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[Continued on next page]

(54) Title: SYRINGE ASSEMBLY HAVING A TELESCOPING PLUNGER ROD

(57) Abstract: A syringe assembly including a syringe barrel having a first end, a second end, and a sidewall extending therebetween defining a chamber is disclosed. The syringe assembly includes a stopper disposed within the chamber of the syringe barrel and a plunger rod having an inner member engaged with the stopper and an outer member adapted for telescopic movement with respect to the inner member. The plunger rod is transitionable from a collapsed position, in which a portion of the inner member is nested within the outer member, to an extended position, in which the same portion of the inner member extends outside the outer member. The syringe assembly also includes a stop member configured for cooperation with a portion of the syringe barrel, upon relative movement of the outer member with respect to the inner member, to limit the outward travel of the plunger rod from the syringe barrel.

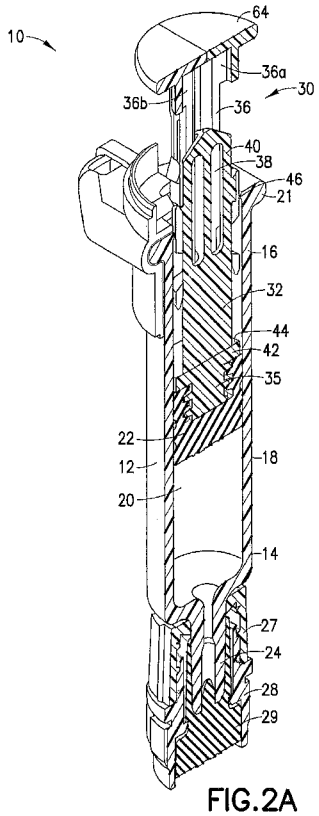


FIG.2A

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SYRINGE ASSEMBLY HAVING A TELESCOPING PLUNGER ROD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to United States Provisional Application Serial No. 61/541,658 filed September 30, 2011, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention is directed to a pre-filled syringe assembly adapted for the dispensing and delivery of a fluid. More particularly, the present invention is directed to a pre-filled syringe assembly having a telescopic plunger rod having a pull-out safety arrangement wherein the plunger rod arrangement results in a smaller packaging footprint allowing for reduced storage space. The present invention is also directed to a packaging system for a pre-filled syringe assembly that prevents unintended actuation of the plunger rod and reduces the likelihood of tampering of the syringe contents.

Description of Related Art

[0003] Conventional syringes are well known to be used in connection with a vial of a medication, wherein the user draws the fluid into the syringe immediately prior to injection and delivery of the fluid to the patient. A conventional syringe typically includes a syringe barrel with an opening at one end and a plunger mechanism disposed through the other end. The plunger mechanism typically includes a plunger rod extending through the barrel, with a plunger head or stopper at the end of the plunger rod within the barrel and with a finger flange at the other end of the plunger rod extending out of the barrel. In use, the plunger rod is retracted through the syringe barrel to fill the syringe barrel with a fluid, such as a medication, with the plunger rod extending out from the rear end of the syringe barrel. For delivery of the medication to a patient, the opening of the syringe barrel is adapted for fluid communication with a patient, such as through a hypodermic needle fitted at the front end of the syringe barrel or through a luer-type fitting extending from the front end of the syringe barrel for attachment with a fluid line of a patient. Upon depression of the plunger rod, the plunger rod and stopper travel through the syringe barrel, thereby forcing the contents of the syringe out through the opening at the front end for delivery to the patient. Such an operation is well known in the medical field, and medical practitioners have become well accustomed to the use of such common fluid delivery procedures through standard syringes.

[0004] Oftentimes, hypodermic syringes may be packaged as "pre-filled" devices, wherein the syringe is pre-filled with medication prior to being packaged and delivered to the end user. In this manner, there is no need for the user to fill the device prior to injection, thereby saving time for the end user and maintaining consistent volumes for delivery. Pre-filled syringes and pre-filled metered dose syringes are often filled with narcotics or other drugs at a production facility, packaged, and then shipped to a medical facility. Once at the facility, these syringes are often placed in controlled storage and/or locked cabinets to reduce theft of the syringes themselves and/or theft of the contents of these syringes. The space within these controlled storage locations is often limited, thus there is a need for a syringe assembly that has a smaller packaging footprint, to reduce the storage space required for containing this syringe. It is also desirable to produce syringes that are uniform in terms of an outer surface shape to allow for stacking of the syringes within the storage cabinet.

[0005] Even though measures, such as controlled storage, are taken to ensure the contents of these syringes remain intact, the risk still remains that the syringe contents can be tampered with and/or stolen and replaced with a saline solution. One technique for preventing tampering is the use of a snap cap for the tip cap that makes a snapping noise when removed from the syringe assembly. Conventional tamper-proof caps for pre-filled syringes may include a top member concentrically disposed in a generally cylindrical sleeve member and connected by frangible elements to the sleeve member. Conventional outer caps for pre-filled syringes cover a cylindrical cover cap which connects with the top wall of a holding member through a frangible portion. The cylindrical cover cap may be broken from the top wall of the holding member for tampering prevention/tamper-proof evidence.

SUMMARY OF THE INVENTION

[0006] In accordance with an embodiment of the present invention, a syringe assembly includes a syringe barrel having a first end, a second end, and a sidewall extending between the first end and the second end defining a chamber. The syringe assembly also includes a stopper disposed within the chamber of the syringe barrel and a plunger rod engaged with the stopper. The plunger rod has an inner member including a distal end secured to the stopper and an outer member adapted for telescopic movement with respect to the inner member. The plunger rod is transitionable from a collapsed position, in which a portion of the inner member is nested within the outer member, to an extended position, in which the same portion of the inner member extends outside the outer member. The syringe assembly further includes at least one stop member configured for cooperation with a portion of the syringe

barrel upon relative movement of the outer member with respect to the inner member to limit the outward travel of the plunger rod from the syringe barrel. The stop member limits pull-out of the plunger rod from the syringe barrel, i.e., wherein too much proximal force is applied to the plunger rod to inadvertently remove the plunger rod from the syringe barrel. The syringe assembly can be of a pre-filled type including a medication or drug disposed within the syringe barrel.

[0007] In certain configurations, the stop member can comprise a laterally extending member positioned at the distal end of the inner member. This laterally extending member is configured to cooperate with an internal portion of a syringe barrel flange to limit the outward travel of the plunger rod from the syringe assembly upon extension of the plunger rod to the ready-to-use position. The inner member can include a locking member for cooperating with an aperture in the outer member for locking the outer member to the inner member in the extended position. The outer member can include a pair of holding members surrounding the aperture and the locking member can include a pair of reverse bevels for cooperating with the pair of holding members to maintain the outer member in the extended position upon the application of a distal and/or a proximal force applied to the outer member. According to one design, the inner member can include a substantially X-shaped profile configured for engagement with a corresponding substantially X-shaped opening within the outer member.

[0008] The syringe can also include at least one detent associated with the outer member which is configured to cooperate with the syringe barrel to limit movement of the outer member into the syringe barrel upon the application of a distally directed force to the plunger rod. This particular feature would prevent the application of a partial dose of a pre-filled syringe, should a distal force be applied to the plunger rod prior to extension of the outer member.

[0009] According to another configuration, the stop member can comprise at least one longitudinally extending arm associated with the outer member wherein the longitudinally extending arm extends along an outer portion of the syringe barrel. The at least one longitudinally extending arm can include an inwardly extending detent at one end thereof configured for contacting an outer flange of the syringe barrel when the outer member is in the extended ready-to-use position, for limiting the outward travel of the outer member. According to one design, the at least one longitudinally extending arm can comprise a pair of arms, each of the arms including the inwardly extending detent at one end thereof configured for contacting the outer flange of the syringe barrel. In this configuration, the syringe barrel

can include at least one pocket for enclosing the at least one longitudinally extending arm when the outer member is in the collapsed position, and the at least one pocket cooperates with the outer flange of the syringe barrel to position and hold the detent in contact with the outer flange.

[0010] The syringe assembly can include a molded cover having a tear tab for removal of the cover. This cover can be of a design that is configured to constrain the plunger rod from inadvertent transition to the extended position.

[0011] In accordance with another embodiment of the present invention, a telescopic plunger rod assembly for use with a syringe assembly includes an inner member having a distal end configured for being secured to a stopper located within a syringe barrel, and an outer member having an open portion configured for telescopically engaging a portion of the inner member. The plunger rod is transitionable from a collapsed position to an extended position. The plunger rod includes at least one stop member configured for cooperation with a portion of the syringe barrel to limit the outward travel of the outer member from the syringe barrel upon transition of the plunger rod to the extended position.

[0012] In certain configurations, the stop member can comprise a laterally extending member positioned at the distal end of the inner member and configured to cooperate with an internal portion of a syringe barrel flange to limit the outward travel of the plunger rod from the syringe assembly upon extension of the plunger rod to the ready-to-use position. The inner member can include a locking member configured for cooperating with an aperture in the outer member for locking the outer member to the inner member in the extended position. According to one design, the inner member can include a substantially X-shaped profile configured for engagement with a corresponding substantially X-shaped opening within the outer member. At least one detent can be associated with an outer sleeve and configured to: cooperate with the syringe barrel to limit movement of the outer sleeve into the syringe barrel upon the application of the distally directed force to the plunger rod; and prevent the application of a partial dose of the syringe contents.

[0013] According to another configuration, the stop member can comprise a pair of longitudinally extending arms associated with the outer member wherein the longitudinally extending arms extend along an outer portion of the syringe barrel. The longitudinally extending arms can include an inwardly extending detent configured for contacting an outer flange of the syringe barrel when the outer member is in the extended ready-to-use position.

