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Canadian Intellectual Property Office
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CA 2901009 A1 2014/09/04

(21) 2 901 009

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) **Date de dépôt PCT/PCT Filing Date:** 2014/02/28
(87) **Date publication PCT/PCT Publication Date:** 2014/09/04
(85) **Entrée phase nationale/National Entry:** 2015/08/11
(86) **N° demande PCT/PCT Application No.:** US 2014/019702
(87) **N° publication PCT/PCT Publication No.:** 2014/134584
(30) **Priorités/Priorities:** 2013/02/28 (US61/770,410); 2013/12/05 (US61/912,547)

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

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(54) **Titre : SYSTEMES, METHODES ET APPAREILS D'ALESAGE D'ELEMENTS OSSEUX**
(54) **Title: SYSTEMS, METHODS, AND APPARATUSES FOR REAMING BONE ELEMENTS**

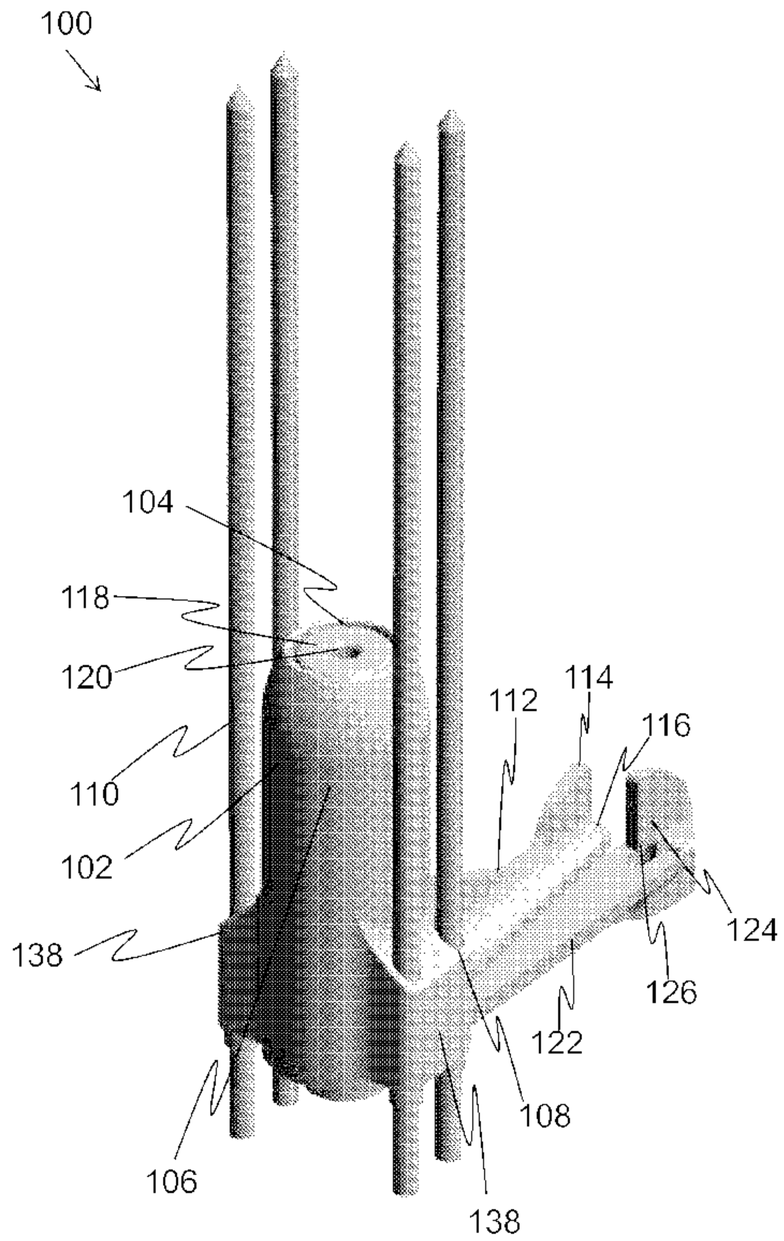


FIG. 1

(57) **Abrégé/Abstract:**
Systems, methods, and apparatuses for reaming bone elements are provided. The implantation of orthopedic implanted devices for fusion, stabilization, and fixation of joints, fractures, and other fusions involves various complicated processes and components. The reaming of bone elements for implantation of orthopedic implanted devices often requires an assistant physically stabilizing the bone elements, which may easily lead to shifting and/or misalignment of bone elements during the reaming procedure.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 September 2014 (04.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/134584 A1

(51) International Patent Classification:
A61B 17/58 (2006.01)

(21) International Application Number:
PCT/US2014/019702

(22) International Filing Date:
28 February 2014 (28.02.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/770,410 28 February 2013 (28.02.2013) US
61/912,547 5 December 2013 (05.12.2013) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

[Continued on next page]

(54) Title: SYSTEMS, METHODS, AND APPARATUSES FOR REAMING BONE ELEMENTS

(57) Abstract: Systems, methods, and apparatuses for reaming bone elements are provided. The implantation of orthopedic implanted devices for fusion, stabilization, and fixation of joints, fractures, and other fusions involves various complicated processes and components. The reaming of bone elements for implantation of orthopedic implanted devices often requires an assistant physically stabilizing the bone elements, which may easily lead to shifting and/or misalignment of bone elements during the reaming procedure.

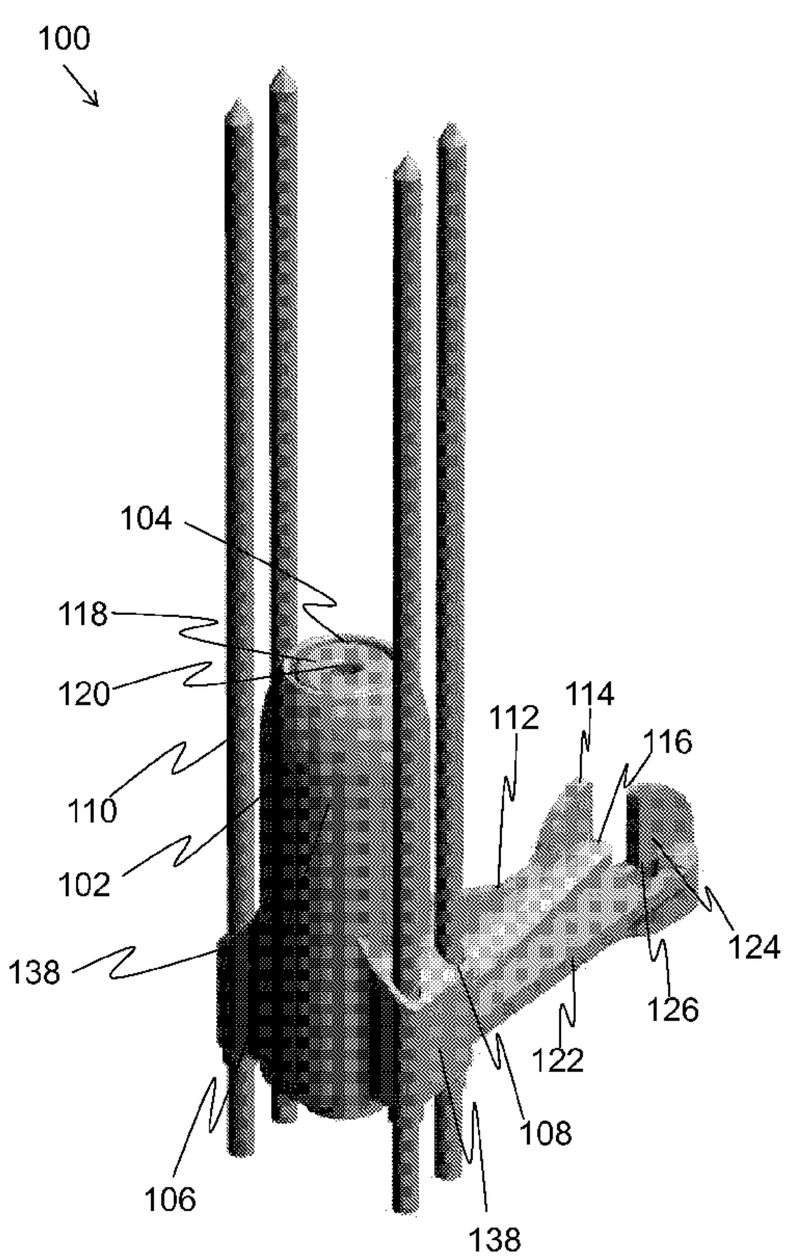


FIG. 1

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SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

SYSTEMS, METHODS, AND APPARATUSES FOR REAMING BONE ELEMENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Patent Application No. 61/770,410, filed on February 28, 2013, and U.S. Provisional Patent Application No. 61/912,547, filed on December 5, 2013, each of which is incorporated by reference herein in its entirety.

BACKGROUND

[0002] The implantation of orthopedic implanted devices for fusion, stabilization, and fixation of joints, fractures, and other fusions involves various complicated processes and components. The reaming of bone elements for implantation of orthopedic implanted devices often requires an assistant physically stabilizing the bone elements, which may easily lead to shifting and/or misalignment of bone elements during the reaming procedure.

[0003] What is needed is a more stable and accurate system, method, and apparatus for reaming bone elements.

