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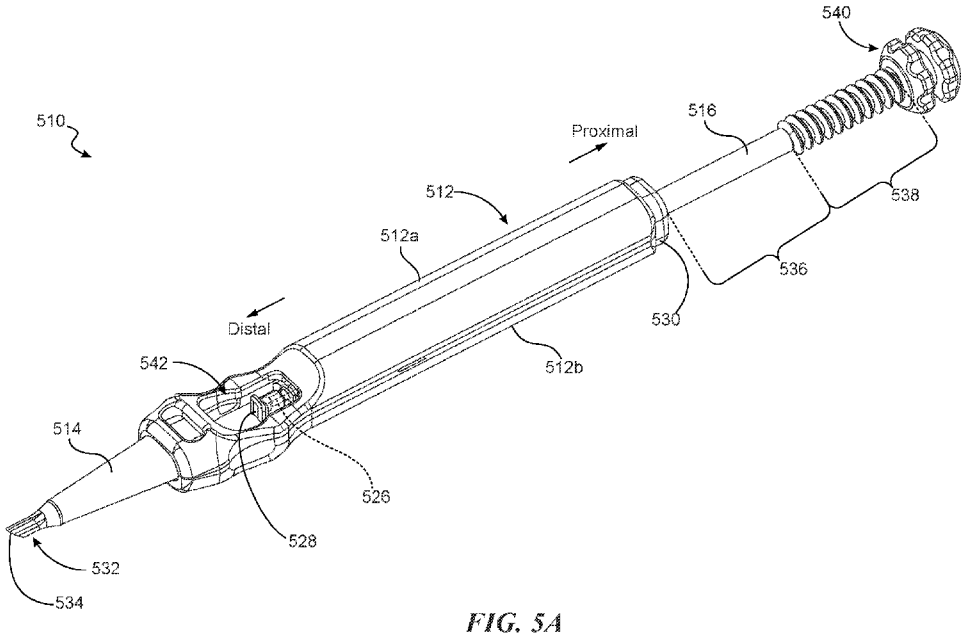


FIG. 5A

(57) Abstract: The present technology relates to delivery systems for accommodating intraocular lenses and associated methods for making and using such systems. At least some of the delivery systems configured in accordance with embodiments of the present technology are configured to receive a base of an AIOL and include a drive shaft configured to displace the base within the delivery system and one or more motion control features configured to create a resistive force that "pauses" movement of the drive shaft. Pausing the movement of the drive shaft is expected to help prevent users from over-advancing the drive shaft and/or applying excessive amounts of force to the base while moving the base through the delivery system.

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DELIVERY SYSTEMS FOR ACCOMMODATING INTRAOCULAR LENSES AND ASSOCIATED METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional Patent App. No. 63/612,926, filed December 20, 2023, and U.S. Provisional Patent App. No. 63/649,194, filed May 17, 2024, both of which are hereby incorporated by reference herein in their entireties.

TECHNICAL FIELD

[0002] The present technology relates to delivery systems for accommodating intraocular lenses and associated methods for making and using such systems.

BACKGROUND

[0003] Cataracts can affect a large percentage of the worldwide adult population with clouding of the native crystalline lens and resulting loss of vision. Patients with cataracts can be treated by native lens removal and surgical implantation of a synthetic intraocular lens (IOL).

[0004] Worldwide, there are millions of IOL implantation procedures performed annually. In the U.S., there are 3.5 million cataract procedures performed, while worldwide there are over 20 million annual procedures performed.

[0005] Although IOL implantation procedures can be effective at restoring vision, conventional IOLs have several drawbacks. For example, many prior IOLs are not able to change focus as a natural lens would (known as accommodation). Other drawbacks of conventional IOLs include refractive errors that occur after implantation and require glasses for correcting distance vision, or in other cases the IOLs can be effective in providing good far vision, but patients need glasses for intermediate and near vision.

[0006] Several multi-focal IOLs have been developed to address these drawbacks, but they too can have drawbacks. For example, although multi-focal IOLs generally perform well for reading and distance vision, in at least some instances such multi-focal IOLs may cause significant glare, halos, reduced contrast sensitivity, and other visual artifacts.

[0007] AIOLs have been proposed to provide accommodative optical power in response to the distance at which a patient views an object. However, such AIOLs are generally still in

development and have different drawbacks. For example, prior AIOLs can provide insufficient accommodation after implantation or produce suboptimal refractive correction of the eye. The amount of accommodation of the prior AIOLs can also decrease after implantation in at least some instances. The prior AIOLs can also be too large to be inserted through a small incision of the eye and may require the incision to be somewhat larger than would be ideal. Also, at least some of the prior AIOLs can be unstable when placed in the eye, which can lead to incorrect accommodation and other errors.

[0008] Improved implantable intraocular lenses that accommodate with the natural mechanisms of controlling focusing of the eye that overcome at least some of the above deficiencies would be desirable. Ideally, such improved AIOLs would provide increased amounts of accommodation when implanted, provide refractive stability, introduce few if any perceptible visual artifacts, and allow the optical power of the eye to change from far vision to near vision in response to the distance of the object viewed by the patient.

[0009] Implanting fluid-filled AIOLs and other accommodating lenses presents additional challenges. For example, AIOLs are at least generally elastic, which allows an AIOL to be folded or compressed through relatively small incisions in a patient's eye. However, many AIOLs have a relative spring force that causes them to unfold or expand as and/or after the AIOL passes through the incision. This unfolding/expansion can occur rapidly, which can make the AIOL difficult to control and/or reduce the accuracy with which the AIOL can be positioned within the eye. Moreover, the spring force of the AIOL can be amplified by the fluid contained within the AIOL, which is also subject to compressive forces when the AIOL is folded/compressed. Accordingly, there is a need for an injector that provides accuracy and control while delivering the lens through the incision site and deploying inside the eye.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Many aspects of the present technology can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale. Instead, emphasis is placed on illustrating clearly the principles of the present technology. Furthermore, components can be shown as transparent in certain views for clarity of illustration only and not to indicate that the component is necessarily transparent. Components may also be shown schematically.

[0011] FIG. 1 is a partially exploded perspective view of an adjustable or accommodating intraocular lens configured in accordance with embodiments of the present technology.

[0012] FIG. 2 is a perspective view of a delivery system configured in accordance with embodiments of the present technology.

[0013] FIG. 3 is a perspective view of another delivery system configured in accordance with embodiments of the present technology.

[0014] FIG. 4 is a perspective view of another delivery system configured in accordance with embodiments of the present technology.

[0015] FIG. 5A is a perspective view of another delivery system configured in accordance with embodiments of the present technology.

[0016] FIG. 5B is an exploded view of the delivery system of FIG. 5A.

[0017] FIG. 5C is a perspective view of a portion of the delivery system of FIG. 5A and a base of the AIOL of FIG. 1.

[0018] FIG. 5D is a top cross-sectional view of a portion of the delivery system of FIG. 5A.

[0019] FIG. 5E is a side cross-sectional view of a portion of the delivery system of FIG. 5A.

[0020] FIG. 5F is a side cross-sectional view of a tip portion of the delivery system of FIG. 5A.

[0021] FIGS. 6A–6E are side cross-sectional views of an injector tip of the delivery system of FIG. 5A during select stages of an AIOL delivery process in accordance with embodiments of the present technology.

[0022] FIGS. 7–9 are perspective views of respective actuation mechanisms for an AIOL delivery system configured in accordance with embodiments of the present technology.

[0023] FIGS. 10A and 10B are perspective views of an AIOL cartridge configured in accordance with embodiments of the present technology.

[0024] FIGS. 11A and 11B are perspective views of another delivery system configured in accordance with embodiments of the present technology.

[0025] FIGS. 12A and 12B are perspective views of a pusher member for a delivery system configured in accordance with embodiments of the present technology.

[0026] FIG. 13 is a side cross-sectional view of another pusher member configured in accordance with embodiments of the present technology.

[0027] FIGS. 14A–14E are side cross-sectional views of an injector tip of a delivery system during select stages of an AIOL delivery process in accordance with embodiments of the present technology.

[0028] FIG. 15A is a perspective view of another delivery system configured in accordance with embodiments of the present technology.

[0029] FIG. 15B is a perspective view of an adapter of the delivery system of FIG. 15A.

DETAILED DESCRIPTION

[0030] The present technology is directed to delivery systems for intraocular lenses, including multi-component adjustable intraocular lenses, and associated methods of making and using such systems. In some embodiments, the delivery systems are configured to receive a base of an AIOL and include (i) a drive shaft configured to displace the base within the delivery system and (ii) one or more motion control features configured to at least partially resist movement (e.g., further movement) of the drive shaft, e.g., during the displacement of the base within the delivery system. In at least some embodiments, for example, the motion control features are configured to create a resistive force that "pauses" movement of the drive shaft unless or until that resistive force is overcome by a user. Pausing movement of the drive shaft is expected to help prevent users from over-advancing the drive shaft and/or applying excessive amounts of force to the base while moving the base through the delivery system.

[0031] At least some of the delivery systems described herein are configured to provide finer/increased control at one or more points in the injection process during which the base is expected to experience the greatest magnitudes of forces, such as when the base passes through the distal terminus of the delivery system. During these and/or other points in the injection process, the delivery systems of the present technology can allow the user to controllably inject the base into the patient's eye while reducing, or even preventing, sudden changes in the forces applied to the base. This, in turn, is expected to increase the control/precision with which the base is positioned within the patient's eye and/or reduce the likelihood that the base breaks during the injection process.

[0032] Specific details of various embodiments of the present technology are described below with reference to FIGS. 1–15B. Although many of the embodiments are described below with respect to AIOLs and associated methods, other embodiments are within the scope of the present technology. Additionally, other embodiments of the present technology can have different configurations, components, and/or procedures than those described herein. For instance, delivery systems configured in accordance with the present technology may include additional elements and features beyond those described herein, or other embodiments may not include several of the elements and features shown and described herein.

[0033] As used herein, the use of relative terminology, such as "about," "approximately," "substantially" and the like refer to the stated value plus or minus ten percent. For example, the use of the term "about 100" refers to a range of from 90 to 110, inclusive. In instances in which the context requires otherwise and/or relative terminology is used in reference to something that does not include a numerical value, the terms are given their ordinary meaning to one skilled in the art.

[0034] FIG. 1 is a partially exploded perspective view of an adjustable or accommodating intraocular lens 100 ("AIOL 100") configured in accordance with embodiments of the present technology. The AIOL 100 can include an adjustable or base lens structure 102 ("base 102") and a fixed power and/or fixed depth of focus lens 104 ("fixed lens 104") that can be removably coupled to the base 102. The base 102 can include or define a fluid-filled adjustable lens 106 configured to provide an adjustable optical power. The base 102 can define a recess or area 108 configured to receive the fixed lens 104. When the base 102 is implanted within a patient's eye, the area 108 can be positioned anterior to the adjustable lens 106, for example, to allow the fixed lens 104 to be positioned within the area 108 while the base 102 is *in vivo*. The fixed lens 104 can be configured to provide a fixed (e.g., static, non-accommodating, non-adjustable) optical power. Additional details regarding AIOLs can be found in International Patent App. No. PCT/US24/52058, filed October 18, 2024, the entirety of which is incorporated by reference herein.

[0035] FIG. 2 is a perspective view of a delivery system 210 ("system") configured in accordance with embodiments of the present technology. The delivery system 210 can include a body 212, a tip portion 214, and an actuator 216. The delivery system 210, and/or one or more elements thereof, can include one or more polymers such as Polypro® and/or other suitable

materials. As illustrated in FIG. 2, the delivery system 210 is configured to receive a base cartridge 218 and a fixed lens cartridge 220.

[0036] The tip portion 214 can be coupled to the body 212. At least a distal portion of the tip portion 214 can be configured to be positioned within an eye of a patient, for example, to facilitate delivery of an AIOL. For example, a distalmost region of the tip portion 214 can be configured to be insertable through an incision of up to about 3.2 mm or about 3.5 mm.

[0037] The actuator 216 can be operably coupled to the body 212 and configured to displace an AIOL from within the tip portion 214 when actuated. The actuator 216 can include a plunger, a screw, a push-button, and/or one or more other suitable actuators.

[0038] The base cartridge 218 can be configured to contain the base 102 for the AIOL 100 (FIG. 1). The base cartridge 218 can be received within/coupled to the tip portion 214 via an opening therein. The base cartridge 218 can define a proximal opening configured to allow the actuator 216 to engage the base 102 and a distal opening configured to allow the actuator 216 to displace the base 102 from within the base cartridge 218. The base 102 can be preloaded into the base cartridge 218 during, e.g., manufacturing, such that a user need not perform this step. In some embodiments, the base 102 and/or the base cartridge 218 can be hydrated before, during, and/or after the base 102 and/or the base cartridge 218 are received within the delivery system 210. Additionally, or alternatively, an ophthalmic viscosurgical device (OVD) can be dispensed into the base cartridge 218 before, during, and/or after the base 102 is received within the base cartridge 218. To reduce the risk of implantation errors, the base 102 can be preloaded into the base cartridge 218, e.g., during manufacturing.

[0039] The fixed lens cartridge 220 can be configured to contain the fixed lens 104 for the AIOL 100 (FIG. 1). The fixed lens cartridge 220 can be received within and/or coupled to the tip portion 214 via the opening therein (e.g., the same opening used to receive the base cartridge 218). The fixed lens cartridge 220 can define a proximal opening configured to allow the actuator 216 to engage the fixed lens 104 and a distal opening configured to allow the actuator 216 to displace the fixed lens 104 from within the fixed lens cartridge 220. To reduce the risk of implantation errors, the fixed lens 104 can be preloaded into the fixed lens cartridge 220, e.g., during manufacturing.

[0040] During an implantation procedure, a user (not shown) can position the base cartridge 218 within the tip portion 214, position a distalmost region of the tip portion 214 within

a patient's eye (e.g., within a capsular bag of the patient's eye), and actuate the actuator 216 to displace the base 102 outwardly from within the base cartridge 218 and into the patient's eye. The user can then remove the base cartridge 218, replace it with the fixed lens cartridge 220, and again actuate the actuator 216 to displace the fixed lens 104 outwardly from within the fixed lens cartridge 220 and/or into the patient's eye. The fixed lens 104 can be operably coupled to the base 102 as described with reference to at least FIG. 1.

[0041] FIG. 3 is a perspective view of another delivery system 310 configured in accordance with embodiments of the present technology. At least some aspects of the delivery system 310 can be at least generally similar or identical in structure and/or function to one or more features of the delivery system 210 of FIG. 2. Accordingly, like names and/or references numbers (e.g., body 312 versus the body 212 of FIG. 2) are used to indicate at least generally similar or identical features. However, whereas the delivery system 210 includes replaceable component cartridges for the base 102 and the fixed lens 104, respectively, the delivery system 310 includes separate tip portions for the base 102 and the fixed lens 104. In the illustrated embodiment, for example, the delivery system 310 includes a base delivery tip 322 and a fixed lens delivery tip 324. The base delivery tip 322 can be configured to receive (e.g., be preloaded with) the base 102 (not shown in FIG. 3) and the fixed lens delivery tip 324 can be configured to receive (e.g., be preloaded with) the fixed lens 104 (not shown in FIG. 3). In at least some embodiments, the base delivery tip 322 and/or the fixed lens delivery tip 324 are single-use or non-reusable components. The body 312 can be reusable or a single-use component. Both the base delivery tip 322 and the fixed lens delivery tip 324 can be releasably coupled to the body 312 at various times during an implant procedure. For example, the base delivery tip 322 can be operably coupled to the body 312 to allow the base 102 to be positioned within a patient's eye. Once the base 102 is so positioned, the base delivery tip 322 can be removed from the body 312 and the fixed lens delivery tip 324 can be operably coupled to the body 312 to allow the fixed lens 104 to be positioned within the patient's eye. The fixed lens delivery tip 324 can be configured to deliver the fixed lens 104 through an incision that is smaller than the incision used to deliver the base 102.

[0042] FIG. 4 is a perspective view of another delivery system 410 configured in accordance with embodiment of the present technology. At least some aspects of the delivery system 410 can be at least generally similar or identical in structure and/or function to one or more features of the delivery system 210 of FIG. 2 and/or the delivery system 310 of FIG. 3.