[0014] In accordance with another embodiment of the present invention, a packaging assembly for use with a pre-filled syringe assembly includes a molded cover configured for

placemcnt about a portion of a syringe barrel, a plunger rod, and a tip cap and a tear tab associated with one end of the molded cover. The tear tab is configured to facilitate removal of the molded cover from the syringe assembly and can be positioned adjacent a top surface of the plunger rod. The cover is configured for placement about the syringe assembly, including the tip cap, to constrain the plunger rod from inadvertent transition to the extended position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a front perspective view of a syringe assembly having a telescopic plunger rod in a collapsed position in accordance with an embodiment of the present invention.

[0016] FIG. 1A is a front perspective view of the telescopic plunger rod of the syringe assembly of **FIG. 1** with the plunger rod in an extended position in accordance with an embodiment of the present invention.

[0017] FIG. 1B is a front perspective view of the syringe assembly of **FIG. 1** with the plunger rod in a collapsed position having a portion of the outer member removed in accordance with an embodiment of the present invention.

[0018] FIG. 2A is a cross-sectional perspective view of the syringe assembly taken along line **IIA-IIA** of **FIG. 1** in accordance with an embodiment of the present invention.

[0019] FIG. 2B is a cross-sectional plan view of the syringe assembly of **FIG. 1** in accordance with an embodiment of the present invention.

[0020] FIG. 3 is an expanded perspective view of the syringe assembly of **FIG. 1** in accordance with an embodiment of the present invention.

[0021] FIG. 4A is a front perspective view of the plunger rod assembly of the syringe assembly of **FIG. 1** in the collapsed position including the partial dose feature in accordance with an embodiment of the present invention.

[0022] FIG. 4B is a side elevation view of the plunger rod assembly of the syringe assembly of **FIG. 4A** in accordance with an embodiment of the present invention.

[0023] FIG. 5A is a side elevation view of the plunger rod assembly of the syringe assembly of **FIG. 4A** showing a proximal force being applied to the plunger rod in accordance with an embodiment of the present invention.

[0024] FIG. 5B is a side elevation view of the plunger rod assembly of the syringe assembly of **FIG. 5A** with the plunger rod in the extended position in accordance with an embodiment of the present invention.

[0025] **FIG. 6A** is a front perspective view of a syringe assembly having a telescopic plunger rod in a collapsed position in accordance with an embodiment of the present invention.

[0026] **FIG. 6B** is a side elevation view of the syringe assembly of **FIG. 6A** in accordance with an embodiment of the present invention.

[0027] **FIG. 7A** is a front perspective view of the syringe assembly of **FIG. 6A** having a telescopic plunger rod in an extended position in accordance with an embodiment of the present invention.

[0028] **FIG. 7B** is a side elevation view of the syringe assembly of **FIG. 7A** in accordance with another embodiment of the present invention.

[0029] **FIGS. 8A-8C** are perspective side views of the syringe assembly of **FIG. 1** illustrating the sequential operational steps for removing a packaging assembly in accordance with an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] For purposes of the description hereinafter, the terms "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", "lateral", "longitudinal", and derivatives thereof shall relate to the invention as it is oriented in the drawing figures. However, it is to be understood that the invention may assume various alternative variations, except where expressly specified to the contrary. It is also to be understood that the specific devices illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the invention. Hence, specific dimensions and other physical characteristics related to the embodiments disclosed herein are not to be considered as limiting.

[0031] Reference is now made to **FIGS. 1**, **1A-1B**, **2A-2B**, **3**, **4A-4B**, and **5A-5B**, which depict a syringe assembly according to an embodiment of the present invention, generally indicated as **10**, adapted for the dispensing and delivery of a fluid. **FIGS. 6A-6B** and **7A-7B** depict a syringe assembly according to a further embodiment of the invention, generally indicated as **100**, which can also be adapted for the dispensing and delivery of a fluid. **FIGS. 8A-8C** depict a packaging assembly, generally indicated as **200**, and the operational steps for removing the packaging assembly, which can be used for packaging the syringe assembly of the invention.

[0032] With particular reference to **FIGS. 1**, **2A-2B**, and **3**, the syringe assembly **10** is intended for use for injection or infusion of fluid, such as a medication, directly into a patient, and is generally shown and described for purposes of the present description as a hypodermic

syringe. Syringe assembly **10** is contemplated for use in connection with a needle such as by connecting syringe assembly **10** to a separate needle assembly (not shown), or alternatively for connection with a separate intravenous (IV) connection assembly (not shown).

[0033] The syringe assembly **10** includes a syringe barrel **12** having a first or distal end **14**, a second or proximal end **16**, and a sidewall **18** extending between the distal end **14** and proximal end **16** defining an interior chamber **20** of the syringe barrel **12**. A stopper **22** is slidably disposed within the chamber **20** of the syringe barrel **12**. The syringe barrel **12** may be in the general form of an elongated cylindrical barrel as is known in the art for the general shape of a hypodermic syringe, although other forms for containing a fluid for delivery are also contemplated by the present invention. Additionally, the syringe barrel **12** may be formed of glass, or may be injection molded from thermoplastic material such as polypropylene and polyethylene according to techniques known to those of ordinary skill in the art, though it is to be appreciated that the syringe barrel **12** may be made from other suitable materials and according to other applicable techniques. In certain configurations, the syringe barrel **12** may include an outwardly extending flange **21** about at least a portion of the proximal end **16**. The flange **21** may be configured for easy grasping by a medical practitioner, as will be discussed herein.

[0034] As illustrated in **FIG. 3**, the distal end **14** of the syringe barrel **12** terminates in a tip **24** having an outlet opening **26**. The proximal end **16** is generally open-ended, but is intended to be closed off to the external environment, via the stopper **22**, as will be discussed herein. According to one non-limiting embodiment, as shown in **FIG. 3**, the syringe assembly **10** can include a tip cap **28**, an interface member **27** interfacing between the tip cap **28** and the tip **24** of the syringe barrel **12**, and a plug **29**, for sealing the outlet opening **26**.

[0035] The syringe barrel **12** may include markings, such as graduations on the sidewall **18** thereof, for providing an indication as to the level or amount of fluid contained within the syringe barrel **12**. Such markings may be provided on the external wall, the internal wall, or integrally formed or otherwise within the wall of syringe barrel **12**. Alternatively, or in addition thereto, the markings may provide a description of the contents of the syringe, or other identifying information, as may be known in the art.

[0036] As noted, distal end **14** of syringe barrel **12** includes an outlet opening **26**. The profile of outlet opening **26** may be adapted for engagement with a separate dispensing device, such as a needle assembly or IV connection assembly, and therefore may include a mechanism for such engagement, for example, a generally tapered luer tip, for engagement with a separate tapered luer mating surface (not shown) of such a separate device for attachment therewith.

In addition, a mechanism for locking engagement therebetween may also be provided, such as a luer collar or luer lock including interior threads. Such luer connections and luer locking mechanisms are well known in the art.

[0037] All of the components of syringe assembly **10** may be constructed of any known material, and are desirably constructed of medical grade polymers. As stated above, the syringe assembly **10** is particularly useful as a pre-filled syringe, and therefore may be provided for end use with a fluid, such as a medication, contained within interior chamber **20** of syringe barrel **12**, pre-filled by the manufacturer. In this manner, syringe assembly **10** can be manufactured, pre-filled with a medication, sterilized, and packaged in appropriate packaging for delivery, storage, and use by the end user, without the need for the end user to fill the syringe with medication from a separate vial prior to use.

[0038] With continuing reference to **FIGS. 1**, **1A-1B**, **2A-2B**, **3**, **4A-4B**, and **5A-5B**, the syringe assembly includes a plunger rod, generally indicated as **30**, for controlling movement of the stopper **22** through the syringe barrel **12** to either expel the syringe contents of a pre-filled type of syringe assembly **10** or, depending upon the desired use of the syringe assembly, to aspirate or withdraw a fluid into the syringe barrel **12**. The plunger rod **30** includes an inner member **32** including a distal end **34** secured to the stopper **22** and an outer member **36** mounted for telescopic movement with respect to the inner member **32**. It can be appreciated that the distal end **34** of the inner member **32** can include a mechanical attachment member **35** for securing the inner member **32** to the stopper. As shown in **FIGS. 1**, **1A-1B**, **2A-2B**, and **3**, the outer member **36** can include a portion **38** for encompassing a portion **40** of the inner member **32**. The plunger rod **30** is transitionable from a collapsed pre-use position, as shown in **FIG. 1**, to an extended ready-to-use position, as shown in **FIG. 1A**. According to one design, the outer member **36** can include a first part **36a** and a second part **36b** which can be mechanically joined together, such as by a snap member **37**, about the inner member **32**.

[0039] The plunger rod **30** can include a thumb press portion **64** or any other type of well-known member, upon which a user can apply a distally directed force to cause the plunger rod **30** to move the stopper **22**, disposed within the syringe barrel **12**, toward the distal end **14** of the syringe barrel **12** to expel the syringe contents during operation of the syringe assembly **10**. This thumb press portion **64** can include a roughened or serrated surface, as is known in the art, to provide a frictional surface for assisting the user in movement or actuation of the plunger rod.

