

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MARYLAND**

ADVANCE MEDICAL DESIGNS, INC.,

Plaintiff,

v.

CORBIN CLINICAL RESOURCES, LLC

Defendant.

Civ. A. No. 1:22-cv-00789-SAG

JURY TRIAL DEMANDED

PLAINTIFF ADVANCE MEDICAL DESIGNS, INC.'S
UPDATED OPENING CLAIM CONSTRUCTION BRIEF

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Exhibit No.	Description
Exhibit A (previously filed DE 58-01)	U.S. Pat. No. 10,064,681 (“’681 Patent”)
Exhibit B (previously filed DE 58-02)	U.S. Pat. No. 11,096,762 (“’762 Patent”)
Exhibit C (previously filed DE 58-03)	U.S. Pat. No. 11,246,677 (“’677 Patent”)
Exhibit D (previously filed DE 58-04)	File History of U.S. App. No. 14/677,286, Office Action of October 6, 2017 (“October 6 Office Action and Response”)
Exhibit E (previously filed DE 58-05)	U.S. Pat. No. 5,494,039 (“Onik”)
Exhibit F (previously filed DE 58-06)	File History of U.S. App. No. 14/677,286, Applicant-Initiated Interview Summary of May 4, 2018 (“May 4 Interview Summary”)
Exhibit G (previously filed DE 58-07)	File History of U.S. App. No. 14/677,286, Office Action of April 2, 2018 (“April 2 Office Action and Response”)
Exhibit H (previously filed DE 58-08)	File History of U.S. App. No. 16/377,754, Office Action of January 17, 2020 (“Jan. 17 Office Action and Response”)
Exhibit I (previously filed DE 58-09)	U.S. Pat. No. 10,743,911
Exhibit J (previously filed DE 58-10)	Merriam-Webster Dictionary Online: https://www.merriam-webster.com/dictionary/
Exhibit K (previously filed DE 58-11)	Cambridge Dictionary Online: https://dictionary.cambridge.org (definition of “frictional”).
Exhibit L (previously filed DE 58-12)	Merriam-Webster Dictionary Online: https://www.merriam-webster.com/dictionary/ (definition of “distal”).

Exhibit No.	Description
Exhibit M (previously filed DE 58-13)	Dictionary.com: https://www.dictionary.com/ (definition of “distal”)
Exhibit N (previously filed DE 58-14)	Merriam-Webster Dictionary Online: https://www.merriam-webster.com/dictionary/ (definition of “offset”).
Exhibit O (previously filed DE 58-15)	Dictionary.com: https://www.dictionary.com/ (definition of “offset”)
Exhibit P (previously filed DE 58-16)	Communication in EPO Patent Application No. EP15773805.5
Exhibit Q (previously filed DE 58-17)	PCT WO 2015/154024 A1
Exhibit R (previously filed DE 58-18)	EU Search Opinion
Exhibit S	U.S. Pat. No. 11,446,056 (“’056 Patent”)
Exhibit T	U.S. Pat. No. 11,547,436 (“’436 Patent”)

Pursuant to Local Rule 805(2)(f) and the April 27, 2023 Scheduling Order, Plaintiff Advance Medical Designs, Inc., (“Advance Medical” or “Counterclaim Defendant”), by and through its undersigned attorneys, hereby submits its opening claim construction brief.

I. ADVANCE MEDICAL’S PROPOSED CONSTRUCTIONS REFLECT THE INVENTION CLAIMED AND DESCRIBED IN THE ASSERTED PATENTS

The patents at issue in this case, U.S. Patent Nos. 10,064,681 (the “’681 Patent”), 11,096,762 (the “’762 Patent”), 11,246,677 (the “’677 Patent”), 11,446,056 (the “’056 Patent”), and 11,547,436 (the “’436 Patent”) (collectively, “Asserted Patents”), are directed to an apparatus for use in taking prostate biopsies. Exs. A-C and S-T at 1.¹ Specifically, they relate to a “system for planning and performing a guided and free-handed transperineal prostate biopsy.” *Id.* The apparatus disclosed in the Asserted Patents generally includes a transrectal ultrasound probe, an access needle configured to perforate a perineal access site of a patient, a biopsy gun, and a guide. *Id.* The guide 100, shown in Figure 1 below, generally includes a stabilization bar 101, fasteners 102, a probe 103, lower mounts 104, and an upper mount 105. Ex. A at 8:38-45.

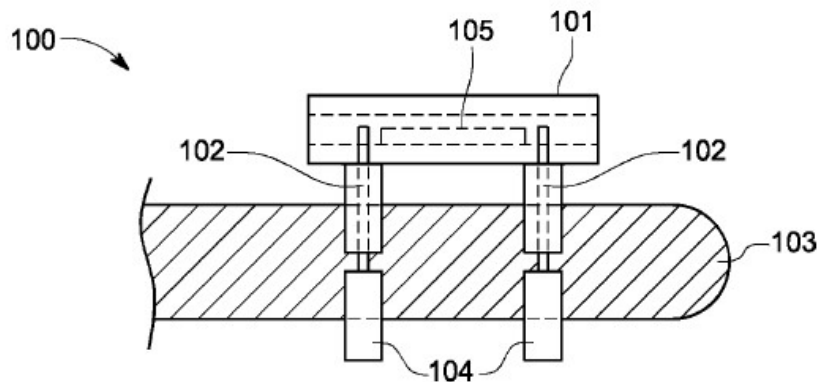


FIG. 1

¹ The written disclosures of the Asserted Patents have substantial overlap and, therefore, are cited collectively. The ’681 Patent, ’762 Patent, and ’677 Patent share substantially identical written descriptions. The ’056 Patent and ’436 Patent include the written description of the other three asserted patents, plus additional new material. The new material is addressed later in this section.

Id., FIG. 1.

The guide also includes a sliding platform 301 that has a hole drilled through the middle 302. The sliding platform is positioned between a pair of stabilization bars 101 on the upper mount 105 as shown in Figure 4 below:

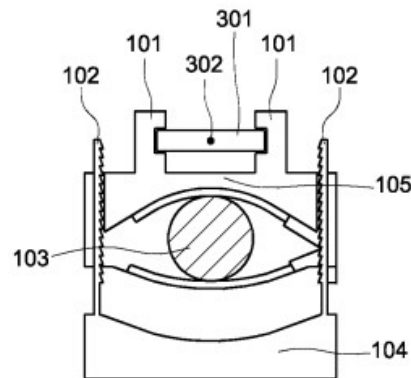


FIG. 4

Ex. A at 9:54-57, FIG. 4. The hole in the sliding platform accommodates a needle used in a biopsy procedure. *Id.* at 6:5-14. The sliding platform moves back and forth along the stabilization bars to allow the medical professional to move the needle into position during the biopsy procedure. *Id.*, *see also* Ex. H at 11 (January 20 Office Action and Response).

The '056 Patent and '436 Patent duplicate the specifications of the other Asserted Patents. *Compare* Exs. A, B, and C *with* Exs. S and T. But the '056 Patent and '436 Patent also add a number of embodiments that include features such as multiple needle receiving ports and configurations to secure the access needle to port such that it remains coupled and/or is prevented from rotating. Ex. T at 25:58-26:8. These features are relevant to Claim Terms 11-13, discussed further below. *See infra* Sections XII-XIV.

In addition to the Asserted Patents (Exs. A-C and S-T), Corbin has also filed a number of related patents based on the same specification including U.S. Patent No. 10,743,911 (Ex. I) and PCT WO 2015/154024 A1 (Ex. Q).

II. THE LEGAL STANDARDS OF CLAIM CONSTRUCTION SUPPORT ADVANCE MEDICAL'S PROPOSED CONSTRUCTIONS

Claim construction “is a question of law, to be determined by the court.” *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 384 (1996) (quotations omitted). Courts construe patent claims to determine their “scope and meaning.” *Wolverine World Wide, Inc. v. Nike, Inc.*, 38 F.3d 1192, 1196 (Fed. Cir. 1994).

While the claims of a patent are generally given their ordinary and customary meaning, they “of course, do not stand alone. Rather, they are part of a fully integrated written instrument consisting principally of a specification that concludes with the claims.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) (quotations omitted). To arrive at the ordinary and customary meaning, the Court considers the “intrinsic evidence of record,” which consist of the patent’s claims, specification, and prosecution history. *Vitronics Corp. v. Conception, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). The claims must be construed as written, **and not as the patentee wishes it had written the claims after seeing the accused product.** See *Chef Am. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1374 (Fed. Cir. 2004) (emphasis added).

Because the meaning of a claim term is often not immediately apparent, courts look to “those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean” which includes, in order of importance, “the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of the technical terms, and the state of the art.” *Phillips v. AWH Corp.*, 415 F.3d at 1314. (quotations omitted).

Claim language is of “primary importance,” as it “provide[s] substantial guidance as to the meaning of particular claim terms.” *Id.* at 1312, 1314. Thus, the context of a claim term, both in the asserted claim and in relation to other claims, “can be highly instructive.” *Id.* at 1314-15.

The prosecution history is also “of primary significance in understanding the claims,” *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 980 (Fed. Cir. 1995) (*en banc*), as it “provides evidence of how the PTO and the inventor understood the patent,” *Phillips*, 415 F.3d at 1317. When a patentee limits the scope of a claim term to overcome a prior art rejection, “the doctrine of prosecution history disclaimer narrows the meaning of the claim consistent with the scope of the claim surrendered.” *Biogen Idec, Inc. v. GlaxoSmithKline LLC*, 713 F.3d 1090, 1095 (Fed. Cir. 2013). Prosecution disclaimer “preclude[s] patentees from recapturing through claim interpretation specific meanings disclaimed during prosecution.” *Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1323 (Fed. Cir. 2003). Such disclaimer can occur through amendment or argument. *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 452-453 (Fed. Cir. 1985).

Finally, “extrinsic evidence,” such as dictionary and witness testimony, may be considered, but only if helpful to determine the meaning of a claim term in the context of the patent. *Phillips*, 415 F.3d at 1317-19. Extrinsic evidence may never be used “to arrive at a claim construction that is at odds with the intrinsic evidence.” *Playtex Prods. Inc. v. Procter & Gamble Co.*, 400 F.3d 901, 908 n.1 (Fed. Cir. 2005).

III. LEVEL OF ORDINARY SKILL IN THE ART

“A court construing a patent claim seeks to accord a claim the meaning it would have to a person of ordinary skill in the art at the time of the invention.” *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004). For the Asserted Patents, a POSITA at the time would have had at least an advanced medical degree (e.g. a Doctor of Medicine or a Doctor of Osteopathic Medicine), at least two years of experience performing biopsy procedures, and some exposure to transperineal procedures and medical device design. Less experience may be compensated by more or different education or training, or vice versa.

IV. TERMS 1 AND 2: “PAIR OF STABILIZATION MEMBERS” AND “PAIR OF STABILIZATION BARS”

Claim Term	Advance Medical’s Construction	Corbin’s Construction
“pair of stabilization members”	Plain and Ordinary Meaning	“two stabilization bars or other structures able to resist movement of the platform or displacement member in all directions except along the length of the probe”
“pair of stabilization bars”	Plain and Ordinary Meaning	“two bars able to resist movement of the platform or displacement member in all directions except along the length of the probe”

“Claim construction is a matter of resolution of disputed meanings and technical scope, to clarify and when necessary to explain what the patentee covered by the claims, for use in the determination of infringement. **It is not an obligatory exercise in redundancy.**” *United States Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997) (emphasis added). “[A]lthough every word used in a claim has meaning, not every word requires construction.” *Orion IP, LLC v. Staples, Inc.*, 406 F. Supp. 2d 717, 738 (E.D. Tex. 2005). For many claim terms attempting to “construe” the claim language adds little clarity. *Phillips*, 415 F.3d at 1313. Where “construing” a claim term would involve simply substituting a synonym for the claim term, it is more appropriate to allow the claim language to speak for itself. Parties and their attorneys are expected to limit the terms they ultimately submit for construction to those that might be unfamiliar or confusing to the jury, or which are unclear or ambiguous in light of the specification and patent history. *See United States Surgical Corp.*, 103 F.3d at 1568.

While a court has a duty in some instances to resolve the scope of claim terms during the claim construction process, that duty only applies when a claim construction ruling would resolve

a fundamental and genuine dispute as to infringement or validity. *See O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008). Courts “are not (and should not be) required to construe *every* limitation present in a patent’s asserted claims.” *Id.* (emphasis in original). Given that “the ordinary meaning of claim language ... may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words,” (*Phillips*, 415 F.3d at 1314), Corbin must articulate an actual dispute arising from the scope of these terms as a threshold matter for claim construction to be appropriate.

Here, “pair of stabilization members” and “pair of stabilization bars” are clear on their face and there is no controversy surrounding their meaning. *Brown v. 3M*, 265 F.3d 1349, 1352 (Fed. Cir. 2001) (recognizing that some limitations “are not technical terms of art, and do not require elaborate interpretation.”) Corbin’s proposed constructions each use the claim term in its construction. “Adding unnecessary verbiage is likely to confuse the jury, and thus, frustrate one of claim construction’s chief purposes”—to provide clarity. *j2 Glob. Commc’ns, Inc. v. Vitelity Commc’ns, LLC*, No. CV 11-07904 DDP (Ex), 2013 U.S. Dist. LEXIS 132263, at *18 (C.D. Cal. Sept. 13, 2013). Here, Corbin’s proposed constructions only serve to add further, confusing claim limitations to the claim terms.

V. TERM 3: “BIOPSY NEEDLE”

Advance Medical’s Construction	Corbin’s Construction
“a needle or needle system capable of obtaining tissue or cell specimens”	“a needle system capable of obtaining tissue or cell specimens”

Here, Advance Medical largely agrees with Corbin’s proposed construction of “biopsy needle.” The dispute is limited to whether a biopsy needle is limited to a “needle system.” The specification never defines a biopsy needle as a “system.” *See generally* EX. A-C and S-T. In fact,

the Asserted Patents describe the biopsy needle as being a component of a larger system. For example, the Asserted Patents state that “a biopsy **instrument** is guided to the target or suspicious areas or object. The biopsy **instrument** may include a biopsy **needle**.” Ex. A at 12:5-7 (emphasis added). While a POSITA, viewing the specification, would understand that a biopsy **instrument** may be a system that includes multiple components, there is nothing in the specification of the Asserted Patents to indicate that a biopsy needle need be anything more than a needle. Therefore, requiring a “biopsy needle” to be a larger “system,” as required by Corbin’s construction would be inconsistent with the plain language of the term and the specification.

VI. TERM 4: “ACCESS NEEDLE”

Advance Medical’s Construction	Corbin’s Construction
“a needle providing access to the body”	“a needle providing access to the body comprising a lumen sized to receive a biopsy needle or other instrument therethrough”

The Parties agree that an “access needle” is a needle providing access to the body. However, Corbin attempts to improperly add the limitation that the access needle has “a lumen sized to receive a biopsy needle or other instrument therethrough” to all claims of the Asserted Patents. As discussed below, adding this limitation is inconsistent with the claim language and would amount to improperly importing limitations from the specification into the claims.

In considering the plain and ordinary meaning of terms, a court “begins and ends in all cases with the actual words of the claim.” *Homeland Housewares, LLC v. Whirlpool Corp.*, 865 F.3d 1372, 1375 (Fed. Cir. 2017) (quoting *Reinshaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998). Claim language is of “primary importance,” as it “provide[s] substantial guidance as to the meaning of particular claim terms.” *Phillips*, 415 F.3d at 1312, 1314. “[T]he context of the surrounding words of the claim also must be considered in determining the ordinary and customary meaning of those terms.” *ACTV, Inc. v. Walt Disney Co.*, 346 F.3d 1082,

1088 (Fed. Cir. 2003). “Differences among claims can also be a useful guide ... For example, the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim. *Phillips*, 415 F.3d at 1314-15 (citation omitted). This concept is often referred to as claim differentiation. This “presumption is especially strong when the limitation in dispute is the only meaningful difference between an independent and dependent claim, and one party is urging that the limitation in the dependent claim should be read into the independent claim.” *SunRace Roots Enter. Co. v. SRAM Corp.*, 336 F.3d 1298, 1303 (Fed. Cir. 2003). Here, the plain language of the claims, as evidenced by the concept of claim differentiation, shows that the term “access needle” does not itself include a limitation related to lumen size.

All claims of the Asserted Patents include the term “access needle.” *See generally* Exs. A-C and S-T. The independent claims of the ’681 Patent claim an apparatus configured to support an “access needle.” Ex. A at 15:10-33, 16:28-46. Only dependent claim 16 of the ’681 Patent requires that “the access needle is configured to receive a biopsy needle therethrough.” *Id.* at 16:23-24. The independent claims of the ’762 Patent claim a method of performing a prostate biopsy. Ex. B at 15:10-18:35. The ’762 Patent’s independent claim 1 recites using a biopsy guide to support an access needle. *Id.* at 15:10-27. However, the step of “inserting a biopsy needle through the access needle” is not required until dependent claim 2. *Id.* at 15:28-30. The remaining independent claims of the ’762 Patent include the limitation of claim 2. *Id.* at 16:5-18:35. All claims of the ’056 Patent recite a method of performing a prostate biopsy and recite the step of “inserting a needle through the access needle.” Ex. S at 35:32-38:28. Finally, all claims of the ’677 Patent and ’436 Patent already include the limitation that the access needle includes a “lumen sized to receive a biopsy needle therethrough.” Ex. C at 15:10-17:12 and Ex. T at 35:45-38:44.

Corbin’s claim construction would be redundant in the claims of the ’677 Patent, ’056 Patent, and ’436 Patent as their claims already recite the same claim language or imply it by including the limitation of a needle being inserted through the access needle. Additionally, Corbin’s proposed construction would violate the fundamental tenant of claim differentiation. Claim 16 of the ’681 Patent, which depends from claim 1, introduces the limitation that the “access needle is configured to receive a biopsy needle therethrough.” Ex. A at 16:23-24. The requirement that the access needle is configured to receive a biopsy needle therethrough is the only meaningful difference between dependent claim 16 and independent claim 1. Therefore, a POSITA would infer that claim 1 does not require that the access needle be configured to receive a biopsy needle therethrough. Otherwise, there would be no meaningful difference between the scope of claim 1 and claim 16 of the ’681 Patent.

Similarly, the ’762 Patent’s claim 1 does not require inserting a biopsy needle through the access needle because that limitation is introduced in dependent claim 2. Ex. B at 15:28-30. Therefore, a POSITA would infer that claim 1 does not require a biopsy needle be inserted through the access needle. Otherwise, there would be no meaningful difference between the scope of claim 1 and the scope of claim 2 of the ’762 Patent.

VII. TERM 5: “AN UPPER MOUNT AND A LOWER MOUNT CONFIGURED TO COUPLE TO EACH OTHER, THE LOWER MOUNT CONFIGURED TO ENGAGE THE TRANSRECTAL PROBE”

Advance Medical’s Construction	Corbin’s Construction
“an upper mount and a lower mount configured to: independently engage a transrectal probe; and couple to an upper mount.	No construction necessary – plain and ordinary meaning

’681 Patent claim 1 requires a “lower mount configured to engage the transrectal probe” and “configured to couple to” an upper mount. The “lower mount” was added to the claim to

distinguish the '681 Patent claims from prior art reference Onik. *See generally* Ex. F and G. Therefore, the configuration of Onik, described further below, cannot include a “lower mount” as recited in the '681 Patent claims. Advance Medical’s construction is consistent with the disclaimers made by Corbin in order to obtain the '681 Patent.

Prosecution disclaimer “preclude[s] patentees from recapturing through claim interpretation specific meanings disclaimed during prosecution.” *Omega Eng’g*, 334 F.3d at 1323. When a “patentee has unequivocally disavowed a certain meaning to obtain his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of the surrender.” *Id.* at 1324. For example, limiting the scope of a claim to overcome a prior art rejection results in “narrow[ing] the meaning of the claim consistent with the scope of the claim surrendered.” *Biogen Idec*, 713 F.3d at 1095. Such disclaimer can occur through amendment or argument. *Standard Oil*, 774 F.2d at 452-453.

During prosecution of the '681 Patent, the claims were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,494,039 to Onik (“Onik”). Ex. D (October 6 Office Action and Response) at 8, ¶ 21. Onik discloses a “biopsy needle insertion guide and method of use with an ultrasound probe in medical procedures to accurately position biopsy needles in internal tissues”:

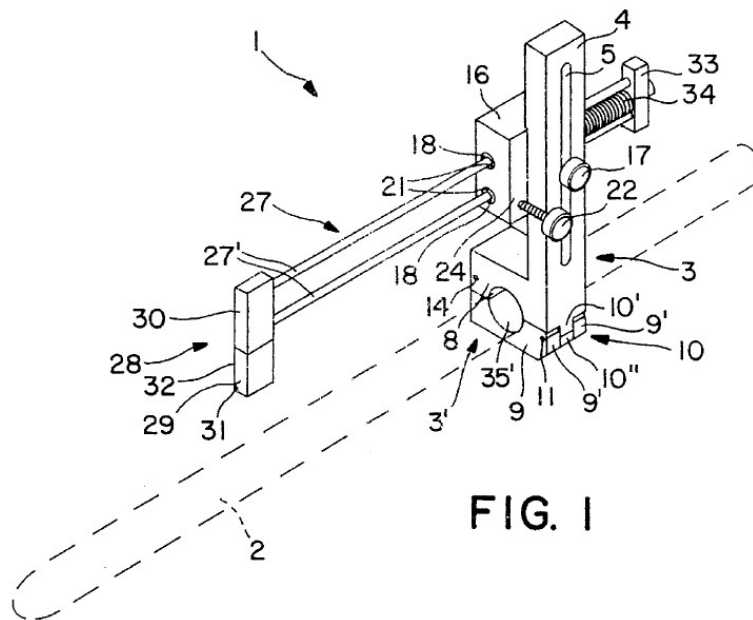


FIG. 1

Ex. E at 1, 2. As shown in Figure 1 of Onik, the “[i]nsertion guide 1 includes a main body portion 3 which is made up of an elongated anterior-posterior adjustment guide 4 extending upward from a first clamp body 8.” *Id.* at 3:37-40. The “first clamp body 8 forms the upper portion of a clamp 3’ whereby insertion guide 1 is removably mountable to ultrasound probe 2. A second clamp body 9 is hingably connected to first clamp body 8 and forms the lower portion of clamp 3’.” *Id.* at 40-44. Figure 3 of Onik shows a preferred embodiment of the clamp 3’:

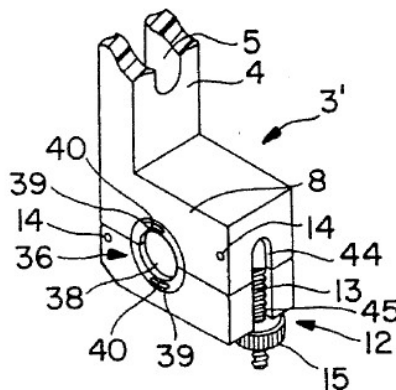


FIG. 3

Id. at FIG. 3. The clamp 3' includes "a pivoting screw post 12 pivotally attached to first clamp body 8 which allows the screw post to pivot through 90°." *Id.* at 4:22-24. The second clamp body 9 "is provided with a slot 45 which lines up with recess 44 when the clamp 3' is closed." *Id.* at 4:24-26.

During examination of the '681 Patent, its claims were rejected as anticipated by Onik, including the lower mount. Ex. G (April 2 Office Action and Response) at 3-4, ¶ 4. After the rejection in view of Onik, the '681 Patent applicant conducted an interview with the Examiner where the "Onik reference was discussed" and "Examiner suggested amending claims to **clarify lower mount to overcome the cited reference.**" Ex. F (May 4 Interview Summary) at 1 (emphasis added). After that interview, the '681 Patent applicant modified the language of its claim as shown in underline and strikethroughs below:

An apparatus configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure ..., the apparatus comprising:

an upper mount and a lower mount configured to couple to each other, the lower mount configured to engage the transrectal probe and secure the upper mount relative to ~~configured to be secured to~~ the transrectal probe...

Ex. G (April 2 Office Action and Response) at 9, ¶ 21. This language was added to distinguish the upper mount and lower mount of Onik from the upper and lower mount claimed in the '681 Patent. Therefore, the '681 Patent disavowed the claim scope of a lower mount and upper mount as described in Onik. Corbin cannot explain how the plain and ordinary meaning of this claim term would exclude the configuration of Onik, as required.

But Advance Medical's proposed construction is consistent with the plain language of the claim and the prosecution history which both emphasize the fact that the lower mount is configured

to engage the transrectal probe directly and not through an intermediate structure such as the upper mount. This is also consistent with the use of a lower mount in the specification which shows and describes the lower mount (104) directly contacting the transrectal probe (103):

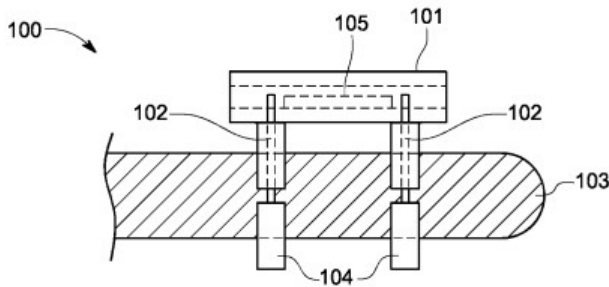


FIG. 1

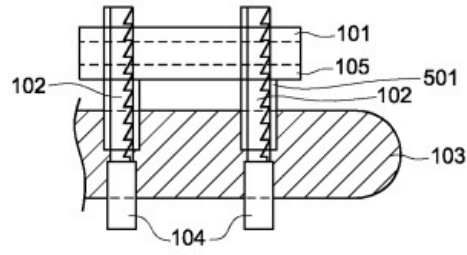


FIG. 5

Ex. A ('681 Patent): FIGS. 2 and 5, 2:23-32; 4:13-15; 5:16-23; 5:40-46; 5:48-50; 6:48-7:14; 8:38-9:40; 9:54-65; 10:4-18; 12:27-42; 14:30-46; 14:56-67; 15:10-32; 15:45-47; 16:18-21. Advance Medical's construction clarifying that the lower mount is configured to independently engage the transrectal probe is consistent with the applicant and Examiner's understanding of the claim language as evidenced by the claim language, specification, and prosecution history.

VIII. TERMS 6 AND 7: “PLATFORM CONFIGURED TO SLIDE (ON THE [A] PAIR OF STABILIZATION BARS [MEMBERS], RELATIVE TO THE BASE, RELATIVE TO THE PAIR OF STABILIZATION MEMBERS, WITHIN THE CHANNEL)” AND “SO AS TO DISPLACE THE ACCESS NEEDLE ALONG THE AT LEAST A PORTION OF THE LENGTH”

Claim Term	Advance Medical’s Construction	Corbin’s Construction
platform configured to slide (on the [a] pair of stabilization bars [members], relative to the base, relative to the pair of stabilization members, within the channel)	“the platform configured to slide (on the pair of stabilization bars [members], relative to the base, relative to the pair of stabilization members, within the channel) while the access needle is engaged with the platform.”	No construction necessary – plain and ordinary meaning
so as to displace the access needle along the at least a portion of the length	“so as to displace the entire platform supporting the access needle between the front portion and the back portion of the stabilization bars”	No construction necessary – plain and ordinary meaning

As stated above, prosecution history disclaimer prevents a patentee from recapturing claim scope that it disavowed in order to obtain a patent. *See supra* Section VII; *see also, Omega Eng’g*, 334 F.3d at 1323. Prosecution disclaimer is not limited to the prosecution of the specific patent asserted – disclaimer may arise from disavowals made during the prosecution of related applications. *See Advanced Cardiovascular Sys., Inc. v. Medtronic, Inc.*, 265 F.3d 1294, 1305 (Fed. Cir. 1999) (“The prosecution history of a related patent can be relevant if, for example, it addresses a limitation in common with the patent in suit.”); *Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 980 (Fed. Cir. 1999) (“When multiple patents derive from the same initial application, the prosecution history regarding a claim limitation in any patent that has issued applies with equal force to subsequently issued patents that contain the same claim limitation.”).

Courts can also consider statements made before a foreign patent office when construing claims if they are relevant and not related to unique aspects of foreign patent law. *Apple Inc. v.*

Motorola, Inc., 757 F.3d 1286, 1312 (Fed. Cir. 2014); *see also Gillette Co. v. Energizer Holdings, Inc.*, 405 F.3d 1367, 1374 (Fed. Cir. 2005) (considering the patentee’s statements before the European Patent Office (“EPO”) and concluding that a “blatant admission by this same defendant before the EPO clearly support[ed]” the court’s construction).

No claim terms have been more heavily scrutinized in prosecution of the Asserted Patents and their related applications than the “platform configured to slide” term and the related “so as to displace the access needle along the at least a portion of the length.” Corbin has been consistent with its prosecution arguments on the “platform configured to slide” term and Advanced Medical’s proposed construction is consistent with those arguments.

In the ’681 Patent application, this claim language was rejected in view of Onik. *See*, Ex. D (October 6 Office Action and Response) at 3-4. The ’681 Patent applicant distinguished its claim language from Onik specifically arguing that Onik did not describe the limitations of a “platform configured to support the access needle and the platform configured to slide on the pair of stabilization bars along at least a portion of the length so as to displace the access needle along at least a portion of the length.” *Id.* at 11. The ’681 Patent applicant used two features of the Onik reference to distinguish it from this claim language.

First, the ’681 Patent applicant argued that Onik did not disclose this claim language because of the timing of when Onik’s “platform” moved relative to when the access needle was inserted into the platform. The ’681 Patent specifically discloses that its sliding platform is configured to move to allow “a user, such a medical practitioner or patient caregiver, to place the access needle along a sagittal transducer plane at optimal positions for obtaining prostate biopsies.” Ex. A (’681 Patent) at 4:24-46. The ’681 Patent applicant distinguished Onik by arguing that “Onik uses a biopsy needle, which is inserted through the notch 31 of the needle holder assembly 28 **once**

the guide 1 is set in position against the patient's body." Ex. D (October 6 Office Action and Response) at 12 (emphasis in original). While Onik disclosed that its "slide block" was "[s]lidably associated with anterior-posterior adjustment guide 4," the '681 Patent applicant argued that merely being capable of sliding is not what was meant by its claimed "platform configured to slide." Rather, the platform needed to slide while the access needle was engaged with the platform as described in the '681 Patent.

This argument is consistent with arguments made in the corresponding EPO patent application. *See* Ex. P at 8-10. There, the applicant was arguing that similar claims to the '681 Patent were novel over Onik, referred to as D1. *See id.*; *see also* Ex. R at 1. In the letter to the EPO, the applicant argued that its claims were novel over Onik "because [Onik] does not describe a sliding platform that is configured to slide from a back to a front of first and second stabilization bars." Ex. P at 8-9. There, Corbin emphasized that Onik's "guide is affixed to an ultrasound probe and advanced until the needle holder assembly 28 engages and bears firmly against the patient's perineum" and then a biopsy needle is "placed in the notch 31, and the surgeon advances the needle into the patient with the guide maintained in position." *Id.* Like in the prosecution of the '681 Patent, Corbin emphasized that a distinguishing feature between Onik and its claims was the fact that Onik's needle holder assembly moves prior to insertion of the biopsy needle whereas the claimed "platform" slides with the access needle already inserted.

These same arguments were also advanced in related application U.S. App. No. 16,377,754 which became U.S. Pat. No. 10,743,911. *See* Ex. H (January 20 Office Action and Response); *see also* Exhibit I. In that application, the applicant similarly argued that "Onik does not disclose that the needle is inserted into the patient **by sliding the displacement member of the biopsy guide relative to the guide member** as required by the claims" because "Onik describes advancing the

needle into the patient **after** the needle holder assembly is in position against the patient's perineum." Ex. H at 11 (January 20 Office Action and Response) (emphasis in original).

The prosecution history of the '681 Patent and related application is rife with instances where the patentee distinguished its claims over the prior art by arguing that its platform is configured to slide when the access needle is engaged with the platform whereas the prior art slides the platform prior to insertion of the access needle. Advance Medical's proposed construction is consistent with the distinction that the patent applicant made in order to receive its patent. Allowing Corbin to recapture the claim scope of a platform or needle holder that slides prior to insertion of the needle would contradict the principle and purpose of prosecution disclaimer.

As stated above, the disavowals made during prosecution of the '681 Patent and related patents are applicable to its continuations including the '762 Patent and the '677 Patent. In addition to being informed by the prosecution history of the '681 Patent, Advance Medical's proposed construction is also consistent with the claim language of the '762 and '677 Patent. As explained above, claim language is of "primary importance," as it "provide[s] substantial guidance as to the meaning of particular claim terms." *Phillips*, 413 F.3d at 1314. The claim language of the '762 and '677 Patents both indicate that the applicant understood "a platform that is configured to slide" is one that slides after the access needle engages it. For example, claim 18 of the '762 patent claims "wherein inserting the access needle into the perineal access site comprises sliding the access needle and platform along a portion of a length of the pair of stabilization members." Ex. B at 16:35-38.

In the '677 Patent, each independent claim includes a dependent claim that recites that "when the biopsy guide is coupled to the transrectal transducer and when the access needle is supported by one of the plurality of needle guides, movement of the access needle is fixed relative

to a movement of the transrectal transducer.” Ex. C at 15:35-39, 16:18-22, 16:63-67. The specification explains that it is the movement of the access needle along the stabilization bars, e.g., the sliding platform, that allows the access needle to remain in a fixed position relative to the movement of the transducer. *Id.* at 4:26-48. Again, it is understood that the platform is configured to slide after it is engaged by the access needle.

The second way that the ’681 Patent applicant distinguished its claims from the prior art was by arguing that Onik’s description of “the guide block of the needle holder assembly [] ‘fixed at the proximal end of shaft 27’” was inconsistent with this claim language. Ex. D at 12 (October 6 Office Action and Response). The applicant argued that this fact and the fact that “Onik uses a biopsy needle, which is inserted through the notch 31 of the needle holder assembly 28 **once the guide 1 is set in position against the patient’s body**” means that “the [Onik] guide does not displace a biopsy needle, an access needle, or any other type of needle for that matter.” *Id.* (emphasis in original)) Advance Medical’s proposed construction that “displac[ing] the access needle” should be construed as so as “to displace the entire platform supporting the access needle between the front portion and the back portion of the stabilization bars” is consistent with the argument applicant made during prosecution.

IX. TERM 8: “THE ACCESS NEEDLE BEING CENTRALLY POSITIONED BETWEEN THE PAIR OF STABILIZATION MEMBERS WHEN THE ACCESS NEEDLE IS ENGAGED WITH THE PLATFORM”

Advance Medical’s Construction	Corbin’s Construction
“the access needle being centrally positioned in the space separating the pair of stabilization members when the access needle is engaged with the platform”	No construction necessary – plain and ordinary meaning

As described above, the ’681 Patent applicant distinguished Onik from the “sliding” and “displacing” claim language by arguing that Onik describing “the guide block of the needle holder

assembly [] ‘fixed at the proximal end of shaft 27’” was inconsistent with this claim language. Ex. D (October 6 Office Action and Response) at 12; *see supra* Section VII-VIII. The ’681 Patent applicant applied the same argument to distinguish Onik from the platform “support[ing] the access needle in a central position between the pair of stabilization bars.” Ex. D (October 6 Office Action and Response) at 13. As stated above, these disavowals during prosecution of the ’681 Patent are applicable to similar language of the ’762 Patent. *See supra* Sections VII-VIII.

Additionally, Advance Medical’s construction is consistent with the claim language and specification. The relevant definition of “between” is “in the time, space, or interval that separates.” *See* Ex. J at 1. Advance Medical has applied the relevant portions of the definition of “between” verbatim to its proposed construction.

This construction is also consistent with the use of the term in the specification. When discussing Figure 3, reproduced below, the ’762 Patent states that the hole 102 “is showed (sic) in a central midline position.” Ex. B at 9:51-54. What the ’762 Patent specification defines as the “central” position is not laterally ahead of or behind the stabilization bars 101, but directly in between them. A POSITA reviewing the “centrally positioned” claim term would review this portion of the ’762 Patent and arrive at an understanding consistent with the construction proposed by Advance Medical.

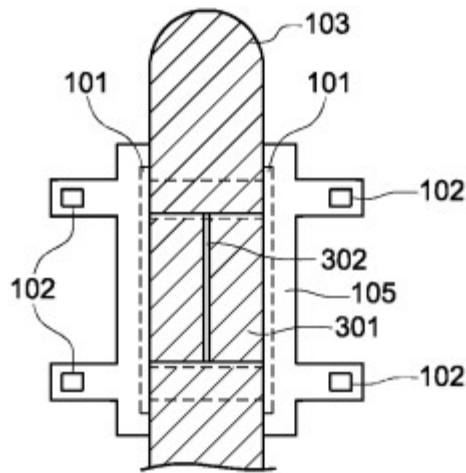


FIG. 3

X. TERM 9: “LUMEN SIZED TO RECEIVE A BIOPSY NEEDLE THERE THROUGH”

Advance Medical’s Construction	Corbin’s Construction
Indefinite due to ambiguity/lack of written support	No construction necessary – plain and ordinary meaning

Independent claims 1, 13, and 22 of the ’677 Patent claim “an access needle comprising a lumen sized to receive a biopsy needle there through.” Ex. C at 15:10-27, 15:59-16:9. 16:34-55. But nothing in the specification defines either the size of a biopsy needle or the size a lumen needs to be to receive said biopsy needle. A POSITA cannot determine the metes and bounds of the ’677 Patent in view of this claim language and the lack of description in the specification.

“Whether a claim complies with the definiteness requirement of 35 U.S.C. § 112 is a matter of claim construction.” *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1311 (Fed. Cir. 2012). The indefiniteness inquiry, like that of claim construction, is a question of law. *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306, 1319 (Fed Cir. 2008). 35 U.S.C. § 112(b) sets forth the definiteness requirement and states that a patent specification shall “conclude with one or more claims

particularly pointing out and distinctly claiming the subject matter which the applicant regards as [the] invention.” A patent is invalid “if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *See Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014).

“The primary purpose of the definiteness requirement is to ensure that the claims are written in such a way that they give notice to the public of the extent of the legal protection afforded by the patent so that interested members of the public, *e.g.* competitors of the patent owner, can determine whether or not they infringe.” *All Dental Prodx, LLC v. Advantage Dental Prods., Inc.*, 309 F.3d 774, 779-80 (Fed. Cir. 2002) (citing *Warner-Jenkinson Co. v. Hilton-Davis Chem. Co.*, 520 U.S. 17, 28-29 (1997)). Put another way, “[a] patent holder should know what he owns, and the public should know what he does not.” *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 731 (2002).

A patent claim is indefinite if, “viewed in light of the specification and prosecution history, [it fails to] inform those skilled in the art about the scope of the invention with reasonable certainty.” *Nautilus*, 134 S. Ct. at 2129. A claim may be indefinite if the patent does not convey with reasonable certainty how to measure a claimed feature. *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 798 F.3d 1335, 1341 (Fed. Cir. 2015). Here, a POSITA cannot determine the size of the lumen claimed in the ’677 Patent even when viewing the specification and the prosecution history.

The ’677 Patent does not define the size of the lumen of the access needle. The term “lumen” is only used three times in the ’677 Patent specification which states that “[a] biopsy gun or any other instrument may be attached to the needle for inserting or extruding any substance

through the lumen of the access needle.” Ex. C at 7:55-58 and 13:29-35 (’677 Patent). The specification goes on to state that “[i]n another embodiment, a biopsy gun may be an 18-gauge biopsy gun, or any other size that is capable of being coaxially inserted through the lumen of the access needle.” *Id.* at 13:42-44. While, in this embodiment specifically involving a biopsy **gun**, the lumen can be presumed to be larger than “18-gauge,” no explanation is given as to how much larger a lumen needs to be such that an 18-gauge device is capable of being coaxially inserted through the lumen. There is no description in the specification for the acceptable size of a lumen in relation to the thing that is being inserted through it.

The specification also does not define the size of a “biopsy needle.” As described above, the specification discusses an embodiment using an 18-gauge biopsy **gun**, however, the ’677 Patent explains that a biopsy gun is an “instrument that may be **attached to the needle** for inserting or extruding any substance through the lumen of the access needle.” *Id.* at 7:55-58 and 13:29-35. The size of a biopsy **gun** does not define the size or range of sizes of a **biopsy needle**.

While the specification gives specific sizes for spinal needles (*id.* at 6:10-47) and access needles (*id.*), it never mentions the size of a biopsy needle. Therefore, a POSITA viewing the ’677 Patent specification would not be able to associate a specific size or ranges of sizes with the term “biopsy needle”

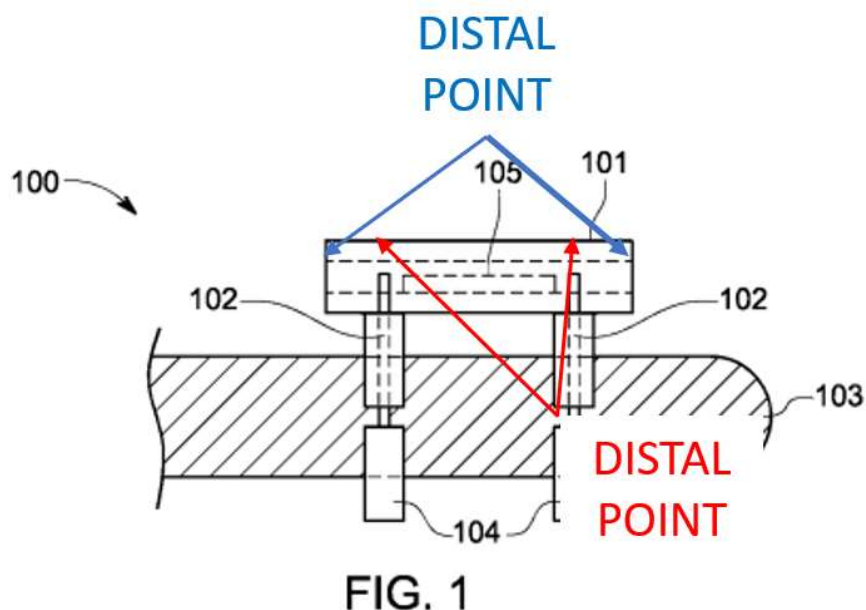
“Because claims delineate the patentee’s right to exclude, the patent statute requires that the scope of the claims be sufficiently definite to inform the public of the bounds of the protected invention, *i.e.*, what subject matter is covered by the exclusive rights of the patent.” *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1249 (Fed. Cir. 2008). Here, a POSITA viewing the ’677 patent knows neither the size of “biopsy needle” nor how much larger the lumen needs to be to be “sized to receive a biopsy needle there through.” Therefore, this claim term does not give

notice to the public of the sizes of lumen that are covered by these claims, and they are indefinite.

XI. TERM 10: “DISTAL POINT OF THE PAIR OF STABILIZATION MEMBERS IS OFFSET FROM (A FASTENER OF THE BASE PORTION, THE MOUNT OF THE BASE)”

Advance Medical’s Construction	Corbin’s Construction
Indefinite due to ambiguity/lack of written support	No construction necessary – plain and ordinary meaning

A claim term is indefinite when it “is open to multiple interpretations reflecting markedly different understandings of the patent’s scope.” *Nautilus*, 134 S. Ct. at 2131. Here, it is impossible for a POSITA to determine what is meant by the distal point of the pair of stabilization members is offset from the fastener or mount of the base portion. Looking at the plain language of the claim, distal can be defined as “situated away from the point of origin or attachment” (Ex. M at 1) or “situated away from the point of attachment or origin or a central point” (Ex. L at 1). The “distal point” on the stabilization bars/members of the ’677 Patent changes depending on which definition is used. For example, the points shown in blue arrows in annotated Figure 1 below are arguably situated aware from the point of origin or central point. However, the points shown in red are situated away from the point of attachment or origin, depending on your definition of origin.



Ex. C, Fig. 1 (annotated). The '677 Patent's failure to define the distal point creates ambiguity and confusion.

Consulting the specification does not resolve this ambiguity. The '677 Patent states that “the off-set 501 from the distal point of the stabilization bar 105 to the fasteners 102 may be 5 mm.” Ex. C at 9:66-10:1. Because element number 105 is the element number for the upper mount it is placed on different locations of the upper mount throughout the figures. *See id.*, FIGS. 1-26. There is no visual or written description of what constitutes the “distal end” of the stabilization bar.

While the '677 Patent identifies an “off-set” as element number 501, element 501 is indicated at different points on different figures of the '677 Patent.

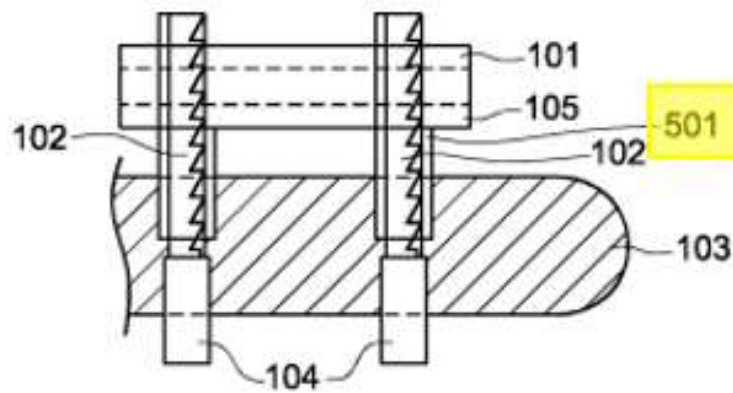


FIG. 5

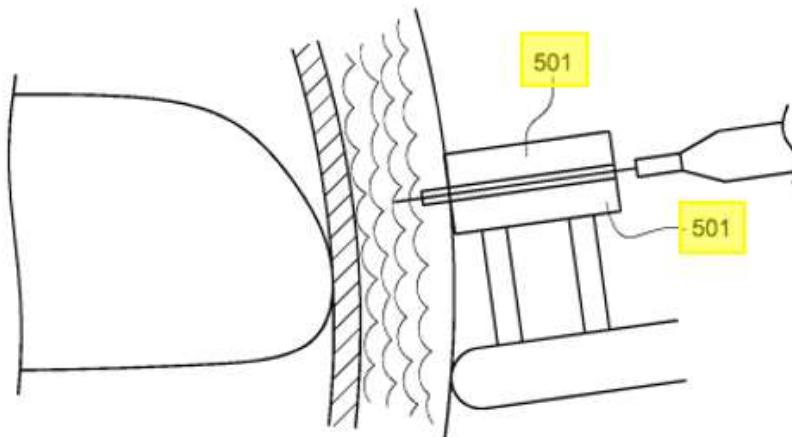


FIG. 20

Id. FIGS. 5 and 20. In addition to being inconsistent, nothing that the '677 Patent points to with its 501 element number meets the common definitions of offset. *See* Exs. N and O. Therefore, a POSITA using the common meaning of these terms and consulting the specification would find it impossible to resolve the ambiguity in this claim term. Therefore, the claim term is indefinite.

XII. TERM 11: “COUPLING [SECURING] THE ACCESS NEEDLE TO THE ONE OF THE PLURALITY OF NEEDLE RECEIVING PORTS OF THE DISPLACEMENT MEMBER OF THE TRANSPERINEAL BIOPSY GUIDE SUCH THAT A POSITION AND ANGLE OF THE ACCESS NEEDLE RELATIVE TO THE DISPLACEMENT MEMBER IS RETAINED [MAINTAINED]”

Advance Medical’s Construction	Corbin’s Construction
“inserting the access needle into one of the plurality of needle receiving ports, wherein the needle receiving port is configured to support the access needle at an angle and position relative to the displacement member”	No construction necessary – plain and ordinary meaning

The ’436 Patent’s independent claim 1 recites “coupling the access needle to the one of the plurality of needle receiving ports ... such that a position and angle of the access needle ... is retained.” Ex. T at 36:1-5. Independent claims 13 and 27 of the ’436 Patent similarly recite “securing” elements. *Id.*, 36:59-61, 38:3-8. Advance Medical’s construction is appropriate as it clarifies that neither “coupling” nor “securing” require locking the access needle in place to completely prevent any movement of the access needle.

Beginning with the plain claim language, the claims only require coupling or securing to retain/maintain “[a] position and angle”—not necessarily locking the access needle in all degrees of freedom. As discussed below, dependent claims, such as ’436 Patent claims 25 and 30 recite further limitations on the movement of the access needle. *See infra* Sections XIII and XIV. Therefore, a POSITA using the principle of claim differentiation would understand that the ’436 Patent independent claims 1, 13, and 27 are less restrictive. Accordingly, the “coupling” and “securing” elements of the ’436 Patent should not require locking the access needle in place, but merely maintaining the stability and directionality of the access needle.

XIII. TERM 12: “WHEREIN SECURING THE ACCESS NEEDLE TO THE ONE OF A PLURALITY OF NEEDLE RECEIVING PORTS OF THE DISPLACEMENT MEMBER INCLUDES INSERTING A STRUCTURE THAT IS ENGAGED WITH THE TUBULAR SHAFT OF THE ACCESS NEEDLE INTO THE ONE OF A PLURALITY OF NEEDLE RECEIVING PORTS”

Advance Medical’s Construction	Corbin’s Construction
“a portion of the access needle other than the tubular shaft is inserted into a corresponding feature within one of the plurality of needle receiving ports such that the access needle remains coupled within the displacement member”	No construction necessary – plain and ordinary meaning

’436 Patent dependent claim 25 recites that “wherein securing the access needle ... includes inserting a structure that is engaged with the tubular shaft of the access needle into the one of a plurality of needle receiving ports.” Ex. T at 38:14-19. This claim language requires two things. *First*, the claim language requires that a structure that is engaged with the tubular shaft of the access needle is inserted into one of a plurality of needle receiving ports. *Second*, the claim language also requires that this engagement is in furtherance of “securing the access needle to one of a plurality of needle receiving ports.” Advance Medical’s proposed construction gives meanings to both of these requirements in accordance with the claim language and specification.

The plain language of ’436 Patent claim 25 is ambiguous in two respects. First, it is unclear from the plain language whether “a structure that is engaged with the tubular shaft of the access needle” is a portion of the access needle, or some other structure. Second, it is unclear how inserting said structure into the one of the plurality of needle receiving ports acts to secure the access needle to said port. But “[i]f there is ambiguity as to the ordinary and customary meaning, it is proper for the Court to look to the specification in order to determine the ‘true intent and meaning of the language in the claims.’” *Stemcells, Inc. v. Neuralstem, Inc.*, No. 08:06-CV-1877-AW, 2011 U.S. Dist. LEXIS 90293, at *9 (D. Md. Aug. 11, 2011), quoting *Bates v. Coe*, 98 U.S.

31 (1878). The '436 Patent's specification resolves the ambiguity in claim 25, consistent with Advance Medical's proposed construction.

Only one passage of the '436 Patent describes inserting a structure into a needle receiving port to secure the access needle:

As seen in FIG. 35D, the access needle 2712 is coupled with the displacement member 2710. More particularly, the bevel 2840 and shaft 2842 of the access needle 2712 are extended through the proximal side 2800 of a particular opening 2770 of a needle receiving port 2768 until the hub 2846 of the access needle 2712 engages with the proximal side 2800 of the port 2768. The ridges 2848 of the access needle 2712 may engage with corresponding features within the opening 2770 of the port 2768 such that the access needle remains coupled with the displacement member 2710. The access needle 2712 may be restrained from rotating by the ridges 2848. In certain embodiments, the access needle 2712 may be secured to the displacement member by, for example, a threaded features on the hub 2846 and opening 2770 of the ports 2768 such that the needle 2712 and the displacement member 2710 may be threadably engaged and disengaged with each other.

Ex. T at 25:58-26:8. This portion of the specification resolves both ambiguities. First, it confirms that the structure engaged with the tubular shaft of the access needle is a portion of the access needle—its hub 2846. Second, this passage explains how engaging the hub of the access needle with the port acts to secure the access needle—portions of the access needle hub, such as ridges 2848, engage with corresponding features on the port. In addition to the ridges embodiment, the specification also describes the hub 2846 and port 2768 as having corresponding threaded features.

This case is similar to the claim construction issue in *Beam Laser Systems, Inc. v. Cox Communications, Inc.*, 144 F. Supp. 2d 475, 489-91 (E.D. Va. 2001). There, the term at issue involved a switching system that was “remotely controlled” by “switch commands.” The patentee

objected to the construction which required that the remote control be in “real time” arguing that, while this was a feature of the preferred embodiments, it should not be included in the claims. *Id.* at 490. But that Court found it “must look outside the claims covering the switching system to understand how the remote control, which is an express limitation in the asserted claims is effected, because the asserted claims are incomplete in this regard.” *Id.* at 490-91. That court looked to the specification to fill in the holes in the claims, holding that it was “not importing limitations from the specification into the claims,” but simply “looking to the specifications to understand a limitation implicit in the asserted claims.” *Id.* at 491. Advance Medical’s construction does the same.

Advance Medical’s construction resolves the ambiguities in ’436 Patent claim 25 while broadly covering at least all of the embodiments described in the specification. Therefore, Advance Medical’s proposed construction is necessary and proper.

XIV. TERM 13: “WHEREIN SECURING THE ACCESS NEEDLE TO THE ONE OF A PLURALITY OF NEEDLE RECEIVING PORTS OF THE DISPLACEMENT MEMBER RESTRICTS ROTATION OF THE ACCESS NEEDLE RELATIVE TO THE DISPLACEMENT MEMBER”

Advance Medical’s Construction	Corbin’s Construction
“wherein a portion of the access needle engages with corresponding features of the one of the plurality of needle receiving ports of the displacement member such that the access needle is restrained from rotating”	No construction necessary – plain and ordinary meaning

’436 Patent dependent claim 30 recites that “ wherein securing the access needle to one of the plurality of needle receiving ports ... restricts rotation of the access needle.” Like ’436 Patent claim 25, discussed above (*see supra* Section XIII), claim 30 is ambiguous because it is unclear how securing the access needle to one of the ports restricts its rotation. The ’436 Patent’s specification resolves the ambiguity in claim 30, consistent with Advance Medical’s proposed

construction.

The '436 Patent passage reproduced in Section XIII above discusses how the access hub's ridges engaging with corresponding features of the port causes the access needle to be "restrained from rotating." *See id.*, *see also* Ex. T at 25:58-26:3. The '436 Patent specification also describes how, "[a]s seen in FIG. 32C, a proximal side 2800 of the needle receiving ports 2768 includes keyed features to lockingly engage the access needle 2712 such that it does not rotate once it is coupled with the port 2768." Ex. T at 23:64-67. Thus, a POSITA would understand that the rotation of the access needle is restricted when the access needle is secured to the needle receiving ports because of the engagement of corresponding features on the access needle and the port.

Advance Medical's construction resolves the ambiguities in '436 Patent claim 30 while broadly covering at least all of the embodiments described in the specification. Therefore, Advance Medical's proposed construction is necessary and proper.

Dated: July 31, 2023

Respectfully submitted,

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Attorneys for Plaintiff
Advance Medical Designs, Inc.

CERTIFICATE OF SERVICE

I hereby certify that on July 31, 2023, I filed a true and correct copy of the foregoing document with the CM/ECF filing system of this Court, which will serve an electronic copy to all attorneys of record.

/s/ Ryan P. Gentes

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Exhibit S

(12) **United States Patent
Allaway**(10) **Patent No.:** **US 11,446,056 B2**(45) **Date of Patent:** ***Sep. 20, 2022**(54) **TRANSPERINEAL PROSTATE BIOPSY
DEVICE, SYSTEMS, AND METHODS OF USE**(71) Applicant: **Corbin Clinical Resources, LLC**,
Cumberland, MD (US)(72) Inventor: **Matthew J. Allaway**, Cumberland, MD
(US)(73) Assignee: **Corbin Clinical Resources, LLC**,
Cumberland, MD (US)(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.This patent is subject to a terminal dis-
claimer.(21) Appl. No.: **17/494,962**(22) Filed: **Oct. 6, 2021**(65) **Prior Publication Data**

US 2022/0022996 A1 Jan. 27, 2022

Related U.S. Application Data(63) Continuation-in-part of application No. 17/314,845,
filed on May 7, 2021, now Pat. No. 11,246,677, and
(Continued)(51) **Int. Cl.**
A61B 90/00 (2016.01)
A61B 17/34 (2006.01)
(Continued)(52) **U.S. Cl.**
CPC **A61B 17/3403** (2013.01); **A61B 8/0841**
(2013.01); **A61B 8/12** (2013.01);
(Continued)(58) **Field of Classification Search**CPC A61B 90/39; A61B 8/0841; A61B 8/12;
A61B 10/0241; A61B 10/04;
(Continued)(56) **References Cited**

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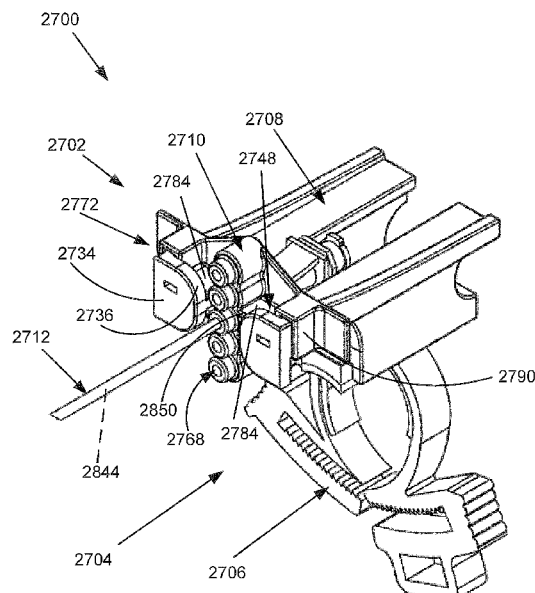
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Primary Examiner — Sanjay Cattungal(74) *Attorney, Agent, or Firm* — Polsinelli PC(57) **ABSTRACT**

A method of performing a transperineal biopsy procedure includes imaging the prostate with a transrectal ultrasound probe with a transperineal biopsy guide coupled to the probe. The transperineal biopsy guide including a mount coupled to the probe, a guide member coupled to the mount and including a rail receiving channel extending a first length, and a displacement member including a rail member extending a second length between a proximal end and a distal end, and a vertically extending member coupled to the distal end of the rail member. The vertically extending member including a plurality of needle receiving ports. The method further includes sliding the rail member within the rail receiving channel. The method further includes inserting an access needle into the perineal access site of the patient and inserting a needle through the access needle and into a first location of the prostate of the patient.

30 Claims, 31 Drawing Sheets

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Related U.S. Application Data

a continuation-in-part of application No. 16/991,150, filed on Aug. 12, 2020, said application No. 17/314,845 is a continuation of application No. 16/115,180, filed on Aug. 28, 2018, now Pat. No. 11,096,762, said application No. 16/991,150 is a continuation of application No. 14/874,104, filed on Oct. 2, 2015, now Pat. No. 10,743,909, said application No. 16/115,180 is a continuation of application No. 14/677,286, filed on Apr. 2, 2015, now Pat. No. 10,064,681, said application No. 14/874,104 is a continuation-in-part of application No. 14/677,286, filed on Apr. 2, 2015, now Pat. No. 10,064,681.

- (60) Provisional application No. 61/974,826, filed on Apr. 3, 2014.

(51) Int. Cl.

A61B 10/02 (2006.01)
A61B 8/08 (2006.01)
A61B 8/12 (2006.01)
A61B 10/04 (2006.01)
A61B 18/02 (2006.01)
A61B 18/12 (2006.01)
A61B 17/00 (2006.01)
A61B 18/00 (2006.01)

(52) U.S. Cl.

CPC **A61B 10/241** (2013.01); **A61B 10/04** (2013.01); **A61B 90/39** (2016.02); **A61B 18/02** (2013.01); **A61B 18/12** (2013.01); **A61B 2010/045** (2013.01); **A61B 2017/00274** (2013.01); **A61B 2017/00477** (2013.01); **A61B 2017/3405** (2013.01); **A61B 2017/3411** (2013.01); **A61B 2017/3413** (2013.01); **A61B 2018/00547** (2013.01); **A61B 2090/3925** (2016.02); **A61B 2090/3933** (2016.02); **A61B 2090/3954** (2016.02); **A61B 2090/3966** (2016.02)

(58) Field of Classification Search

CPC **A61B 17/3403**; **A61B 18/02**; **A61B 18/12**; **A61B 2010/045**; **A61B 2017/00274**; **A61B 2017/00477**; **A61B 2017/3413**; **A61B 2018/00547**

See application file for complete search history.