SUMMARY

[0004] In one embodiment, a stabilization apparatus for reaming bone elements is provided, the stabilization apparatus comprising: an outer sleeve; an inner sleeve; wherein in at least one of the outer sleeve and the inner sleeve include at least one support rod aperture operable to receive and guide a support rod for affixing the stabilization apparatus relative to a bone element.

[0005] In another embodiment, a stabilization apparatus for reaming bone elements is provided, the stabilization apparatus comprising: an outer sleeve, the outer sleeve comprising: a soft tissue protection element for operatively protecting soft tissue during a medical procedure and used to guide a reamer, and an outer sleeve handle with at least one

interlocking mechanical device to interlock with an inner sleeve handle; and an inner sleeve, the inner sleeve further comprising: a pilot hole guide portion for drilling a pilot hole during a medical procedure.

[0006] In another embodiment, a stabilization apparatus for reaming bone elements, the apparatus comprising: an outer sleeve; a bore extending substantially centrally through the outer sleeve; an inner sleeve including a pilot hole guide portion; wherein in at least one of the outer sleeve and the inner sleeve include at least one support rod aperture operable to receive and guide a support rod for affixing the stabilization apparatus relative to a bone element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying figures, which are incorporated in and constitute a part of the specification, illustrate various example apparatuses, systems, and methods, and are used merely to illustrate various example embodiments.

[0008] **FIG. 1** illustrates an example arrangement of a stabilization apparatus.

[0009] **FIG. 2** illustrates an anterior view of an example arrangement of a stabilization apparatus.

[0010] **FIG. 3** illustrates an example arrangement of an inner sleeve of a stabilization apparatus.

[0011] **FIG. 4** illustrates an example arrangement of an outer sleeve of a stabilization apparatus.

[0012] **FIG. 5** illustrates an example arrangement of a stabilization apparatus in use.

[0013] **FIG. 6** illustrates a system for causing compression of bone elements.

[0014] **FIG. 7** illustrates an example arrangement of a stabilization apparatus.

[0015] FIG. 8 illustrates an example arrangement of a stabilization apparatus.

DETAILED DESCRIPTION

[0016] FIG. 1 illustrates an example arrangement of a stabilization apparatus **100**. Stabilization apparatus **100** may comprise an outer sleeve **102** through which an inner sleeve **104** may extend. Stabilization apparatus **100** may also comprise one or more support rod aperture offsets **138** containing one or more support rod apertures **108** through which support rods **110** may be guided for securing stabilization apparatus **100** prior to, or while, using stabilization apparatus **100** for a medical procedure.

[0017] Outer sleeve **102** and inner sleeve **104** of stabilization apparatus **100** may also comprise at least one interlocking mechanical device configured to interlock inner sleeve **104** with outer sleeve **102**, which may be an interlocking outer sleeve handle **112** and interlocking inner sleeve handle **122** such that inner sleeve **104** may be selectively secured to outer sleeve **102** when using inner sleeve **104** via interlocking handles **112** and **122**.

[0018] Stabilization apparatus **100** may be configured to maintain one or more bone elements in a specific desired orientation for reaming a hole through the one or more bone elements. Stabilization apparatus **100** may be configured to maintain one or more bone elements in a specific desired orientation for implantation of an orthopedic implanted device through one or more bone elements. In one embodiment, stabilization apparatus **100** is configured to maintain one or more joints in a specific desired orientation for reaming a hole through the one or more bone elements making up the joint, for insertion of an apparatus for causing compression between bone elements.

[0019] Outer sleeve **102** may comprise a substantially cylindrical soft tissue protection element **106** with a series of support rod apertures **108** extending longitudinally through one or more support rod aperture offsets **138** disposed around soft tissue protection element **106**.

The support rod apertures **108** may permit the passing of any of support rod **110** or like fixation device through outer sleeve **102**. Outer sleeve **102** is operable to mate with inner sleeve **104** with pilot hole guide portion **118** of inner sleeve **104** contained within substantially cylindrical soft tissue protection element **106** of outer sleeve **102**. Inner sleeve **104** may be contained at least partially within outer sleeve **102**.

[0020] Inner sleeve **104** may comprise a pilot hole guide portion **118** with a central pilot hole aperture **120**. When outer sleeve **102** of stabilization apparatus **100** is substantially fixated by one or more support rods **110** to a body area during a medical procedure, pilot hole guide portion **118** with pilot hole aperture **120** of inner sleeve **104** may be inserted into soft tissue protection element **106** of outer sleeve **102** and rotated such that interlocking outer sleeve handle **112** and interlocking inner sleeve handle **122** are interlocked to prevent at least one of axial, transverse, and rotational movement of inner sleeve **104** relative to the body area during a medical procedure.

[0021] Pilot hole guide portion **118** and pilot hole aperture **120** may be used to drill a pilot hole through one or more bone elements. In one embodiment, pilot aperture **120** is used to drill a pilot hole prior to a bone reaming procedure. In another embodiment, the size, shape, and geometry of pilot hole guide portion **118** and pilot hole aperture **120** may vary based on medical procedure, bone size, and location of bone reaming.

[0022] Support rod apertures **108** for support rods **110** may be offset to either side of outer sleeve **102** by support rod aperture offsets **138**. Size, shape, and geometry of support rod aperture offsets **138** may be varied to vary a location of one or more support rod apertures **108**. In one embodiment, support rod apertures **108** are offset according to medical procedure. In another embodiment, support rod apertures **108** are offset according to bone size. In another embodiment, support rod apertures **108** are offset according to bone location.

In one embodiment, two or more support rod apertures **108** for support rods **110** may be substantially opposed, and oriented about 180 degrees relative to soft tissue protection element **106**. In another embodiment, stabilization apparatus **100** comprises three or more support rod apertures **108** for support rods **110** in which support rod apertures **108** may be substantially evenly distributed about soft tissue protection element **106**. That is, three support rod apertures **108** may be oriented about 120 degrees relative to soft tissue protection element **106**, while four support rod apertures **108** may be oriented about 90 degrees relative to soft tissue protection element **106**, and so on.

[0023] In one embodiment, one or more support rods **110** comprise a cutting tip configured to create a channel through bone elements upon rotation of support rods **110**. In another embodiment, one or more support rods **110** are configured to be inserted following the drilling of a channel through bone elements with a drill bit. Drilling a channel through bone elements with a drill bit may use support rod apertures **108** as a drilling guide. In another embodiment, one or more support rods **110** comprise a pointed tip configured to create a channel through bone elements upon being driven with an axial force. In one embodiment, support rods **110** may be threaded for drilling into one or more bone elements.

[0024] Outer sleeve **102** may use soft tissue protection element **106** to provide protection of soft tissues adjacent to or surrounding the site of bone elements to be reamed. For example, soft tissue protection element **106** may protect at least one of skin, muscle, ligament, cartilage, bone, fat, or any tissue, from contacting or being damaged by a pilot hole drill bit or bone reaming drill bit during use of stabilization apparatus **100**. In one embodiment, after pilot hole guide portion **118** and pilot hole aperture **120** are used to drill a pilot hole, inner sleeve **104** may rotated relative to outer sleeve **102** to unlock inner sleeve **104** from outer sleeve **102** such that inner sleeve **104** is removed from outer sleeve **102** during a medical procedure. In another embodiment, after using pilot hole guide portion **118**

and pilot hole aperture **120** to drill a pilot hole during a medical procedure, inner sleeve **104** is removed from outer sleeve **102** and soft tissue protection element **106** in conjunction with the drilled pilot hole is used to ream a larger diameter portion of one or more bone elements. In one embodiment, inner diameter of soft tissue protection element **106** varies based on an outer diameter of a bone implant being inserted into bones, and accordingly, the size of pilot hole guide portion **118** would vary proportionally to provide a flush fit of pilot hole guide portion **118** within soft tissue protection element **106**.

[0025] Inner sleeve **104** and outer sleeve **102** of stabilization apparatus **100** may comprise an interlocking mechanical device, such as interlocking inner sleeve handle **122** and interlocking outer sleeve handle **112**, respectively. Interlocking inner sleeve handle **122** may comprise mechanical stop **124** which corresponds to a mechanical stop **114** of interlocking outer sleeve handle **112** to limit rotation of interlocking inner sleeve handle **122** and interlocking outer sleeve handle **112** relative to one another, thus defining a locking position. Interlocking inner sleeve handle **122** may also comprise, or may instead comprise, a mechanical stop **126**, for example an overlay portion, which corresponds to a mechanical stop **116**, for example an underlay portion, to limit removal of inner sleeve **104** from outer sleeve **102** when in a locking position.

[0026] Any of outer sleeve **102**, inner sleeve **104**, and support rods **110** may comprise any of a variety of materials, including one or more of a metal, an alloy, a composite, a polymer, or another organic material or biocompatible material. In one embodiment, any of outer sleeve **102**, inner sleeve **104**, and support rods **110** comprises a radio translucent (radiolucent) material, a non-radio translucent (non-radiolucent) material, or a combination of a radiolucent material and a non-radiolucent material. Outer sleeve **102** and/or soft tissue protection element may comprise a substantially resilient material configured to minimize the effect of its contact with soft tissues.

[0027] In one embodiment, stabilization apparatus **100** may be used for placement of an initial pilot hole into bone elements to be fixated, while protecting soft tissues as well as maintaining the position of the bone elements and guiding a ream during a reaming of one or more bone elements to accept an orthopedic implanted device.