[0040] The syringe assembly **10** further includes at least one stop member **42** configured for cooperation with a portion of the syringe barrel **12** upon proximal movement of the outer member **36** with respect to the inner member **32** in a direction away from the first or distal end **14** of the syringe barrel **12** to limit the outward travel **OT**, shown in **FIG. 1A**, of the plunger rod **30** from the syringe barrel **12**. The stop member **42** prevents pull-out of the plunger rod **30** from the syringe barrel **12**. In other words, the stop member **42** prevents an inadvertent removal of the plunger rod **30** from the syringe assembly **10** upon the application of a proximal force **PF**, as shown in **FIG. 5A**, to extend the outer member **36** with respect to the inner member **32**.

[0041] According to the configuration shown in **FIGS. 1**, **1A-1B**, **2A-2B**, **3**, **4A-4B**, and **5A-5B**, the stop member **42** can comprise a laterally extending member **44** positioned at the distal end **34** of the inner member **32**. This laterally extending member **44** extends in a lateral direction with respect to a longitudinal centerline **L** of the syringe barrel, as shown in **FIG. 3**, and is configured to cooperate with an internal portion **46** of the syringe barrel flange **21** to limit the outward travel **OT** of the plunger rod **30** from the syringe assembly **10** upon extension of the plunger rod **30** to the ready-to-use position.

[0042] With particular reference to **FIGS. 4A-4B** and **5A-5B**, the inner member **32** can include a locking member **48** for cooperating with an aperture **50** in the outer member **36** for locking the outer member **36** to the inner member **32** in the extended position. The outer member **36** can include a pair of holding members, such as a distal holding member **52**, and a proximal holding member **54** surrounding the aperture **50**. The distal holding member **52** and proximal holding member **54** can extend about the outer diameter of the outer member **36** in a lateral direction with respect to the longitudinal length **L** of the syringe assembly **10** and can have any shape which allows them to move throughout the syringe barrel **12** and which can adequately trap the locking member **48** when the outer member **36** is in the extended ready-to-use position. As shown in **FIG. 5A**, the proximal holding member **54** can have a configuration and a cooperating surface **55** that can receive the locking member **48** and allow the proximal holding member **54** to ride over the locking member **48** upon the application of the proximal force **PF** to the outer member **36** to extend the outer member **36** with respect to the inner member **32**. Also, the locking member **48** can be mounted at the end of a flexible member **49**, so that the locking member **48** flexes via the flexible member **49** in an inward direction with respect to the longitudinal centerline **L** of the syringe assembly **10** during extension of the outer member **36**.

[0043] The locking member **48** can include a pair of reverse bevel surfaces **56, 58** for cooperating with corresponding bevel surfaces **60, 62** on the pair of holding members **52, 54** to maintain the outer member **36** in the extended and locked position upon the application of either a distal force **DF** or a proximal force **PF** applied to the outer member **36**, as shown in **FIG. 5B**.

[0044] According to one design, as shown in **FIG. 1B**, the inner member **32** can include a substantially X-shaped profile **70** configured for engagement with a corresponding substantially X-shaped opening **72** within the outer member **36**. Although the drawings show an X-shaped profile, it can be appreciated that the inner member **32** and the outer member **36** can have any multi-lobe or any other type of configuration known in the art which allows for adequate telescoping of the outer member **36** with respect to the inner member **32**.

[0045] With continuing reference to **FIGS. 4A-4B** and **5A-5B**, the syringe assembly **10** can also include at least one detent **76** associated with the outer member **36** which is configured to cooperate with the syringe barrel **12** to limit movement of the outer member **36** into the syringe barrel **12** upon an application of a distally directed force to the plunger rod **30**. This particular feature would prevent the application of a partial dose of a pre-filled syringe, should a distal force be applied to the plunger rod **30** prior to extension of the outer member **36**. According to one embodiment, this detent **76** can comprise a flex finger **78** having a ramped portion **80** at one end thereof that prevents the application of a partial dose from a pre-filled syringe, as it limits or prevents the depression of the outer member **36** into the syringe barrel **12** prior to the desired use of the syringe assembly, i.e., until the extension of the outer member **36** with respect to the inner member **32**. In operation and with particular reference to **FIGS. 4A-4B** and **5A**, when the outer member **36** is in the collapsed position, a sidewall portion **82** of the inner member **32** supports or applies a supporting surface against the detent **76** and, should a distally directed force be applied to the plunger rod **30**, the ramped portion **80** will engage against a top surface **90** of the flange **21** of the syringe barrel **12** to prevent movement of the plunger rod **30** into the syringe barrel **12** and to prevent the application of a partial dose of the syringe contents. Once the outer member **36** is extended with respect to the inner member **32**, as shown in **FIG. 5B**, the sidewall portion **82** of the inner member **32** no longer provides a supporting surface against the detent **76**. This will allow the flex finger **78** to flex inward with respect to the longitudinal centerline **L** of the syringe assembly **10**. Accordingly, the application of a distally directed force to the plunger rod **30** to expel the syringe contents will cause the plunger rod **30** to move into the syringe barrel **12** and, when the ramped portion **80** of the detent **76** contacts the top surface **90** of the

flange **21**, the flex member **78** can flex in an inward direction to allow the outer member **36** to enter into the syringe barrel **12**.

[0046] Reference is now made to **FIGS. 6A-6B** and **7A-7B** which depict a syringe assembly according to a further embodiment of the present invention, generally indicated as **100**, which can also be adapted for the dispensing and delivery of a fluid. The syringe assembly **100** is similar to syringe assembly **10**, as discussed in detail above and includes a first or distal end **114**, a second or proximal end **116**, and a sidewall **118** extending between the distal end **114** and proximal end **116** defining an interior chamber **120** of a syringe barrel **112**. A stopper **122** is disposed within the chamber **120** of the syringe barrel **112**. The syringe barrel **112** may include an outwardly extending flange **121** about at least a portion of the proximal end **116**. The flange **121** may be configured for easy grasping by a medical practitioner. The syringe assembly **100** can also include a tip cap **128**.

[0047] With continuing reference to **FIGS. 6A-6B** and **7A-7B**, a plunger rod, generally indicated as **130**, controls movement of the stopper **122** through the syringe barrel **112** to either expel the syringe contents of a pre-filled type of syringe assembly **100** or, depending upon the desired use of the syringe assembly, to aspirate or withdraw a fluid into the syringe barrel **112**. The plunger rod **130** includes an inner member **132** including a distal end **134** secured to the stopper **122**, and an outer member **136** mounted for telescopic movement with respect to the inner member **132**. As shown in **FIGS. 6B** and **7B**, the outer member **136** can include a portion **138** for encompassing a portion **140** of the inner member **132**. The plunger rod **130** is transitionable from a collapsed pre-use position, as shown in **FIGS. 6A-6B**, to an extended ready-to-use position, as shown in **FIGS. 7A-7B**.

[0048] The syringe assembly **100** further includes at least one stop member **142** configured for cooperation with a portion of the syringe barrel **112** upon proximal movement of the outer member **136** with respect to the inner member **132** in a direction away from the first or distal end **114** of the syringe barrel **112** to limit the outward travel **OT**, shown in **FIGS. 7A-7B**, of the plunger rod **130** from the syringe barrel **112**. The stop member **142** prevents pull-out of the plunger rod **130** from the syringe barrel **112**. In other words, the stop member **142** prevents an inadvertent removal of the plunger rod **130** from the syringe assembly **100** upon the application of a proximal force **PF**, as shown in **FIG. 5A**, to extend the outer member **136** with respect to the inner member **132**.

[0049] According to the configuration shown in **FIGS. 6A-6B**, the stop member **142** can comprise at least one longitudinally extending arm **143** having one end **145** associated with the outer member **136** wherein the longitudinally extending arm **143** extends along an outer

portion **147** of the syringe barrel sidewall **118**. The at least one longitudinally extending arm **143** can include an inwardly extending detent **149** at one end, such as a distal end **153** thereof, configured for contacting a bottom portion **157** of an outer portion **159** of the flange **121** of the syringe barrel **112** when the outer member **136** is in the extended ready-to-use position, as shown in **FIGS. 7A-7B**, for limiting the outward travel of the outer member **136**. According to one design, the at least one longitudinally extending arm **143** can comprise a pair of arms, each of the arms **143** including the inwardly extending detent **149** configured for contacting the bottom portion **157** of the outer portion **159** of the flange **121** of the syringe barrel **112**. In this configuration, the syringe barrel **112** can include at least one or a pair of pockets **161** for enclosing the longitudinally extending arms **143** when the outer member **136** is in the collapsed pre-use position. The at least one or pair of pockets **161** cooperate with the outer portion **159** of the flange **121** of the syringe barrel **112** to position and hold the detent **149** in contact with the outer portion **159** of the flange **121**.

[0050] Reference is now made to **FIGS. 8A-8C** which depict a packaging assembly, generally indicated as **200**, and the sequential operational steps for removing the packaging assembly **200** from the syringe assembly **10, 100** in accordance with an embodiment of the present invention. The packaging assembly **200** includes a molded cover **202** configured for placement about a portion of the syringe barrel **12, 112**, the plunger rod **30, 130**, and the tip cap **28, 128**. A tear tab **204** can be associated with one end **206** of the molded cover **202**. The tear tab **204** is configured, such as by the inclusion of a frangible portion **207**, to facilitate removal of the molded cover **202** from the syringe assembly **12, 112** and can be positioned adjacent a top surface or thumb press **64, 164** of the plunger rod **30, 130**. The tear tab **204** can include a roughened or serrated surface **208**, as is known in the art, to provide a frictional surface for assisting the user in grasping of the tear tab **204**. The cover **202** is configured for placement about the syringe assembly **10, 100** to constrain the plunger rod **30, 130** from inadvertent extension and to prevent tampering of the syringe assembly **10, 110**. The cover **202** can include an end portion **209** configured to fit about the tip cap **28, 128** to prevent its removal from the syringe assembly **10, 100**. The cover **202** can also be placed at a location about the syringe barrel **12, 112** to prevent damage to the syringe barrel **12, 112** during packaging, shipment, and handling.

