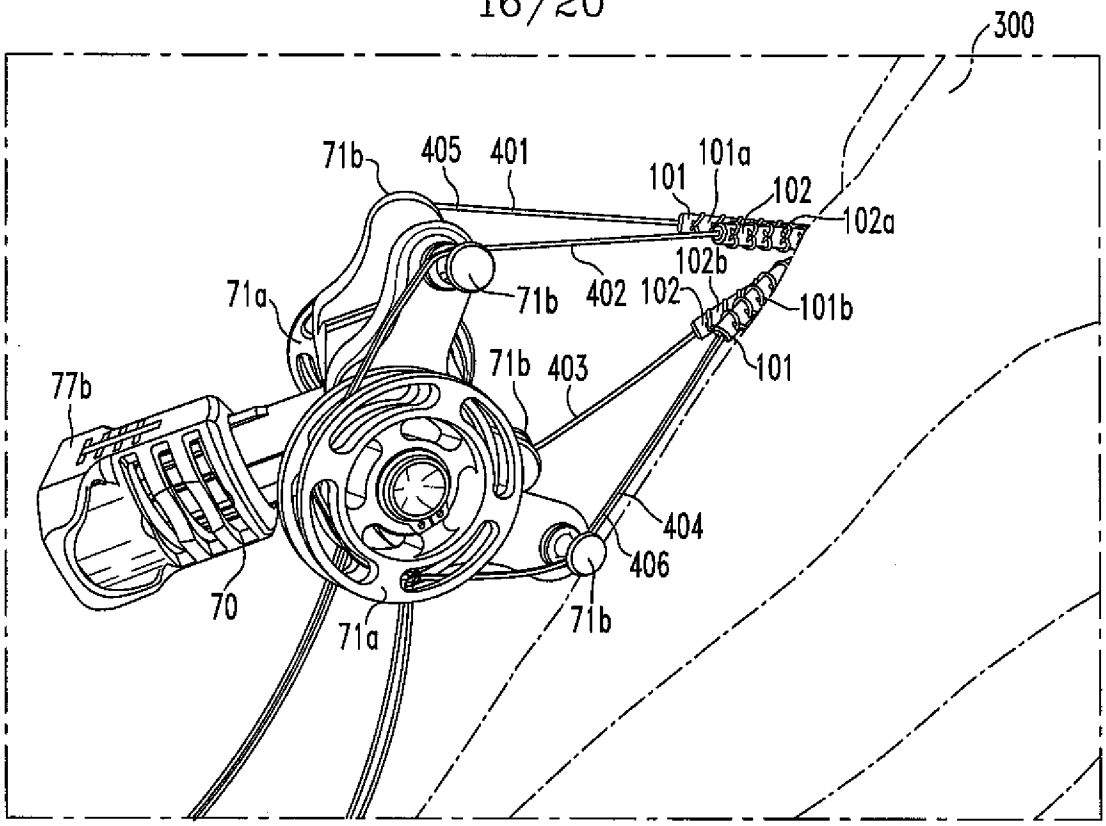

FIG.16

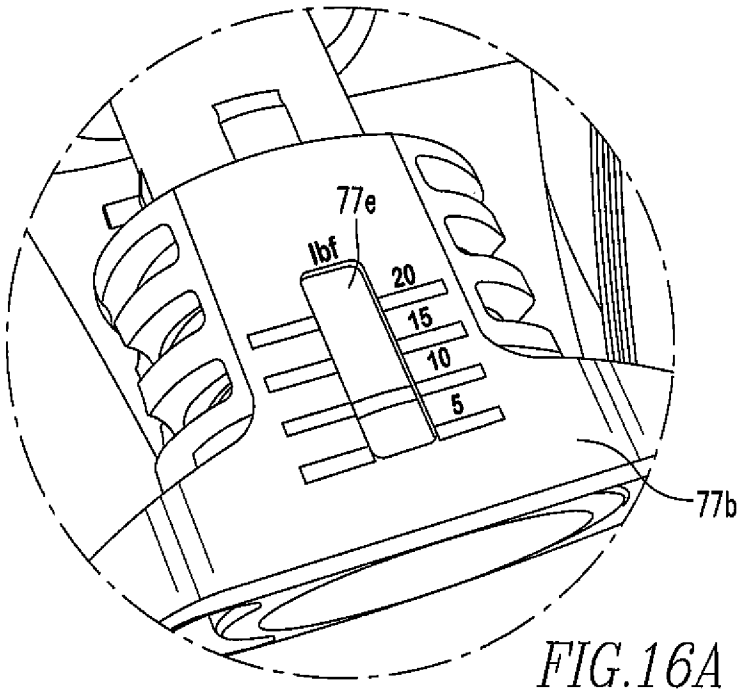

FIG.16A