[0028] In one embodiment, outer sleeve **102** comprises a bore extending substantially centrally through outer sleeve **102**. This bore may be configured to guide a reamer during reaming. This bore may be configured to guide an orthopedic implant during implantation in a patient's body.

[0029] **Figure 2** illustrates an anterior view of stabilization apparatus **200**. Stabilization apparatus **200** may comprise outer sleeve **202**, and inner sleeve **204**. Pilot hole guide portion **218** with pilot hole **220** of inner sleeve **204** may couple with soft tissue protection element **206** of outer sleeve **202** to join portions **202** and **204**. Portions **202** and **204** may be interlocked by means of mechanical stops **214**, **216**, **224**, and **226** or other like interlocking mechanical device disposed on handles **212** and **222** respectively. In addition to mechanical stops **214**, **216**, **224**, and **226** to interlock both handles, outer sleeve handle **212** may contain movement limiting insert **228** which corresponds to detent **230** on inner sleeve handle **222**. Movement limiting insert **228** allows for an insertion of a movement limiting device such a spring loaded ball bearing, pin, or other like device to interact with and frictionally engage detent **230** to limit rotational movement of outer sleeve **202** relative to inner sleeve **204** to keep the two portions locked. Support rod apertures **208** are disposed about soft tissue protection element **206** on outer sleeve **202**.

[0030] **Figure 3** illustrates an example embodiment of inner sleeve **304**. Inner sleeve **304** may comprise a handle **322** on which is disposed a pilot hole guide portion **318** with pilot hole aperture **320** for use in drilling a pilot hole in one or more bone elements during a

medical procedure, and mechanical stops **324**, **326**, and detent **330** used to interact with other mechanical devices to limit rotational movement of handle **322** during a medical procedure.

[0031] **Figure 4** illustrates an example embodiment of outer sleeve **402**. Outer sleeve **402** may comprise a handle **412** on which is disposed a soft tissue protection element **406** for protecting soft tissue during a medical procedure and further operable to guide a bone element reamer, support rod aperture offsets **438** disposed around soft tissue protection element **406**, support rod aperture offsets comprising one or more apertures **408** for receiving and guiding a support rod during a medical procedure, and mechanical stops **414**, **416**, and movement limiting insert **428** used to interact with other mechanical devices to limit rotational movement of handle **412** during a medical procedure.

[0032] **Figure 5** illustrates an example embodiment of stabilization apparatus **500** used during an example medical procedure. Stabilization apparatus **500** may be secured relative to one or more bones during a medical procedure. In this example embodiment, stabilization apparatus is secured to calcaneus bone **532**, talus bone **534**, and tibia bone **536**. Stabilization apparatus may be secured to bones **532**, **534**, and **536** by first excising soft tissue for an area of the body an inserting soft tissue protection element **506** into the soft tissue. One or more support rods **510** are guided through support rod apertures **508** on support rod aperture offset **538** to interact with bones **532**, **534**, and **536** to secure stabilization apparatus **500** relative to bones **532**, **534**, and **536**. Pilot hole guide portion (not shown) and pilot hole aperture (not shown) of inner sleeve **504** are used to guide a pilot hole through bones **532**, **534**, and **536**. Handle **522** is rotated relative to handle **512** to disengage mechanical stops **514**, **516**, **524**, and **526** such that inner sleeve **504** may be removed from outer sleeve **502**. Once inner sleeve **504** is removed from outer sleeve **502**, soft tissue protection element **506** in addition to the drilled pilot hole may be used to guide a larger diameter bone reamer through bones **532**, **534**, and **536** such that a corresponding diameter bone implant may be inserted into the bore. Soft

tissue protection element **506** is left in place for a remainder of the medical procedure to protect the soft tissue during the insertion of the bone implant. Alternatively, soft tissue protection element **506** is removed after reaming.

[0033] **Figure 6** illustrates an example arrangement of a system **601** for causing compression between bone elements as used in a medical procedure fusing ankle bones **632**, **634**, and **636**. **Figure 6** illustrates a medial view of bones **632**, **634**, and **636** within a human left foot. System **601** may include bone implant apparatus **603** for causing compression between bone elements in addition to targeting arm **660**, soft tissue protective sleeve **606** of stabilization apparatus **600**, and tensioning device **668**.

[0034] In an example embodiment, an apparatus **603** for causing compression between bone elements is inserted into bones **632**, **634**, and **636**. Before insertion of apparatus **603**, soft tissue protection element **606** is used to prepare bones **632**, **634**, and **636** for insertion. Soft tissue on the bottom of the foot proximate to calcaneus **632** is excised to allow for at least partial insertion of soft tissue protection element **606** into the soft tissue proximate to calcaneus **632**. Soft tissue protection element **606** further comprises an inner sleeve (not shown) which fits into and is removable from soft tissue protection element **606**. After insertion of soft tissue protection element **606** into the soft tissue at the bottom of the foot, one or more support rods **610** are inserted into support rod alignment apertures **608** on soft tissue protection element **606**. Support rods **610** are drilled into bones **632**, **634**, and **636** to hold soft tissue protection element **606** in place within the soft tissue and relative to bones **632**, **634**, and **636**. An inner sleeve with a central guide for drilling a pilot hole is inserted into soft tissue protection element **606**. A pilot hole is drilled through bones **632**, **634**, and **636** and inner sleeve is removed from soft tissue protection element **606**. Inner-diameter of soft tissue protection element **606** is sized accordingly to match an outer diameter of apparatus **603**. Using the drilled pilot hole as a guide, soft tissue protection element **606** is

used as a guide to ream the full outer diameter of apparatus **603** from bones **632**, **634**, and **636**. Accordingly, inner diameter of soft tissue protection element **606** may vary based on the outer diameter size of apparatus **603** to be inserted, and inner sleeve diameter will vary accordingly to ensure a proper fit between inner sleeve and soft tissue protection element **606**. Soft tissue protection element **606** protects surrounding soft tissue during the drilling and reaming of bones **632**, **634**, and **636**. After bones are reamed to the appropriate diameter, targeting arm **662** is used to drill apertures through bones **632**, **634**, and **636**. Referring to system **601** targeting arm **660**, targeting arm **660** has multiple apertures **662** corresponding to apertures of compression slot **607**, dynamization slot **609**, and static fixation apertures **611** on apparatus **603**. Targeting arm **660** is used as a guide to drill apertures corresponding to compression slot **607**, dynamization slot **609**, and static fixation apertures **611** through bones **632**, **634**, and **636**. Target arm **660** rotates in intervals of 90 degrees to match the 90 degree offset of apertures corresponding to compression slot **607**, dynamization slot **609**, and static fixation apertures **611** on apparatus **603** such that apertures drilled through bones **632**, **634**, and **636** will match precisely with those apertures of compression slot **607**, dynamization slot **609**, and static fixation apertures **611** on apparatus **603** once apparatus **603** is inserted into bones **632**, **634**, and **636**. After apertures are drilled through bones **632**, **634**, and **636**, distal end **820** of elongated shaft **602** is inserted through soft tissue protection element **606** and through **632**, **634**, and **636** until proper alignment of apparatus **603** relative to the drilled bone apertures is achieved. Nail fastener (not shown) may be used to manipulate apparatus **603** to achieve proper alignment within the body. Once apparatus **603** is aligned, calcaneal screws **646** are inserted through calcaneus **632** and through corresponding static fixation apertures on apparatus **603** to partially, statically fix apparatus **603** relative to bones **632**, **634**, and **636**. A transverse bolt is inserted through the corresponding drilled aperture in tibia **636** for compression slot **607** and through compression slot **607**. A cable, not shown, within an inner

longitudinal bore of apparatus **603** is positioned appropriately to interact with the transverse bolt through compression slot **607**. Cable ends (not shown) pass through support device **650** and further to tensioning device **668** and portions of the cable are secured to cable securing cams **670** of tensioning device **668**. Cables may be tensioned by twisting ratcheting tension adjustment **672** which incrementally increases tension to the cable, and thus the tension between the cable and transverse bolt through compression slot **607**. As the cable is tensioned, bones **632**, **634**, and **636** and their respective joints are drawn to each other until a proper tensioning has been achieved. Once a proper tensioning is achieve, more transverse bolts are secured through the drilled apertures on bones **632**, **634**, and **636** and through apertures corresponding to dynamization slot **609**, and static fixation apertures **611** of apparatus **603** to provide a final fixation of apparatus **603** within bones **632**, **634**, and **636**. After apparatus **603** has been finally fixated, cams **670** are released to slacken the cable, and tensioning device **668** is removed from system **601**. Cable is remove from apparatus **603** via apertures (not shown) on support device **650**. Support device **650** and its corresponding portion within soft tissue protection element **606** are removed in addition to the nail fastener. Targeting arm **660** is removed to leave soft tissue protection element **606** as anchored in place. Support rods **610** may either remain within the body or be removed with soft tissue protection element **606** and the soft tissue left after removal of soft tissue protection element **606** is closed to complete this example embodiment of a bone compression and fixation procedure. Accordingly, other procedures and steps may be used to effectuate this example embodiment and the example embodiment was used to illustrate use of apparatus **603** relative to system **601** for a compression between bone elements medical procedure.