[0051] It can be appreciated that each of the syringe assembly embodiments disclosed above result in a syringe assembly having a reduced footprint which is desirable in the packaging of the syringe assemblies as it requires less packaging. This reduced footprint provides for syringe assemblies having consistently sized profiles which allow for easy stacking and

require less storage space, both of these features being desirable in a controlled storage environment.

[0052] While specific embodiments of the invention have been described in detail, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of invention.

THE INVENTION CLAIMED IS:

1. A syringe assembly comprising:

a syringe barrel having a first end, a second end, and a sidewall extending between the first end and the second end defining a chamber;

a stopper disposed within the chamber of the syringe barrel;

a plunger rod having an inner member engaged with the stopper and an outer member adapted for telescopic movement with respect to the inner member, wherein the plunger rod is transitionable from a collapsed position in which a portion of the inner member is nested within the outer member, to an extended position in which the same portion of the inner member extends outside the outer member; and

at least one stop member configured for cooperation with a portion of the syringe barrel upon relative movement of the outer member with respect to the inner member to limit the outward travel of the plunger rod from the syringe barrel.

2. The syringe assembly of claim 1, wherein the at least one stop member limits pull-out of the plunger rod from the syringe barrel.

3. The syringe assembly of claim 1, wherein the at least one stop member comprises a laterally extending member positioned at a distal end of the inner member.

4. The syringe assembly of claim 3, wherein the laterally extending member is configured to cooperate with an internal portion of a syringe barrel flange to limit the outward travel of the plunger rod from the syringe assembly upon extension of the plunger rod to the extended position.

5. The syringe assembly of claim 4, wherein the inner member comprises a locking member for cooperating with an aperture in the outer member for locking the outer member to the inner member in the extended position.

6. The syringe assembly of claim 5, wherein the outer member comprises a pair of holding members surrounding the aperture and the locking member comprises a pair of reverse bevels for cooperating with the pair of holding members to maintain the outer

member in the extended position upon the application of a distal force and a proximal force applied to the outer member.

7. The syringe assembly of claim 1, wherein the inner member comprises a substantially X-shaped profile configured for engagement with a corresponding substantially X-shaped opening within the outer member.

8. The syringe assembly of claim 1, comprising at least one detent associated with the outer member and configured to cooperate with the syringe barrel to limit movement of the outer member into the syringe barrel upon the application of a distally directed force to the plunger rod.

9. The syringe assembly of claim 1, wherein the at least one stop member comprises at least one longitudinally extending arm associated with the outer member and wherein the at least one longitudinally extending arm extends along an outer portion of the syringe barrel.

10. The syringe assembly of claim 9, wherein the at least one longitudinally extending arm comprises an inwardly extending detent at one end thereof configured for contacting an outer flange of the syringe barrel when the outer member is in the extended position, for limiting the outward travel of the outer member.

11. The syringe assembly of claim 10, wherein the at least one longitudinally extending arm comprises a pair of arms, each of the arms comprising the inwardly extending detent at one end thereof configured for contacting the outer flange of the syringe barrel.

12. The syringe assembly of claim 10, wherein the syringe barrel comprises at least one pocket for enclosing the at least one longitudinally extending arm when the outer member is in the collapsed position.

13. The syringe assembly of claim 12, wherein the at least one pocket cooperates with the outer flange of the syringe barrel to position and/or hold the detent with respect to the outer flange.

14. The syringe assembly of claim 1, further comprising a molded cover having a tear tab for removal of the cover, wherein the cover is configured to constrain the plunger rod from inadvertent transition to the extended position.

15. The syringe assembly of claim 1, further comprising a medication or drug disposed within the syringe barrel.

16. A telescopic plunger rod assembly comprising a plunger rod for use with a syringe assembly, the plunger rod comprising:

an inner member having a distal end configured for being secured to a stopper located within a syringe barrel;

an outer member having an open portion configured for telescopically engaging a portion of the inner member, wherein the plunger rod is transitionable from a collapsed position to an extended position; and

at least one stop member configured for cooperation with a portion of the syringe barrel to limit the outward travel of the outer member from the syringe barrel upon transition of the plunger rod to the extended position.

17. The telescopic plunger rod assembly of claim 16, wherein the at least one stop member comprises a laterally extending member positioned at the distal end of the inner member and configured to cooperate with an internal portion of a syringe barrel flange to limit the outward travel of the plunger rod from the syringe assembly upon extension of the plunger rod to the extended position.

18. The telescopic plunger rod assembly of claim 17, wherein the inner member comprises a locking member configured for cooperating with an aperture in the outer member for locking the outer member to the inner member in the extended position.

19. The telescopic plunger rod assembly of claim 18, wherein the inner member comprises a substantially X-shaped profile configured for engagement with a corresponding substantially X-shaped opening within the outer member.

20. The telescopic plunger rod assembly of claim 17, comprising at least one detent associated with the outer member and configured to cooperate with the syringe barrel

to limit movement of the outer member into the syringe barrel upon the application of a distally directed force to the plunger rod.

21. The telescopic plunger rod assembly of claim 17, wherein the at least one stop member comprises a pair of longitudinally extending arms associated with the outer member extending along an outer portion of the syringe barrel and including an inwardly extending detent for contacting an outer flange of the syringe barrel when the outer member is in the extended position.

22. A packaging assembly for use with a pre-filled syringe assembly, the packaging assembly comprising:

a molded cover configured for placement about a portion of a syringe barrel, a plunger rod, and a tip cap; and

a tear tab associated with one end of the molded cover, the tear tab configured to facilitate removal of the molded cover from the syringe assembly.

23. The packaging assembly of claim 22, wherein the tear tab is positioned adjacent a top surface of the plunger rod and the molded cover is configured for placement about the syringe assembly to constrain the plunger rod from inadvertent transition to an extended position.