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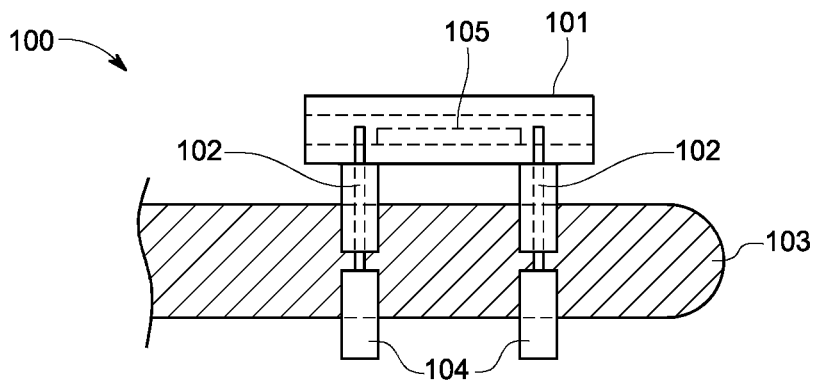


FIG. 1

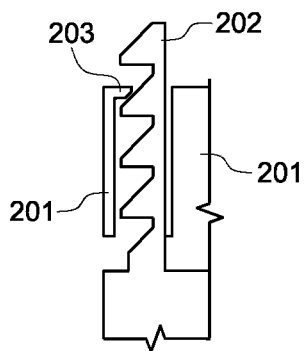


FIG. 2A

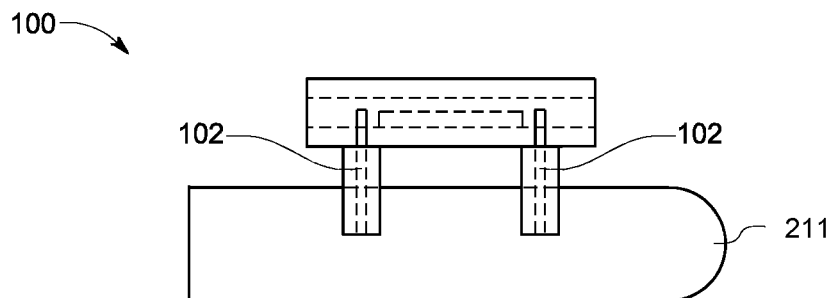


FIG. 2B

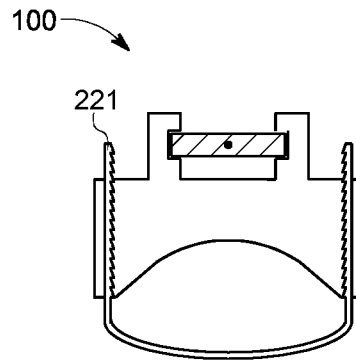


FIG. 2C

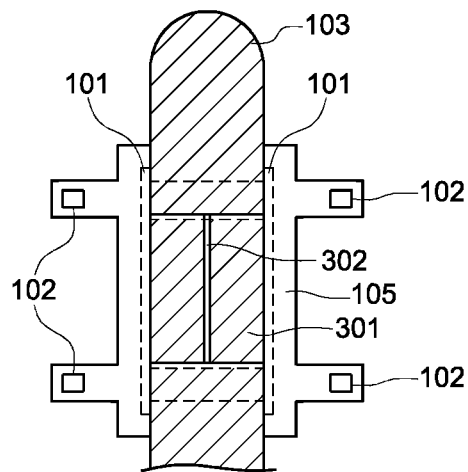


FIG. 3

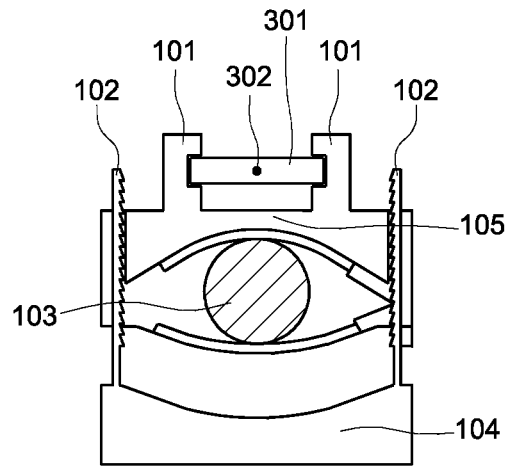


FIG. 4

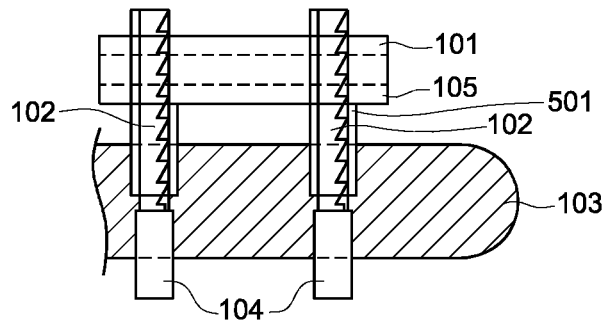


FIG. 5

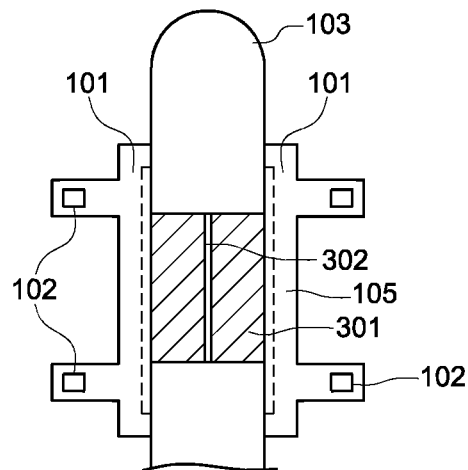


FIG. 6

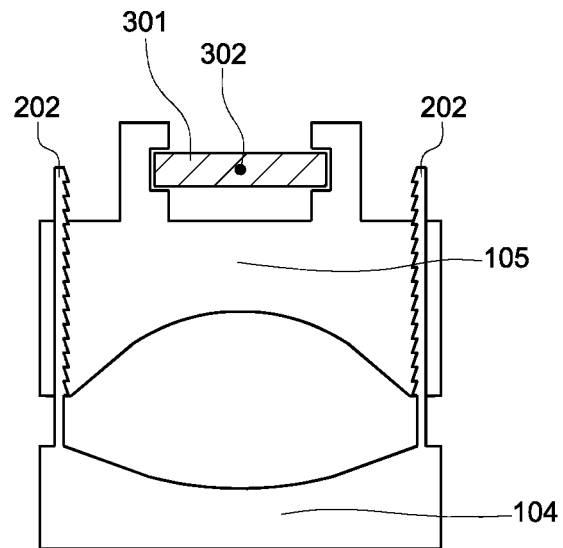


FIG. 7

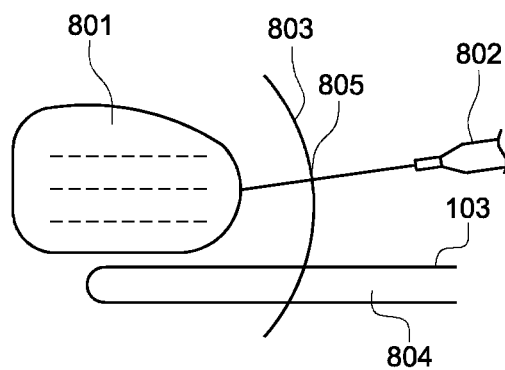


FIG. 8

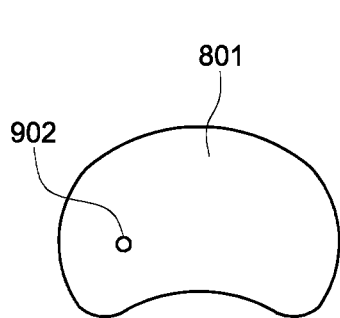


FIG. 9

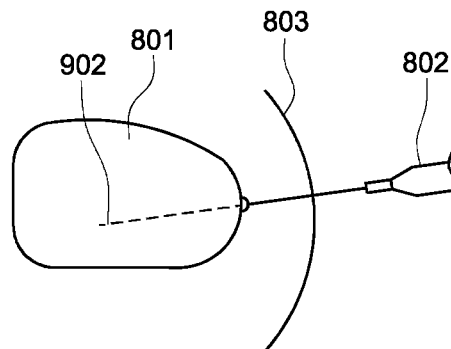


FIG. 10

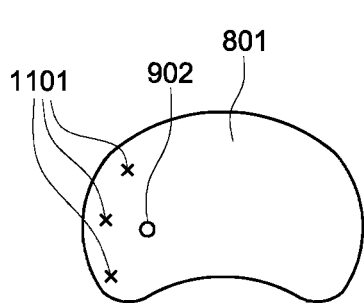


FIG. 11

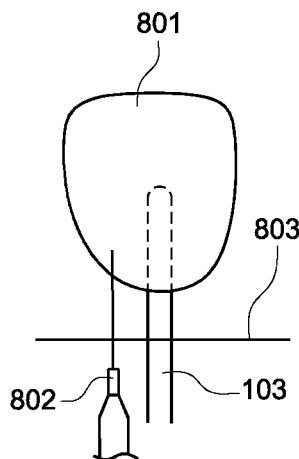


FIG. 12

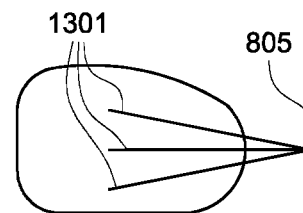


FIG. 13

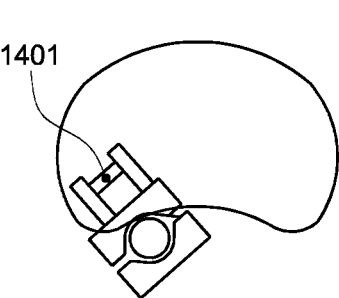


FIG. 14

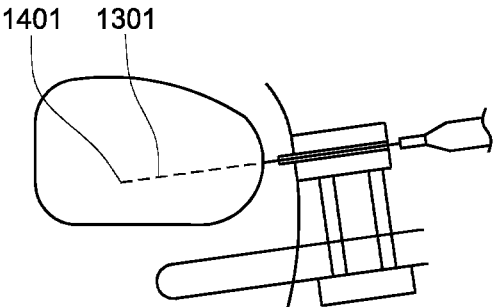


FIG. 15

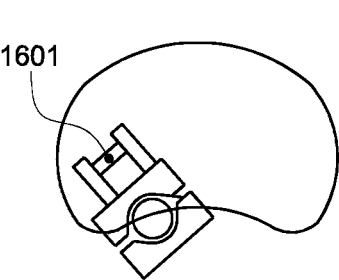


FIG. 16

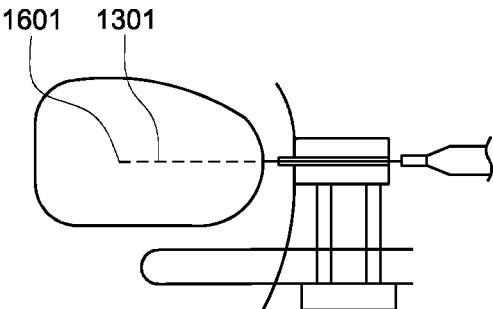


FIG. 17

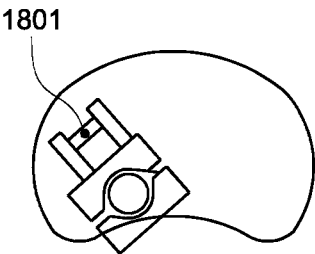


FIG. 18

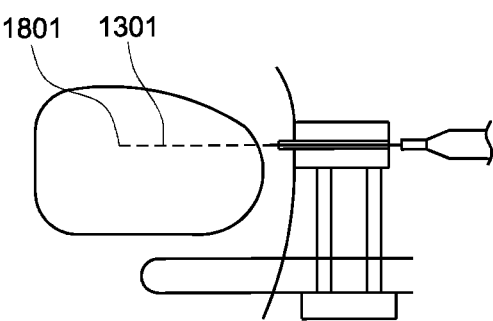


FIG. 19

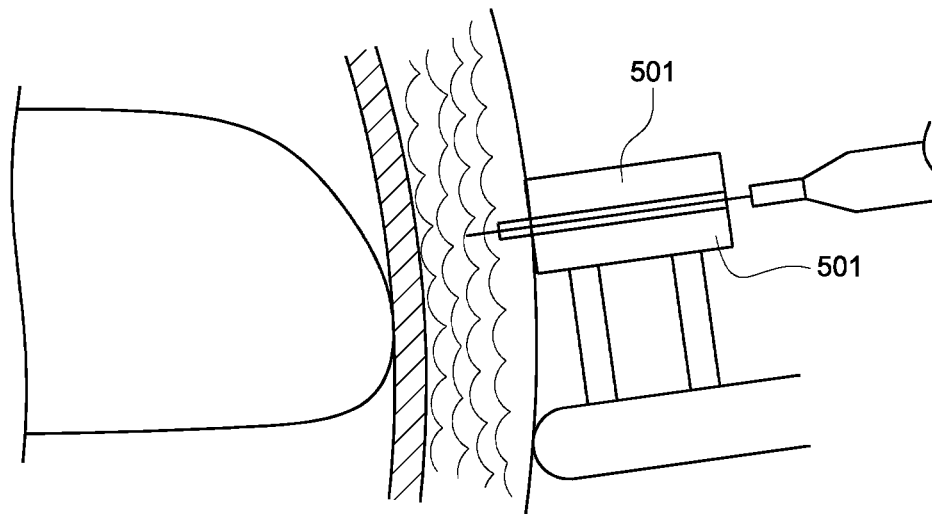


FIG. 20

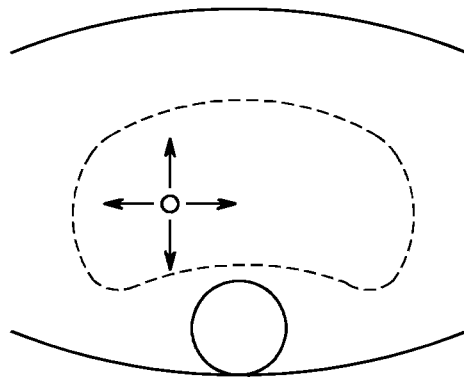


FIG. 21

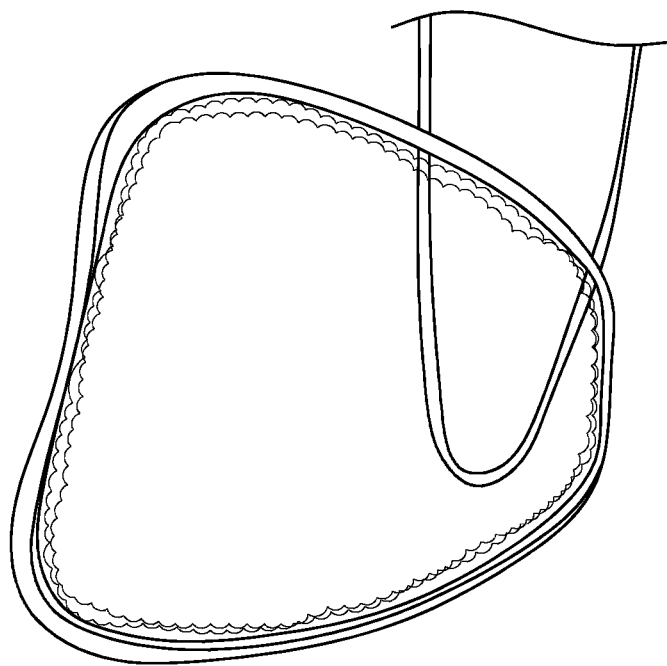


FIG. 22

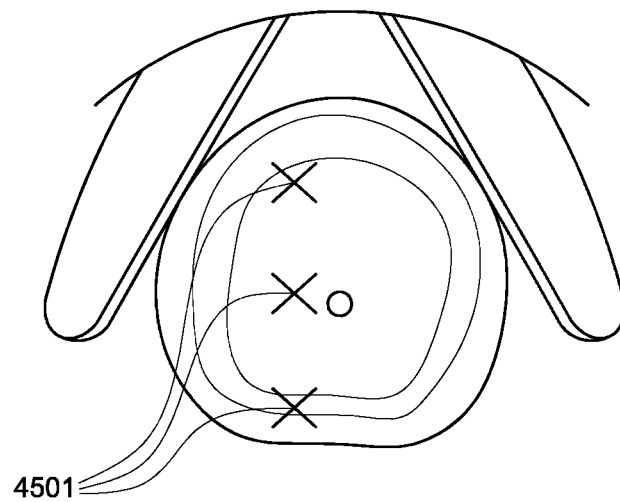
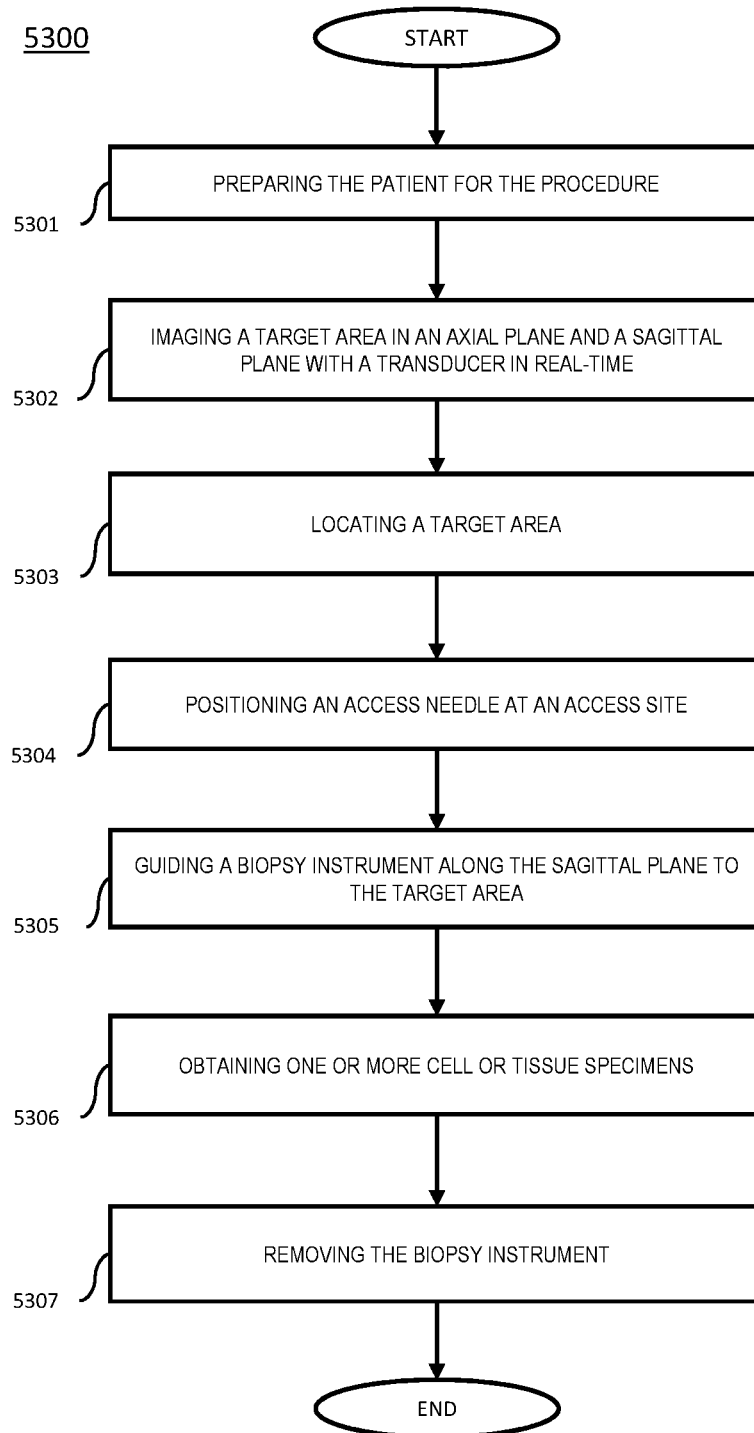


FIG. 23

FIG. 24



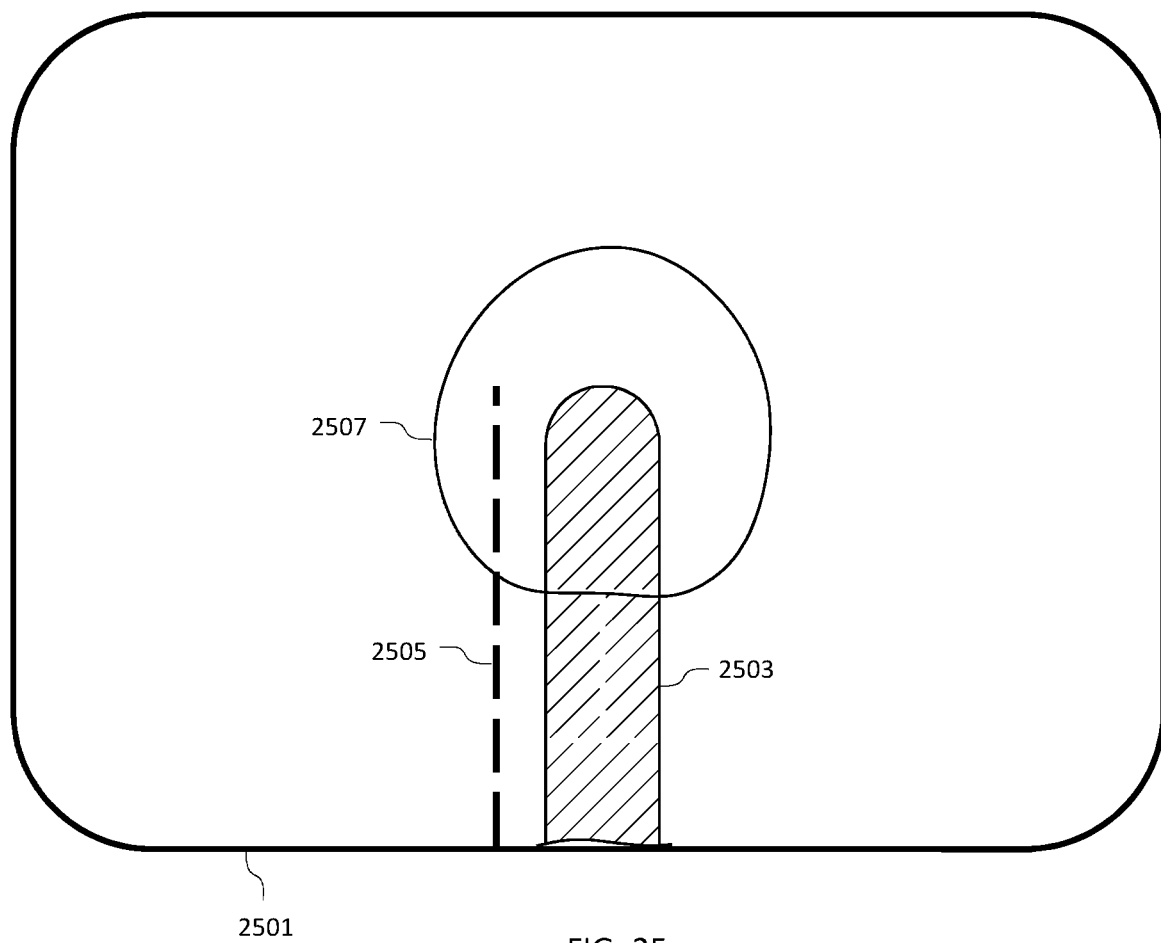


FIG. 25

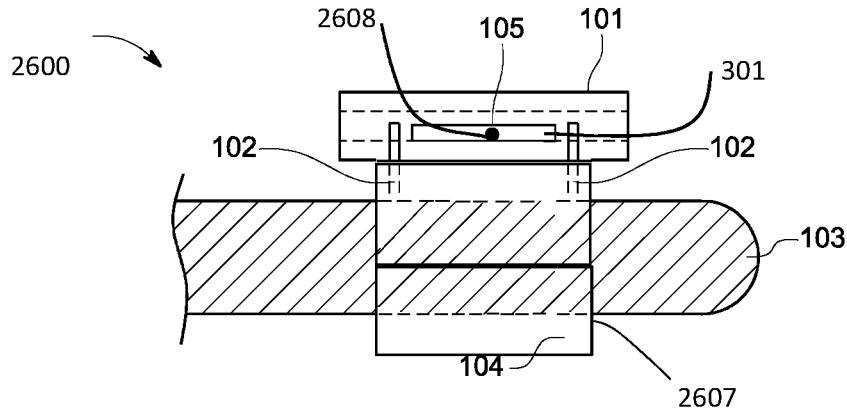


FIG. 26A

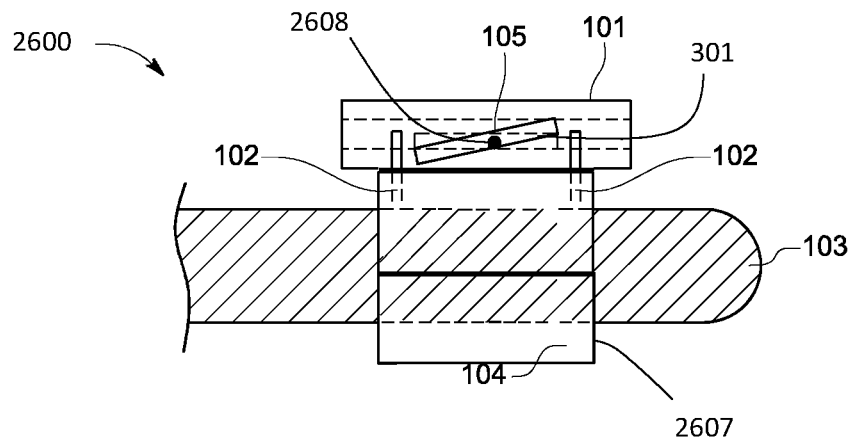


FIG. 26B

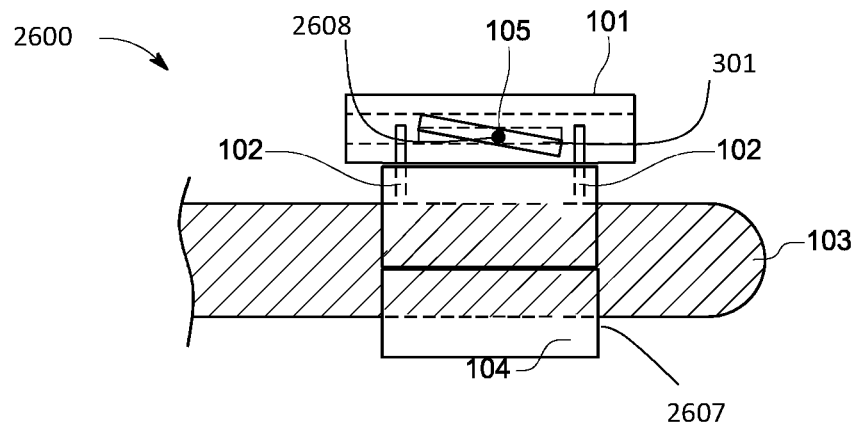


FIG. 26C

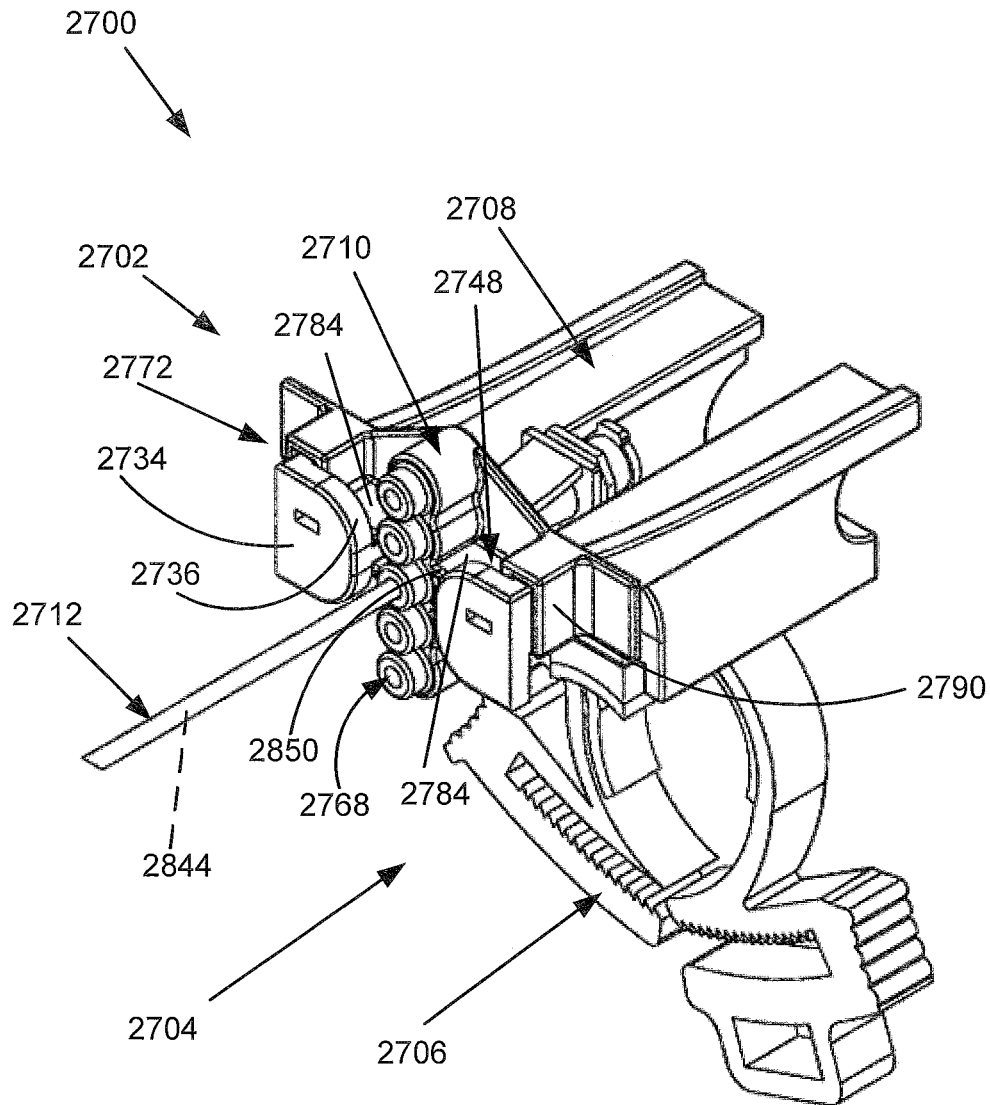
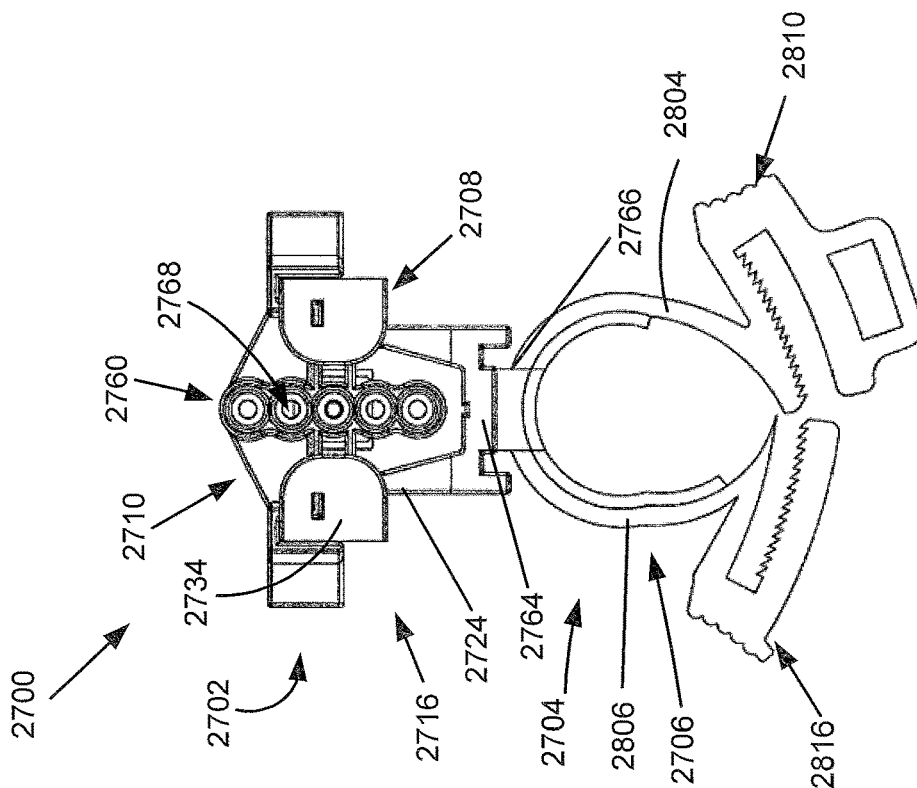
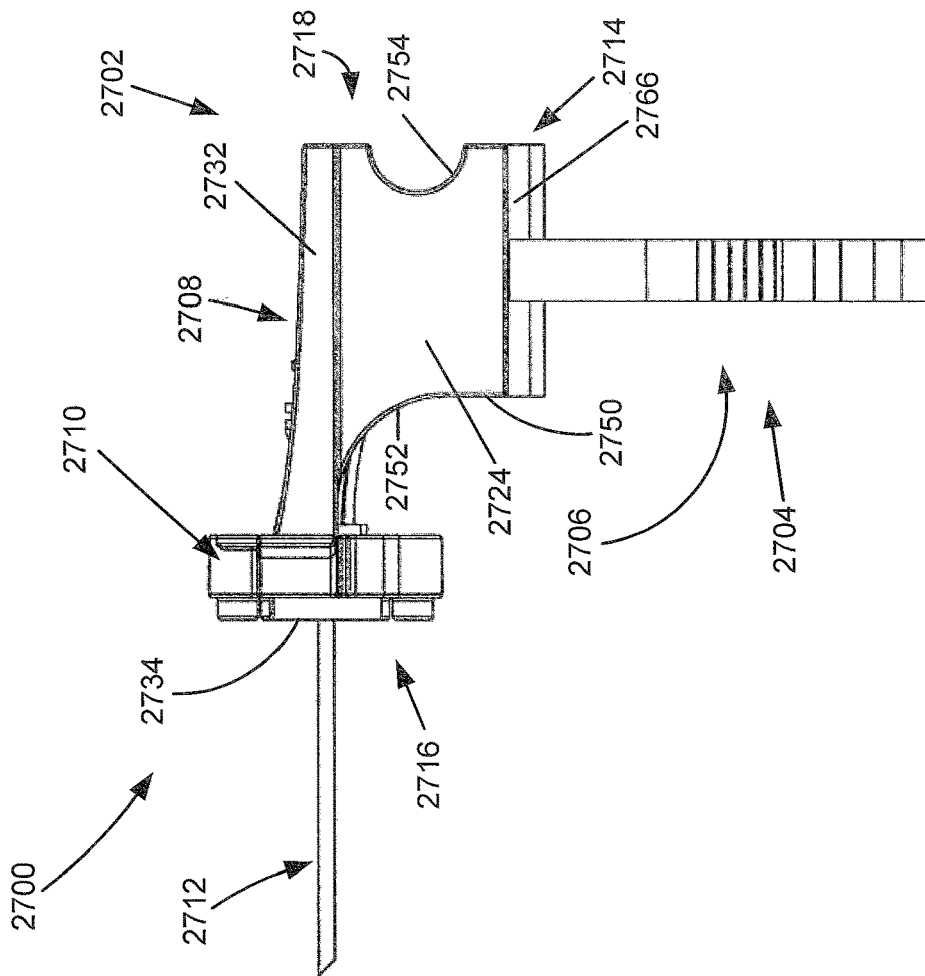


FIG. 27



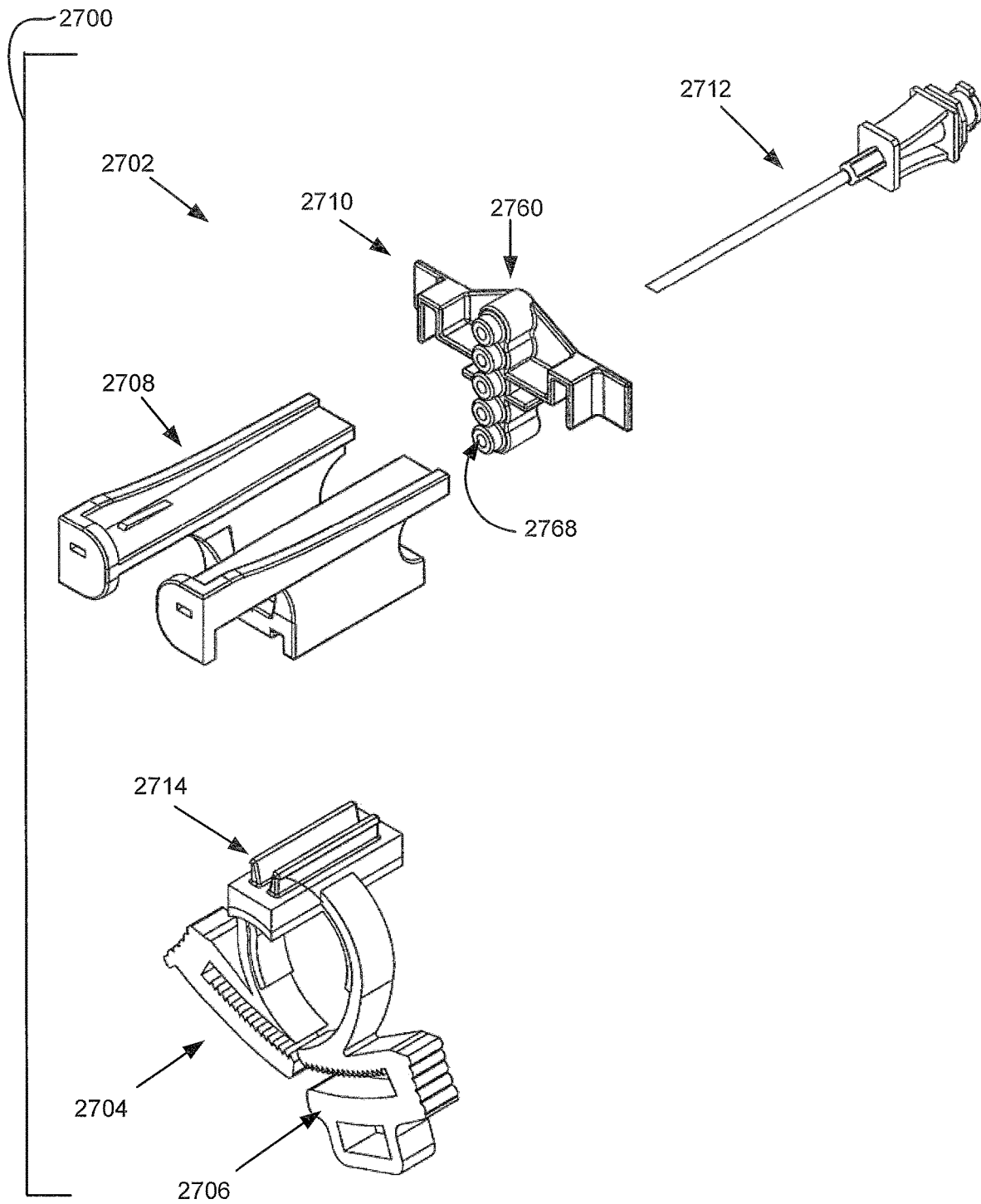


FIG. 30

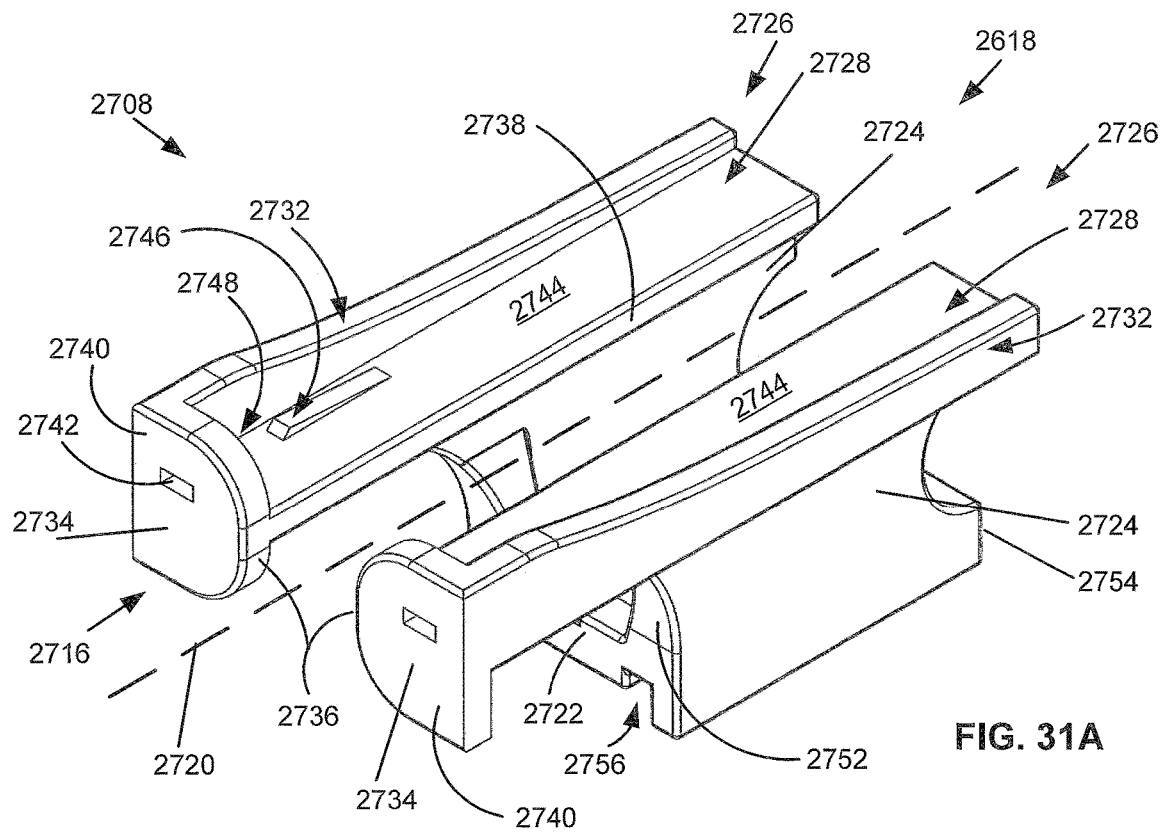


FIG. 31A

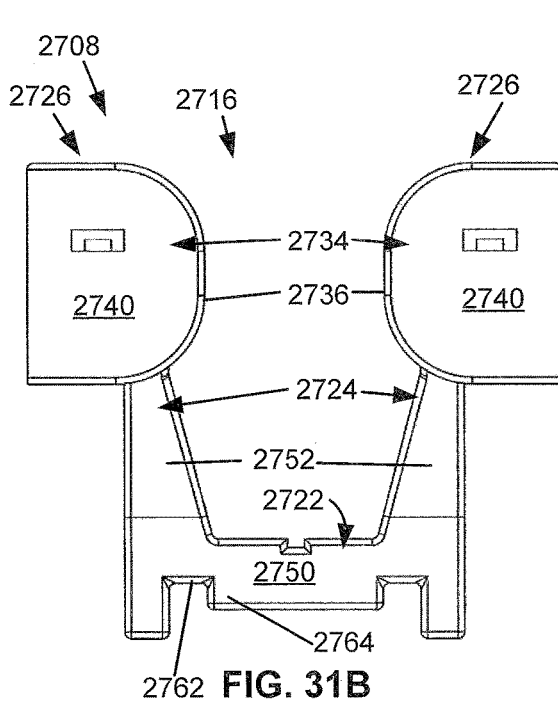


FIG. 31B

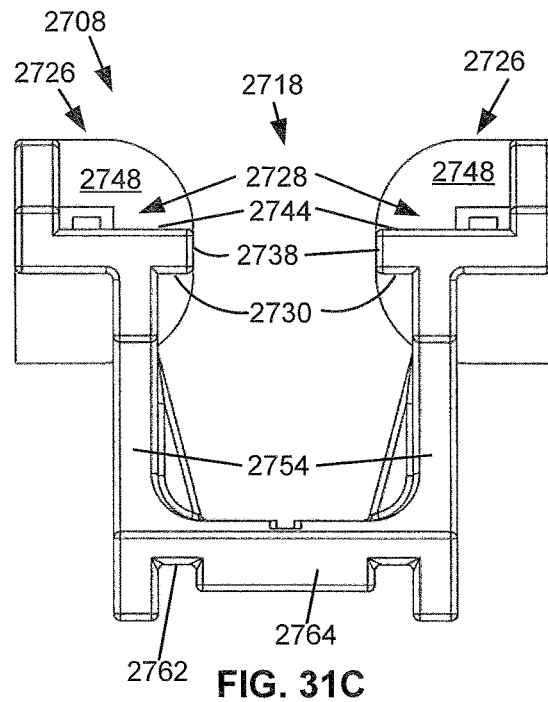


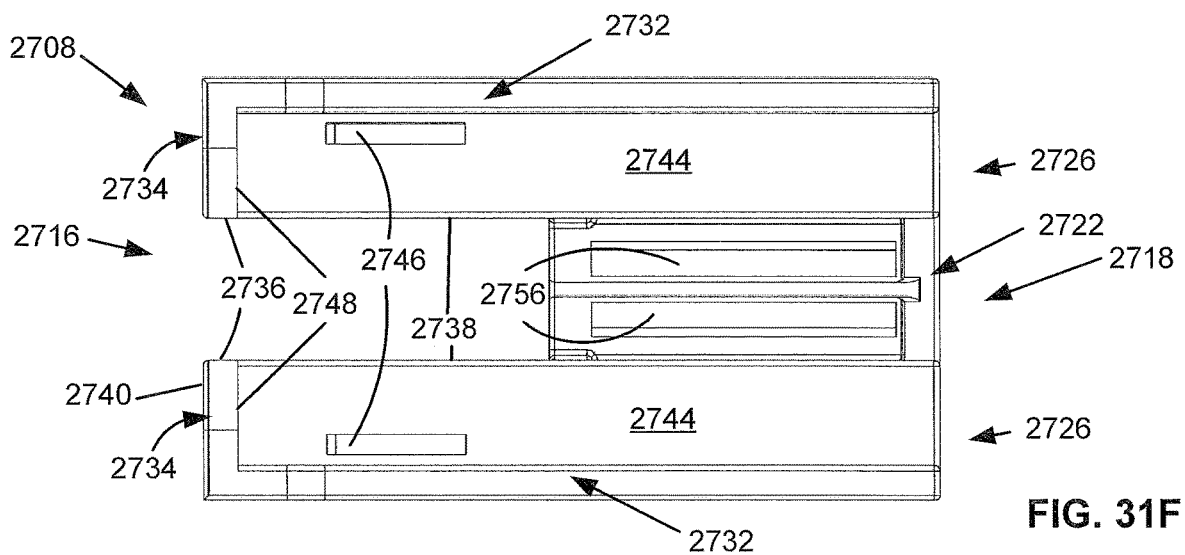
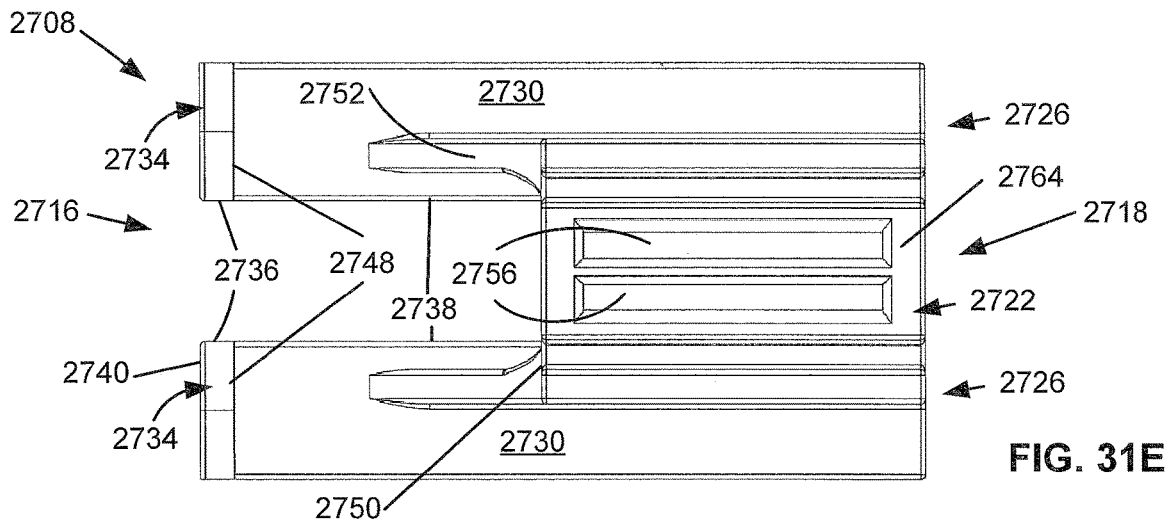
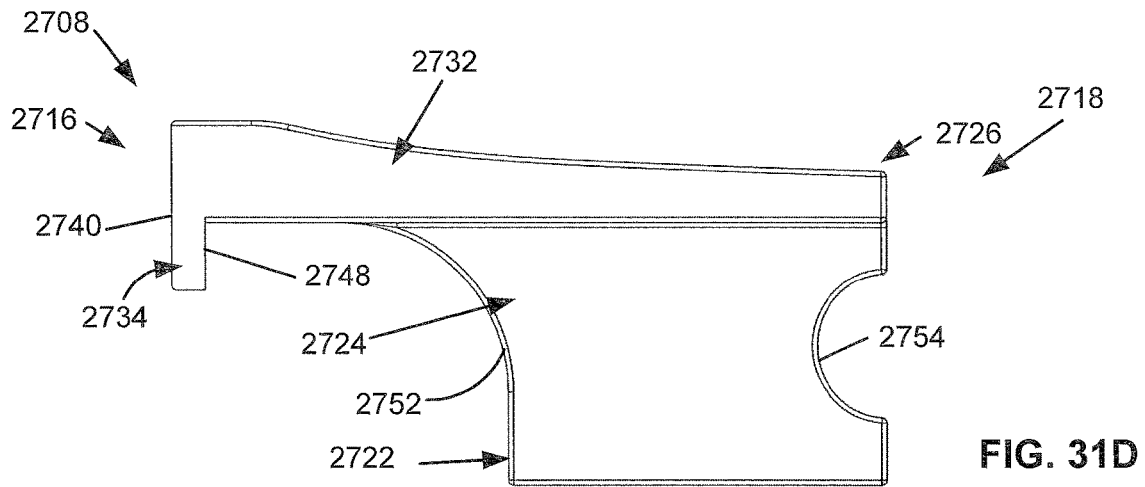
FIG. 31C

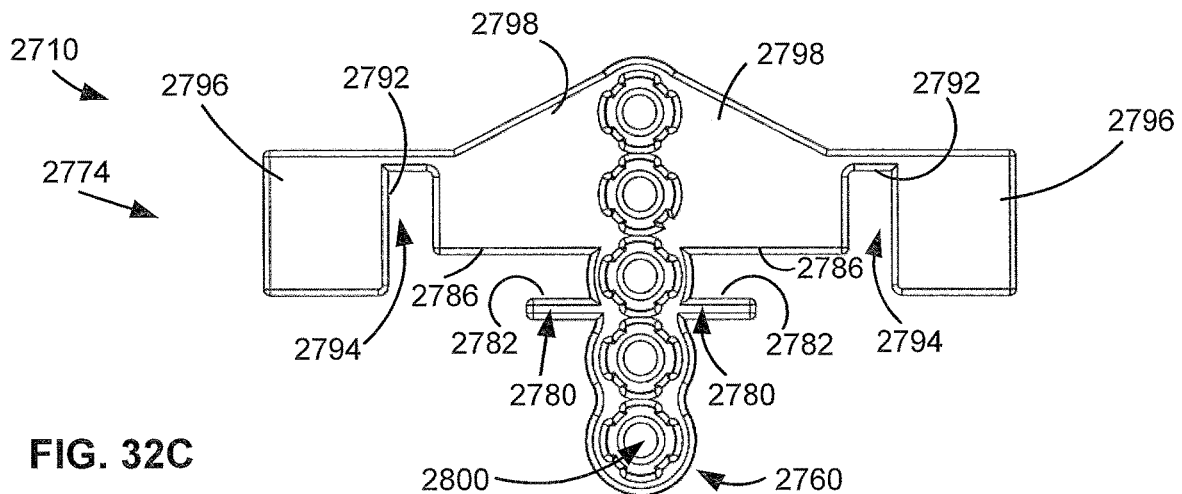
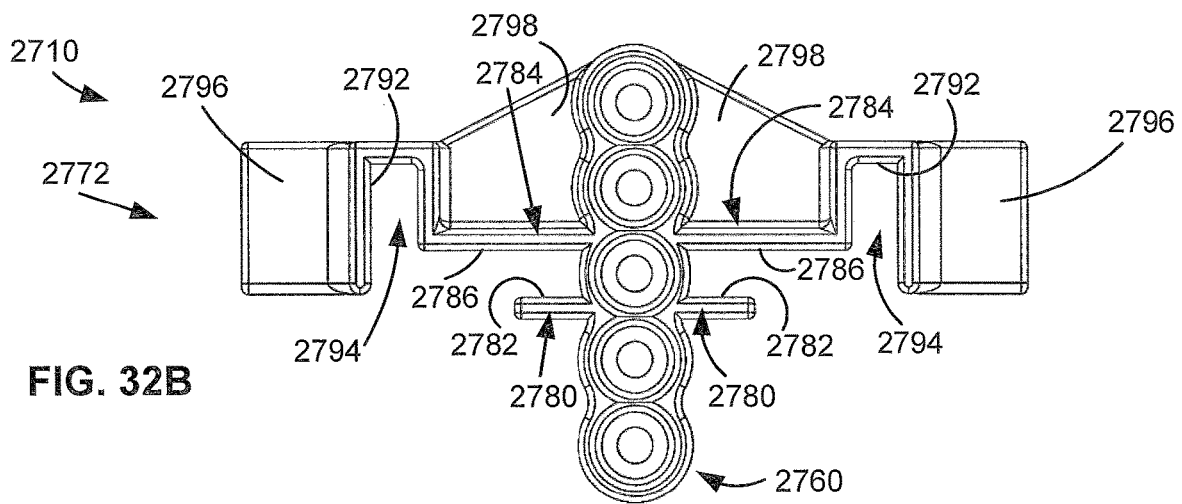
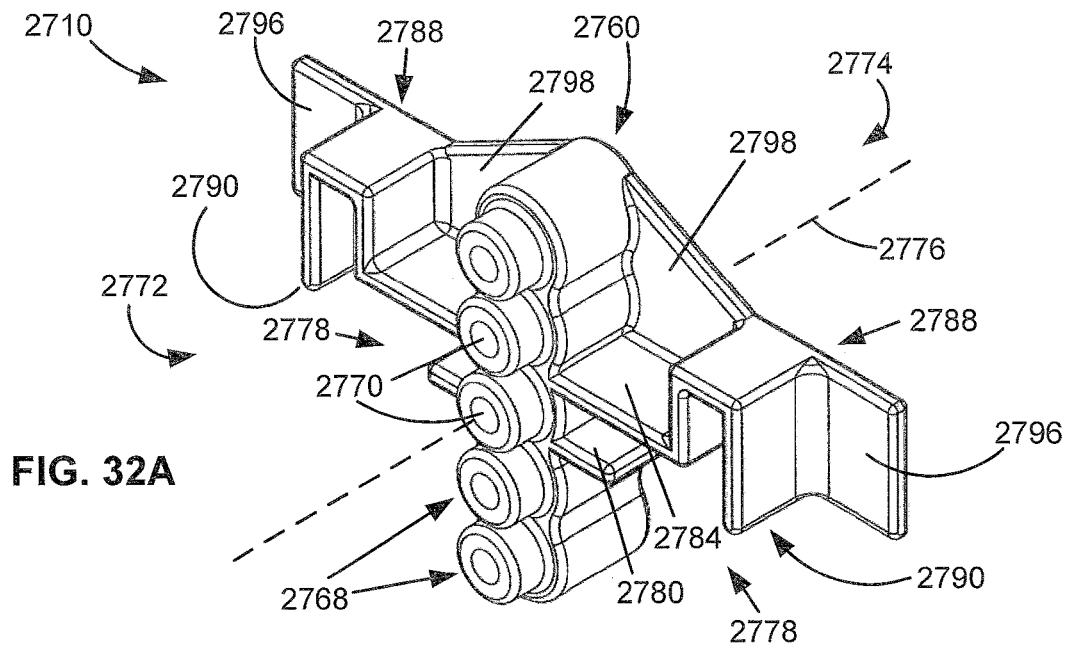
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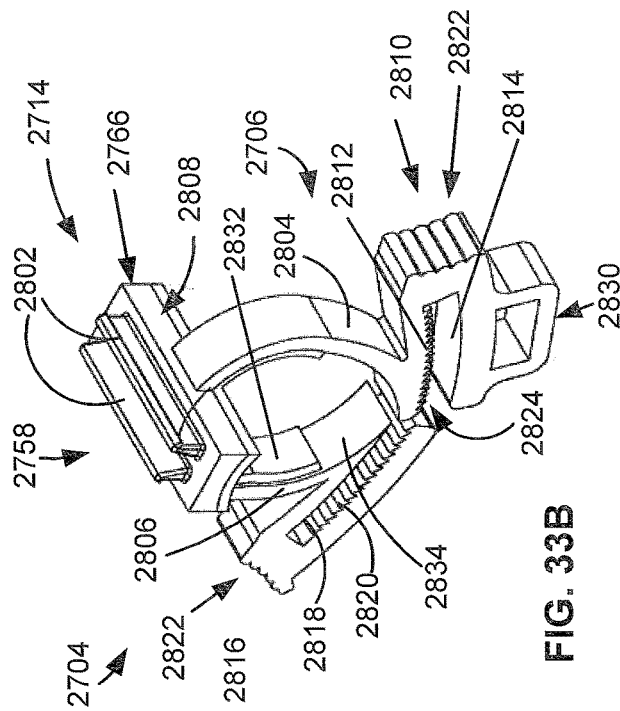
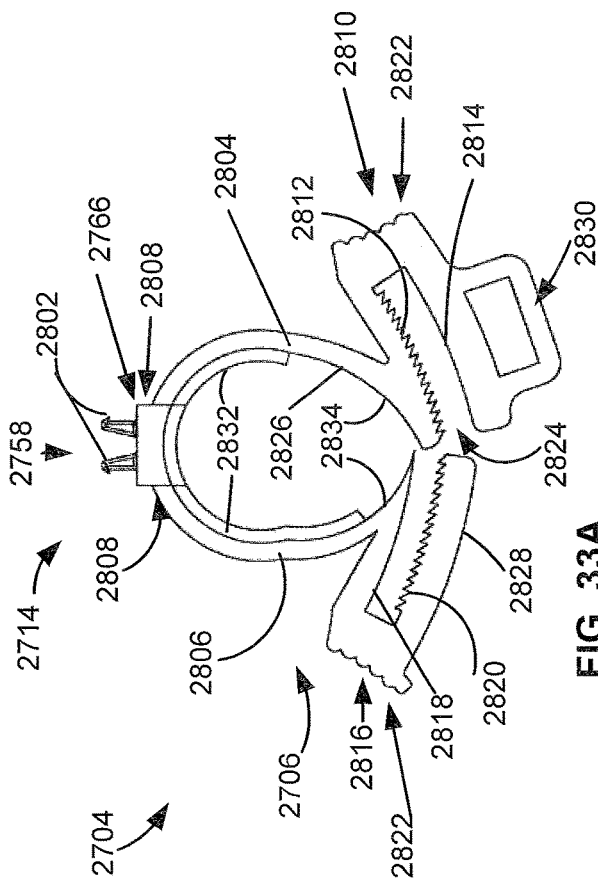
**ELI**

FIG. 33A

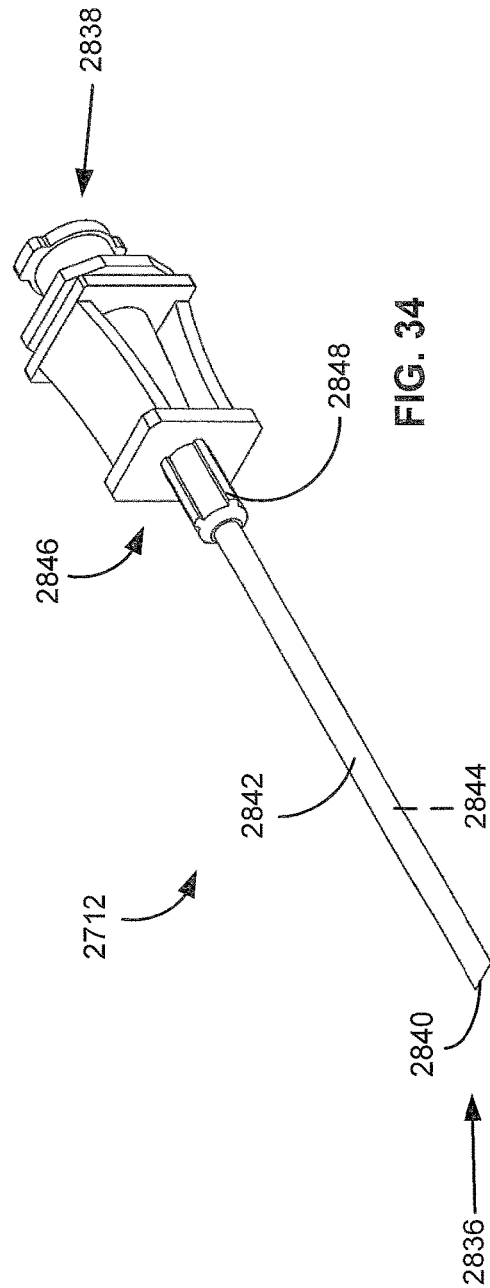


FIG. 34

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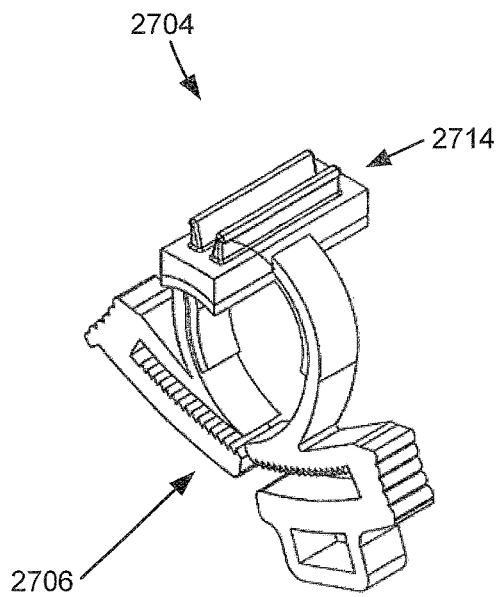