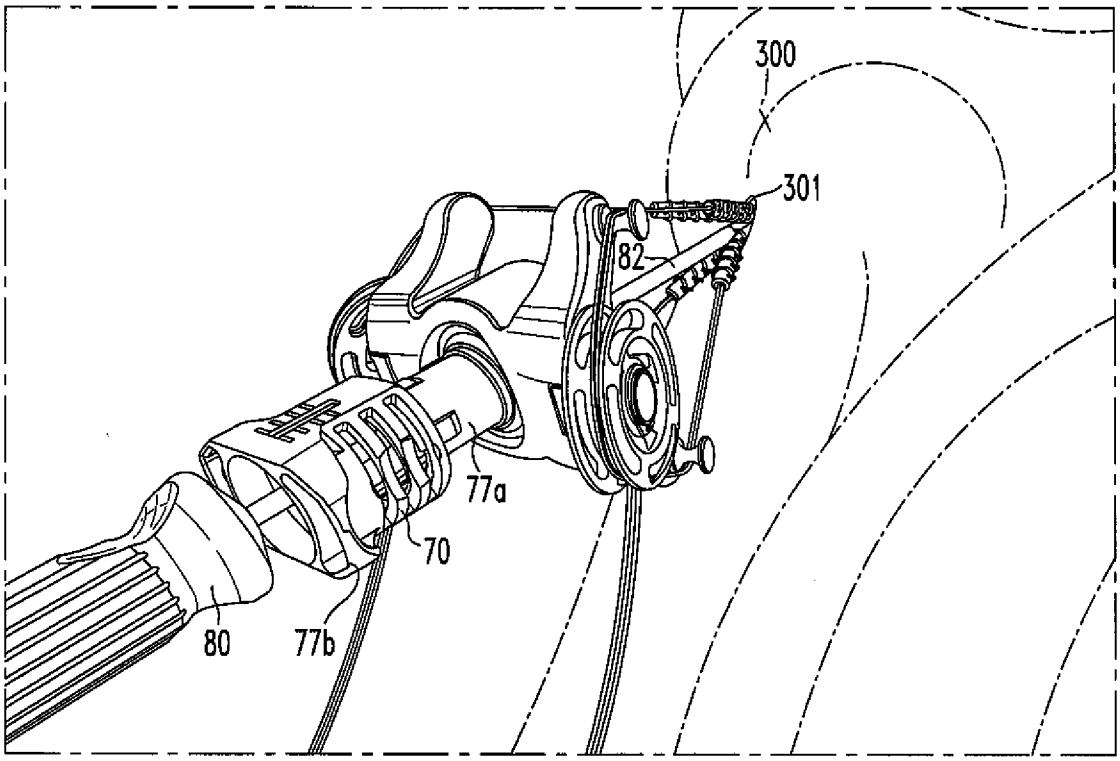

FIG.17

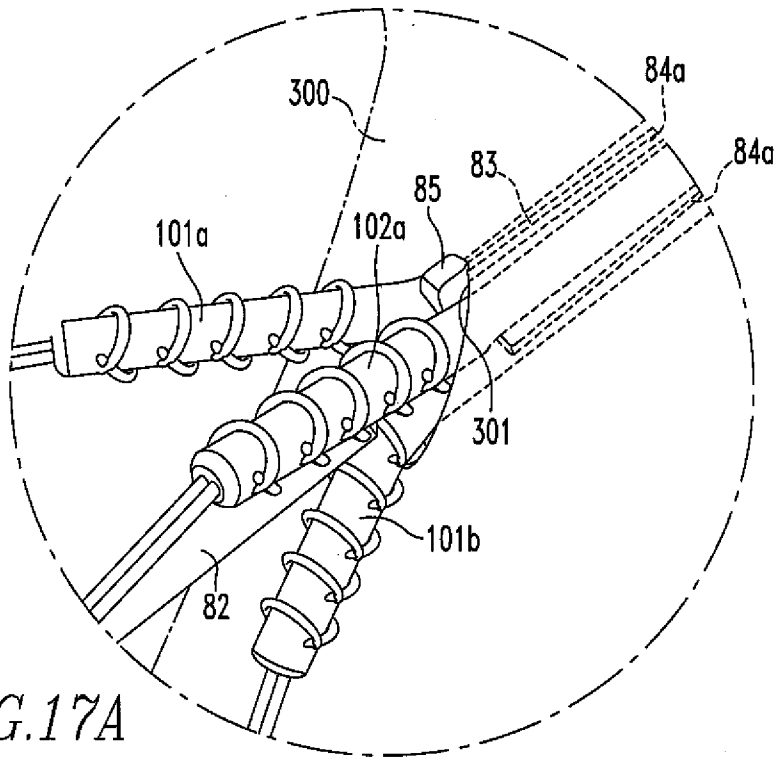

FIG.17A