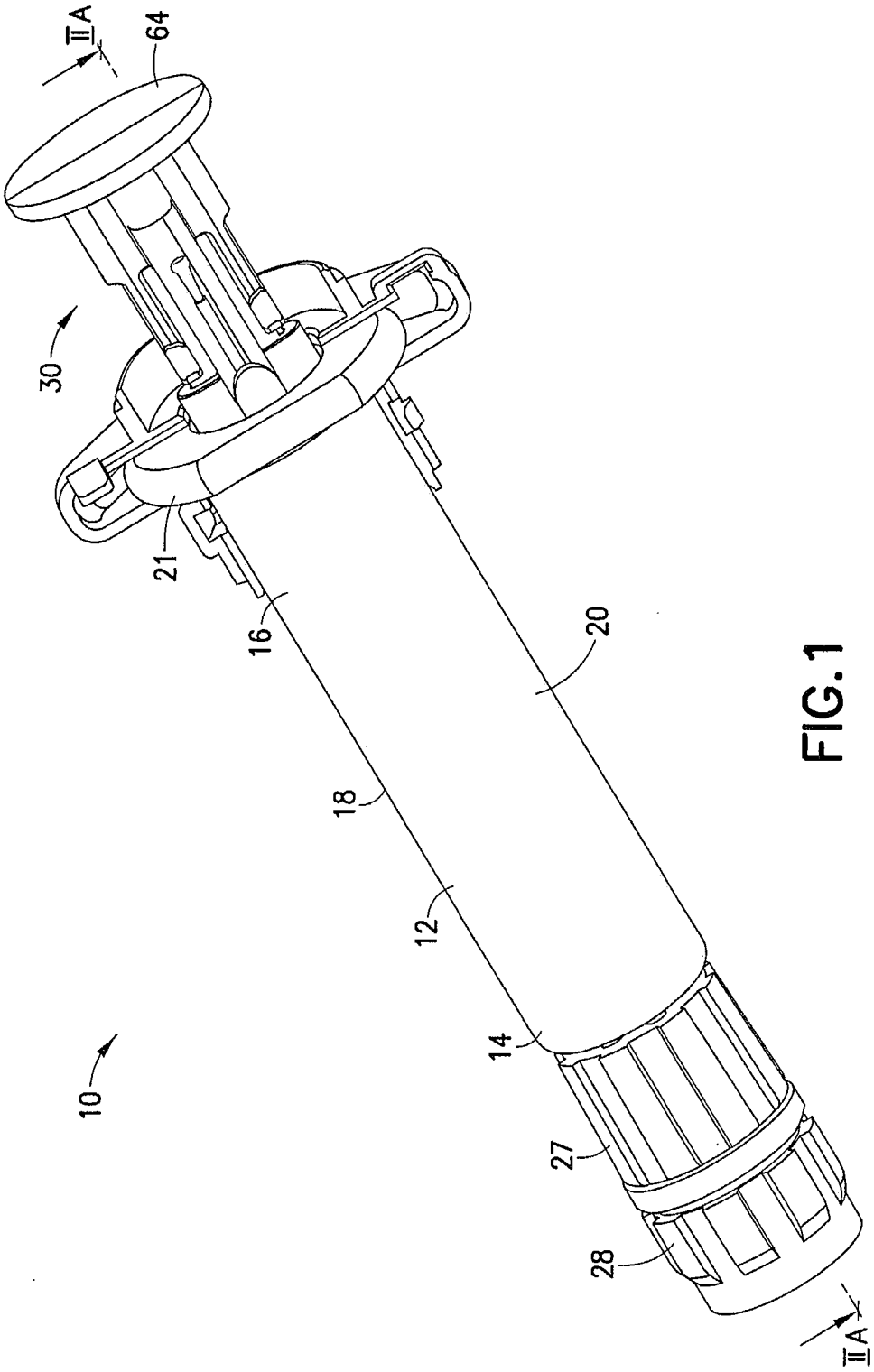


FIG. 1

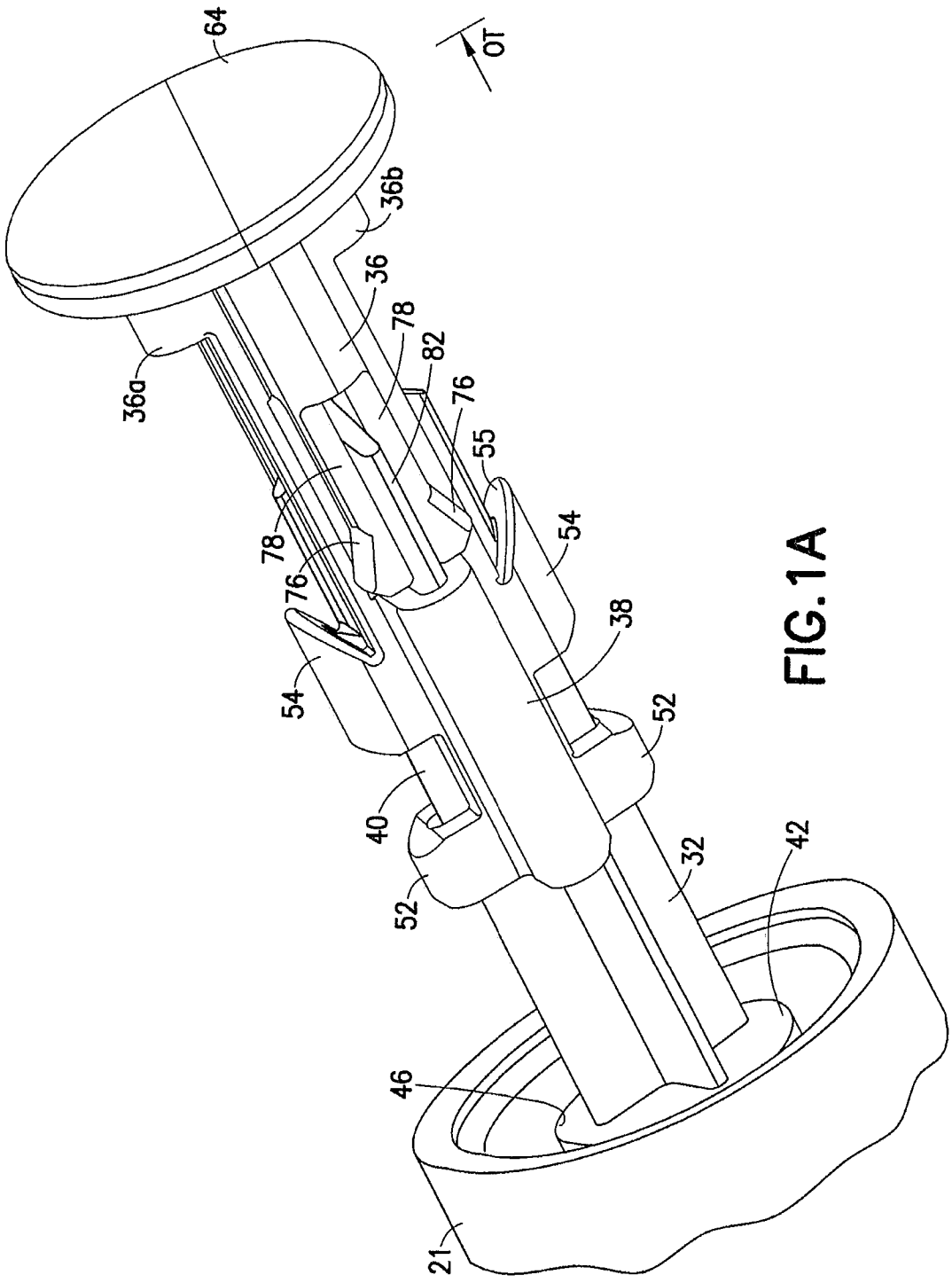


FIG. 1A

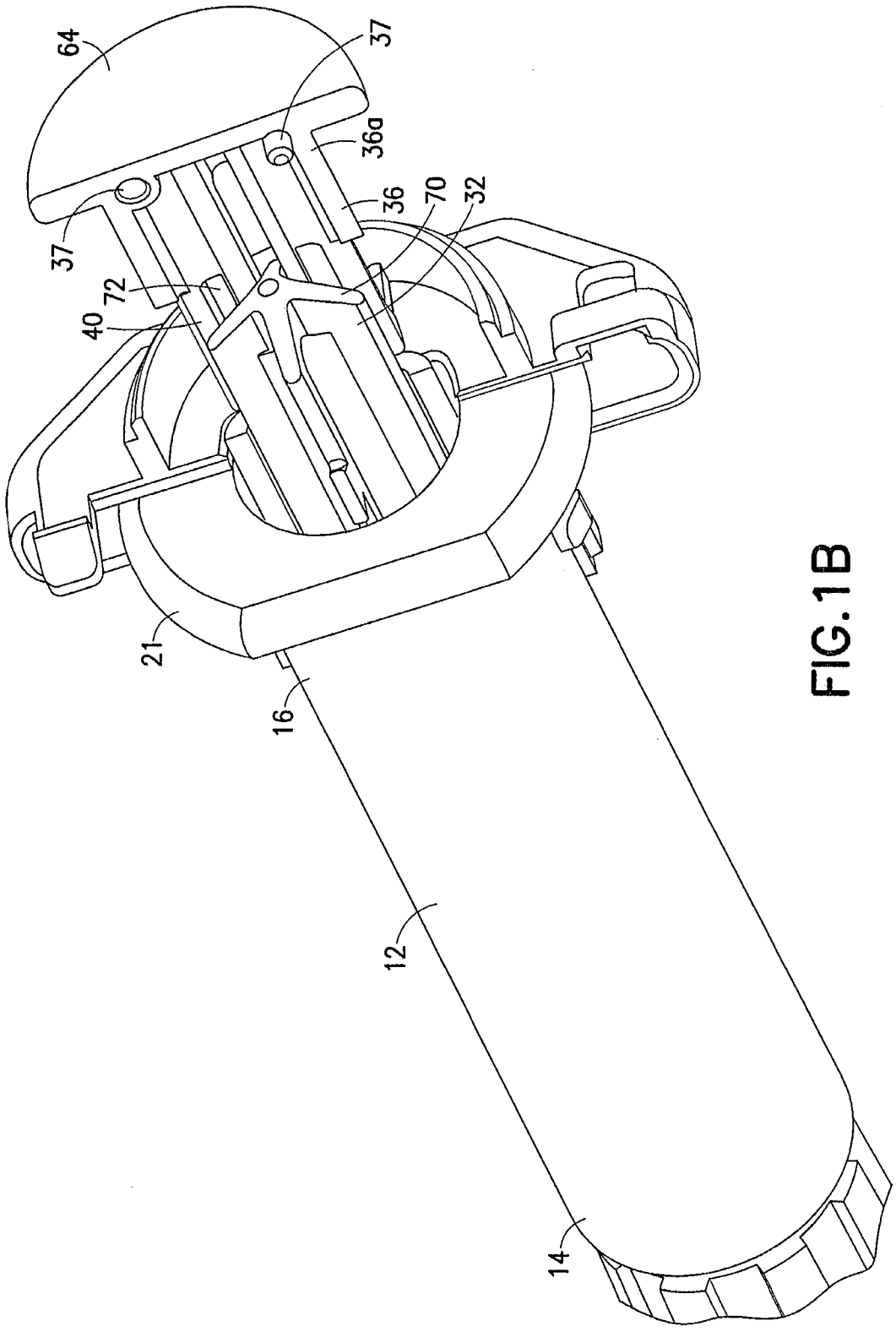


FIG.1B

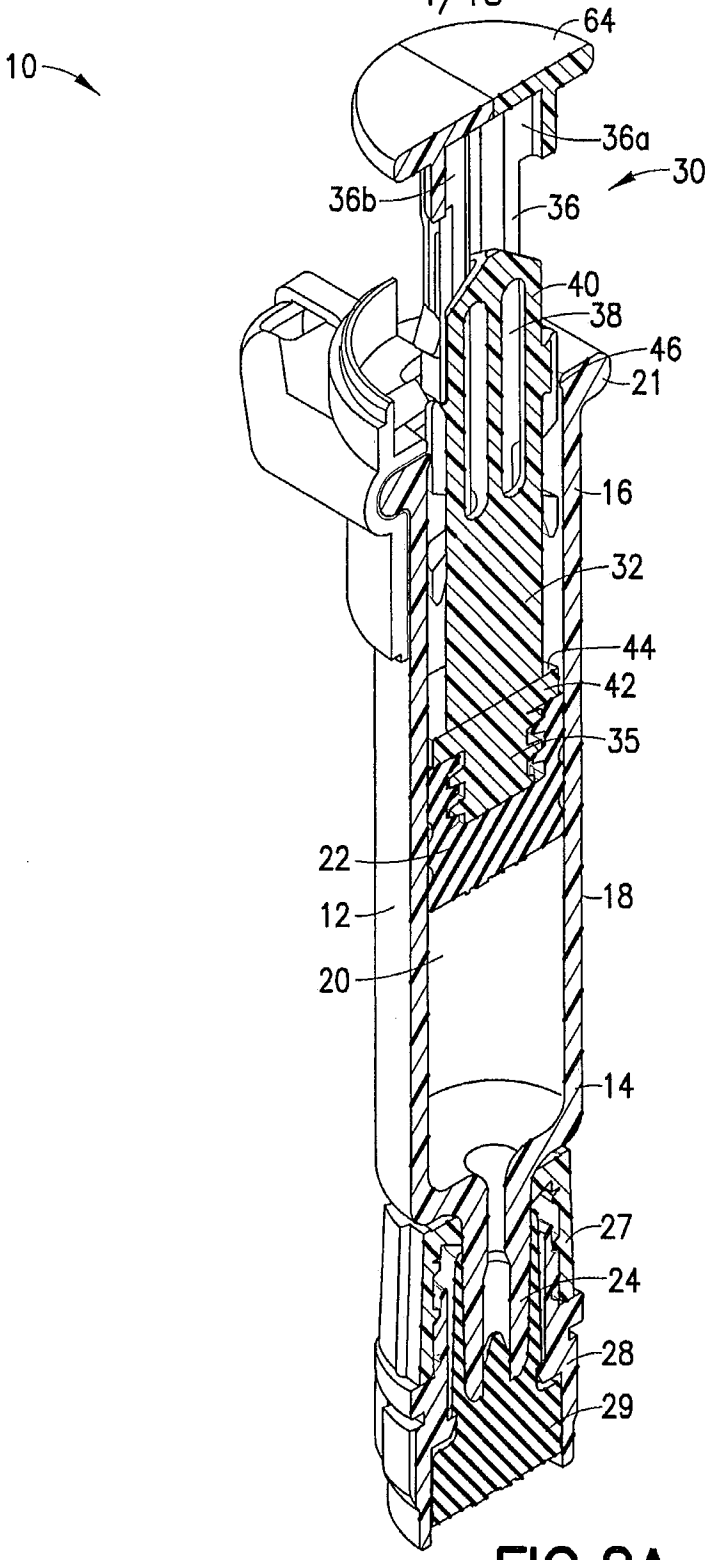

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36b
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FIG.2A