FIG. 35A

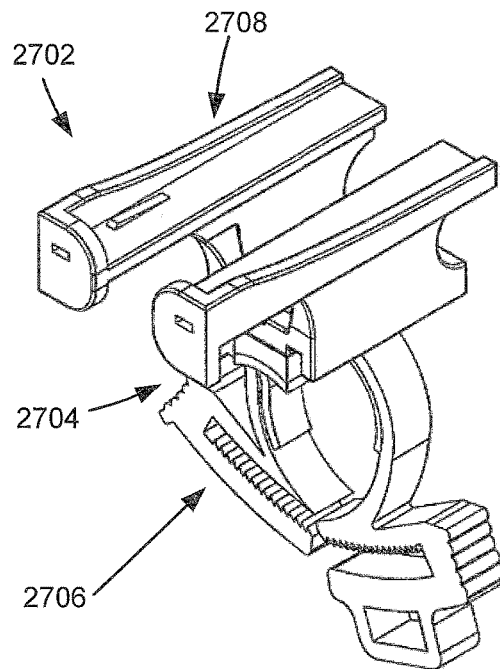


FIG. 35B

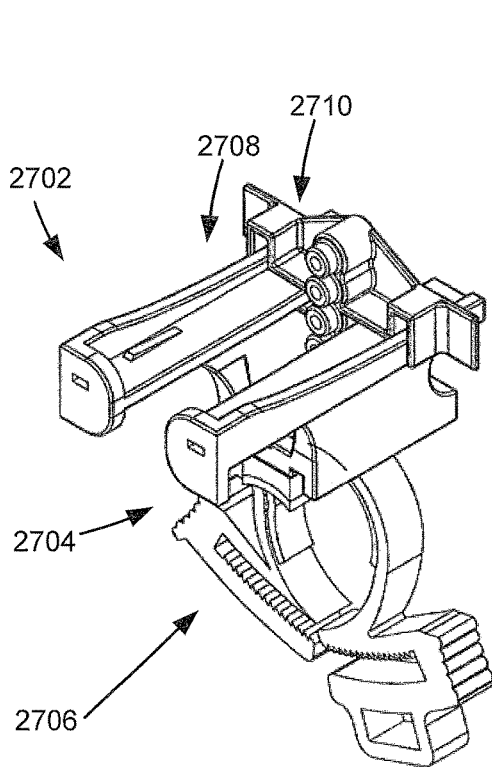


FIG. 35C

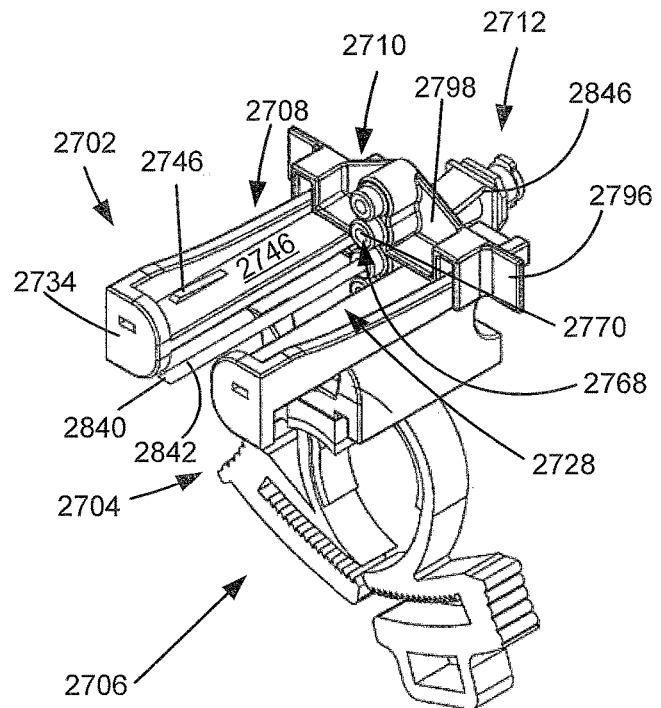


FIG. 35D

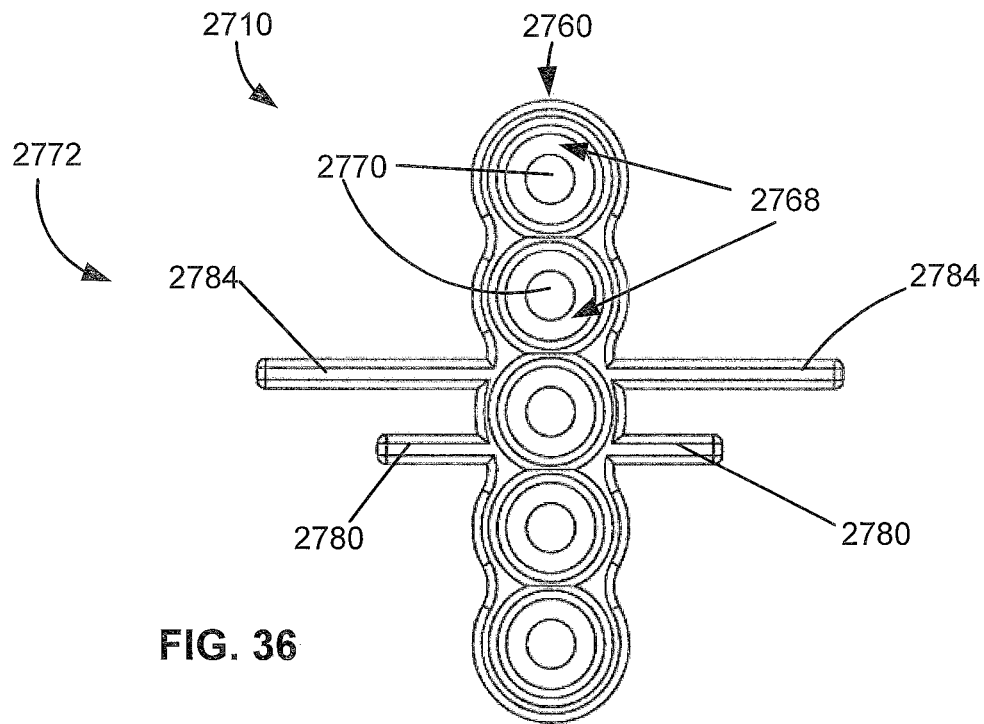


FIG. 36

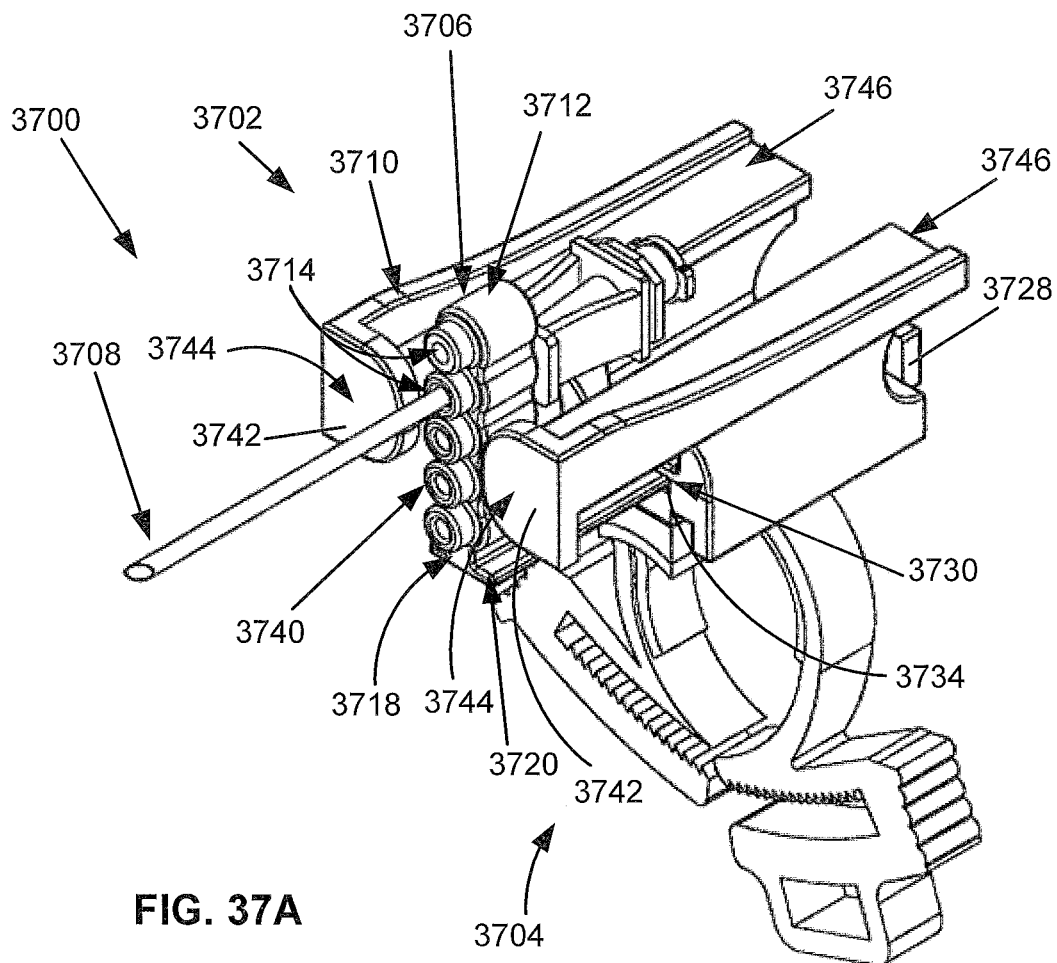
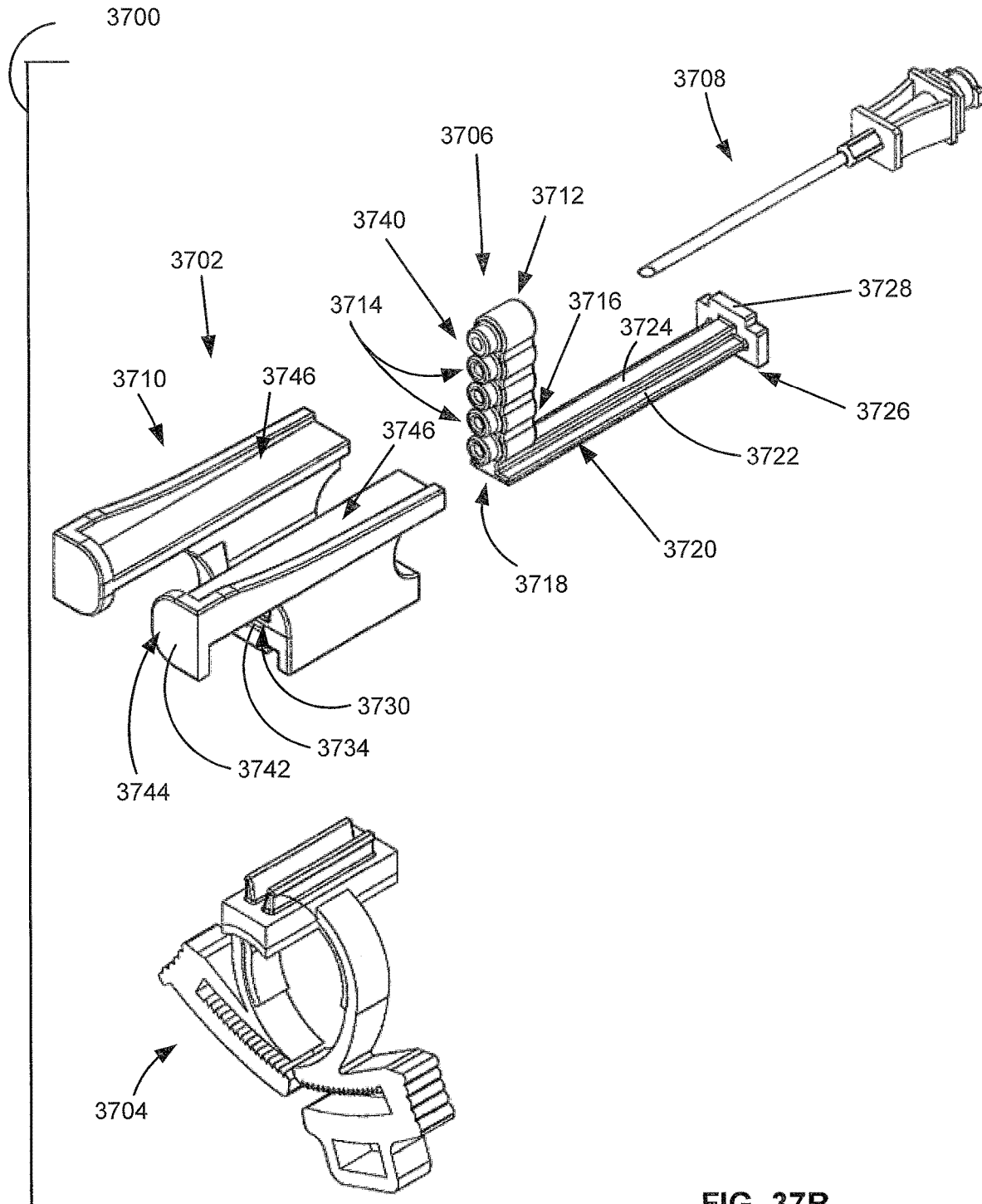
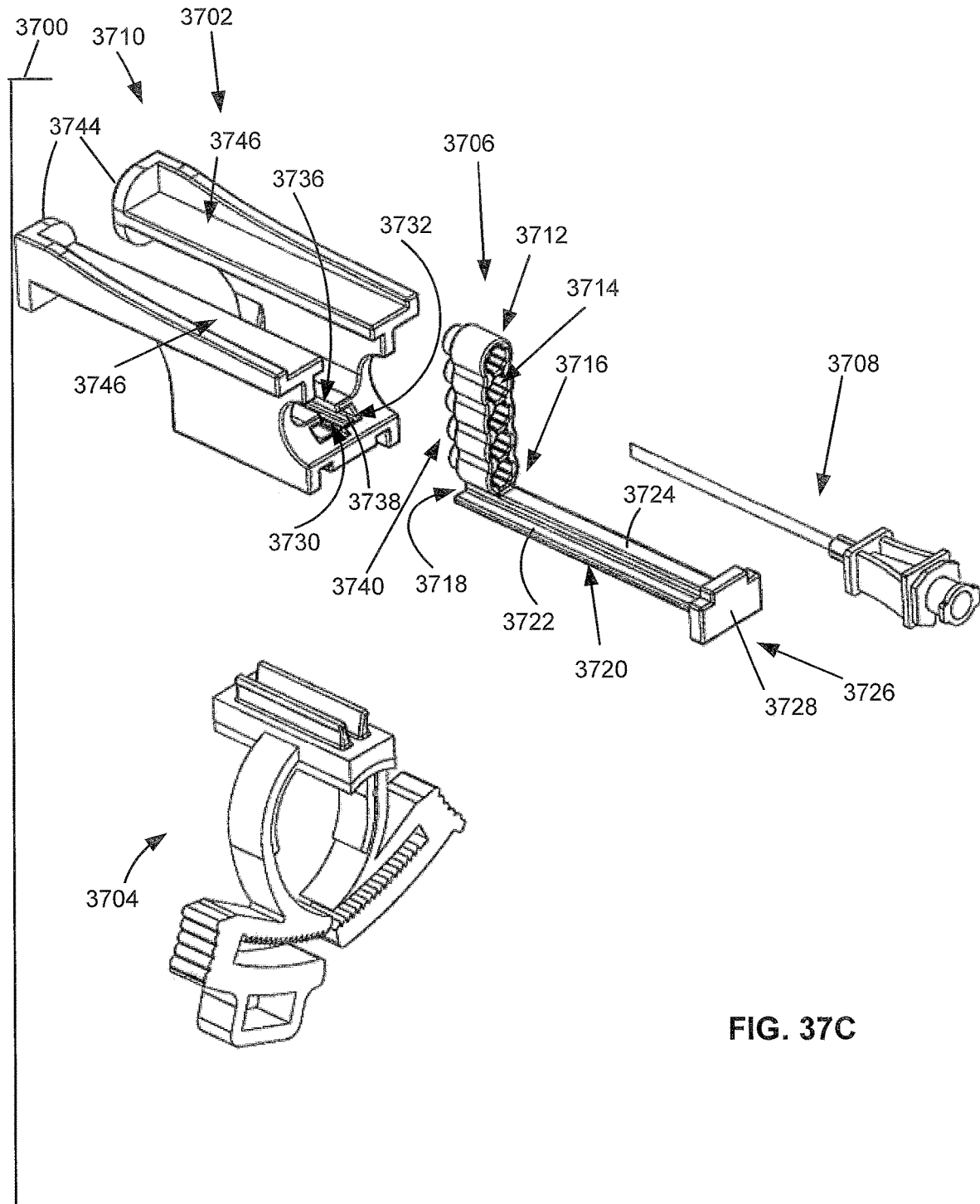
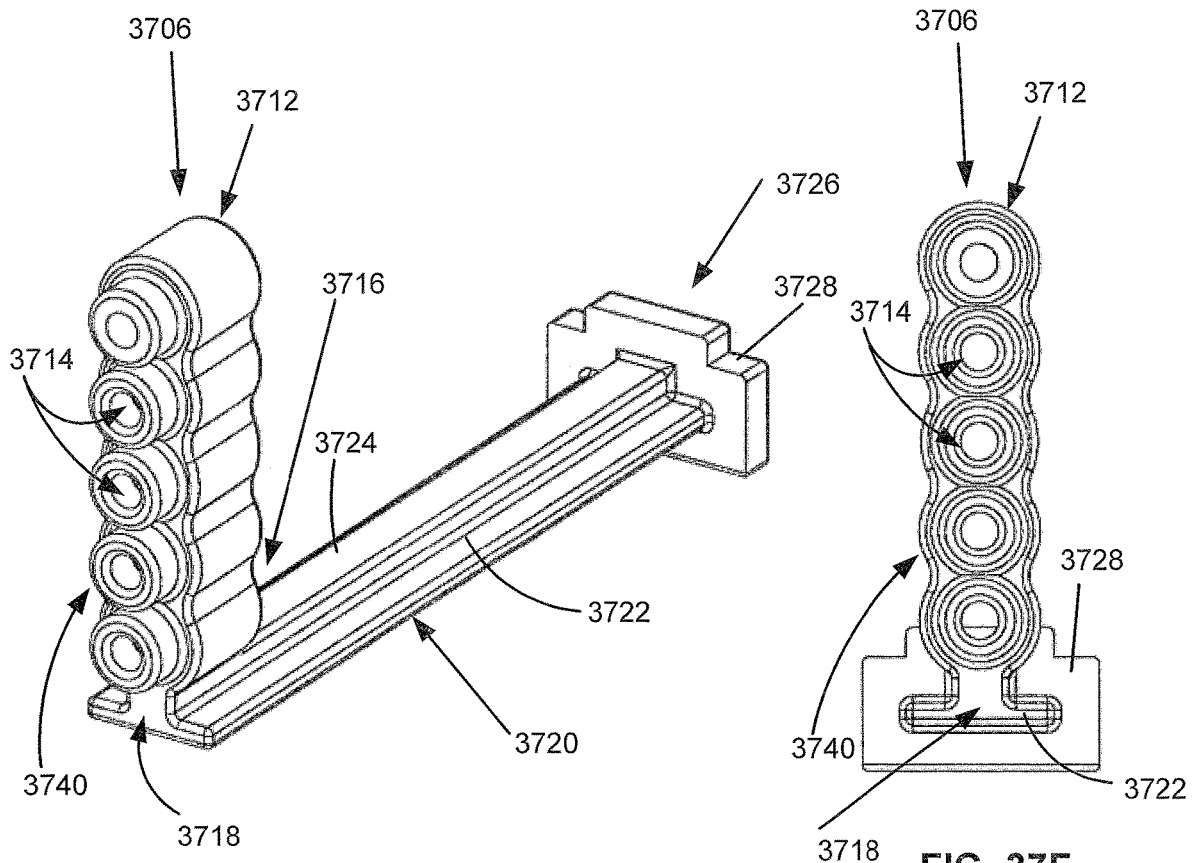
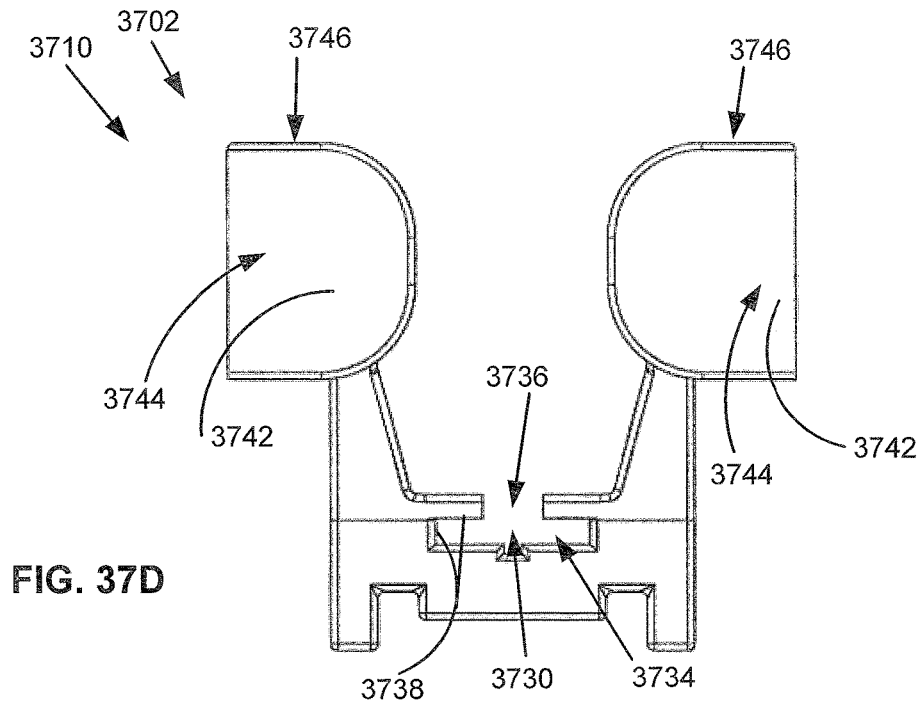
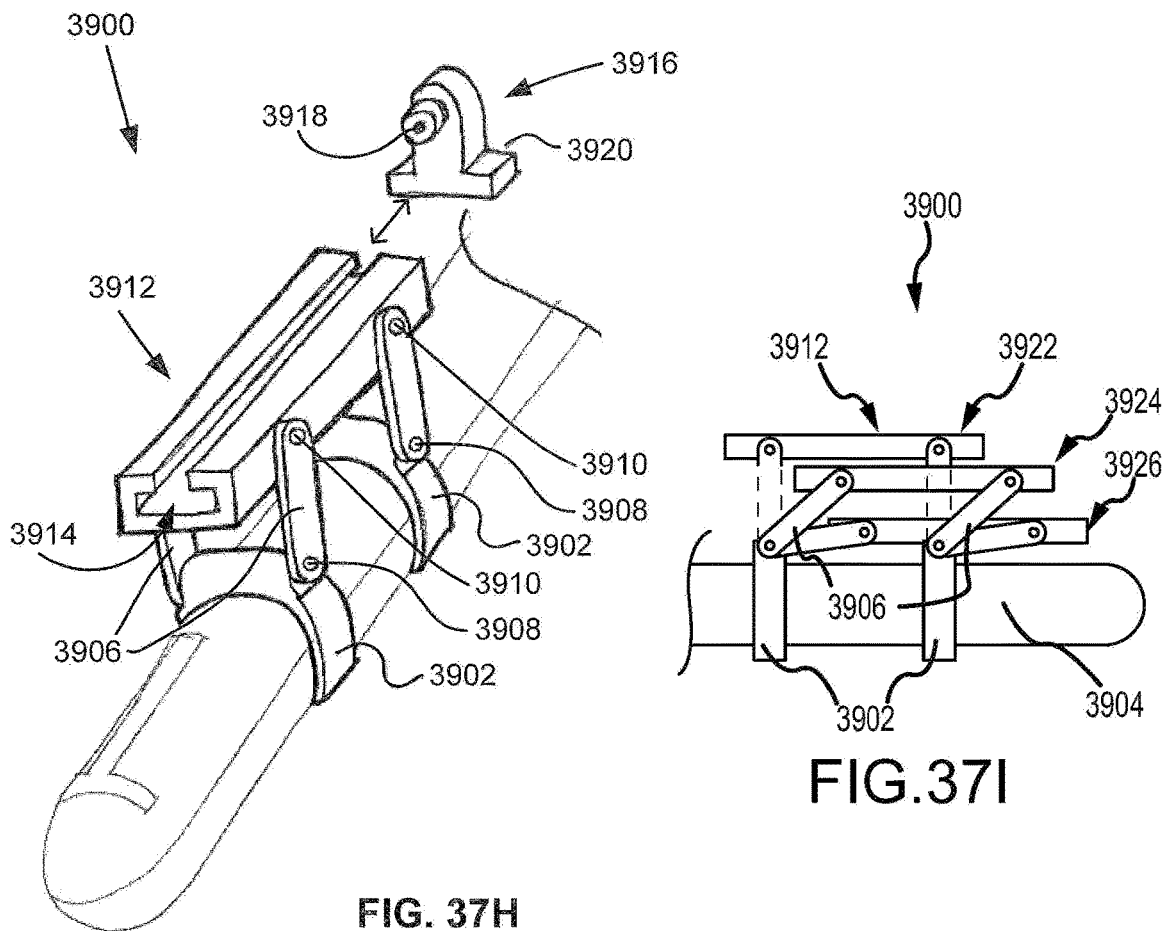
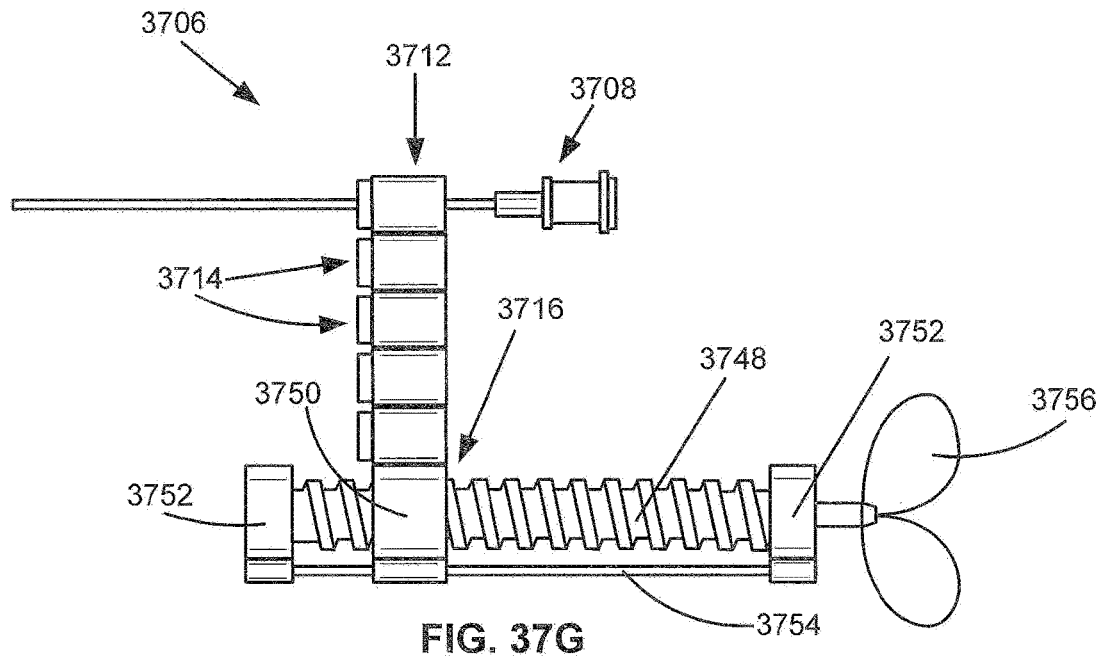


FIG. 37A









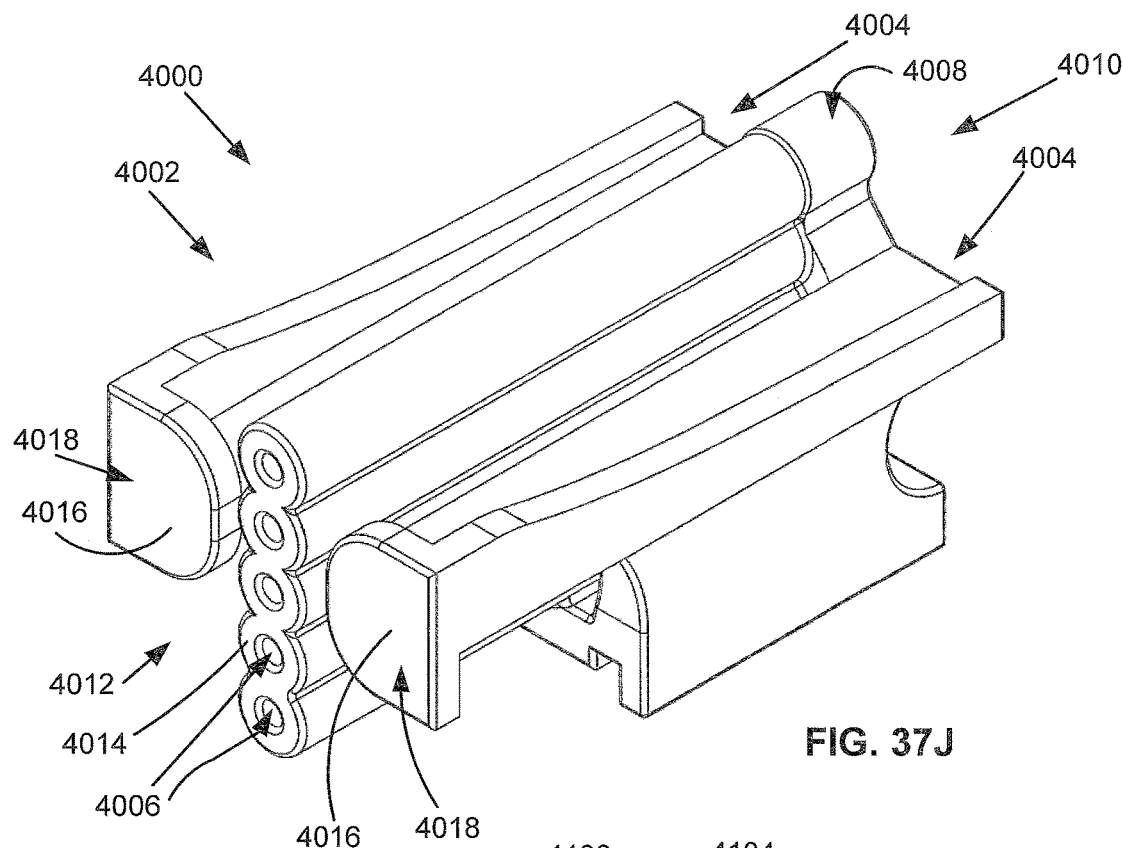


FIG. 37J

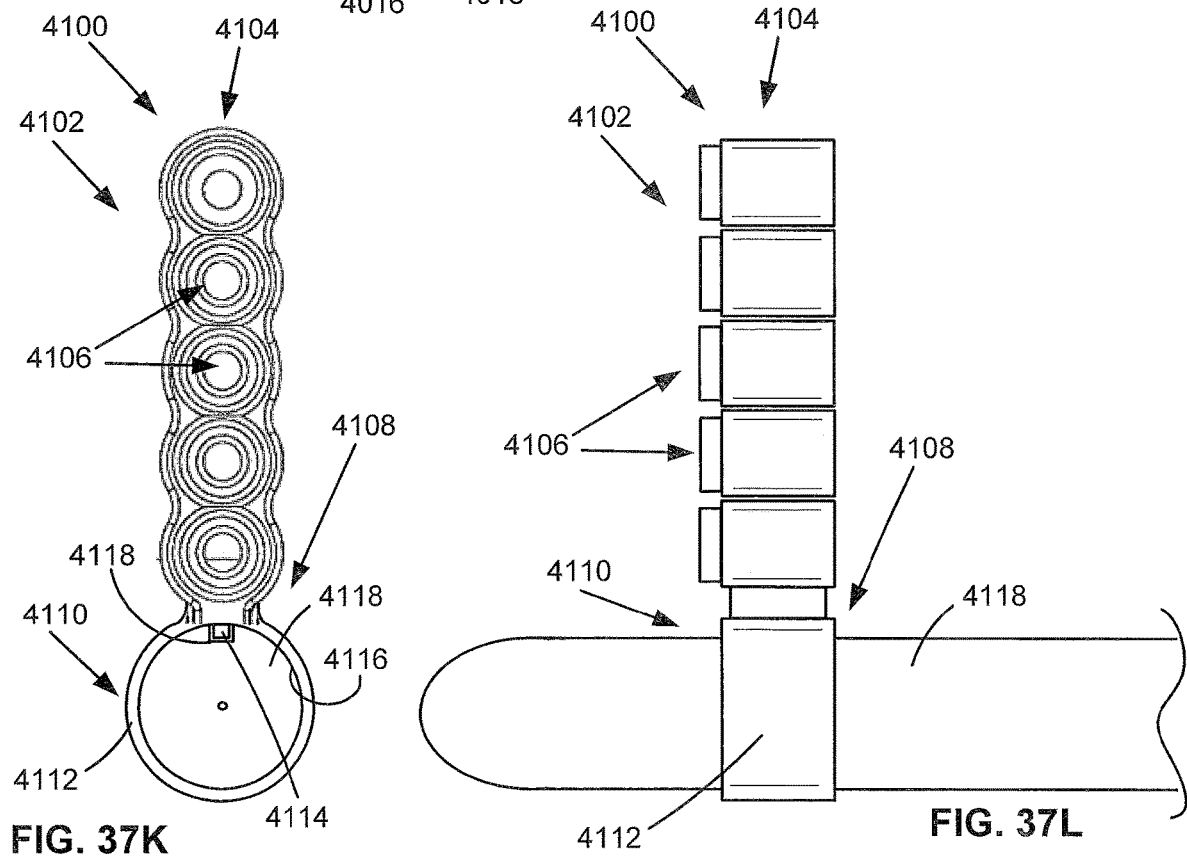


FIG. 37K

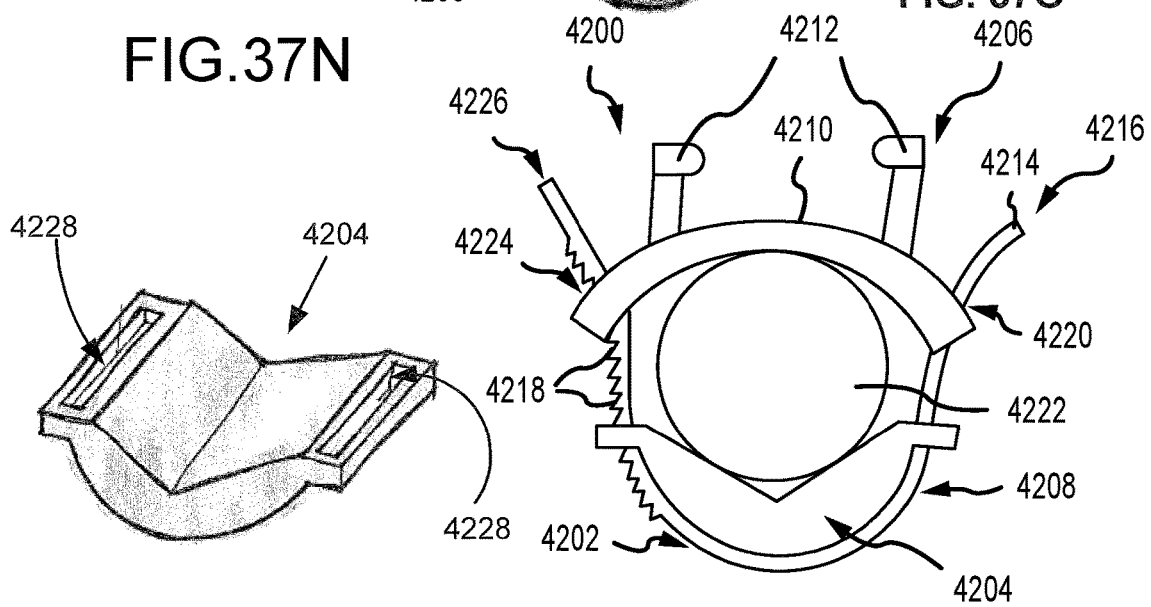
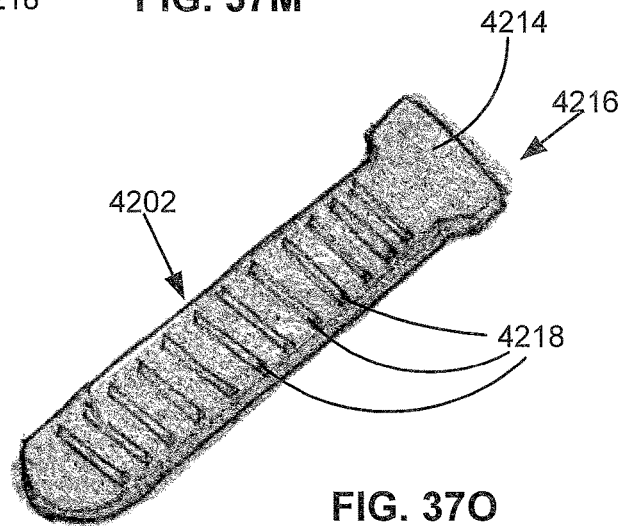
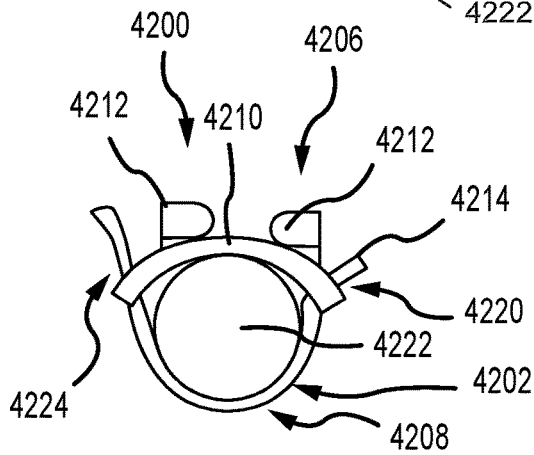
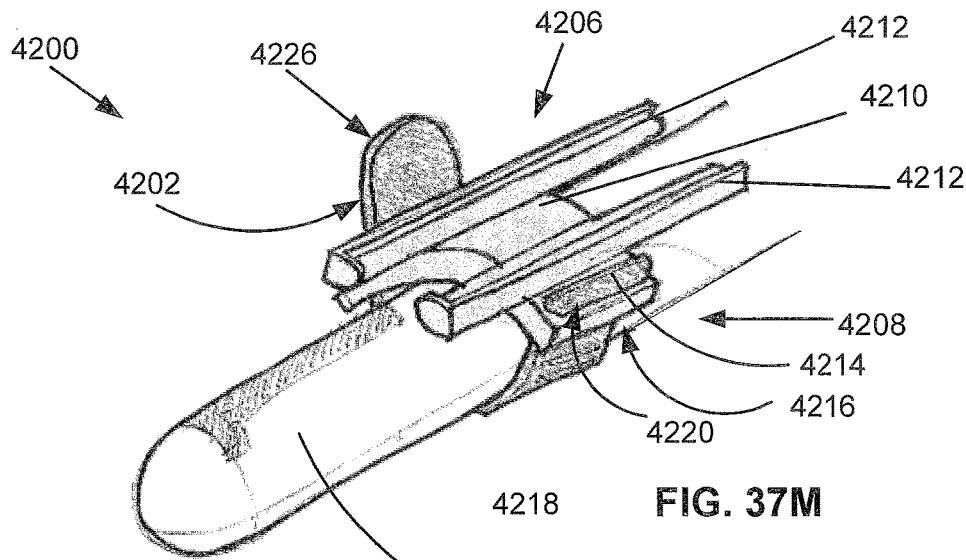
FIG. 37L

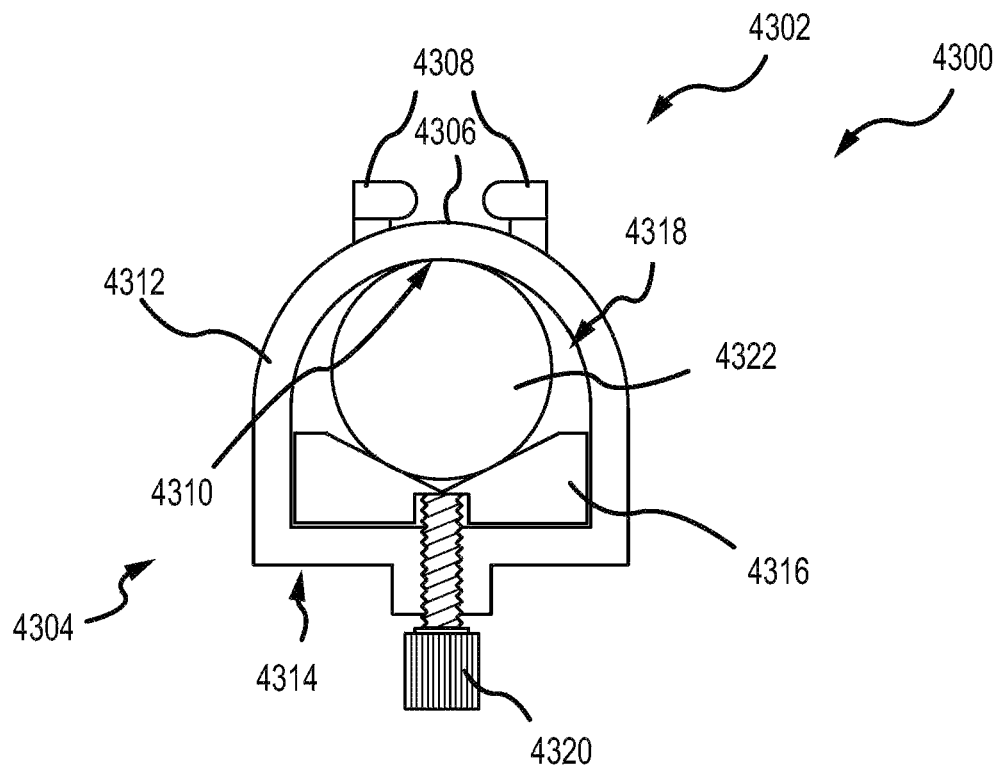
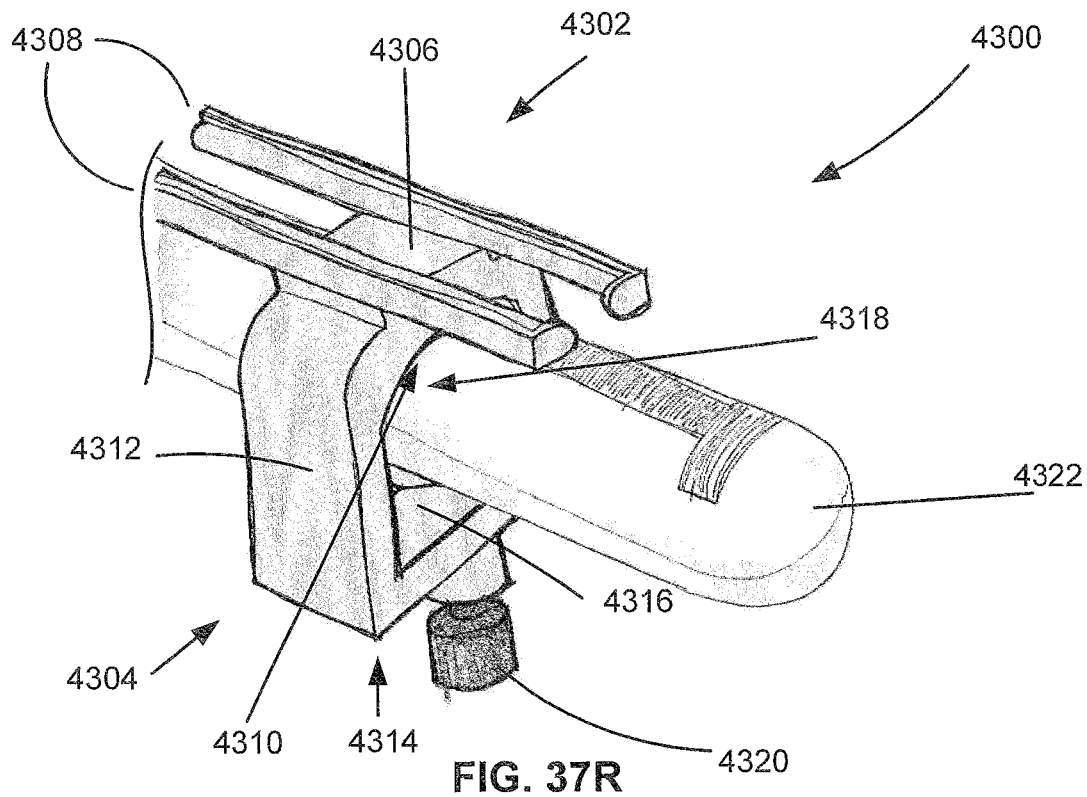
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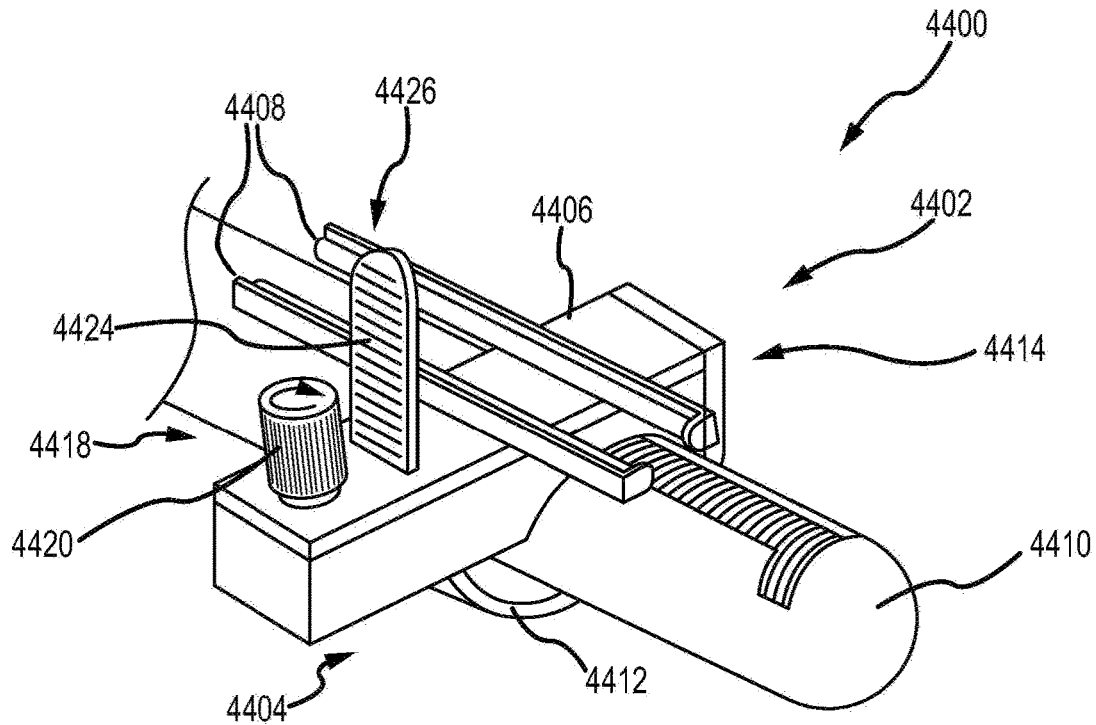


FIG. 37T

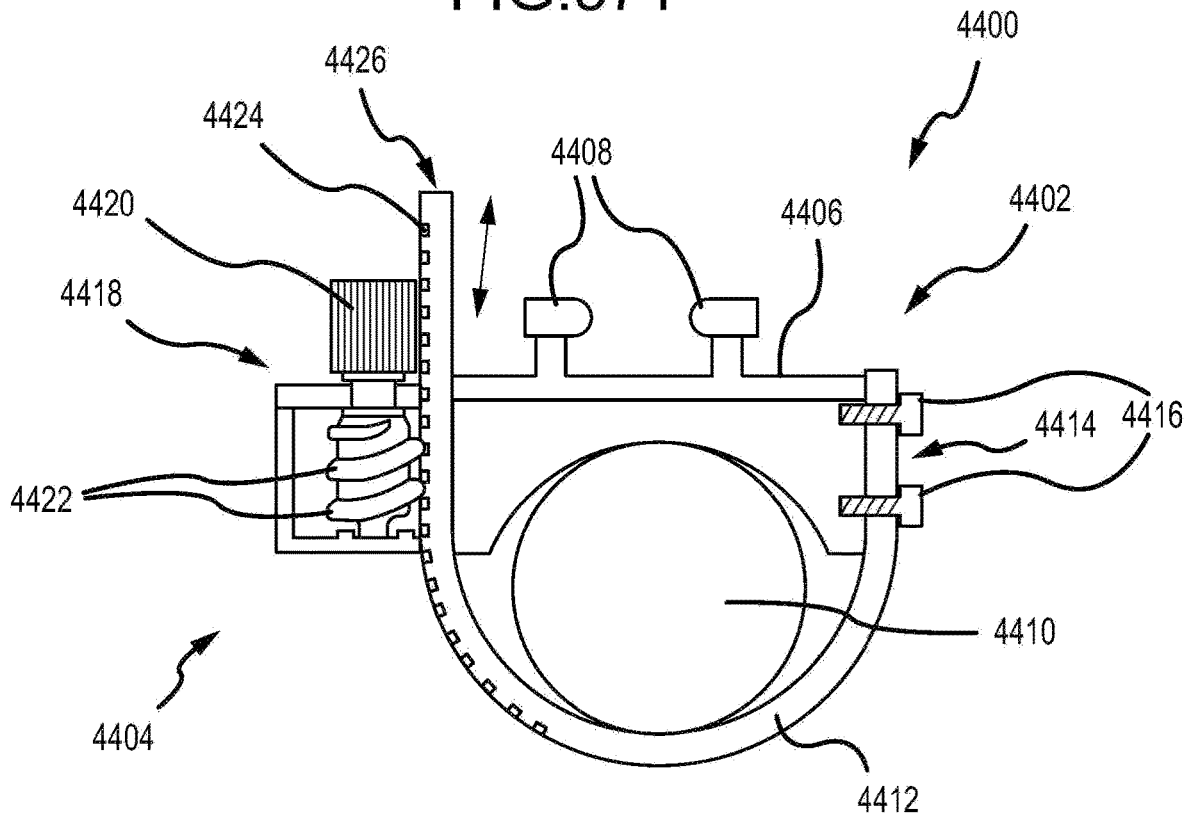


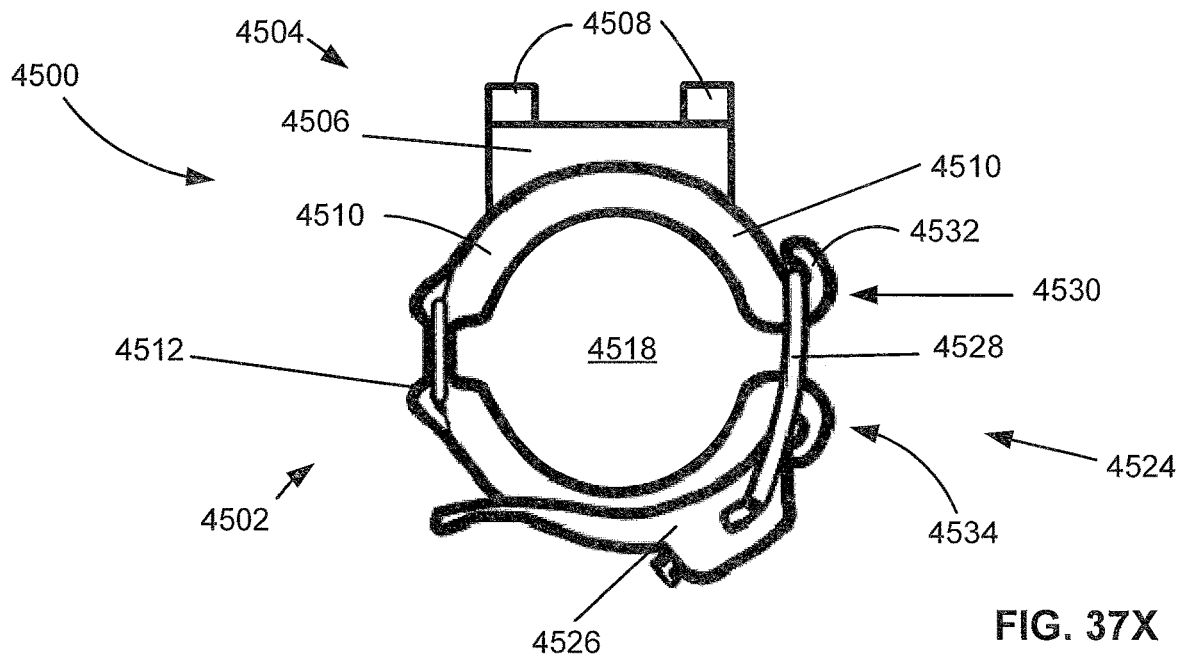
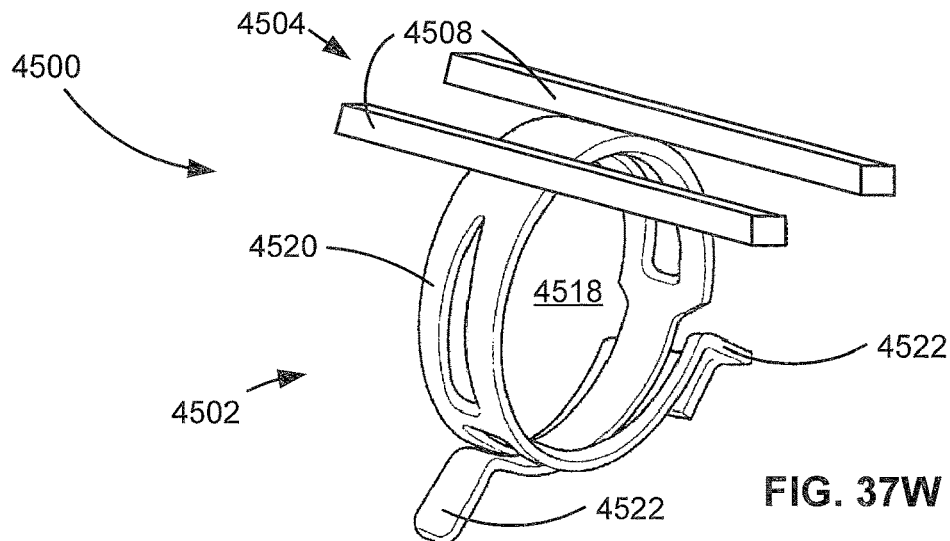
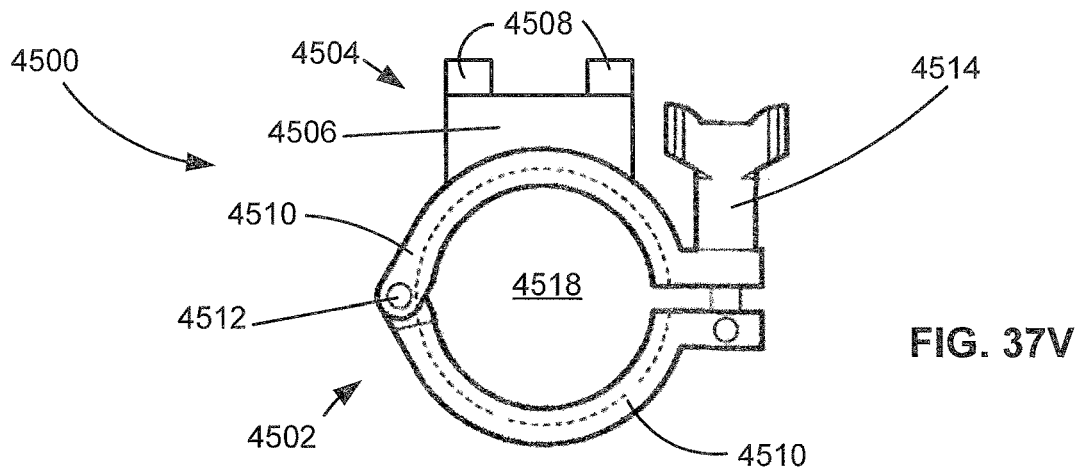
FIG. 37U

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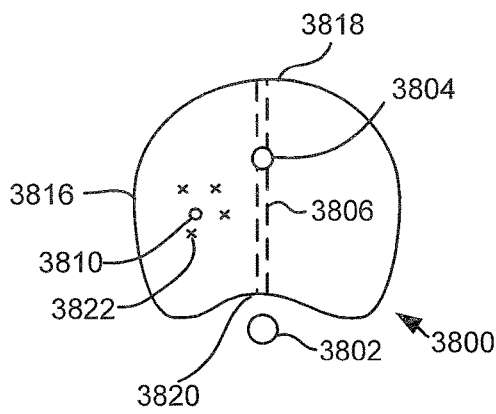


FIG. 38A

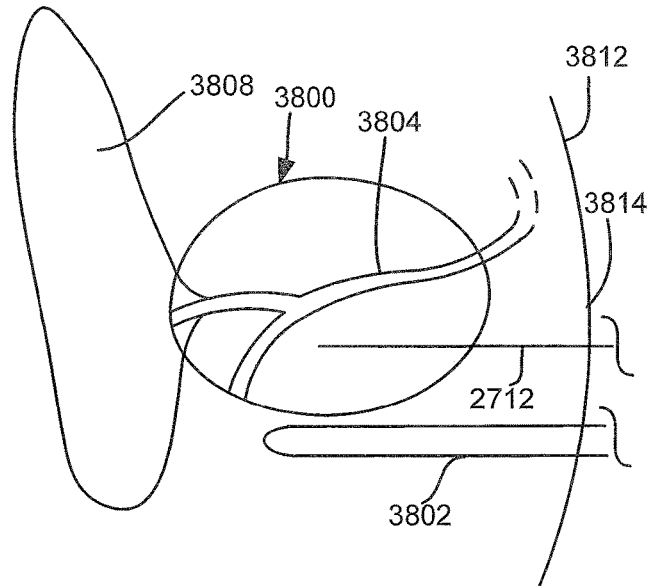


FIG. 38B

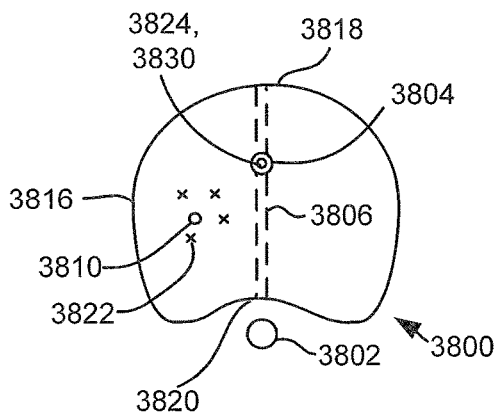


FIG. 38C

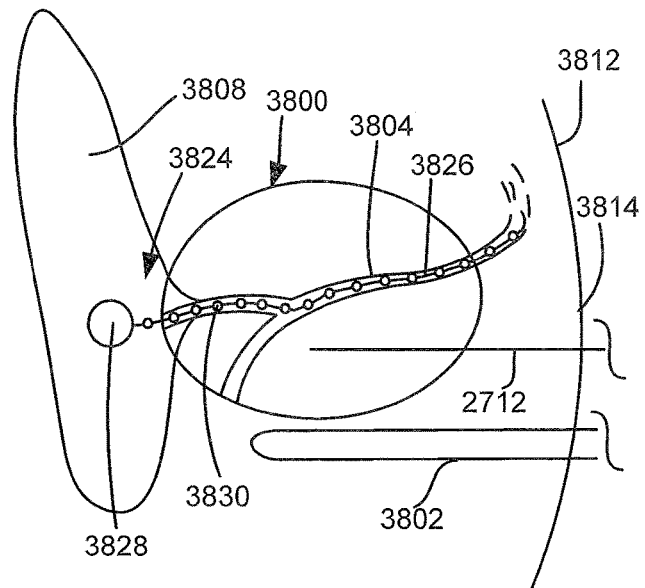


FIG. 38D

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**TRANSPERINEAL PROSTATE BIOPSY
DEVICE, SYSTEMS, AND METHODS OF USE****CROSS-REFERENCE TO RELATED
APPLICATIONS**

The present application is a continuation-in-part of U.S. application Ser. No. 17/314,845 filed May 7, 2021, which application is a continuation of U.S. application Ser. No. 16/115,180 filed Aug. 28, 2018, now U.S. Pat. No. 11,096,762, which application is a continuation of U.S. application Ser. No. 14/677,286 filed Apr. 2, 2015, now U.S. Pat. No. 10,064,681, which claims priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application No. 61/974,826 filed Apr. 3, 2014.

The present application is also a continuation-in-part of U.S. application Ser. No. 16/991,150 filed Aug. 12, 2020, which application is a continuation of U.S. application Ser. No. 14/874,104 filed Oct. 2, 2015, now U.S. Pat. No. 10,743,909, which application is a continuation-in-part of U.S. patent application Ser. No. 14/677,286 filed Apr. 2, 2015, now U.S. Pat. No. 10,064,681, which claims priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application No. 61/974,826 filed Apr. 3, 2014.

All the above-referenced applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

Aspects of the present disclosure relates to biopsy procedures and systems. In particular, the disclosure relates to methods, systems, and apparatus useful for planning and performing guided and free-handed transperineal prostate biopsies.

BACKGROUND

A biopsy is a medical procedure that involves sampling and removing tissues or cells from a living body for further examination and analysis. A prostate biopsy may be performed by a care provider for diagnosis and treatment of a patient's prostate. For example, the vast majority of patients with an abnormal prostate specific antigen (PSA) or suspicious results from a digital rectal examination (DRE) undergo biopsy. Typical biopsy procedures include transrectal ultrasound-guided (TRUS) biopsies and transperineal ultrasound-guided (TPUS) biopsies.

TRUS involves obtaining tissue or cell specimens by passing a biopsy needle or other biopsy instruments through the rectal wall and into the prostate at various locations using a sagittal imaging plane. The biopsy needle or other biopsy instruments may be guided by ultrasound in a sagittal plane. There are disadvantages associated with TRUS. In particular, the patient may be required to take antibiotics prior to the procedure to reduce the risk of infections. Also, TRUS requires the patient to perform bowel preparation, which is a procedure usually undertaken before the biopsy, for cleansing the intestines of fecal matter and secretions. Further, the passage of the biopsy needle through the rectal wall may introduce bacteria from the rectum into the prostate, such as coliform bacteria that may lead to an infection or other complications. Additionally, many clinically significant prostate cancers are found in locations of the prostate that are often too difficult to access when using the transrectal approach.

TPUS includes obtaining tissue or cells specimens by passing one or more biopsy needles through the perineum

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and into the prostate. TRUS has been favored over TPUS. Unlike TRUS, TPUS does not require a patient to take antibiotics prior to the procedure or to undergo the bowel preparation for lowering the risk of bacterial issues. Further, TPUS uses a more effective route to access the prostate and is capable of accessing target locations that may be difficult to access utilizing the transrectal approach in comparison with TRUS. In addition, the needle does not pass through the rectal wall which eliminates the risk associated with TRUS of coliform bacteria entering the prostate or the bloodstream.

Systems configured for TPUS include a biopsy grid that may be fixed to, for example, a floor, platform, or table on which the patient receiving the biopsy lies. The biopsy grid may provide multiple apertures through which a biopsy needle or other biopsy instruments may be inserted. An ultrasound probe is fixed directly to the apparatus and is used to axially guide the biopsy needle or other instruments, for example other biopsy instruments. Thus, TPUS systems require imaging in an axial plane of the ultrasound or a transverse transducer for positioning the biopsy needle.

It is with these observations in mind, among others, that various aspects of the present disclosure were conceived and developed.

SUMMARY

Aspects of the present disclosure involve a biopsy guide configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The biopsy guide may include a guide member and a displacement member supported by the guide member. The guide member may be configured to operably couple with the transrectal probe and including a distal end, a proximal end opposite the distal end, and a length extending along a longitudinal axis between the distal and proximal ends. The displacement member may be configured to support the access needle and displace the access needle along at least a portion of the length of the guide member between the distal and proximal ends. The access needle may be configured to extend into the subcutaneous tissue when the access needle is displaced to the distal end.

In certain embodiments, the biopsy guide may further include the access needle.

In certain embodiments, the biopsy guide may further include the transrectal probe.

In certain embodiments, the displacement member may be configured to displace along the at least a portion of the length of the guide member between the distal and proximal ends. In certain embodiments, the guide member may include a guide rail extending at least a portion of the length between the distal and proximal ends, and the displacement member may include a coupling mechanism to releasably couple with the guide member. In certain embodiments, the displacement member may be configured to displace relative to the guide member via interaction of the coupling mechanism and the guide rail.

In certain embodiments, the displacement member may be configured to slidably displace relative to the guide member via interaction of the coupling mechanism and the guide rail.

In certain embodiments, the guide rail may include a first guide rail and a second guide rail opposed to the first guide rail, the displacement member releasably coupled between the first and the second guide rails.

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In certain embodiments, the coupling mechanism may include: first upper and lower members which may be configured to sandwich the first guide rail; and second upper and lower members which may be configured to sandwich the second guide rail.

In certain embodiments, the coupling mechanism may include upper and lower members which may be configured to sandwich the guide rail.

In certain embodiments, the displacement member may include a plurality of needle receiving ports for positioning the access needle in a plurality of orientations relative to the transrectal probe. In certain embodiments, each of the plurality of needle receiving ports may be configured to align the access needle parallel with a longitudinal axis of the transrectal probe. In certain embodiments, the plurality of needle receiving ports may include five needle receiving ports.

In certain embodiments, the biopsy guide may include a lower mount releasably coupled to the guide member and including a probe coupling mechanism for releasably coupling with the transrectal probe.

In certain embodiments, the probe coupling mechanism extends at least partially around the transrectal probe, wherein the guide rail extends distally beyond the probe coupling mechanism.

In certain embodiments, the probe coupling mechanism extends at least partially around the transrectal probe, wherein the displacement member may be configured to distally displace beyond the probe coupling mechanism.

In certain embodiments, the guide member may include a slot extending a first length between the distal and proximal ends, the displacement member including a rail member may be configured to be received within the slot such that the displacement member is displaceable along the at least a portion of the length of the guide member between the distal and proximal ends. In certain embodiments, a longitudinal axis of the slot is generally parallel with a longitudinal axis of the transrectal probe when the guide member is secured to the transrectal probe. In certain embodiments, interaction between the slot and the rail member constrains lateral movement of the displacement member relative to the guide member. In certain embodiments, interaction between the slot and the rail member constrains the vertical tilting of the displacement member relative to the guide member. In certain embodiments, the displacement member may include a plurality of needle receiving ports oriented vertically or in a single plane relative to each other. In certain embodiments, the guide member may include a pair of guide rails, the displacement member may be configured to displace between the pair of guide rails.

In certain embodiments, the access needle may extend beyond the distal end of the guide member when the access needle is displaced to the distal end. In certain embodiments, the access needle may be configured to be locked into position at the distal end.

Aspects of the present disclosure may also involve a biopsy guide which may be configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The biopsy guide may include a guide member and a displacement member. The guide member may be configured to operably couple with the transrectal probe and may include a distal end, a proximal end opposite the distal end, and a length between the distal and proximal ends. The displacement member may be

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supported by the guide member and may be configured to support and displace the access needle along at least a portion of the length of the guide member between the distal and proximal ends while maintaining a fixed trajectory of the access needle.

In certain embodiments, may include the transrectal probe.

In certain embodiments, may include the access needle.

In certain embodiments, the displacement member may slidably couple with the guide member via a coupling mechanism such that the displacement member is displaceable relative to the guide member. In certain embodiments, the guide member may include a first rail member, and the coupling mechanism may include upper and lower members that sandwich the first rail member. In certain embodiments, the guide member may further include a second rail member opposite the first rail member, the upper and lower members sandwiching the second rail member. In certain embodiments, the fixed trajectory is generally parallel to a longitudinal axis of the transrectal probe. In certain embodiments, the guide member may include a pair of guide rails extending the length, and the displacement member may be positioned between the pair of guide rails and slidably couple with the pair of guide rails via a coupling mechanism. In certain embodiments, the coupling mechanism may include upper and lower members that sandwich each of the pair of guide rails.

In certain embodiments, the guide member may include a sheath in which the probe resides when the guide member is operably coupled with the transrectal probe.

In certain embodiments, the biopsy guide further includes a mechanical arrangement between the guide member and the displacement member that at least facilitates the displacement of the access needle along the at least a portion of the length of the guide member, wherein the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage.

In certain embodiments, the guide member operably couples with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

Aspects of the present disclosure also involve a biopsy guide which may be configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The transrectal probe may include a distal end, a proximal end opposite the distal end, and a longitudinal axis between the distal and proximal ends. The biopsy guide may include a displacement member which may be configured to be operably coupled with the transrectal probe and to support and displace the access needle along at least a portion of the transrectal probe. The displacement of the access needle may be along a trajectory that is parallel to the longitudinal axis of the transrectal probe.

In certain embodiments, the biopsy guide may further include a guide member operably coupled to the displacement member and by which the displacement member is operably coupled with the transrectal probe.

In certain embodiments, at least a portion of the displacement member displaces relative to the guide member when the access needle is displaced along the trajectory that is parallel to the longitudinal axis of the transrectal probe.

In certain embodiments, the biopsy guide may further include a mechanical arrangement between the guide mem-

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ber and the displacement member that at least facilitates the displacement of the access needle along the trajectory that is parallel to the longitudinal axis of the transrectal probe, wherein the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage.

In certain embodiments, the guide member may operably couple with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

In certain embodiments, the biopsy guide may further include a mechanical interface by which the displacement member is operably coupled with the transrectal probe and by which the displacement member displaces the access needle along the trajectory that is parallel to the longitudinal axis of the transrectal probe. In certain embodiments, the mechanical interface may include at least one of a sliding arrangement directly between the transrectal probe and the displacement member or a rolling arrangement directly between the transrectal probe and the displacement member.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the transrectal probe may include a first portion of the sliding arrangement and the displacement member may include a second portion of the sliding arrangement directly engaged in sliding contact with the first portion. In certain embodiments, at least one of the first portion or second portion comprises a slot, a rail, or a bar.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the sliding arrangement may include at least a portion of the displacement member being in direct sliding contact with an exterior surface of the transrectal probe.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the rolling arrangement may include a roller bearing arrangement supported on the displacement member being in direct rolling contact with an exterior surface of the transrectal probe.

Related art systems and prostate biopsy TPUS methods do not allow free-hand movement of the ultrasound probe, and heavily rely on the axial ultrasound plane to confirm positioning of the biopsy needle or other instruments. Moreover, such systems and methods include extracting prostate tissue specimens by delivering separate punctures into the transperineal tissue. Also, a care provider executing TPUS procedure using related art systems may experience substantial difficulty in freely handling and positioning a biopsy needle at a desired target location of the prostate relying on the sagittal plane in using the TRUS methods.

An apparatus in accordance with an embodiment may include an upper mount and a lower mount. The lower mount may be configured to connect with the upper mount to secure a transrectal probe therebetween. The upper mount may be configured to support an access needle, the access needle configured for perforation of subcutaneous tissue of a perineum at an access site of a target area of a patient. The upper mount may be configured to guide the access needle whereby movement of the access needle is fixed relative to movement of the transrectal probe.