Accordingly, like names and/or references numbers (e.g., body 412 versus the body 212 of FIG. 2 and/or the body 312 of FIG. 3) are used to indicate at least generally similar or identical features. However, the body 412 of the delivery system 410 can be integrated with a tip portion 414 of the delivery system 410, e.g., to form a single-piece component. Accordingly, the user does not need to load any AIOL components into the delivery system 410 prior to use in a procedure; instead; this process can be handled by the manufacturer and the delivery system 410 can be shipped to the user in a ready-for-use state. In the illustrated embodiment, for example, the base 102 of the AIOL 100 (FIG. 1) is loaded into the tip portion 414. In other embodiments, the fixed lens 104 of the AIOL 100 (FIG. 1) can be loaded into the tip portion 414.

[0043] FIG. 5A is a perspective view of another delivery system 510 configured in accordance with embodiments of the present technology. FIG. 5B is an exploded view of the delivery system 510. Referring to FIGS. 5A and 5B together, the delivery system 510 can include a body 512, an injector tip 514, an actuator 516, a drive shaft 526, a pusher member 528, and a receiving feature or nut 530. The body 512 can be configured to receive an intraocular lens (e.g., the AIOL 100 of FIG. 1) and can include a first or upper portion 512a and a second or lower portion 512b. The injector tip 514 can be coupled to the body 512 at a distal end portion of the body 512 and can include a distal portion 532 that defines a distalmost terminus 534 of the delivery system 510. In some embodiments, one or more interior surfaces of the injector tip 514 are sloped or tapered to, e.g., compress, fold, slow, etc. the base 102 (FIG. 1) as the base 102 passes through the injector tip 514.

[0044] The actuator 516 can be operably coupled to the body 512 (via, e.g., the receiving feature 530) and to the drive shaft 526. The actuator 516 can include a first or distal portion 536, a second or proximal portion 538, and a handle 540. The first portion 536 and/or the second portion 538 can be configured to adjust how the actuator 516 moves relative to the body 512. In the illustrated embodiment, for example, the second portion 538 is threaded and the first portion 536 is unthreaded. The pusher member 528 can be coupled to a distal end of the drive shaft 526. Accordingly, a user can move the actuator 516 relative to the body (in, e.g., a distal direction) and thereby move the drive shaft 526 and the pusher member 528 toward and/or into the injector tip 514, e.g., to displace an intraocular lens (e.g., the AIOL 100) from within the body 512 and/or into an eye of a patient.

[0045] The receiving feature 530 can define an opening (not shown) configured to threadably/rotatably engage the second portion 538, e.g., while allowing the first portion 536 to

move slidably and/or rotatably through the receiving feature 530. Accordingly, when the first portion 536 is positioned at least partially within the receiving feature 530, the user can advance the first portion 536 of the actuator 516 distally through, and/or rotate the first portion 536 freely relative to, the receiving feature 530. Likewise, when the second portion 538 is positioned at least partially within the receiving feature, the user can advance the second portion 538 of the actuator 516 distally through the receiving feature 530 by rotating the actuator 516 relative to the receiving feature 530. The user can manipulate, grip, and/or otherwise interact with the handle 540 to cause these and/or other movements of the actuator 516 relative to the body 512. The threaded configuration of the second portion 538 can provide more precise control over the position and/or movement of the actuator 516 (e.g., relative to the unthreaded first portion 536), but in doing so may reduce the speed at which the user can advanced the actuator 516 distally through the body 512. Accordingly, the first portion 536 and/or the second portion 538 can provide different levels of control over the advancement of the drive shaft 526. In some embodiments, the first portion 536 or both the first and second portions 536, 538 can be threaded. In some embodiments, the pitch of the threading (of, e.g., the second portion 538) can vary along the length of the second portion 538 to, e.g., increase or decrease the displacement of the drive shaft 526 for a given rotation of the actuator 516. In at least some embodiments, for example, a proximal portion of the threading can have a first pitch and a distal portion of the threading can have a second pitch less than the first pitch, e.g., to provide increased control over the actuator 516 as the base 102 moves through the distal portion 532 of the injector tip 514 and forces on the base 102 increase, as described below with reference to FIGS. 6A–6D.

[0046] In some embodiments, the body 512 can define an opening or aperture 542. The opening 542 can be configured to receive one or more cartridges, such as the base cartridge 218 and/or the fixed lens cartridge 220 of FIG. 2. When positioned within the opening 542, the cartridge can be aligned with the pusher member 528. Accordingly, the user can move the actuator 516 relative to the body 512 such that the pusher member 528 displaces an AIOL base (such as the base 102 of FIG. 1) and/or an AIOL fixed lens (such as the fixed lens 104 of FIG. 1) from within the cartridge and/or at least partially into and/or through the injector tip 514.

[0047] FIG. 5C is a perspective view of a portion of the delivery system 510 and the base 102 of the AIOL 100 (FIG. 1). In some embodiments, the base 102 and/or the fixed lens 104 (not shown in FIG. 5C) can be placed within (e.g., directly within) the body 512 via the opening 542, e.g., without using a cartridge or other component that houses or otherwise contains the

base 102 and/or the fixed lens 104. The base 102 can be oriented within the delivery system 510 so that a visual indicator 599 of the base 102 is proximate to/pointing toward the injector tip 514. In some embodiments, the pusher member 528 includes a detent and/or other positional fiducial feature configured to engage an indent or flowthrough feature in the outer periphery of the base 102 and opposite the visual indicator 599, e.g., to keep the base 102 in the orientation shown in FIG. 5C. The pusher member 528 can be withdrawn (e.g., proximally) to allow the base 102 to be received through the opening 542 and then advanced (e.g., distally) to move the base 102 toward, into, and/or through the injector tip 514.

[0048] FIG. 5D is a top cross-sectional view of a portion of the delivery system 510. As best shown in FIG. 5D, the actuator 516 can include a circular slot or narrowed region 544 and the drive shaft 526 can include an annular tab 546 configured to be movably (e.g., rotatably) received within the annular slot 544. This engagement between the annular slot 544 and the annular tab 546 can allow the user to rotate the actuator 516 relative to the drive shaft 526 without, or at least substantially without, rotating the drive shaft 526. As the user advances the actuator 516 (e.g., distally), the pusher member 528 can contact and/or drive the base 102 toward, into, and/or through the injector tip 514.

[0049] FIG. 5E is a side cross-sectional view of a portion of the delivery system 510. As shown in FIG. 5E, the body 512 (e.g., the second portion 512b of the body 512) can define one or more motion control features 548, each of which can be configured to operably engage the drive shaft 526, e.g., by receiving a detent or other fiducial feature 554 extending from the drive shaft 526. In at least some embodiments, for example, the motion control features 548 can include one or more indents 550 (individually identified as a first or proximal indent 550a and a second or distal indent 550b) and/or one or more channels 552 (individually identified as a first or proximal channel 552a and a second or distal channel 552b). The one or more indents 550 and the one or more channels 552 can be arranged in series relative to one another. In the illustrated embodiment, for example, the first channel 552a is positioned between the first and second indents 550a, 550b, and the second channel 552b is positioned distally of the second indent 550b. In other embodiments, the one or more indents 550 and/or the one or more channels 552 can be arranged in other suitable orders.

[0050] As the drive shaft 526 moves through (e.g., distally through) the body 512, the detent 554 can engage the motion control features 548 (e.g., the one or more indents 550 and/or the one or more channels 552) successively. The one or more indents 550 can be configured to

at least partially resist movement (e.g., further movement) of the drive shaft 526. In at least some embodiments, for example, when the detent 554 is received within one of the indents 550, the contact between the indent 550 and the detent 554 can create a resistive force that at least partially resists movement of the drive shaft 526 relative to the body 512. This resistance to the movement of the drive shaft 526 can pause movement of the base 102 through the injector tip 514 (FIGS. 5C and 5D) which, in turn, can improve the user's control over the positioning of the base 102 during an implantation procedure and/or reduce the risk that the base 102 is inadvertently deployed from the delivery system 510. The user can apply increased force to the drive shaft 526 (via, e.g., the actuator 516) to overcome the resistive force and continue moving the drive shaft 526 through the body 512. The one or more channels 552 can allow the detent 554 to freely move along their length and, by extension, allow the drive shaft 526 to freely move through the body 512. In some embodiments, a spring or other damping element (not shown) can act against the actuator 516 and/or the drive shaft 526, e.g., to provide further resistance to the movement of these components.

[0051] The locations of one or more of the motion control features 548 can be based at least partially on the travel path of the base 102 through the delivery system 510. In at least some embodiments, for example, the first indent 550a can be positioned such that, when the detent 554 is received within the first indent 550a, the pusher member 528 is withdrawn from the opening 542 (FIG. 5C) in, e.g., a loading position to allow the base 102 to be seated within the body 512. Additionally, or alternatively, the second indent 550b can be positioned such that, when the detent 554 is received within the second indent 550b, a leading/proximal-most edge of the base 102 is positioned at least partially within or otherwise contacting the distal portion 532 (FIGS. 5A and 5B) of the injector tip 514 in, e.g., a pre-delivery position. It can be advantageous to resist or pause further movement of the drive shaft 526 when the base 102 is at these and/or other locations, e.g., to provide the user with feedback (e.g., haptic feedback, tactile feedback, audible feedback, etc., caused by the detent 554 engaging these motion control features 548) regarding the current operational state of the delivery system 510 and/or to reduce the risk that the base 102 is inadvertently deployed from and/or damaged by the delivery system 510. In some embodiments, a surgical assistant can (i) load the base 102 into the delivery system 510, (ii) actuate the drive shaft 526 from the loading position toward and/or to the pre-delivery position, and (iii) hand the delivery system 510 with the drive shaft 526 in the pre-load position to a practitioner so that the practitioner can use the delivery system 510 to position the base 102 within the patient's eye. The distance between the first indent 550a and the second indent 550b

(e.g., the length of the first channel 552a) can be equal to, or at least approximately equal to, the distance the base 102 travels/is displaced between the opening 542 and the distal portion 532 of the injector tip 514.

[0052] In some embodiments, the motion control features 548 can include the one or more indents 550 and omit the one or more channels 552. In at least some embodiments, for example, the motion control features 548 include a plurality of indents 550 arranged in series, e.g., adjacent to or immediately adjacent to one another. In such embodiments, the user can advance the drive shaft 526 incrementally through the plurality of indents 550, with the drive shaft 526 pausing as the detent 554 engages each successive indent 550, providing finer control over the positioning of the base 102 within the delivery system 410.

[0053] FIG. 5F is a side cross-sectional view of the injector tip 514 of the delivery system 510 (FIGS. 5A and 5B). As best seen in FIG. 5F, the distal portion 532 of the injector tip 514 can include a tapered region 556a, a barrel region 556b, and a beveled region 556c. The tapered region 556a can be angled, inwardly-sloped, or otherwise configured to compress the base 102 (FIGS. 5C and 5D) passing distally through the tapered region 556a. The barrel region 556b can have a constant, or at least generally constant, inner diameter configured to prevent, or at least partially prevent, further compression of the portion of the base 102 positioned therewith. The beveled region 556c can define the distalmost terminus 534 and can be configured to form an incision within an eye of a patient and/or form the incision. In some embodiments, the beveled region 556c can be angled and the angle of the beveled region 556c can be selected to allow the AIOL to be quickly and controllably delivered into the eye in a desired position and/or orientation, e.g., without flipping or inverting. In some embodiments, the angle of the beveled region 556c is, relative to a longitudinal axis of the delivery system 510, about 20 degrees, 25 degrees, 30 degrees, 35 degrees, 40 degrees, 45 degrees, 50 degrees, 55 degrees, or 60 degrees.

[0054] The distal portion 532 can have an outer diameter that is less than or equal to about 3.5 mm, 3.25 mm, 3 mm, 2.75 mm, 2.5 mm, 2.25 mm, or 2 mm. The overall length of the distal portion 532 can be less than a diameter of the base 102 (FIGS. 5C and 5D). In at least some embodiments, for example, the distal portion 532 can have a length that is up to 5%, 10%, 20%, 25%, 30%, 35%, 40%, 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 90%, or 99% of the diameter of the base 102. The diameter of the base 102 can be a diameter of the base 102 in a native, resting, or uncompressed/unstressed state. Additional details regarding injector tips and

other aspects of AIOL delivery systems can be found in U.S. Patent App. Pub. No. US 2022/0192818, the entirety of which is hereby incorporated by reference.

[0055] FIGS. 6A–6E are side cross-sectional views of the injector tip 514 during select stages of an AIOL delivery process in accordance with embodiments of the present technology. Specifically, FIGS. 6A–6E illustrate how fluid 658 within the base 102 is redistributed as the base 102 passes through the distal portion 532 of the injector tip 514. FIG. 6A, for example, shows how the fluid 658 is distributed before the base 102 engages the distal portion 532.

[0056] Referring to FIG. 6B, as the tapered region 556a compresses a distal portion of the base 102, the fluid 658 within the base 102 can redistribute/shift proximally (as shown by arrow P), increasing forces within a proximal portion of the base 102. Increasing the fluid pressure and/or other forces within the proximal portion of the base 102 can, in turn, increase a magnitude one or more forces applied to the base 102 itself. In at least some embodiments, for example, the fluid redistribution within the base 102 can stress and/or strain the base 102 and, based at least in part on the magnitude of the stress/strain, increase the likelihood that the base 102 will break or otherwise fail during injection.

[0057] Referring to FIG. 6C, as the pusher member 528 continues to move the base 102 distally through the injector tip 514, the base 102 can pass through an equilibrium position. The equilibrium position can be associated with a change to the distribution of the fluid 658 within the base 102. When the base 102 is positioned at or distally beyond (e.g., immediately distally beyond) the equilibrium position, the compressive forces (from, e.g., the injector tip 514 and/or the distal portion 532 thereof) on the proximal portion of base 102 can be higher than the compressive forces on the distal portion of the base 102. In at least some embodiments, for example, when the base 102 is at or distally beyond the equilibrium position, at least part of the distal portion of the base 102 can be positioned exterior to and/or otherwise unconstrained by the injector tip 514, such as shown in FIG. 6C. Accordingly, when positioned at or distally beyond the equilibrium position, the balance of forces on the base 102 can cause the fluid 658 within the base 102 to redistribute or shift distally. This distal shift of the fluid 658 can urge the base 102 out from the injector tip 514 automatically, e.g., without further movement of the pusher member 528. In the illustrated embodiment, for example, the base 102 is positioned just distally beyond an equilibrium position and the fluid 658 within the base 102 has begun to shift distally, as shown by arrow D.

[0058] In at least some embodiments, acting on the base 102 with the pusher member 528 during the distal redistribution of the fluid 658 may damage the base 102 and/or cause an unintended change to the base's orientation within the eye. Accordingly, in at least some embodiments, one or more of the motion control features 548 (FIG. 5F), such as one or more of the indents 550 (FIG. 5F), can be positioned to arrest the drive shaft 526 and/or otherwise prevent a user from advancing the pusher member 528 any further distally once the base 102 is at or past the equilibrium position.

[0059] Referring to FIG. 6D, after the distal portion of the base 102 has begun to extend distally beyond the beveled region 556c (see, e.g., FIG. 6C), the base 102 can expand or otherwise return towards its resting/uncompressed state which, in turn, can allow the fluid 658 to redistribute/shift distally, increasing forces within a distal portion of the base 102. As described above with reference to at least FIG. 6C, this distal redistribution of fluid, shown by the arrow D in FIG. 6D, can urge (or continue to urge) the base 102 out from the injector tip 514 automatically, e.g., without further movement of the pusher member 528. For example, as best seen in FIGS. 6C and 6D, the pusher member 528 has the same (or a substantially similar) position relative to the injector tip 514 in both FIGS. 6C and 6D but the base 102 has moved further distally through the injector tip 514 and away from the pusher member 528 in FIG. 6D compared to FIG. 6C. The angled/beveled nature of the distal portion 532 of the injector tip 514 can, in at least some embodiments, cause the base 102 to exit the injector tip 514 along a path that is angled relative to a longitudinal axis of the injector tip 514, such as along a path defined at least in part by the arrow D.

[0060] Referring to FIG. 6E, after the base 102 exits the injector tip 514, the base 102 and the fluid 658 distribution can return toward and/or to the resting/uncompressed state shown in FIG. 6A, including flow/redistributing distally (as shown by arrow D). If unaccounted for, the fluid 658 flow/redistribution within the base 102 can create sudden changes in the forces applied to the base 102 which, in turn, can increase the likelihood that the base 102 bursts, breaks, or otherwise fails.