[0035] **FIG.** 7 illustrates an example arrangement of a stabilization apparatus **700**. Stabilization apparatus **700** may comprise an outer sleeve **702** through which a guide wire **704** and support rod **706** may extend. Stabilization apparatus **700** may also comprise a blunt

tip soft tissue protection element **708** and handle **710**. In one embodiment, the term "outer sleeve" may be interchangeable with the term "body portion." In another embodiment, the term "support rod" may be interchangeable with "stabilizing wires" or "stabilization wires." In another embodiment, the term "soft tissue protection element" may be interchangeable with the term "outer sleeve." In another embodiment, the term "handle" may be interchangeable with the term "mounting portion."

[0036] Stabilization apparatus **700** may be configured to maintain one or more bone elements in a specific desired orientation for reaming a hole through the one or more bone elements. Stabilization apparatus **700** may be configured to maintain one or more bone elements in a specific desired orientation for implantation of an orthopedic implanted device through one or more bone elements. In one embodiment, stabilization apparatus **700** is configured to maintain one or more joints in a specific desired orientation for reaming a hole through the one or more bone elements making up the joint, for insertion of an apparatus for causing compression between bone elements.

[0037] Outer sleeve **702** may comprise a substantially cylindrical profile with a series of apertures extending longitudinally through the body of outer sleeve **702**. The apertures may permit the passing of any of guide wire **704** or support rod **706** through outer sleeve **702**. The aperture for guide wire **704** may be substantially centrally located within outer sleeve **702**.

[0038] The apertures for support rod **706** may be offset to either side of outer sleeve **702**. In one embodiment, the apertures for support rod **706** may be substantially opposed, and oriented about 180 degrees relative to the aperture for guide wire **704**. In another embodiment, stabilization apparatus **700** comprises three or more apertures for support rod **706**, which apertures may be substantially evenly distributed about the periphery of outer sleeve **702**. That is, three apertures may be oriented about 120 degrees relative to the

aperture for guide wire **704**, while four apertures may be oriented about 90 degrees relative to the aperture for guide wire **704**, and so on.

[0039] In one embodiment, one or more of guide wire **704** and support rod **706** comprise a cutting tip configured to create a channel through bone elements upon rotation of guide wire **704** or support rod **706**. In another embodiment, one or more of guide wire **104** and support rod **706** are configured to be inserted following the drilling of a channel through bone elements with a drill bit. In another embodiment, one or more of guide wire **704** and support rod **706** comprise a pointed tip configured to create a channel through bone elements upon being driven with an axial force.

[0040] Soft tissue protection element **708** may be oriented radially outwardly of outer sleeve **702**. Soft tissue protection element **708** may be configured to provide protection of soft tissues adjacent to or surrounding the site of bone elements to be reamed. For example, soft tissue protection element **708** may protect skin, muscle, and ligament from contacting or being damaged by any of guide wire **704**, support rod **706**, or outer sleeve **702** during use of stabilization apparatus **700**.

[0041] Handle **710** may comprise any of a variety of devices configured to maintain control of stabilization apparatus **700** by a user, including a handle or tab for holding in a user's hand or selectively connecting to an anchoring device configured to provide stability to stabilization apparatus **700** relative to the patient or the patient's bone elements.

[0042] Any of outer sleeve **702**, guide wire **704**, support rod **706**, soft tissue protection element **708**, and handle **710** may comprise any of a variety of materials, including one or more of a metal, an alloy, a composite, a polymer, or another organic material or biocompatible material. In one embodiment, any of outer sleeve **702**, guide wire **704**, support rod **706**, soft tissue protection element **708**, and handle **710** comprises a radiolucent material,

a non-radiolucent material, or a combination of a radiolucent material and a non-radiolucent material. Soft tissue protection element **708** may comprise a substantially resilient material configured to minimize the effect of its contact with soft tissues.

[0043] In one embodiment, stabilization apparatus **700** may be used for placement of an initial guide wire into bone elements to be fixated, while protecting soft tissues as well as maintaining the position of the bone elements during placement of a longitudinal bore to accept an orthopedic implanted device.

[0044] **FIG. 8** illustrates an end view of an example arrangement of a stabilization apparatus **800** comprising an outer sleeve **802**, a pilot hole aperture **804**, one or more support rod apertures **806**, a handle **810**, and an inner sleeve **812**. In one embodiment, the term "pilot hole aperture" may be interchangeable with the term "guide wire aperture." In another embodiment, the term "inner sleeve" may be interchangeable with the term "removable insert."

[0045] Stabilization apparatus **800** may be configured substantially similar to stabilization apparatus **700** illustrated in **FIG. 7**.

[0046] Inner sleeve **812** may comprise a substantially cylindrical body including pilot hole aperture **804** and configured to fit within a bore **814** of stabilization apparatus **800**. Inner sleeve **812** may comprise any of a variety of materials, including one or more of a metal, an alloy, a composite, a polymer, or another organic material or biocompatible material. In one embodiment, inner sleeve **812** comprises at least one of a radiolucent material, a non-radiolucent material, or a combination of a radiolucent material and a non-radiolucent material.

[0047] In one embodiment, inner sleeve **812** may comprise a series of removable inserts, each with larger pilot hole apertures **804** extending longitudinally through their length. In

use, stabilization apparatus **800** may be loaded with a first inner sleeve **812** having a pilot hole aperture **804** configured to accept a guide wire fitted with a cutting head. Following the reaming of bone elements with a guide wire, the guide wire and first inner sleeve **812** may be removed. A second inner sleeve **812** including a larger pilot hole aperture **804** may be inserted into stabilization apparatus **800**, after which a guide wire having a greater diameter than that used with first inner sleeve **812** may be extended through second inner sleeve **812**. In one embodiment, a third inner sleeve **812** with a larger pilot hole aperture **804** may replace the second inner sleeve **812**, and so on.

[0048] In one embodiment, bore **814** comprises about the same diameter as the outside diameter of the orthopedic implanted device to be implanted. A reamer having an outside diameter about the same diameter as bore **814** may be extended through stabilization apparatus **800** and the bone elements to be fixated, and removed. The orthopedic implanted device may be inserted through bore **814** of stabilization apparatus **800** and through the bone elements to be fixated. Upon placement of the orthopedic implanted device, stabilization apparatus **800** may be removed, leaving the orthopedic implanted device installed within the bone elements.

[0049] To the extent that the term "includes" or "including" is used in the specification or the claims, it is intended to be inclusive in a manner similar to the term "comprising" as that term is interpreted when employed as a transitional word in a claim. Furthermore, to the extent that the term "or" is employed (e.g., A or B) it is intended to mean "A or B or both." When the applicants intend to indicate "only A or B but not both" then the term "only A or B but not both" will be employed. Thus, use of the term "or" herein is the inclusive, and not the exclusive use. See Bryan A. Garner, A Dictionary of Modern Legal Usage 624 (2d. Ed. 1995). Also, to the extent that the terms "in" or "into" are used in the specification or the claims, it is intended to additionally mean "on" or "onto." To the extent that the term

"selectively" is used in the specification or the claims, it is intended to refer to a condition of a component wherein a user of the apparatus may activate or deactivate the feature or function of the component as is necessary or desired in use of the apparatus. To the extent that the term "operatively connected" is used in the specification or the claims, it is intended to mean that the identified components are connected in a way to perform a designated function. To the extent that the term "substantially" is used in the specification or the claims, it is intended to mean that the identified components have the relation or qualities indicated with degree of error as would be acceptable in the subject industry. As used in the specification and the claims, the singular forms "a," "an," and "the" include the plural. Finally, where the term "about" is used in conjunction with a number, it is intended to include ± 10% of the number. In other words, "about 10" may mean from 9 to 11.

[0050] As stated above, while the present application has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art, having the benefit of the present application. Therefore, the application, in its broader aspects, is not limited to the specific details, illustrative examples shown, or any apparatus referred to. Departures may be made from such details, examples, and apparatuses without departing from the spirit or scope of the general inventive concept.

CLAIMS

1. A stabilization apparatus for reaming bone elements, the stabilization apparatus comprising:

an outer sleeve;

an inner sleeve;

wherein in at least one of the outer sleeve and the inner sleeve include at least one support rod aperture operable to receive and guide a support rod for affixing the stabilization apparatus relative to a bone element.

2. The stabilization apparatus of claim 1, wherein the outer sleeve comprises a soft tissue protection element for operatively protecting soft tissue during a medical procedure.

3. The stabilization apparatus of claim 1, wherein the outer sleeve is operable to guide a reamer.

4. The stabilization apparatus of claim 1, wherein the outer sleeve comprises a handle and the inner sleeve comprises a handle, and wherein the outer sleeve handle includes at least one interlocking mechanical device to interlock with inner sleeve handle.

5. The stabilization apparatus of claim 1, wherein the outer sleeve comprises at least one offset, wherein the at least one offset comprises the at least one support rod aperture operable to receive and guide the support rod.

6. The stabilization apparatus of claim 1, wherein the inner sleeve comprises a pilot hole guide portion for drilling a pilot hole during a medical procedure.

7. The stabilization apparatus of claim 1, wherein the outer sleeve is operable to mate with the inner sleeve, wherein the inner sleeve is contained at least partially within in the outer sleeve.