A system in accordance with an embodiment may include a biopsy guide and a transrectal transducer fixed to the biopsy guide. The biopsy guide may be configured to guide an access needle to perforate an access site in subcutaneous tissue of a perineum, whereby movement of the access needle is fixed relative to a movement of the transrectal transducer.

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A method of performing a prostate biopsy in accordance with an embodiment may include imaging a prostate in an axial plane and a sagittal plane with a transducer providing a real-time image, locating a target area of the prostate, and positioning an access needle and an access site in subcutaneous tissue of a perineum wherein the access site is at a midpoint between a lateral edge of the prostate and a urethra along a first axis and a midpoint between an anterior capsule and a posterior capsule along a second axis. The method may include guiding a biopsy instrument along a sagittal plane to the target using the real-time image, and obtaining one or more specimens of the prostate through the access needle with a biopsy instrument.

Accordingly, there is a demand for transperineal biopsy methods, systems, and apparatus that enables a biopsy that is less burdensome for the patient and for the practitioner performing the biopsy, increased guidance of needle or other biopsy instruments, and with a higher rate of efficacy and lower rate of health risk than related art TPUS and TRUS systems and methods. Apparatus, systems, and methods disclosed herein satisfy these demands.

Other implementations are also described and recited herein. Further, while multiple implementations are disclosed, still other implementations of the presently disclosed technology will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative implementations of the presently disclosed technology. As will be realized, the presently disclosed technology is capable of modifications in various aspects, all without departing from the spirit and scope of the presently disclosed technology. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of a guide secured to a probe in accordance with an embodiment;

FIG. 2A shows an internal view of a guide fastener in accordance with an embodiment;

FIG. 2B shows a sheath-based guide fastener in accordance with an embodiment;

FIG. 2C shows a zip-tie-based guide fastener in accordance with an embodiment;

FIG. 3 shows a top view of a guide secured to a probe in accordance with an embodiment;

FIG. 4 shows a cross-sectional view of the back of a guide secured to a probe in accordance with an embodiment.

FIG. 5 shows a magnified view of a guide secured to a probe in accordance with an embodiment;

FIG. 6 is a magnified top view of a guide fastener in accordance with an embodiment;

FIG. 7 is a magnified view of a guide in accordance with an embodiment;

FIG. 8 is a side view of a biopsy instrument that has penetrated the prostate in accordance with an embodiment;

FIG. 9 is a front view of a designated area of the prostate where a biopsy instrument will penetrate in accordance with an embodiment;

FIG. 10 is a side view of a biopsy instrument penetrating the prostate in accordance with an embodiment;

FIG. 11 is a front view of a designated area of the prostate where a biopsy instrument will penetrate with areas in which the cell or tissue specimen has already been extracted in accordance with an embodiment;

FIG. 12 is a top view of a biopsy instrument that has penetrated the prostate in accordance with an embodiment;

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FIG. 13 is a side view of a prostate and the path of the biopsy instrument;

FIG. 14 is a front view of a guide positioned at a designated area of the prostate in accordance with an embodiment;

FIG. 15 is a side view of a guide positioned at a designated area of the prostate in accordance with an embodiment;

FIG. 16 is a front view of a guide positioned at another designated area of the prostate in accordance with an embodiment;

FIG. 17 is a side view of a guide positioned at another designated area of the prostate;

FIG. 18 is a front view of a guide positioned at a higher designated area of the prostate, according to one embodiment;

FIG. 19 is a right side view of a guide positioned at a higher designated area of the prostate in comparison with that shown in FIGS. 14-17 in accordance with an embodiment;

FIG. 20 is a side view of a guide and a biopsy instrument firmly penetrating a fat plane and perineum skin of a patient in accordance with an embodiment;

FIG. 21 is a view of an access needle positioned at the access site in accordance with an embodiment;

FIG. 22 is a magnified view of the right side of a prostate and a biopsy instrument in accordance with an embodiment;

FIG. 23 is an image of the front side of a prostate and a biopsy instrument being retrieved from the prostate, and other targeted areas in accordance with an embodiment;

FIG. 24 shows a method for performing a prostate biopsy in accordance with an embodiment;

FIG. 25 is an ultrasound image showing a transducer, access needle path extending from an access point at a perineal site to a prostate, and a prostate;

FIGS. 26A-26C show side views of a guide configured with a pivoting mount in accordance with an embodiment;

FIG. 27 is an isometric front view of another embodiment of a biopsy guide;

FIG. 28 is a front view of the biopsy guide of FIG. 27;

FIG. 29 is a side view of the biopsy guide of FIG. 27;

FIG. 30 is an isometric front exploded view of the biopsy guide of FIG. 27;

FIG. 31A is a front isometric view of the upper mount of the biopsy guide;

FIG. 31B is a front view of the upper mount of the biopsy guide;

FIG. 31C is a back view of the upper mount of the biopsy guide;

FIG. 31D is a side view of the upper mount of the biopsy guide;

FIG. 31E is a bottom view of the upper mount of the biopsy guide;

FIG. 31F is a top view of the upper mount of the biopsy guide;

FIG. 32A is a front isometric view of the displacement member of the biopsy guide;

FIG. 32B is a front view of the displacement member;

FIG. 32C is a back view of the displacement member;

FIG. 33A is an isometric front view of the lower mount of the biopsy guide;

FIG. 33B is a front view of the lower mount;

FIG. 34 is front isometric view of an access needle;

FIG. 35A is a front isometric view of the lower mount;

FIG. 35B is a front isometric view of the lower mount coupled with the upper mount;

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FIG. 35C is a front isometric view of the lower mount coupled with the upper mount and the sliding platform engaging with the rails of the upper mount;

FIG. 35D is a front isometric view of the assembly of FIG. 35C with an access needle supported by the sliding platform;

FIG. 36 is a front view of another embodiment of the displacement member;

FIG. 37A is an isometric front view of another embodiment of the biopsy guide;

FIG. 37B is an isometric front exploded view of the upper mount of the biopsy guide of FIG. 37A;

FIG. 37C is an isometric back exploded view of the upper mount of the biopsy guide of FIG. 37A;

FIG. 37D is a front view of the upper mount of the biopsy guide;

FIG. 37E is a front isometric view of the displacement member of the biopsy guide;

FIG. 37F is a front view of the displacement member;

FIG. 37G is a side view of another embodiment of the displacement member with the access needle partially positioned within the top needle receiving port of the vertically extending member;

FIG. 37H is a front isometric view of another embodiment of the a biopsy guide;

FIG. 37I is a side view of the biopsy guide of FIG. 37H showing the platform member in various positions relative to the probe;

FIG. 37J is a front isometric view of another embodiment of an upper mount;

FIG. 37K is a front view of another embodiment of a biopsy guide;

FIG. 37L is a side view of the biopsy guide of FIG. 37K;

FIG. 37M is a front isometric view of another embodiment of a biopsy guide;

FIG. 37N is a front view of the biopsy guide of FIG. 37M;

FIG. 37O is a front isometric view of a cinch strap;

FIG. 37P is a front isometric view of a V-block insert;

FIG. 37Q is a front view of the biopsy guide of FIG. 37M with a V-block insert of FIG. 37P;

FIG. 37R is a front isometric view of another embodiment of a biopsy guide;

FIG. 37S is a front view of the biopsy guide of FIG. 37R;

FIG. 37T is a front isometric view of another embodiment of a biopsy guide;

FIG. 37U is a front view of the biopsy guide of FIG. 37T;

FIG. 37V is a front view of another embodiment of a lower mount;

FIG. 37W is an isometric front view of another embodiment of a lower mount;

FIG. 37X is a front view of another embodiment of a lower mount;

FIG. 38A is a transverse plane or slice view of a prostate depicting the urethra and an access site for penetration of the access needle;

FIG. 38B is a sagittal plane or slice view of the prostate depicting the urethra and an access site for penetration of the access needle;

FIG. 38C is the same transverse plane or slice view as FIG. 38A, but including a marking device positioned within the urethra for biopsy navigation; and

FIG. 38D is the same sagittal plane or slice view as FIG. 38B, but including a marking device positioned within the urethra for biopsy navigation.

DETAILED DESCRIPTION

The apparatus, systems, and methods provided herein enable real-time visualization, free-handed, guided, and

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multi-sample transperineal methods for performing a biopsy. The methods, systems, and apparatus provided herein also enable a complete biopsy of the prostate with only one perforation, or with minimal perforations of a patient's skin by way of an initial access site, such that the access needle is freely moveable. The biopsy guide may be placed on or fitted to an assortment of ultrasound probes of different sizes and shapes due to an adjustable mounting system. The guide may be configured to fit to the probe using any suitably configured fastening system. For example, the guide may be configured as a sleeve that is formed to slide over an end of a probe and into an operable position. Alternatively, the guide may be configured to fit to a probe using screws, flanges, zip ties, or other temporary, permanent, or semi-permanent fastening systems.

In one embodiment, the guide allows biopsies of one or more tissue or cell samples to be obtained through an initial access needle, while providing direct, real-time ultrasound visualization by, for instance, fixing a position of the access needle relative to an ultrasound probe to provide. For example, the guide is fixed to an ultrasound probe that is not fixed and may be freely moveable in operation. Stabilization bars that are built into the guide facilitate the positioning and holding of the perineal skin and subcutaneous tissue to allow positioning of the access needle. The position of the access needle is facilitated by locking the access needle into the subcutaneous tissue of the perineum using a sliding platform that allows a user, such as a medical practitioner or patient caregiver, to place the access needle along a sagittal transducer plane at optimal positions for obtaining prostate biopsies. In some embodiments, upon placement of the access needle into a locked position, for example, in the pelvic floor, a user may then pass a biopsy needle through the access needle to a desired location of the prostate. In yet further embodiments, the passing of the biopsy needle through the access needle and to the prostate may be facilitated by direct sagittal plane visualization based on the alignment of the access needle.

Methods and systems provided herein do not require a patient to take antibiotics at any point prior to the biopsy procedure, nor do they require a patient to undergo bowel preparation in advance of the procedure. Methods, systems, and apparatus can reduce or eliminate multiple skin perforations by using a single access location or access site, while allowing multiple extractions of tissue or cell specimens from the prostate. Methods, systems, and apparatus in accordance with embodiments allow for real-time visualization during a free-handed, guided, transperineal approach, while also facilitating a complete assessment of the prostate with, for example, only one perforation of the patient's skin wherein the access needle is freely moveable in each plane.

Methods, systems, and apparatus of embodiments may include and facilitate treatment that uses a cryoablation probe for focal therapy of prostate cancer, a radiofrequency instrument, a thermotherapy instrument, any instrument for treatment of the cancerous area, or a combination of any of these instruments.

Methods, systems, and apparatus of embodiments enable planning and performing the free-hand transperineal prostate biopsies under the guidance of a device and of a real-time transducer in the sagittal imaging plane.

The biopsy is performed using a system that includes a biopsy guide, a transducer, an access needle, and a biopsy instrument. The access needle may allow the anesthesia to be injected into the patient, and the tissue or cell specimens of the prostate to be extracted. If anesthesia is used, a syringe may be included in the system. The transducer may be an

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ultrasound probe or any other type of device that is capable of causing a visualization of the prostate in a display device. In embodiments, the biopsy guide may be disposable. In embodiments, the biopsy guide may be formed of materials intended for a single use. In other embodiments, the biopsy guide is reusable. In some embodiments, the biopsy guide may be formed of materials intended for multiple uses.

The guide may include a sliding platform, stabilization bars, one or more upper and lower mounts, and a fastener. The upper and lower mounts may be curvilinear in shape. The upper and lower mounts may be positioned proximally or distally along an ultrasound probe, such as a transrectal ultrasound probe. The configuration and positioning of the upper and lower mounts are adjustable based on the shape of the ultrasound probe and the patient's body habitus.

The guide may be made of any material such as a plastic or metallic material. The guide may be disposable and made of a biodegradable plastic material. In other embodiments, the guide may be reusable and made of stainless steel. The dimensions, for example, the length, width, height, depth, and breadth of the sliding platform, stabilization bars, upper and lower mounts, and the fastener may vary and may be adjustable. The variable and adjustable dimensions, for example, of the stabilization bars, provide a user with flexibility in achieving and maintaining the guide in an appropriate ultrasound plane while performing biopsy procedures, while the user's patients may vary in size and levels of perineal subcutaneous tissue and fat. In a patient with an excessive amount of perineal subcutaneous tissue and fat, a larger stabilization bar will assist in locking the guide in the proper ultrasound plane.

The adjustable stabilization bars and mounts may be curvilinear in shape, allowing the guide to be placed proximally or distally along any cylindrical instrument, such as the transrectal ultrasound probe, which is determined by the surgeon based on the shape of the probe and the patient's body habitus. This allows the guide to be mounted to any assortment of ultrasound probes. Similarly, the platform may, for example, have various thicknesses.

The stabilization bars may be fixed to a top portion of the upper curvilinear mounts of the guide, and may extend beyond the front edge of the upper mounts. The stabilization bars may extend beyond the front edge of the upper curvilinear mount by approximately 8 mm. The guide may be approximately 60 mm wide, or the guide may be approximately 50 mm long, for example. The stabilization bars may have grooves for accommodating a sliding platform that is shorter in length than the stabilization bars. The grooves being configured to allow the platform to slide forward and backward along the stabilization bars.

An inner portion of the stabilization bars may have built-in grooves. The grooves accommodate a sliding platform which is shorter in length than the stabilization bars. This allows the sliding platform to slide from the back to the front of the stabilization bars. The stabilization bars may include a resistance as to prevent the sliding bar to freely move back and forth on the stabilization bar. This resistance may be introduced by the sliding platform or both the stabilization bar and the sliding platform. The resistance may be provided by a strip of rubber or any other material capable of providing friction or other. The strip may be curvilinear. The resistance may be generated by a mechanical system, such as a spring mechanism.

The sliding platform may have a hole through the platform. In some embodiments, the hole is drilled in the center of the platform. The hole can accommodate various types of needles, including access needles having various diameters,

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for example, spinal needles having a gauge in the range of 14-18. The hole can also accommodate needles having various lengths. The lengths of the needle may depend, in part, on the body habitus. The needle may be a reusable needle, such as a reusable spinal needle. The needle may be a disposable needle, such as a disposable spinal needle.

A flange of the guide secures the placement of the access needle to the guide. The flange may be configured to snap into the guide to secure the needle. The flange may be secured to the guide by other securing mechanisms. The flange can be of various shapes and configurations. For example, the flange may be u-shaped. As another example, the flange may have a thin or slim configuration. The guide assists in providing the appropriate angle of penetration and direction of the access needle, or other instruments that may be used in combination with the guide.

The hole in the guide is placed so that once the guide is mounted to the ultrasound probe, the drilled hole will be parallel to the sagittal transducer. The drilled hole may also accommodate the tip of a biopsy gun, or any other biopsy instrument. The sliding platform may be interchangeable and may be removed to allow placement of another sliding platform with a different sized to permit different sizes of needles and other instruments. The hole may be configured to accommodate a cryoablation instrument, a radiofrequency instrument, thermotherapy instrument, or any other instrument for diagnosis and treatment of a bodily tissue, including a cancerous area of a prostate.

The platform may have or define a predrilled hole in the center of the platform that can accommodate various sizes of needles and instruments. For example, the hole may be configured to accommodate a needle having a range of 14-18 gauges, such as a reusable 14 gauge spinal needle. Central hole placement on the platform enables alignment of the hole with a sagittal transducer when the guide is mounted to an ultrasound probe. The platform may have multiple holes to accommodate various applications and body habitus. Further, the platform may be of various thicknesses.

Once the one or more upper curvilinear mounts are placed at the desired location on the transrectal ultrasound probe, the access hole for a needle, such as a 14 gauge reusable spinal needle, will remain a fixed distance from the ultrasound probe. In embodiments, having one or more lower curvilinear mounts, the mounts may be positioned to cradle an upper aspect of the ultrasound probe.

At least two lower mounts are provided and may be individually positioned to accommodate various types of probes, which may have variable diameters along their shafts. In embodiments, a probe, such as a transrectal ultrasound probe, may have one or more diameters along the probe's shaft. In yet further embodiments, one end of the guide may be fixed at a location of the probe having a different diameter than the location where the other end of the guide is fixed. The separate lower mounts allow for the fixation of the guide, even with varying probe diameters.

The lower mount of the guide may include a lower right mount and a lower left mount connected by an adjustable mid-joint or fastener. The adjustable mid-joint or fastener allows the guide to be secured to the probe even if the diameter of the shaft of the probe is longer than the width of the lower mount. The mid-joint or fastener may be flexible to allow the right lower mount to form an acute angle with the left lower mount. This also allows for fixation of the guide to a probe shaft that is not circular in shape.

The lateral edges on both ends of the lower mounts may contain a notched post. Corresponding locations of the upper mounts contain holes, such as square shaped holes, to

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accommodate the notched post of a corresponding lower mount. An upper aspect of each hole includes a flange for locking the notched post in a fixed position. This configuration allows the lower mounts and the upper mounts to be secured to each other and to the probe.

Methods may include locating a suspicious area, positioning an access needle, and obtaining one or more tissue or cell specimens from an accurate point in the prostate. The method allows for multiple tissue or cell specimens to be obtained from a bodily organ, such as the prostate, and permits access to the prostate from different angles through a single initial access needle. The method may include calculating the volume of the prostate by positioning the access needle at a mid-point in the x axis from the lateral edge of the prostate to the urethra.

Methods may be performed using no anesthesia. Alternatively, an anesthetic may be used. For example, the anesthetic may be lidocaine, or any type of local anesthetic. The lidocaine may include 1 or 2% of a lidocaine solution.

The suspicious area or bodily organ may be located by using a transducer. The transducer may be any type of probe for accessing and viewing a targeted site or object, such as an ultrasound probe, or any type of transducer capable of providing visualization of the prostate and/or instruments and devices for diagnosis and treatment of the tissue. The biopsy may be performed using a biopsy gun, a suction device, or any type of instrument that is small enough to be introduced through the access needle and capable of extracting the tissue or cell specimen. The biopsy may be performed while the patient is in a dorsal lombothy position, prone position, or any position that allows for access to the perineal area.

Methods may include applying an antiseptic solution to the perineal area. The antiseptic solution may include beta-dine, or any other substance that reduces the possibility of infection, sepsis, or putrefaction. Methods may include applying bacitracin to the skin at the puncture site or any other type of topical preparation for preventing the possibility of infection.

Methods may include attaching a needle to a luer lock syringe, which may contain an anesthetic, or any other type of device capable of retaining its contents and dispensing its contents through the needle. A biopsy gun or any other instrument that may be attached to the needle and used for inserting or extracting any substance thru the lumen of the access needle.

Methods may include releasing the syringe from the needle after the anesthetic is injected. Methods may include dividing the prostate in three different regions and designating lateral, mid, apical prostate, and may include labeling the tissue or cell specimen containers, which will identify the tissue or cell specimens.

Methods may include securing the guide to the probe. This will permit the practitioner to take the biopsy gun as many times as necessary using his/her other hand, and, consequently, extract multiple tissue or cell specimens. It is contemplated that this can be done without assistance of any other person, and that the biopsy gun may also be attached to the guide in order to permit the surgeon to, for example, label the container with the tissue or cell specimen while performing the biopsy. Methods may also include monitoring all the actions in the prostate by way of a display device that provides images captured by the probe.

Methods may include moving the needle in x, y, and z planes. By being able to move the needle in x, y, and z planes, the surgeon is capable of extracting tissue or cell specimens from several different areas of the prostate with-

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out having to retrieve the needle and preventing other perforation of the patient's skin. In embodiments, movement of the needle within the patient's body is facilitated by using a display device.

Methods may include removing the access needle from the perineal area. This may be done while the biopsy gun is secured to the access needle or after the biopsy gun has been detached from the access needle.

Methods may include realigning the needle in the desired prostate region. If the surgeon wishes to start at the right lateral prostate region and notices that the needle tip is not directed at the lateral region, the surgeon rolls the ultrasound probe slightly and to note that the needle tip is directed to the desired region, then the surgeon may realign the needle to obtain tissue or cell specimen. The surgeon may realign the needle using one hand while having the needle attached to the biopsy gun, which may be attached to the probe through the guide.

Methods may include identifying the areas in which biopsy have already been performed. After each extraction of tissue or cell specimen during the biopsy, a hyperechoic streak remains visible on ultrasound display. This allows the surgeon to identify the area of the prostate and that an extraction has been made, as to allow the surgeon to prevent overlap of extractions.

In another embodiment, the method includes identifying the path of the urethra. This allows the surgeon from preventing passing the biopsy needle thru or into this path.

FIG. 1 is a side view of a guide 100 secured to a probe including a stabilization bar 101, fasteners 102, probe 103, lower mounts 104, and an upper mount 105. The stabilization bar 101 is an extension of the upper mount 105, as further discussed in FIG. 4. In embodiments, the distance between the fasteners 102 and the upper mount 105 may be adjustable to accommodate various applications and body habitus.

FIG. 2A is an internal view of a guide's fastener, including an aperture 201, teeth 202, and a flange 203. The flange 203 may be an extension of the aperture 201, which is part of the upper mount 105. Aperture 201 will allow the teeth 202 to be inserted into the upper mount 105, and the flange 203 will lock the teeth 202, which is connected to lower mount 104, to the upper mount 105. The aperture 201 with flange 203 and teeth 202 allows for adjusting the height of the guide 100.

In one embodiment, the fastener (e.g., via the aperture 201, flange 203, and/or the teeth 202) can be configured to fasten the guide 100 to the probe 103 with, e.g., varying levels of tension to provide for adjustments of the relative positions of the guide 100 and the probe 103 even after the guide 100 has been mounted to the probe 103. For example, the fastener 102 can provide a first level of tension sufficient to hold the position of an access needle (e.g., introduced through a hole or other needle mount of the guide 100) rotationally fixed to the probe 103 while still allowing for a forward or reverse sliding of the probe 103 with respect to the guide 100. By way of example, the forward or reverse sliding adjustment can be performed to adjust the penetration depth of the probe 103 with respect to the patient depending on a size of the patient. Once the final adjustment is made, the fastener can be actuated to final position or tension that will then lock further adjustments of the positioning of the guide 101 relative to the probe 103.

It is noted that the guide's fastener as described above is one example embodiment among other possible example fasteners that are applicable to various embodiments of the guide 100. Accordingly, it is contemplated that various

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embodiments of the guide 100 may use any now known or later developed fastening system that can secure the guide 100 to the probe 103.

By way illustration and not limitation, examples of two fasteners are discussed with respect to FIGS. 2B and 2C. FIG. 2B shows a sheath-based fastener whereby the fasteners 102 are attached to a sheath 211 that is configured to slide over an end of a probe 103 and into an operable position. Although the sheath 211 is shown as a closed sheath, in another embodiment, the sheath 211 can be configured as a sleeve that is open-ended to slide over the probe 103. By way of example, the sheath 211 can be made of a flexible material (e.g., rubber) to provide for stretching and tension on probe 103.

In another embodiment, as shown in FIG. 2C, the guide 100 can be configured with a zip-tie style fastener in place of a lower mount mechanism to secure the guide 100 to the probe 100. In other embodiments (now shown), the guide 100 may be configured to fit to the probe 100 using screws, flanges, or other temporary, permanent, or semi-permanent fastening systems. In addition, although the fasteners 102 of the guide 100 may be configured as generic and adjustable fasteners that can support probes of a variety sizes and shapes, it is also contemplated that the fasteners can be fit to specific models of probes for customized applications.

FIG. 3 is a top view of a guide secured to a probe. This figure includes a sliding platform 301, a drilled hole 302, stabilization bars 101, fasteners 102, an upper mount 105, and a probe 103. As previously described, in one embodiment, the drilled hole 102 can accommodate or support various sizes and/or configurations of needles (e.g., straight needles, curved needles, etc.) and instruments for performing a biopsy so that the needle can be aligned relative to the probe 103, thereby, also providing an alignment between the needle and an image produced by the ultrasound probe 103. In one embodiment, the drilled hole 102 can support an access needle through which a biopsy needle or other instrument can be introduced at a known alignment with respect to the probe 103. In addition, although the hole 102 to support, e.g., an access needle or other instrument is showed in a central midline position, the location of the hole can be configured at any position of the guide 100.

FIG. 4 is a cross-section view of the back of a guide secured to a probe including a sliding platform 301, drilled hole 302, stabilization bars 101, lower mount 104, upper mount 105, fasteners 102, and probe 103.

FIG. 5 is a magnified view of FIG. 1. FIG. 5 demonstrates minimum dimensions of preferred embodiments, which includes stabilization bars 101 and upper mount 105 from 30 mm to 50 mm long; the upper mount 105 with a height ranging from 10 mm to 15 mm; the stabilization bars 101 with a height that is about 1/3 of the height of the upper mount 105; fasteners 102 with a height of about 25 mm and 10 mm wide; a lower mount 104 10 mm wide. Additionally, the offset 501 from the distal point of the stabilization bar 105 to the fasteners 102 may be 5 mm. It is contemplated that any of these dimensions may vary, including the stabilization bar 101, which may be longer than the upper mount 105.

FIG. 6 is a magnified internal view of the guide fastener shown in FIG. 2. FIG. 6 demonstrates minimum dimensions of preferred embodiments. The fasteners 102 may have an aperture 201 to accommodate teeth 202, wherein the fastener 102 is 5 mm to 10 mm wide. Additionally, the sliding platform 301, which may be from 12 mm to 25 mm wide, is slightly shorter than the distance between the two stabiliza-

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tion bars **101** as to accommodate the sliding platform while also securing it to the guide **100**.

FIG. **7** is a magnified view of the guide depicted FIG. **3**, without the probe **103**. FIG. **7** also demonstrates minimum dimensions of preferred embodiments, wherein the height of the upper mount **105** ranges from 5 mm to 10 mm; and the teeth **202** is from 5 mm to 8 mm wide.

FIG. **8** is a side view of a biopsy instrument that is about to penetrate the prostate, including a prostate **801**, a probe **103**, a biopsy instrument **802**, a perineum skin **803**, an anus **804**, and a perforation point **805**. The probe **103** is inserted into the anus **804** to provide real-time images of the biopsy, including images of the biopsy instrument **802** and the prostate **801**. It is contemplated that the biopsy instrument **802** includes a needle and any other instrument capable of performing a biopsy.

FIG. **9** is a front view of a targeted area **902** of the prostate **801**. FIG. **10** is a side view of a biopsy instrument penetrating the prostate **801**, including a targeted area **902** of the prostate **801**. The targeted area **902** is reached by biopsy instrument **802** after perforating perineum skin **803**.

FIG. **11** is a front view of a targeted area of the prostate where a biopsy instrument will penetrate with areas in which the cell or tissue specimen has already been extracted. FIG. **11** depicts both an extracted area **1101** and a targeted area **902**. The possibility of viewing the area in which the cell or tissue specimen has already been extracted permits the practitioner to avoid placing the access needle in an area that cell or tissue specimen has already been extracted. This allows the biopsy to be more efficient and more accurate.

FIG. **12** is a top view of FIG. **8**, depicting a prostate **801**, perineum skin **803**, a probe **103**, and a biopsy instrument **802**. FIG. **13** is a right side view of a prostate and the path of the biopsy instrument including the path of the biopsy instrument **1301** and the perforation point **805**. FIG. **13** illustrates that only one initial perforation to the skin of the patient is necessary in order to extract one or more cell or tissue specimens.

FIG. **14** is a front view of a guide determining a lower targeted or suspicious area **1401** of the prostate in which to penetrate the biopsy instrument, a prostate, and a probe. FIG. **16** is a front view of a guide determining a mid-targeted or suspicious area **1601** of the prostate in which to penetrate the biopsy instrument, a prostate, and a probe. FIG. **18** is a front view of a guide determining a higher targeted or suspicious area **1801** of the prostate in which to penetrate the biopsy instrument, a prostate, a probe. FIGS. **14**, **16**, and **18** demonstrates the variety of angles and positions in which a guide may be positioned in order to reach several regions of the prostate, such as the lateral region, mid region, and apical region. In order to be able to reach these areas, FIGS. **14**, **16**, and **18** demonstrate how the upper mount **105**, the stabilization bars **101**, or a combination of thereof can adjust in order to reach a lower targeted or suspicious area **1401**, a mid-targeted or suspicious area **1601**, or a higher targeted or suspicious area **1801** of the prostate.

FIGS. **15**, **17**, and **19** demonstrate a side view of FIGS. **14**, **16**, and **18** and the paths of the biopsy instrument **1301** taken by a biopsy instrument to reach lower targeted or suspicious area **1401**, a mid-targeted or suspicious area **1601**, or a higher targeted or suspicious area **1801** of the prostate.

FIG. **20** is a right side view of a guide, and a biopsy instrument firmly penetrating a fat plane of perineum skin, including offset **501** of a stabilization bar **101**. This allows for stabilization in a patient with an excessive amount of perineal subcutaneous tissue, fat, or a combination thereof. A larger stabilization bar **101** will assist in locking the guide

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in the proper ultrasound plane. Accordingly, the offset **501** may longer than 5 mm for these purposes.

FIG. **21** is a front view of a prostate, a probe, a targeted or suspicious area, wherein the biopsy instrument may reach any area of the prostate. FIG. **21** demonstrates that the biopsy instrument can reach the entire prostate while using only one perforation point **805**. After obtaining one cell or tissue specimen, the biopsy instrument **802** may be partially retrieved from the perineum area at a point in which the distal point of the biopsy instrument **802** is redirected to another targeted or suspicious area. Then, the biopsy instrument (usually the needle of the biopsy instrument) is inserted to the second targeted or suspicious area for obtaining a cell or tissue specimen of another area of the prostate.

FIG. **22** is a magnified view of the right side of a prostate and a biopsy instrument. FIG. **22** depicts the location of the biopsy instrument inside the prostate and the other paths in which the biopsy instrument may take utilize for additional samples or retrieval. In embodiments, the biopsy needle or other instruments do not reach the initial part of the penis, which is in a different plane from the prostate.

FIG. **23** is an image of the front side of a prostate and a biopsy instrument being retrieved from the prostate, and other targeted areas. FIG. **23** shows a procedure being applied to the apical region of the prostate.

The urethra should be avoided in any part of the procedure, but it is mostly important when extracting cell or tissue specimens from the apical region of the prostate, when the chances of perforation is greater. After several extractions, the practitioner is able to see the blood streak from where the cell or tissue specimen was taken so as to avoid overlapping.

After this procedure, the patient may be put with restriction for no more than 1 day. If the patient is put on restriction for 1 day, after the one-day-restriction, no restriction is made.

In an embodiment, the biopsy system performs the processes **2400** of FIG. **24**. At **2401**, a patient is prepared for the biopsy procedure by having the patient get into a lithotomic position, prone position, or any position that allows for access to the perineal area. The biopsy procedure may be a prostate biopsy. In some embodiments, the patient's scrotum is elevated using, for example, two strips of plastic tape. The perineum is prepared with an antiseptic solution to the perineal area, for example, the antiseptic solution may include betadine.

At **2402**, a target area or object, such as the prostate, is imaged. Imaging may be performed with a transducer, such as an ultrasound probe. Imaging of a target area may be in a sagittal and/or axial plane and may be performed in real-time with direct visualization. Utilizing the real-time image, a user can identify areas of interest, e.g. suspicious areas or the target area or object at **2403**.

The user may determine an access site for positioning an access needle. At **2404**, an access needle is positioned at an access site in subcutaneous tissue of the perineum. The access site may be at a midpoint between a lateral edge of the prostate and the urethra along an x axis, and a midpoint between an anterior capsule and a posterior capsule along a y axis. The access needle is guided and positioned at the access site by using the guide.

At **2405**, a biopsy instrument is guided to the target or suspicious areas or object. The biopsy instrument may include a biopsy needle. The guiding of the biopsy instrument can be facilitated by using the real-time visualization provided by the transducer. Real-time visualization also facilitates obtaining tissue or cell specimens from an accurate point in the prostate, for example. The method allows

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for one or more tissue or cell specimens to be obtained from a bodily organ, such as the prostate at **2406**, and permits access to the prostate from different angles through a single initial access needle.

At **2407**, the biopsy instrument may be retrieved and removed from the patient. The method may include calculating the volume of the prostate by positioning the access needle at a mid-point in x axis from the lateral edge of the prostate to the urethra.

FIG. **25** shows an ultrasound **2501** showing a transrectal probe **2503** and an access needle guide line **2505**. The needle guide line enables the practitioner to observe a needle path whereby the access needle has contacted the prostate **2507**, thereby enabling the practitioner to avoid overlapping sampling, and to avoid perforating the prostate.

FIGS. **26A-26C** show side views of an alternative embodiment of a guide **2600** secured to a probe including a stabilization bar **101**, fasteners **102**, probe **103**, lower mount **104**, and an upper mount **105**. The stabilization bar **101** is an extension of the upper mount **105**, as further discussed in FIG. **4**. In embodiments, the distance between the fasteners **102** and the upper mount **105** may be adjustable to accommodate various applications and body habitus.

The guide **2600** includes a sliding platform **301**. The guide is fitted to the probe **103** by a sleeve **2607**. The sleeve **2607** is formed by the lower mount **104** and the upper mount **105**. The sleeve **2607** may be configured to slide over an end of the probe **103** into an operable position as shown in FIGS. **26A-26C**. The sleeve **2607** is a partial sleeve that has an opening at both ends of the sleeve **2607** to enable slidable mounting to and removal from the probe **103**.

The sliding platform **301** of the guide **2600** may be pivotably mounted to enable movement in a direction perpendicular to a longitudinal axis of the probe **103**, as shown in FIGS. **26A-26C**. In particular FIGS. **26A-26C** show that the sliding platform **103** is fixed to the guide at a pivot point **2608**. The sliding platform **103** is configured to pivot at pivot point **2608** to enable, for example, normal or vertical adjustment of an access needle (not shown) in directions perpendicular to a longitudinal axis of the probe **103** while ensuring that a longitudinal axis of the access needle (not shown) remains parallel to the longitudinal axis of the probe **103**.

For example, FIG. **26A** shows a sliding platform **301** in a first position at which a lateral planar surface of the platform **301** extends in a direction parallel to the longitudinal axis of the probe **103**. FIG. **26B** shows the sliding platform **301** pivoted to a second position wherein a front end the platform **301** is disposed a distance from the probe **103** that is greater than a distance between an opposite rear portion of the platform **301** and the probe **103**. FIG. **26C** shows the sliding platform **301** pivoted to a third position wherein the rear end of the platform **301** is disposed a distance from the probe **103** that is greater than a distance between the opposite front end of the platform **301** and the probe **103**.

In another embodiment, the method may be performed without the patient taking antibiotics or undergoing bowel preparation before having the procedure. During the procedure, the practitioner may administer an anesthetic to the patient, for example, lidocaine, or any type of local, anesthetic. The lidocaine may be included in a solution having 1% of lidocaine.

In an embodiment, the suspicious area is located by using a transducer. The transducer may be any type of transrectal probe for prostate cancer, such as an ultrasound probe, or any type of transducer capable of imaging the prostate and the extraction device. The biopsy may be performed using a biopsy gun, a suction-mechanism, or any type of instrument

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that is small enough to be introduced through the access needle and capable of extracting the tissue or cell specimen. The biopsy may be performed while the patient is in a lithotomy position, prone position, or any position that allows for access to the perineal area.

In another embodiment, methods may include applying an antiseptic solution to the perineal area such as betadine, or any other substance that reduces the possibility of infection, sepsis, or putrefaction.

In another embodiment, the ultrasound probe may be a B&K 8848 transrectal ultrasound probe, or any other ultrasound capable of causing visualization of the prostate and the extraction device. The frequency range may be 5-12 MHZ, and the focal range may be 3-60 mm. The ultrasound probe may be able to cause the visualization of the prostate and extraction devices at least in the axial plane, sagittal plane, or a combination thereof.

In another embodiment, methods may include attaching a needle to a luer lock syringe, which may contain an anesthetic, or any other type of device capable of retaining its contents and to dispense its contents through the needle. A biopsy gun or any other instrument may be attached to the needle for inserting or extracting any substance through the lumen of the access needle.

In another embodiment, the method includes releasing the syringe from the needle after the anesthetic is injected. The method may include dividing the prostate in three different regions and designating lateral, mid, apical prostate, and may include labeling the tissue or cell specimen containers, which will identify the tissue or cell specimens.

In another embodiment, a biopsy gun may be an 18 gauge biopsy gun, or any other size that is capable of being coaxially inserted thru the lumen of the access needle.

In another embodiment, methods may include securing the guide to the probe. This will permit the practitioner to take the biopsy gun as many times as necessary using his or her other hand, and, consequently, extract multiple tissue or cell specimens. It is contemplated that this can be done without assistance of any other person, and that the biopsy gun may also be attached to the guide in order to permit the surgeon to e.g. label the container with the tissue or cell specimen while performing the biopsy. The method may also include monitoring all the actions in the prostate thru a display device, which will transmit images captured by the probe.

In another embodiment, methods may include moving the needle in x, y, and z planes. By being able to move the needle in x, y, and z planes, the surgeon is capable of extracting tissue or cell specimens from several different areas of the prostate without having to retrieve the needle and preventing other perforation of the patient's skin.

Methods may further include removing the access needle from the perineal area. Removal of the access needle may be performed while the biopsy gun is secured to the access needle or after the biopsy gun has been detached from the access needle.

Methods may include realigning the needle in the desired prostate region. If the surgeon wishes to start at the right lateral prostate region and notices that the needle tip is not directed at the lateral region, the surgeon rolls the ultrasound probe slightly and to note that the needle tip is directed to the desired region, then the surgeon may realign the needle to obtain tissue or cell specimen. The surgeon may realign the needle using one hand while having the needle attached to the biopsy gun, which may be attached to the probe through the guide.

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Methods may include identifying the area in which a biopsy has already been performed. After each extraction of tissue or cell specimen during the biopsy, a hyperechoic streak remains visible on ultrasound display. This allows the surgeon to identify the area of the prostate and that an extraction has been made, as to allow the surgeon to prevent overlap of extractions.

In another embodiment, methods may include identifying the path of the urethra. This allows the surgeon from preventing passing the biopsy needle thru or into this path. In another embodiment, the method includes pressuring the perineum. In yet another embodiment, the method includes applying bacitracin to the skin at the puncture site or any other type of topical preparation for preventing the possibility of infection. In another embodiment, positioning the access needle is performed without the need of a biopsy grip, wherein the guide provides the precise point for the biopsy.

An apparatus and system in accordance with embodiments discussed above is used to carry out these methods. In an alternative embodiment of apparatus and systems, a guide may not include a lower mount, and may include an access needle. The guide includes a stabilization bar, sliding platform, a hole located in approximately the center of the platform, an upper mount, teeth, aperture, arms, and a connector. The access needle includes a hub and is secured to the guide. The teeth may be part of, or may be attached to, a lower mount. The teeth may be inserted into the aperture in order to secure the guide to a probe, for example. It is contemplated that the combination of the aperture and the teeth may form a fastener mechanism. In embodiments, connector is part of, or may be attached to, an access needle, and may be secured to the upper mount in order to provide stabilization of the access needle and to allow the practitioner to move the access needle by merely moving, for example, a probe that may be secured to the guide.

A connector and a hub permit the use of various other instruments such as, for example, a non-biopsy instrument, to be secured. A biopsy instrument may be inserted into the access needle in order to reach a targeted area. The upper mount may include arms. In embodiments, the arms may be shorter, longer, or may not exist, in which case the aperture is disposed directly in the upper mount. When the aperture is directly in the upper mount, upper mount may be longer, thicker, or a combination thereof.

In some embodiments, the guide may include lower mounts that have teeth. Arms may extend from the upper mount to allow the height of the guide to be adjusted and to be placed farther from or closer to the probe. The arms permit the access needle to be maintained at a certain distance from a probe. In embodiments, the material of the guide may be a plastic or any other material, including other plastic materials, or any other material that is cost effective. In embodiments, the guide may be reusable and may be formed with a stainless steel. The lower mount may be curvilinear and flexible to allow the lower mount to bend if necessary to secure the guide to the probe.

Reference is made to FIGS. 27-35D, which depict various views of another embodiment of a transperineal biopsy guide 2700. As with the previously described embodiments, the biopsy guide 2700 may couple with a transrectal probe and may be used in guiding an access needle in a transperineal prostate biopsy procedure. While reference will be made to the embodiment in FIGS. 27-35D, aspects of the previously described embodiments may be incorporated into the present embodiment without limitation. And, aspects of the present embodiment may be similarly incorporated into the previously described embodiments without limitation.

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To begin, reference is made to FIGS. 27-30, which depict, respectively, a front isometric view, a front view, a side view, and a front isometric exploded view of the transperineal biopsy guide 2700. As seen in the figures, the biopsy guide 2700 includes an upper mount 2702 and a lower mount 2704. The lower mount 2704 includes a probe coupling or fastening mechanism 2706 to couple the lower mount 2704 with a transrectal probe (not shown in FIGS. 27-28, but shown in FIGS. 1, 2B, and 3-6, for example). The lower mount 2704 additionally includes an upper mount coupling mechanism 2714 to couple the lower mount 2704 with the upper mount 2702. While FIGS. 27-30 depict a single coupling mechanism 2706, it is foreseen that the biopsy guide 2700 may include more than one coupling mechanism 2706, as shown and described in previous embodiments.

The upper mount 2702 may couple with the lower mount 2704 and may include a guide member 2708 and a displacement member, translating member, or sliding platform 2710. The displacement member 2710 may couple with an access needle 2712 and be supported by the guide member 2708. More particularly, the displacement member 2710 may slidably couple with the guide member 2708 such that the displacement member 2710 and the access needle 2712 are guided along a trajectory that is fixed relative to the guide member 2708 and the transrectal probe. The trajectory of the access needle 2712 may be generally parallel with a longitudinal axis of the transrectal probe when the biopsy guide 2700 is coupled with the probe.

Reference is made to FIGS. 31A-31F, which depict various views of the guide member 2708 of the upper mount 2702 of the biopsy guide 2700. FIG. 31A is a front isometric view of the guide member 2708; FIG. 31B is a front view of the guide member 2708; FIG. 31C is a back view of the guide member 2708; FIG. 31D is a side view of the guide member 2708;

FIG. 31E is a bottom view of the guide member 2708; and, FIG. 31F is a top view of the guide member 2708.

As seen in the figures, the guide member 2708 includes a distal end 2716, a proximal end 2718 opposite the distal end 2716, and a longitudinal axis 2720 extending through the distal and proximal ends 2716, 2718. As described herein locational orientations of distal and proximal are relative to the patient or, more particularly, the perineum of the patient. As such, distal generally refers to towards the patient and proximal refers to away from the patient.

Referring back to the figures, the guide member 2708 further includes a base platform 2722 extending substantially perpendicularly between a pair of vertical extension members 2724. Atop each of the vertical extension members 2724 is a guide rail or stabilization bar 2726 that is adapted to slidably engage with and allow the displacement member 2710 to translate along a trajectory that is parallel with the longitudinal axis 2720 of the guide member 2708.

As best seen in FIGS. 31A and 31C, each of the guide rails 2726 includes a generally rectangular member 2728 that is perpendicularly oriented to the vertical extension members 2724. The rectangular member 2728 extends from the proximal end 2718 to the distal end 2716 of the guide member 2708. The vertical extension members 2724 couples with a bottom surface 2730 of the rectangular member 2728. An outer lateral edge of the rectangular member is coupled with a side member 2732 that extends from the proximal end 2718 to the distal end 2716 of the guide member 2708. A distal member or flange 2734 extends inwardly from the rectangular member 2728 a distance that is equal to the width of the rectangular member 2728. More particularly, the distal member 2734 includes a rounded inner edge 2736

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that is coplanar, at its apex, with an inner edge 2738 of the rectangular member 2728. The distal member 2734 may include a planar distal face or surface 2740 with an opening 2742 formed therein. The opening 2742 may facilitate an access point for injection molding. As with previously described embodiments, the guide rails 2726 and, more particularly, the distal face 2740 of the guide rails 2726 may facilitate the positioning and holding of the perineal skin and subcutaneous tissue to allow positioning of the access needle 2712.

As seen in FIGS. 31A, 31C, and 31F, a top surface 2744 of the rectangular member 2728 includes a stop feature 2746 to secure or lock the displacement member 2710 in a distal or deployed condition or position. The stop feature 2746 is a ramp that distally slopes upward until the apex of the ramp at which point the ramp distally slopes downward. In the distal position, the displacement member 2710 is at a distal-most position and abuts or is adjacent a proximal face 2748 of the distal member 2734. The distal member 2734, thus, prevents further distal movement of the displacement member 2710 and the stop feature 2746 restrains proximal movement a certain amount. In certain embodiments, as seen in the figures, the proximal end 2718 of the rectangular member 2728 is open such that the displacement member 2710 can be slidably engaged with the rectangular member 2728.

As seen in FIGS. 31A and 31D-31F, the base platform 2722 extends about one half of the overall longitudinal distance of the guide rails 2726. In this way, the guide rails 2726 extend beyond both the base platform 2722 and the vertical extension members 2724 such that the guide rails 2726 may contact the perineal skin and subcutaneous tissue of the patient but not a distal edge 2750 of the base platform 2722 or a distal edge 2752 of the vertical extension members 2724. And since a distal portion of the lower mount 2704 lies generally flush with the distal edge 2750 of the base platform 2722, the lower mount 2704 also may be spaced apart from the skin of the patient during the biopsy procedure. In this way, in certain embodiments, the guide rails 2726 may contact the skin of the patient while the other portions of the guide 2700 remain spaced apart from the patient's skin.

As seen in FIG. 31D, the distal edge 2752 of the vertical extension member 2724 is arcuate and a proximal edge 2754 of the vertical extension member 2724 includes a semi-circular path about halfway between the base platform 2722 and the guide rails 2726. As seen in FIGS. 31E-31F, the base platform 2722 includes a pair of channels 2756 extending parallel to each other and extending longitudinally. These channels 2756 may coaxially align with snap features 2758 in the upper mount coupling mechanism 2714 of the lower mount 2704 to facilitate the upper mount 2702 being coupled with the lower mount 2704. Once the channels 2756 and the snap features 2758 are aligned, the upper and lower mounts 2702, 2704 may be snapped together such that the snap feature 2758 extends through the channels 2756 to securely couple the mounts together. While the figures show channels 2756 and snap features 2758, other mechanisms are possible to couple the upper and lower mounts 2702, 2704. For example, the base platform 2722 and the upper mount coupling mechanism 2714 may each include through holes that coaxially align. And, screws or nuts/bolts may be used to secure the mounts 2702, 2704 together.

As seen in FIGS. 31B-31C and 31E, the bottom surface 2762 of the base platform 2722 includes a rectangular rail or protrusion 2764 extending longitudinally. The top surface of the base platform 2722 includes a longitudinally extending groove, which may be used to align the guide member 2708

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with the sagittal plane of the ultrasound probe. As seen in FIG. 31E, the channels 2756 extend through the rail 2764. As will be described subsequently, the rail 2764 may engage with a platform 2766 of the upper mount coupling mechanism 2714 of the lower mount 2704 so as to align the upper and lower mounts 2702, 2704 upon coupling together.

Reference is made to FIGS. 32A-32C, which depict, respectively, a front isometric view, a front view, and a back view of the displacement member 2710. As described previously, the translating or displacement member 2710 may be coupled with the guide rails 2726 of the guide member 2708 so as to be displaceable or slidable between the proximal end 2718 of the guide member 2708 to the distal end 2716. Thus, when the access needle 2712 is coupled with the displacement member 2710, the access needle 2712 is also displaceable between the proximal end 2718 of the guide member 2708 to the distal end 2716.

As seen in the figures, the displacement member 2710 includes a central vertically extending member 2760 having five needle receiving ports 2768 formed therein. Each needle receiving port 2768 includes an opening 2770 extending from a distal end 2772 to a proximal end 2774 of the displacement member 2710. Each of the openings 2770 of the needle receiving ports 2768 are generally vertically aligned with each other and each includes a trajectory axis 2776 defining a trajectory of the access needle 2712 when positioned within the opening 2770. The trajectory axis 2776 is generally parallel to the longitudinal axis 2720 of the guide member 2708 when the displacement member 2710 is coupled with the guide member 2708. The trajectory axis is also generally parallel with a longitudinal axis of the probe when the biopsy guide 2700 is coupled with the probe. Thus, the trajectory axis 2776 of the access needle 2712 may be generally fixed or constant, in a generally parallel orientation to the previously described axes, as the displacement member 2710 displaces distal-proximal relative to the guide member 2708.

A particular needle receiving port 2768 may be chosen based on a desired distance from the probe. Thus, if a physician desires that the access needle 2712 should be positioned nearer the probe, a particular needle receiving port 2768 may be chosen that is at the bottom of the displacement member 2710. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 5 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 3 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 4 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart at any interval between about 2 mm to about 6 mm, among other distances.

While the vertically extending member 2760 includes five needle receiving ports 2768, it is foreseen that more or less ports may be included in the displacement member 2710 without limitation.

The displacement member 2710 further includes a coupling mechanism 2778 to displaceably couple the displacement member 2710 and the guide rails 2726. The coupling mechanism 2778 includes a pair of lower tab members 2780 extending laterally out and away from the vertically extending member 2760. When coupled with the guide rails 2726, the lower tab members 2780 may abut or be positioned adjacent the bottom surface 2730 of the rectangular member 2728. The tab members 2780 include a planar top surface 2782 that may provide sliding contact with the bottom surface 2730 of the rectangular member 2728. The planar

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contact between the surfaces may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing vertical tilt of the displacement member 2710.

The coupling mechanism 2778 further include an upper member 2784 positioned above the lower tab members 2780. A bottom surface 2786 of the upper members 2784 may abut or be positioned adjacent the top surface 2744 of the rectangular member 2728 when the displacement member 2710 is coupled with the guide rails 2726. The bottom surface 2786 of the upper members 2784 is planar and, thus, the planar contact between the surfaces may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing vertical tilt of the displacement member 2710. The upper members 2784 and the lower tab members 2780 operate to sandwich the rectangular members 2728 of the guide rails 2726 when the displacement member 2710 is coupled with the guide member 2708.

The coupling mechanism 2778 further includes a lateral brace mechanism 2788 at lateral ends of the upper members 2784. The lateral brace mechanism 2788 includes an upside-down U-shaped member 2790 having three inner surfaces 2792 that define a longitudinal extending channel 2794 therein. The channel 2794 may receive the side members 2732 therein when the displacement member 2710 couples with the guide rails 2726. In this way, the lateral brace mechanism 2788 may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing lateral tilt of the displacement member 2710. It is foreseen that the displacement member 2710 may not include the lateral brace mechanism 2792 and may instead only include the upper member 2784 and the lower tab members 2780. Alternatively, it is foreseen that the displacement member 2710 may not include the upper member 2784 and the lower tab members 2780, but may only include the lateral brace mechanism 2792. Additionally and alternatively, other mechanisms are possible to facilitate the displacement member 2710 displacing between the proximal and distal ends 2718, 2716 of the guide member 2708. For example, the guide member 2708 could include longitudinally extending rods (not shown) and the displacement member 2710 may include a sleeve that engages and is guided by the rods. In such an embodiment, the rods may be adapted to slide within the openings 2770 of the needle receiving ports 2768 with or without modification to the displacement member 2708.

Still referring to FIGS. 32A-32C, flanges 2796 extend laterally from the upside-down U-shaped members 2790, which may act as grasping points for the physician. The flanges 2796 extend inwardly and are coplanar with a back wall member 2798 that spans between the upside-down U-shaped members 2790, the vertically extending member 2760, and the upper members 2784. The back wall member 2798 may function to provide rigidity between the various components of the displacement member 2710. As seen in FIG. 32C, a proximal side 2800 of the needle receiving ports 2768 includes keyed features to lockingly engage the access needle 2712 such that it does not rotate once it is coupled with the port 2768.

Reference is made to FIGS. 33A and 33B, which depict, respectively, a front isometric view and a front view of the lower mount 2704 of the biopsy guide 2700. As previously described, the upper mount coupling mechanism 2714 includes the snap features 2758 to couple with the channel 2756 in the base platform 2722. Each of the snap features 2758 may be vertical flanges 2802 with a lip 2804 at its vertical termination. As the inner surfaces defining the

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channels 2756 contact the vertical flanges 2802, the inner surfaces compress the lips 2804 together relative to each other until the flanges 2802 “snap” or expand outwardly relative to each other such that the lips 2804 are on a top surface of the base platform 2722. The vertical flanges 2802 extend from the platform 2766 of the upper mount coupling mechanism 2714. The platform 2766 is coupled with the probe coupling mechanism 2706, which, as seen in the figures, may be a snap-grip or snap-clip type of hose or tube clamp. The mechanism 2706 may include a first and a second arm member 2804, 2806 extending from opposite sides 2808 of the platform 2766. The arm members 2804, 2806 are flexible and designed to wrap around a portion of the probe fitted within the opening formed by the first and second arms 2804, 2806. The first arm member 2804 includes a first clamping structure 2810 including an upper row of teeth 2812 and a lower smooth sliding surface 2814. The second arm member 2806 includes a second clamping structure 2816 including an upper smooth sliding surface 2818 and a lower row of teeth 2820. The first and second clamping structures 2810, 2816 work together to provide a clamping or gripping function to securely support the transrectal probe to the lower mount 2704 and, thus, the upper mount 2702.

In operation, a transrectal probe is positioned within the opening between the first and second clamping structures 2810, 2816. The physician may determine a desired position on the probe based on the patient’s anatomy, the particular transrectal probe, or the particular procedure to be performed, among other possible criteria. Once a position for the lower mount 2704 is chosen, the physician may cause the first and second arm members 2804, 2806 to be contracted relative to each other by pushing on the outer ends 2822 of the clamping structures 2810, 2816, respectively. As the clamping structures 2810, 2816 converge relative to each other, the lower row of teeth 2820 on the second clamping structure 2806 is received within an opening 2824 formed between the upper row of teeth 2812 and the lower smooth surface 2814. The upper row of teeth 2812 are caused to engage with the lower row of teeth 2820. Additionally, the upper smooth surface 2818 is caused to slide on an inner smooth surface 2826 of the first arm member. And, the lower smooth sliding surface 2814 is caused to slide on a lowest smooth surface 2828 on the second clamping structure 2816. The teeth of the upper and lower row 2812, 2820 are arranged in a saw tooth like manner such that when they are increasingly engaged with each other the teeth grip each other and resist moving in the opposite direction. Once engaged, the teeth may be disengaged by pulling on a tab 2830 on a bottom portion of the first clamping structure 2810. Pulling on the tab 2830 allows the teeth 2812, 2820 to disengage with each other and the flexible nature of the first and second arms 2804, 2806 are caused to spring back into the shape shown in FIG. 33B. As seen in FIGS. 33B-33B, an inner surface 2834 of the first and second arms 2804, 2806 includes a gasket 2832 that may be flexible and deformable to provide for a gripping surface between the probe and the lower mount 2704.

Reference is made to FIG. 34, which depicts a front isometric view of an access needle 2712. As seen in the figure, the needle 2712 includes a distal end 2836 and a proximal end 2838 opposite the distal end 2836. At the distal end 2836 is the bevel 2840 extending distally from a shaft 2842. Within the shaft 2842 is a lumen 2844 for communication of fluids or, in the case of the access needle 2712, a shaft of a smaller gage biopsy needle. The proximal end 2838 of the needle 2712 includes a hub 2846 with ridges

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2848 extending longitudinally around a circumference of the hub 2846. The ridges 2848 may engage with corresponding and negatively shaped features on the proximal side 2800 of the needle receiving ports 2768.

The following discussion will focus on use of the biopsy guide 2700 and will refer to FIGS. 35A-35D, which depict, respectively: a front isometric view of the lower mount 2704; a front isometric view of the lower mount 2704 coupled with the upper mount 2702; a front isometric view of the lower mount 2704 coupled with the upper mount 2702 and the displacement member 2710 positioned at a proximal end of the guide member 2708; and, a front isometric view of the lower mount 2704 coupled with the upper mount 2702 and the displacement member 2710 positioned at a proximal end of the guide member 2708 with the access needle 2712 positioned within one of the needle receiving ports 2768.

As seen in FIG. 35A, the lower mount 2704 is positioned with the first and second clamping structures 2810, 2816 of the first and second arm members 2804, 2806 uncoupled such that a transrectal probe may positioned between the arm members 2804, 2806. While it is not depicted in the figures, the first and second clamping structures 2810, 2816 may be engaged with each other or coupled as described previously to grasp the probe between the arm members 2804, 2806 and against the gasket 2832.

As seen in FIG. 35B, the upper mount 2702 may be coupled with the lower mount 2704. More particularly, the vertical flanges 2802 on the platform 2766 of the upper mount coupling mechanism 2714 may be engaged with or snapped together with the channels 2756 on the base platform 2722 of the guide member 2708.

As seen in FIG. 35C, the displacement member 2710 may be engaged with the guide member 2708. More particularly, the distal end 2772 of the displacement member 2710 is longitudinally aligned with the proximal end 2718 of the guide member 2708 such that the proximal ends of the guide rails 2726 are positioned to extend into the corresponding features of the displacement member 2710. That is, the rectangular member 2728 is aligned with the opening between the upper members 2784 and the lower tab members 2780, and the vertically extending side members 2732 are aligned with the channels 2794 between the inner surfaces 2792 of the upside-down U-shaped member 2790 of the displacement member 2710. Once aligned, the displacement member 2710 is displaced, moved, or translated into engagement with the guide member 2708, as seen in FIG. 35C, which depicts the displacement member 2710 in a proximal-most position.

As seen in FIG. 35D, the access needle 2712 is coupled with the displacement member 2710. More particularly, the bevel 2840 and shaft 2842 of the access needle 2712 are extended through the proximal side 2800 of a particular opening 2770 of a needle receiving port 2768 until the hub 2846 of the access needle 2712 engages with the proximal side 2800 of the port 2768. The ridges 2848 of the access needle 2712 may engaged with corresponding features within the opening 2770 of the port 2768 such that the access needle 2712 remains coupled with the displacement member 2710. The access needle 2712 may be restrained from rotating by the ridges 2848. In certain embodiments, the access needle 2712 may be secured to the displacement member 2710 by, for example, a threaded features on the hub 2846 and openings 2770 of the ports 2768 such that the needle 2712 and the displacement member 2710 may be threadably engaged and disengaged with each other.

In the orientation shown in FIG. 35D, the displacement member 2710 and the access needle 2712 are in a proximal-

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most position or condition. As seen in the figure, in this particular embodiment, the bevel 2840 of the access needle 2712 lies about flush with the planar distal face 2740 of the distal member 2734. In other embodiments or with a different sized needle 2712, the bevel 2840 of the access needle 2712 may extend beyond the distal face 2740 of the distal member 2734 when the displacement member 2710 is in the proximal-most position, or the bevel 2840 of the access needle 2712 may be positioned proximal of the distal face 2740 of the distal member 2734 when the displacement member 2710 is in the proximal-most position.

In certain embodiments where the bevel 2840 of the access needle 2712 does not extend past the distal face 2740 of the distal member 2734, the physician may use the distal member 2734 to manipulate the perineal skin and subcutaneous tissue of the patient while having the displacement member 2710 coupled to the guide member 2708, but while not having the bevel 2840 of the access needle 2712 contact the patient's skin.

While FIG. 35D depicts the access needle 2712 coupling with the displacement member 2710 when the displacement member 2710 is in the proximal-most position, the access needle 2712 may be engaged with the displacement member 2710 when the displacement member is at the distal-most position or at any position between the distal-most position and the proximal-most position. When the access needle 2712 is in the proximal-most position, as shown in FIG. 35D, the physician may manipulate the probe and the distal member 2734 of the upper mount 2702 to manipulate the perineal skin and subcutaneous tissue of the patient. When the trajectory of the access needle 2712 is appropriately positioned relative to the patient's perineal skin and subcutaneous tissue, the physician may distally displace the access needle 2712 by pushing on one or more of the back wall member 2798 or flanges 2796 of the displacement member 2710, or the hub 2846 of the access needle 2712. In certain embodiments, the displacement member 2710 may be biased or spring-loaded such that the physician may actuate a mechanism that distally advances the displacement member 2710 and the access needle 2712 without a need for manual advancement by the physician. As the access needle 2712 and the displacement member distally advance or displace, the displacement member 2712 will lock or be secured into the distal-most position via the ramps of the stop feature 2746 positioned on the top surface 2744 of the rectangular member 2728. In the distal-most position, as seen in FIG. 27, the displacement member 2710 is prevented from further distal displacement via the distal member 2734. In particular, a front edge or surface 2850 of the distal end 2772 of the displacement member 2710 abuts or is adjacent a proximal surface 2748 of the distal member 2734 when the displacement member 2710 is in the distal-most position. In certain embodiments, as seen in FIG. 27, the back surface 2748 may abut or be adjacent the front edge or surface 2850 of the upper members 2784, the lower tab members 2780 (not seen in FIG. 27) and/or part of the upside-down U-shaped member 2790.

As further seen in FIG. 27, the distal members 2734 extend inward towards the needle receiving ports 2768 but may define an opening or gap between the rounded inner edges 2736 for the access needle 2712 to extend there-through.

Once the access needle 2712 is in position in the patient's skin and subcutaneous tissue, the biopsy procedure may continue, as described previously, with the physician extending a biopsy needle through the lumen 2844 of the access needle 2712 and into the patient's prostate. Once procedure

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is complete, the physician may remove the access needle 2712 from the patient's body by proximally displacing the displacement member 2710 and the access needle 2712 by pulling or pushing on the displacement member 2710 or access needle. Alternatively, the access needle 2712 may be disengaged with the displacement member 2710 while the displacement member 2710 is in the distal-most position.

The discussion will now focus on additional and alternative embodiments of the biopsy guide. As seen in FIG. 36, the displacement member 2710 may include the upper members 2784 and the lower tab members 2780 for engaging with and sliding or displacing relative to the rectangular members 2728 of the guide rails 2726. The displacement member 2710 of FIG. 36, however, does not include an upside-down U-shaped member for engaging with the side members 2732 of the guide rails 2726 and, further, does not include the back wall member 2798 and the flanges 2796. Features of both embodiments of the displacement member 2710 may be combined as needed and without limitation.

The lower mount 2704, as described herein, may take many forms without departing from the scope of the present disclosure. Other mechanisms to couple the upper mount 2702 to the probe are possible and contemplated herein. For example, the upper mount 2702 may couple with or be integrally formed with a thin sheath or sleeve of latex, polyurethane, or other materials, such as a male condom. The sheath may be fitted over the probe in a tight fitting manner such that the upper mount 2702 is secured in position relative to the probe.

Additional or alternative embodiments of the lower mount 2704 may include rubber or rubber-type cinch straps that are coupled with or integral with the upper mount 2702.

The upper mount 2702, as described herein, may take many forms without departing from the scope of the present disclosure. Other mechanisms to guide the access needle 2712 are possible and contemplated herein. For example, the displacement member 2710 supporting the access needle 2712 may be coupled to a platform on a coupler side of a four-bar linkage (e.g., parallelogram linkage) where the fixed portion of the linkage may be coupled with the base platform 2722 of the guide member 2710. The platform may be displaceable distal-proximal by urging the platform distally or proximally, while displacing in an arcuate path. In the case of a parallelogram linkage, the trajectory of the access needle 2712 may remain parallel to the longitudinal axes of the probe and guide member 2710 while vertically displacing. In this way, such a linkage may be used for distal-proximal displacement as well as vertical displacement or adjustment, as needed for a particular biopsy procedure. This type of displacement member 2710 may be used with the guide member 2708 as described herein with or without modification.

As another example, the displacement member 2710 supporting the access needle 2712 may be coupled to a carriage or lead screw nut that is displaced relative to the guide member 2708 (and probe) via rotation of a lead screw. The lead screw may be positioned parallel to the longitudinal axis of the guide member 2708 and the probe such that displacement of the lead screw nut and, thus, the displacement member 2710 and access needle 2712 displace or translate distal-proximal while maintaining a trajectory of the access needle 2712 that may be fixed. A bottom side of the lead screw nut may include a feature or protrusion that extends into a channel formed in the base platform 2722 of the guide member 2708 such that the lead screw nut does not rotate, but, rather, displaces or translates linearly distal-proximal in response to rotation of the lead screw. The lead

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screw may be rotatable by hand via, for example, a handle at the proximal end of the lead screw.

Reference is now made to FIGS. 37A-37F, which depict various views of another embodiment of the biopsy guide 3700. As seen in FIG. 37A, which is a front isometric view of the biopsy guide 3700, the guide 3700 is similar to previously described embodiments of the guide in that it includes an upper mount 3702 and a lower mount 3704. The lower mount 3704 is adapted to secure the guide 3700 to a transrectal probe and includes the same features as the previously described embodiment. The upper mount 3702 may releasably couple with the lower mount 3704. As seen in FIGS. 37B and 37C, which are, respectively, front and back isometric exploded views of the upper mount 3702, the biopsy guide 3700 further includes a guide member 3710 and a displacement, sliding, or translating member 3706 that is adapted to couple with an access needle 3708.