[0061] In some embodiments, the pusher member 528 (FIGS. 5A and 5B) can seal a space or volume 697 between the pusher member 528, the base 102, and an interior surface of the injector tip 514. The seal can be a substantially fluid-impermeable seal and/or can be configured to slow, or otherwise at least partially inhibit, distal movement of the base 102 brought about by fluid 658 redistribution within the base 102. For example, as the fluid 658 within the base 102

redistributes/shifts distally (e.g., as shown in FIG. 6C), the fluid 658 redistribution can create a distal force that urges the base 102 to rapidly exit the injector tip 514 without, e.g., the user moving the pusher member 528 further distally as described above. However, this distal force can be at least partially counteracted by a proximally-directed force created as the base 102 moves away from the pusher member 528 and, e.g., increases a volume of and/or decreases a pressure within the space 697. This proximally-directed vacuum force can be less than the distal fluid redistribution force such that the base 102 still exits the injector tip 514 automatically, but at a slower speed and/or in more controllable manner. Other features described herein (e.g., one or more of the actuation mechanisms described with reference to FIGS. 7–9), can also help control (e.g., reduce) the rate at which the base 102 exits the injector tip 514.

[0062] The structure of the injector tip 514, including the distal portion 532 and the regions 556 thereof described previously with reference to FIG. 5F, is expected to reduce or even minimize (i) the compressive forces on the base 102 during delivery, (ii) the internal pressures on the base 102 from the fluid 658 redistribution, and/or (iii) forces applied to the base 102 due to the fluid 658 redistribution. For example, the length of the barrel region 556b being less than the diameter of the base 102 in a native/resting state is expected to prevent the entire base 102 from being compressed within the barrel region 556b (and, accordingly, exposed to high compressive and/or internal fluid pressures) during delivery. This, in turn, is expected to reduce the likelihood that the base 102 fails (by, e.g., undergoing plastic deformation or bursting) during delivery.

[0063] FIG. 7 is a perspective view of an actuation mechanism 760 for an AIOL delivery system configured in accordance with embodiments of the present technology. Any of the delivery systems described herein can be configured to use the actuation mechanism 760 in addition to or instead of, e.g., the actuation mechanisms described and/or illustrated with reference to those delivery systems.

[0064] The actuation mechanism 760 can include a drive shaft 726, one or more motion control features 748, and a detent 754. The drive shaft 726, which can be at least generally similar to the drive shaft 526 (FIGS. 5A and 5B), can include the motion control features 748, which can be at least generally similar to the motion control features 548 (FIG. 5E). The detent 754, which can be at least generally similar to the detent 554 (FIG. 5E), is positioned to engage the one or more motion control features 748 to at least partially resist movement (e.g., further movement) of the drive shaft 726. The detent 754 can be supported in position by a spring

element 762 (e.g., a coil spring) configured to press the detent 754 against the drive shaft 726 and/or into engagement with the one or more motion control features 748. In some embodiments, the detent 754 and/or the spring element 762 are held in place by a set screw 764 or other adjustable support component. The set screw 764 can (i) apply a compressive force to the spring element 762 and/or (ii) be rotated to change (e.g., increase or decrease) the compressive force applied to the spring element 762 to, e.g., change (e.g., increase or decrease) the force with which the spring element 762 presses the detent 754 against the drive shaft 726 and/or into engagement with the one or more motion control features 748. Accordingly, the set screw 764 can be rotated to change the amount of resistance to further movement of the drive shaft 726 when the detent 754 engages the one or more motion control features 748.

[0065] In the illustrated embodiment, the motion control features 748 include one or more indents 750 (individually identified as first through sixth indents 750a-f, respectively), and each of the indents 750 can be configured to receive the detent 754 (e.g., in succession) as the drive shaft 726 is moved proximally and/or distally. The spacing between individual ones of the indents 750 can be selected based at least partially on a desired degree of control over the movement of the drive shaft 726. For example, the first through fourth indents 750a-d are immediately adjacent one another and, accordingly, can provide a finer degree of control over the movement of the drive shaft 726 compared to the fifth and sixth indents 750e, 750f, which are spaced farther apart from one another. In some embodiments, the detent 754 engages the fourth indent 750d at the same time as the drive shaft 726 positions the leading/proximal-most edge of the base 102 at least partially within or otherwise contacting a distal portion (e.g., distal portion 532 of FIG. 5A) of an injector tip (e.g., injector tip 514 of FIG. 5A). Accordingly, the immediately adjacent positioning of the first through third detents 750a-c can provide a greater degree of control over further distal movement of the base 102 through the distal portion of the injector tip, e.g., to prevent or at least partially prevent the user from applying excessive amounts of force to the base 102 as it nears the equilibrium position described above with reference to at least FIG. 6C.

[0066] FIG. 8 is a perspective view of an actuation mechanism 860 for an AIOL delivery system configured in accordance with embodiments of the present technology. Any of the delivery systems described herein can be configured to use the actuation mechanism 860 in addition to or instead of, e.g., the actuation mechanisms described and/or illustrated with reference to those delivery systems.

[0067] The actuation mechanism 860 can include a drive shaft 826, one or more motion control features 848, and a detent 854. The drive shaft 826, which can be at least generally similar to the drive shaft 526 (FIGS. 5A and 5B), can include the motion control features 848, each of which can be at least generally similar to the motion control features 548 (e.g., the indents 550) (FIG. 5E). The detent 854, which can be at least generally similar to the detent 554 (FIG. 5E), is positioned to selectively engage the one or more motion control features 848 to at least partially resist movement (e.g., further movement) of the drive shaft 826.

[0068] The detent 854 can be a portion of or coupled to a pivotable body or pawl 868.The motion control features 848 can include a rack gear 870, and the pawl 868 can be configured to operably engage the rack gear 870 to (i) allow the drive shaft 826 to move relative to the pawl 868 in a first (e.g., distal) direction and (ii) prevent the drive shaft 826 from moving relative to the pawl 868 in a second (e.g., proximal) direction opposite the first direction. In some embodiments, the actuation mechanism 860 can include a second rack gear and pawl operably associated with the drive shaft 826 and configured to prevent the drive shaft 826 from moving in the first direction to, e.g., "lock" the drive shaft 826 in a given position unless or until the second rack gear and pawl are disengaged to "unlock" the drive shaft 826. For example, the second rack gear can have teeth facing a direction opposite the teeth of the rack gear 870. The spacing between individual teeth in the rack gear 870 can be selected based at least in part on a desired degree of control over the movement of the drive shaft 826, as described previously herein with reference to at least FIG. 7. In at least some embodiments, for example, the spacing varies along the length of the rack gear 870 such that, e.g., some pairs of the teeth are closer to each other than other pairs of the teeth. In one example, a proximal subset of the teeth can have a first spacing and a distal subset of the teeth can have a second spacing less than the first spacing to, e.g., provide increased control over the drive shaft 826 as the base 102 moves through the distal portion 532 of the injector tip 514 and forces on the base 102 increase, as described herein with reference to at least FIGS. 6A–6D.

[0069] FIG. 9 is a perspective view of an actuation mechanism 960 for an AIOL delivery system configured in accordance with embodiments of the present technology. Any of the delivery systems described herein can be configured to use the actuation mechanism 960 in addition to or instead of, e.g., the actuation mechanisms described and/or illustrated with reference to those delivery systems.

[0070] The actuation mechanism 960 can include an actuator 916, a drive shaft 926, one or more racks or linear gears 970 (individually identified as a first linear gear 970a and a second linear gear 970b), and one or more pinions or circular gears 972 (individually identified as a first circular gear 972a and a second circular gear 972b). The actuator 916, which can be at least generally similar to the actuator 516 (FIG. 5A), can include the first linear gear 970a, and the drive shaft 926, which can be at least generally similar to the drive shaft 526 (FIGS. 5A and 5B), can include the second linear gear 970b. The first linear gear 970a is configured to operably engage the first circular gear 972a, the first circular gear 972a is configured to operably engage the second circular gear 972b, and the second circular gear 972b is configured to operably engage the second linear gear 970b. Accordingly, moving (e.g., linearly translating) the actuator 916 can rotate the first and second gears 972a, 972b and thereby move (e.g., linearly translate) the drive shaft 926. The ratios of the linear gears 970 and the circular gears 972, respectively, can be configured to increase or decrease the movement of the drive shaft 926 relative to the movement of the actuator 916. In at least some embodiments, for example, the ratios of one or more of the linear gears 970 and/or the circular gears 972 can be configured to slow the advancement of the drive shaft 926 as the drive shaft 926 travels further distally. This, in turn, can help control (e.g., reduce) the rate at which the base 102 exits the injector tip 514, as described previously with reference to at least FIGS. 6A–6D. In some embodiments, one or more of the circular gears 972 can be movably mounted (in addition to be rotatably mounted) such that the actuator 916 can be moved toward the drive shaft 926 and/or the drive shaft 926 can be moved toward the actuator 916 to, e.g., engage a detent and resist or prevent further movement of these components. In some embodiments, elliptical gears can be used in addition to or instead of one or more of the circular gears 972.

[0071] FIGS. 10A and 10B are perspective views of a cartridge 1018 and a cartridge carrier 1078 for use with an AIOL delivery system and configured in accordance with embodiments of the present technology. Referring to FIGS. 10A and 10B together, the cartridge 1018 includes a pair of prongs 1074 configured to releasably couple the cartridge 1018 to a delivery system, such as any of the delivery systems described previously herein. The cartridge 1018 can be configured to contain the base 102. In at least some embodiments, for example, the cartridge 1018 can be configured to receive and/or otherwise contain the base 102 in an alignment that facilitates injection via one or more of the injector systems described herein. In one specific example, the cartridge 1018 can be configured to align the base 102 in the orientation shown and described with reference to FIG. 5C. In other embodiments, the cartridge

1018 can be configured to contain the fixed lens 104 (FIG. 1), in addition to or instead of the base 102. The cartridge 1018 can define an opening or aperture 1076 through which the base 102 and/or the fixed lens 104 can be visualized. In some embodiments, the base 102 and/or the fixed lens 104 can be positioned within the cartridge 1018 via the opening 1076. Additionally, or alternatively, the cartridge 1018 can include a latching mechanism configured to control access to an interior of the cartridge 1018. The cartridge carrier 1078 can be configured to be releasably coupled to the cartridge 1018 and used to, for example, position the cartridge 1018 within a delivery system. In the illustrated embodiment, for example, the cartridge carrier 1078 includes one or more coupling features 1080 (individually identified as a first coupling feature 1080a and a second coupling feature 1080b) configured to receive and/or otherwise couple to one or more receiving features 1082 (individually identified as a first receiving feature 1082a and a second receiving features 1082b) of the cartridge 1018. The coupling features 1080 can be bent or deflected relative to one or more other portions of the cartridge carrier 1078 to cause the cartridge carrier 1078 to release the cartridge 1018.

[0072] FIGS. 11A and 11B are perspective views of another delivery system 1110 configured in accordance with embodiments of the present technology. Referring to FIGS. 11A and 11B together, the delivery system 1110 can include a body 1112, an injector tip 1114, a drive shaft 1126, a pusher member 1128, and an opening 1142, each of which can be at least generally similar to the correspondingly named and/or numbered feature of the delivery system 510 (of, e.g., FIG. 5A). Additionally, the delivery system 1110 includes a feedback window 1198. The feedback window 1198 can include an opening defined through the body 1112 and/or an at least partially transparent portion of the body 1112. The feedback window 1198 can be aligned with the drive shaft 1126 so that a user can view and/or otherwise determine a position of the drive shaft 1126 by looking through the feedback window 1198. As best shown in FIG. 11B, the drive shaft 1126 can include a position indicator 1197 configured to be aligned with and/or otherwise visible through the feedback window 1198 when, e.g., the position indicator 1197 is moved into alignment with the feedback window 1198. The position indicator 1197 can be coupled to the drive shaft 1126 such that, when position indicator 1197 is visible through the feedback window 1198, the drive shaft 1126 is in a predetermined position relative to the body 1112. In at least some embodiments, for example, the drive shaft 1126 is in the pre-delivery position described previously with reference to FIG. 5E or the base 102 is in the equilibrium position described previously with reference to at least FIG. 6C when the indicator 1197 is visible through the feedback window 1198.

[0073] FIGS. 12A and 12B are perspective views of a pusher member 1228 for a delivery system (e.g., the delivery system 510 of FIGS. 5A and 5B) configured in accordance with embodiments of the present technology. The pusher member 1228 includes a buffer or rod 1296 and a sleeve 1295. The rod 1296 can define a first distal-most terminus or face 1294 and can be seated on and/or otherwise coupled to a drive shaft 1226 (e.g., such as the drive shaft 526 of FIGS. 5A and 5B). The sleeve 1295 can define a second distal-most terminus or face 1293 and can be configured to be received around the rod 1296. The rod 1296 and/or the sleeve 1295 can be formed from silicone and/or one or more other suitable materials.

[0074] The pusher member 1228 can be configured to transition between a first configuration, shown in FIG. 12A, and a second configuration, shown in FIG. 12B. Referring to FIG. 12A, in the first configuration the second face 1293 of the sleeve 1295 can be positioned at least generally coplanar with the first face 1294 of the rod 1296. Friction forces at the interface between the sleeve 1295 and the rod 1296 can hold the faces 1293, 1294 in this coplanar alignment, e.g., unless or until a force greater than these friction forces is applied to the sleeve 1295. In at least some embodiments, for example, the pusher member 1228 is included as part of an intraocular lens delivery system that includes a tapered or narrowing injector tip, such as the injector tip 514 of FIGS. 5A and 5B. As the pusher member 1228 is advanced further distally into the injector tip 514, the cross-sectional area of the injector tip 514 decreases, which can increase the magnitude of the forces applied to the sleeve 1295 from the injector tip 514. Once the magnitude of these forces equals or exceeds the magnitude of the friction forces at the interface between the sleeve 1295 and the rod 1296, the rod 1296 can break free from the sleeve 1295 and continue to move distally, e.g., without the sleeve 1295. This movement of the rod 1296 relative to the sleeve 1295 can, in turn, transition the pusher member 1228 from the first configuration toward and/or to the second configuration (FIG. 12B), in which the second face 1293 of the sleeve 1295 is located proximal to the first face 1294 of the rod 1296.

[0075] Referring again to FIG. 12A, in some embodiments, the sleeve 1295 can include one or more wings or protruding portions 1292 projecting radially outward from one or more other portions of the sleeve 1295. The wings 1292 can be configured to increase the ability of the pusher member 1228 to seal against the interior of an injector tip, as described previously with reference to at least FIG. 6D. In some embodiments, the sleeve 1295 and/or the rod 1296 can include visual markers 1291 (individually identified as a first visual marker 1291a of the rod 1296 and a second visual marker 1291b of the sleeve 1295) that are colored and/or otherwise

configured to facilitate visualization of these components by a user. The user can view the visual markers 1291 to determine a position of the pusher member 1228 with a delivery system and/or compare the visual markers 1291 to determine a relative position of the rod 1296 and the sleeve 1295. In the illustrated embodiment, for example, the visual markers 1291a and 1291b are located at or proximate to the faces 1293, 1294 of the sleeve 1295 and the rod 1296, respectively, so if a user sees that the visual markers 1291a and 1291b are at least generally coplanar the user can determine that the faces 1293, 1294 are also at least generally coplanar and/or that the pusher member is in the first configuration.

[0076] FIG. 13 is a side cross-sectional view of another pusher member 1328 configured in accordance with embodiments of the present technology. At least some aspects of the pusher member 1328 can be at least generally similar or identical in structure and/or function to the pusher member 1228 of FIG. 12. For example, the pusher member 1328 can include a rod 1396 configured to be coupled to a drive shaft 1326 and a sleeve 1395 configured to be received around the rod 1396. However, in addition to or instead of the sleeve 1395 being held in place relative to the rod 1396 via friction forces, the sleeve 1395 and the rod 1396 can include respective coupling features 1390 (individually identified as a first coupling features 1390a and a second coupling feature 1390b) configured to releasably hold the sleeve 1395 in place relative to the rod 1396. In the illustrated embodiment, for example, the first coupling features 1390a include a detent or protrusion and the second coupling features 1390b include a channel or groove configured to receive the detent, e.g., to mechanically hold the sleeve 1395 in place relative to the rod 1396 unless or until a force greater than this mechanical hold (and any friction forces that are also present) is applied to the sleeve 1395. In some embodiments, the sleeve 1395 includes wings 1392 that are at least generally similar to the wings 1292 (FIG. 12), but only extend along a portion of a length of the sleeve 1395.

[0077] FIGS. 14A–14E are side cross-sectional views of the pusher member 1228 of FIGS. 12A and 12B during select stages of an AIOL delivery process in accordance with embodiments of the present technology. FIGS. 14A–14E are at least generally similar to FIGS. 6A–6E, but illustrate how a delivery processes involving the pusher member 1228 can differ from a delivery process involving the pusher member 528.