8. The stabilization apparatus of claim 1, wherein the outer sleeve comprises a bore extending substantially centrally through the outer sleeve.

9. The stabilization apparatus of claim 1, wherein at least one of the outer sleeve and the inner sleeve comprises at least one of: a radiolucent material, a non-radiolucent material, or a combination of a radiolucent material and a non-radiolucent material.

10. A stabilization apparatus for reaming bone elements, the stabilization apparatus comprising:

an outer sleeve, the outer sleeve comprising:

a soft tissue protection element for operatively protecting soft tissue during a medical procedure and used to guide a reamer, and

an outer sleeve handle with at least one interlocking mechanical device to interlock with an inner sleeve handle; and

an inner sleeve, the inner sleeve further comprising: a pilot hole guide portion for drilling a pilot hole during a medical procedure.

11. The stabilization apparatus of claim 10, wherein the inner sleeve handle includes at least one interlocking mechanical device to interlock with the outer sleeve.

12. The stabilization apparatus of claim 10, wherein the outer sleeve further comprises at least one offset, the at least one offset having at least one support rod aperture operable to receive and guide a support rod for affixing the stabilization apparatus relative to a bone element.

13. The stabilization apparatus of claim 10, wherein the outer sleeve is operable to mate with the inner sleeve, wherein the inner sleeve is contained at least partially within in the outer sleeve.

14. The stabilization apparatus of claim 10, wherein the outer sleeve comprises a bore extending substantially centrally through the outer sleeve.

15. The stabilization apparatus of claim 10, wherein at least one of the outer sleeve and the inner sleeve comprises at least one of: a radiolucent material, a non-radiolucent material, or a combination of a radiolucent material and a non-radiolucent material.

16. A stabilization apparatus for reaming bone elements, the apparatus comprising:

an outer sleeve;

a bore extending substantially centrally through the outer sleeve;

an inner sleeve including a pilot hole guide portion;

wherein in at least one of the outer sleeve and the inner sleeve include at least one support rod aperture operable to receive and guide a support rod for affixing the stabilization apparatus relative to a bone element.

17. The stabilization apparatus of claim 16, wherein the support rod is operable to extend through a first bone element and into a second bone element.

18. The stabilization apparatus of claim 16, wherein at least one of the outer sleeve and the inner sleeve comprises at least one of: a radiolucent material, a non-radiolucent material, or a combination of a radiolucent material and a non-radiolucent material.

19. The stabilization apparatus of claim 16, wherein the outer sleeve comprises a soft tissue protection element for operatively protecting soft tissue during a medical procedure.

20. The stabilization apparatus of claim 16, wherein the outer sleeve comprises a handle and the inner sleeve comprises a handle, and wherein the outer sleeve handle includes at least one interlocking mechanical device to interlock with inner sleeve handle.