As seen in FIGS. 37B-37C and 37E-37F, the displacement member 3706 includes a vertically extending member 3712 having five needle receiving ports 3714 formed within the member 3712. The ports 3714 may receive the access needle 3708 within any of the ports 3714, as previously described, to vary the height of the access needle 3708 relative to the probe (not shown). The access needle 3708 may couple with the needle receiving ports 3714 such that they may be displaced together relative to the guide member 3710.

As seen in the figures, a bottom end 3716 of the vertically extending member 3712 is coupled to a distal end 3718 of a rail member 3720 that may slidably engage with the guide member 3710. The rail member 3720 includes a flange member 3722 and a web member 3724 arranged in a T-beam shape. That is, the flange member 3722 is wider than the web member 3724, which projects upward and substantially perpendicularly from a central portion of the flange member 3722. From the distal end 3718, the rail member 3720 extends proximally to a proximal end 3726. At the proximal end 3726 is an end plate member 3728, which prevents distal displacement of the displacement member 3706 past a certain point.

As seen in FIGS. 37C and 37D, the guide member 3710 includes a rail receiving slot or channel 3730 having a proximal opening 3732, a distal opening 3734 (seen in FIG. 37B), and a top opening 3736. The rail receiving slot 3730 is generally a negative shape of the rail member 3720 and may receive the rail member 3720 therein and permit the rail member 3720 and, thus, the displacement member 3706 and access needle 3708 to displace relative to the guide member 3710. When the rail member 3720 is positioned within the rail receiving slot 3730, inner surfaces 3738 of the slot 3730 may contact the flange and web members 3722, 3724 and restrain the displacement member 3706 from lateral displacement and vertical tilting while allowing distal-proximal displacement or translation of the displacement member 3706. Thus, the displacement member 3706 may be displaced or translated distally and proximally while maintaining alignment of a trajectory of the access needle 3708 substantially parallel with a longitudinal axis of the probe when the biopsy guide 3700 is coupled with the probe.

As seen in FIG. 37A, the displacement member 3706 is in a distal-most position with the distal end 3718 of the rail member 3720 and a distal end 3740 of the vertically extending member 3712 being about coplanar with a distal face 3742 of a distal member 3744 of the guide rail members 3746, which may be similar to as previously described in relation to previous embodiments. In the distal-most position, the rail member 3720 extends past the distal opening 3734 of the rail receiving slot 3730, and the end plate

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member 3728 of the rail member 3720 abuts or is adjacent the proximal opening 3732 of the rail receiving slot 3730. To proximally displace the displacement member 3706 from the distal-most position, the physician may pull or push on the end plate member 3728, the vertically extending member 3712, or the access needle 3708.

It is noted that the guide rail members 3746 and, more particularly, the distal members 3744 may be used by the physician to manipulate the perineal skin and subcutaneous tissue of the patient, as described previously. And while the embodiment of the biopsy guide 3700 in FIGS. 37A-37F describe a rail and slot type of arrangement between the displacement member 3706 and the guide member 3710, other mechanisms are possible to displace the displacement member 3706 relative to the guide member 3710. Additionally or alternatively, features and elements from other embodiments of the biopsy guide may be incorporated into the present embodiment without limitation. Similarly, features and elements from the present embodiment of the biopsy guide may be incorporated into any of the other embodiments of the biopsy guide without limitation.

As seen in FIG. 37G, which is a side view of another embodiment of the displacement member 3706 with the access needle 3708 partially positioned within the top needle receiving port 3714 of the vertically extending member 3712, the rail member 3720 may be replaced by a lead screw 3748 and the bottom end 3716 of the vertically extending member 3712 may include a lead screw nut 3750 that rotationally engages with the lead screw 3748 to cause the displacement member 3706 and the access needle 3708 to displace or linearly translate relative to the probe and the guide member 3710 (not shown). The lead screw 3748 may be rotationally coupled with bearings 3752 at opposite ends which allow the lead screw 3748 to rotate thereon. The lead screw nut 3750 may be prevented from rotating by a guide rail 3754 that extends between the bearings 3752 and also extends through a passageway in the lead screw nut 3750. In this way, as the lead screw 3748 rotates, the lead screw nut 3750, as well as the vertically extending member 3712 and the access needle 3708, are caused to displace or translate distal-proximal because the lead screw nut 3750 is prevented from rotating by the guide rail 3754. The lead screw 3748 may include a handle 3756 for rotating the lead screw 3748. The displacement member 3706 shown in FIG. 37G may be coupled with the guide member 3710 shown in the previous figures such that the lead screw 3748 is generally parallel with the longitudinal axis of the guide member 3710 and the probe. The displacement member 3706 may, for example, couple with the base platform of the guide member 3710 at the bearings 3752, or at other parts of the member 3706.

As seen in FIGS. 37H-37I, which are, respectively, an isometric front view and a side view of another embodiment of the biopsy guide 3900, it includes a probe coupling mechanism 3902 in the form of collars that may be adjustably secured to the probe 3904. Four arm members 3906 are pivotally coupled at bottom ends 3908 to the probe coupling mechanism 3902 and pivotally coupled at top ends 3910 to a platform member 3912. The arm members 3906 may be of equal length such that the platform member 3912 is capable of displacing distal-proximal while maintaining a parallel orientation relative to the probe 3904. More particularly, as seen in FIG. 37I, the platform member 3912 may include a longitudinal axis that is generally parallel to a longitudinal axis of the probe 3904 in all distal-proximal orientations of the platform member 3912 relative to the probe 3904. The platform member 3912 may include a longitudinally extending channel 3914 for receiving and guiding a displacement

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member 3916 having a needle receiving port 3918. The displacement member 3916 may include a flanged lower body portion 3920 that matches a shape of the channel 3914 such that the displacement member 3916 may slide within the channel 3914 or displace relative to the platform member 3912 while maintaining an orientation of a needle positioned within the needle receiving port 3918 that is generally parallel to the longitudinal axis of the probe 3904.

As seen in FIG. 37I, the biopsy guide 3900 may function as a four bar parallel or parallelogram linkage during displacement of the platform member 3912. In particular, FIG. 37I shows three positions of the platform member 3912 as it displaces. A first position 3922 shows the platform member 3912 at a highest position relative to the probe 3904 where the arm members 3906 are vertically extended to their maximum. A second position 3924 shows the platform member 3912 as it distally displaces while rotating clockwise and lowering the platform member 3912 relative to the probe. A third position 3926 shows the platform member 3912 as it further distally displaces while rotating clockwise and lowering the platform member 3912 relative to the probe. As seen in all positions 3922, 3924, 3926, a longitudinal axis of the platform member 3912 may remain generally parallel with a longitudinal axis of the probe 3904.

Reference is now made to FIG. 37J, which is a front isometric view of another embodiment of an upper mount 4000. As seen in the figure, the upper mount 4000 includes a guide member 4002 that is similar to previously described embodiments in that it includes a pair of guide rails 4004 that extend longitudinally and are spaced apart from each other. This embodiment of the upper mount 4000, however, does not include a displacement member. Rather, the guide mount 4002 of the upper mount 4000 of FIG. 37J includes a vertically oriented member 4008 including needle receiving ports 4006 that are also vertically aligned. The member 4008 may not be displaceable relative to the guide member 4002 in this particular embodiment.

That is, the needle receiving ports 4006 may align a trajectory of an access needle in any of the ports 4006 such that a trajectory of the access needle may be generally parallel to a longitudinal axis of the probe. The needle receiving ports 4006 may be integrally formed with the guide member 4002. Or, the vertical member 4008 including the needle receiving ports 4006 may be releasably coupled to the guide member. In a releasable arrangement, the vertical member 4008 may be coupled with the guide member via any coupling mechanism described herein or known in the art. As seen in the figure, the needle receiving ports 4006 are cylindrical and extend generally from a proximal end 4010 to a distal end 4012 of the guide member 4002. The distal tip 4014 of the needle receiving ports 4006 may be about coplanar with a distal face 4016 of the distal members 4018 of the guide rails 4004.

Reference is made to FIGS. 37K-37L, which are, respectively, front and side views of another embodiment of a biopsy guide 4100. As seen in the figures, the biopsy guide 4100 includes displacement member 4102 including a vertically oriented body 4104 having five vertically aligned needle receiving ports 4106 for receiving, supporting, and orienting an access needle. At a bottom end 4108 of the vertical body 4104 is a probe coupling mechanism 4110 including a collar 4112 having a guide rail or protrusion 4114 extending from an inner surface 4116 of the collar 4112. The guide rail 4114 extends longitudinally in the collar 4112 and may be received by a correspondingly shaped channel or slot 4120 in a transrectal probe 4118. In this way, the displacement member 4102 may slide, displace, or

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translate relative to the probe **4118** while being restrained from certain movements by the interaction between the guide rail **4114** and the channel **4120**. As such, the access needle supported by the needle receiving port **4106** may displace or translate distal-proximal relative to the probe **4118** while maintaining a trajectory that is generally parallel with a longitudinal axis of the probe **4118**.

The inner surface **4116** may include roller bearings or similar structures to permit the collar **4112** to roll, translate, or displace relative to the probe **4118**. While the channel **4120** is described as being formed in the probe **4118**, the channel **4120** may be formed in a separate member that is coupled to the probe **4118**. In this case, a specialized probe having a channel may not be needed; rather, any off-the-shelf ultrasound probe may be used with the separate member having the channel **4120** to utilize the biopsy guide **4100** of the present embodiment.

Reference is made to FIGS. 37M-37U, which depict various views of alternative embodiments of the lower mount. To begin, reference is made to FIGS. 37M-37Q. FIG. 37M is a front isometric view of a biopsy guide **4200**. FIG. 37N is a front view of the biopsy guide **4200**. FIG. 37O is a front isometric view of a cinch strap **4202**. FIG. 37P is a front isometric view of a V-block insert **4204**. FIG. 37Q is a front view of the biopsy guide **4200** of FIG. 37M with an insert **4204** of FIG. 37P.

As seen in FIG. 37M, the biopsy guide **4200** includes an upper mount **4206** and a lower mount **4208**. The upper mount **4206** may include a base platform **4210** and a pair of guide rails **4212** extending longitudinally from the base platform **4210**. The guide rails **4212** may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount **4208** may include a cinch strap **4202**, as shown in FIG. 37), which may include a flange **4214** at one end **4216** and a series of transversely extending ridges **4218**. The cinch strap **4202** may be fitted or positioned within a slot **4220** in the base platform **4210** such that the flange **4214** abuts the surfaces of the slot **4220** and is prevented from extending through the slot **4220**. The cinch strap **4202** may be fitted around the transrectal probe **4222** and positioned within a locking opening **4224** opposite the slot **4220** in the base platform **4210**. The cinch strap **4202**, which may be rubber or otherwise made of a flexible material, may be pulled tightly at the free end **4226** such that the ridges **4218** are progressively locked by the locking opening **4224**. Once appropriately tightened, the upper mount **4206** is now secured to the probe **4222**.

As seen in FIGS. 37P-37Q, the lower mount **4208** of the biopsy guide **4200** may include a V-block insert **4204** positioned between the probe **4222** and the cinch strap **4202**. The V-block insert **4204** may include a pair of slots **4228** on opposite sides of the insert **4204** that may be sized to receive the cinch strap **4202** therethrough to secure the V-block insert **4204** into position relative to the cinch strap **4202**. The V-block insert **4204** ensures at least three points of contact between the probe and the biopsy guide **4200**: one point of contact between the probe **4222** and an underside of the base platform **4210**; and, two points of contact between the probe **4222** and the V-block insert **4204**.

Reference is made to FIGS. 37R-37S, which depict, respectively, a front isometric view and a front view of another embodiment of a biopsy guide **4300**. Similar to the previously described embodiments, the biopsy guide **4300** includes an upper mount **4302** and a lower mount **4304**. The upper mount **4302** may include a base platform **4306** and a pair of guide rails **4308** extending longitudinally and spaced

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apart from each other. The guide rails **4308** may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount **4304** may include a curvilinear shaped inner surface **4310** opposite the base platform **4306** and pair of opposing arms **4312** extending downward. The arms **4312** may converge on a bottom side **4314** of the lower mount **4304**. A V-block insert **4316** may be positioned an opening **4318** of the lower mount **4304**. The opening **4318** may be sized and shaped to receive the transrectal probe **4322** therein. The V-block insert **4316** may be vertically adjustable within the opening **4318** via a thumb-screw **4320**. When actuated or rotated, the thumb-screw **4320** may push the V-block insert **4316** vertically to exert a force on the probe **4322**, which, in turn, exerts a force on the inner surface **4310** of the base platform **4306** of the lower mount **4304**.

Reference is made to FIGS. 37T-37U, which depict, respectively, a front isometric view and a front view of another embodiment of a biopsy guide **4400**. As seen in the figures, the device **4400** includes an upper mount **4402** and a lower mount **4404**. The upper mount **4402** may include a base platform **4406** and a pair of guide rails **4408** extending longitudinally and spaced apart from each other. The guide rails **4408** may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount **4404** couples the upper mount **4402** to the probe **4410** and may include a strap **4412** that is affixed at one side **4414** via a pair of fasteners (e.g., screws, bolts) **4416**. The strap **4412** may wrap around the probe **4410** and be secured in place via a worm gear mount **4418**. The worm gear mount **4418** may include a thumb-knob **4420** that is rotatable and extending to a threaded feature (e.g., ACME threads) **4422** that threadably engage with slots **4424** on the second end **4426** of the strap **4412**. As the thumb-knob **4420** is tightened, the thread feature **4422** advances on the slots **4424** and pulls the strap **4412** tighter on the probe **4410** (similar to a hose clamp). This embodiment may include a V-block insert (not shown). As seen in the figures, an underside **4426** of the base platform **4406** may be curvilinear to match the shape of the probe **4410**. These features among features from other embodiments may be combined as needed to modify any of the features of any of the biopsy guides described herein.

Reference is made to FIGS. 37V-37X, which depict additional and alternative embodiments of a lower mount **4502** of a biopsy guide **4500**. As seen in FIG. 37V, which is a front view of a lower mount **4502**, the upper mount **4504** may be similar to previously describe embodiments in that it includes a base platform **4506** and a pair of guide rails **4508**. The lower mount may include a pair of semi-circular arm members, clamps, or collars **4510** that are pivotally coupled together at a joint **4512** (e.g., pin). The pair of semi-circular arm members **4510** may open and close about the joint **4512** in a clam-shell type manner. Opposite the joint **4512**, the arm members **4510** are adjustably secured together via a thumb-screw **4514** that extends between a pair of flanges **4516**. Thus, turning the thumb-screw **4514** in a first direction may cause the pair of arm members **4510** to constrict against a probe (not shown) positioned within the opening **4518** between the arm members **4510**. And, turning the thumb-screw **4514** in a second direction may cause the pair of arm members **4510** to loosen against the probe positioned within the opening **4518**.

FIG. 37W depicts a front isometric view of the lower mount **4504** including a flexible spring band or biasing collar **4520** extending circumferentially and terminating in a

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pair of flanges or tabs **4522** that may be compressed together, relative to each other, to selectively enlarge the opening **4518**. The probe (not shown) may be positioned within the opening **4518** and the spring band **4520** may compress against the probe and cause a constant force to be exerted on the probe, allowing it to be used on probes of multiple diameters. The flat spring band **4520** may be replaced by a wire spring band (i.e., dumbbell clamp) without departing from the scope of the disclosure.

FIG. 37X depicts a front view of a lower mount **4504** having a pair of semi-circular arm members, clamps, or collars **4510** that are pivotally coupled together at a joint **4512** (e.g., pin). The pair of semi-circular arm members **4510** may open and close about the joint **4512** in a clamshell type manner. Opposite the joint **4512**, the arm members **4510** are adjustably secured together via a snap-clip, ratchet, or clamp assembly **4524** including a lever arm handle **4526** a wire arm or loop **4528**. The lever arm handle **4526** is attached to one free end **4534** of the arm members **4510** and the wire arm **4528** is attached to the lever arm handle **4526**. The other free end **4530** of the other arm member **4510** includes a lip **4532** such that the wire arm **4528** may be fitted around the lip **4532** with the lever arm handle **4526** in an opened position. Once the wire arm **4528** is positioned within the lip **4532**, the lever arm handle **4526** may be pivoted towards the arm member **4510**, which pulls the free ends **4534**, **4530** together to secure the arm members **4510** against the probe (not shown). To remove the probe from the lower mount **4504**, the lever arm handle **4526** may be pivoted outward away from the arm member **4510** of the free end **4534** and the arm members **4510** will expand relative to each other and release the probe.

As with many of the embodiments of the biopsy guide described herein, there may be a particular type of mechanical arrangement between the guide member and the displacement member that at least facilitates the displacement of the access needle along at least a portion of the length of the guide member. As discussed in relation to each of the embodiments, the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage. And, as described with reference to the various embodiments of the biopsy guide, the guide member may operably couple with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

Reference is now made to FIGS. 38A-38D, which depict, respectively, a transverse plane or slice image of a prostate **3800** and a urethra **3804**, a sagittal plane or slice image of a prostate **3800** and a urethra **3804**, a transverse plane or slice image of a prostate **3800** and a urethra **3804** with a marking device **3824** positioned within the urethra **3804**, and a sagittal plane or slice image of a prostate **3800** and a urethra **3804** with a marking device **3824** positioned within the urethra **3804**. As mentioned previously, during a prostate biopsy procedure it may important for the physician to identify the path of the urethra so that he or she can avoid puncturing the urethra with the access needle and the biopsy needle. The biopsy guides described herein may be used with various systems to locate the urethra via the transrectal probe in sagittal and axial planes.

As described previously, the probe or transducer provides imaging in axial and sagittal planes so as to provide real-time images of the prostate. As seen in FIG. 38A, which is a transverse plane showing the prostate **3800** and the probe **3802**, the urethra **3804** is shown, as well as a path **3806** of the urethra **3804**, as would be seen in a sagittal plane. As

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seen in FIG. 38B, which is a sagittal plane showing the prostate **3800** and the probe **3802**, the urethra **3804** is shown extending over the prostate **3800** and connecting with the bladder **3808**.

When the prostate is viewed, as seen in FIGS. 38A and 38B, the physician may then position the access needle **2712** in an access site **3810** in the subcutaneous tissue **3812** of the perineum **3814**, where the access site **3810** is at a midpoint between a lateral edge of the prostate **3816** and the urethral path **3806** along a first axis and a midpoint between an anterior capsule **3818** and a posterior capsule **3820** along a second axis. The physician may guide the probe **3802** and the biopsy guide (not shown) along a sagittal plane to the target using the real-time image from the probe **3802**, and the physician may obtain one or more specimens **3822** of the prostate **3800** through the access needle **2712** being guided by the biopsy guide.

Identifying the urethra may be accomplished via a number of methods. First, as seen in FIGS. 38C-38D, a marking device **3824** such as, for example, a balloon catheter can be inserted into the urethra **3804** and used by the physician to locate the urethra **3804**. As seen in FIG. 38C-38D, the marking device **3824** may include a catheter **3826** and a balloon **3828**. The balloon **3828** may be expanded in the bladder **3808** and the catheter **3826** may extend through the urethra **3804** and out of the patient's body. The balloon **3828** and/or catheter **3826** may be visible in certain planes during the biopsy procedure and may aid in identifying the urethra **3804**.

Additionally or alternatively, the marking device **3824** may include markers **3830** such as physical or chemical markers that are visible in an ultrasound environment (e.g., pellets of polylactic and polyglycolic acids containing carbon dioxide, polyglycolic acid pads) along the length of the catheter **3826** so that the physician can view the path of the urethra **3804** as viewed in transverse or sagittal planes. Thus, the physician may be able to position a trajectory of the access needle **2712** to be adjacent and not intersecting with the path of the urethra as indicated by the markers **3830** on the catheter **3826**. The markers **3830** may be positioned on the catheter at certain intervals so as to provide a way to estimate the size or volume of the prostate **3800**. Additionally or alternatively, the catheter **3826** may include a contrast medium (e.g., dye) for visualization purposes and may otherwise function similarly to markers **3830** positioned on the catheter **3826**.

The biopsy guides and devices described herein may additionally include markers or sensors positioned on the biopsy guide or access needle such that movement of the guide or needle, or any device/material placed through the access needle, may be visualized via the markers/sensors by ultrasound equipment (e.g., probe) or other equipment using different imaging modalities (e.g., MRI, CT). In this way, for example, a marker positioned at a distal end of the access needle may provide visual guidance as to the location of the tip of the access needle relative to the boundaries of the prostate.

Although various representative implementations have been described above with a certain degree of particularity, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from the spirit or scope of the inventive subject matter set forth in the specification. All directional references (e.g., distal, proximal, front, back, side, top, bottom, fore, aft, right, left, etc.) are only used for identification purposes to aid the reader's understanding of the implementations, and do not create limitations, particularly as to the position, orientation, or use

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of the embodiments described herein unless specifically set forth in the claims. Joinder references (e.g., attached, coupled, connected, and the like) are to be construed broadly and may include intermediate members between a connection of elements and relative movement between elements. As such, joinder references do not necessarily infer that two elements are directly connected and in fixed relation to each other.

It is believed that the present disclosure and many of its attendant advantages will be understood by the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the components without departing from the disclosed subject matter or without sacrificing all of its material advantages. The form described is merely explanatory, and it is the intention of the following claims to encompass and include such changes.

While the present disclosure has been described with reference to various embodiments, it will be understood that these embodiments are illustrative and that the scope of the disclosure is not limited to them. Many variations, modifications, additions, and improvements are possible. More generally, embodiments in accordance with the present disclosure have been described in the context of particular implementations. Functionality may be separated or combined in blocks differently in various embodiments of the disclosure or described with different terminology. These and other variations, modifications, additions, and improvements may fall within the scope of the disclosure as defined in the claims that follow.

What is claimed is:

1. A method of performing a transperineal biopsy procedure on a prostate of a patient using a transrectal ultrasound probe configured to provide imaging, the patient comprising a perineal access site leading to the prostate, the method comprising:

imaging the prostate of the patient with the transrectal ultrasound probe, wherein a transperineal biopsy guide is coupled to the transrectal ultrasound probe, the transperineal biopsy guide comprising a mount coupled to the transrectal ultrasound probe, a guide member coupled to the mount and including a rail receiving channel extending a first length between a proximal end and a distal end of the rail receiving channel, and a displacement member including a rail member extending a second length between a proximal end and a distal end of the rail member and a vertically extending member extending from the distal end of the rail member, the vertically extending member including a plurality of needle receiving ports, wherein the rail receiving channel is positioned generally parallel with a longitudinal axis of the transrectal ultrasound probe; sliding the rail member within the rail receiving channel so as to position the vertically extending member of the displacement member adjacent the perineal access site of the patient;

inserting an access needle into the perineal access site of the patient, the access needle supported by one of the plurality of needle receiving ports; and inserting a needle through the access needle and into a first location of the prostate of the patient.

2. The method of claim 1, further comprising: contacting a distal end of a pair of guide rails of the guide member with the perineal access site of the patient, the pair of guide rails being spaced apart from each other and positioned on opposite sides of the rail receiving channel.

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3. The method of claim 1, further comprising injecting a substance into the patient via the needle.

4. The method of claim 1, further comprising taking a first biopsy of the first location of the prostate of the patient via the needle.

5. The method of claim 4, further comprising taking a second biopsy of a second location of the prostate of the patient via the needle, the second location being different than the first location.

6. The method of claim 5, wherein the access needle remains positioned within the perineal access site of the patient for the first biopsy and the second biopsy.

7. The method of claim 1, wherein the displacement member includes an end plate coupled to the proximal end of the rail member, the end plate configured to contact a proximal end of the guide member in order to limit displacement of the displacement member relative to the guide member.

8. The method of claim 1, wherein the plurality of needle receiving ports comprises at least five needle receiving ports oriented vertically relative to the rail member.

9. The method of claim 1, further comprising engaging a portion of the guide member to the perineal access site of the patient prior to inserting the access needle into the perineal access site of the patient.

10. The method of claim 1, wherein the access needle has a needle size of 14 gauge, 15 gauge, or 16 gauge.

11. The method of claim 10, wherein the needle is a biopsy needle with a needle size of 18 gauge.

12. The method of claim 1, wherein the needle is a biopsy needle with a needle size of 18 gauge.

13. The method of claim 1, further comprising securing the access needle to the one of the plurality of needle receiving ports such that movement of the access needle relative to the vertically extending member is restrained.

14. The method of claim 13, wherein the access needle and the plurality of needle receiving ports including corresponding features that restrain relative movement when secured together.

15. The method of claim 1, wherein the mount includes a releasable fastener, and wherein a distal portion of the guide member is offset from the releasable fastener of the mount.

16. A method of performing a transperineal biopsy procedure on a prostate of a patient using a transrectal ultrasound probe configured to provide imaging, the patient comprising a perineal access site leading to the prostate, the method comprising:

imaging the prostate of the patient with the transrectal ultrasound probe, wherein a transperineal biopsy guide is coupled to the transrectal ultrasound probe, the transperineal biopsy guide comprising a mount coupled to the transrectal ultrasound probe, a guide member coupled to the mount and including a rail receiving channel extending a first length between a proximal end and a distal end of the rail receiving channel, and a displacement member including a rail member extending a second length between a proximal end and a distal end of the rail member and being positioned within the rail receiving channel of the guide member and a vertically extending member extending from the distal end of the rail member, the vertically extending member including a plurality of needle receiving ports, the guide member further including a pair of stabilization members extending away from the rail receiving channel;

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positioning the vertically extending member of the displacement member adjacent the perineal access site of the patient;
inserting an access needle into the perineal access site of the patient, the access needle supported by one of the plurality of needle receiving ports; and
inserting a needle through the access needle and into a first location of the prostate of the patient.
17. The method of claim 16, further comprising: contacting a distal end of the pair of stabilization members of the guide member with the perineal access site of the patient, the pair of stabilization members being spaced apart from each other and positioned on opposite sides of the rail receiving channel.
18. The method of claim 16, further comprising injecting a substance into the patient via the needle.
19. The method of claim 16, further comprising taking a first biopsy of the first location of the prostate of the patient via the needle.
20. The method of claim 19, further comprising taking a second biopsy of a second location of the prostate of the patient via the needle, the second location being different than the first location.
21. The method of claim 20, wherein the access needle remains positioned within the perineal access site of the patient for the first biopsy and the second biopsy.
22. The method of claim 16, wherein the rail receiving channel is positioned generally parallel with a longitudinal axis of the transrectal ultrasound probe.

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23. The method of claim 16, wherein the displacement member includes an end plate coupled to the proximal end of the rail member, the end plate configured to contact a proximal end of the guide member in order to limit displacement of the displacement member relative to the guide member.
24. The method of claim 16, wherein the plurality of needle receiving ports comprises at least five needle receiving ports oriented vertically relative to the rail member.
25. The method of claim 16, further comprising engaging a portion of the guide member to the perineal access site of the patient prior to inserting the access needle into the perineal access site of the patient.
26. The method of claim 16, wherein the access needle has a needle size of 14 gauge, 15 gauge, or 16 gauge.
27. The method of claim 26, wherein the needle is a biopsy needle with a needle size of 18 gauge.
28. The method of claim 16, wherein the needle is a biopsy needle with a needle size of 18 gauge.
29. The method of claim 16, further comprising securing the access needle to the one of the plurality of needle receiving ports such that movement of the access needle relative to the vertically extending member is restrained.
30. The method of claim 29, wherein the access needle and the plurality of needle receiving ports including corresponding features that restrain relative movement when secured together.

* * * * *

Exhibit T

(12) **United States Patent**
Allaway

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(54) **TRANSPERINEAL PROSTATE BIOPSY
DEVICE, SYSTEMS, AND METHODS OF USE**

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ABSTRACT

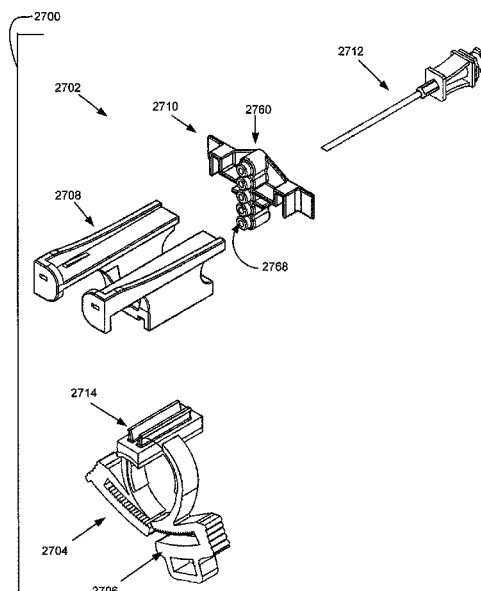
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A61B 10/02 (2006.01)
 (Continued)

A method of performing a transperineal biopsy procedure including the steps of: inserting an access needle into one of a plurality of needle receiving ports of a displacement member of a transperineal biopsy guide that is secured to the transrectal ultrasound probe; securing the access needle to the displacement member such that a position of the access needle relative to the displacement member is maintained; imaging the prostate of the patient with the transrectal ultrasound probe; inserting the access needle into the perineal access site of the patient; and inserting the biopsy needle through the access needle and into the prostate of the patient.

(52) **U.S. Cl.**
CPC *A61B 17/3403* (2013.01); *A61B 8/0841*
(2013.01); *A61B 8/12* (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A61B 17/3403; A61B 8/0841; A61B 8/12;
A61B 10/0241; A61B 10/04; A61B

30 Claims, 31 Drawing Sheets



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Related U.S. Application Data

continuation-in-part of application No. 17/314,845, filed on May 7, 2021, now Pat. No. 11,246,677, which is a continuation of application No. 16/115,180, filed on Aug. 28, 2018, now Pat. No. 11,096,762, which is a continuation of application No. 14/677,286, filed on Apr. 2, 2015, now Pat. No. 10,064,681, said application No. 17/494,962 is a continuation-in-part of application No. 16/991,150, filed on Aug. 12, 2020, which is a continuation of application No. 14/874,104, filed on Oct. 2, 2015, now Pat. No. 10,743,909, which is a continuation-in-part of application No. 14/677,286, filed on Apr. 2, 2015, now Pat. No. 10,064,681.

- (60) Provisional application No. 61/974,826, filed on Apr. 3, 2014, provisional application No. 61/974,826, filed on Apr. 3, 2014.

(51) **Int. Cl.**

A61B 8/08 (2006.01)
A61B 8/12 (2006.01)
A61B 90/00 (2016.01)
A61B 10/04 (2006.01)
A61B 18/02 (2006.01)
A61B 18/12 (2006.01)
A61B 17/00 (2006.01)
A61B 18/00 (2006.01)

(52) **U.S. Cl.**

CPC *A61B 10/0241* (2013.01); *A61B 10/04* (2013.01); *A61B 90/39* (2016.02); *A61B 18/02* (2013.01); *A61B 18/12* (2013.01); *A61B 2010/045* (2013.01); *A61B 2017/00274* (2013.01); *A61B 2017/00477* (2013.01); *A61B 2017/3405* (2013.01); *A61B 2017/3411* (2013.01); *A61B 2017/3413* (2013.01); *A61B 2018/00547* (2013.01); *A61B 2090/3925* (2016.02); *A61B 2090/3933* (2016.02); *A61B 2090/3954* (2016.02); *A61B 2090/3966* (2016.02)

(58) **Field of Classification Search**

CPC .. *A61B 2017/3413*; *A61B 2018/00547*; *A61B 2090/3925*; *A61B 2090/3933*; *A61B 2090/3954*; *A61B 2090/3966*

See application file for complete search history.

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U.S. Patent Litigation Document, Exhibit B—Answer, Affirmative Defenses, Counterclaims and Jury Demand, dated Apr. 15, 2022.

U.S. Patent Litigation Document, Exhibit C—Answer, Affirmative Defenses, Counterclaims and Jury Demand, dated Apr. 15, 2022.

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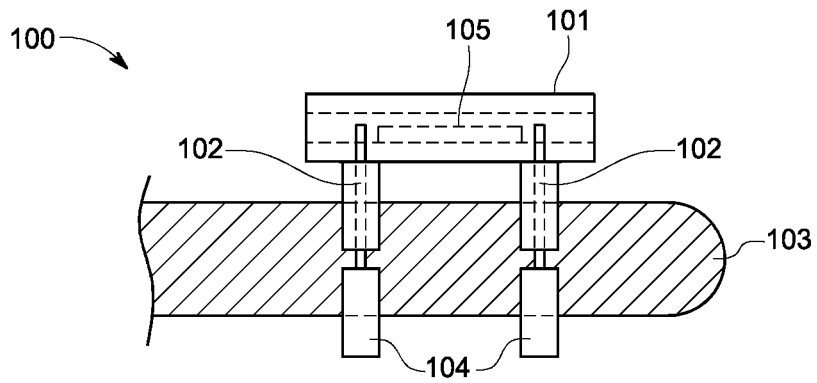


FIG. 1

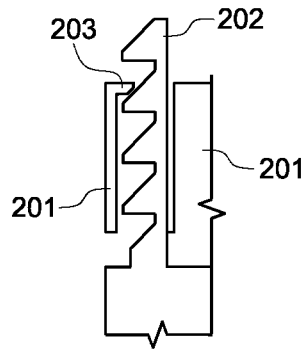


FIG. 2A

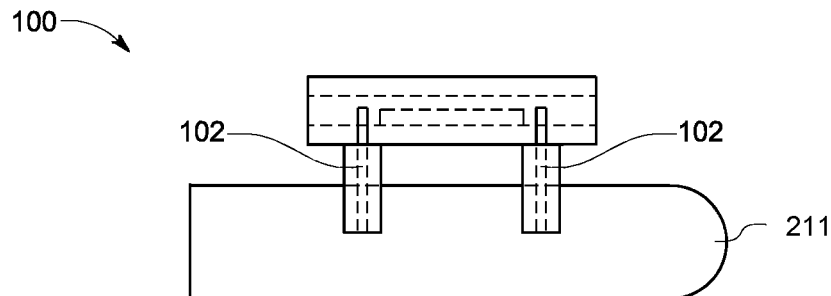


FIG. 2B

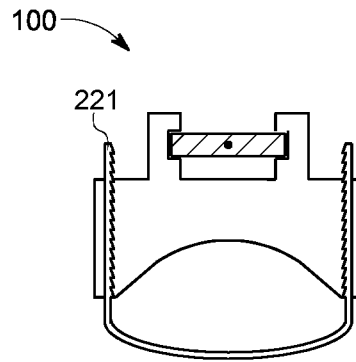


FIG. 2C

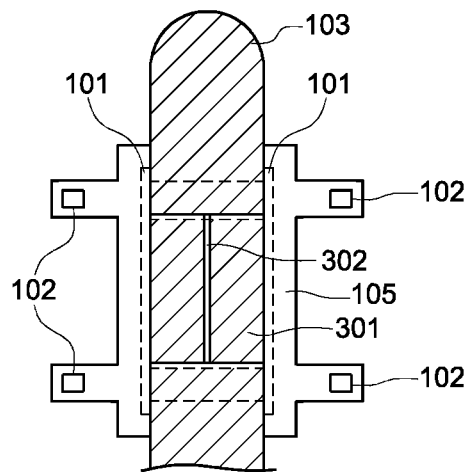


FIG. 3

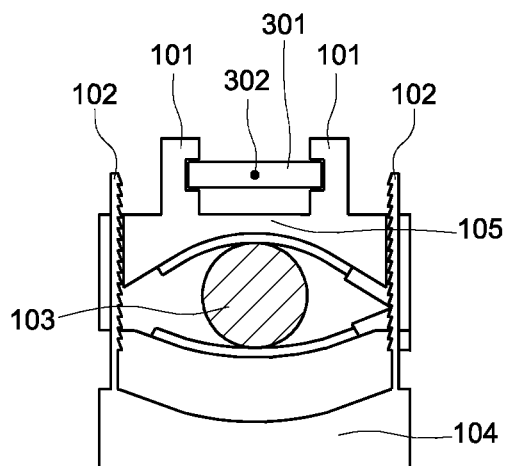


FIG. 4

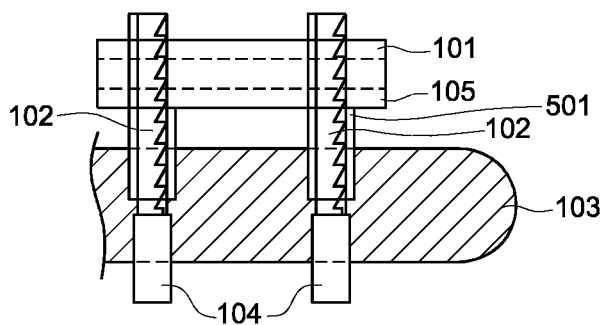


FIG. 5

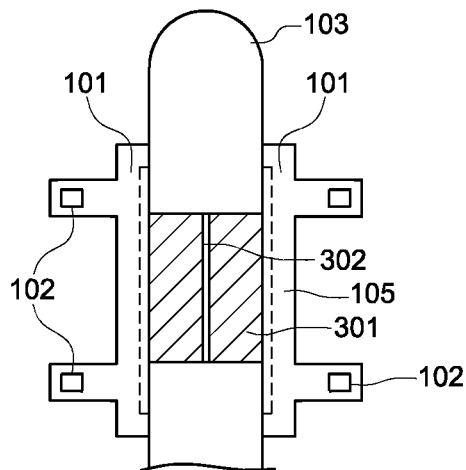


FIG. 6

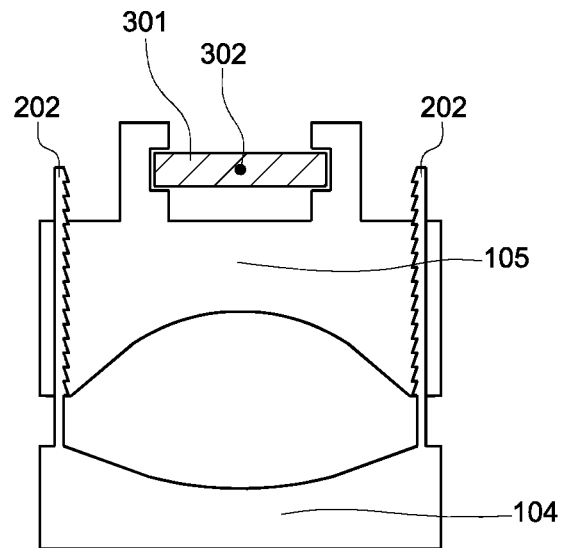


FIG. 7

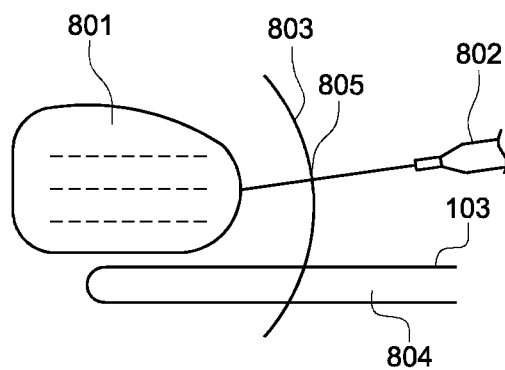


FIG. 8

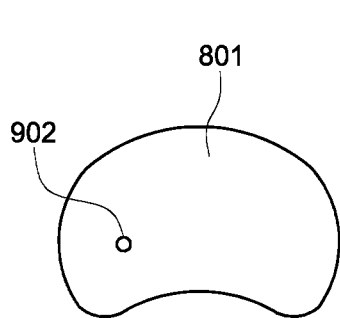


FIG. 9

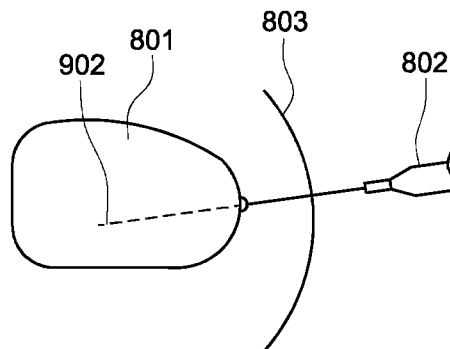


FIG. 10

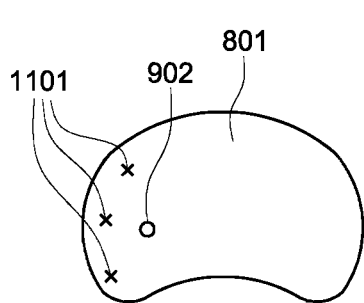


FIG. 11

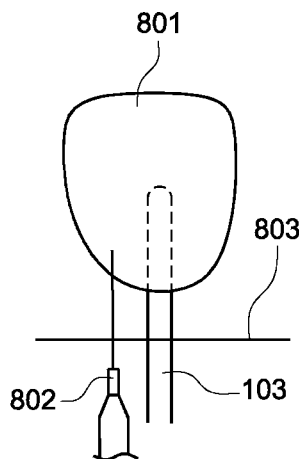


FIG. 12

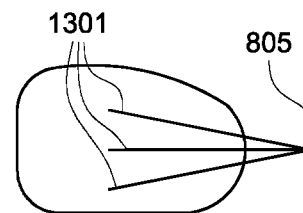


FIG. 13

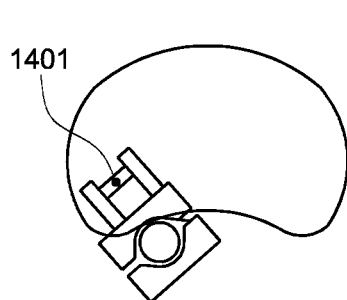


FIG. 14

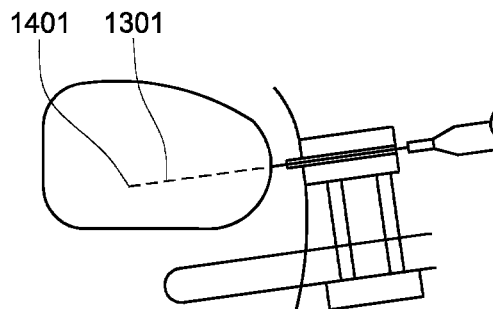


FIG. 15

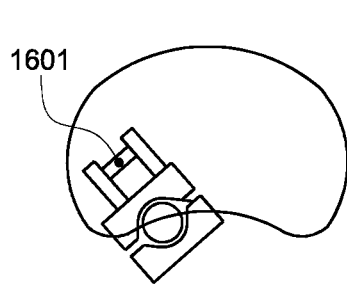


FIG. 16

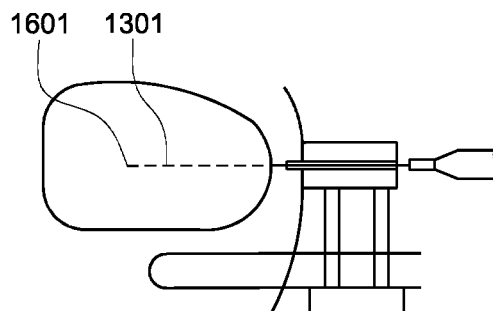


FIG. 17

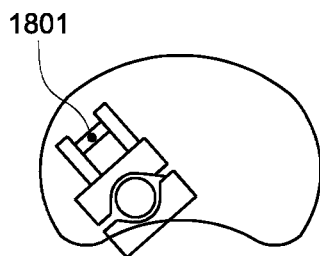


FIG. 18

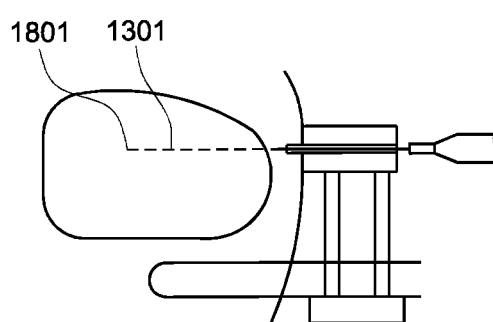


FIG. 19

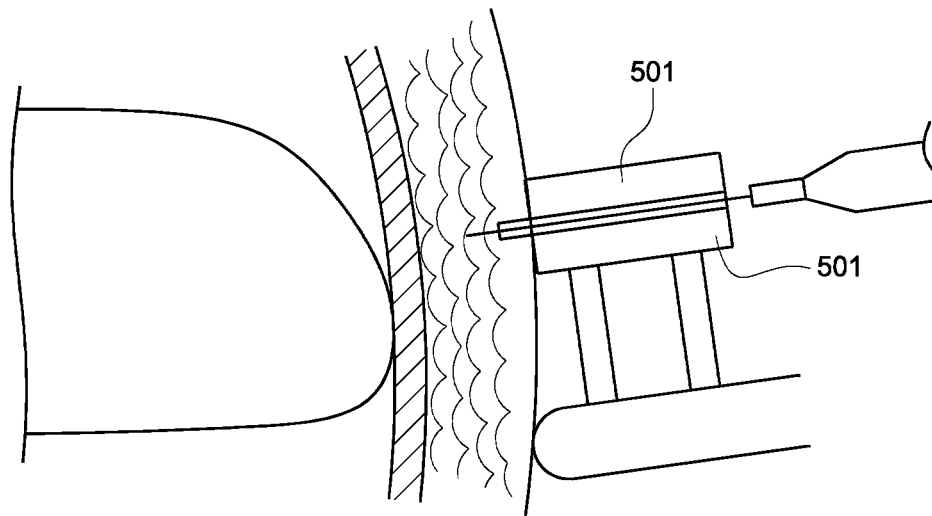


FIG. 20

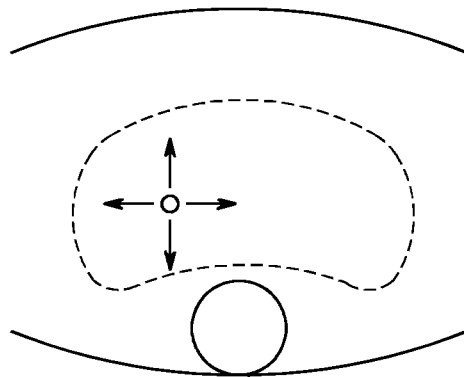


FIG. 21

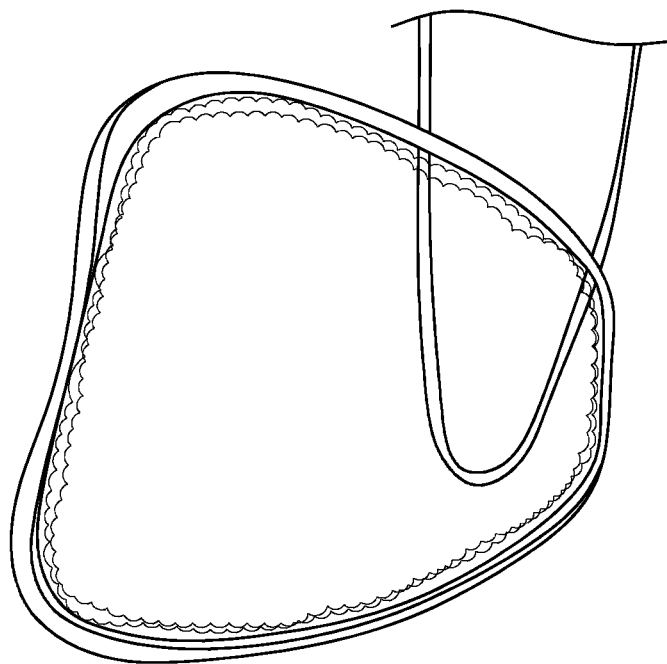


FIG. 22

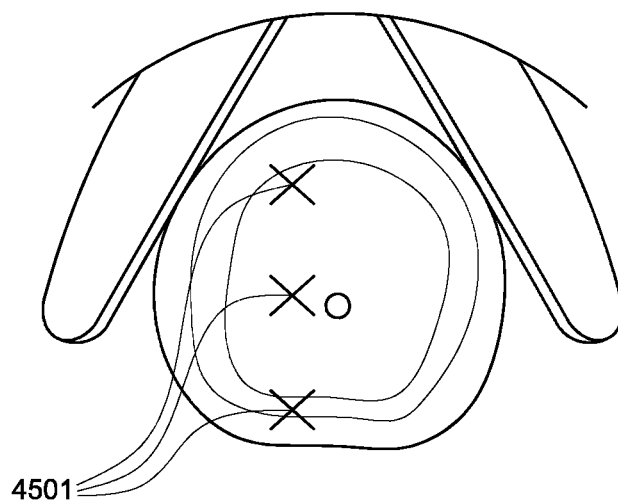
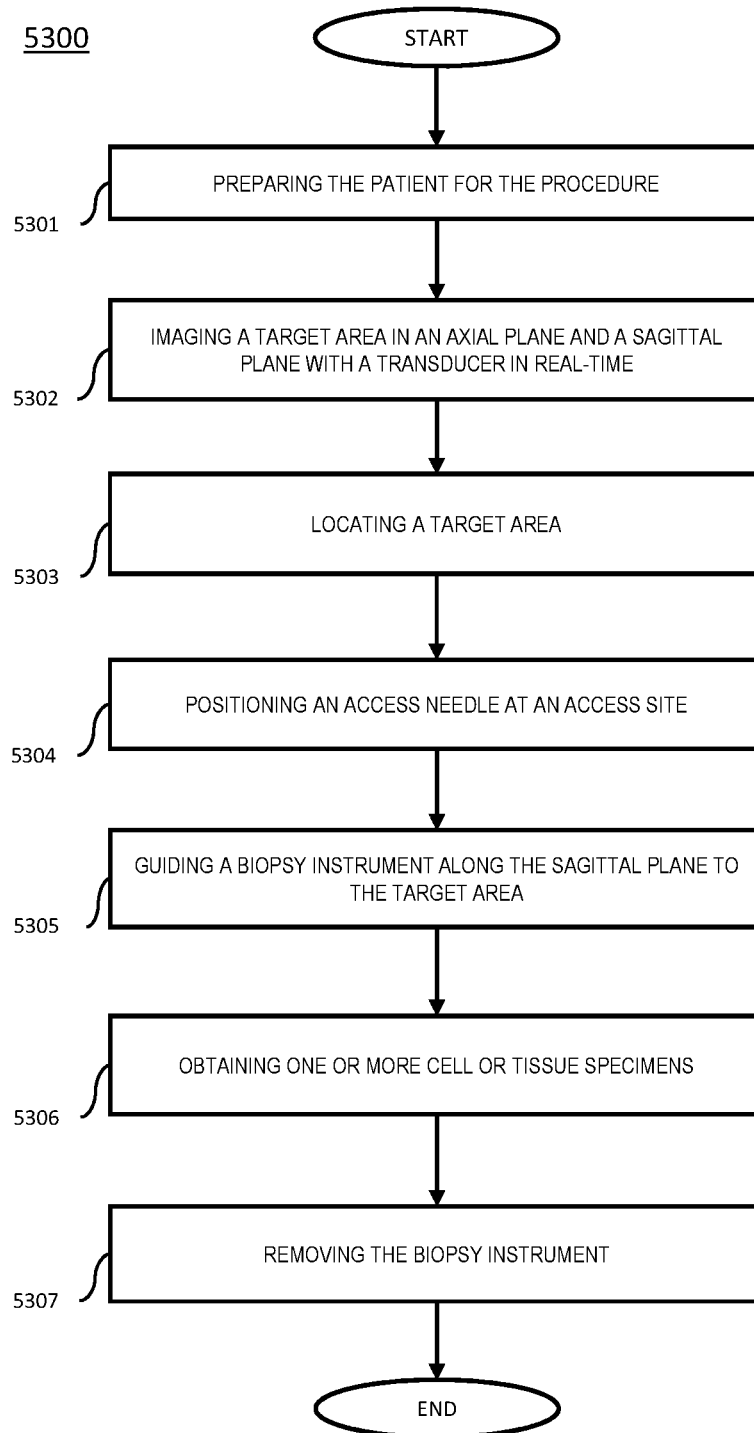