[0078] FIG. 14A shows how the fluid 658 is distributed before the base 102 engages the distal portion 532 of the injector tip 514. The pusher member 1228, including the rod 1296, the

sleeve 1295, and the drive shaft 1226, can be advanced distally together (in, e.g., the first configuration shown in FIG. 12A) to move the base 102 distally through the injector tip 514.

[0079] Referring to FIG. 14B, as the tapered region 556a compresses a distal portion of the base 102, the fluid 658 within the base 102 can redistribute/shift proximally (as shown by arrow P), increasing forces within a proximal portion of the base 102. The pusher member 1228 can be configured to remain in the first configuration (FIG. 12A) during all or at least a portion of this stage.

[0080] Referring to FIG. 14C, as the pusher member 1228 continues to move the base 102 distally through the injector tip 514, the base 102 can pass through the equilibrium position, e.g., as described previously with reference to at least FIG. 6C. At or distally beyond the equilibrium position, the balance of forces on the base 102 can cause the fluid 658 to redistribute/shift distally, shown by arrow D in FIG. 14C, and thereby urge the base 102 out from the injector tip 514 automatically, e.g., without further movement of the pusher member 528. Accordingly, in at least some embodiments, one or more of the motion control features 548 (FIG. 5F), such as one or more of the indents 550 (FIG. 5F), can be positioned to arrest the drive shaft 1226 and/or otherwise prevent a user from advancing the pusher member 1228 any further distally once the base 102 is at or past the equilibrium position. It may also, however, be advantageous to allow the user to continue to advance the drive shaft 1226 once the base 102 has traveled beyond the equilibrium position. In at least some embodiments, for example, the base 102 may become stuck or lodged in the distal portion 532 of the injector tip 514 such that the base 102 no longer exits the injector tip 514 automatically. Accordingly, in at least some embodiments, once the base 102 has reached or traveled beyond the equilibrium position, the user can continue to advance the drive shaft 1226 to cause the rod 1296 to break free from the sleeve 1295 and transition the pusher member 1228 from the first configuration (FIG. 12A) toward and/or to the second configuration (FIG. 12B). For example, referring to FIG. 14D, the rod 1296 can be configured (e.g., sized) to extend into and/or at least partially through the distal portion 532 of the injector tip 514, such that continued distal movement of the drive shaft 1226 can advance the base 102 through the distal portion 532. After the distal portion of the base 102 begins to extend distally beyond the beveled region 556c, the base 102 can expand or otherwise return towards its resting/uncompressed state, as shown in FIG. 14E. As best seen in FIG. 14E, in at least some embodiments the rod 1296 can be advanced entirely through the distal portion 532 of the injector tip 514 to fully displace the base 102 out from within the injector tip 514.

[0081] FIG. 15A is a perspective view of another delivery system 1510 configured in accordance with embodiments of the present technology. The delivery system 1510 can include a body 1512, an injector tip 1514, and an actuator 1516, each of which can be at least generally similar to the correspondingly named and/or numbered feature of one or more of the other delivery systems described herein. The delivery system 1510 can further include an adapter 1589 configured to releasably couple the injector tip 1514 to the body 1512. In the illustrated embodiment, for example, the adapter 1589 includes one or more coupling tabs 1588, a distal end portion of the body 1512 includes one or more docking features or recesses 1587, and each of the coupling tabs 1588 can be configured to be received within a corresponding one of the docking features 1587 to releasably couple the injector tip 1514 to the body 1512. In some embodiments, the adapter can be configured to receive an AIOL, such as the base 102 and/or the fixed lens 104 (FIG. 1), and/or a cartridge carrying an AIOL, such as any of the cartridges described herein.

[0082] FIG. 15B is a top view of the adapter 1589. Referring to FIGS. 15A and 15B together, in addition to the coupling tabs 1588, the adapter 1586 can also include one or more orientation tabs 1586. Each of the orientation tabs 1586 can be vertically offset from one or more of the coupling tabs 1588 and configured to prevent an AIOL, such as the base 102 and/or the fixed lens 104 (FIG. 1), and/or a cartridge carrying an AIOL, such as any of the cartridges described herein, from being loaded into the adapter 1586 from the wrong side. As best seen in FIG. 15B, in the illustrated embodiment the orientation tabs 1586 are positioned below the coupling tabs 1588 to prevent the AIOL and/or the cartridge from being loaded into the adapter 1589 from below.

[0083] The AIOL devices described herein may be implanted by preparing the eye and removing the native lens from the capsule in any appropriate manner. The fluid-filled structure may then be placed in the capsule of the eye. The patient may then be evaluated for a base optical power and/or astigmatic correction, and a fixed lens can be selected to provide the desired based power or astigmatic correction for the fluid-filled structure in the implanted state in the capsule of the eye. The specific fixed lens to provide the post-implant base power or astigmatic correction is then inserted into the previously implanted fluid-filled structure of the AIOL. The chosen fixed lens may then be coupled to the fluid-filled structure within the eye capsule. This is possible in the AIOLs of the present technology because the fixed lenses are anteriorly-positioned when implanted, e.g., positioned anterior to the adjustable lens and/or attached to the

anterior first component of the AIOLs. As described above, one or both of the fluid-filled accommodating structure or the fixed lens may be flexible such that they may be reconfigured (e.g., folded) to a reduced-profile delivery configuration for delivery into the lens capsule. In some instances, it may be required to make a further correction to the fixed portion after the time of the surgery. Such instance may occur anywhere from days to years after the surgery. At such times, the patient may return to the physician and the fixed lens may be replaced with a new fixed lens having a different optical power or other prescription. In such instances, the new prescription may be characterized prior to or after removal of the original fixed lens. In some instances, the new fixed lens may be fabricated and implanted at the time of the examination, in others the patient may return for implantation of the fixed lens sometime after the examination.

[0084] Several embodiments of the present technology are directed to a kit having an accommodating structure and a first fixed lens that has no optical base power. The kit can further include one or more second fixed lenses having various based powers or other optical properties. In practice, the accommodating structure can be implanted into the native eye capsule, and then the first fixed lens can be coupled to the accommodating structure. The optical properties of the implanted accommodating structure can then be assessed in situ with the first fixed lens in place to determine the desired optical properties of the fixed lens. If the optical properties of the assembled accommodating structure and first fixed lens without a base power are appropriate, then the system can remain implanted without additional changes. However, if a different base power or some other optical property is desired (e.g., toric or other asymmetrical optics), then the first fixed lens without a base power can be replaced with a second fixed lens having the desired optical properties based on the optical properties of the implanted accommodating portion with a fixed lens attached.

[0085] In some embodiments, the fixed portion of the AIOL may be fabricated from materials different from the accommodating portion. Such materials include hydrophilic or hydrophobic methacrylate or silicones and any other materials traditionally used in non-accommodating IOLs. The fixed lens may be fabricated from materials harder than those used for the accommodating portion. One or both of the accommodating portion/lens and the fixed portion/lens may be machined, cast molded (e.g., reactive cast molded), injected molded, and/or formed by other processes or combinations of processes. Any or all of the structures described herein may be constructed from a transparent or translucent material. For example, the above-

described accommodating structures and fixed lenses can be constructed from transparent materials, even if they are illustrated as opaque in the associated figures.

[0086] Any of the features of the intraocular lens systems described herein may be combined with any of the features of the other intraocular lenses described herein and vice versa. Additionally, several specific examples of embodiments in accordance with the present technology are set forth below in the following examples.

Examples

[0087] Several aspects of the present technology are set forth in the following examples:

1. A delivery system for a fluid-filled intraocular lens, the delivery system comprising:

a body configured to receive the fluid-filled intraocular lens;

an injector tip coupled to the body;

a drive shaft positioned at least partially within the body and operable to displace the fluid-filled intraocular lens distally through the body and the injector tip and into an eye of a patient; and

a motion control feature configured to operably engage the drive shaft to at least partially prevent further distal movement of the drive shaft once the fluid-filled intraocular lens has passed distally beyond an equilibrium position within the injector tip,

wherein the equilibrium position is associated with a change to a distribution of the fluid within the fluid-filled intraocular lens.

2. The delivery system of example 1 wherein the drive shaft includes a detent, and wherein the motion control feature includes an indentation in an interior surface of the body and positioned to receive the detent.

3. The delivery system of example 1 wherein the motion control feature includes a detent, and wherein the drive shaft includes an indentation positioned to receive the detent.

4. The delivery system of example 3 wherein the detent is held in place by a set screw operably coupled to the body and a spring element configured to press the detent against the drive shaft, and wherein the set screw is configured to be rotated relative to the body to

change a magnitude of the force with which the spring element presses the detent against the drive shaft.

5. The delivery system of any of examples 1–4 wherein the motion control feature is configured to arrest further distal movement of the drive shaft when the fluid-filled intraocular lens reaches the equilibrium position.

6. The delivery system of any of examples 1–5 wherein the motion control feature is a first motion control feature, and wherein the delivery system further comprises:

a second motion control feature configured to at least partially prevent further distal movement of the drive shaft when the drive shaft is in a loading position configured to allow the fluid-filled intraocular lens to be received within the body; and

a third motion control feature configured to at least partially prevent further distal movement of the drive shaft when the drive shaft is in a pre-delivery position in which the fluid-filled intraocular lens has been advanced into contact with the injector tip.

7. The delivery system of example 6 wherein:

the second motion control feature is positioned distally of the first motion control feature, and

the third motion control feature is positioned distally of the second motion control feature.

8. The delivery system of any of examples 1–7, further comprising the fluid-filled intraocular lens, wherein, once distal to the equilibrium position, the fluid-filled intraocular lens is configured to exit the injector tip without further distal movement of the drive shaft.

9. The delivery system of any of examples 1–8, further comprising a pusher member coupled to the drive shaft, wherein the pusher member is configured to contact the fluid-filled intraocular lens and, when the fluid-filled intraocular lens reaches the equilibrium position, seal a space within the injector tip between the fluid-filled intraocular lens and the pusher member to

increase a resistance to further distal movement of the fluid-filled intraocular lens through the injector tip.

10. The delivery system of any of examples 1–9, further comprising a pusher member, and wherein:

the pusher member includes—

a rod defining a first distal face and configured to be coupled to the drive shaft, and

a sleeve defining a second distal face and configured to be received around the rod;

the sleeve is configured to be held in place relative to the rod such that the first and second distal faces are at least generally coplanar during a first portion of the distal movement of the drive shaft; and

the rod is configured to be advanced distally relative to the sleeve such that the first distal face travels distally beyond the second distal face during a second portion of the distal movement of the drive shaft.

11. The delivery system of any of examples 1–10, further comprising a cartridge configured to contain the fluid-filled intraocular lens, wherein the body defines an opening proximal of the injector tip configured to receive the cartridge to position the fluid-filled intraocular lens distally of the drive shaft.

12. The delivery system of any of examples 1–11 wherein the delivery system is configured to transition the fluid-filled intraocular lens from a resting configuration toward and/or to a folded configuration.

13. The delivery system of any of examples 1–12 wherein the injector tip includes an interior surface configured to contact the fluid-filled intraocular lens, and wherein the interior surface is configured to transition the fluid-filled intraocular lens from as the fluid-filled intraocular lens moves distally along the interior surface.

14. The delivery system of any of examples 1–13 wherein the fluid-filled intraocular lens is a base lens of an adjustable intraocular lens system that defines an adjustable optical

power, and wherein the base lens is configured to receive a fixed lens having a fixed optical power.

15. The delivery system of any of examples 1–14 the equilibrium position is associated with a distal redistribution of the fluid within the fluid-filled intraocular lens.

16. A method for delivering a fluid-filled intraocular lens into an eye of a patient using a delivery system, the method comprising:

advancing a drive shaft of the delivery system distally to move the fluid-filled intraocular lens distally through the delivery system toward and/or into an injector tip of the delivery system;

engaging, with the drive shaft, a motion control feature of the delivery system to at least partially prevent further distal movement of the drive shaft when the fluid-filled intraocular lens passes distally beyond an equilibrium position within the injector tip, wherein the fluid-filled intraocular lens passing distally beyond the equilibrium position causes a distal redistribution of the fluid within the fluid-filled intraocular lens; and

delivering the fluid-filled intraocular lens.

17. The method of example 16 wherein:

the drive shaft includes a detent,

the motion control feature includes an indentation in an interior surface of the delivery system, and

engaging the motion control feature includes positioning the detent at least partially within the indentation.

18. The method of example 16 wherein:

the motion control feature includes a detent,

the drive shaft includes an indentation; and

engaging the motion control feature includes causing the indentation to receive the detent.

19. The method of any of examples 16–18 wherein delivering the fluid-filled intraocular lens includes allowing the fluid-filled intraocular lens to exit the injector tip automatically without further distal movement of the drive shaft.

20. The method of any of examples 16–19 wherein delivering the fluid-filled intraocular lens includes allowing the fluid-filled intraocular lens to exit the injector tip automatically while maintaining a position of the drive shaft relative to the injector tip.

21. The method of any of examples 16–20 wherein:

the delivery system includes a pusher member coupled to the drive shaft and configured to contact the fluid-filled intraocular lens, and

the method further comprises, when the fluid-filled intraocular lens reaches the equilibrium position, causing the pusher member to seal a space within the injector tip between the fluid-filled intraocular lens and the pusher member to increase a resistance to further distal movement of the fluid-filled intraocular lens through the injector tip.

22. The method of any of examples 16–21 wherein the injector tip includes an interior surface configured to contact the fluid-filled intraocular lens, and wherein advancing the drive shaft includes moving the fluid-filled intraocular lens along the interior surface to transition the fluid-filled intraocular lens from a resting configuration toward and/or to a folded configuration.

23. The method of any of examples 16–22 wherein positioning the fluid-filled intraocular lens within the delivery system includes positioning a cartridge containing the fluid-filled intraocular lens within the delivery system.

24. The method of any of examples 16–23 wherein the fluid-filled intraocular lens is a base lens of an adjustable intraocular lens system that defines an adjustable optical power, and wherein the base lens is configured to receive a fixed lens having a fixed optical power.

25. The method of any of examples 16–24 wherein the motion control feature is a first motion control feature and wherein the method further comprises, before positioning the fluid-filled intraocular lens within the delivery system, moving the drive shaft to a loading

position to allow the fluid-filled intraocular lens to be positioned within the delivery system, wherein moving the drive shaft to the loading position includes engaging, with the drive shaft, a second motion control feature configured to at least partially hold the drive shaft in the loading position.

26. The method of any of examples 16–25 wherein the motion control feature is a first motion control feature and wherein the method further comprises, before moving the fluid-filled intraocular lens to the equilibrium position, advancing the drive shaft into a pre-delivery position in which a distal portion of the fluid-filled intraocular lens is positioned in contact with the injector tip, wherein advancing the drive shaft into the pre-delivery position includes engaging, with the drive shaft, a second motion control feature configured to at least partially hold the drive shaft in the pre-delivery position.

Conclusion

[0088] The above detailed description of embodiments of the technology are not intended to be exhaustive or to limit the technology to the precise form disclosed above. Although specific embodiments of, and examples for, the technology are described above for illustrative purposes, various equivalent modifications are possible within the scope of the technology as those skilled in the relevant art will recognize. For example, any of the features of the AIOLs described herein may be combined with any of the features of the other AIOLs described herein and vice versa. Moreover, although steps are presented in a given order, alternative embodiments may perform steps in a different order. The various embodiments described herein may also be combined to provide further embodiments.

[0089] From the foregoing, it will be appreciated that specific embodiments of the technology have been described herein for purposes of illustration, but well-known structures and functions associated with AIOLs have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments of the technology. Where the context permits, singular or plural terms may also include the plural or singular term, respectively.

[0090] Moreover, unless the word "or" is expressly limited to mean only a single item exclusive from the other items in reference to a list of two or more items, then the use of "or" in

such a list is to be interpreted as including (a) any single item in the list, (b) all of the items in the list, or (c) any combination of the items in the list. Additionally, the term "comprising" is used throughout to mean including at least the recited feature(s) such that any greater number of the same feature and/or additional types of other features are not precluded. It will also be appreciated that specific embodiments have been described herein for purposes of illustration, but that various modifications may be made without deviating from the technology. Further, while advantages associated with some embodiments of the technology have been described in the context of those embodiments, other embodiments may also exhibit such advantages, and not all embodiments need necessarily exhibit such advantages to fall within the scope of the technology. Accordingly, the disclosure and associated technology can encompass other embodiments not expressly shown or described herein.