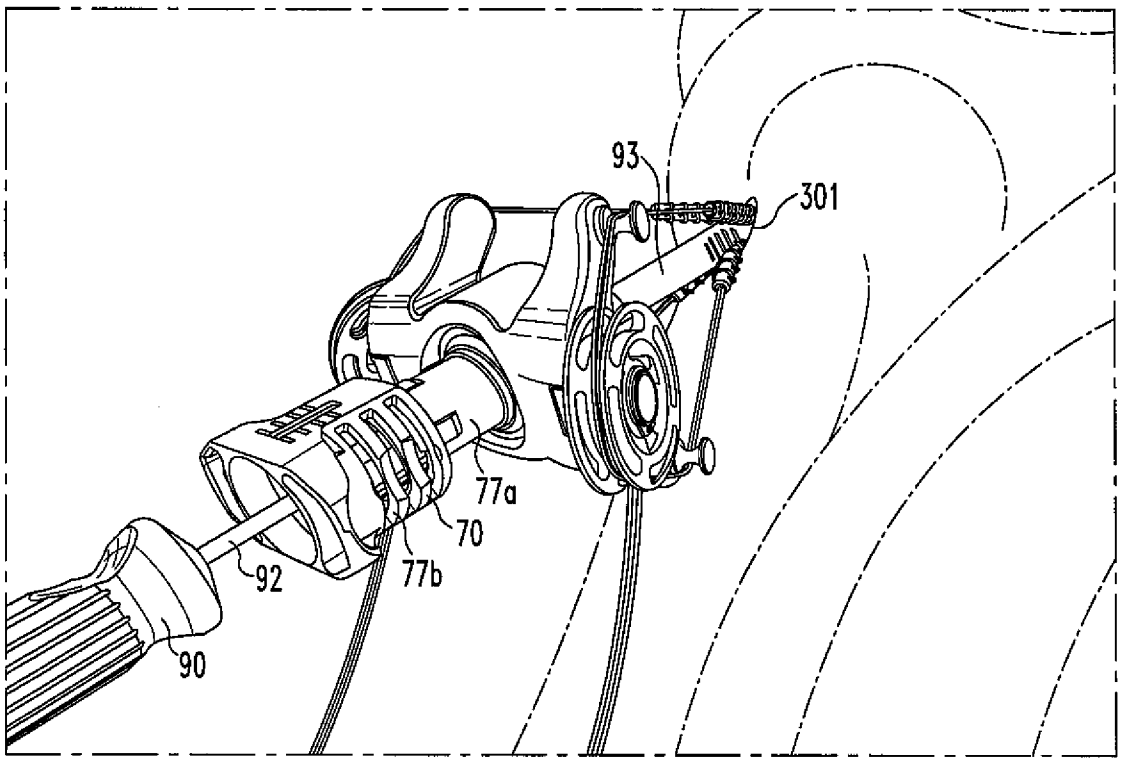

FIG.18

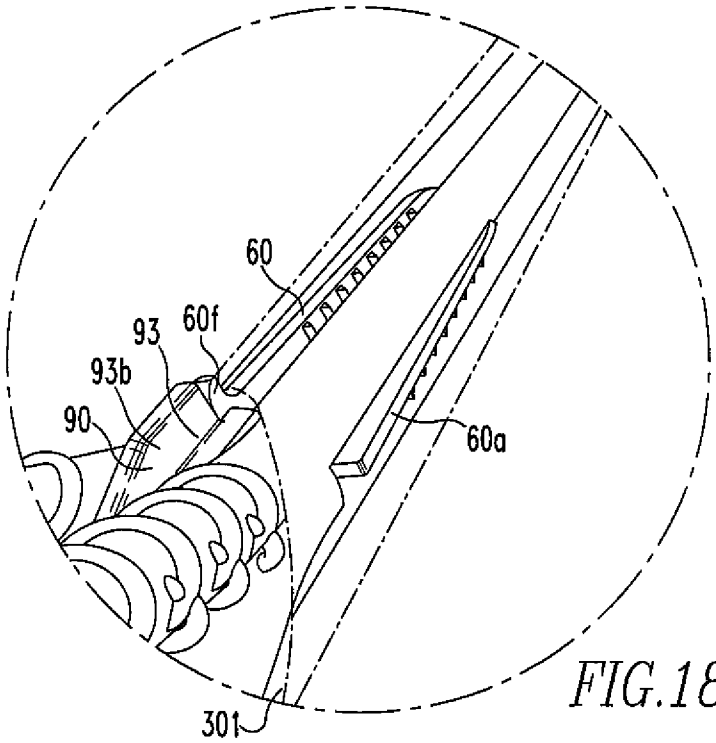

FIG.18A