FIG. 23

FIG. 24



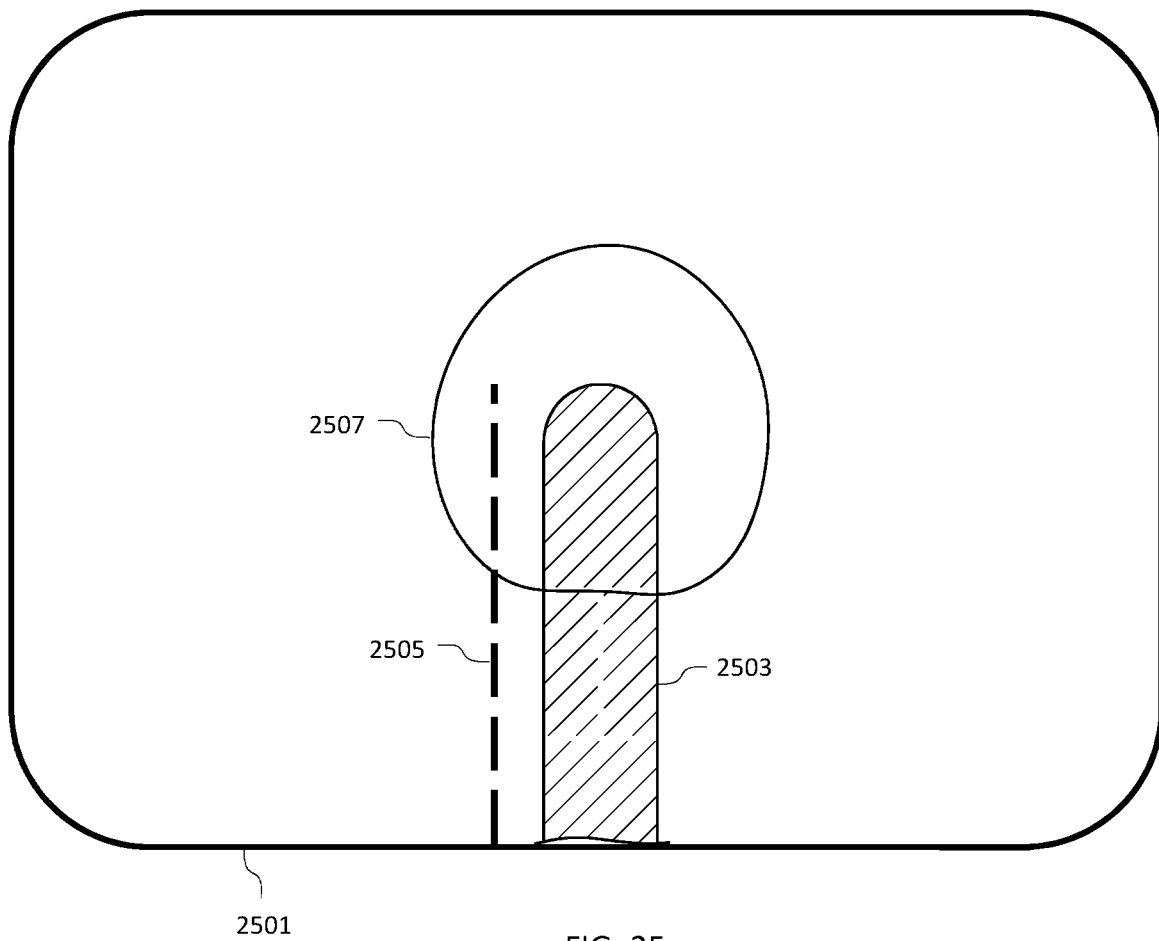


FIG. 25

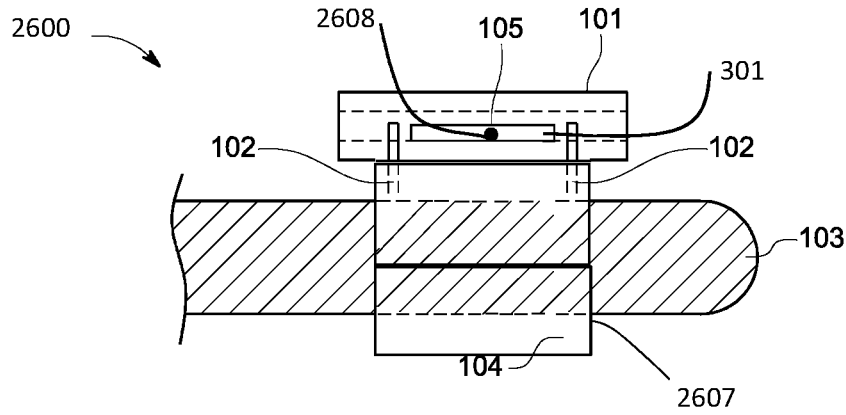


FIG. 26A

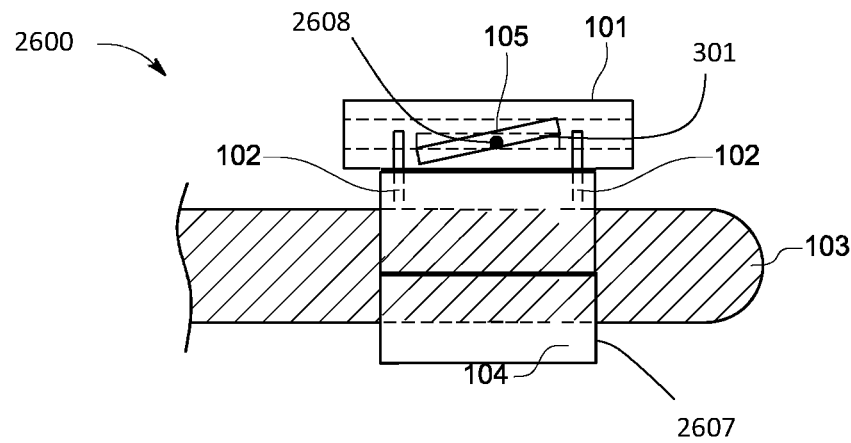


FIG. 26B

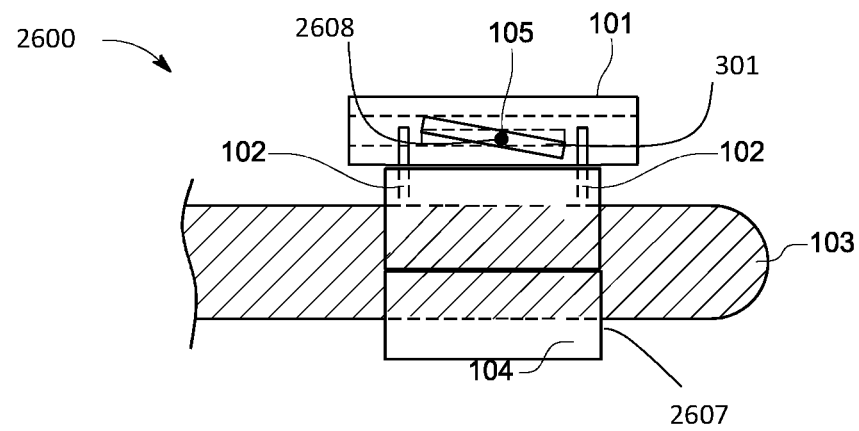


FIG. 26C

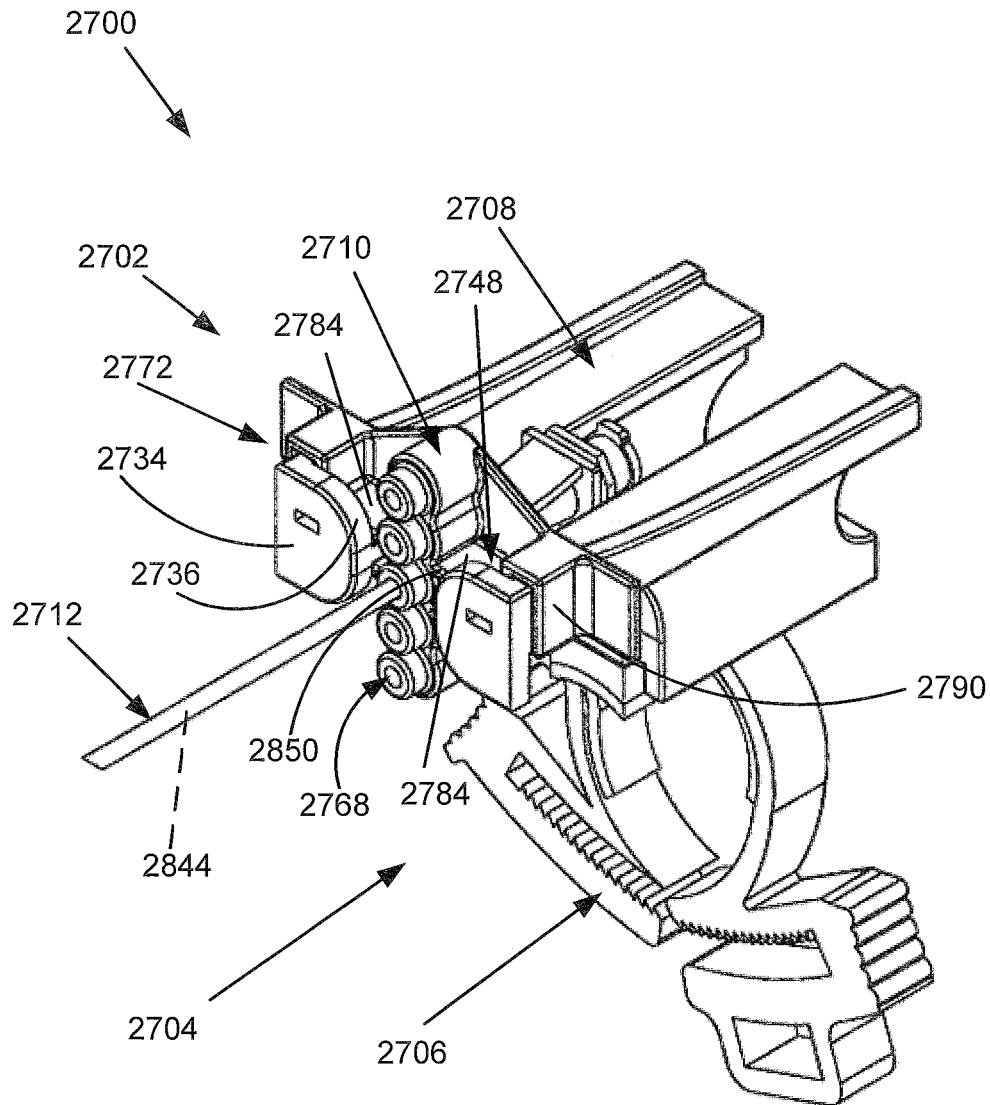


FIG. 27

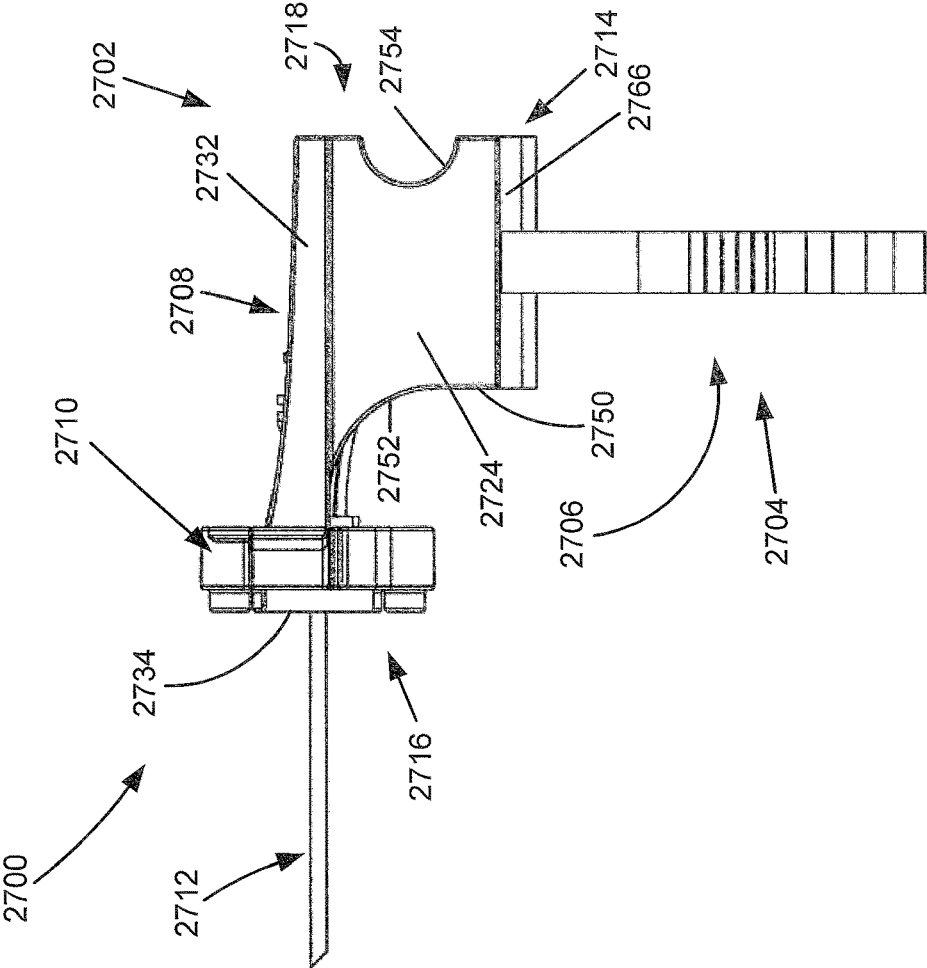


FIG. 29

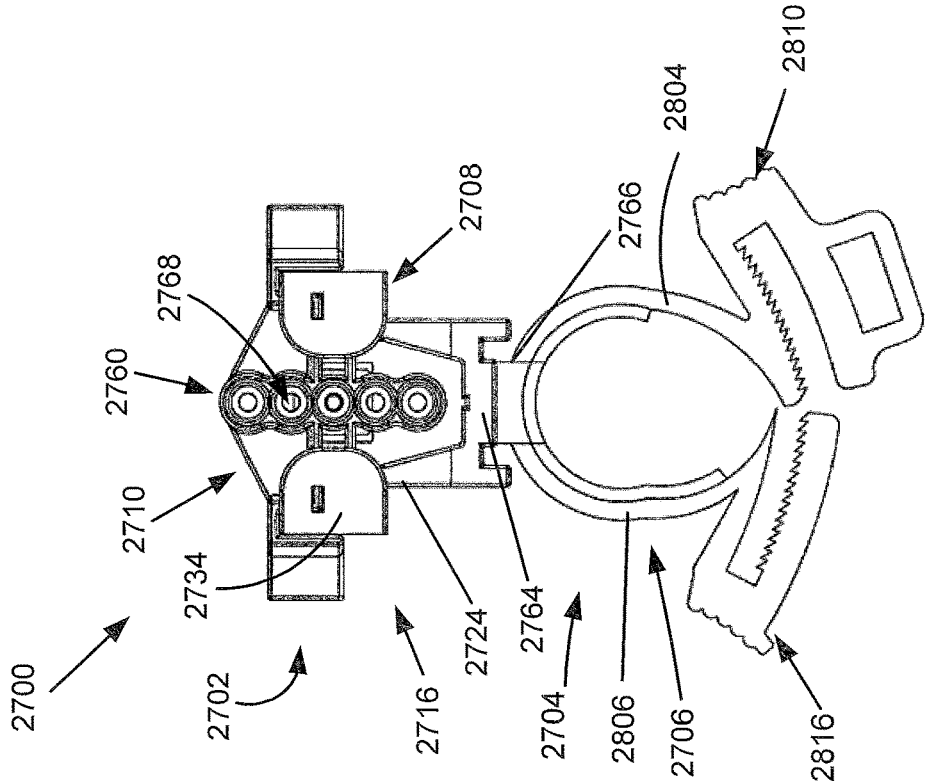


FIG. 28

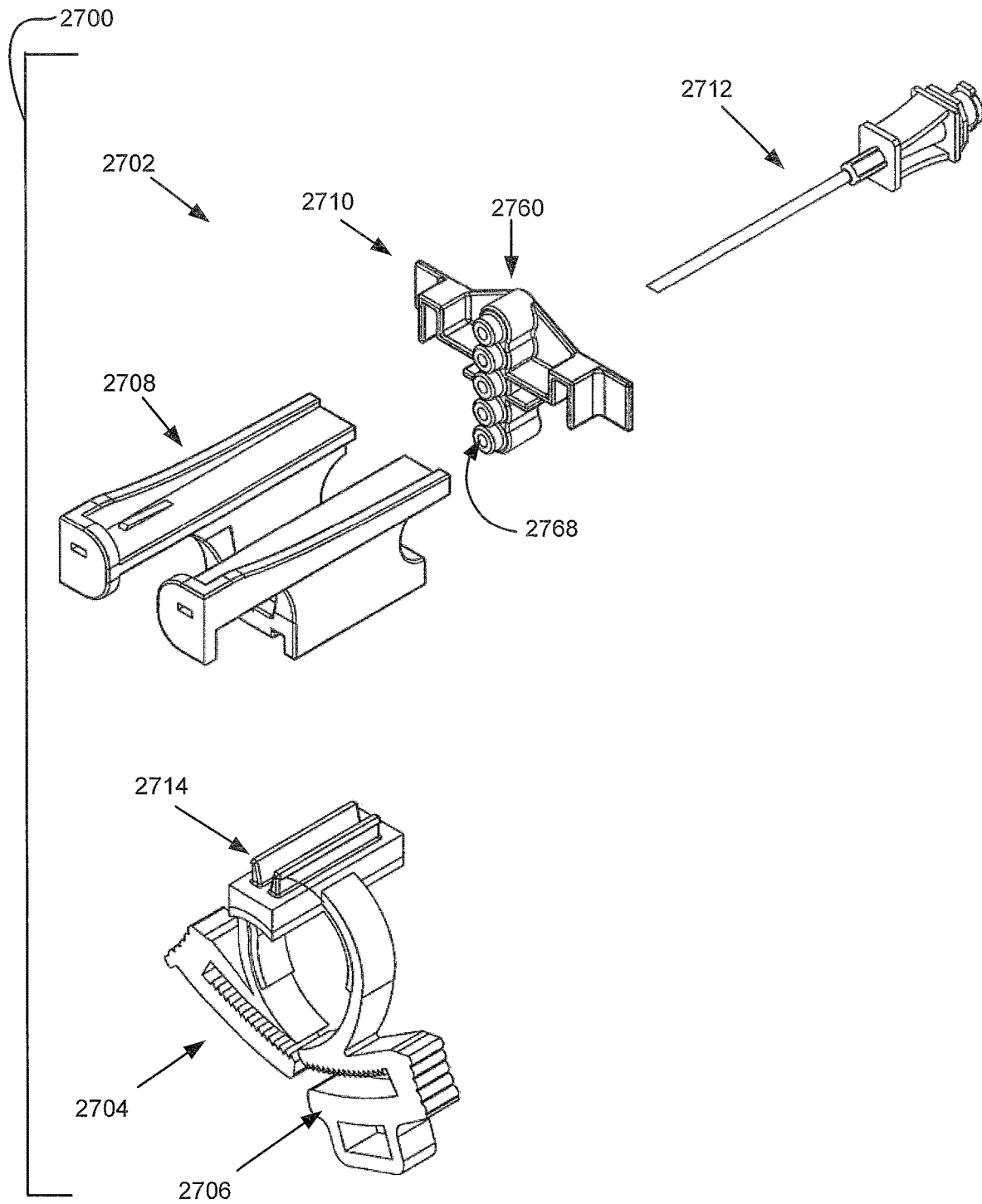


FIG. 30

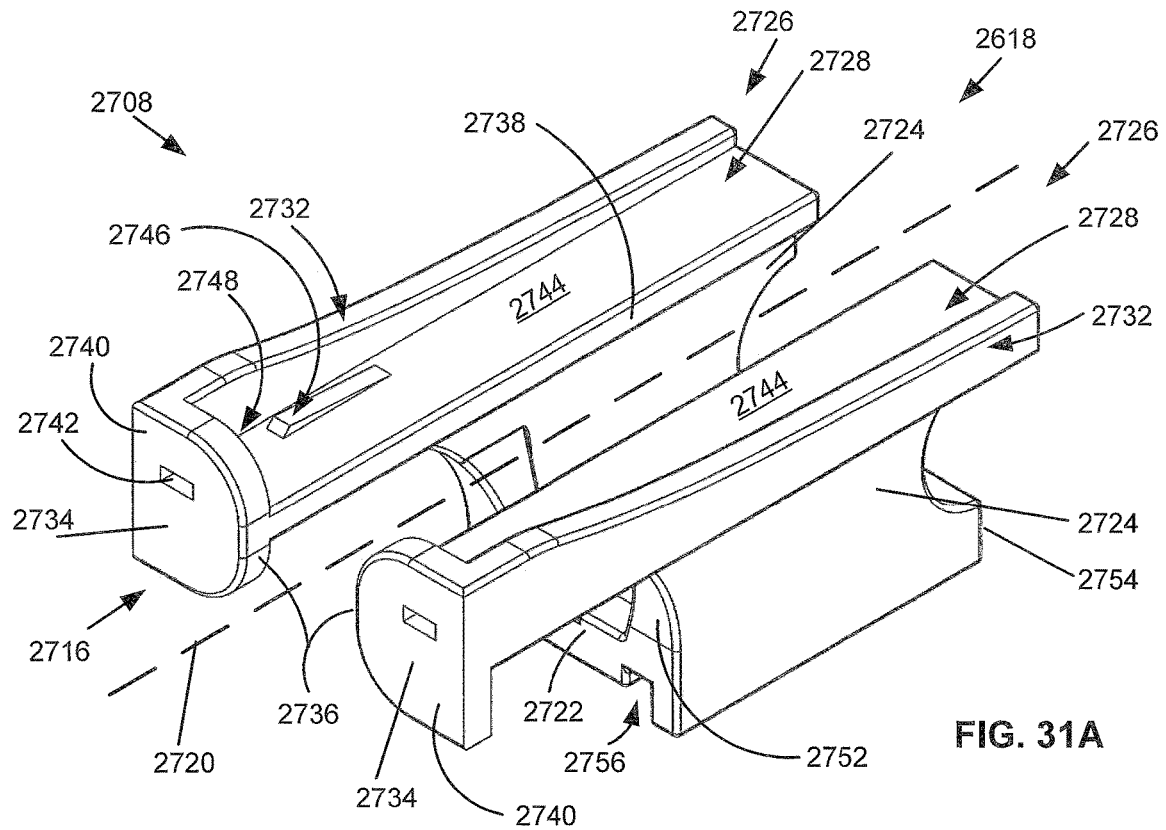


FIG. 31A

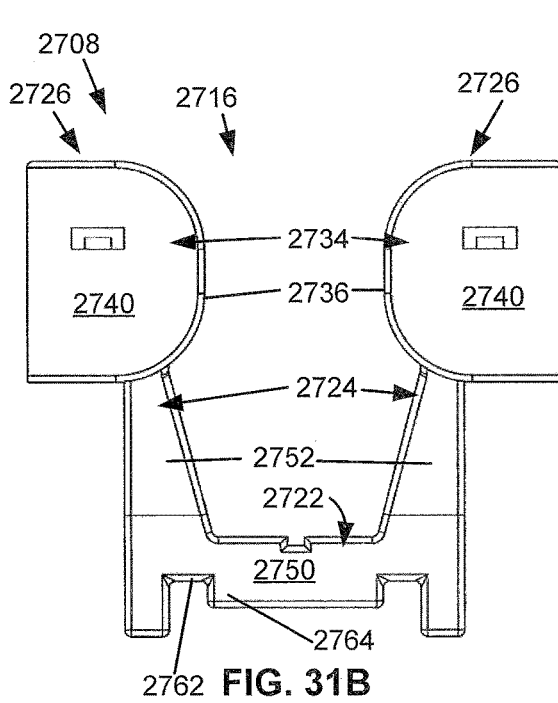


FIG. 31B

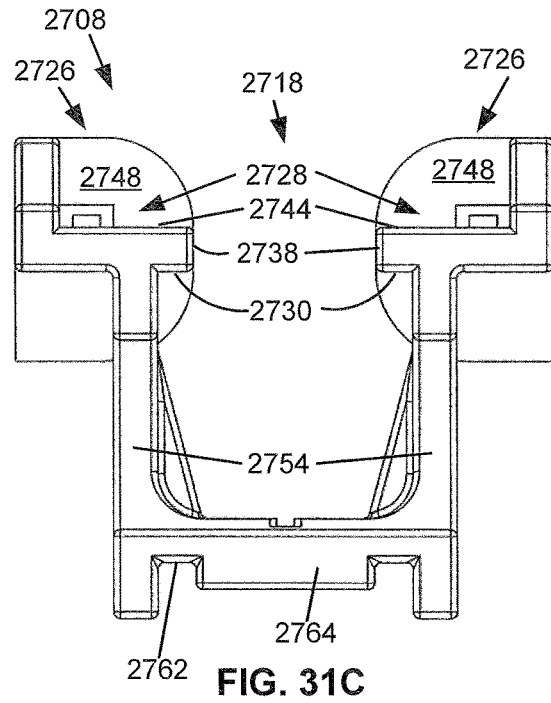


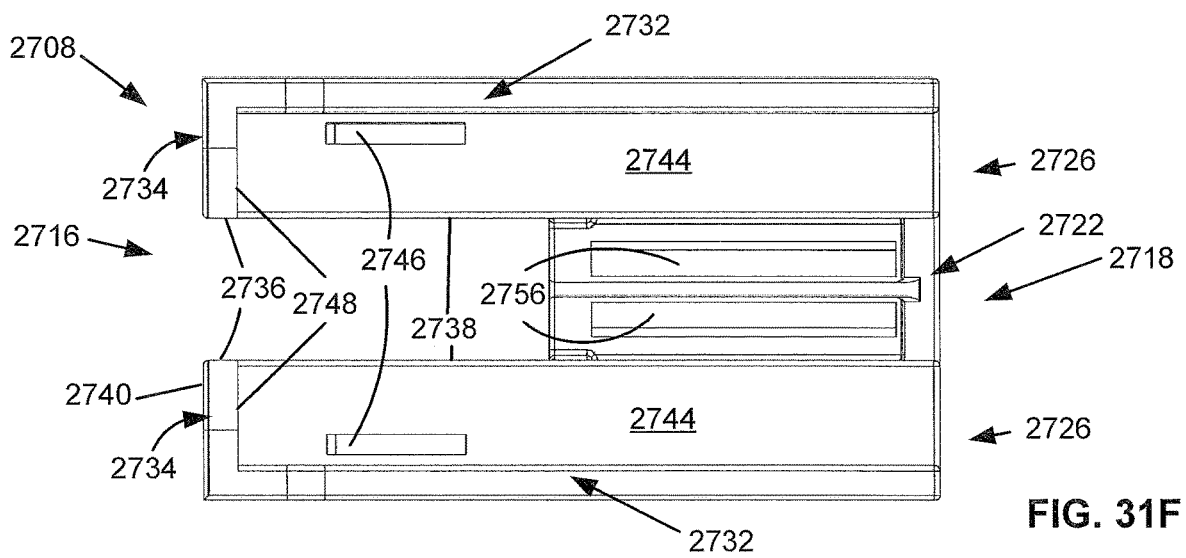
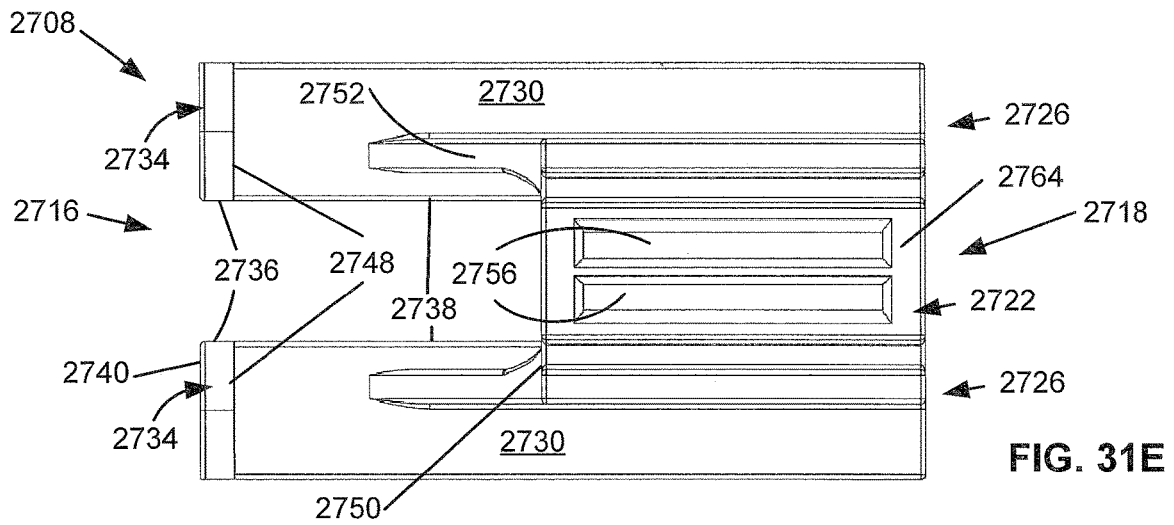
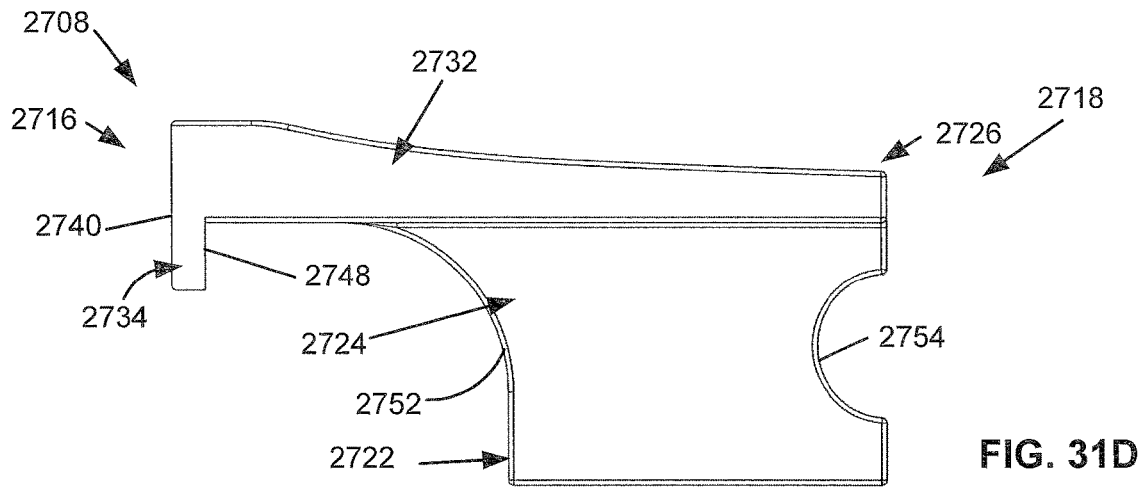
FIG. 31C

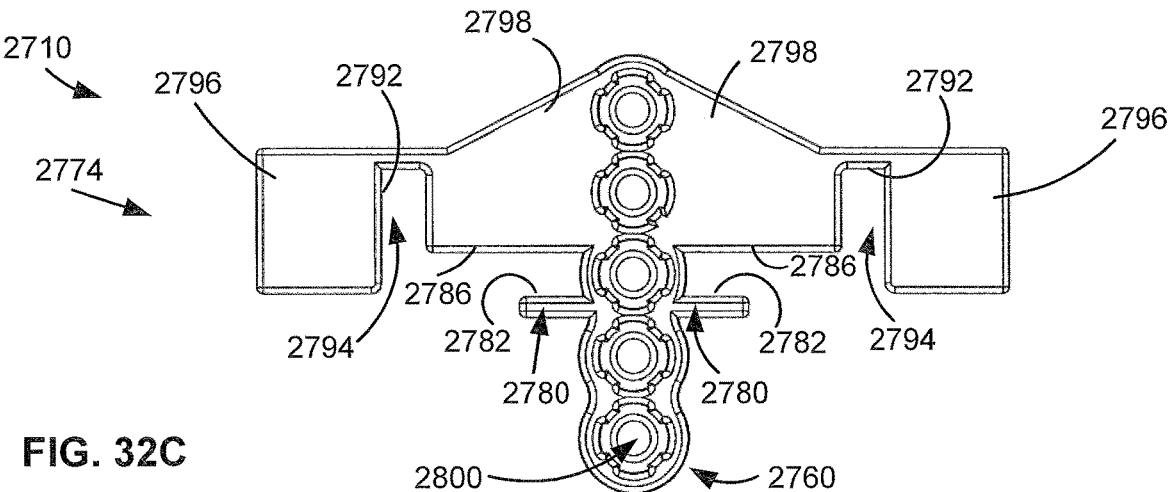
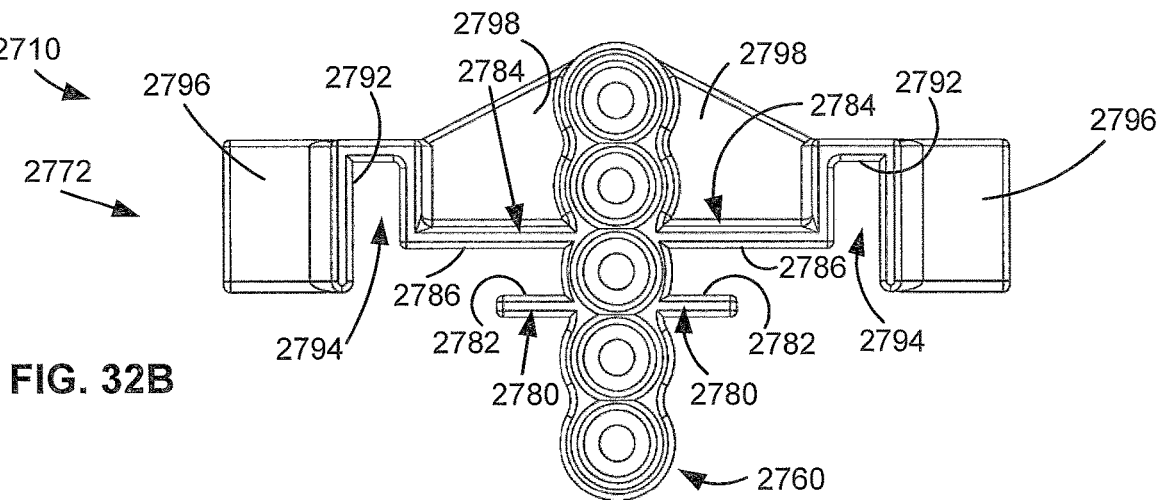
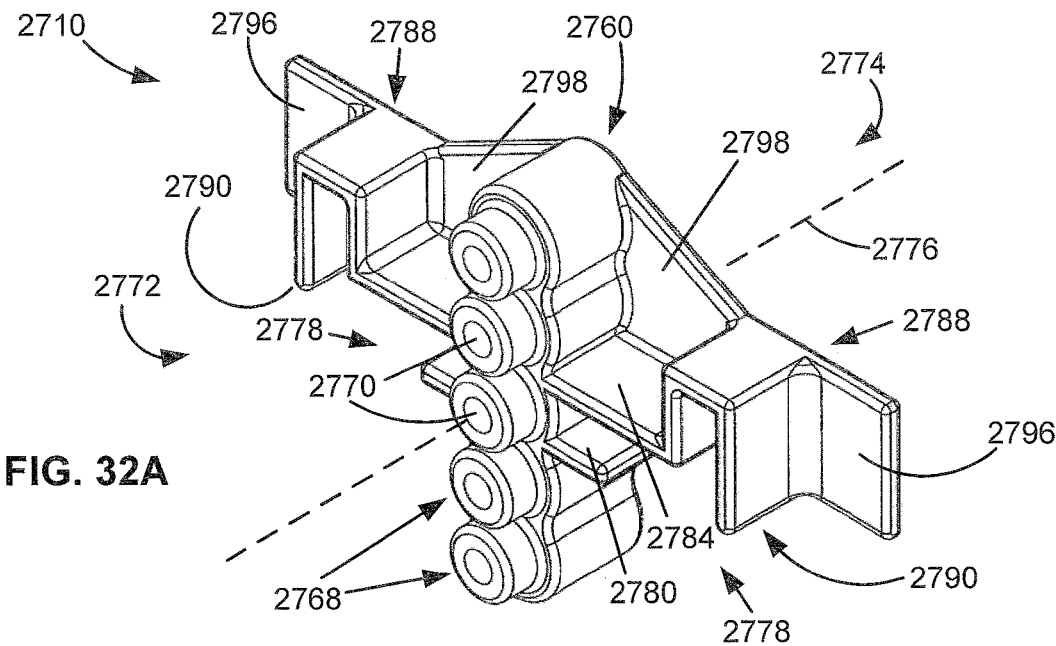
U.S. Patent

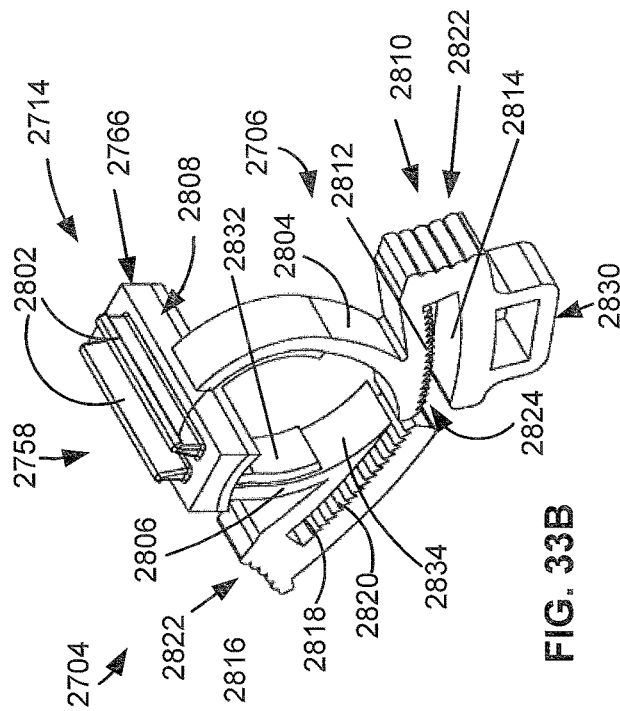
Jan. 10, 2023

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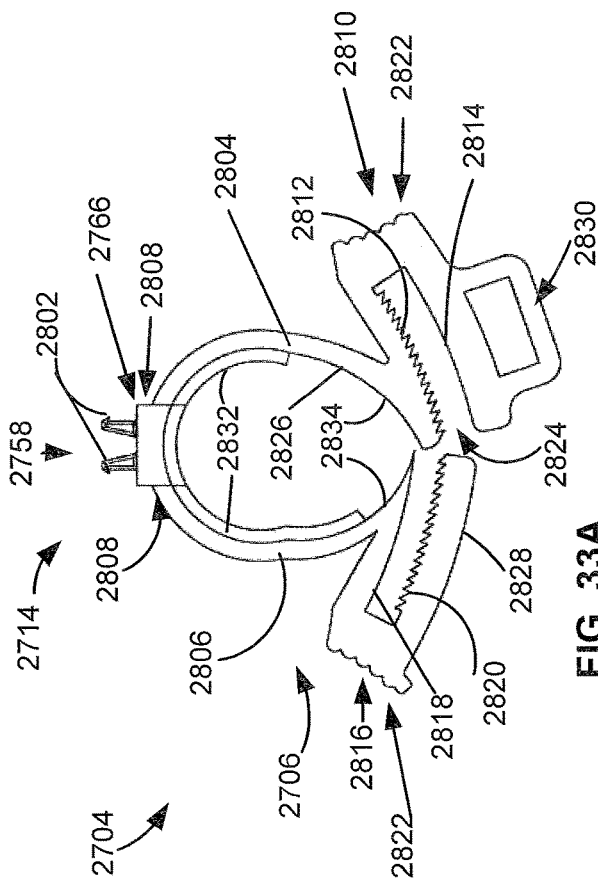


FIG. 33A

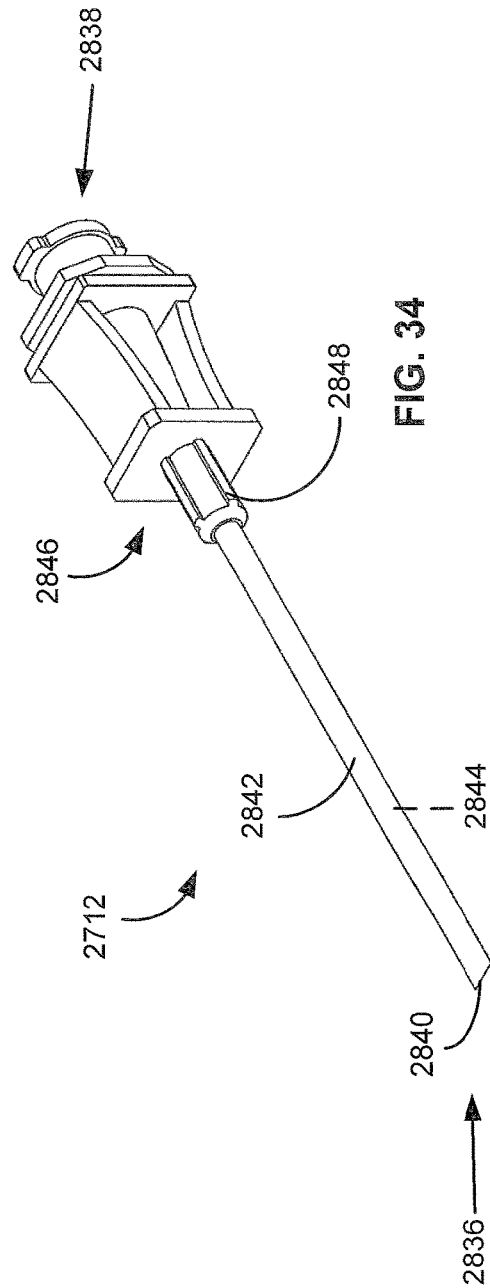


FIG. 34

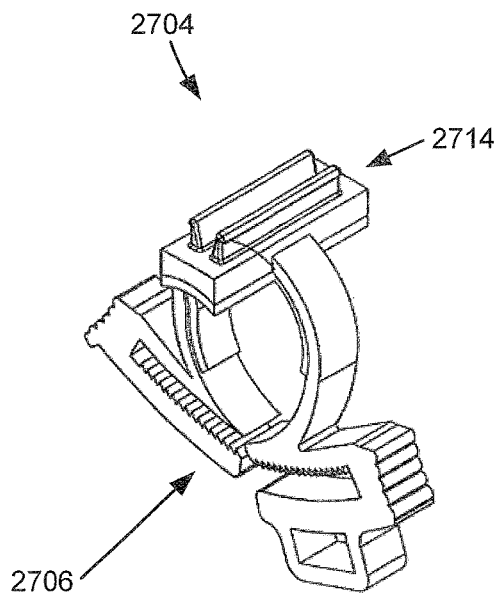


FIG. 35A

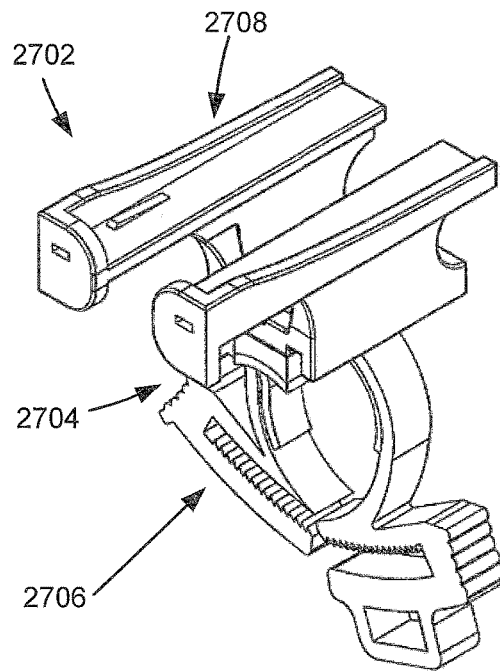


FIG. 35B

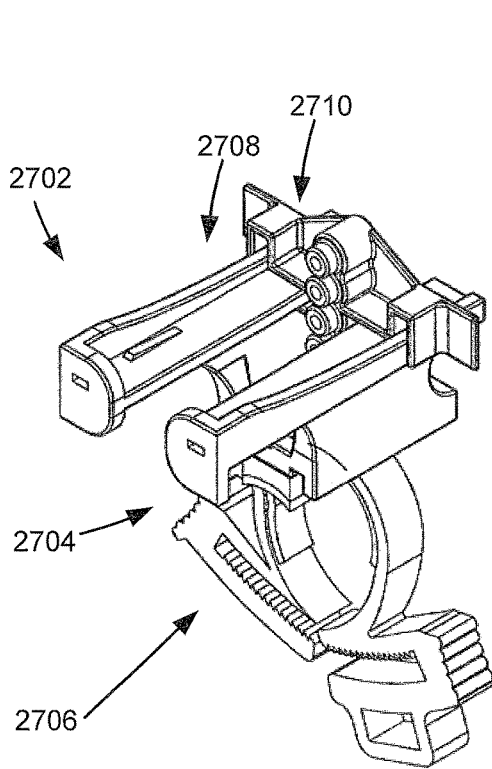


FIG. 35C

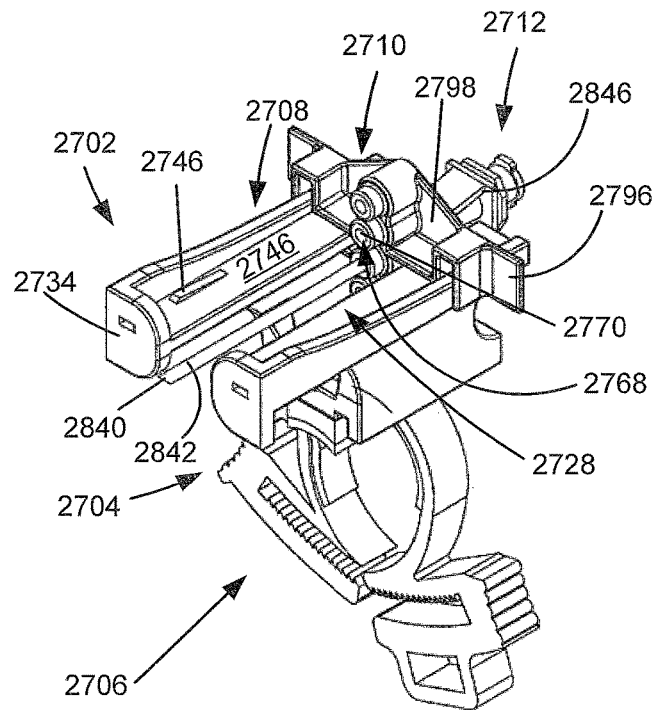
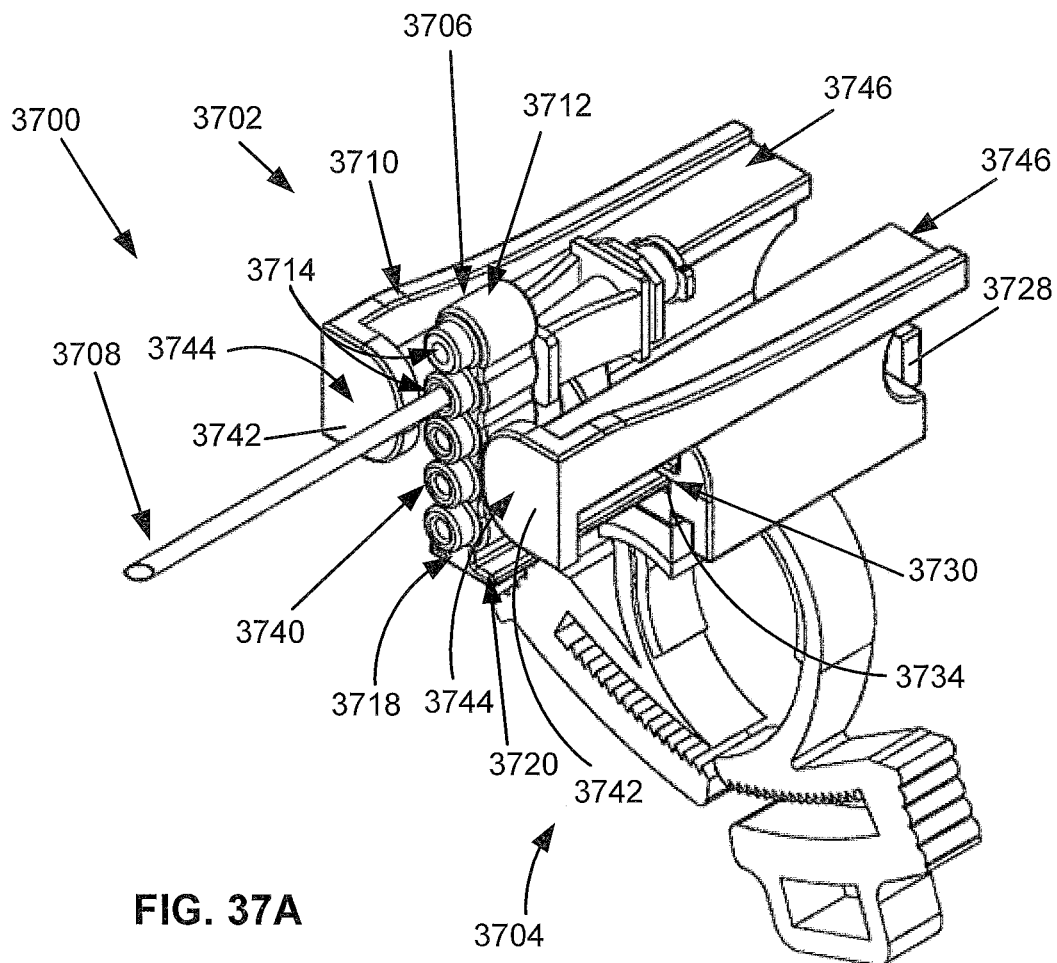
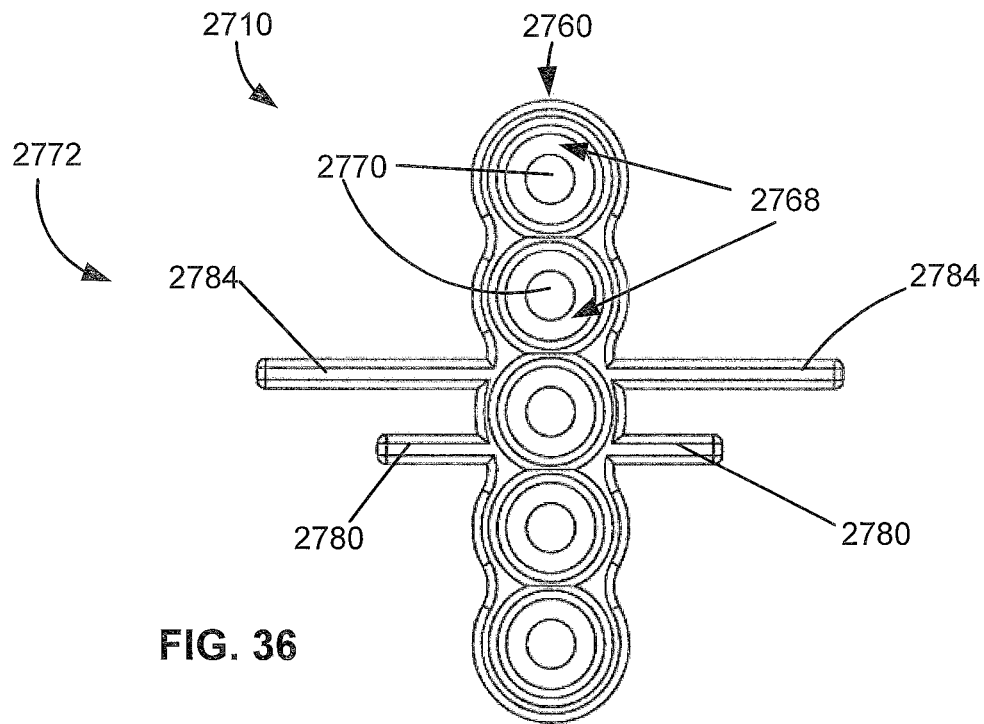
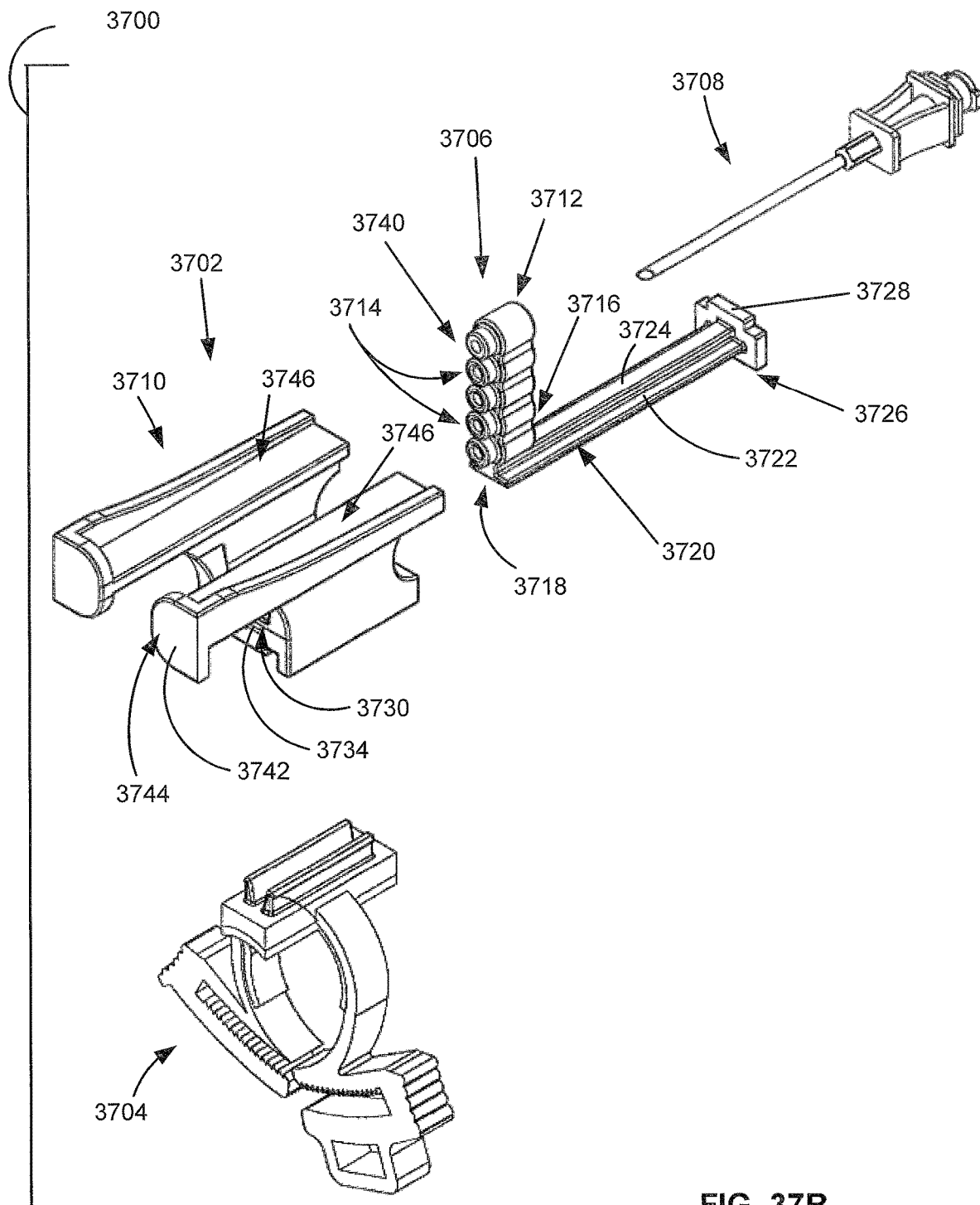
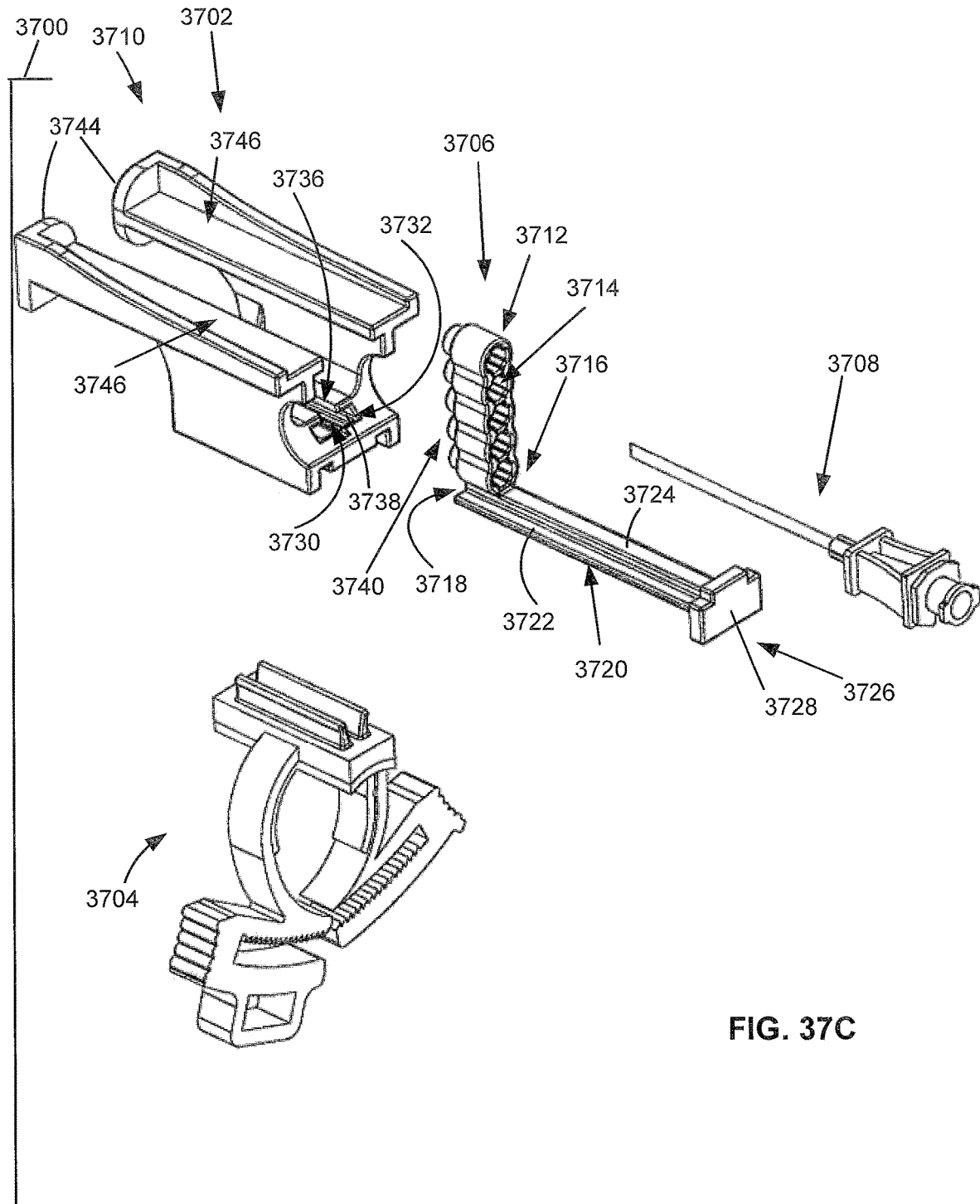
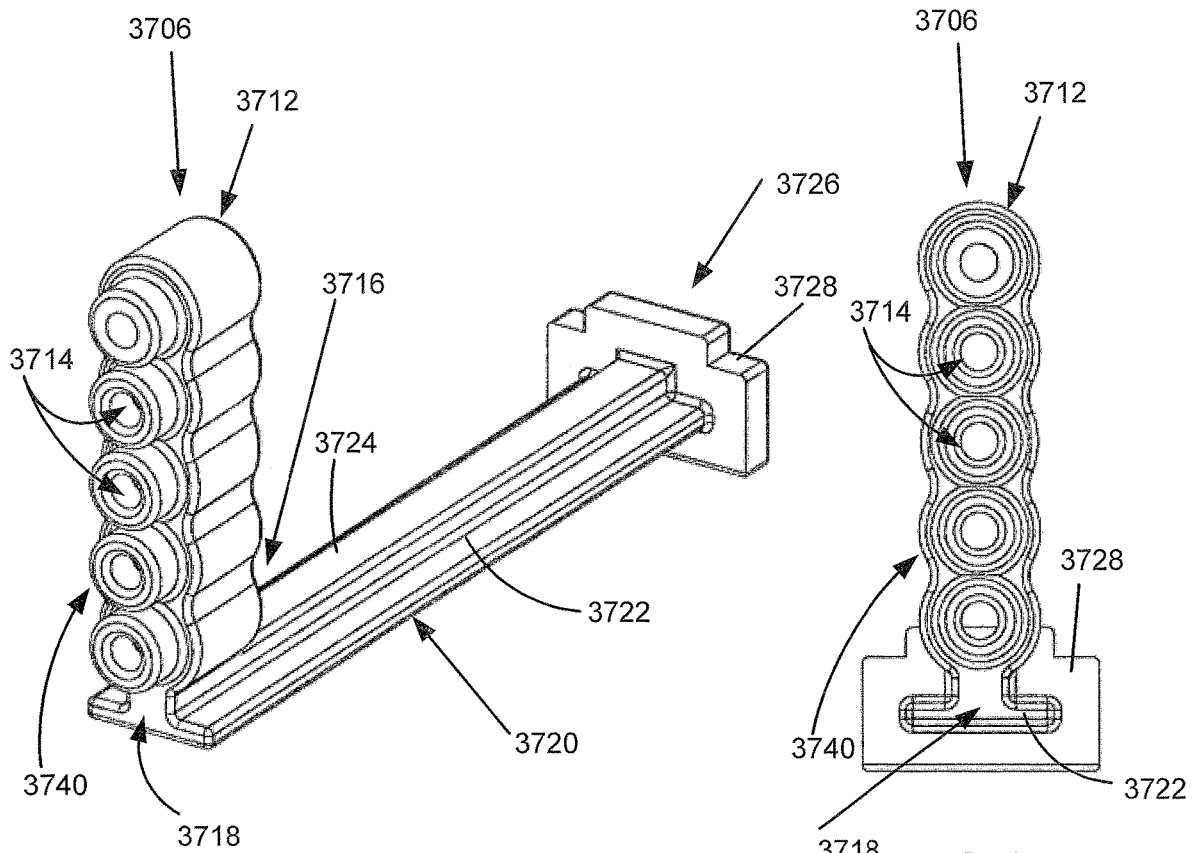
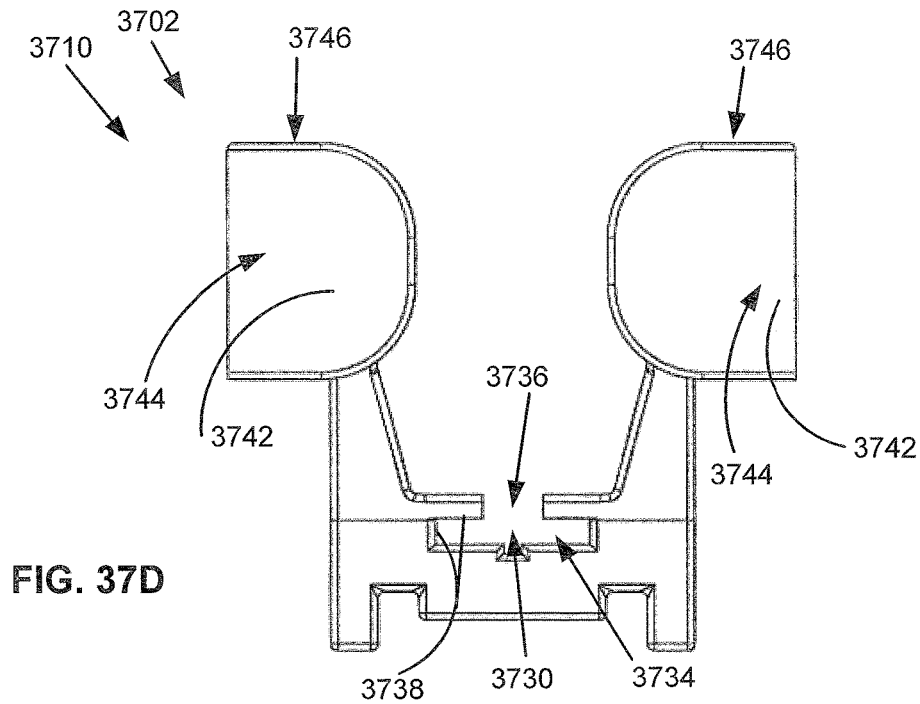


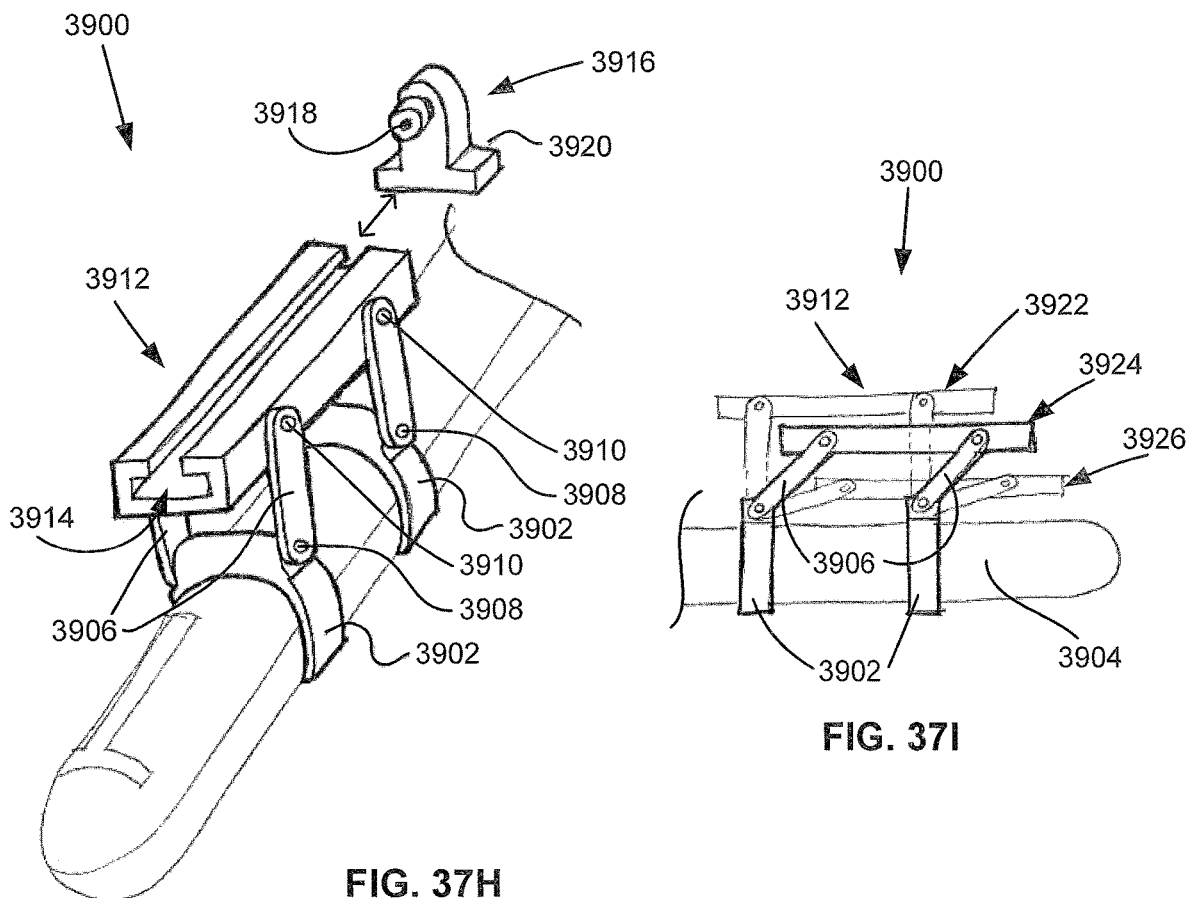
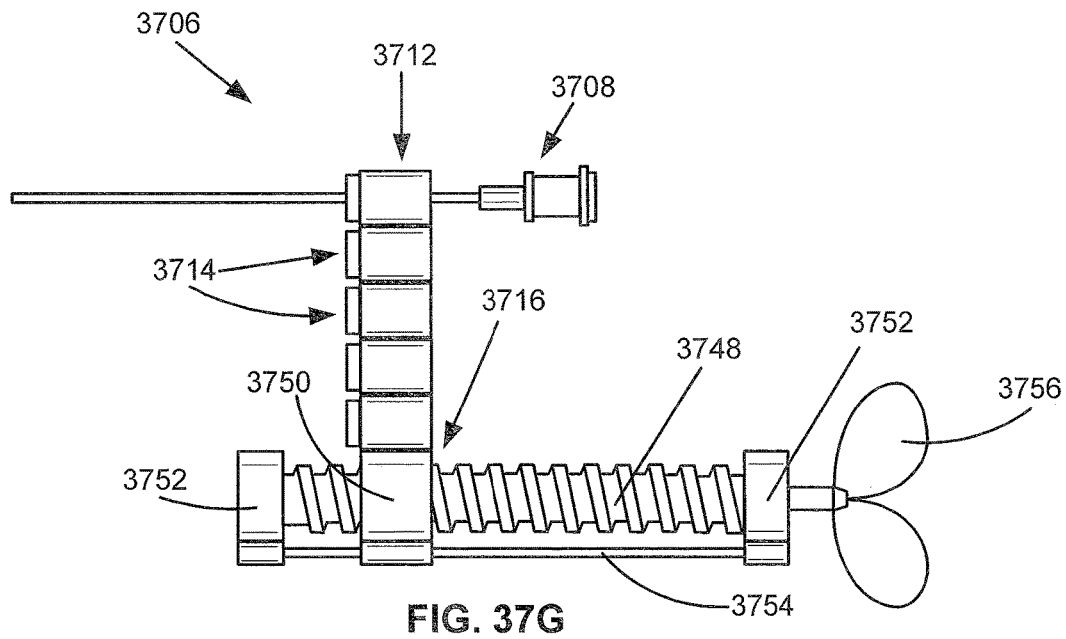
FIG. 35D