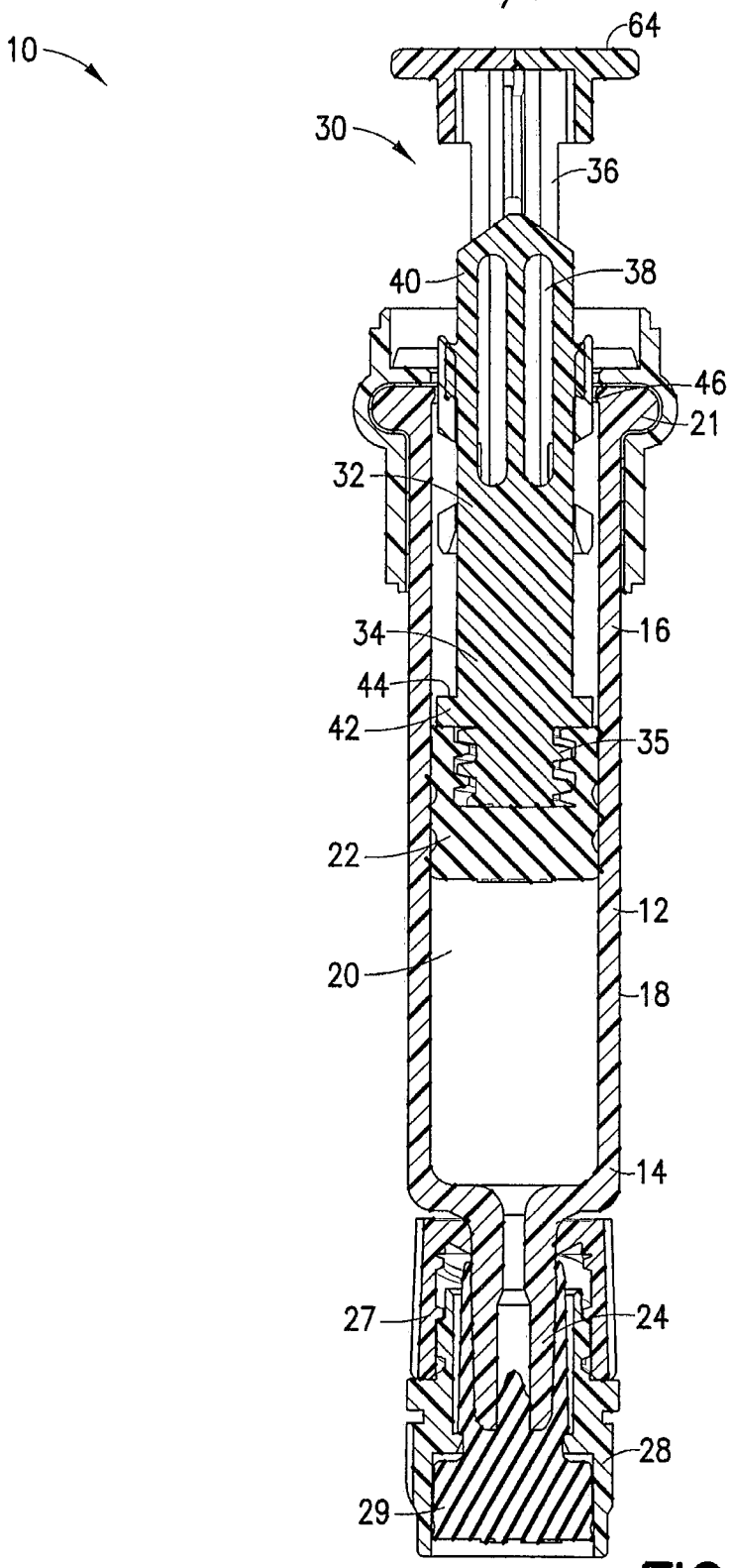


FIG.2B

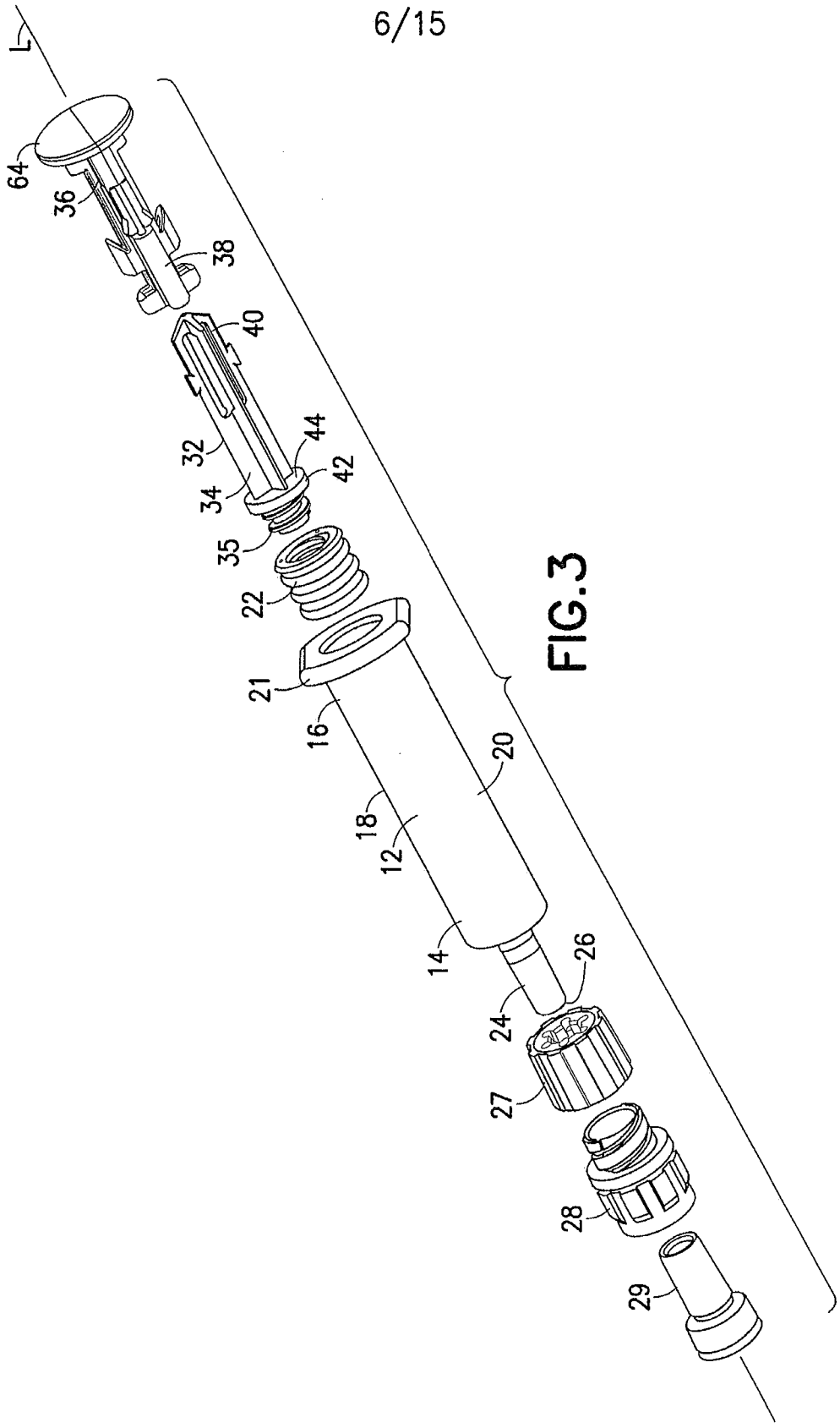


FIG.3

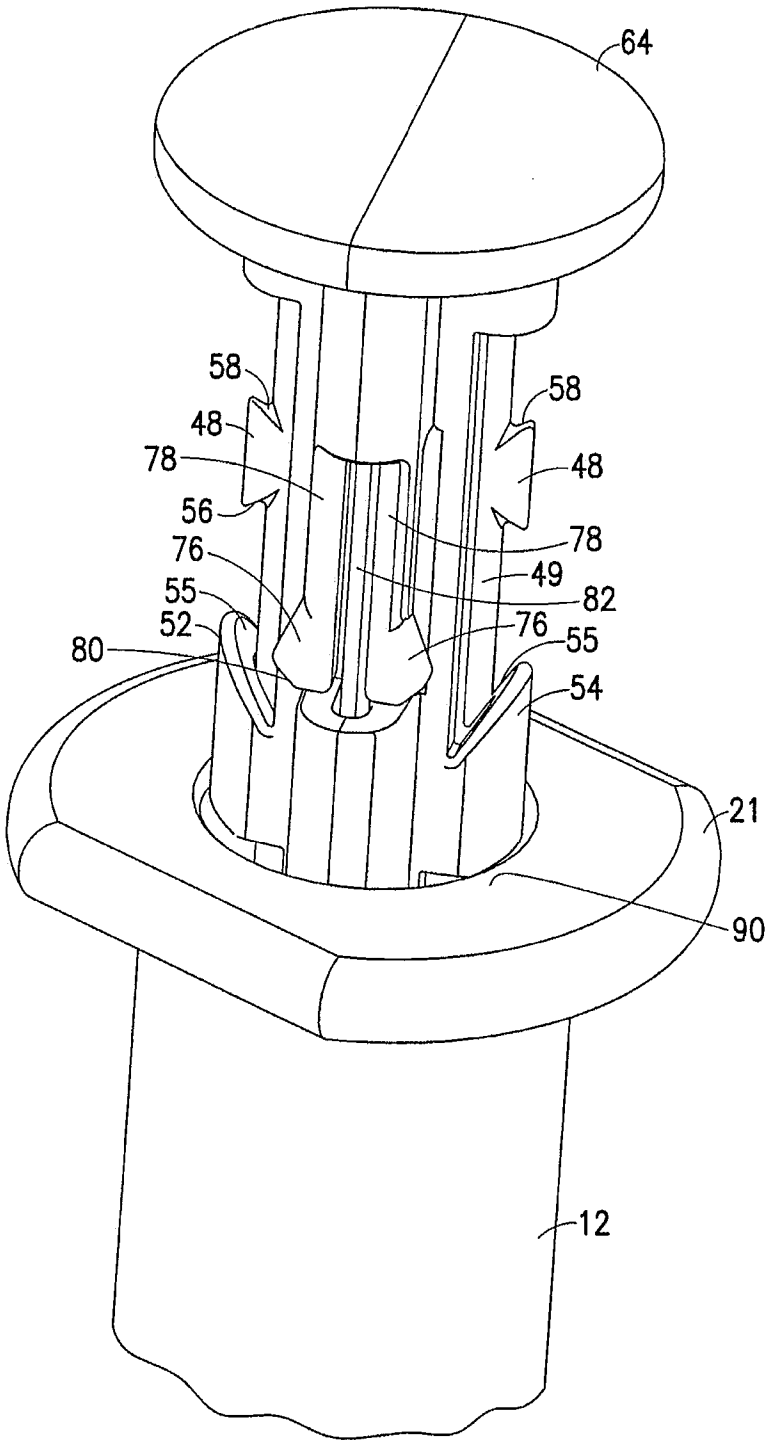


FIG.4A

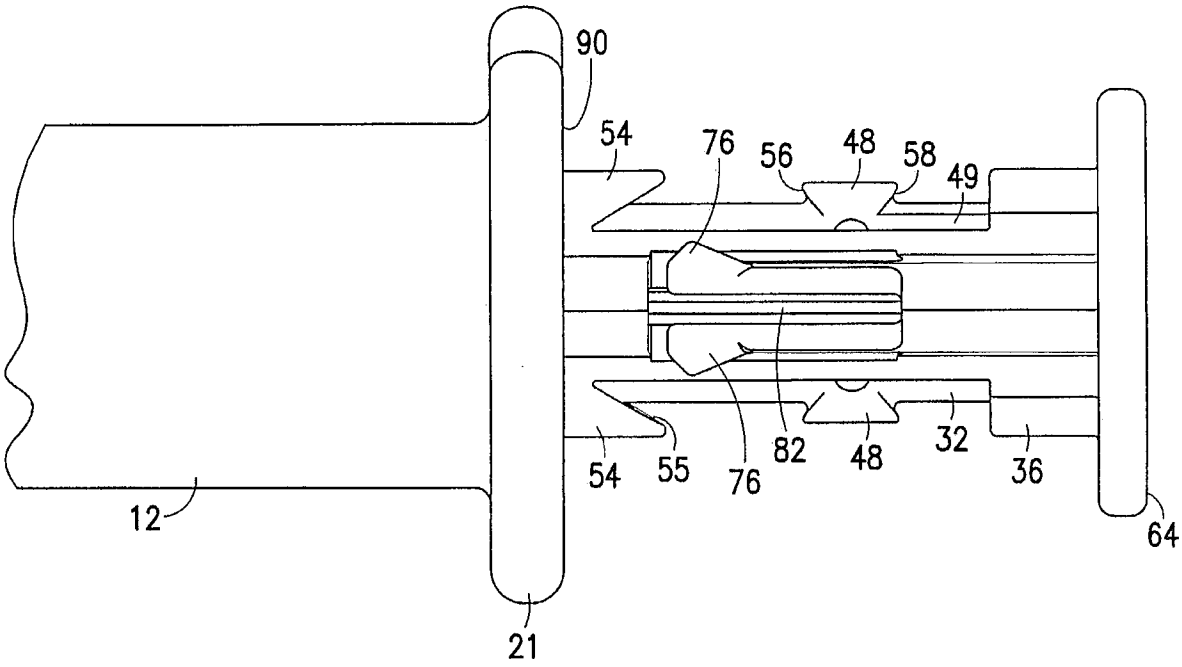

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FIG.4B

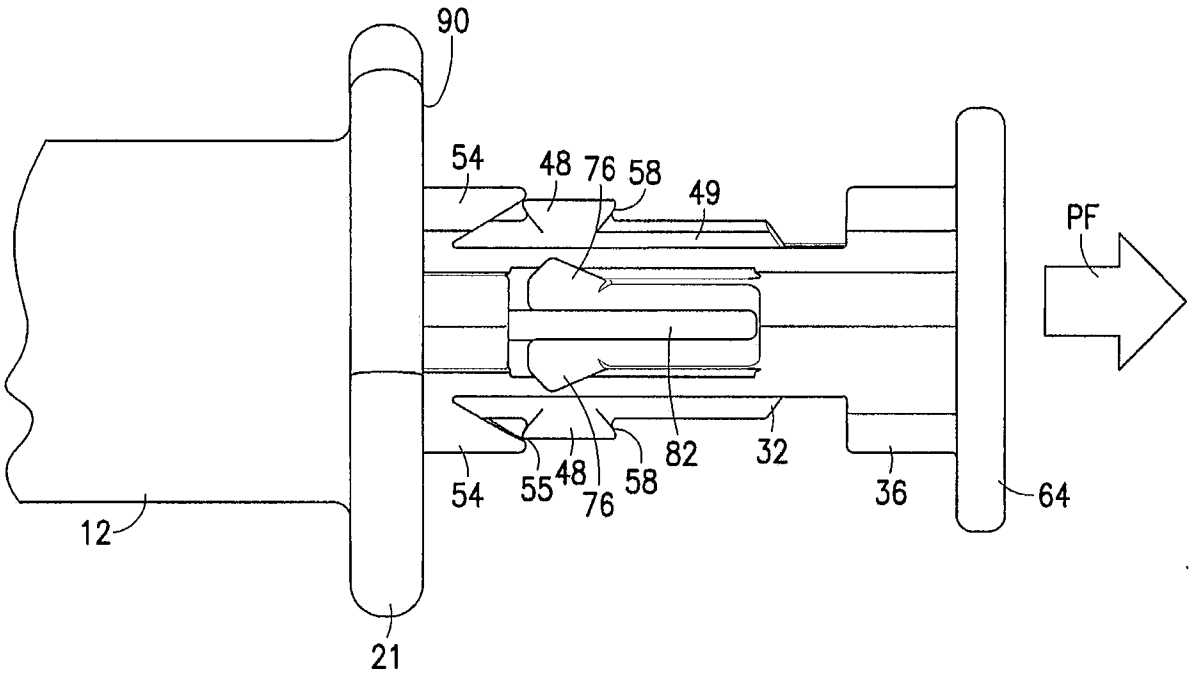