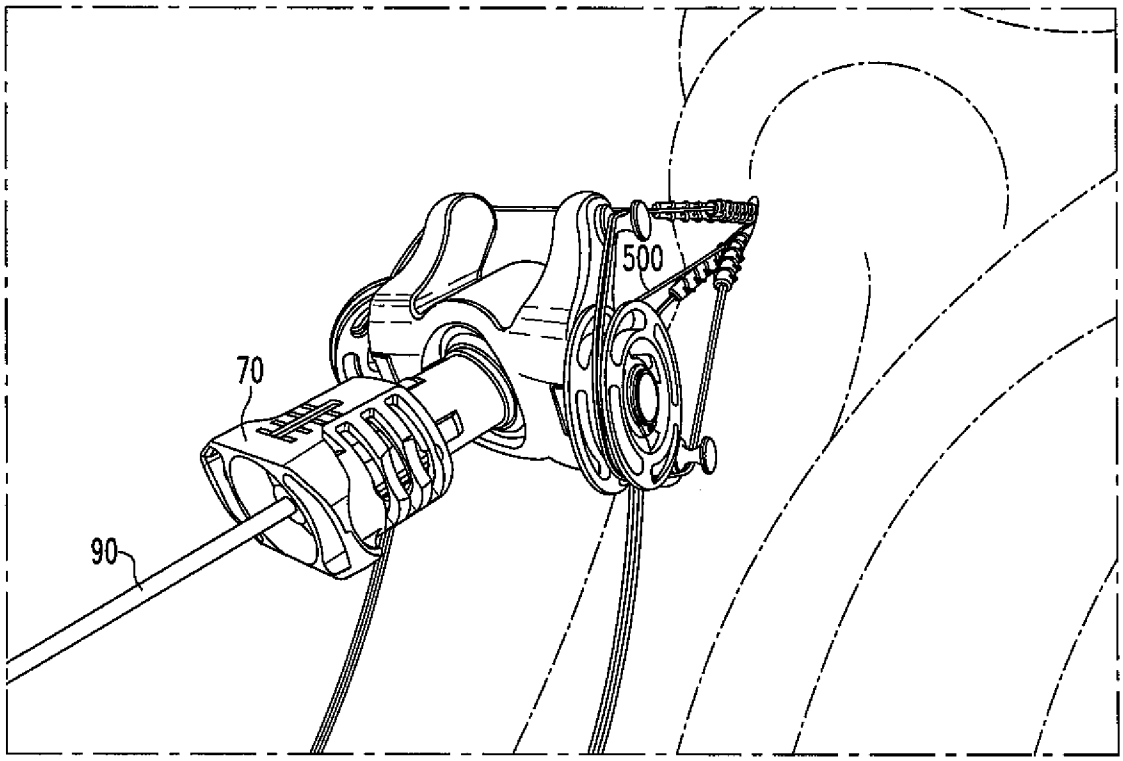

FIG.19

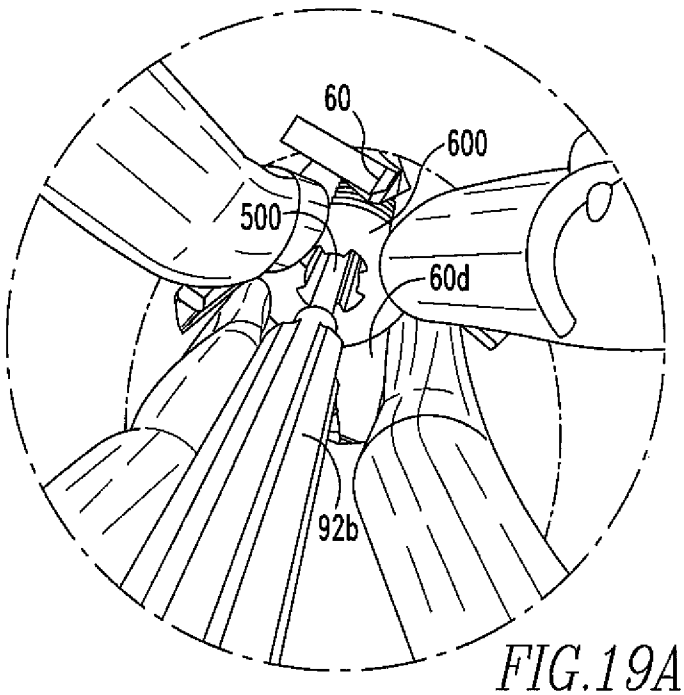

FIG.19A