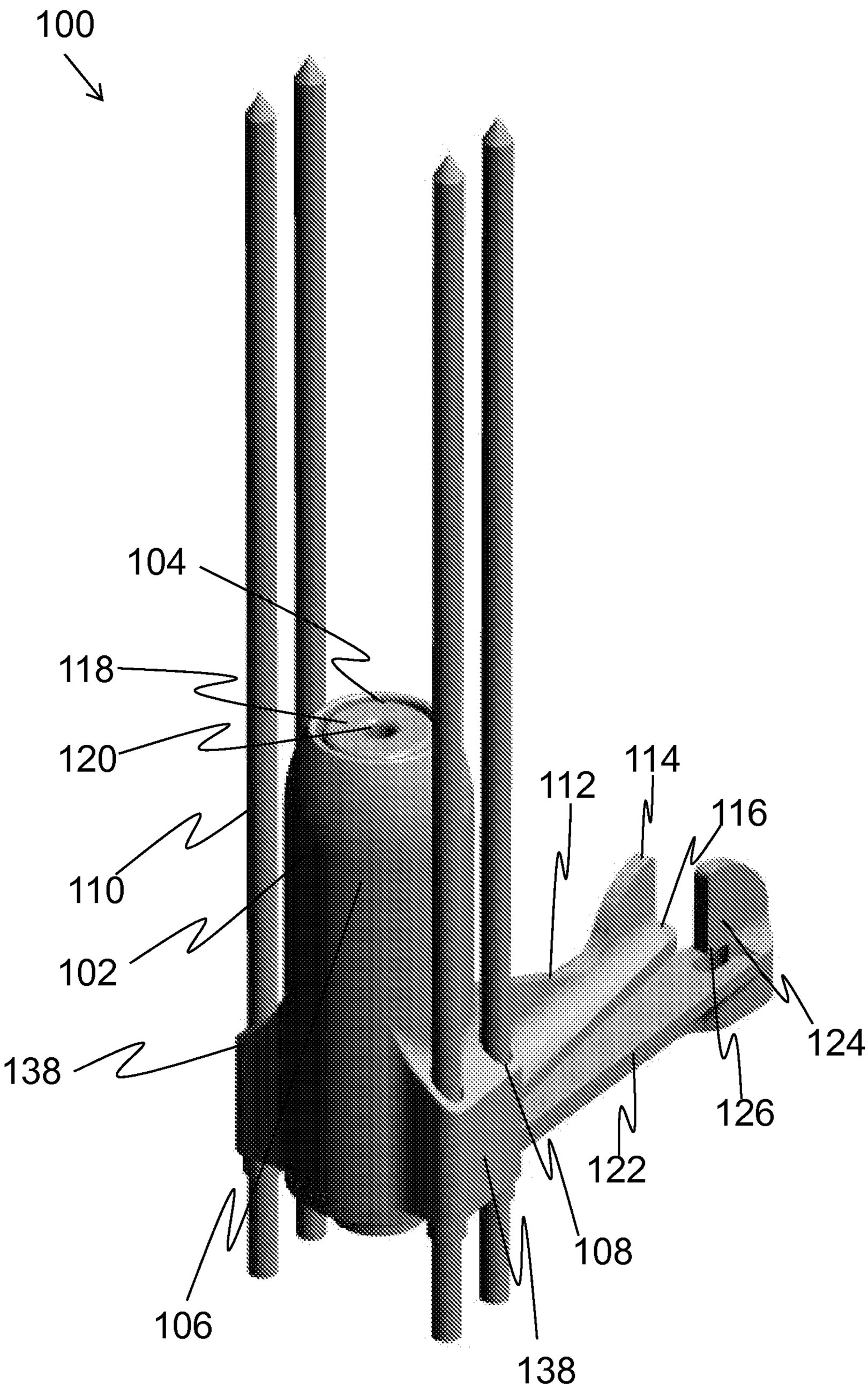


FIG. 1

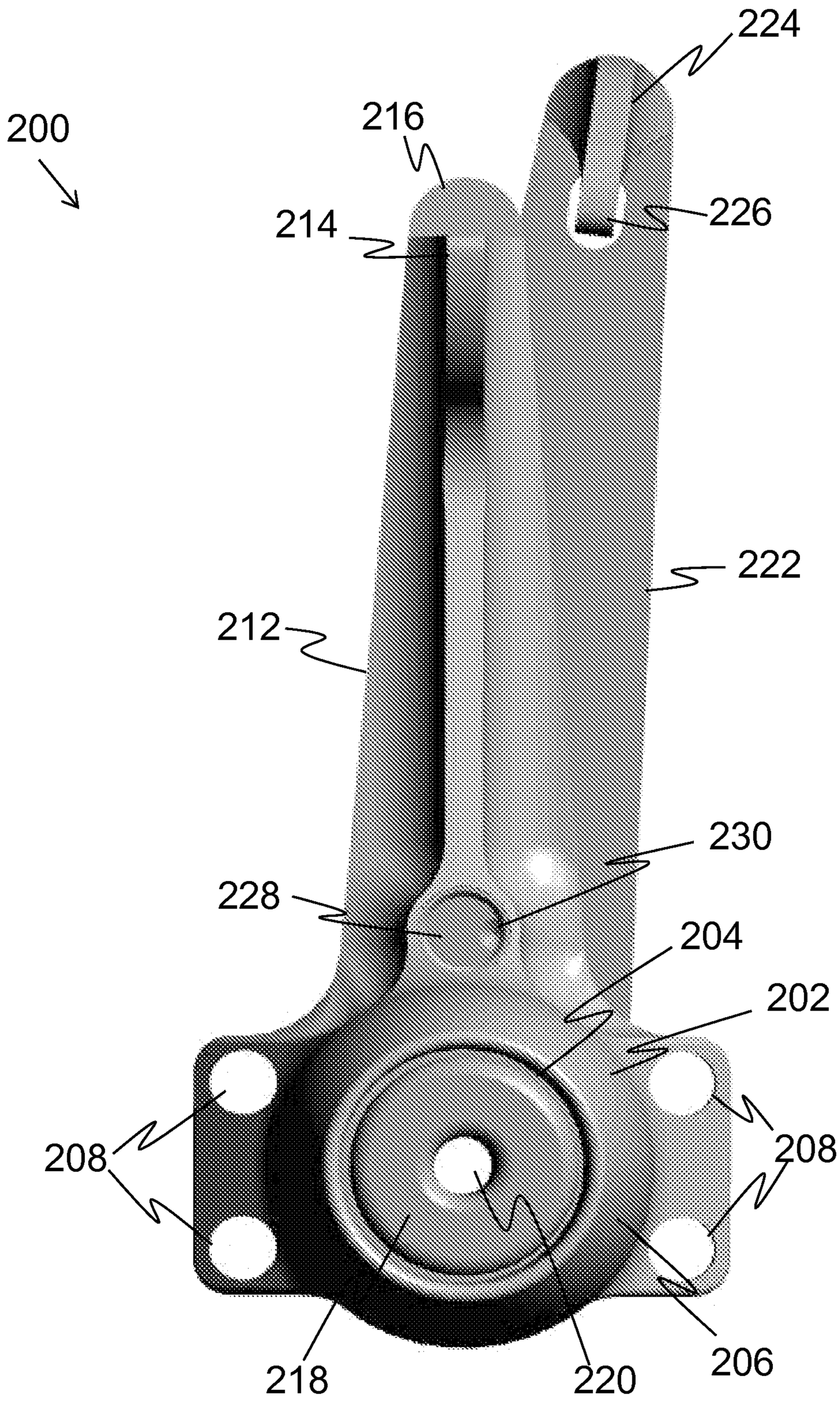


FIG. 2

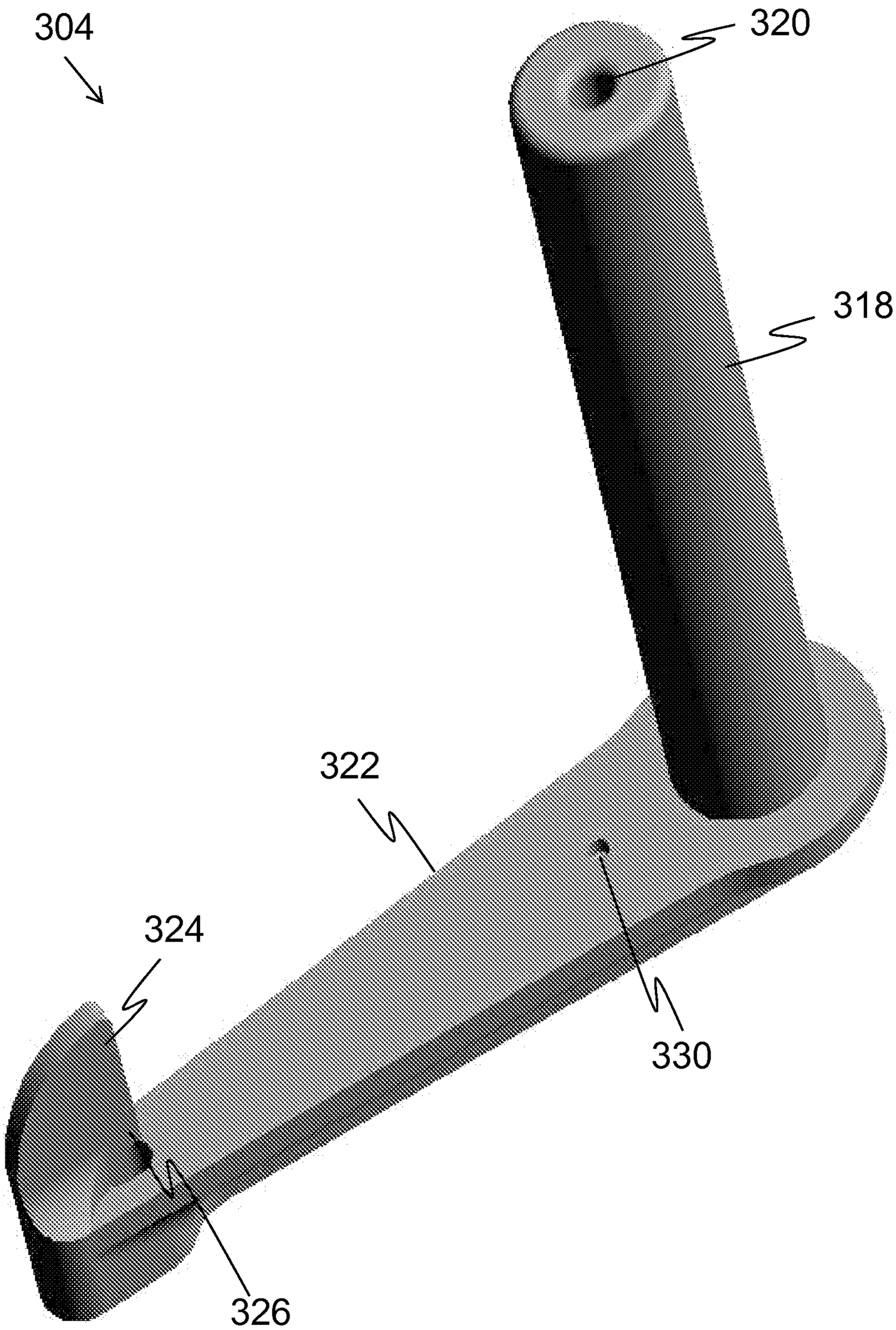


FIG. 3