CLAIMS

I/We claim:

1. A delivery system for a fluid-filled intraocular lens, the delivery system comprising:

a body configured to receive the fluid-filled intraocular lens;

an injector tip coupled to the body;

a drive shaft positioned at least partially within the body and operable to displace the fluid-filled intraocular lens distally through the body and the injector tip and into an eye of a patient; and

a motion control feature configured to operably engage the drive shaft to at least partially prevent further distal movement of the drive shaft once the fluid-filled intraocular lens has passed distally beyond an equilibrium position within the injector tip,

wherein the equilibrium position is associated with a change to a distribution of the fluid within the fluid-filled intraocular lens.

2. The delivery system of claim 1 wherein the drive shaft includes a detent, and wherein the motion control feature includes an indentation in an interior surface of the body and positioned to receive the detent.

3. The delivery system of claim 1 wherein the motion control feature includes a detent, and wherein the drive shaft includes an indentation positioned to receive the detent.

4. The delivery system of claim 3 wherein the detent is held in place by a set screw operably coupled to the body and a spring element configured to press the detent against the drive shaft, and wherein the set screw is configured to be rotated relative to the body to change a magnitude of the force with which the spring element presses the detent against the drive shaft.

5. The delivery system of claim 1 wherein the motion control feature is configured to arrest further distal movement of the drive shaft when the fluid-filled intraocular lens reaches the equilibrium position.

6. The delivery system of claim 1 wherein the motion control feature is a first motion control feature, and wherein the delivery system further comprises:

a second motion control feature configured to at least partially prevent further distal movement of the drive shaft when the drive shaft is in a loading position configured to allow the fluid-filled intraocular lens to be received within the body; and

a third motion control feature configured to at least partially prevent further distal movement of the drive shaft when the drive shaft is in a pre-delivery position in which the fluid-filled intraocular lens has been advanced into contact with the injector tip.

7. The delivery system of claim 6 wherein:

the second motion control feature is positioned distally of the first motion control feature, and

the third motion control feature is positioned distally of the second motion control feature.

8. The delivery system of claim 1, further comprising the fluid-filled intraocular lens, wherein, once distal to the equilibrium position, the fluid-filled intraocular lens is configured to exit the injector tip without further distal movement of the drive shaft.

9. The delivery system of claim 1, further comprising a pusher member coupled to the drive shaft, wherein the pusher member is configured to contact the fluid-filled intraocular lens and, when the fluid-filled intraocular lens reaches the equilibrium position, seal a space within the injector tip between the fluid-filled intraocular lens and the pusher member to increase a resistance to further distal movement of the fluid-filled intraocular lens through the injector tip.

10. The delivery system of claim 1, further comprising a pusher member, and wherein:

the pusher member includes—

a rod defining a first distal face and configured to be coupled to the drive shaft, and

a sleeve defining a second distal face and configured to be received around the rod;

the sleeve is configured to be held in place relative to the rod such that the first and second distal faces are at least generally coplanar during a first portion of the distal movement of the drive shaft; and

the rod is configured to be advanced distally relative to the sleeve such that the first distal face travels distally beyond the second distal face during a second portion of the distal movement of the drive shaft.

11. The delivery system of claim 1, further comprising a cartridge configured to contain the fluid-filled intraocular lens, wherein the body defines an opening proximal of the injector tip configured to receive the cartridge to position the fluid-filled intraocular lens distally of the drive shaft.

12. The delivery system of claim 1 wherein the delivery system is configured to transition the fluid-filled intraocular lens from a resting configuration toward and/or to a folded configuration.

13. The delivery system of claim 1 wherein the injector tip includes an interior surface configured to contact the fluid-filled intraocular lens, and wherein the interior surface is configured to transition the fluid-filled intraocular lens from as the fluid-filled intraocular lens moves distally along the interior surface.

14. The delivery system of claim 1 wherein the fluid-filled intraocular lens is a base lens of an adjustable intraocular lens system that defines an adjustable optical power, and wherein the base lens is configured to receive a fixed lens having a fixed optical power.

15. The delivery system of claim 1 the equilibrium position is associated with a distal redistribution of the fluid within the fluid-filled intraocular lens.

16. A method for delivering a fluid-filled intraocular lens into an eye of a patient using a delivery system, the method comprising:

advancing a drive shaft of the delivery system distally to move the fluid-filled intraocular lens distally through the delivery system toward and/or into an injector tip of the delivery system;

engaging, with the drive shaft, a motion control feature of the delivery system to at least partially prevent further distal movement of the drive shaft when the fluid-filled intraocular lens passes distally beyond an equilibrium position within the injector tip, wherein the fluid-filled intraocular lens passing distally beyond the equilibrium position causes a distal redistribution of the fluid within the fluid-filled intraocular lens; and

delivering the fluid-filled intraocular lens.

17. The method of claim 16 wherein:

the drive shaft includes a detent,

the motion control feature includes an indentation in an interior surface of the delivery system, and

engaging the motion control feature includes positioning the detent at least partially within the indentation.

18. The method of claim 16 wherein:

the motion control feature includes a detent,

the drive shaft includes an indentation; and

engaging the motion control feature includes causing the indentation to receive the detent.

19. The method of claim 16 wherein delivering the fluid-filled intraocular lens includes allowing the fluid-filled intraocular lens to exit the injector tip automatically without further distal movement of the drive shaft.

20. The method of claim 16 wherein delivering the fluid-filled intraocular lens includes allowing the fluid-filled intraocular lens to exit the injector tip automatically while maintaining a position of the drive shaft relative to the injector tip.

21. The method of claim 16 wherein:

the delivery system includes a pusher member coupled to the drive shaft and configured to contact the fluid-filled intraocular lens, and

the method further comprises, when the fluid-filled intraocular lens reaches the equilibrium position, causing the pusher member to seal a space within the injector tip between the fluid-filled intraocular lens and the pusher member to increase a resistance to further distal movement of the fluid-filled intraocular lens through the injector tip.

22. The method of claim 16 wherein the injector tip includes an interior surface configured to contact the fluid-filled intraocular lens, and wherein advancing the drive shaft includes moving the fluid-filled intraocular lens along the interior surface to transition the fluid-filled intraocular lens from a resting configuration toward and/or to a folded configuration.

23. The method of claim 16 wherein positioning the fluid-filled intraocular lens within the delivery system includes positioning a cartridge containing the fluid-filled intraocular lens within the delivery system.

24. The method of claim 16 wherein the fluid-filled intraocular lens is a base lens of an adjustable intraocular lens system that defines an adjustable optical power, and wherein the base lens is configured to receive a fixed lens having a fixed optical power.

25. The method of claim 16 wherein the motion control feature is a first motion control feature and wherein the method further comprises, before positioning the fluid-filled intraocular lens within the delivery system, moving the drive shaft to a loading position to allow the fluid-filled intraocular lens to be positioned within the delivery system, wherein moving the drive shaft to the loading position includes engaging, with the drive shaft, a second motion control feature configured to at least partially hold the drive shaft in the loading position.

26. The method of claim 16 wherein the motion control feature is a first motion control feature and wherein the method further comprises, before moving the fluid-filled intraocular lens to the equilibrium position, advancing the drive shaft into a pre-delivery position in which a distal portion of the fluid-filled intraocular lens is positioned in contact with the

injector tip, wherein advancing the drive shaft into the pre-delivery position includes engaging, with the drive shaft, a second motion control feature configured to at least partially hold the drive shaft in the pre-delivery position.

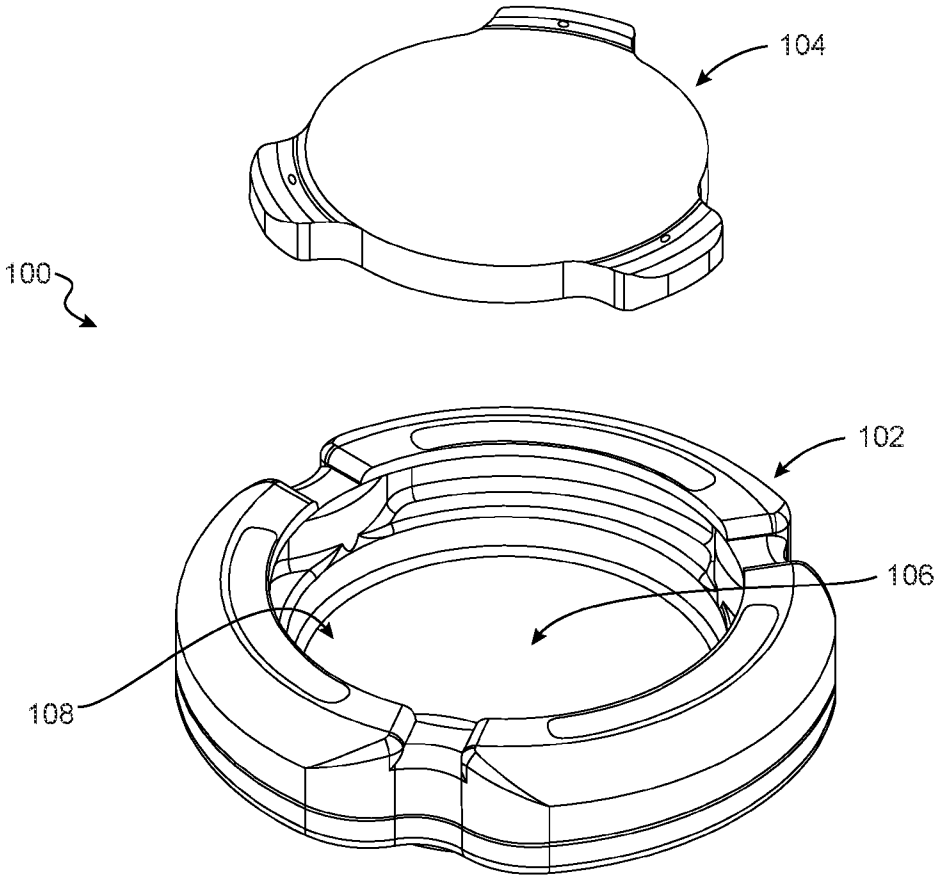


FIG. 1

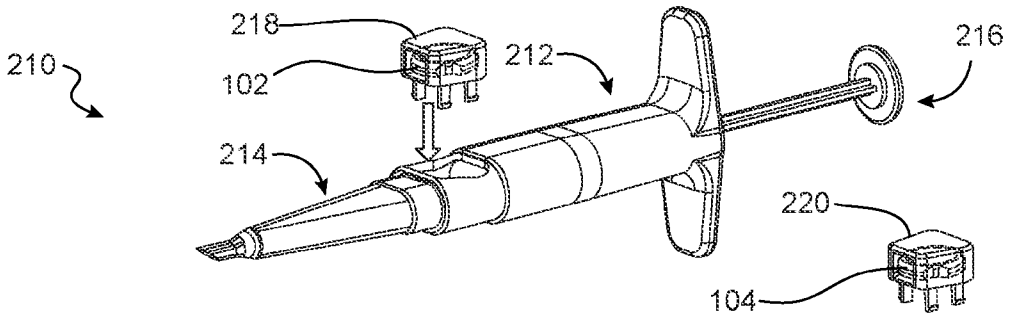


FIG. 2

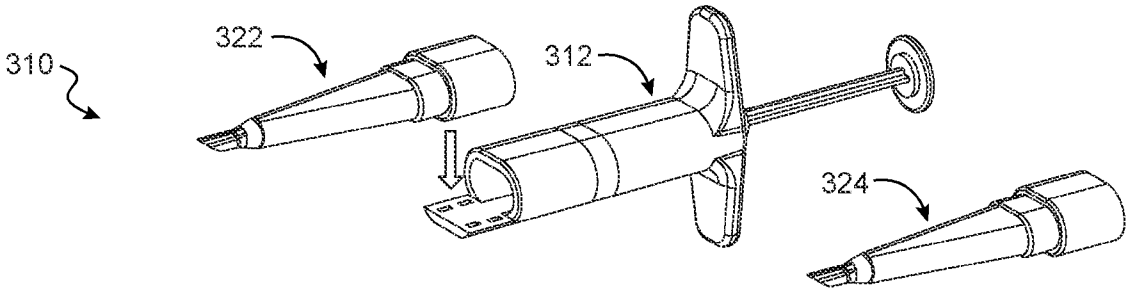


FIG. 3

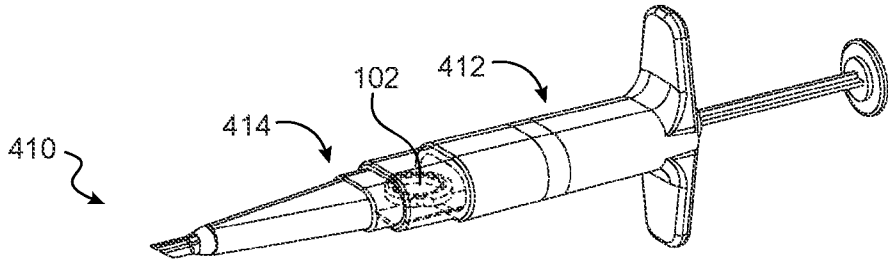


FIG. 4

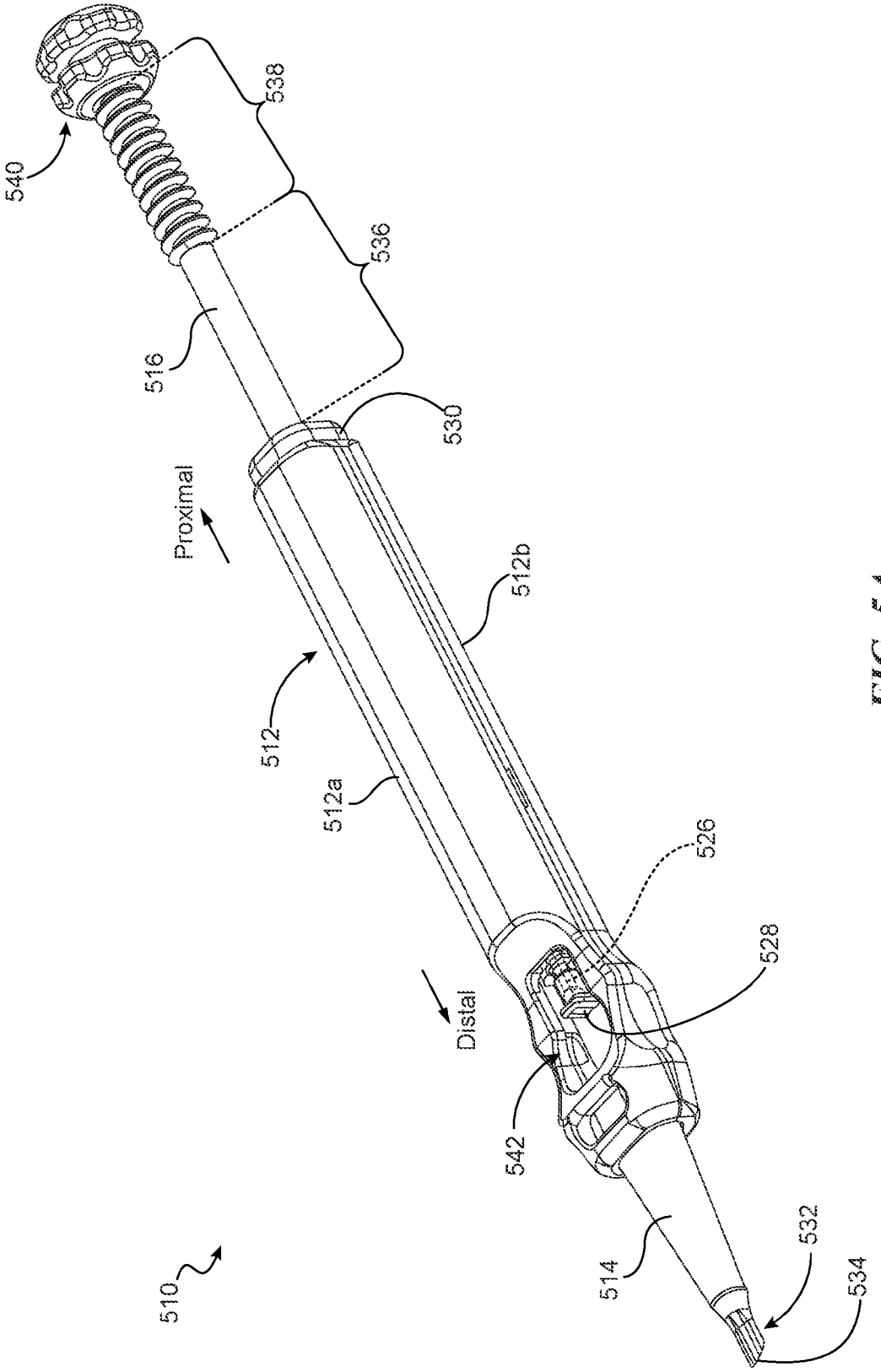

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Proximal
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Distal
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FIG. 5A