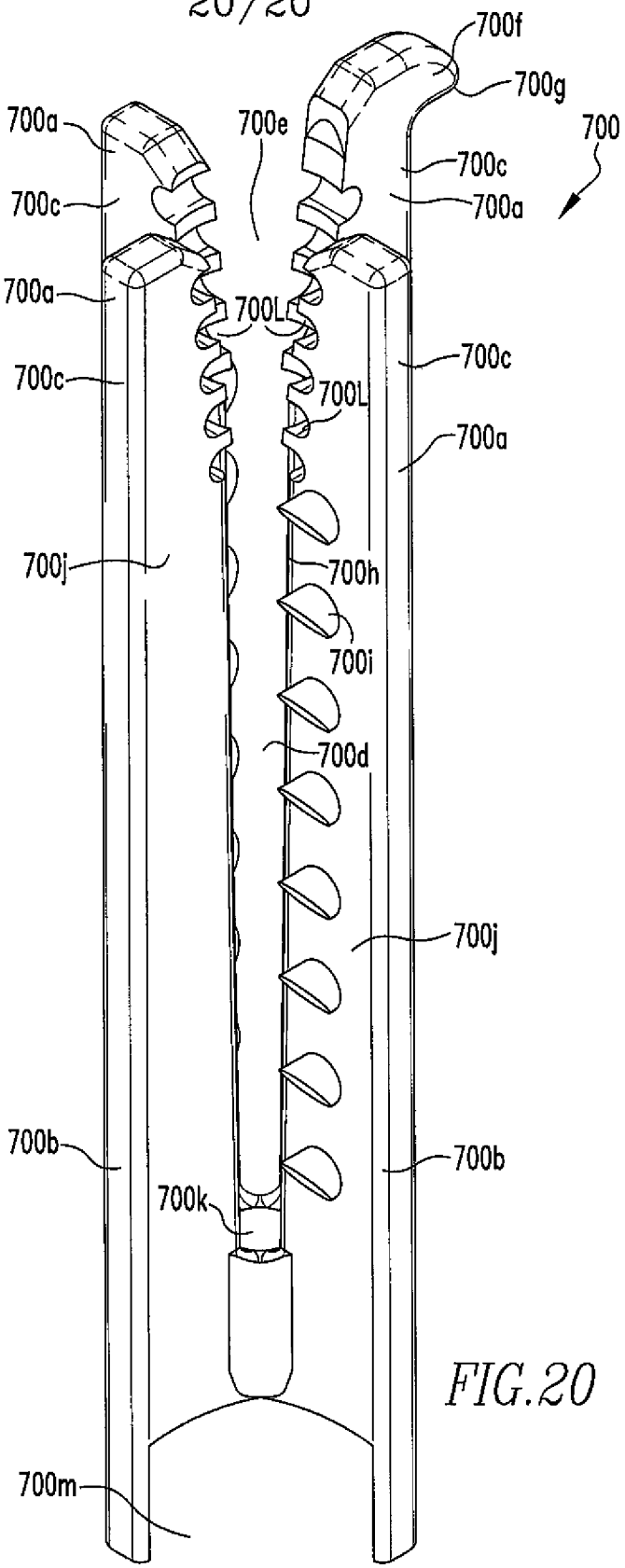
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FIG.20