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FIG.5A

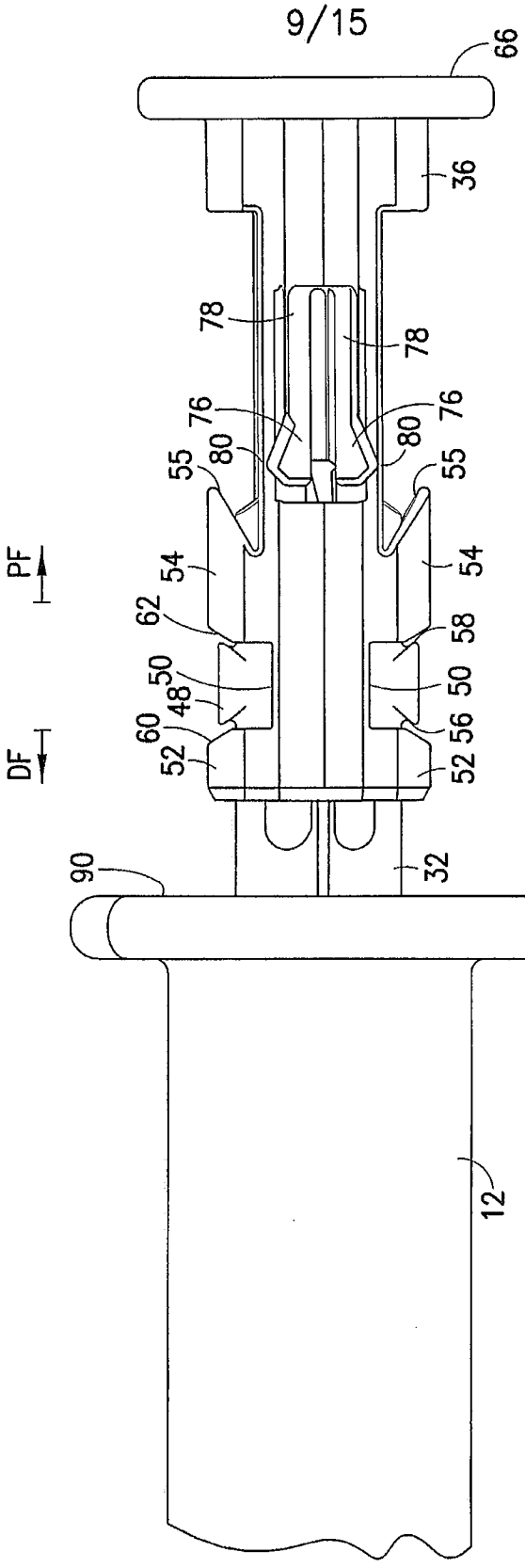

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FIG.5B

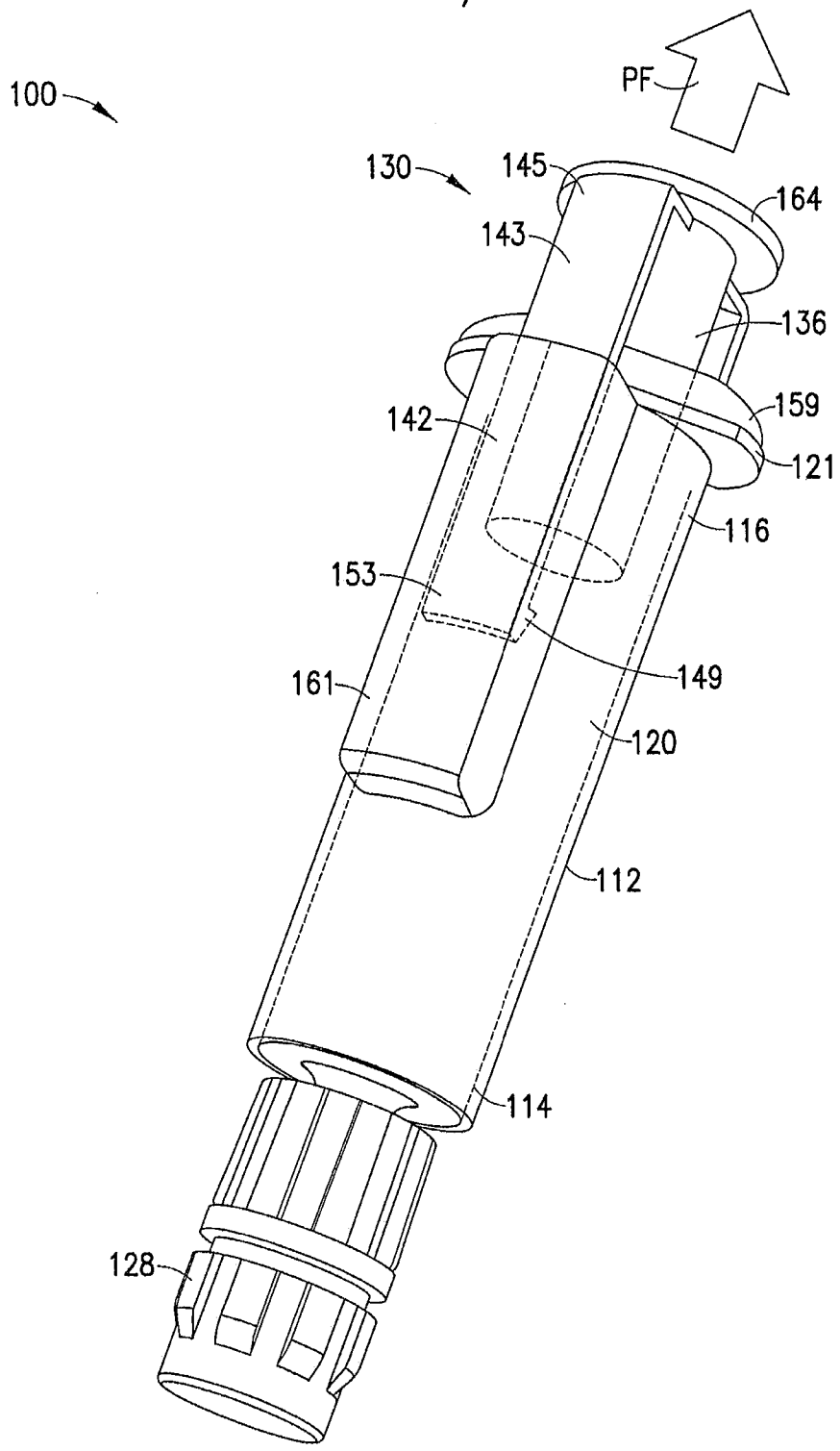

100
PF
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142
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112