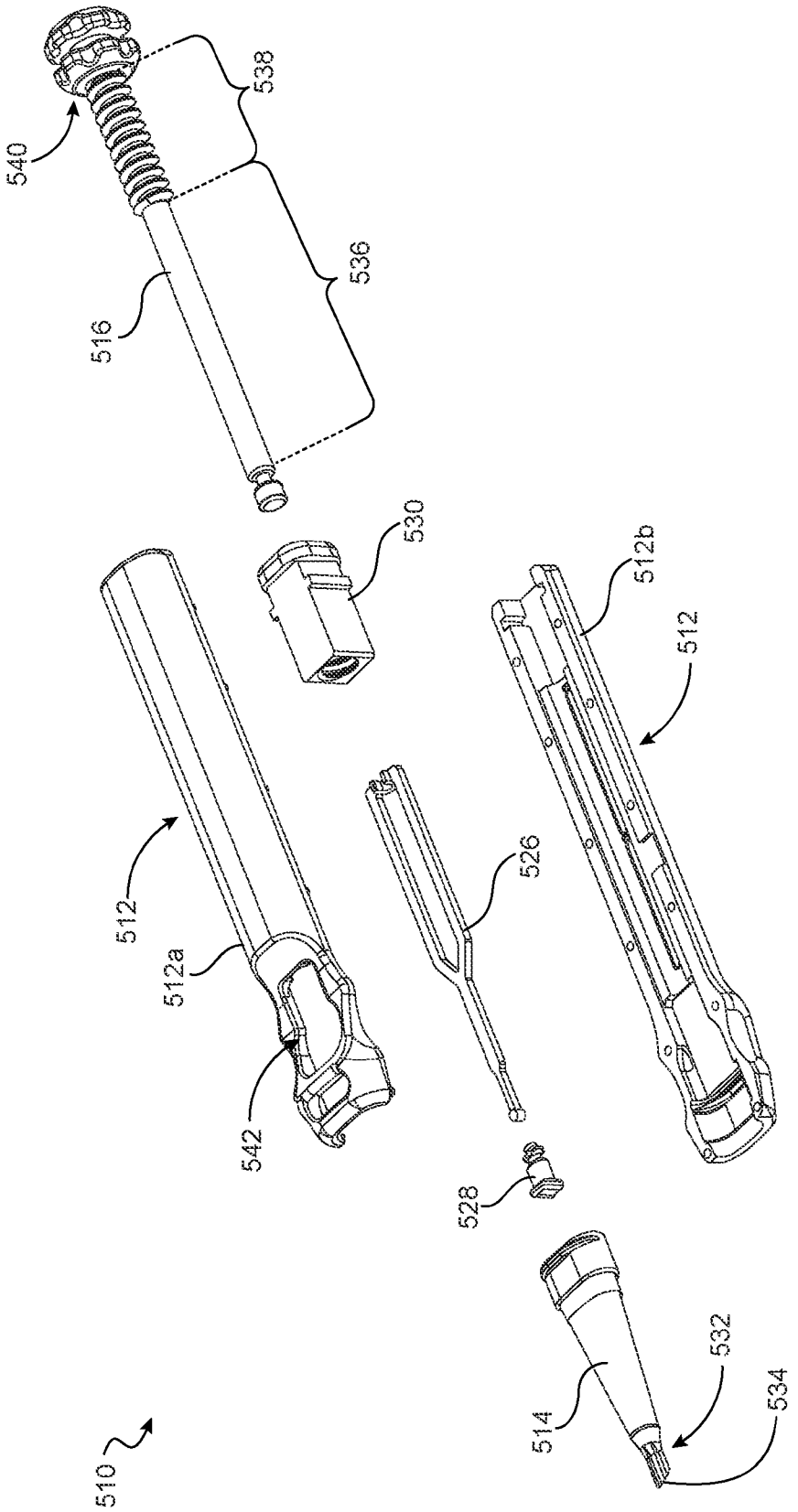

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FIG. 5B

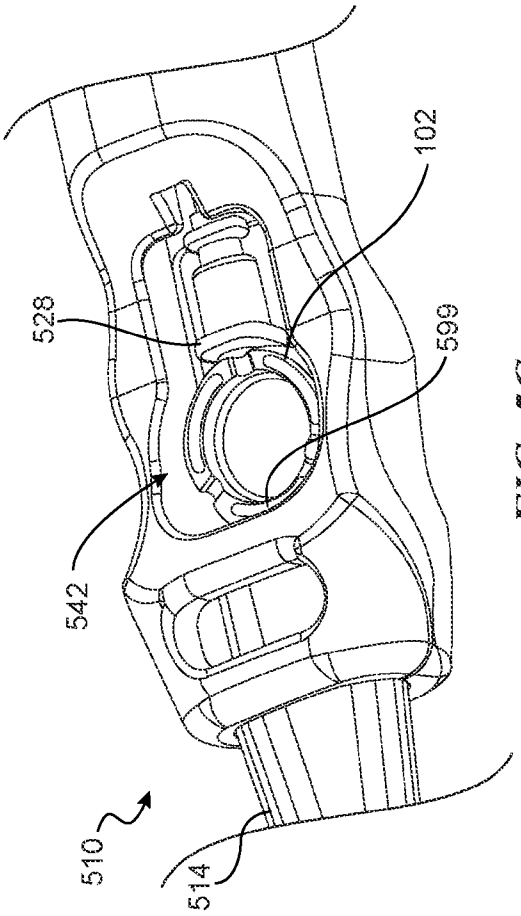


FIG. 5C

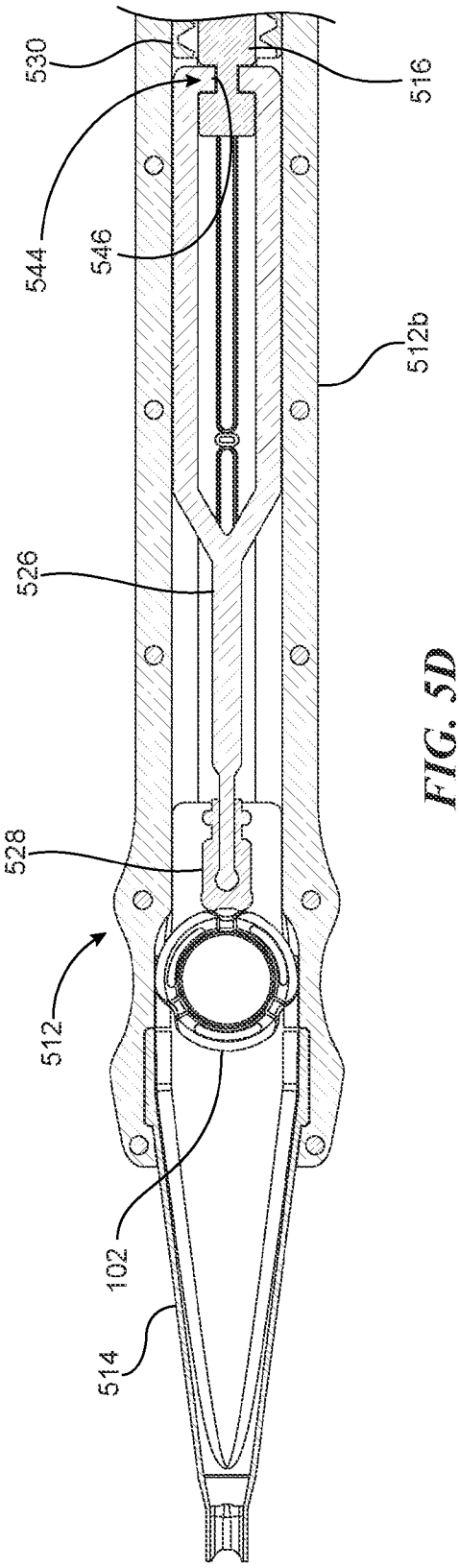


FIG. 5D

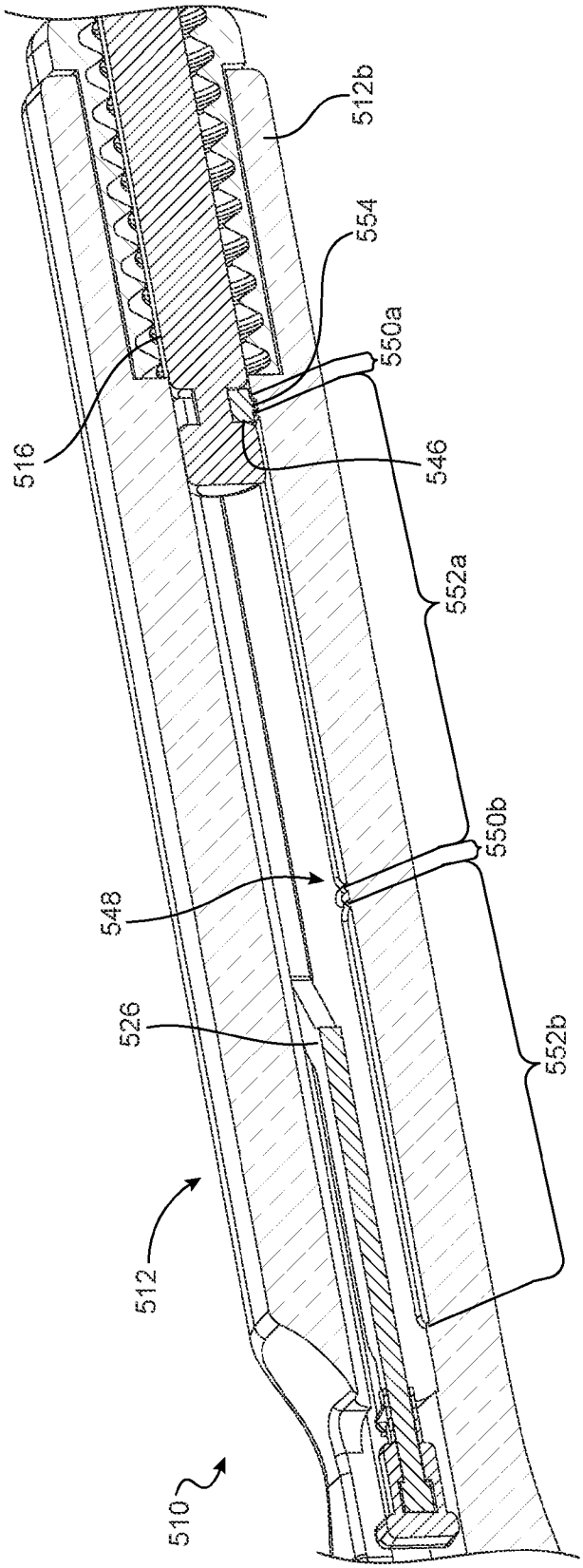


FIG. 5E

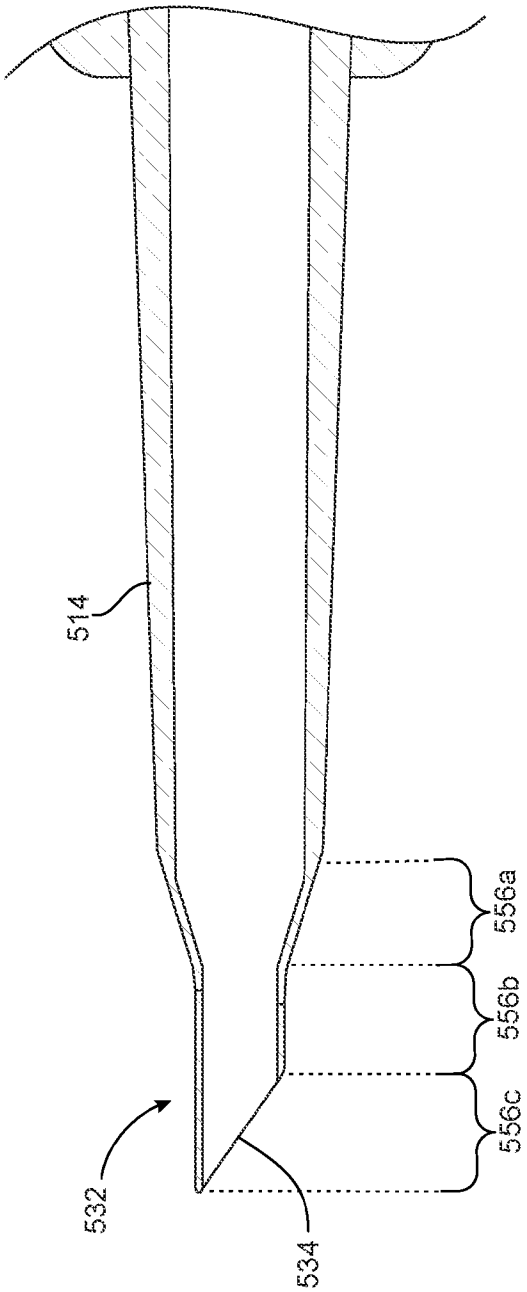


FIG. 5F

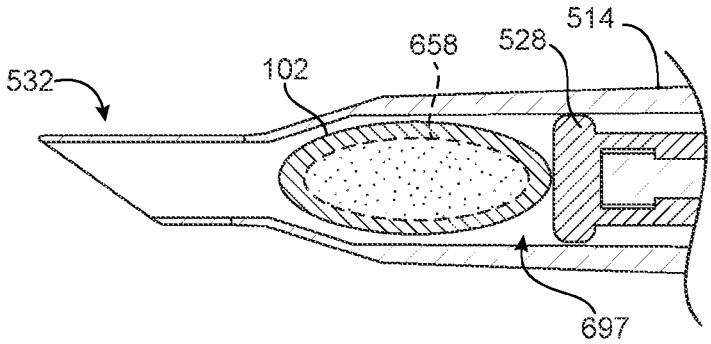


FIG. 6A

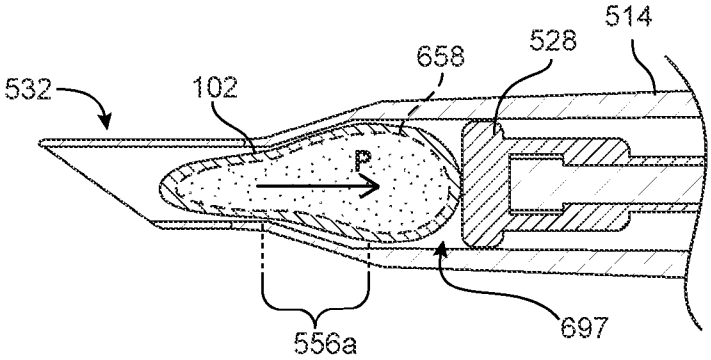


FIG. 6B

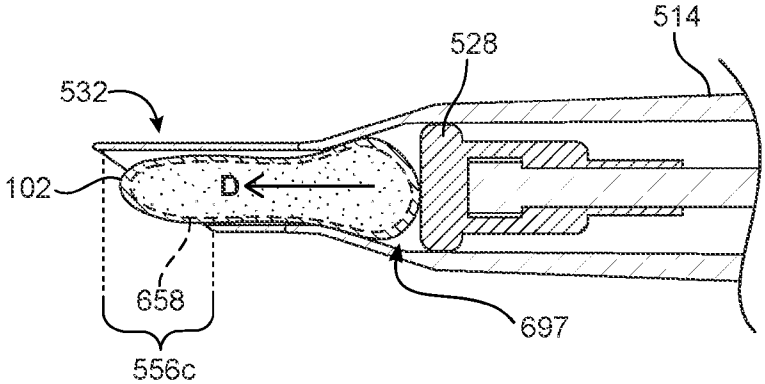


FIG. 6C

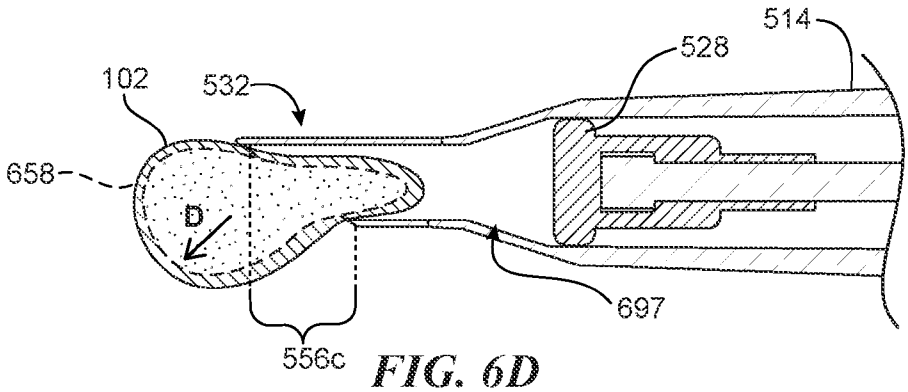


FIG. 6D

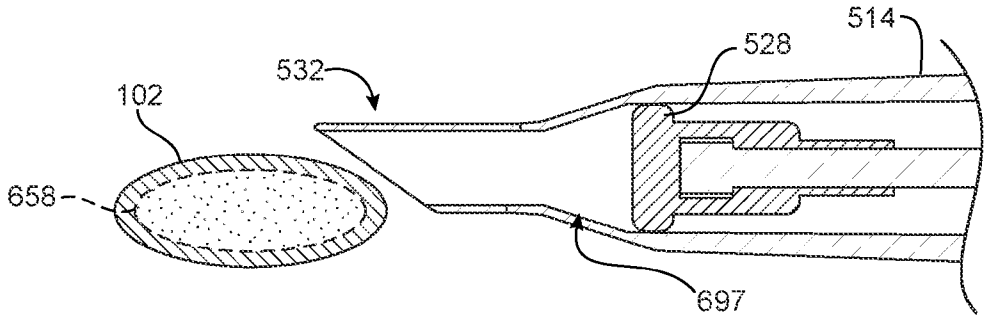


FIG. 6E

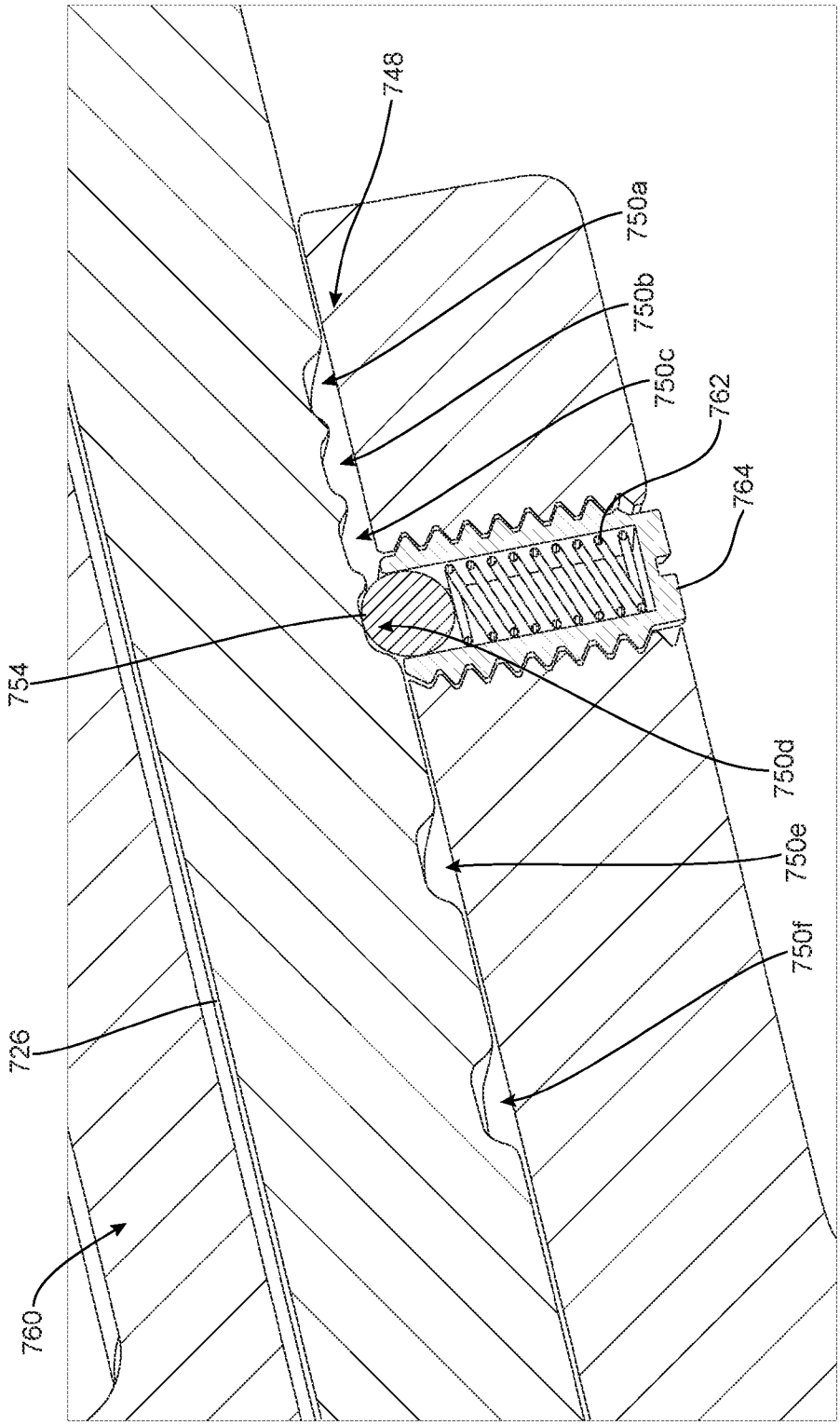


FIG. 7

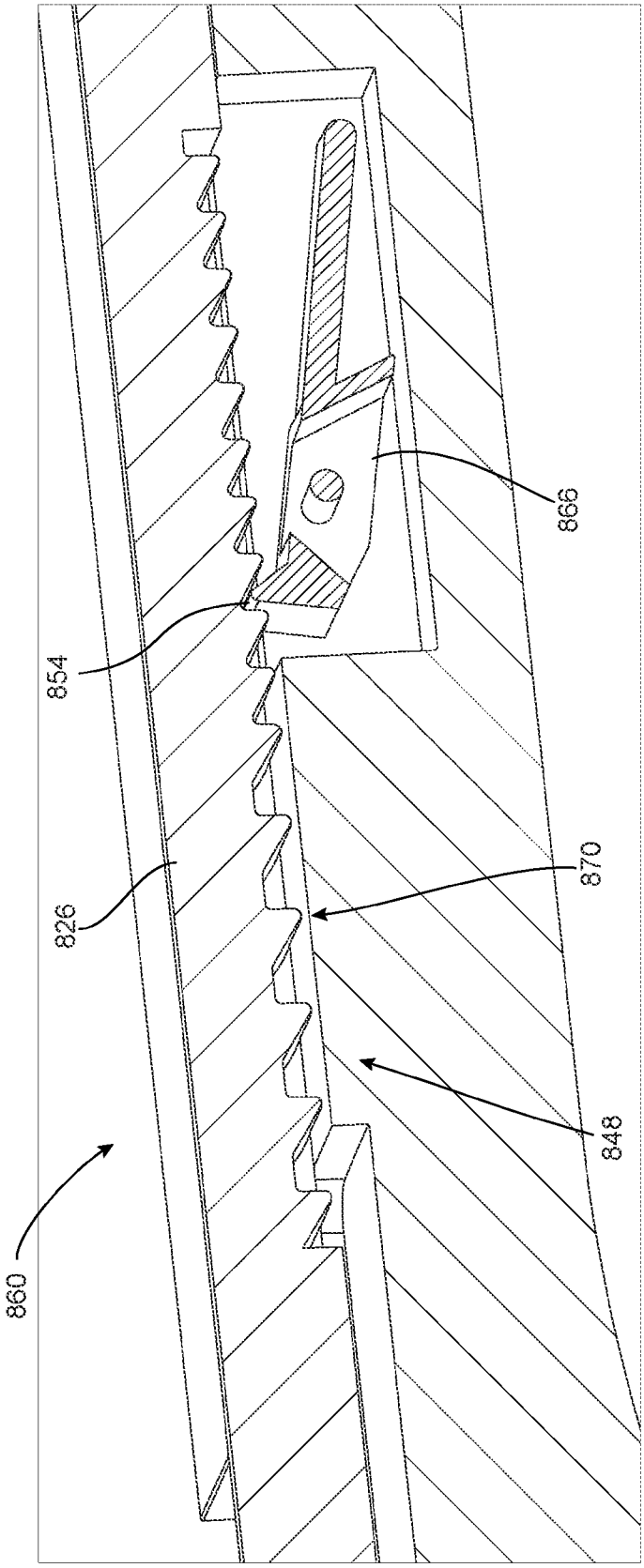


FIG. 8

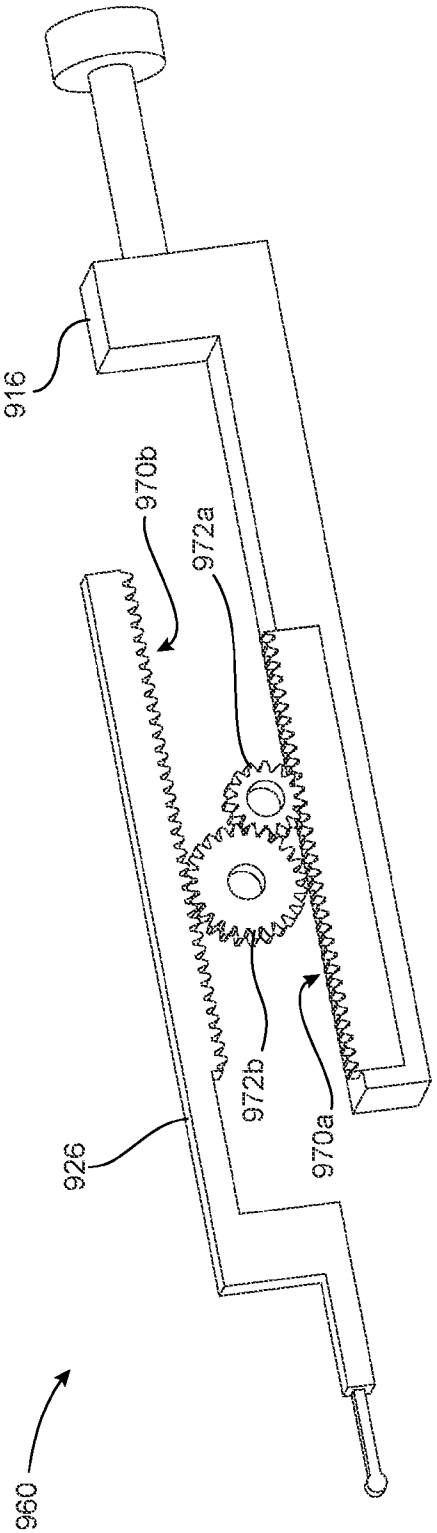


FIG. 9

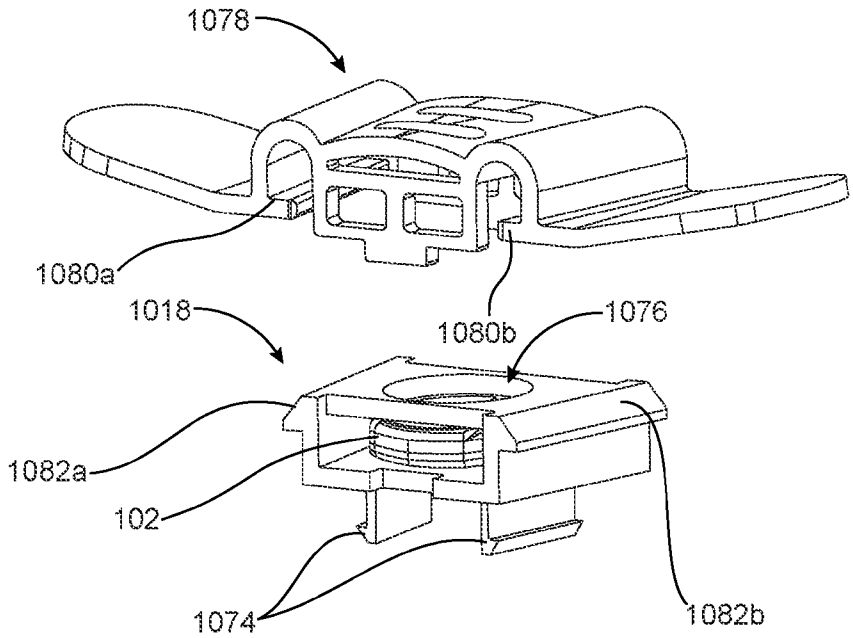


FIG. 10A

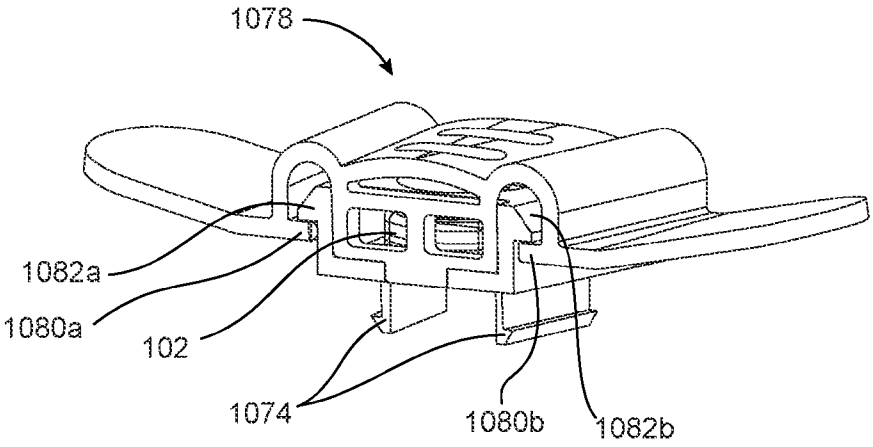