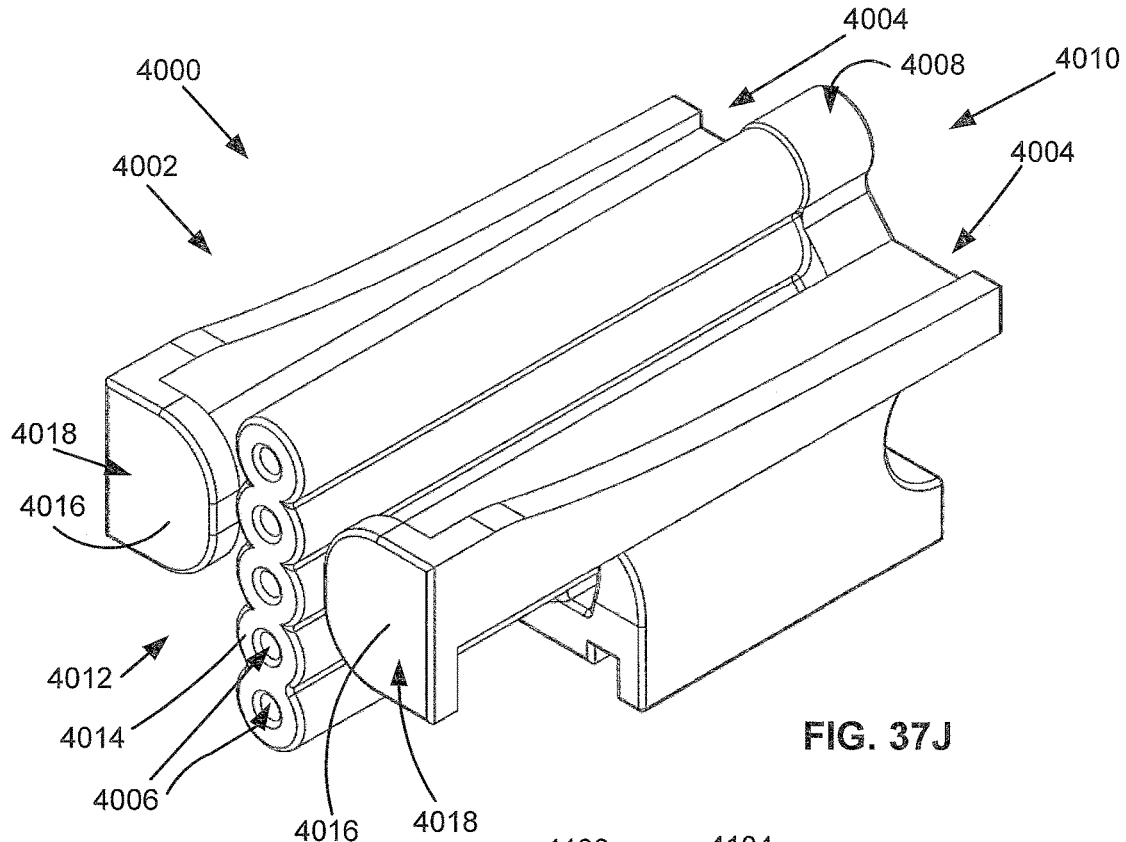


FIG. 37J

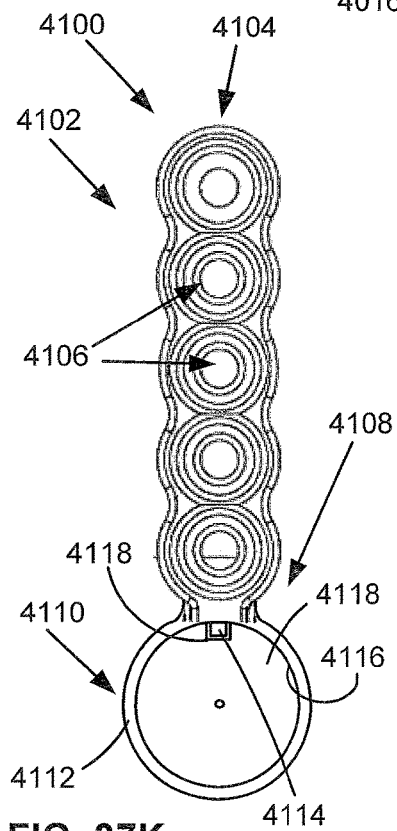


FIG. 37K

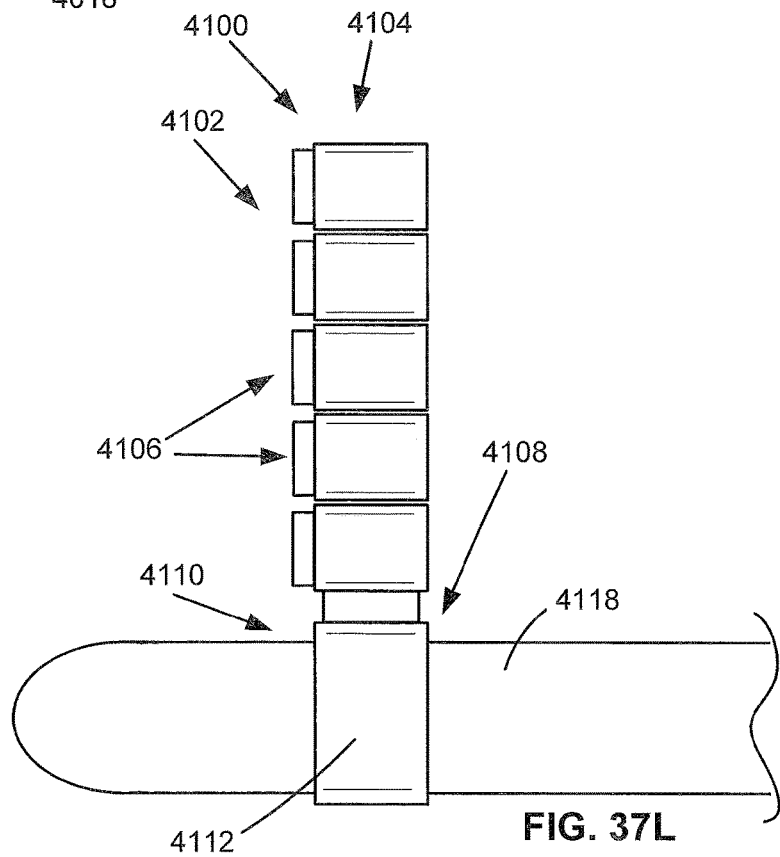
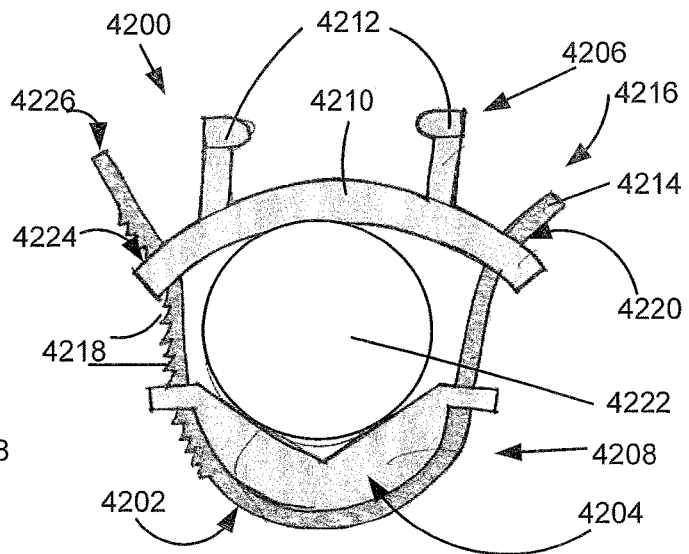
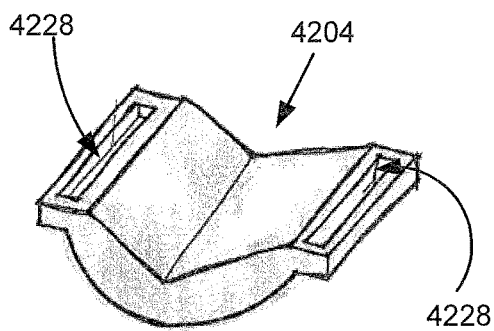
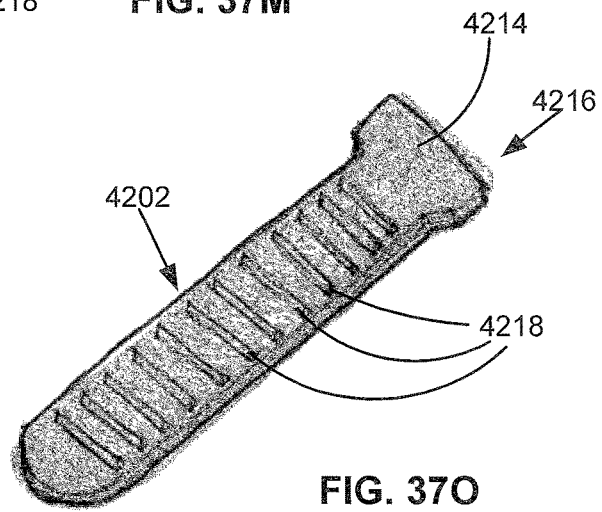
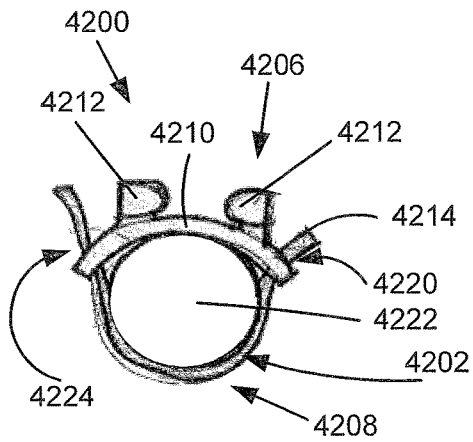
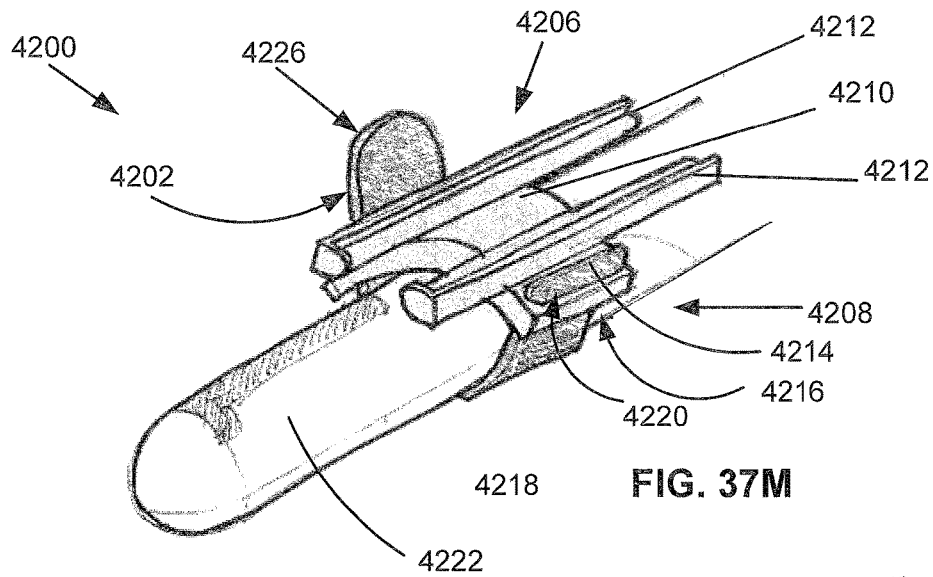
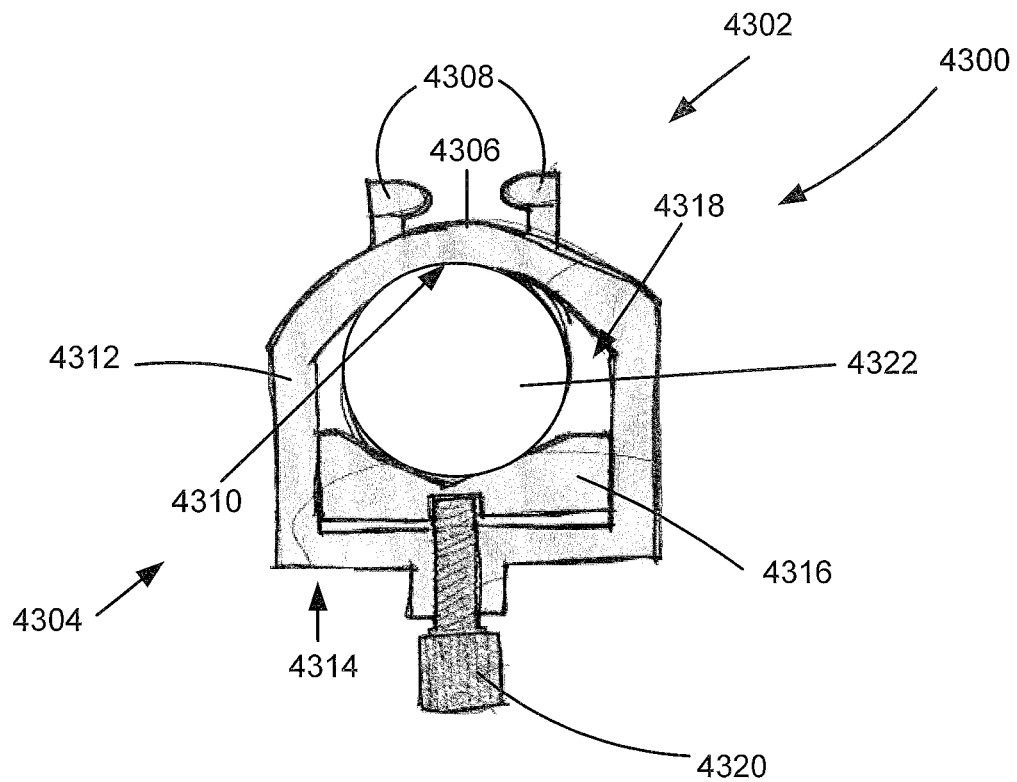
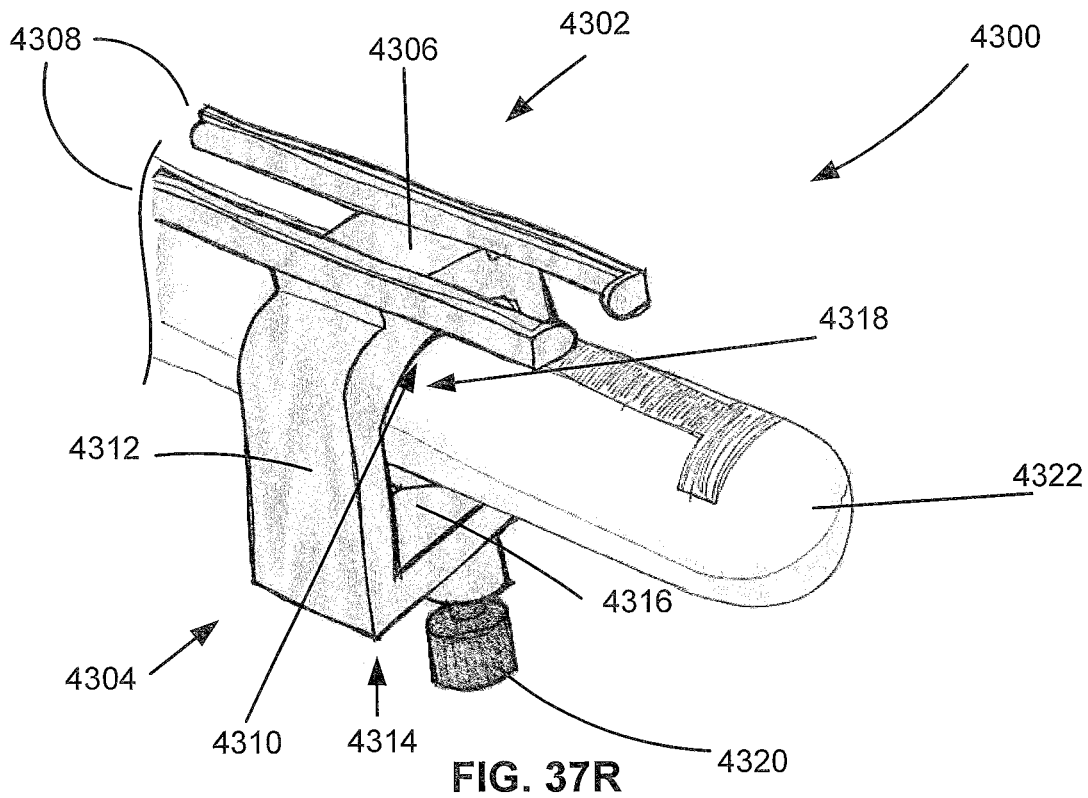
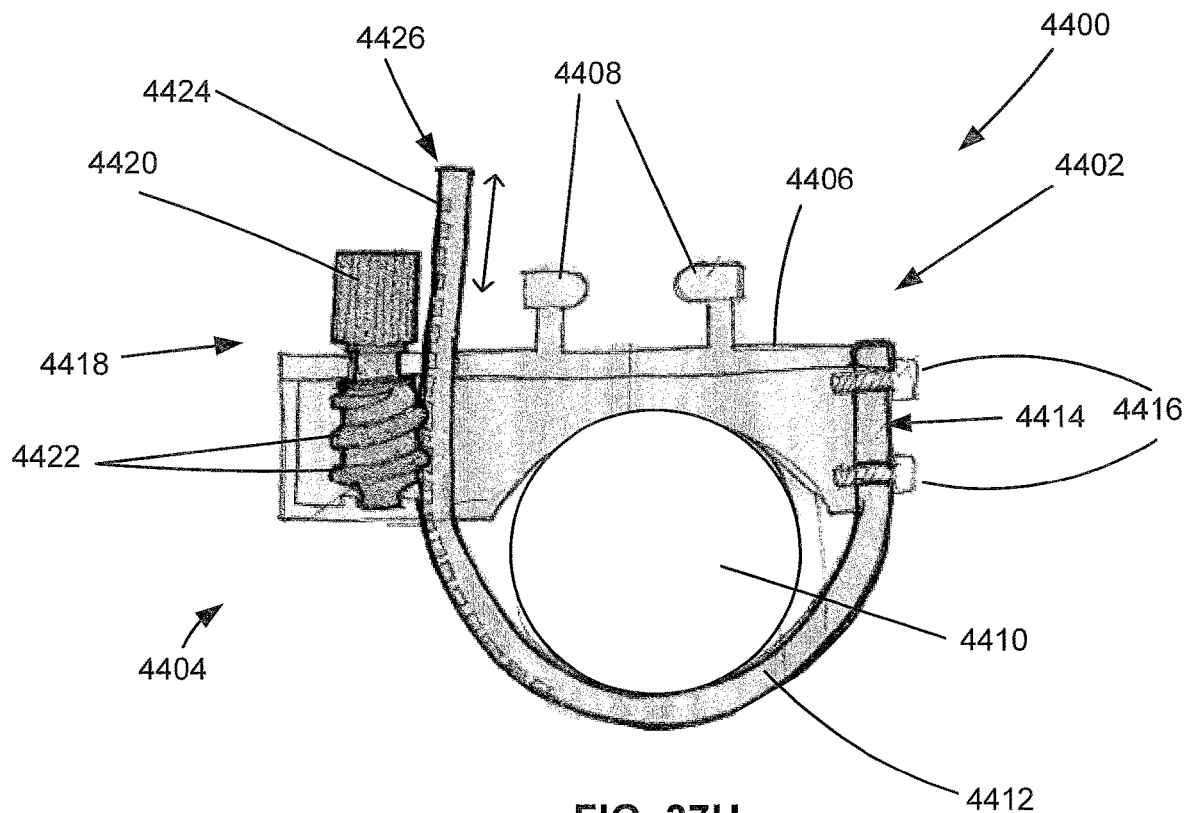
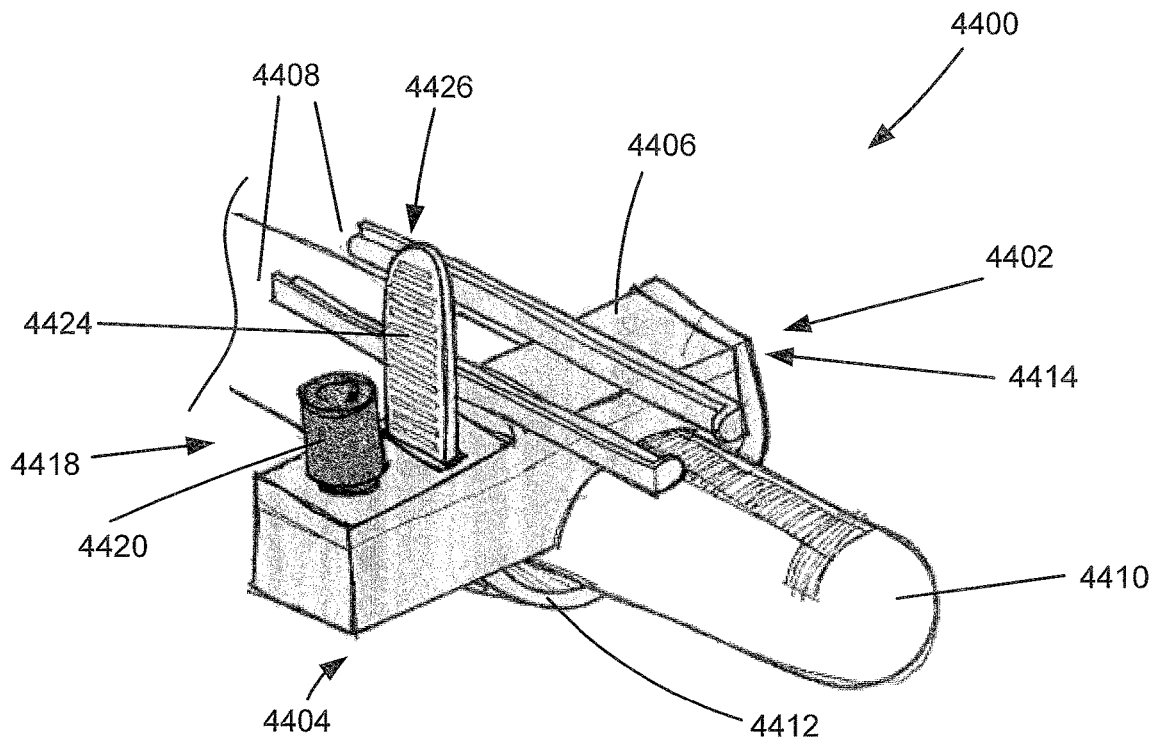


FIG. 37L





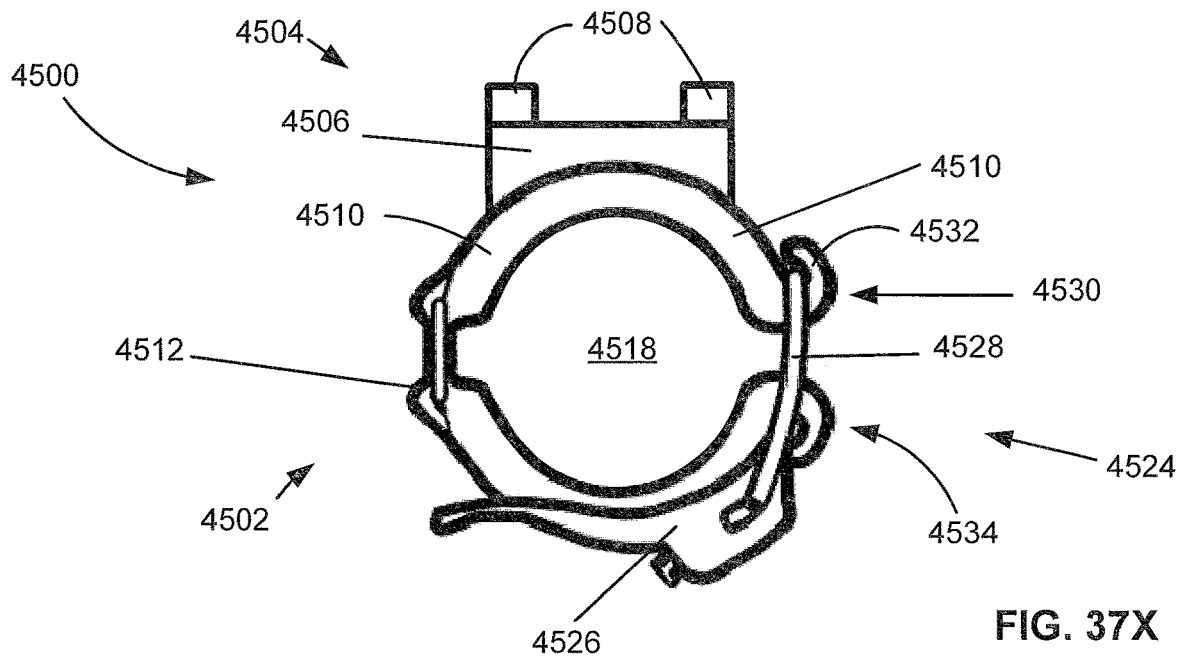
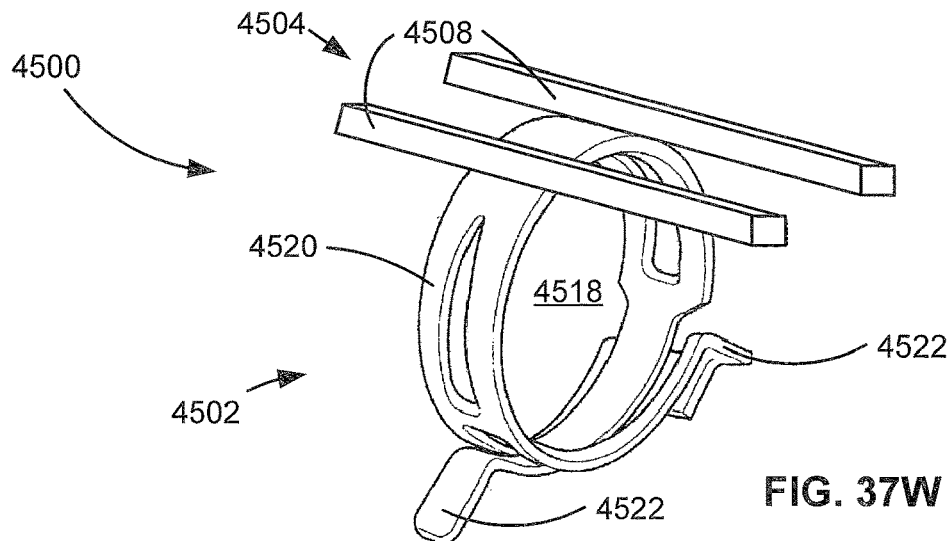
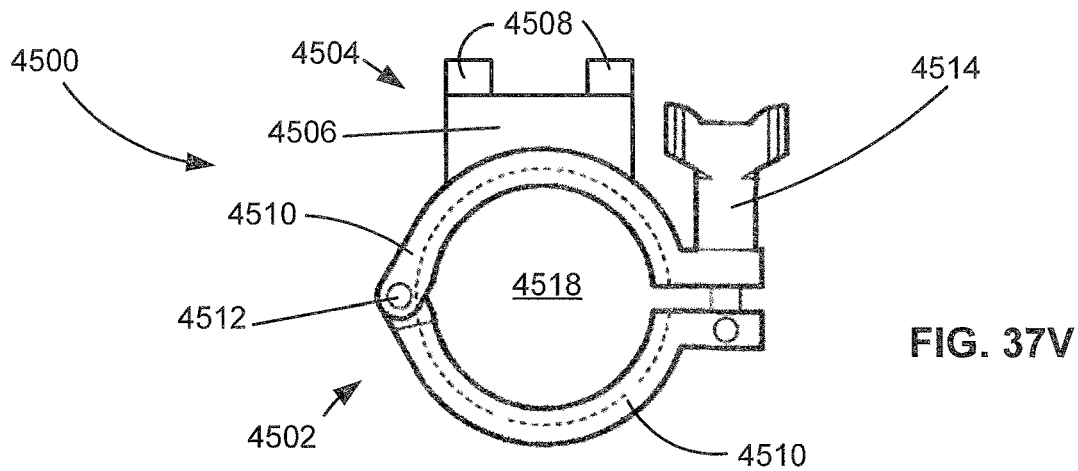


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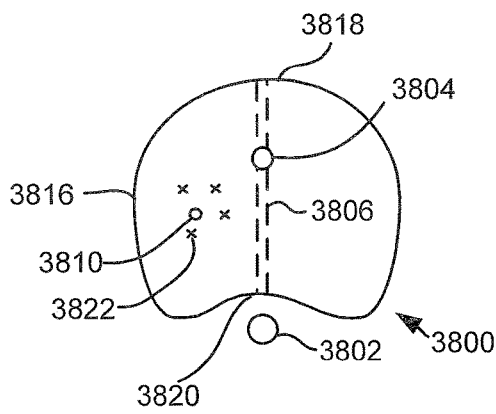


FIG. 38A

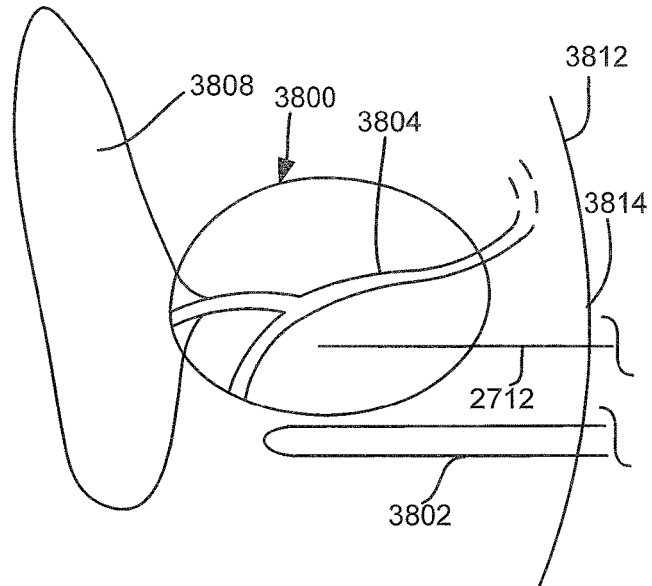


FIG. 38B

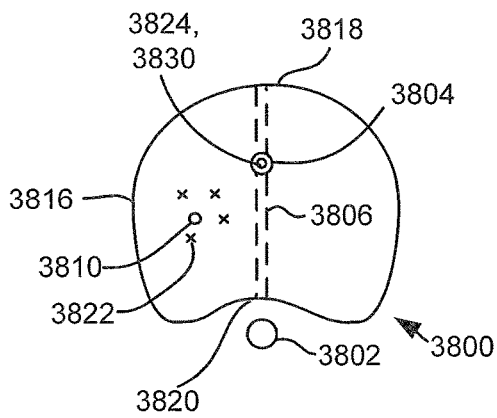


FIG. 38C

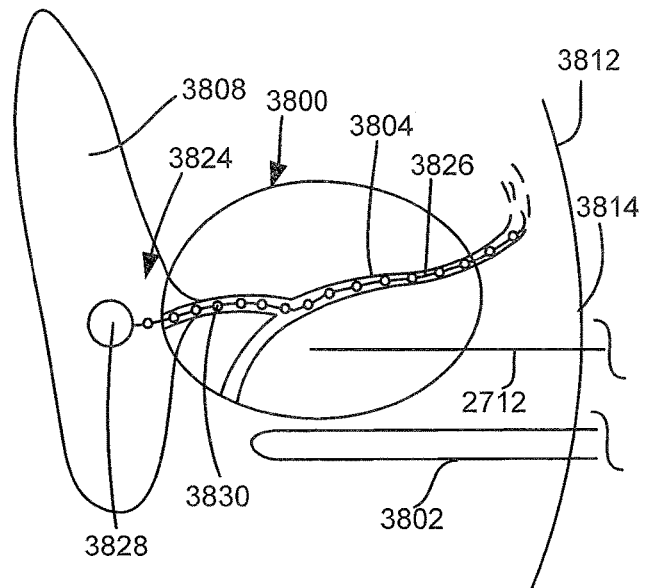


FIG. 38D

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**TRANSPERINEAL PROSTATE BIOPSY
DEVICE, SYSTEMS, AND METHODS OF USE****CROSS-REFERENCE TO RELATED
APPLICATIONS**

The present application is a continuation of U.S. application Ser. No. 17/494,962 filed Oct. 6, 2021, which application is a continuation-in-part of U.S. application Ser. No. 17/314,845 filed May 7, 2021, now U.S. Pat. No. 11,246,677, which application is a continuation of U.S. application Ser. No. 16/115,180 filed Aug. 28, 2018, now U.S. Pat. No. 11,096,762, which application is a continuation of U.S. application Ser. No. 14/677,286 filed Apr. 2, 2015, now U.S. Pat. No. 10,064,681, which claims priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application No. 61/974,826 filed Apr. 3, 2014.

Application Ser. No. 17/494,962 is also a continuation-in-part of U.S. application Ser. No. 16/991,150 filed Aug. 12, 2020, which application is a continuation of U.S. application Ser. No. 14/874,104 filed Oct. 2, 2015, now U.S. Pat. No. 10,743,909, which application is a continuation-in-part of U.S. patent application Ser. No. 14/677,286 filed Apr. 2, 2015, now U.S. Pat. No. 10,064,681, which claims priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application No. 61/974,826 filed Apr. 3, 2014.

All the above-referenced applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

Aspects of the present disclosure relates to biopsy procedures and systems. In particular, the disclosure relates to methods, systems, and apparatus useful for planning and performing guided and free-handed transperineal prostate biopsies.

BACKGROUND

A biopsy is a medical procedure that involves sampling and removing tissues or cells from a living body for further examination and analysis. A prostate biopsy may be performed by a care provider for diagnosis and treatment of a patient's prostate. For example, the vast majority of patients with an abnormal prostate specific antigen (PSA) or suspicious results from a digital rectal examination (DRE) undergo biopsy. Typical biopsy procedures include transrectal ultrasound-guided (TRUS) biopsies and transperineal ultrasound-guided (TPUS) biopsies.

TRUS involves obtaining tissue or cell specimens by passing a biopsy needle or other biopsy instruments through the rectal wall and into the prostate at various locations using a sagittal imaging plane. The biopsy needle or other biopsy instruments may be guided by ultrasound in a sagittal plane. There are disadvantages associated with TRUS. In particular, the patient may be required to take antibiotics prior to the procedure to reduce the risk of infections. Also, TRUS requires the patient to perform bowel preparation, which is a procedure usually undertaken before the biopsy, for cleansing the intestines of fecal matter and secretions. Further, the passage of the biopsy needle through the rectal wall may introduce bacteria from the rectum into the prostate, such as coliform bacteria that may lead to an infection or other complications. Additionally, many clinically significant prostate cancers are found in locations of the prostate that are often too difficult to access when using the transrectal approach.

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TPUS includes obtaining tissue or cells specimens by passing one or more biopsy needles through the perineum and into the prostate. TRUS has been favored over TPUS. Unlike TRUS, TPUS does not require a patient to take antibiotics prior to the procedure or to undergo the bowel preparation for lowering the risk of bacterial issues. Further, TPUS uses a more effective route to access the prostate and is capable of accessing target locations that may be difficult to access utilizing the transrectal approach in comparison with TRUS. In addition, the needle does not pass through the rectal wall which eliminates the risk associated with TRUS of coliform bacteria entering the prostate or the bloodstream.

Systems configured for TPUS include a biopsy grid that may be fixed to, for example, a floor, platform, or table on which the patient receiving the biopsy lies. The biopsy grid may provide multiple apertures through which a biopsy needle or other biopsy instruments may be inserted. An ultrasound probe is fixed directly to the apparatus and is used to axially guide the biopsy needle or other instruments, for example other biopsy instruments. Thus, TPUS systems require imaging in an axial plane of the ultrasound or a transverse transducer for positioning the biopsy needle.

It is with these observations in mind, among others, that various aspects of the present disclosure were conceived and developed.

SUMMARY

Aspects of the present disclosure involve a biopsy guide configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The biopsy guide may include a guide member and a displacement member supported by the guide member. The guide member may be configured to operably couple with the transrectal probe and including a distal end, a proximal end opposite the distal end, and a length extending along a longitudinal axis between the distal and proximal ends. The displacement member may be configured to support the access needle and displace the access needle along at least a portion of the length of the guide member between the distal and proximal ends. The access needle may be configured to extend into the subcutaneous tissue when the access needle is displaced to the distal end.

In certain embodiments, the biopsy guide may further include the access needle.

In certain embodiments, the biopsy guide may further include the transrectal probe.

In certain embodiments, the displacement member may be configured to displace along the at least a portion of the length of the guide member between the distal and proximal ends. In certain embodiments, the guide member may include a guide rail extending at least a portion of the length between the distal and proximal ends, and the displacement member may include a coupling mechanism to releasably couple with the guide member. In certain embodiments, the displacement member may be configured to displace relative to the guide member via interaction of the coupling mechanism and the guide rail.

In certain embodiments, the displacement member may be configured to slidably displace relative to the guide member via interaction of the coupling mechanism and the guide rail.

In certain embodiments, the guide rail may include a first guide rail and a second guide rail opposed to the first guide

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rail, the displacement member releasably coupled between the first and the second guide rails.

In certain embodiments, the coupling mechanism may include: first upper and lower members which may be configured to sandwich the first guide rail; and second upper and lower members which may be configured to sandwich the second guide rail.

In certain embodiments, the coupling mechanism may include upper and lower members which may be configured to sandwich the guide rail.

In certain embodiments, the displacement member may include a plurality of needle receiving ports for positioning the access needle in a plurality of orientations relative to the transrectal probe. In certain embodiments, each of the plurality of needle receiving ports may be configured to align the access needle parallel with a longitudinal axis of the transrectal probe. In certain embodiments, the plurality of needle receiving ports may include five needle receiving ports.

In certain embodiments, the biopsy guide may include a lower mount releasably coupled to the guide member and including a probe coupling mechanism for releasably coupling with the transrectal probe.

In certain embodiments, the probe coupling mechanism extends at least partially around the transrectal probe, wherein the guide rail extends distally beyond the probe coupling mechanism.

In certain embodiments, the probe coupling mechanism extends at least partially around the transrectal probe, wherein the displacement member may be configured to distally displace beyond the probe coupling mechanism.

In certain embodiments, the guide member may include a slot extending a first length between the distal and proximal ends, the displacement member including a rail member may be configured to be received within the slot such that the displacement member is displaceable along the at least a portion of the length of the guide member between the distal and proximal ends. In certain embodiments, a longitudinal axis of the slot is generally parallel with a longitudinal axis of the transrectal probe when the guide member is secured to the transrectal probe. In certain embodiments, interaction between the slot and the rail member constrains lateral movement of the displacement member relative to the guide member. In certain embodiments, interaction between the slot and the rail member constrains the vertical tilting of the displacement member relative to the guide member. In certain embodiments, the displacement member may include a plurality of needle receiving ports oriented vertically or in a single plane relative to each other. In certain embodiments, the guide member may include a pair of guide rails, the displacement member may be configured to displace between the pair of guide rails.

In certain embodiments, the access needle may extend beyond the distal end of the guide member when the access needle is displaced to the distal end. In certain embodiments, the access needle may be configured to be locked into position at the distal end.

Aspects of the present disclosure may also involve a biopsy guide which may be configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The biopsy guide may include a guide member and a displacement member. The guide member may be configured to operably couple with the transrectal probe and may include a distal end, a proximal

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end opposite the distal end, and a length between the distal and proximal ends. The displacement member may be supported by the guide member and may be configured to support and displace the access needle along at least a portion of the length of the guide member between the distal and proximal ends while maintaining a fixed trajectory of the access needle.

In certain embodiments, may include the transrectal probe.

In certain embodiments, may include the access needle.

In certain embodiments, the displacement member may slidably couple with the guide member via a coupling mechanism such that the displacement member is displaceable relative to the guide member. In certain embodiments, the guide member may include a first rail member, and the coupling mechanism may include upper and lower members that sandwich the first rail member. In certain embodiments, the guide member may further include a second rail member opposite the first rail member, the upper and lower members sandwiching the second rail member. In certain embodiments, the fixed trajectory is generally parallel to a longitudinal axis of the transrectal probe. In certain embodiments, the guide member may include a pair of guide rails extending the length, and the displacement member may be positioned between the pair of guide rails and slidably couple with the pair of guide rails via a coupling mechanism. In certain embodiments, the coupling mechanism may include upper and lower members that sandwich each of the pair of guide rails.

In certain embodiments, the guide member may include a sheath in which the probe resides when the guide member is operably coupled with the transrectal probe.

In certain embodiments, the biopsy guide further includes a mechanical arrangement between the guide member and the displacement member that at least facilitates the displacement of the access needle along the at least a portion of the length of the guide member, wherein the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage.

In certain embodiments, the guide member operably couples with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

Aspects of the present disclosure also involve a biopsy guide which may be configured to couple with a transrectal probe and for use in guiding an access needle in a transperineal prostate biopsy procedure. The access needle may be configured to perforate and be positioned within subcutaneous tissue of a perineum at an access site of a target area of a patient. The transrectal probe may include a distal end, a proximal end opposite the distal end, and a longitudinal axis between the distal and proximal ends. The biopsy guide may include a displacement member which may be configured to be operably coupled with the transrectal probe and to support and displace the access needle along at least a portion of the transrectal probe. The displacement of the access needle may be along a trajectory that is parallel to the longitudinal axis of the transrectal probe.

In certain embodiments, the biopsy guide may further include a guide member operably coupled to the displacement member and by which the displacement member is operably coupled with the transrectal probe.

In certain embodiments, at least a portion of the displacement member displaces relative to the guide member when the access needle is displaced along the trajectory that is parallel to the longitudinal axis of the transrectal probe.

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In certain embodiments, the biopsy guide may further include a mechanical arrangement between the guide member and the displacement member that at least facilitates the displacement of the access needle along the trajectory that is parallel to the longitudinal axis of the transrectal probe, wherein the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage.

In certain embodiments, the guide member may operably couple with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

In certain embodiments, the biopsy guide may further include a mechanical interface by which the displacement member is operably coupled with the transrectal probe and by which the displacement member displaces the access needle along the trajectory that is parallel to the longitudinal axis of the transrectal probe. In certain embodiments, the mechanical interface may include at least one of a sliding arrangement directly between the transrectal probe and the displacement member or a rolling arrangement directly between the transrectal probe and the displacement member.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the transrectal probe may include a first portion of the sliding arrangement and the displacement member may include a second portion of the sliding arrangement directly engaged in sliding contact with the first portion. In certain embodiments, at least one of the first portion or second portion comprises a slot, a rail, or a bar.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the sliding arrangement may include at least a portion of the displacement member being in direct sliding contact with an exterior surface of the transrectal probe.

In certain embodiments, the biopsy guide may further include the transrectal probe and wherein the rolling arrangement may include a roller bearing arrangement supported on the displacement member being in direct rolling contact with an exterior surface of the transrectal probe.

Related art systems and prostate biopsy TPUS methods do not allow free-hand movement of the ultrasound probe, and heavily rely on the axial ultrasound plane to confirm positioning of the biopsy needle or other instruments. Moreover, such systems and methods include extracting prostate tissue specimens by delivering separate punctures into the transperineal tissue. Also, a care provider executing TPUS procedure using related art systems may experience substantial difficulty in freely handling and positioning a biopsy needle at a desired target location of the prostate relying on the sagittal plane in using the TRUS methods.

An apparatus in accordance with an embodiment may include an upper mount and a lower mount. The lower mount may be configured to connect with the upper mount to secure a transrectal probe therebetween. The upper mount may be configured to support an access needle, the access needle configured for perforation of subcutaneous tissue of a perineum at an access site of a target area of a patient. The upper mount may be configured to guide the access needle whereby movement of the access needle is fixed relative to movement of the transrectal probe.

A system in accordance with an embodiment may include a biopsy guide and a transrectal transducer fixed to the biopsy guide. The biopsy guide may be configured to guide an access needle to perforate an access site in subcutaneous

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tissue of a perineum, whereby movement of the access needle is fixed relative to a movement of the transrectal transducer.

A method of performing a prostate biopsy in accordance with an embodiment may include imaging a prostate in an axial plane and a sagittal plane with a transducer providing a real-time image, locating a target area of the prostate, and positioning an access needle and an access site in subcutaneous tissue of a perineum wherein the access site is at a midpoint between a lateral edge of the prostate and a urethra along a first axis and a midpoint between an anterior capsule and a posterior capsule along a second axis. The method may include guiding a biopsy instrument along a sagittal plane to the target using the real-time image, and obtaining one or more specimens of the prostate through the access needle with a biopsy instrument.

Accordingly, there is a demand for transperineal biopsy methods, systems, and apparatus that enables a biopsy that is less burdensome for the patient and for the practitioner performing the biopsy, increased guidance of needle or other biopsy instruments, and with a higher rate of efficacy and lower rate of health risk than related art TPUS and TRUS systems and methods. Apparatus, systems, and methods disclosed herein satisfy these demands.

Other implementations are also described and recited herein. Further, while multiple implementations are disclosed, still other implementations of the presently disclosed technology will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative implementations of the presently disclosed technology. As will be realized, the presently disclosed technology is capable of modifications in various aspects, all without departing from the spirit and scope of the presently disclosed technology. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of a guide secured to a probe in accordance with an embodiment;

FIG. 2A shows an internal view of a guide fastener in accordance with an embodiment;

FIG. 2B shows a sheath-based guide fastener in accordance with an embodiment;

FIG. 2C shows a zip-tie-based guide fastener in accordance with an embodiment;

FIG. 3 shows a top view of a guide secured to a probe in accordance with an embodiment;

FIG. 4 shows a cross-sectional view of the back of a guide secured to a probe in accordance with an embodiment.

FIG. 5 shows a magnified view of a guide secured to a probe in accordance with an embodiment;

FIG. 6 is a magnified top view of a guide fastener in accordance with an embodiment;

FIG. 7 is a magnified view of a guide in accordance with an embodiment;

FIG. 8 is a side view of a biopsy instrument that has penetrated the prostate in accordance with an embodiment;

FIG. 9 is a front view of a designated area of the prostate where a biopsy instrument will penetrate in accordance with an embodiment;

FIG. 10 is a side view of a biopsy instrument penetrating the prostate in accordance with an embodiment;

FIG. 11 is a front view of a designated area of the prostate where a biopsy instrument will penetrate with areas in which

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the cell or tissue specimen has already been extracted in accordance with an embodiment;

FIG. 12 is a top view of a biopsy instrument that has penetrated the prostate in accordance with an embodiment;

FIG. 13 is a side view of a prostate and the path of the biopsy instrument;

FIG. 14 is a front view of a guide positioned at a designated area of the prostate in accordance with an embodiment;

FIG. 15 is a side view of a guide positioned at a designated area of the prostate in accordance with an embodiment;

FIG. 16 is a front view of a guide positioned at another designated area of the prostate in accordance with an embodiment;

FIG. 17 is a side view of a guide positioned at another designated area of the prostate;

FIG. 18 is a front view of a guide positioned at a higher designated area of the prostate, according to one embodiment;

FIG. 19 is a right side view of a guide positioned at a higher designated area of the prostate in comparison with that shown in FIGS. 14-17 in accordance with an embodiment;

FIG. 20 is a side view of a guide and a biopsy instrument firmly penetrating a fat plane and perineum skin of a patient in accordance with an embodiment;

FIG. 21 is a view of an access needle positioned at the access site in accordance with an embodiment;

FIG. 22 is a magnified view of the right side of a prostate and a biopsy instrument in accordance with an embodiment;

FIG. 23 is an image of the front side of a prostate and a biopsy instrument being retrieved from the prostate, and other targeted areas in accordance with an embodiment;

FIG. 24 shows a method for performing a prostate biopsy in accordance with an embodiment;

FIG. 25 is an ultrasound image showing a transducer, access needle path extending from an access point at a perineal site to a prostate, and a prostate;

FIGS. 26A-26C show side views of a guide configured with a pivoting mount in accordance with an embodiment;

FIG. 27 is an isometric front view of another embodiment of a biopsy guide;

FIG. 28 is a front view of the biopsy guide of FIG. 27;

FIG. 29 is a side view of the biopsy guide of FIG. 27;

FIG. 30 is an isometric front exploded view of the biopsy guide of FIG. 27;

FIG. 31A is a front isometric view of the upper mount of the biopsy guide;

FIG. 31B is a front view of the upper mount of the biopsy guide;

FIG. 31C is a back view of the upper mount of the biopsy guide;

FIG. 31D is a side view of the upper mount of the biopsy guide;

FIG. 31E is a bottom view of the upper mount of the biopsy guide;

FIG. 31F is a top view of the upper mount of the biopsy guide;

FIG. 32A is a front isometric view of the displacement member of the biopsy guide;

FIG. 32B is a front view of the displacement member;

FIG. 32C is a back view of the displacement member;

FIG. 33A is an isometric front view of the lower mount of the biopsy guide;

FIG. 33B is a front view of the lower mount;

FIG. 34 is front isometric view of an access needle;

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FIG. 35A is a front isometric view of the lower mount;

FIG. 35B is a front isometric view of the lower mount coupled with the upper mount;

FIG. 35C is a front isometric view of the lower mount coupled with the upper mount and the sliding platform engaging with the rails of the upper mount;

FIG. 35D is a front isometric view of the assembly of FIG. 35C with an access needle supported by the sliding platform;

FIG. 36 is a front view of another embodiment of the displacement member;

FIG. 37A is an isometric front view of another embodiment of the biopsy guide;

FIG. 37B is an isometric front exploded view of the upper mount of the biopsy guide of FIG. 37A;

FIG. 37C is an isometric back exploded view of the upper mount of the biopsy guide of FIG. 37A;

FIG. 37D is a front view of the upper mount of the biopsy guide;

FIG. 37E is a front isometric view of the displacement member of the biopsy guide;

FIG. 37F is a front view of the displacement member;

FIG. 37G is a side view of another embodiment of the displacement member with the access needle partially positioned within the top needle receiving port of the vertically extending member;

FIG. 37H is a front isometric view of another embodiment of the a biopsy guide;

FIG. 37I is a side view of the biopsy guide of FIG. 37H showing the platform member in various positions relative to the probe;

FIG. 37J is a front isometric view of another embodiment of an upper mount;

FIG. 37K is a front view of another embodiment of a biopsy guide;

FIG. 37L is a side view of the biopsy guide of FIG. 37K;

FIG. 37M is a front isometric view of another embodiment of a biopsy guide;

FIG. 37N is a front view of the biopsy guide of FIG. 37M;

FIG. 37O is a front isometric view of a cinch strap;

FIG. 37P is a front isometric view of a V-block insert;

FIG. 37Q is a front view of the biopsy guide of FIG. 37M with a V-block insert of FIG. 37P;

FIG. 37R is a front isometric view of another embodiment of a biopsy guide;

FIG. 37S is a front view of the biopsy guide of FIG. 37R;

FIG. 37T is a front isometric view of another embodiment of a biopsy guide;

FIG. 37U is a front view of the biopsy guide of FIG. 37T;

FIG. 37V is a front view of another embodiment of a lower mount;

FIG. 37W is an isometric front view of another embodiment of a lower mount;

FIG. 37X is a front view of another embodiment of a lower mount;

FIG. 38A is a transverse plane or slice view of a prostate depicting the urethra and an access site for penetration of the access needle;

FIG. 38B is a sagittal plane or slice view of the prostate depicting the urethra and an access site for penetration of the access needle;

FIG. 38C is the same transverse plane or slice view as FIG. 38A, but including a marking device positioned within the urethra for biopsy navigation; and

FIG. 38D is the same sagittal plane or slice view as FIG. 38B, but including a marking device positioned within the urethra for biopsy navigation.

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DETAILED DESCRIPTION

The apparatus, systems, and methods provided herein enable real-time visualization, free-handed, guided, and multi-sample transperineal methods for performing a biopsy. The methods, systems, and apparatus provided herein also enable a complete biopsy of the prostate with only one perforation, or with minimal perforations of a patient's skin by way of an initial access site, such that the access needle is freely moveable. The biopsy guide may be placed on or fitted to an assortment of ultrasound probes of different sizes and shapes due to an adjustable mounting system. The guide may be configured to fit to the probe using any suitably configured fastening system. For example, the guide may be configured as a sleeve that is formed to slide over an end of a probe and into an operable position. Alternatively, the guide may be configured to fit to a probe using screws, flanges, zip ties, or other temporary, permanent, or semi-permanent fastening systems.

In one embodiment, the guide allows biopsies of one or more tissue or cell samples to be obtained through an initial access needle, while providing direct, real-time ultrasound visualization by, for instance, fixing a position of the access needle relative to an ultrasound probe to provide. For example, the guide is fixed to an ultrasound probe that is not fixed and may be freely moveable in operation. Stabilization bars that are built into the guide facilitate the positioning and holding of the perineal skin and subcutaneous tissue to allow positioning of the access needle. The position of the access needle is facilitated by locking the access needle into the subcutaneous tissue of the perineum using a sliding platform that allows a user, such as a medical practitioner or patient caregiver, to place the access needle along a sagittal transducer plane at optimal positions for obtaining prostate biopsies. In some embodiments, upon placement of the access needle into a locked position, for example, in the pelvic floor, a user may then pass a biopsy needle through the access needle to a desired location of the prostate. In yet further embodiments, the passing of the biopsy needle through the access needle and to the prostate may be facilitated by direct sagittal plane visualization based on the alignment of the access needle.

Methods and systems provided herein do not require a patient to take antibiotics at any point prior to the biopsy procedure, nor do they require a patient to undergo bowel preparation in advance of the procedure. Methods, systems, and apparatus can reduce or eliminate multiple skin perforations by using a single access location or access site, while allowing multiple extractions of tissue or cell specimens from the prostate. Methods, systems, and apparatus in accordance with embodiments allow for real-time visualization during a free-handed, guided, transperineal approach, while also facilitating a complete assessment of the prostate with, for example, only one perforation of the patient's skin wherein the access needle is freely moveable in each plane.

Methods, systems, and apparatus of embodiments may include and facilitate treatment that uses a cryoablation probe for focal therapy of prostate cancer, a radiofrequency instrument, a thermotherapy instrument, any instrument for treatment of the cancerous area, or a combination of any of these instruments.

Methods, systems, and apparatus of embodiments enable planning and performing the free-hand transperineal prostate biopsies under the guidance of a device and of a real-time transducer in the sagittal imaging plane.

The biopsy is performed using a system that includes a biopsy guide, a transducer, an access needle, and a biopsy

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instrument. The access needle may allow the anesthesia to be injected into the patient, and the tissue or cell specimens of the prostate to be extracted. If anesthesia is used, a syringe may be included in the system. The transducer may be an ultrasound probe or any other type of device that is capable of causing a visualization of the prostate in a display device. In embodiments, the biopsy guide may be disposable. In embodiments, the biopsy guide may be formed of materials intended for a single use. In other embodiments, the biopsy guide is reusable. In some embodiments, the biopsy guide may be formed of materials intended for multiple uses.

The guide may include a sliding platform, stabilization bars, one or more upper and lower mounts, and a fastener. The upper and lower mounts may be curvilinear in shape. The upper and lower mounts may be positioned proximally or distally along an ultrasound probe, such as a transrectal ultrasound probe. The configuration and positioning of the upper and lower mounts are adjustable based on the shape of the ultrasound probe and the patient's body habitus.

The guide may be made of any material such as a plastic or metallic material. The guide may be disposable and made of a biodegradable plastic material. In other embodiments, the guide may be reusable and made of stainless steel. The dimensions, for example, the length, width, height, depth, and breadth of the sliding platform, stabilization bars, upper and lower mounts, and the fastener may vary and may be adjustable. The variable and adjustable dimensions, for example, of the stabilization bars, provide a user with flexibility in achieving and maintaining the guide in an appropriate ultrasound plane while performing biopsy procedures, while the user's patients may vary in size and levels of perineal subcutaneous tissue and fat. In a patient with an excessive amount of perineal subcutaneous tissue and fat, a larger stabilization bar will assist in locking the guide in the proper ultrasound plane.

The adjustable stabilization bars and mounts may be curvilinear in shape, allowing the guide to be placed proximally or distally along any cylindrical instrument, such as the transrectal ultrasound probe, which is determined by the surgeon based on the shape of the probe and the patient's body habitus. This allows the guide to be mounted to any assortment of ultrasound probes. Similarly, the platform may, for example, have various thicknesses.

The stabilization bars may be fixed to a top portion of the upper curvilinear mounts of the guide, and may extend beyond the front edge of the upper mounts. The stabilization bars may extend beyond the front edge of the upper curvilinear mount by approximately 8 mm. The guide may be approximately 60 mm wide, or the guide may be approximately 50 mm long, for example. The stabilization bars may have grooves for accommodating a sliding platform that is shorter in length than the stabilization bars. The grooves being configured to allow the platform to slide forward and backward along the stabilization bars.

An inner portion of the stabilization bars may have built-in grooves. The grooves accommodate a sliding platform which is shorter in length than the stabilization bars. This allows the sliding platform to slide from the back to the front of the stabilization bars. The stabilization bars may include a resistance as to prevent the sliding bar to freely move back and forth on the stabilization bar. This resistance may be introduced by the sliding platform or both the stabilization bar and the sliding platform. The resistance may be provided by a strip of rubber or any other material capable of providing friction or other. The strip may be curvilinear. The resistance may be generated by a mechanical system, such as a spring mechanism.

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The sliding platform may have a hole through the platform. In some embodiments, the hole is drilled in the center of the platform. The hole can accommodate various types of needles, including access needles having various diameters, for example, spinal needles having a gauge in the range of 14-18. The hole can also accommodate needles having various lengths. The lengths of the needle may depend, in part, on the body habitus. The needle may be a reusable needle, such as a reusable spinal needle. The needle may be a disposable needle, such as a disposable spinal needle.

A flange of the guide secures the placement of the access needle to the guide. The flange may be configured to snap into the guide to secure the needle. The flange may be secured to the guide by other securing mechanisms. The flange can be of various shapes and configurations. For example, the flange may be u-shaped. As another example, the flange may have a thin or slim configuration. The guide assists in providing the appropriate angle of penetration and direction of the access needle, or other instruments that may be used in combination with the guide.

The hole in the guide is placed so that once the guide is mounted to the ultrasound probe, the drilled hole will be parallel to the sagittal transducer. The drilled hole may also accommodate the tip of a biopsy gun, or any other biopsy instrument. The sliding platform may be interchangeable and may be removed to allow placement of another sliding platform with a different sized to permit different sizes of needles and other instruments. The hole may be configured to accommodate a cryoablation instrument, a radiofrequency instrument, thermotherapy instrument, or any other instrument for diagnosis and treatment of a bodily tissue, including a cancerous area of a prostate.

The platform may have or define a predrilled hole in the center of the platform that can accommodate various sizes of needles and instruments. For example, the hole may be configured to accommodate a needle having a range of 14-18 gauges, such as a reusable 14 gauge spinal needle. Central hole placement on the platform enables alignment of the hole with a sagittal transducer when the guide is mounted to an ultrasound probe. The platform may have multiple holes to accommodate various applications and body habitus. Further, the platform may be of various thicknesses.

Once the one or more upper curvilinear mounts are placed at the desired location on the transrectal ultrasound probe, the access hole for a needle, such as a 14 gauge reusable spinal needle, will remain a fixed distance from the ultrasound probe. In embodiments, having one or more lower curvilinear mounts, the mounts may be positioned to cradle an upper aspect of the ultrasound probe.

At least two lower mounts are provided and may be individually positioned to accommodate various types of probes, which may have variable diameters along their shafts. In embodiments, a probe, such as a transrectal ultrasound probe, may have one or more diameters along the probe's shaft. In yet further embodiments, one end of the guide may be fixed at a location of the probe having a different diameter than the location where the other end of the guide is fixed. The separate lower mounts allow for the fixation of the guide, even with varying probe diameters.

The lower mount of the guide may include a lower right mount and a lower left mount connected by an adjustable mid-joint or fastener. The adjustable mid-joint or fastener allows the guide to be secured to the probe even if the diameter of the shaft of the probe is longer than the width of the lower mount. The mid-joint or fastener may be flexible to allow the right lower mount to form an acute angle with

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the left lower mount. This also allows for fixation of the guide to a probe shaft that is not circular in shape.

The lateral edges on both ends of the lower mounts may contain a notched post. Corresponding locations of the upper mounts contain holes, such as square shaped holes, to accommodate the notched post of a corresponding lower mount. An upper aspect of each hole includes a flange for locking the notched post in a fixed position. This configuration allows the lower mounts and the upper mounts to be secured to each other and to the probe.

Methods may include locating a suspicious area, positioning an access needle, and obtaining one or more tissue or cell specimens from an accurate point in the prostate. The method allows for multiple tissue or cell specimens to be obtained from a bodily organ, such as the prostate, and permits access to the prostate from different angles through a single initial access needle. The method may include calculating the volume of the prostate by positioning the access needle at a mid-point in the x axis from the lateral edge of the prostate to the urethra.

Methods may be performed using no anesthesia. Alternatively, an anesthetic may be used. For example, the anesthetic may be lidocaine, or any type of local anesthetic. The lidocaine may include 1 or 2% of a lidocaine solution.

The suspicious area or bodily organ may be located by using a transducer. The transducer may be any type of probe for accessing and viewing a targeted site or object, such as an ultrasound probe, or any type of transducer capable of providing visualization of the prostate and/or instruments and devices for diagnosis and treatment of the tissue. The biopsy may be performed using a biopsy gun, a suction device, or any type of instrument that is small enough to be introduced through the access needle and capable of extracting the tissue or cell specimen. The biopsy may be performed while the patient is in a dorsal lithotomy position, prone position, or any position that allows for access to the perineal area.

Methods may include applying an antiseptic solution to the perineal area. The antiseptic solution may include betadine, or any other substance that reduces the possibility of infection, sepsis, or putrefaction. Methods may include applying bacitracin to the skin at the puncture site or any other type of topical preparation for preventing the possibility of infection.

Methods may include attaching a needle to a luer lock syringe, which may contain an anesthetic, or any other type of device capable of retaining its contents and dispensing its contents through the needle. A biopsy gun or any other instrument that may be attached to the needle and used for inserting or extracting any substance thru the lumen of the access needle.

Methods may include releasing the syringe from the needle after the anesthetic is injected. Methods may include dividing the prostate in three different regions and designating lateral, mid, apical prostate, and may include labeling the tissue or cell specimen containers, which will identify the tissue or cell specimens.

Methods may include securing the guide to the probe. This will permit the practitioner to take the biopsy gun as many times as necessary using his/her other hand, and, consequently, extract multiple tissue or cell specimens. It is contemplated that this can be done without assistance of any other person, and that the biopsy gun may also be attached to the guide in order to permit the surgeon to, for example, label the container with the tissue or cell specimen while performing the biopsy. Methods may also include monitor-

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ing all the actions in the prostate by way of a display device that provides images captured by the probe.

Methods may include moving the needle in x, y, and z planes. By being able to move the needle in x, y, and z planes, the surgeon is capable of extracting tissue or cell specimens from several different areas of the prostate without having to retrieve the needle and preventing other perforation of the patient's skin. In embodiments, movement of the needle within the patient's body is facilitated by using a display device.

Methods may include removing the access needle from the perineal area. This may be done while the biopsy gun is secured to the access needle or after the biopsy gun has been detached from the access needle.

Methods may include realigning the needle in the desired prostate region. If the surgeon wishes to start at the right lateral prostate region and notices that the needle tip is not directed at the lateral region, the surgeon rolls the ultrasound probe slightly and to note that the needle tip is directed to the desired region, then the surgeon may realign the needle to obtain tissue or cell specimen. The surgeon may realign the needle using one hand while having the needle attached to the biopsy gun, which may be attached to the probe through the guide.

Methods may include identifying the areas in which biopsy have already been performed. After each extraction of tissue or cell specimen during the biopsy, a hyperechoic streak remains visible on ultrasound display. This allows the surgeon to identify the area of the prostate and that an extraction has been made, as to allow the surgeon to prevent overlap of extractions.

In another embodiment, the method includes identifying the path of the urethra. This allows the surgeon from preventing passing the biopsy needle thru or into this path.

FIG. 1 is a side view of a guide 100 secured to a probe including a stabilization bar 101, fasteners 102, probe 103, lower mounts 104, and an upper mount 105. The stabilization bar 101 is an extension of the upper mount 105, as further discussed in FIG. 4. In embodiments, the distance between the fasteners 102 and the upper mount 105 may be adjustable to accommodate various applications and body habitus.

FIG. 2A is an internal view of a guide's fastener, including an aperture 201, teeth 202, and a flange 203. The flange 203 may be an extension of the aperture 201, which is part of the upper mount 105. Aperture 201 will allow the teeth 202 to be inserted into the upper mount 105, and the flange 203 will lock the teeth 202, which is connected to lower mount 104, to the upper mount 105. The aperture 201 with flange 203 and teeth 202 allows for adjusting the height of the guide 100.

In one embodiment, the fastener (e.g., via the aperture 201, flange 203, and/or the teeth 202) can be configured to fasten the guide 100 to the probe 103 with, e.g., varying levels of tension to provide for adjustments of the relative positions of the guide 100 and the probe 103 even after the guide 100 has been mounted to the probe 103. For example, the fastener 102 can provide a first level of tension sufficient to hold the position of an access needle (e.g., introduced through a hole or other needle mount of the guide 100) rotationally fixed to the probe 103 while still allowing for a forward or reverse sliding of the probe 103 with respect to the guide 100. By way of example, the forward or reverse sliding adjustment can be performed to adjust the penetration depth of the probe 103 with respect to the patient depending on a size of the patient. Once the final adjustment is made, the fastener can be actuated to final position or

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tension that will then lock further adjustments of the positioning of the guide 101 relative to the probe 103.

It is noted that the guide's fastener as described above is one example embodiment among other possible example fasteners that are applicable to various embodiments of the guide 100. Accordingly, it is contemplated that various embodiments of the guide 100 may use any now known or later developed fastening system that can secure the guide 100 to the probe 103.

By way illustration and not limitation, examples of two fasteners are discussed with respect to FIGS. 2B and 2C. FIG. 2B shows a sheath-based fastener whereby the fasteners 102 are attached to a sheath 211 that is configured to slide over an end of a probe 103 and into an operable position. Although the sheath 211 is shown as a closed sheath, in another embodiment, the sheath 211 can be configured as a sleeve that is open-ended to slide over the probe 103. By way of example, the sheath 211 can be made of a flexible material (e.g., rubber) to provide for stretching and tension on probe 103.

In another embodiment, as shown in FIG. 2C, the guide 100 can be configured with a zip-tie style fastener in place of a lower mount mechanism to secure the guide 100 to the probe 100. In other embodiments (now shown), the guide 100 may be configured to fit to the probe 100 using screws, flanges, or other temporary, permanent, or semi-permanent fastening systems. In addition, although the fasteners 102 of the guide 100 may be configured as generic and adjustable fasteners that can support probes of a variety sizes and shapes, it is also contemplated that the fasteners can be fit to specific models of probes for customized applications.

FIG. 3 is a top view of a guide secured to a probe. This figure includes a sliding platform 301, a drilled hole 302, stabilization bars 101, fasteners 102, an upper mount 105, and a probe 103. As previously described, in one embodiment, the drilled hole 102 can accommodate or support various sizes and/or configurations of needles (e.g., straight needles, curved needles, etc.) and instruments for performing a biopsy so that the needle can be aligned relative to the probe 103, thereby, also providing an alignment between the needle and an image produced by the ultrasound probe 103. In one embodiment, the drilled hole 102 can support an access needle through which a biopsy needle or other instrument can be introduced at a known alignment with respect to the probe 103. In addition, although the hole 102 to support, e.g., an access needle or other instrument is shown in a central midline position, the location of the hole can be configured at any position of the guide 100.

FIG. 4 is a cross-section view of the back of a guide secured to a probe including a sliding platform 301, drilled hole 302, stabilization bars 101, lower mount 104, upper mount 105, fasteners 102, and probe 103.

FIG. 5 is a magnified view of FIG. 1. FIG. 5 demonstrates minimum dimensions of preferred embodiments, which includes stabilization bars 101 and upper mount 105 from 30 mm to 50 mm long; the upper mount 105 with a height ranging from 10 mm to 15 mm; the stabilization bars 101 with a height that is about 1/3 of the height of the upper mount 105; fasteners 102 with a height of about 25 mm and 10 mm wide; a lower mount 104 10 mm wide. Additionally, the offset 501 from the distal point of the stabilization bar 105 to the fasteners 102 may be 5 mm. It is contemplated that any of these dimensions may vary, including the stabilization bar 101, which may be longer than the upper mount 105.

FIG. 6 is a magnified internal view of the guide fastener shown in FIG. 2. FIG. 6 demonstrates minimum dimensions

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of preferred embodiments. The fasteners **102** may have an aperture **201** to accommodate teeth **202**, wherein the fastener **102** is 5 mm to 10 mm wide. Additionally, the sliding platform **301**, which may be from 12 mm to 25 mm wide, is slightly shorter than the distance between the two stabilization bars **101** as to accommodate the sliding platform while also securing it to the guide **100**.

FIG. **7** is a magnified view of the guide depicted FIG. **3**, without the probe **103**. FIG. **7** also demonstrates minimum dimensions of preferred embodiments, wherein the height of the upper mount **105** ranges from 5 mm to 10 mm; and the teeth **202** is from 5 mm to 8 mm wide.

FIG. **8** is a side view of a biopsy instrument that is about to penetrate the prostate, including a prostate **801**, a probe **103**, a biopsy instrument **802**, a perineum skin **803**, an anus **804**, and a perforation point **805**. The probe **103** is inserted into the anus **804** to provide real-time images of the biopsy, including images of the biopsy instrument **802** and the prostate **801**. It is contemplated that the biopsy instrument **802** includes a needle and any other instrument capable of performing a biopsy.

FIG. **9** is a front view of a targeted area **902** of the prostate **801**. FIG. **10** is a side view of a biopsy instrument penetrating the prostate **801**, including a targeted area **902** of the prostate **801**. The targeted area **902** is reached by biopsy instrument **802** after perforating perineum skin **803**.

FIG. **11** is a front view of a targeted area of the prostate where a biopsy instrument will penetrate with areas in which the cell or tissue specimen has already been extracted. FIG. **11** depicts both an extracted area **1101** and a targeted area **902**. The possibility of viewing the area in which the cell or tissue specimen has already been extracted permits the practitioner to avoid placing the access needle in an area that cell or tissue specimen has already been extracted. This allows the biopsy to be more efficient and more accurate.

FIG. **12** is a top view of FIG. **8**, depicting a prostate **801**, perineum skin **803**, a probe **103**, and a biopsy instrument **802**. FIG. **13** is a right side view of a prostate and the path of the biopsy instrument including the path of the biopsy instrument **1301** and the perforation point **805**. FIG. **13** illustrates that only one initial perforation to the skin of the patient is necessary in order to extract one or more cell or tissue specimens.

FIG. **14** is a front view of a guide determining a lower targeted or suspicious area **1401** of the prostate in which to penetrate the biopsy instrument, a prostate, and a probe. FIG. **16** is a front view of a guide determining a mid-targeted or suspicious area **1601** of the prostate in which to penetrate the biopsy instrument, a prostate, and a probe. FIG. **18** is a front view of a guide determining a higher targeted or suspicious area **1801** of the prostate in which to penetrate the biopsy instrument, a prostate, a probe. FIGS. **14**, **16**, and **18** demonstrates the variety of angles and positions in which a guide may be positioned in order to reach several regions of the prostate, such as the lateral region, mid region, and apical region. In order to be able to reach these areas, FIGS. **14**, **16**, and **18** demonstrate how the upper mount **105**, the stabilization bars **101**, or a combination of thereof can adjust in order to reach a lower targeted or suspicious area **1401**, a mid-targeted or suspicious area **1601**, or a higher targeted or suspicious area **1801** of the prostate.

FIGS. **15**, **17**, and **19** demonstrate a side view of FIGS. **14**, **16**, and **18** and the paths of the biopsy instrument **1301** taken by a biopsy instrument to reach lower targeted or suspicious area **1401**, a mid-targeted or suspicious area **1601**, or a higher targeted or suspicious area **1801** of the prostate.

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FIG. **20** is a right side view of a guide, and a biopsy instrument firmly penetrating a fat plane of perineum skin, including offset **501** of a stabilization bar **101**. This allows for stabilization in a patient with an excessive amount of perineal subcutaneous tissue, fat, or a combination thereof. A larger stabilization bar **101** will assist in locking the guide in the proper ultrasound plane. Accordingly, the offset **501** may longer than 5 mm for these purposes.