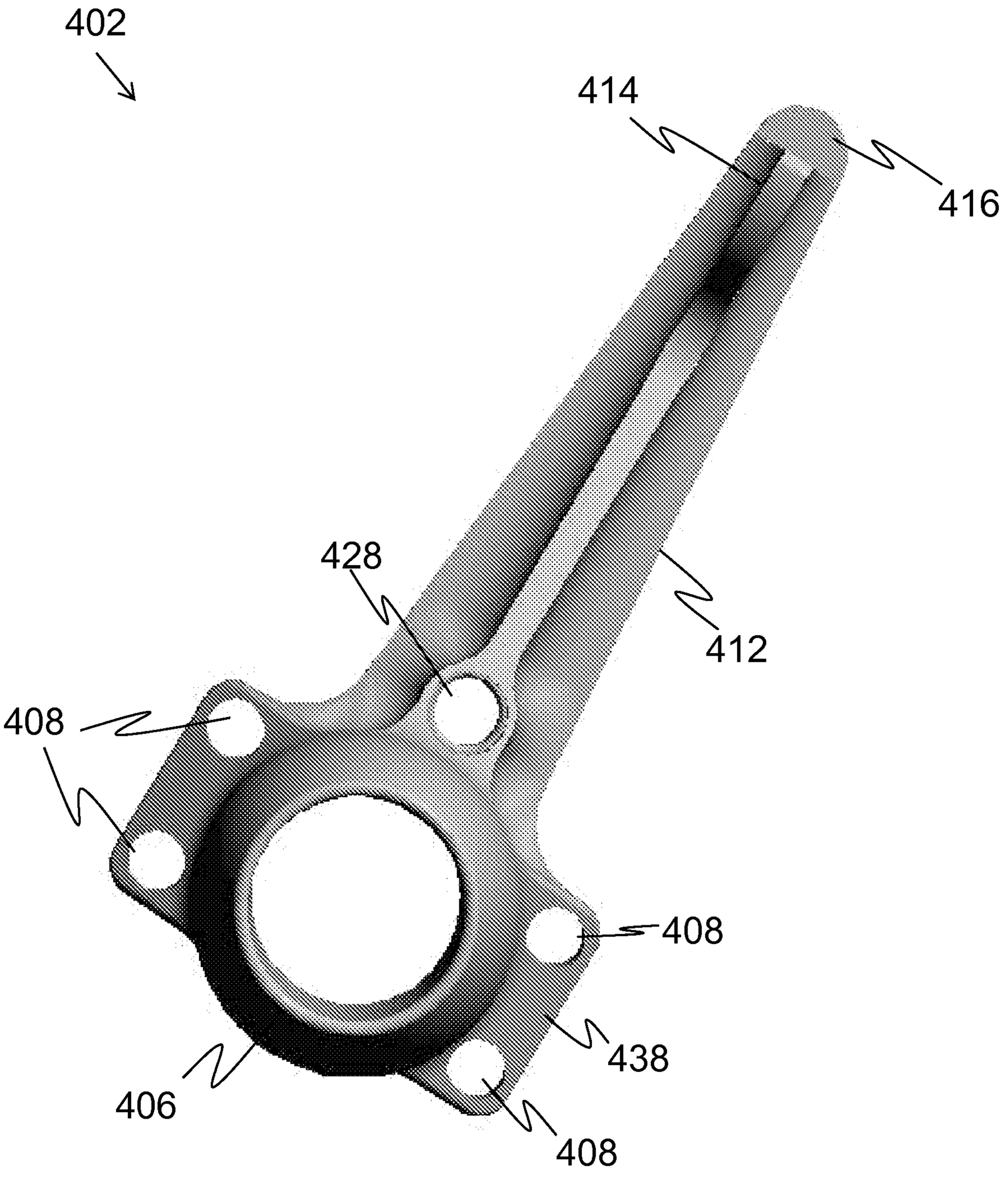


FIG. 4

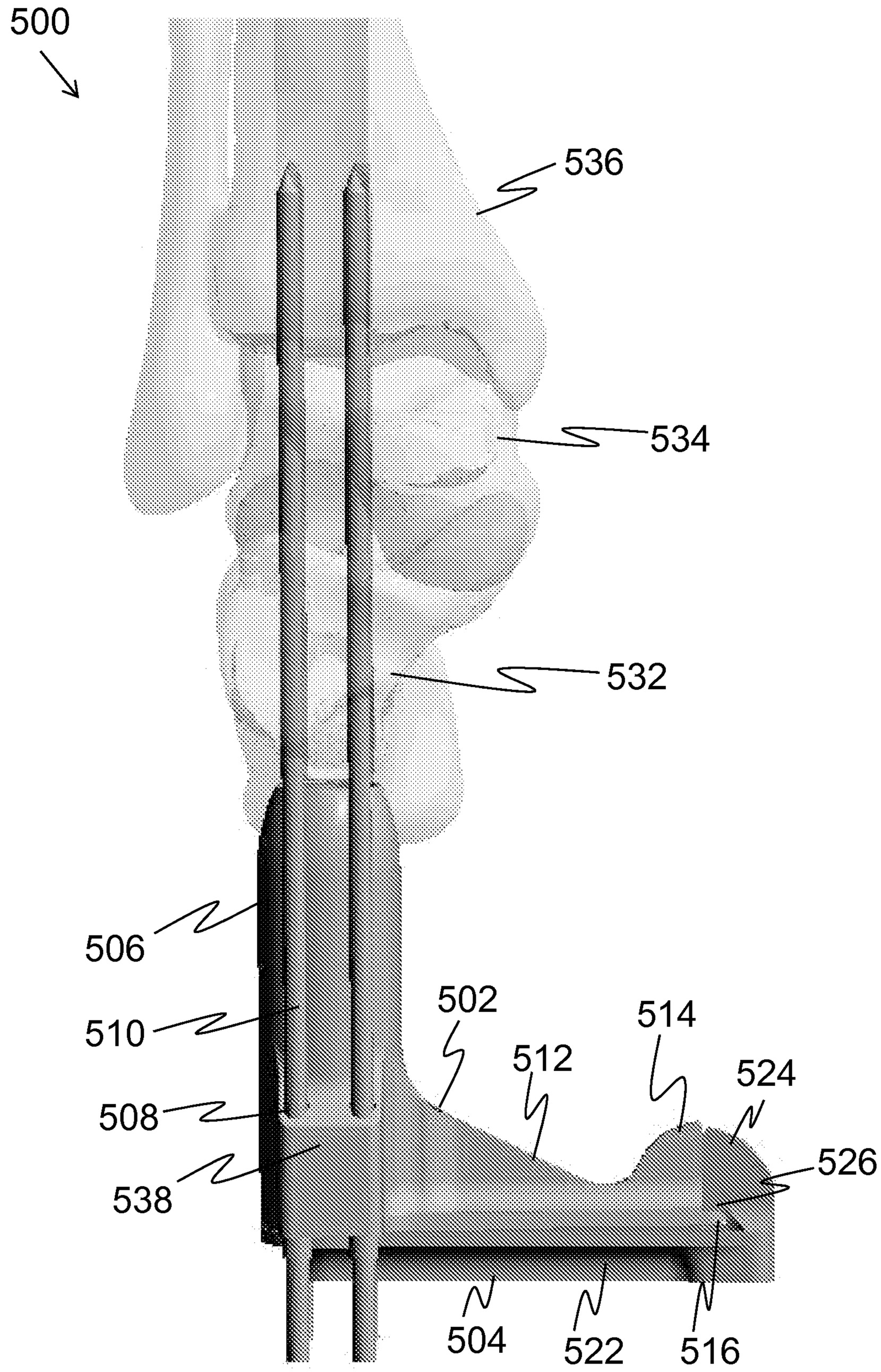


FIG. 5

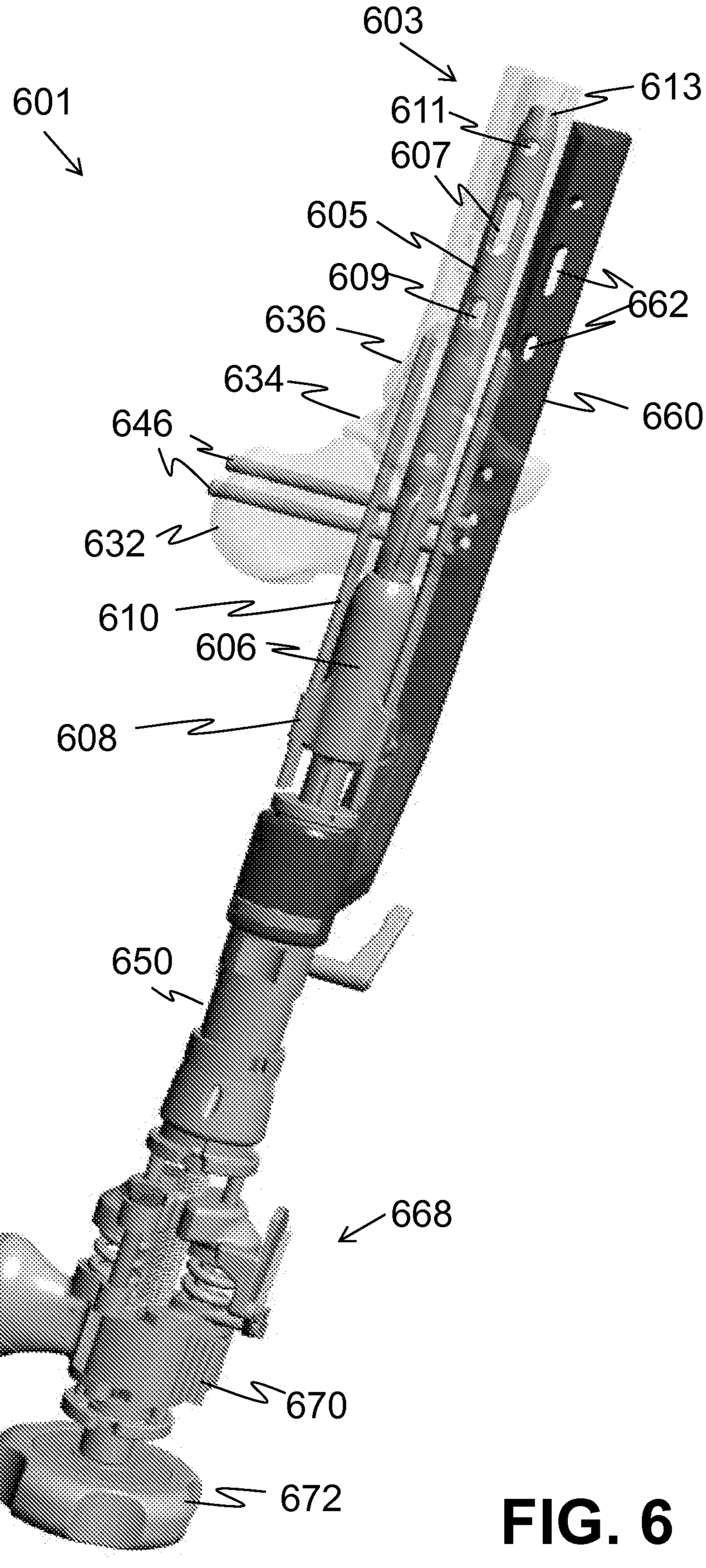

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FIG. 6