FIG. 10B

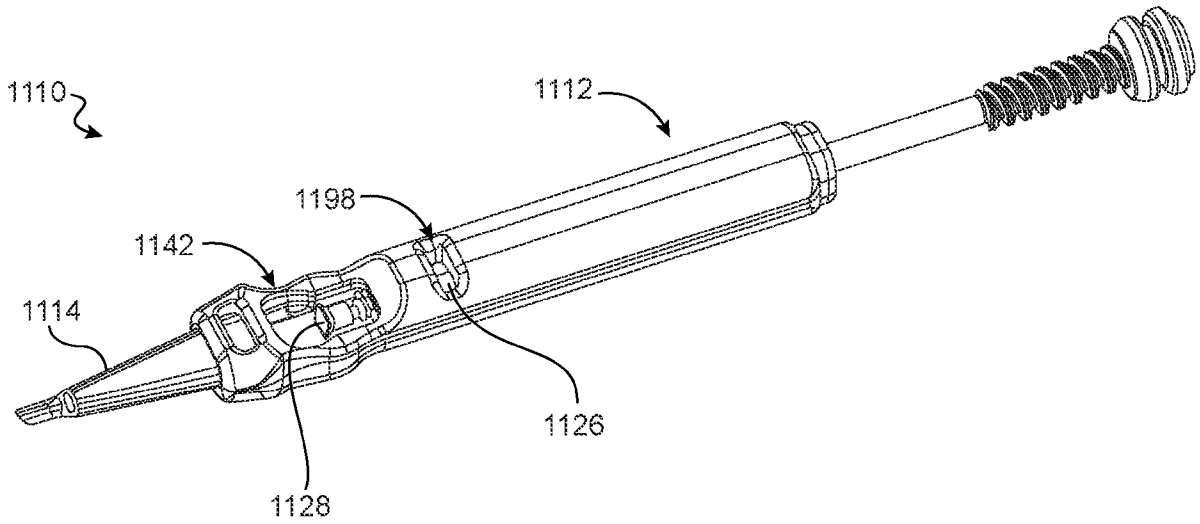


FIG. 11A

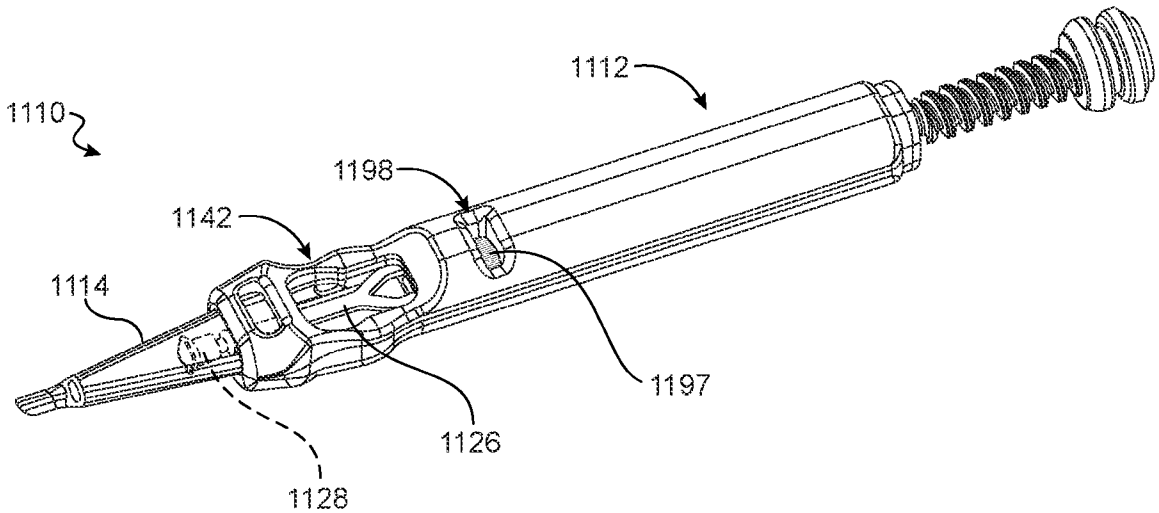


FIG. 11B

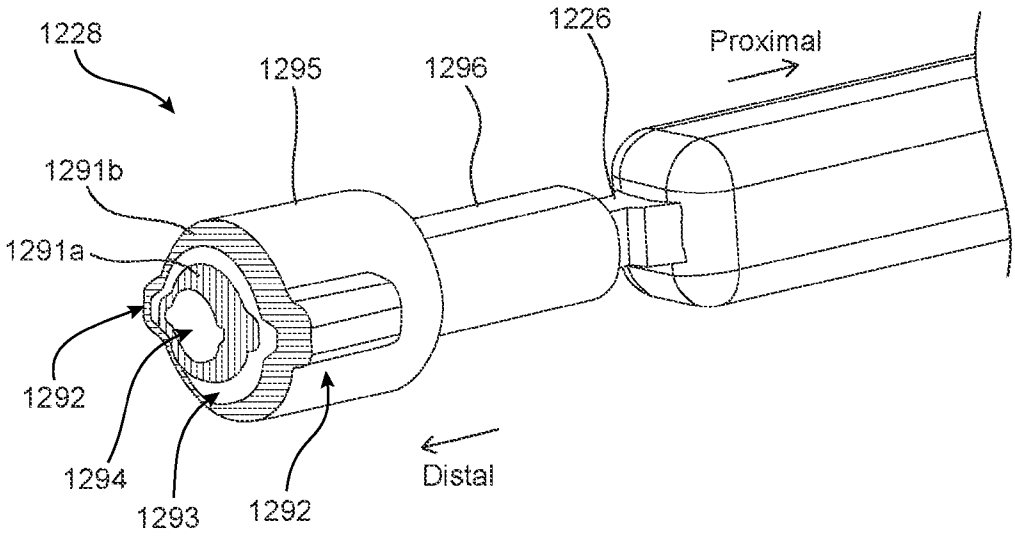


FIG. 12A

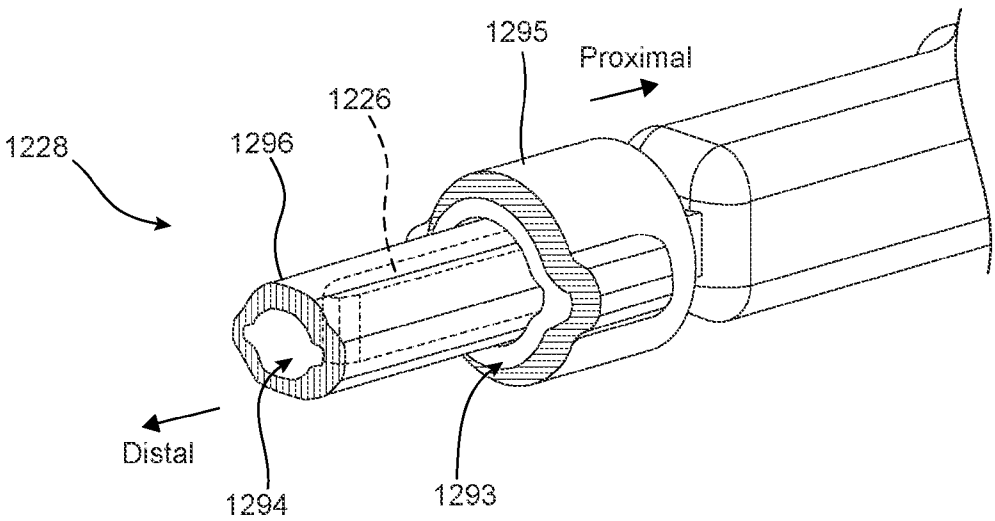


FIG. 12B

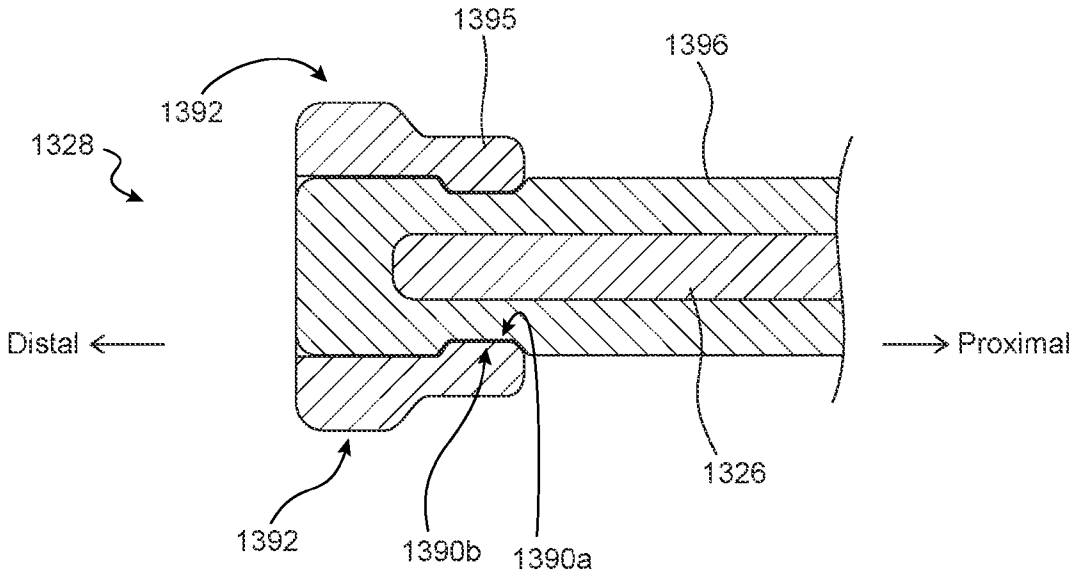


FIG. 13

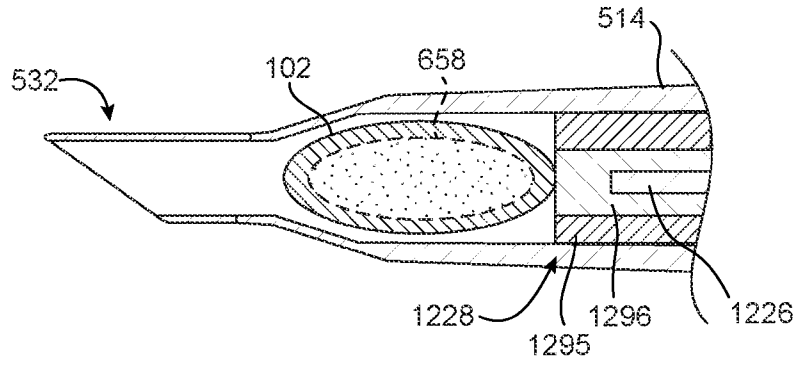


FIG. 14A

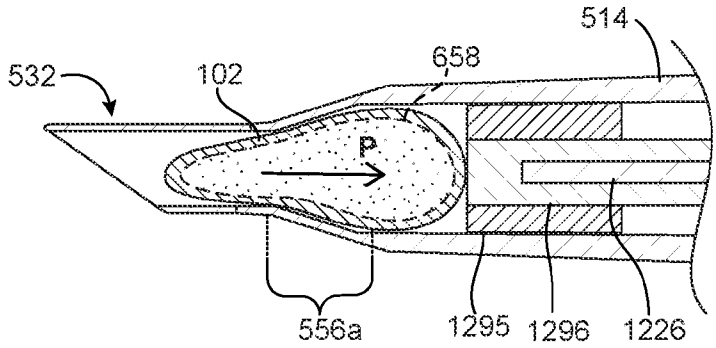


FIG. 14B

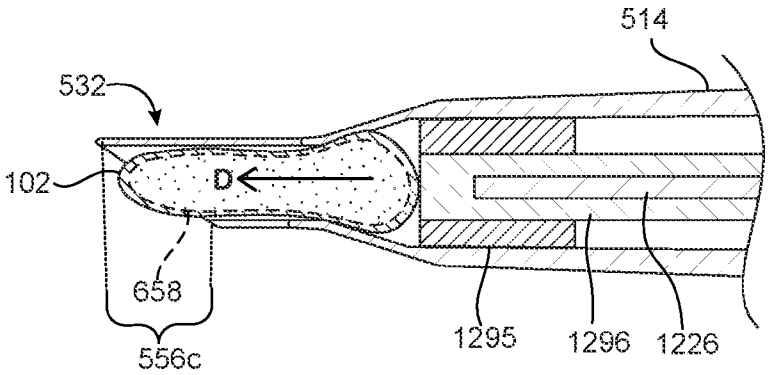


FIG. 14C

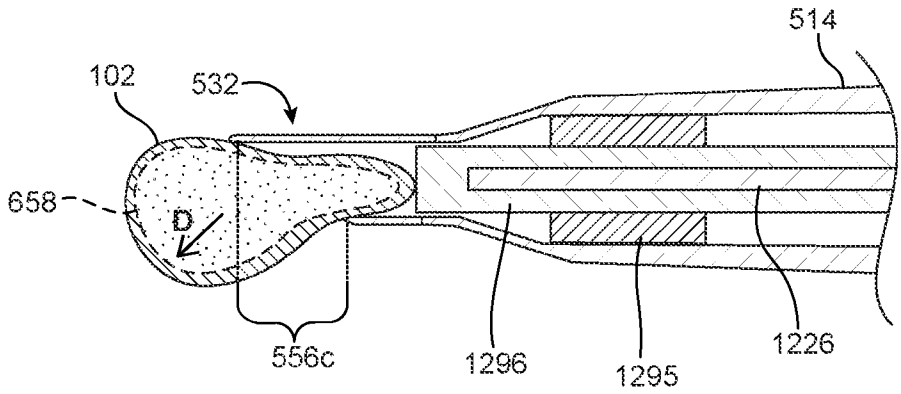


FIG. 14D

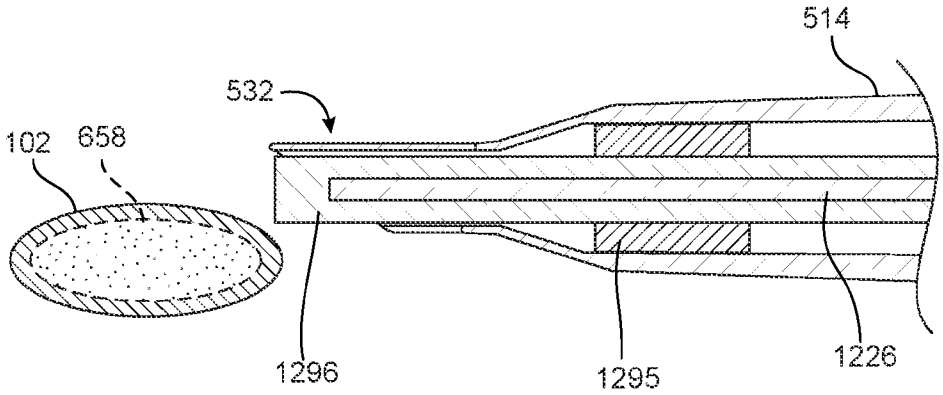


FIG. 14E

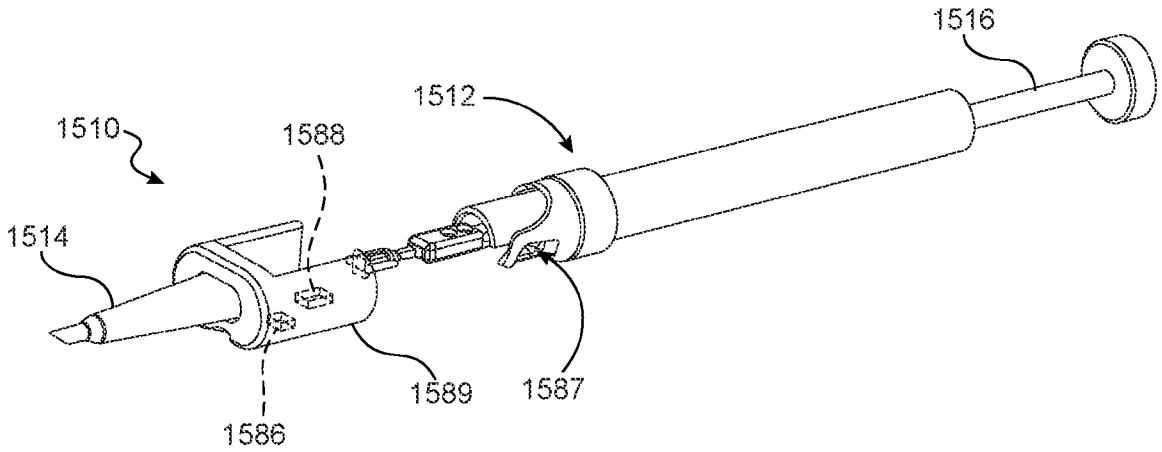


FIG. 15A

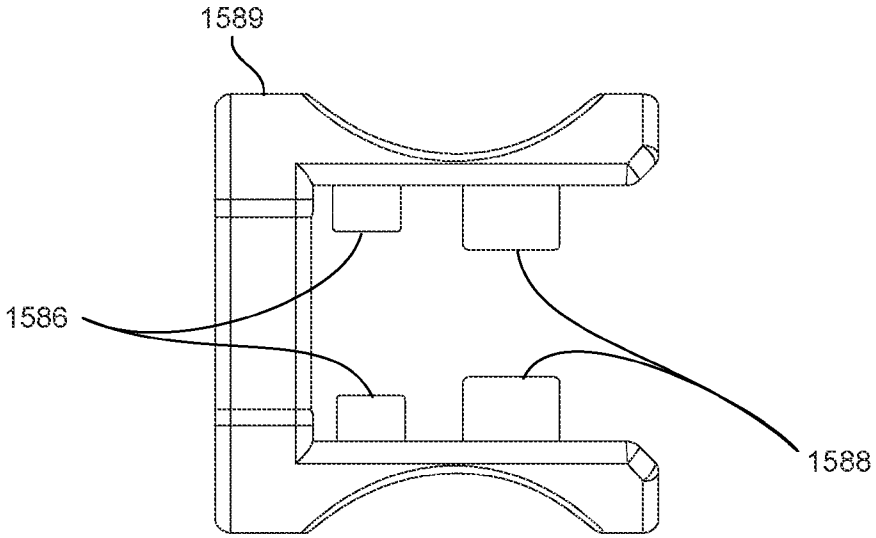


FIG. 15B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2024/061348

A. CLASSIFICATION OF SUBJECT MATTER

IPC: ***A61F 2/16*** (2024.01); ***A61F 9/00*** (2024.01); *A61F 2/14* (2024.01)

CPC: ***A61F2/167; A61F9/00;*** *A61F2/1672*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/0172727 A1 (ATRION MEDICAL PRODUCTS INC.) 22 June 2017 (22.06.2017) Abstract, FIGs. 2-4, Paragraphs [0033], [0035], [0037]-[0038], [0044], [0056]-[0057], [0071]	1-3, 5-8, 11-13, 15-20, 22-23, 25-26
Y		4, 9-10, 14, 21, 24
Y	US 2015/0297290 A1 (BIOSENSE WEBSTER (ISRAEL) LTD.) 22 October 2015 (22.10.2015) Abstract, paragraph [0077]	4
Y	US 2022/0192818 A1 (SHIFAMED HOLDINGS LLC) 23 June 2022 (23.06.2022) Abstract, FIGs. 17P, 17Q, 17U Paragraphs [0160], [0168]	4, 9-10, 14, 21, 24

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 2025 (11.02.2025)	**28 February 2025 (28.02.2025)**

Name and mailing address of the ISA/US	Authorized officer
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