FIG. **21** is a front view of a prostate, a probe, a targeted or suspicious area, wherein the biopsy instrument may reach any area of the prostate. FIG. **21** demonstrates that the biopsy instrument can reach the entire prostate while using only one perforation point **805**. After obtaining one cell or tissue specimen, the biopsy instrument **802** may be partially retrieved from the perineum area at a point in which the distal point of the biopsy instrument **802** is redirected to another targeted or suspicious area. Then, the biopsy instrument (usually the needle of the biopsy instrument) is inserted to the second targeted or suspicious area for obtaining a cell or tissue specimen of another area of the prostate.

FIG. **22** is a magnified view of the right side of a prostate and a biopsy instrument. FIG. **22** depicts the location of the biopsy instrument inside the prostate and the other paths in which the biopsy instrument may take utilize for additional samples or retrieval. In embodiments, the biopsy needle or other instruments do not reach the initial part of the penis, which is in a different plane from the prostate.

FIG. **23** is an image of the front side of a prostate and a biopsy instrument being retrieved from the prostate, and other targeted areas. FIG. **23** shows a procedure being applied to the apical region of the prostate.

The urethra should be avoided in any part of the procedure, but it is mostly important when extracting cell or tissue specimens from the apical region of the prostate, when the chances of perforation is greater. After several extractions, the practitioner is able to see the blood streak from where the cell or tissue specimen was taken so as to avoid overlapping.

After this procedure, the patient may be put with restriction for no more than 1 day. If the patient is put on restriction for 1 day, after the one-day-restriction, no restriction is made.

In an embodiment, the biopsy system performs the processes **2400** of FIG. **24**. At **2401**, a patient is prepared for the biopsy procedure by having the patient get into a lithotomic position, prone position, or any position that allows for access to the perineal area. The biopsy procedure may be a prostate biopsy. In some embodiments, the patient's scrotum is elevated using, for example, two strips of plastic tape. The perineum is prepared with an antiseptic solution to the perineal area, for example, the antiseptic solution may include betadine.

At **2402**, a target area or object, such as the prostate, is imaged. Imaging may be performed with a transducer, such as an ultrasound probe. Imaging of a target area may be in a sagittal and/or axial plane and may be performed in real-time with direct visualization. Utilizing the real-time image, a user can identify areas of interest, e.g. suspicious areas or the target area or object at **2403**.

The user may determine an access site for positioning an access needle. At **2404**, an access needle is positioned at an access site in subcutaneous tissue of the perineum. The access site may be at a midpoint between a lateral edge of the prostate and the urethra along an x axis, and a midpoint between an anterior capsule and a posterior capsule along a y axis. The access needle is guided and positioned at the access site by using the guide.

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At **2405**, a biopsy instrument is guided to the target or suspicious areas or object. The biopsy instrument may include a biopsy needle. The guiding of the biopsy instrument can be facilitated by using the real-time visualization provided by the transducer. Real-time visualization also facilitates obtaining tissue or cell specimens from an accurate point in the prostate, for example. The method allows for one or more tissue or cell specimens to be obtained from a bodily organ, such as the prostate at **2406**, and permits access to the prostate from different angles through a single initial access needle.

At **2407**, the biopsy instrument may be retrieved and removed from the patient. The method may include calculating the volume of the prostate by positioning the access needle at a mid-point in x axis from the lateral edge of the prostate to the urethra.

FIG. **25** shows an ultrasound **2501** showing a transrectal probe **2503** and an access needle guide line **2505**. The needle guide line enables the practitioner to observe a needle path whereby the access needle has contacted the prostate **2507**, thereby enabling the practitioner to avoid overlapping sampling, and to avoid perforating the prostate.

FIGS. **26A-26C** show side views of an alternative embodiment of a guide **2600** secured to a probe including a stabilization bar **101**, fasteners **102**, probe **103**, lower mount **104**, and an upper mount **105**. The stabilization bar **101** is an extension of the upper mount **105**, as further discussed in FIG. **4**. In embodiments, the distance between the fasteners **102** and the upper mount **105** may be adjustable to accommodate various applications and body habitus.

The guide **2600** includes a sliding platform **301**. The guide is fitted to the probe **103** by a sleeve **2607**. The sleeve **2607** is formed by the lower mount **104** and the upper mount **105**. The sleeve **2607** may be configured to slide over an end of the probe **103** into an operable position as shown in FIGS. **26A-26C**. The sleeve **2607** is a partial sleeve that has an opening at both ends of the sleeve **2607** to enable slidable mounting to and removal from the probe **103**.

The sliding platform **301** of the guide **2600** may be pivotably mounted to enable movement in a direction perpendicular to a longitudinal axis of the probe **103**, as shown in FIGS. **26A-26C**. In particular FIGS. **26A-26C** show that the sliding platform **103** is fixed to the guide at a pivot point **2608**. The sliding platform **103** is configured to pivot at pivot point **2608** to enable, for example, normal or vertical adjustment of an access needle (not shown) in directions perpendicular to a longitudinal axis of the probe **103** while ensuring that a longitudinal axis of the access needle (not shown) remains parallel to the longitudinal axis of the probe **103**.

For example, FIG. **26A** shows a sliding platform **301** in a first position at which a lateral planar surface of the platform **301** extends in a direction parallel to the longitudinal axis of the probe **103**. FIG. **26B** shows the sliding platform **301** pivoted to a second position wherein a front end the platform **301** is disposed a distance from the probe **103** that is greater than a distance between an opposite rear portion of the platform **301** and the probe **103**. FIG. **26C** shows the sliding platform **301** pivoted to a third position wherein the rear end of the platform **301** is disposed a distance from the probe **103** that is greater than a distance between the opposite front end of the platform **301** and the probe **103**.

In another embodiment, the method may be performed without the patient taking antibiotics or undergoing bowel preparation before having the procedure. During the procedure, the practitioner may administer an anesthetic to the

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patient, for example, lidocaine, or any type of local, anesthetic. The lidocaine may be included in a solution having 1% of lidocaine.

In an embodiment, the suspicious area is located by using a transducer. The transducer may be any type of transrectal robe for prostate cancer, such as an ultrasound probe, or any type of transducer capable of imaging the prostate and the extraction device. The biopsy may be performed using a biopsy gun, a suction-mechanism, or any type of instrument that is small enough to be introduced through the access needle and capable of extracting the tissue or cell specimen. The biopsy may be performed while the patient is in a lithotomy position, prone position, or any position that allows for access to the perineal area.

In another embodiment, methods may include applying an antiseptic solution to the perineal area such as betadine, or any other substance that reduces the possibility of infection, sepsis, or putrefaction.

In another embodiment, the ultrasound probe may be a B&K 8848 transrectal ultrasound probe, or any other ultrasound capable of causing visualization of the prostate and the extraction device. The frequency range may be 5-12 MHZ, and the focal range may be 3-60 mm. The ultrasound probe may be able to cause the visualization of the prostate and extraction devices at least in the axial plane, sagittal plane, or a combination thereof.

In another embodiment, methods may include attaching a needle to a luer lock syringe, which may contain an anesthetic, or any other type of device capable of retaining its contents and to dispense its contents through the needle. A biopsy gun or any other instrument may be attached to the needle for inserting or extracting any substance through the lumen of the access needle.

In another embodiment, the method includes releasing the syringe from the needle after the anesthetic is injected. The method may include dividing the prostate in three different regions and designating lateral, mid, apical prostate, and may include labeling the tissue or cell specimen containers, which will identify the tissue or cell specimens.

In another embodiment, a biopsy gun may be an 18 gauge biopsy gun, or any other size that is capable of being coaxially inserted thru the lumen of the access needle.

In another embodiment, methods may include securing the guide to the probe. This will permit the practitioner to take the biopsy gun as many times as necessary using his or her other hand, and, consequently, extract multiple tissue or cell specimens. It is contemplated that this can be done without assistance of any other person, and that the biopsy gun may also be attached to the guide in order to permit the surgeon to e.g. label the container with the tissue or cell specimen while performing the biopsy. The method may also include monitoring all the actions in the prostate thru a display device, which will transmit images captured by the probe.

In another embodiment, methods may include moving the needle in x, y, and z planes. By being able to move the need in x, y, and z planes, the surgeon is capable of extracting tissue or cell specimens from several different areas of the prostate without having to retrieve the needle and preventing other perforation of the patient's skin.

Methods may further include removing the access needle from the perineal area. Removal of the access needle may be performed while the biopsy gun is secured to the access needle or after the biopsy gun has been detached from the access needle.

Methods may include realigning the needle in the desired prostate region. If the surgeon wishes to start at the right

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lateral prostate region and notices that the needle tip is not directed at the lateral region, the surgeon rolls the ultrasound probe slightly and to note that the needle tip is directed to the desired region, then the surgeon may realign the needle to obtain tissue or cell specimen. The surgeon may realign the needle using one hand while having the needle attached to the biopsy gun, which may be attached to the probe through the guide.

Methods may include identifying the area in which a biopsy has already been performed. After each extraction of tissue or cell specimen during the biopsy, a hyperechoic streak remains visible on ultrasound display. This allows the surgeon to identify the area of the prostate and that an extraction has been made, as to allow the surgeon to prevent overlap of extractions.

In another embodiment, methods may include identifying the path of the urethra. This allows the surgeon from preventing passing the biopsy needle thru or into this path. In another embodiment, the method includes pressuring the perineum. In yet another embodiment, the method includes applying bacitracin to the skin at the puncture site or any other type of topical preparation for preventing the possibility of infection. In another embodiment, positioning the access needle is performed without the need of a biopsy grip, wherein the guide provides the precise point for the biopsy.

An apparatus and system in accordance with embodiments discussed above is used to carry out these methods. In an alternative embodiment of apparatus and systems, a guide may not include a lower mount, and may include an access needle. The guide includes a stabilization bar, sliding platform, a hole located in approximately the center of the platform, an upper mount, teeth, aperture, arms, and a connector. The access needle includes a hub and is secured to the guide. The teeth may be part of, or may be attached to, a lower mount. The teeth may be inserted into the aperture in order to secure the guide to a probe, for example. It is contemplated that the combination of the aperture and the teeth may form a fastener mechanism. In embodiments, connector is part of, or may be attached to, an access needle, and may be secured to the upper mount in order to provide stabilization of the access needle and to allow the practitioner to move the access needle by merely moving, for example, a probe that may be secured to the guide.

A connector and a hub permit the use of various other instruments such as, for example, a non-biopsy instrument, to be secured. A biopsy instrument may be inserted into the access needle in order to reach a targeted area. The upper mount may include arms. In embodiments, the arms may be shorter, longer, or may not exist, in which case the aperture is disposed directly in the upper mount. When the aperture is directly in the upper mount, upper mount may be longer, thicker, or a combination thereof.

In some embodiments, the guide may include lower mounts that have teeth. Arms may extend from the upper mount to allow the height of the guide to be adjusted and to be placed farther from or closer to the probe. The arms permit the access needle to be maintained at a certain distance from a probe. In embodiments, the material of the guide may be a plastic or any other material, including other plastic materials, or any other material that is cost effective. In embodiments, the guide may be reusable and may be formed with a stainless steel. The lower mount may be curvilinear and flexible to allow the lower mount to bend if necessary to secure the guide to the probe.

Reference is made to FIGS. 27-35D, which depict various views of another embodiment of a transperineal biopsy guide 2700. As with the previously described embodiments,

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the biopsy guide 2700 may couple with a transrectal probe and may be used in guiding an access needle in a transperineal prostate biopsy procedure. While reference will be made to the embodiment in FIGS. 27-35D, aspects of the previously described embodiments may be incorporated into the present embodiment without limitation. And, aspects of the present embodiment may be similarly incorporated into the previously described embodiments without limitation.

To begin, reference is made to FIGS. 27-30, which depict, respectively, a front isometric view, a front view, a side view, and a front isometric exploded view of the transperineal biopsy guide 2700. As seen in the figures, the biopsy guide 2700 includes an upper mount 2702 and a lower mount 2704. The lower mount 2704 includes a probe coupling or fastening mechanism 2706 to couple the lower mount 2704 with a transrectal probe (not shown in FIGS. 27-28, but shown in FIGS. 1, 2B, and 3-6, for example). The lower mount 2704 additionally includes an upper mount coupling mechanism 2714 to couple the lower mount 2704 with the upper mount 2702. While FIGS. 27-30 depict a single coupling mechanism 2706, it is foreseen that the biopsy guide 2700 may include more than one coupling mechanism 2706, as shown and described in previous embodiments.

The upper mount 2702 may couple with the lower mount 2704 and may include a guide member 2708 and a displacement member, translating member, or sliding platform 2710. The displacement member 2710 may couple with an access needle 2712 and be supported by the guide member 2708. More particularly, the displacement member 2710 may slidably couple with the guide member 2708 such that the displacement member 2710 and the access needle 2712 are guided along a trajectory that is fixed relative to the guide member 2708 and the transrectal probe. The trajectory of the access needle 2712 may be generally parallel with a longitudinal axis of the transrectal probe when the biopsy guide 2700 is coupled with the probe.

Reference is made to FIGS. 31A-31F, which depict various views of the guide member 2708 of the upper mount 2702 of the biopsy guide 2700. FIG. 31A is a front isometric view of the guide member 2708; FIG. 31B is a front view of the guide member 2708; FIG. 31C is a back view of the guide member 2708; FIG. 31D is a side view of the guide member 2708; FIG. 31E is a bottom view of the guide member 2708; and, FIG. 31F is a top view of the guide member 2708.

As seen in the figures, the guide member 2708 includes a distal end 2716, a proximal end 2718 opposite the distal end 2716, and a longitudinal axis 2720 extending through the distal and proximal ends 2716, 2718. As described herein locational orientations of distal and proximal are relative to the patient or, more particularly, the perineum of the patient. As such, distal generally refers to towards the patient and proximal refers to away from the patient.

Referring back to the figures, the guide member 2708 further includes a base platform 2722 extending substantially perpendicularly between a pair of vertical extension members 2724. Atop each of the vertical extension members 2724 is a guide rail or stabilization bar 2726 that is adapted to slidably engage with and allow the displacement member 2710 to translate along a trajectory that is parallel with the longitudinal axis 2720 of the guide member 2708.

As best seen in FIGS. 31A and 31C, each of the guide rails 2726 includes a generally rectangular member 2728 that is perpendicularly oriented to the vertical extension members 2724. The rectangular member 2728 extends from the proximal end 2718 to the distal end 2716 of the guide member 2708. The vertical extension members 2724 couples with a

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bottom surface 2730 of the rectangular member 2728. An outer lateral edge of the rectangular member is coupled with a side member 2732 that extends from the proximal end 2718 to the distal end 2716 of the guide member 2708. A distal member or flange 2734 extends inwardly from the rectangular member 2728 a distance that is equal to the width of the rectangular member 2728. More particularly, the distal member 2734 includes a rounded inner edge 2736 that is coplanar, at its apex, with an inner edge 2738 of the rectangular member 2728. The distal member 2734 may include a planar distal face or surface 2740 with an opening 2742 formed therein. The opening 2742 may facilitate an access point for injection molding. As with previously described embodiments, the guide rails 2726 and, more particularly, the distal face 2740 of the guide rails 2726 may facilitate the positioning and holding of the perineal skin and subcutaneous tissue to allow positioning of the access needle 2712.

As seen in FIGS. 31A, 31C, and 31F, a top surface 2744 of the rectangular member 2728 includes a stop feature 2746 to secure or lock the displacement member 2710 in a distal or deployed condition or position. The stop feature 2746 is a ramp that distally slopes upward until the apex of the ramp at which point the ramp distally slopes downward. In the distal position, the displacement member 2710 is at a distal-most position and abuts or is adjacent a proximal face 2748 of the distal member 2734. The distal member 2734, thus, prevents further distal movement of the displacement member 2710 and the stop feature 2746 restrains proximal movement a certain amount. In certain embodiments, as seen in the figures, the proximal end 2718 of the rectangular member 2728 is open such that the displacement member 2710 can be slidably engaged with the rectangular member 2728.

As seen in FIGS. 31A and 31D-31F, the base platform 2722 extends about one half of the overall longitudinal distance of the guide rails 2726. In this way, the guide rails 2726 extend beyond both the base platform 2722 and the vertical extension members 2724 such that the guide rails 2726 may contact the perineal skin and subcutaneous tissue of the patient but not a distal edge 2750 of the base platform 2722 or a distal edge 2752 of the vertical extension members 2724. And since a distal portion of the lower mount 2704 lies generally flush with the distal edge 2750 of the base platform 2722, the lower mount 2704 also may be spaced apart from the skin of the patient during the biopsy procedure. In this way, in certain embodiments, the guide rails 2726 may contact the skin of the patient while the other portions of the guide 2700 remain spaced apart from the patient's skin.

As seen in FIG. 31D, the distal edge 2752 of the vertical extension member 2724 is arcuate and a proximal edge 2754 of the vertical extension member 2724 includes a semi-circular path about halfway between the base platform 2722 and the guide rails 2726. As seen in FIGS. 31E-31F, the base platform 2722 includes a pair of channels 2756 extending parallel to each other and extending longitudinally. These channels 2756 may coaxially align with snap features 2758 in the upper mount coupling mechanism 2714 of the lower mount 2704 to facilitate the upper mount 2702 being coupled with the lower mount 2704. Once the channels 2756 and the snap features 2758 are aligned, the upper and lower mounts 2702, 2704 may be snapped together such that the snap feature 2758 extends through the channels 2756 to securely couple the mounts together. While the figures show channels 2756 and snap features 2758, other mechanisms are possible to couple the upper and lower mounts 2702, 2704. For example, the base platform 2722 and the upper

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mount coupling mechanism 2714 may each include through holes that coaxially align. And, screws or nuts/bolts may be used to secure the mounts 2702, 2704 together.

As seen in FIGS. 31B-31C and 31E, the bottom surface 2762 of the base platform 2722 includes a rectangular rail or protrusion 2764 extending longitudinally. The top surface of the base platform 2722 includes a longitudinally extending groove, which may be used to align the guide member 2708 with the sagittal plane of the ultrasound probe. As seen in FIG. 31E, the channels 2756 extend through the rail 2764. As will be described subsequently, the rail 2764 may engage with a platform 2766 of the upper mount coupling mechanism 2714 of the lower mount 2704 so as to align the upper and lower mounts 2702, 2704 upon coupling together.

Reference is made to FIGS. 32A-32C, which depict, respectively, a front isometric view, a front view, and a back view of the displacement member 2710. As described previously, the translating or displacement member 2710 may be coupled with the guide rails 2726 of the guide member 2708 so as to be displaceable or slidable between the proximal end 2718 of the guide member 2708 to the distal end 2716. Thus, when the access needle 2712 is coupled with the displacement member 2710, the access needle 2712 is also displaceable between the proximal end 2718 of the guide member 2708 to the distal end 2716.

As seen in the figures, the displacement member 2710 includes a central vertically extending member 2760 having five needle receiving ports 2768 formed therein. Each needle receiving port 2768 includes an opening 2770 extending from a distal end 2772 to a proximal end 2774 of the displacement member 2710. Each of the openings 2770 of the needle receiving ports 2768 are generally vertically aligned with each other and each includes a trajectory axis 2776 defining a trajectory of the access needle 2712 when positioned within the opening 2770. The trajectory axis 2776 is generally parallel to the longitudinal axis 2720 of the guide member 2708 when the displacement member 2710 is coupled with the guide member 2708. The trajectory axis is also generally parallel with a longitudinal axis of the probe when the biopsy guide 2700 is coupled with the probe. Thus, the trajectory axis 2776 of the access needle 2712 may be generally fixed or constant, in a generally parallel orientation to the previously described axes, as the displacement member 2710 displaces distal-proximal relative to the guide member 2708.

A particular needle receiving port 2768 may be chosen based on a desired distance from the probe. Thus, if a physician desires that the access needle 2712 should be positioned nearer the probe, a particular needle receiving port 2768 may be chosen that is at the bottom of the displacement member 2710. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 5 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 3 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart about 4 mm. In certain embodiments, the openings 2770 of the needle receiving ports 2768 may be vertically spaced apart at any interval between about 2 mm to about 6 mm, among other distances.

While the vertically extending member 2760 includes five needle receiving ports 2768, it is foreseen that more or less ports may be included in the displacement member 2710 without limitation.

The displacement member 2710 further includes a coupling mechanism 2778 to displaceably couple the displacement member 2710 and the guide rails 2726. The coupling

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mechanism 2778 includes a pair of lower tab members 2780 extending laterally out and away from the vertically extending member 2760. When coupled with the guide rails 2726, the lower tab members 2780 may abut or be positioned adjacent the bottom surface 2730 of the rectangular member 2728. The tab members 2780 include a planar top surface 2782 that may provide sliding contact with the bottom surface 2730 of the rectangular member 2728. The planar contact between the surfaces may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing vertical tilt of the displacement member 2710.

The coupling mechanism 2778 further include an upper member 2784 positioned above the lower tab members 2780. A bottom surface 2786 of the upper members 2784 may abut or be positioned adjacent the top surface 2744 of the rectangular member 2728 when the displacement member 2710 is coupled with the guide rails 2726. The bottom surface 2786 of the upper members 2784 is planar and, thus, the planar contact between the surfaces may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing vertical tilt of the displacement member 2710. The upper members 2784 and the lower tab members 2780 operate to sandwich the rectangular members 2728 of the guide rails 2726 when the displacement member 2710 is coupled with the guide member 2708.

The coupling mechanism 2778 further includes a lateral brace mechanism 2788 at lateral ends of the upper members 2784. The lateral brace mechanism 2788 includes an upside-down U-shaped member 2790 having three inner surfaces 2792 that define a longitudinal extending channel 2794 therein. The channel 2794 may receive the side members 2732 therein when the displacement member 2710 couples with the guide rails 2726. In this way, the lateral brace mechanism 2788 may contribute to stability of the displacement member 2710 relative to the guide rails 2726 by reducing lateral tilt of the displacement member 2710. It is foreseen that the displacement member 2710 may not include the lateral brace mechanism 2792 and may instead only include the upper member 2784 and the lower tab members 2780. Alternatively, it is foreseen that the displacement member 2710 may not include the upper member 2784 and the lower tab members 2780, but may only include the lateral brace mechanism 2792. Additionally and alternatively, other mechanisms are possible to facilitate the displacement member 2710 displacing between the proximal and distal ends 2718, 2716 of the guide member 2708. For example, the guide member 2708 could include longitudinally extending rods (not shown) and the displacement member 2710 may include a sleeve that engages and is guided by the rods. In such an embodiment, the rods may be adapted to slide within the openings 2770 of the needle receiving ports 2768 with or without modification to the displacement member 2708.

Still referring to FIGS. 32A-32C, flanges 2796 extend laterally from the upside-down U-shaped members 2790, which may act as grasping points for the physician. The flanges 2796 extend inwardly and are coplanar with a back wall member 2798 that spans between the upside-down U-shaped members 2790, the vertically extending member 2760, and the upper members 2784. The back wall member 2798 may function to provide rigidity between the various components of the displacement member 2710. As seen in FIG. 32C, a proximal side 2800 of the needle receiving ports 2768 includes keyed features to lockingly engage the access needle 2712 such that it does not rotate once it is coupled with the port 2768.

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Reference is made to FIGS. 33A and 33B, which depict, respectively, a front isometric view and a front view of the lower mount 2704 of the biopsy guide 2700. As previously described, the upper mount coupling mechanism 2714 includes the snap features 2758 to couple with the channel 2756 in the base platform 2722. Each of the snap features 2758 may be vertical flanges 2802 with a lip 2804 at its vertical termination. As the inner surfaces defining the channels 2756 contact the vertical flanges 2802, the inner surfaces compress the lips 2804 together relative to each other until the flanges 2802 “snap” or expand outwardly relative to each other such that the lips 2804 are on a top surface of the base platform 2722. The vertical flanges 2802 extend from the platform 2766 of the upper mount coupling mechanism 2714. The platform 2766 is coupled with the probe coupling mechanism 2706, which, as seen in the figures, may be a snap-grip or snap-clip type of hose or tube clamp. The mechanism 2706 may include a first and a second arm member 2804, 2806 extending from opposite sides 2808 of the platform 2766. The arm members 2804, 2806 are flexible and designed to wrap around a portion of the probe fitted within the opening formed by the first and second arms 2804, 2806. The first arm member 2804 includes a first clamping structure 2810 including an upper row of teeth 2812 and a lower smooth sliding surface 2814. The second arm member 2806 includes a second clamping structure 2816 including an upper smooth sliding surface 2818 and a lower row of teeth 2820. The first and second clamping structures 2810, 2816 work together to provide a clamping or gripping function to securely support the transrectal probe to the lower mount 2704 and, thus, the upper mount 2702.

In operation, a transrectal probe is positioned within the opening between the first and second clamping structures 2810, 2816. The physician may determine a desired position on the probe based on the patient’s anatomy, the particular transrectal probe, or the particular procedure to be performed, among other possible criteria. Once a position for the lower mount 2704 is chosen, the physician may cause the first and second arm members 2804, 2806 to be contracted relative to each other by pushing on the outer ends 2822 of the clamping structures 2810, 2816, respectively. As the clamping structures 2810, 2816 converge relative to each other, the lower row of teeth 2820 on the second clamping structure 2806 is received within an opening 2824 formed between the upper row of teeth 2812 and the lower smooth surface 2814. The upper row of teeth 2812 are caused to engage with the lower row of teeth 2820. Additionally, the upper smooth surface 2818 is caused to slide on an inner smooth surface 2826 of the first arm member. And, the lower smooth sliding surface 2814 is caused to slide on a lowest smooth surface 2828 on the second clamping structure 2816. The teeth of the upper and lower row 2812, 2820 are arranged in a saw tooth like manner such that when they are increasingly engaged with each other the teeth grip each other and resist moving in the opposite direction. Once engaged, the teeth may be disengaged by pulling on a tab 2830 on a bottom portion of the first clamping structure 2810. Pulling on the tab 2830 allows the teeth 2812, 2820 to disengage with each other and the flexible nature of the first and second arms 2804, 2806 are caused to spring back into the shape shown in FIG. 33B. As seen in FIGS. 33B-33B, an inner surface 2834 of the first and second arms 2804, 2806 includes a gasket 2832 that may be flexible and deformable to provide for a gripping surface between the probe and the lower mount 2704.

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Reference is made to FIG. 34, which depicts a front isometric view of an access needle 2712. As seen in the figure, the needle 2712 includes a distal end 2836 and a proximal end 2838 opposite the distal end 2836. At the distal end 2836 is the bevel 2840 extending distally from a shaft 2842. Within the shaft 2842 is a lumen 2844 for communication of fluids or, in the case of the access needle 2712, a shaft of a smaller gage biopsy needle. The proximal end 2838 of the needle 2712 includes a hub 2846 with ridges 2848 extending longitudinally around a circumference of the hub 2846. The ridges 2848 may engage with corresponding and negatively shaped features on the proximal side 2800 of the needle receiving ports 2768.

The following discussion will focus on use of the biopsy guide 2700 and will refer to FIGS. 35A-35D, which depict, respectively: a front isometric view of the lower mount 2704; a front isometric view of the lower mount 2704 coupled with the upper mount 2702; a front isometric view of the lower mount 2704 coupled with the upper mount 2702 and the displacement member 2710 positioned at a proximal end of the guide member 2708; and, a front isometric view of the lower mount 2704 coupled with the upper mount 2702 and the displacement member 2710 positioned at a proximal end of the guide member 2708 with the access needle 2712 positioned within one of the needle receiving ports 2768.

As seen in FIG. 35A, the lower mount 2704 is positioned with the first and second clamping structures 2810, 2816 of the first and second arm members 2804, 2806 uncoupled such that a transrectal probe may positioned between the arm members 2804, 2806. While it is not depicted in the figures, the first and second clamping structures 2810, 2816 may be engaged with each other or coupled as described previously to grasp the probe between the arm members 2804, 2806 and against the gasket 2832.

As seen in FIG. 35B, the upper mount 2702 may be coupled with the lower mount 2704. More particularly, the vertical flanges 2802 on the platform 2766 of the upper mount coupling mechanism 2714 may be engaged with or snapped together with the channels 2756 on the base platform 2722 of the guide member 2708.

As seen in FIG. 35C, the displacement member 2710 may be engaged with the guide member 2708. More particularly, the distal end 2772 of the displacement member 2710 is longitudinally aligned with the proximal end 2718 of the guide member 2708 such that the proximal ends of the guide rails 2726 are positioned to extend into the corresponding features of the displacement member 2710. That is, the rectangular member 2728 is aligned with the opening between the upper members 2784 and the lower tab members 2780, and the vertically extending side members 2732 are aligned with the channels 2794 between the inner surfaces 2792 of the upside-down U-shaped member 2790 of the displacement member 2710. Once aligned, the displacement member 2710 is displaced, moved, or translated into engagement with the guide member 2708, as seen in FIG. 35C, which depicts the displacement member 2710 in a proximal-most position.

As seen in FIG. 35D, the access needle 2712 is coupled with the displacement member 2710. More particularly, the bevel 2840 and shaft 2842 of the access needle 2712 are extended through the proximal side 2800 of a particular opening 2770 of a needle receiving port 2768 until the hub 2846 of the access needle 2712 engages with the proximal side 2800 of the port 2768. The ridges 2848 of the access needle 2712 may engaged with corresponding features within the opening 2770 of the port 2768 such that the access needle 2712 remains coupled with the displacement member

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2710. The access needle 2712 may be restrained from rotating by the ridges 2848. In certain embodiments, the access needle 2712 may be secured to the displacement member 2710 by, for example, a threaded features on the hub 2846 and openings 2770 of the ports 2768 such that the needle 2712 and the displacement member 2710 may be threadably engaged and disengaged with each other.

In the orientation shown in FIG. 35D, the displacement member 2710 and the access needle 2712 are in a proximal-most position or condition. As seen in the figure, in this particular embodiment, the bevel 2840 of the access needle 2712 lies about flush with the planar distal face 2740 of the distal member 2734. In other embodiments or with a different sized needle 2712, the bevel 2840 of the access needle 2712 may extend beyond the distal face 2740 of the distal member 2734 when the displacement member 2710 is in the proximal-most position, or the bevel 2840 of the access needle 2712 may be positioned proximal of the distal face 2740 of the distal member 2734 when the displacement member 2710 is in the proximal-most position.

In certain embodiments where the bevel 2840 of the access needle 2712 does not extend past the distal face 2740 of the distal member 2734, the physician may use the distal member 2734 to manipulate the perineal skin and subcutaneous tissue of the patient while having the displacement member 2710 coupled to the guide member 2708, but while not having the bevel 2840 of the access needle 2712 contact the patient's skin.

While FIG. 35D depicts the access needle 2712 coupling with the displacement member 2710 when the displacement member 2710 is in the proximal-most position, the access needle 2712 may be engaged with the displacement member 2710 when the displacement member is at the distal-most position or at any position between the distal-most position and the proximal-most position. When the access needle 2712 is in the proximal-most position, as shown in FIG. 35D, the physician may manipulate the probe and the distal member 2734 of the upper mount 2702 to manipulate the perineal skin and subcutaneous tissue of the patient. When the trajectory of the access needle 2712 is appropriately positioned relative to the patient's perineal skin and subcutaneous tissue, the physician may distally displace the access needle 2712 by pushing on one or more of the back wall member 2798 or flanges 2796 of the displacement member 2710, or the hub 2846 of the access needle 2712. In certain embodiments, the displacement member 2710 may be biased or spring-loaded such that the physician may actuate a mechanism that distally advances the displacement member 2710 and the access needle 2712 without a need for manual advancement by the physician. As the access needle 2712 and the displacement member distally advance or displace, the displacement member 2712 will lock or be secured into the distal-most position via the ramps of the stop feature 2746 positioned on the top surface 2744 of the rectangular member 2728. In the distal-most position, as seen in FIG. 27, the displacement member 2710 is prevented from further distal displacement via the distal member 2734. In particular, a front edge or surface 2850 of the distal end 2772 of the displacement member 2710 abuts or is adjacent a proximal surface 2748 of the distal member 2734 when the displacement member 2710 is in the distal-most position. In certain embodiments, as seen in FIG. 27, the back surface 2748 may abut or be adjacent the front edge or surface 2850 of the upper members 2784, the lower tab members 2780 (not seen in FIG. 27) and/or part of the upside-down U-shaped member 2790.

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As further seen in FIG. 27, the distal members 2734 extend inward towards the needle receiving ports 2768 but may define an opening or gap between the rounded inner edges 2736 for the access needle 2712 to extend there-through.

Once the access needle 2712 is in position in the patient's skin and subcutaneous tissue, the biopsy procedure may continue, as described previously, with the physician extending a biopsy needle through the lumen 2844 of the access needle 2712 and into the patient's prostate. Once procedure is complete, the physician may remove the access needle 2712 from the patient's body by proximally displacing the displacement member 2710 and the access needle 2712 by pulling or pushing on the displacement member 2710 or access needle. Alternatively, the access needle 2712 may be disengaged with the displacement member 2710 while the displacement member 2710 is in the distal-most position.

The discussion will now focus on additional and alternative embodiments of the biopsy guide. As seen in FIG. 36, the displacement member 2710 may include the upper members 2784 and the lower tab members 2780 for engaging with and sliding or displacing relative to the rectangular members 2728 of the guide rails 2726. The displacement member 2710 of FIG. 36, however, does not include an upside-down U-shaped member for engaging with the side members 2732 of the guide rails 2726 and, further, does not include the back wall member 2798 and the flanges 2796. Features of both embodiments of the displacement member 2710 may be combined as needed and without limitation.

The lower mount 2704, as described herein, may take many forms without departing from the scope of the present disclosure. Other mechanisms to couple the upper mount 2702 to the probe are possible and contemplated herein. For example, the upper mount 2702 may couple with or be integrally formed with a thin sheath or sleeve of latex, polyurethane, or other materials, such as a male condom. The sheath may be fitted over the probe in a tight fitting manner such that the upper mount 2702 is secured in position relative to the probe.

Additional or alternative embodiments of the lower mount 2704 may include rubber or rubber-type cinch straps that are coupled with or integral with the upper mount 2702.

The upper mount 2702, as described herein, may take many forms without departing from the scope of the present disclosure. Other mechanisms to guide the access needle 2712 are possible and contemplated herein. For example, the displacement member 2710 supporting the access needle 2712 may be coupled to a platform on a coupler side of a four-bar linkage (e.g., parallelogram linkage) where the fixed portion of the linkage may be coupled with the base platform 2722 of the guide member 2710. The platform may be displaceable distal-proximal by urging the platform distally or proximally, while displacing in an arcuate path. In the case of a parallelogram linkage, the trajectory of the access needle 2712 may remain parallel to the longitudinal axes of the probe and guide member 2710 while vertically displacing. In this way, such a linkage may be used for distal-proximal displacement as well as vertical displacement or adjustment, as needed for a particular biopsy procedure. This type of displacement member 2710 may be used with the guide member 2708 as described herein with or without modification.

As another example, the displacement member 2710 supporting the access needle 2712 may be coupled to a carriage or lead screw nut that is displaced relative to the guide member 2708 (and probe) via rotation of a lead screw. The lead screw may be positioned parallel to the longitudi-

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nal axis of the guide member 2708 and the probe such that displacement of the lead screw nut and, thus, the displacement member 2710 and access needle 2712 displace or translate distal-proximal while maintaining a trajectory of the access needle 2712 that may be fixed. A bottom side of the lead screw nut may include a feature or protrusion that extends into a channel formed in the base platform 2722 of the guide member 2708 such that the lead screw nut does not rotate, but, rather, displaces or translates linearly distal-proximal in response to rotation of the lead screw. The lead screw may be rotatable by hand via, for example, a handle at the proximal end of the lead screw.

Reference is now made to FIGS. 37A-37F, which depict various views of another embodiment of the biopsy guide 3700. As seen in FIG. 37A, which is a front isometric view of the biopsy guide 3700, the guide 3700 is similar to previously described embodiments of the guide in that it includes an upper mount 3702 and a lower mount 3704. The lower mount 3704 is adapted to secure the guide 3700 to a transrectal probe and includes the same features as the previously described embodiment. The upper mount 3702 may releasably couple with the lower mount 3704. As seen in FIGS. 37B and 37C, which are, respectively, front and back isometric exploded views of the upper mount 3702, the biopsy guide 3700 further includes a guide member 3710 and a displacement, sliding, or translating member 3706 that is adapted to couple with an access needle 3708.

As seen in FIGS. 37B-37C and 37E-37F, the displacement member 3706 includes a vertically extending member 3712 having five needle receiving ports 3714 formed within the member 3712. The ports 3714 may receive the access needle 3708 within any of the ports 3714, as previously described, to vary the height of the access needle 3708 relative to the probe (not shown). The access needle 3708 may couple with the needle receiving ports 3714 such that they may be displaced together relative to the guide member 3710.

As seen in the figures, a bottom end 3716 of the vertically extending member 3712 is coupled to a distal end 3718 of a rail member 3720 that may slidably engage with the guide member 3710. The rail member 3720 includes a flange member 3722 and a web member 3724 arranged in a T-beam shape. That is, the flange member 3722 is wider than the web member 3724, which projects upward and substantially perpendicularly from a central portion of the flange member 3722. From the distal end 3718, the rail member 3720 extends proximally to a proximal end 3726. At the proximal end 3726 is an end plate member 3728, which prevents distal displacement of the displacement member 3706 past a certain point.

As seen in FIGS. 37C and 37D, the guide member 3710 includes a rail receiving slot or channel 3730 having a proximal opening 3732, a distal opening 3734 (seen in FIG. 37B), and a top opening 3736. The rail receiving slot 3730 is generally a negative shape of the rail member 3720 and may receive the rail member 3720 therein and permit the rail member 3720 and, thus, the displacement member 3706 and access needle 3708 to displace relative to the guide member 3710. When the rail member 3720 is positioned within the rail receiving slot 3730, inner surfaces 3738 of the slot 3730 may contact the flange and web members 3722, 3724 and restrain the displacement member 3706 from lateral displacement and vertical tilting while allowing distal-proximal displacement or translation of the displacement member 3706. Thus, the displacement member 3706 may be displaced or translated distally and proximally while maintaining alignment of a trajectory of the access needle 3708

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substantially parallel with a longitudinal axis of the probe when the biopsy guide **3700** is coupled with the probe.

As seen in FIG. **37A**, the displacement member **3706** is in a distal-most position with the distal end **3718** of the rail member **3720** and a distal end **3740** of the vertically extending member **3712** being about coplanar with a distal face **3742** of a distal member **3744** of the guide rail members **3746**, which may be similar to as previously described in relation to previous embodiments. In the distal-most position, the rail member **3720** extends past the distal opening **3734** of the rail receiving slot **3730**, and the end plate member **3728** of the rail member **3720** abuts or is adjacent the proximal opening **3732** of the rail receiving slot **3730**. To proximally displace the displacement member **3706** from the distal-most position, the physician may pull or push on the end plate member **3728**, the vertically extending member **3712**, or the access needle **3708**.

It is noted that the guide rail members **3746** and, more particularly, the distal members **3744** may be used by the physician to manipulate the perineal skin and subcutaneous tissue of the patient, as described previously. And while the embodiment of the biopsy guide **3700** in FIGS. **37A-37F** describe a rail and slot type of arrangement between the displacement member **3706** and the guide member **3710**, other mechanisms are possible to displace the displacement member **3706** relative to the guide member **3710**. Additionally or alternatively, features and elements from other embodiments of the biopsy guide may be incorporated into the present embodiment without limitation. Similarly, features and elements from the present embodiment of the biopsy guide may be incorporated into any of the other embodiments of the biopsy guide without limitation.

As seen in FIG. **37G**, which is a side view of another embodiment of the displacement member **3706** with the access needle **3708** partially positioned within the top needle receiving port **3714** of the vertically extending member **3712**, the rail member **3720** may be replaced by a lead screw **3748** and the bottom end **3716** of the vertically extending member **3712** may include a lead screw nut **3750** that rotationally engages with the lead screw **3748** to cause the displacement member **3706** and the access needle **3708** to displace or linearly translate relative to the probe and the guide member **3710** (not shown). The lead screw **3748** may be rotationally coupled with bearings **3752** at opposite ends which allow the lead screw **3748** to rotate thereon. The lead screw nut **3750** may be prevented from rotating by a guide rail **3754** that extends between the bearings **3752** and also extends through a passageway in the lead screw nut **3750**. In this way, as the lead screw **3748** rotates, the lead screw nut **3750**, as well as the vertically extending member **3712** and the access needle **3708**, are caused to displace or translate distal-proximal because the lead screw nut **3750** is prevented from rotating by the guide rail **3754**. The lead screw **3748** may include a handle **3756** for rotating the lead screw **3748**. The displacement member **3706** shown in FIG. **37G** may be coupled with the guide member **3710** shown in the previous figures such that the lead screw **3748** is generally parallel with the longitudinal axis of the guide member **3710** and the probe. The displacement member **3706** may, for example, couple with the base platform of the guide member **3710** at the bearings **3752**, or at other parts of the member **3706**.

As seen in FIGS. **37H-37L**, which are, respectively, an isometric front view and a side view of another embodiment of the biopsy guide **3900**, it includes a probe coupling mechanism **3902** in the form of collars that may be adjustably secured to the probe **3904**. Four arm members **3906** are pivotally coupled at bottom ends **3908** to the probe coupling

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mechanism **3902** and pivotally coupled at top ends **3910** to a platform member **3912**. The arm members **3906** may be of equal length such that the platform member **3912** is capable of displacing distal-proximal while maintaining a parallel orientation relative to the probe **3904**. More particularly, as seen in FIG. **37I**, the platform member **3912** may include a longitudinal axis that is generally parallel to a longitudinal axis of the probe **3904** in all distal-proximal orientations of the platform member **3912** relative to the probe **3904**. The platform member **3912** may include a longitudinally extending channel **3914** for receiving and guiding a displacement member **3916** having a needle receiving port **3918**. The displacement member **3916** may include a flanged lower body portion **3920** that matches a shape of the channel **3914** such that the displacement member **3916** may slide within the channel **3914** or displace relative to the platform member **3912** while maintaining an orientation of a needle positioned within the needle receiving port **3918** that is generally parallel to the longitudinal axis of the probe **3904**.

As seen in FIG. **37I**, the biopsy guide **3900** may function as a four bar parallel or parallelogram linkage during displacement of the platform member **3912**. In particular, FIG. **37I** shows three positions of the platform member **3912** as it displaces. A first position **3922** shows the platform member **3912** at a highest position relative to the probe **3904** where the arm members **3906** are vertically extended to their maximum. A second position **3924** shows the platform member **3912** as it distally displaces while rotating clockwise and lowering the platform member **3912** relative to the probe. A third position **3926** shows the platform member **3912** as it further distally displaces while rotating clockwise and lowering the platform member **3912** relative to the probe. As seen in all positions **3922**, **3924**, **3926**, a longitudinal axis of the platform member **3912** may remain generally parallel with a longitudinal axis of the probe **3904**.

Reference is now made to FIG. **37J**, which is a front isometric view of another embodiment of an upper mount **4000**. As seen in the figure, the upper mount **4000** includes a guide member **4002** that is similar to previously described embodiments in that it includes a pair of guide rails **4004** that extend longitudinally and are spaced apart from each other. This embodiment of the upper mount **4000**, however, does not include a displacement member. Rather, the guide mount **4002** of the upper mount **4000** of FIG. **37J** includes a vertically oriented member **4008** including needle receiving ports **4006** that are also vertically aligned. The member **4008** may not be displaceable relative to the guide member **4002** in this particular embodiment.

That is, the needle receiving ports **4006** may align a trajectory of an access needle in any of the ports **4006** such that a trajectory of the access needle may be generally parallel to a longitudinal axis of the probe. The needle receiving ports **4006** may be integrally formed with the guide member **4002**. Or, the vertical member **4008** including the needle receiving ports **4006** may be releasably coupled to the guide member. In a releasable arrangement, the vertical member **4008** may be coupled with the guide member via any coupling mechanism described herein or known in the art. As seen in the figure, the needle receiving ports **4006** are cylindrical and extend generally from a proximal end **4010** to a distal end **4012** of the guide member **4002**. The distal tip **4014** of the needle receiving ports **4006** may be about coplanar with a distal face **4016** of the distal members **4018** of the guide rails **4004**.

Reference is made to FIGS. **37K-37L**, which are, respectively, front and side views of another embodiment of a biopsy guide **4100**. As seen in the figures, the biopsy guide

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4100 includes displacement member 4102 including a vertically oriented body 4104 having five vertically aligned needle receiving ports 4106 for receiving, supporting, and orienting an access needle. At a bottom end 4108 of the vertical body 4104 is a probe coupling mechanism 4110 including a collar 4112 having a guide rail or protrusion 4114 extending from an inner surface 4116 of the collar 4112. The guide rail 4114 extends longitudinally in the collar 4112 and may be received by a correspondingly shaped channel or slot 4120 in a transrectal probe 4118. In this way, the displacement member 4102 may slide, displace, or translate relative to the probe 4118 while being restrained from certain movements by the interaction between the guide rail 4114 and the channel 4120. As such, the access needle supported by the needle receiving port 4106 may displace or translate distal-proximal relative to the probe 4118 while maintaining a trajectory that is generally parallel with a longitudinal axis of the probe 4118.

The inner surface 4116 may include roller bearings or similar structures to permit the collar 4112 to roll, translate, or displace relative to the probe 4118. While the channel 4120 is described as being formed in the probe 4118, the channel 4120 may be formed in a separate member that is coupled to the probe 4118. In this case, a specialized probe having a channel may not be needed; rather, any off-the-shelf ultrasound probe may be used with the separate member having the channel 4120 to utilize the biopsy guide 4100 of the present embodiment.

Reference is made to FIGS. 37M-37U, which depict various views of alternative embodiments of the lower mount. To begin, reference is made to FIGS. 37M-37Q. FIG. 37M is a front isometric view of a biopsy guide 4200. FIG. 37N is a front view of the biopsy guide 4200. FIG. 37O is a front isometric view of a cinch strap 4202. FIG. 37P is a front isometric view of a V-block insert 4204. FIG. 37Q is a front view of the biopsy guide 4200 of FIG. 37M with an insert 4204 of FIG. 37P.

As seen in FIG. 37M, the biopsy guide 4200 includes an upper mount 4206 and a lower mount 4208. The upper mount 4206 may include a base platform 4210 and a pair of guide rails 4212 extending longitudinally from the base platform 4210. The guide rails 4212 may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount 4208 may include a cinch strap 4202, as shown in FIG. 37P, which may include a flange 4214 at one end 4216 and a series of transversely extending ridges 4218. The cinch strap 4202 may be fitted or positioned within a slot 4220 in the base platform 4210 such that the flange 4214 abuts the surfaces of the slot 4220 and is prevented from extending through the slot 4220. The cinch strap 4202 may be fitted around the transrectal probe 4222 and positioned within a locking opening 4224 opposite the slot 4220 in the base platform 4210. The cinch strap 4202, which may be rubber or otherwise made of a flexible material, may be pulled tightly at the free end 4226 such that the ridges 4218 are progressively locked by the locking opening 4224. Once appropriately tightened, the upper mount 4206 is now secured to the probe 4222.

As seen in FIGS. 37P-37Q, the lower mount 4208 of the biopsy guide 4200 may include a V-block insert 4204 positioned between the probe 4222 and the cinch strap 4202. The V-block insert 4204 may include a pair of slots 4228 on opposite sides of the insert 4204 that may be sized to receive the cinch strap 4202 therethrough to secure the V-block insert 4204 into position relative to the cinch strap 4202. The V-block insert 4204 ensures at least three points of contact

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between the probe and the biopsy guide 4200: one point of contact between the probe 4222 and an underside of the base platform 4210; and, two points of contact between the probe 4222 and the V-block insert 4204.

Reference is made to FIGS. 37R-37S, which depict, respectively, a front isometric view and a front view of another embodiment of a biopsy guide 4300. Similar to the previously described embodiments, the biopsy guide 4300 includes an upper mount 4302 and a lower mount 4304. The upper mount 4302 may include a base platform 4306 and a pair of guide rails 4308 extending longitudinally and spaced apart from each other. The guide rails 4308 may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount 4304 may include a curvilinear shaped inner surface 4310 opposite the base platform 4306 and pair of opposing arms 4312 extending downward. The arms 4312 may converge on a bottom side 4314 of the lower mount 4304. A V-block insert 4316 may be positioned an opening 4318 of the lower mount 4304. The opening 4318 may be sized and shaped to receive the transrectal probe 4322 therein. The V-block insert 4316 may be vertically adjustable within the opening 4318 via a thumb-screw 4320. When actuated or rotated, the thumb-screw 4320 may push the V-block insert 4316 vertically to exert a force on the probe 4322, which, in turn, exerts a force on the inner surface 4310 of the base platform 4306 of the lower mount 4304.

Reference is made to FIGS. 37T-37U, which depict, respectively, a front isometric view and a front view of another embodiment of a biopsy guide 4400. As seen in the figures, the device 4400 includes an upper mount 4402 and a lower mount 4404. The upper mount 4402 may include a base platform 4406 and a pair of guide rails 4408 extending longitudinally and spaced apart from each other. The guide rails 4408 may guide a displacement member (not shown), which may support an access needle (not shown), as described in previous embodiments. The lower mount 4404 couples the upper mount 4402 to the probe 4410 and may include a strap 4412 that is affixed at one side 4414 via a pair of fasteners (e.g., screws, bolts) 4416. The strap 4412 may wrap around the probe 4410 and be secured in place via a worm gear mount 4418. The worm gear mount 4418 may include a thumb-knob 4420 that is rotatable and extending to a threaded feature (e.g., ACME threads) 4422 that threadably engage with slots 4424 on the second end 4426 of the strap 4412. As the thumb-knob 4420 is tightened, the thread feature 4422 advances on the slots 4424 and pulls the strap 4412 tighter on the probe 4410 (similar to a hose clamp). This embodiment may include a V-block insert (not shown). As seen in the figures, an underside 4426 of the base platform 4406 may be curvilinear to match the shape of the probe 4410. These features among features from other embodiments may be combined as needed to modify any of the features of any of the biopsy guides described herein.

Reference is made to FIGS. 37V-37X, which depict additional and alternative embodiments of a lower mount 4502 of a biopsy guide 4500. As seen in FIG. 37V, which is a front view of a lower mount 4502, the upper mount 4504 may be similar to previously describe embodiments in that it includes a base platform 4506 and a pair of guide rails 4508. The lower mount may include a pair of semi-circular arm members, clamps, or collars 4510 that are pivotally coupled together at a joint 4512 (e.g., pin). The pair of semi-circular arm members 4510 may open and close about the joint 4512 in a clam-shell type manner. Opposite the joint 4512, the arm members 4510 are adjustably secured

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together via a thumb-screw **4514** that extends between a pair of flanges **4516**. Thus, turning the thumb-screw **4514** in a first direction may cause the pair of arm members **4510** to constrict against a probe (not shown) positioned within the opening **4518** between the arm members **4510**. And, turning the thumb-screw **4514** in a second direction may cause the pair of arm members **4510** to loosen against the probe positioned within the opening **4518**.

FIG. 37W depicts a front isometric view of the lower mount **4504** including a flexible spring band or biasing collar **4520** extending circumferentially and terminating in a pair of flanges or tabs **4522** that may be compressed together, relative to each other, to selectively enlarge the opening **4518**. The probe (not shown) may be positioned within the opening **4518** and the spring band **4520** may compress against the probe and cause a constant force to be exerted on the probe, allowing it to be used on probes of multiple diameters. The flat spring band **4520** may be replaced by a wire spring band (i.e., dumbbell clamp) without departing from the scope of the disclosure.

FIG. 37X depicts a front view of a lower mount **4504** having a pair of semi-circular arm members, clamps, or collars **4510** that are pivotally coupled together at a joint **4512** (e.g., pin). The pair of semi-circular arm members **4510** may open and close about the joint **4512** in a clamshell type manner. Opposite the joint **4512**, the arm members **4510** are adjustably secured together via a snap-clip, ratchet, or clamp assembly **4524** including a lever arm handle **4526** a wire arm or loop **4528**. The lever arm handle **4526** is attached to one free end **4534** of the arm members **4510** and the wire arm **4528** is attached to the lever arm handle **4526**. The other free end **4530** of the other arm member **4510** includes a lip **4532** such that the wire arm **4528** may be fitted around the lip **4532** with the lever arm handle **4526** in an opened position. Once the wire arm **4528** is positioned within the lip **4532**, the lever arm handle **4526** may be pivoted towards the arm member **4510**, which pulls the free ends **4534**, **4530** together to secure the arm members **4510** against the probe (not shown). To remove the probe from the lower mount **4504**, the lever arm handle **4526** may be pivoted outward away from the arm member **4510** of the free end **4534** and the arm members **4510** will expand relative to each other and release the probe.

As with many of the embodiments of the biopsy guide described herein, there may be a particular type of mechanical arrangement between the guide member and the displacement member that at least facilitates the displacement of the access needle along at least a portion of the length of the guide member. As discussed in relation to each of the embodiments, the mechanical arrangement may include at least one of a sliding arrangement, a lead screw, or a parallel bar linkage. And, as described with reference to the various embodiments of the biopsy guide, the guide member may operably couple with the transrectal probe via at least one of a sheath arrangement, a ratchet arrangement, a biased collar arrangement, a flexible strap arrangement, a clamping arrangement, or a clamshell collar arrangement.

Reference is now made to FIGS. 38A-38D, which depict, respectively, a transverse plane or slice image of a prostate **3800** and a urethra **3804**, a sagittal plane or slice image of a prostate **3800** and a urethra **3804**, a transverse plane or slice image of a prostate **3800** and a urethra **3804** with a marking device **3824** positioned within the urethra **3804**, and a sagittal plane or slice image of a prostate **3800** and a urethra **3804** with a marking device **3824** positioned within the urethra **3804**. As mentioned previously, during a prostate biopsy procedure it may be important for the physician to

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identify the path of the urethra so that he or she can avoid puncturing the urethra with the access needle and the biopsy needle. The biopsy guides described herein may be used with various systems to locate the urethra via the transrectal probe in sagittal and axial planes.

As described previously, the probe or transducer provides imaging in axial and sagittal planes so as to provide real-time images of the prostate. As seen in FIG. 38A, which is a transverse plane showing the prostate **3800** and the probe **3802**, the urethra **3804** is shown, as well as a path **3806** of the urethra **3804**, as would be seen in a sagittal plane. As seen in FIG. 38B, which is a sagittal plane showing the prostate **3800** and the probe **3802**, the urethra **3804** is shown extending over the prostate **3800** and connecting with the bladder **3808**.

When the prostate is viewed, as seen in FIGS. 38A and 38B, the physician may then position the access needle **2712** in an access site **3810** in the subcutaneous tissue **3812** of the perineum **3814**, where the access site **3810** is at a midpoint between a lateral edge of the prostate **3816** and the urethral path **3806** along a first axis and a midpoint between an anterior capsule **3818** and a posterior capsule **3820** along a second axis. The physician may guide the probe **3802** and the biopsy guide (not shown) along a sagittal plane to the target using the real-time image from the probe **3802**, and the physician may obtain one or more specimens **3822** of the prostate **3800** through the access needle **2712** being guided by the biopsy guide.

Identifying the urethra may be accomplished via a number of methods. First, as seen in FIGS. 38C-38D, a marking device **3824** such as, for example, a balloon catheter can be inserted into the urethra **3804** and used by the physician to locate the urethra **3804**. As seen in FIG. 38C-38D, the marking device **3824** may include a catheter **3826** and a balloon **3828**. The balloon **3828** may be expanded in the bladder **3808** and the catheter **3826** may extend through the urethra **3804** and out of the patient's body. The balloon **3828** and/or catheter **3826** may be visible in certain planes during the biopsy procedure and may aid in identifying the urethra **3804**.

Additionally or alternatively, the marking device **3824** may include markers **3830** such as physical or chemical markers that are visible in an ultrasound environment (e.g., pellets of polylactic and polyglycolic acids containing carbon dioxide, polyglycolic acid pads) along the length of the catheter **3826** so that the physician can view the path of the urethra **3804** as viewed in transverse or sagittal planes. Thus, the physician may be able to position a trajectory of the access needle **2712** to be adjacent and not intersecting with the path of the urethra as indicated by the markers **3830** on the catheter **3826**. The markers **3830** may be positioned on the catheter at certain intervals so as to provide a way to estimate the size or volume of the prostate **3800**. Additionally or alternatively, the catheter **3826** may include a contrast medium (e.g., dye) for visualization purposes and may otherwise function similarly to markers **3830** positioned on the catheter **3826**.

The biopsy guides and devices described herein may additionally include markers or sensors positioned on the biopsy guide or access needle such that movement of the guide or needle, or any device/material placed through the access needle, may be visualized via the markers/sensors by ultrasound equipment (e.g., probe) or other equipment using different imaging modalities (e.g., MRI, CT). In this way, for example, a marker positioned at a distal end of the access

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needle may provide visual guidance as to the location of the tip of the access needle relative to the boundaries of the prostate.

Although various representative implementations have been described above with a certain degree of particularity, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from the spirit or scope of the inventive subject matter set forth in the specification. All directional references (e.g., distal, proximal, front, back, side, top, bottom, fore, aft, right, left, etc.) are only used for identification purposes to aid the reader's understanding of the implementations, and do not create limitations, particularly as to the position, orientation, or use of the embodiments described herein unless specifically set forth in the claims. Joinder references (e.g., attached, coupled, connected, and the like) are to be construed broadly and may include intermediate members between a connection of elements and relative movement between elements. As such, joinder references do not necessarily infer that two elements are directly connected and in fixed relation to each other.

It is believed that the present disclosure and many of its attendant advantages will be understood by the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the components without departing from the disclosed subject matter or without sacrificing all of its material advantages. The form described is merely explanatory, and it is the intention of the following claims to encompass and include such changes.

While the present disclosure has been described with reference to various embodiments, it will be understood that these embodiments are illustrative and that the scope of the disclosure is not limited to them. Many variations, modifications, additions, and improvements are possible. More generally, embodiments in accordance with the present disclosure have been described in the context of particular implementations. Functionality may be separated or combined in blocks differently in various embodiments of the disclosure or described with different terminology. These and other variations, modifications, additions, and improvements may fall within the scope of the disclosure as defined in the claims that follow.

What is claimed is:

1. A method of performing a transperineal biopsy procedure on a prostate of a patient using a transrectal ultrasound probe configured to provide imaging, the patient comprising a perineal access site leading to the prostate, the transrectal ultrasound probe including a shaft and a handle proximal to the shaft, the method comprising:

inserting an access needle into the perineal access site of the patient, the access needle including a hub at a proximal end of the access needle and a tubular shaft extending distally from the hub, the tubular shaft including a lumen sized to receive a biopsy needle therethrough;

inserting at least a portion of the tubular shaft of the access needle into one of a plurality of needle receiving ports of a displacement member of a transperineal biopsy guide, the transperineal biopsy guide comprising: a mount releasably coupled to the transrectal ultrasound probe; a guide member coupled to the mount; and the displacement member configured to slide relative to the guide member and including a vertically extending member including the plurality of needle receiving ports;

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coupling the access needle to the one of the plurality of needle receiving ports of the displacement member of the transperineal biopsy guide such that a position and angle of the access needle relative to the displacement member is retained; and

inserting the biopsy needle through the access needle and into a first location of the prostate of the patient.

2. The method of claim 1, further comprising: contacting a distal end of a pair of guide rails of the guide member with the perineal access site of the patient.

3. The method of claim 1, further comprising injecting a substance into the patient via the biopsy needle.

4. The method of claim 1, further comprising taking a first biopsy of the first location of the prostate of the patient via the biopsy needle.

5. The method of claim 4, further comprising taking a second biopsy of a second location of the prostate of the patient via the biopsy needle, the second location being different than the first location.

6. The method of claim 5, wherein the access needle remains positioned within the perineal access site of the patient for the first biopsy and the second biopsy.

7. The method of claim 1, further comprising coupling the transperineal biopsy guide to the shaft of the transrectal ultrasound probe via a releasable fastener.

8. The method of claim 7, wherein the releasable fastener does not wrap around the handle of the transrectal ultrasound probe.

9. The method of claim 1, further comprising imaging the prostate of the patient with the transrectal ultrasound probe.

10. The method of claim 1, wherein coupling the access needle to one of the plurality of needle receiving ports of the displacement member of the transperineal biopsy guide comprises inserting a portion of the hub into one of the plurality of needle receiving ports.

11. The method of claim 1, wherein the access needle has a needle size of 15 gauge or 16 gauge.

12. The method of claim 1, wherein the biopsy needle has a needle size of 18 gauge.

13. A method of performing a transperineal biopsy procedure on a prostate of a patient using a transrectal ultrasound probe configured to provide imaging, the patient comprising a perineal access site leading to the prostate, the transrectal ultrasound probe including a shaft and a handle proximal to the shaft, the method comprising:

inserting an access needle into one of a plurality of needle receiving ports of a displacement member of a transperineal biopsy guide that is secured to the transrectal ultrasound probe, the access needle including a hub at a proximal end of the access needle and a tubular shaft extending distally from the hub, the tubular shaft including a lumen sized to receive a biopsy needle therethrough, the transperineal biopsy guide comprising a mount configured to releasably couple to the transrectal ultrasound probe, a guide member extending from the mount, and the displacement member configured to slide relative to the guide member;

securing the access needle to the displacement member such that a position and angle of the access needle relative to the displacement member is maintained;

imaging the prostate of the patient with the transrectal ultrasound probe;

inserting the access needle into the perineal access site of the patient; and

inserting the biopsy needle through the access needle and into the prostate of the patient.

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14. The method of claim 13, further comprising: contacting a distal end of a pair of guide rails of the guide member with the perineal access site of the patient.

15. The method of claim 13, further comprising injecting a substance into the patient via the biopsy needle.

16. The method of claim 13, further comprising taking a first biopsy of a first location of the prostate of the patient via the biopsy needle.

17. The method of claim 16, further comprising taking a second biopsy of a second location of the prostate of the patient via the biopsy needle, the second location being different than the first location.

18. The method of claim 17, wherein the access needle remains positioned within the perineal access site of the patient for the first biopsy and the second biopsy.

19. The method of claim 13, further comprising coupling the transperineal biopsy guide to the shaft of the transrectal ultrasound probe via a releasable fastener.

20. The method of claim 19, wherein the releasable fastener does not wrap around the handle of the transrectal ultrasound probe.

21. The method of claim 13, wherein imaging the prostate of the patient with the transrectal ultrasound probe is performed in a sagittal imaging plane.

22. The method of claim 13, wherein securing the access needle to the displacement member comprises inserting a portion of the hub into one of the plurality of needle receiving ports.

23. The method of claim 13, wherein the access needle has a needle size of 15 gauge or 16 gauge, and wherein the biopsy needle has a needle size of 18 gauge.

24. A method of performing a transperineal biopsy procedure on a prostate of a patient using an ultrasound probe configured to provide imaging, the patient comprising a perineal access site leading to the prostate, the ultrasound probe including a shaft and a handle proximal to the shaft, the method comprising:

inserting an access needle into one of a plurality of needle receiving ports of a displacement member of a transperineal biopsy guide that is secured to the ultrasound probe, the access needle including a tubular shaft and a lumen extending through the tubular shaft, the lumen sized to receive a biopsy needle therethrough, the transperineal biopsy guide operably coupled to the ultrasound probe and including a guide member and the

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displacement member, the displacement member configured to slide relative to the guide member;

securing the access needle to the one of a plurality of needle receiving ports of the displacement member such that position and angle of the access needle relative to the displacement member is maintained and further insertion of the access needle relative to the displacement member is restricted;

imaging the prostate of the patient with the ultrasound probe;

inserting the access needle into the perineal access site of the patient; and

inserting the biopsy needle through the access needle and into a first location of the prostate of the patient.

25. The method of claim 24, wherein securing the access needle to the one of a plurality of needle receiving ports of the displacement member includes inserting a structure that is engaged with the tubular shaft of the access needle into the one of a plurality of needle receiving portions of the displacement member.

26. The method of claim 25, wherein the structure is a hub of the access needle, the hub coupled to the tubular shaft.

27. The method of claim 24, wherein the guide member includes a first stabilization member having a first groove, and a second stabilization member having a second groove, the first and second stabilization members opposing each other, wherein a portion of the displacement member is configured to be received within the first and second grooves.

28. The method of claim 24, further comprising:

taking a first biopsy of the first location of the prostate of the patient via the biopsy needle;

taking a second biopsy of a second location of the prostate of the patient via the biopsy needle, the second location being different than the first location, wherein the access needle remains positioned within the perineal access site of the patient for the first biopsy and the second biopsy.

29. The method of claim 24, wherein the access needle has a needle size of 15 gauge or 16 gauge, and wherein the biopsy needle has a needle size of 18 gauge.

30. The method of claim 24, wherein securing the access needle to the one of a plurality of needle receiving ports of the displacement member restricts rotation of the access needle relative to the displacement member.

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