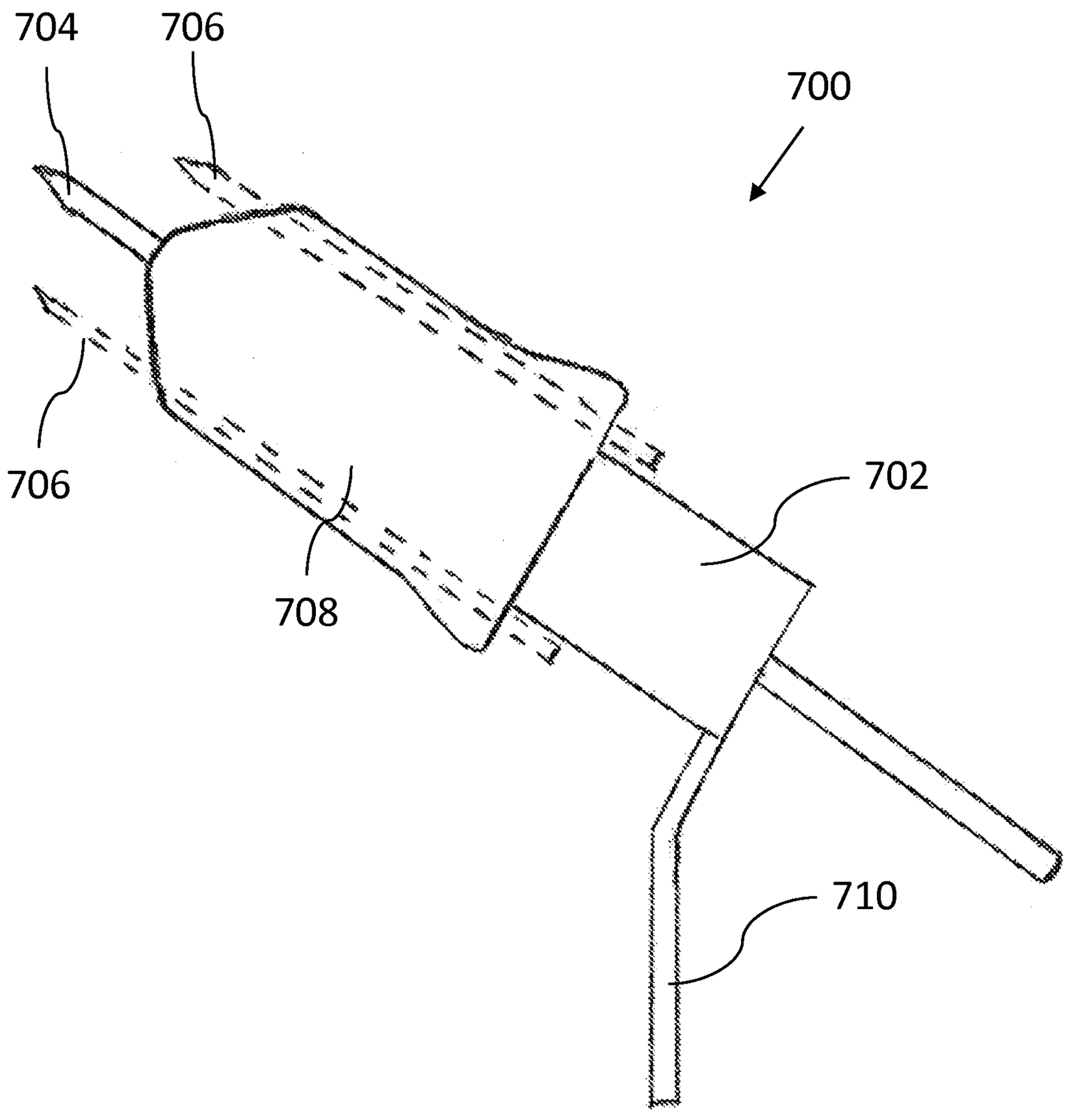


FIG. 7

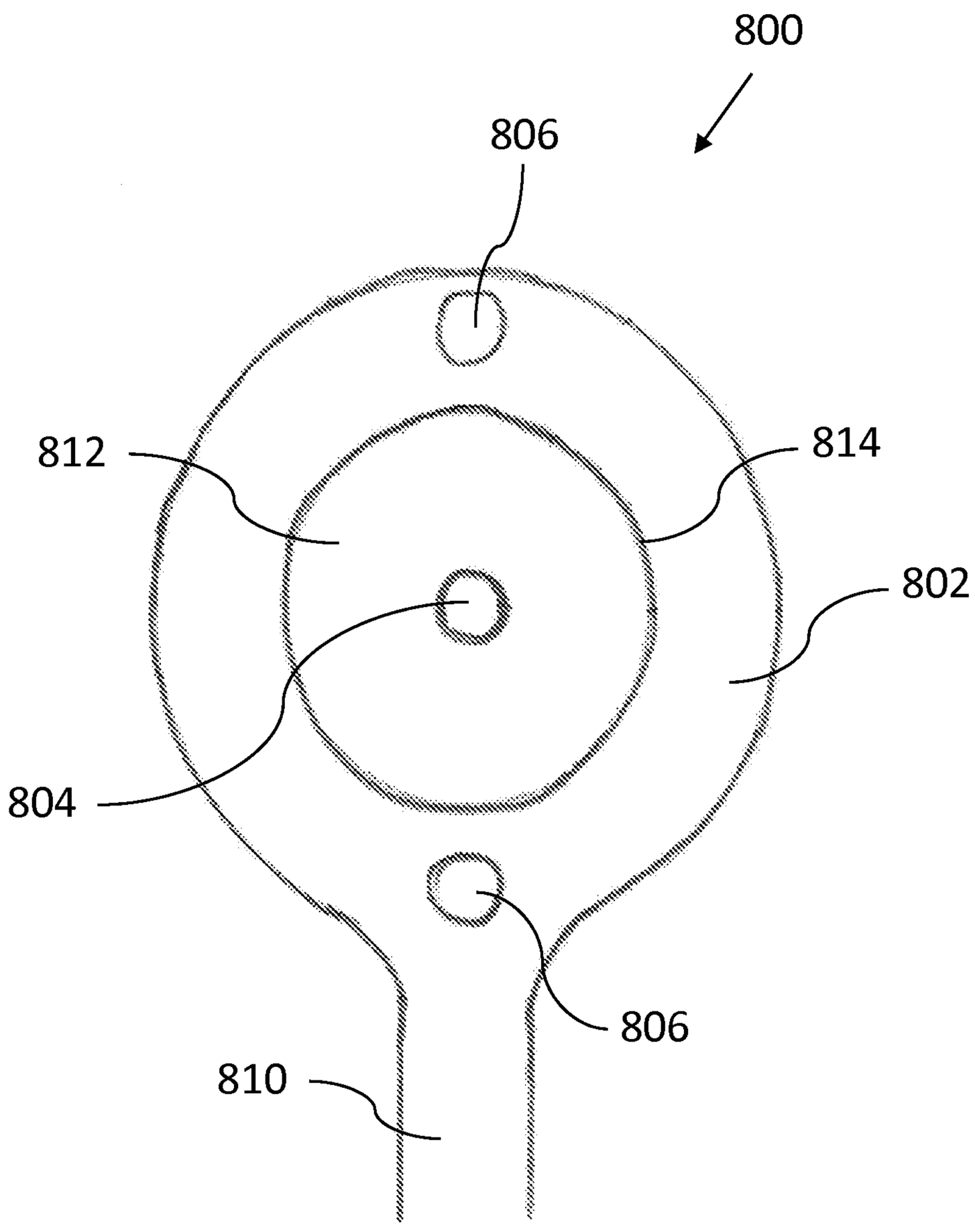


FIG.8

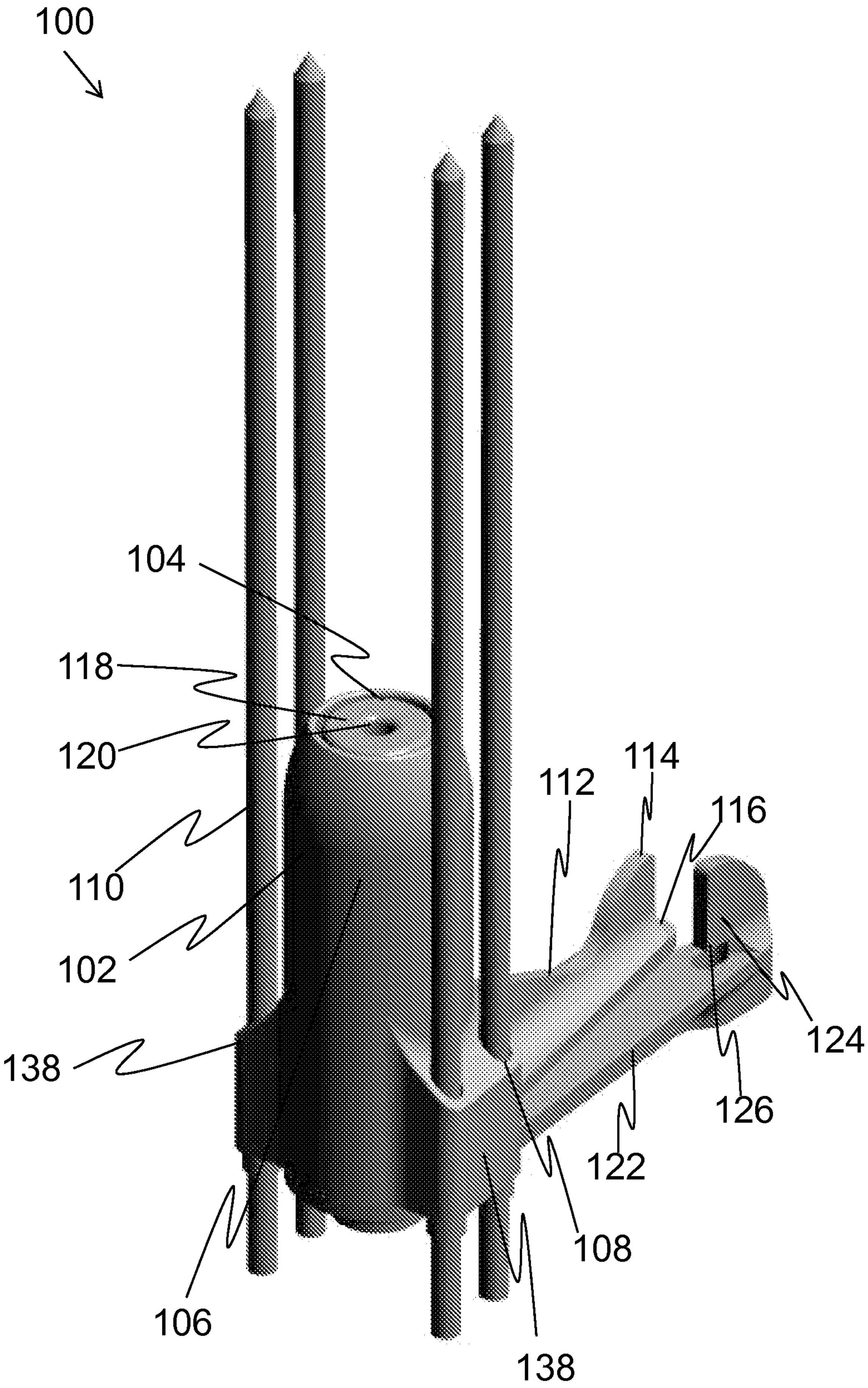


FIG. 1