114
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FIG.6A

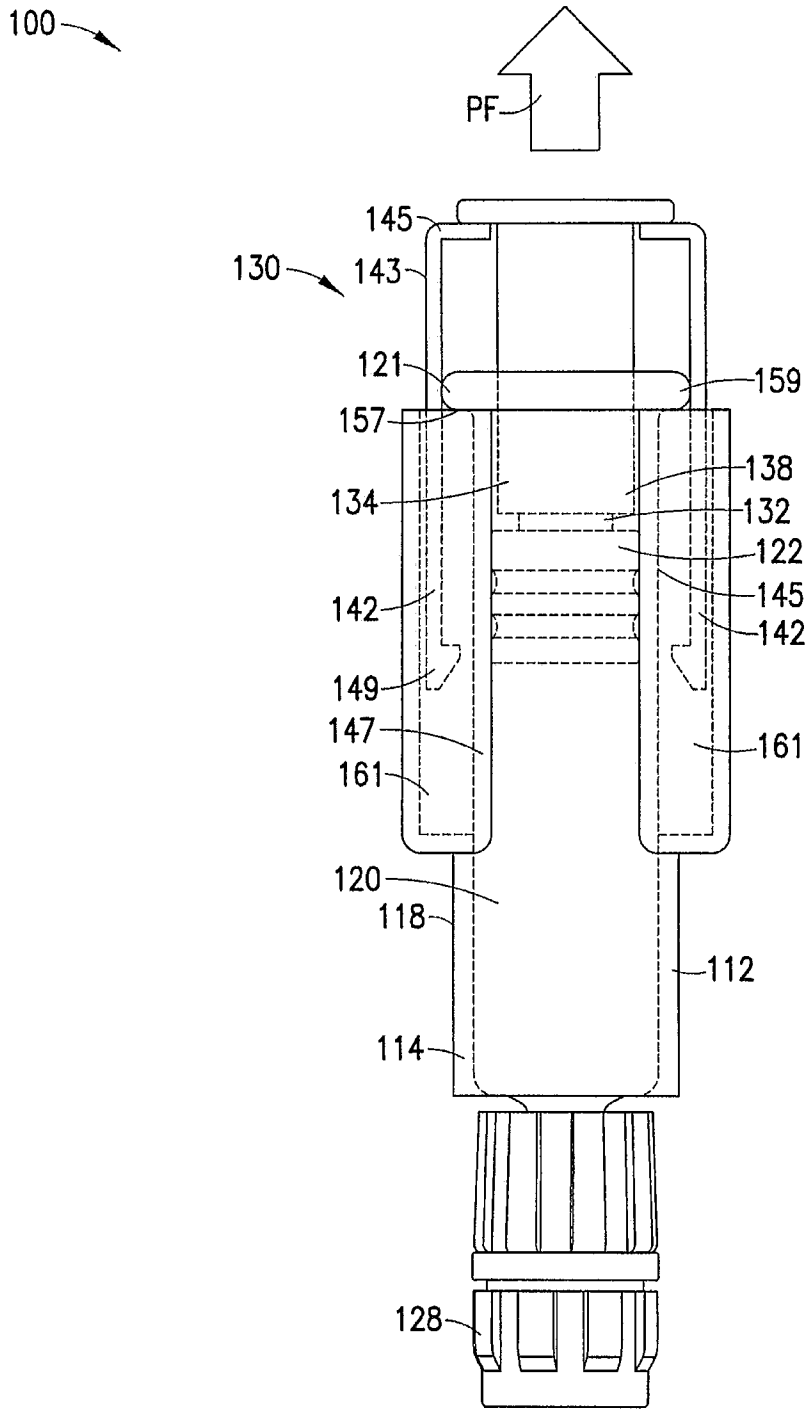

100
PF
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130
143
121
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132
122
145
142
142
149
147
161
161
120
118
112
114
128

FIG.6B

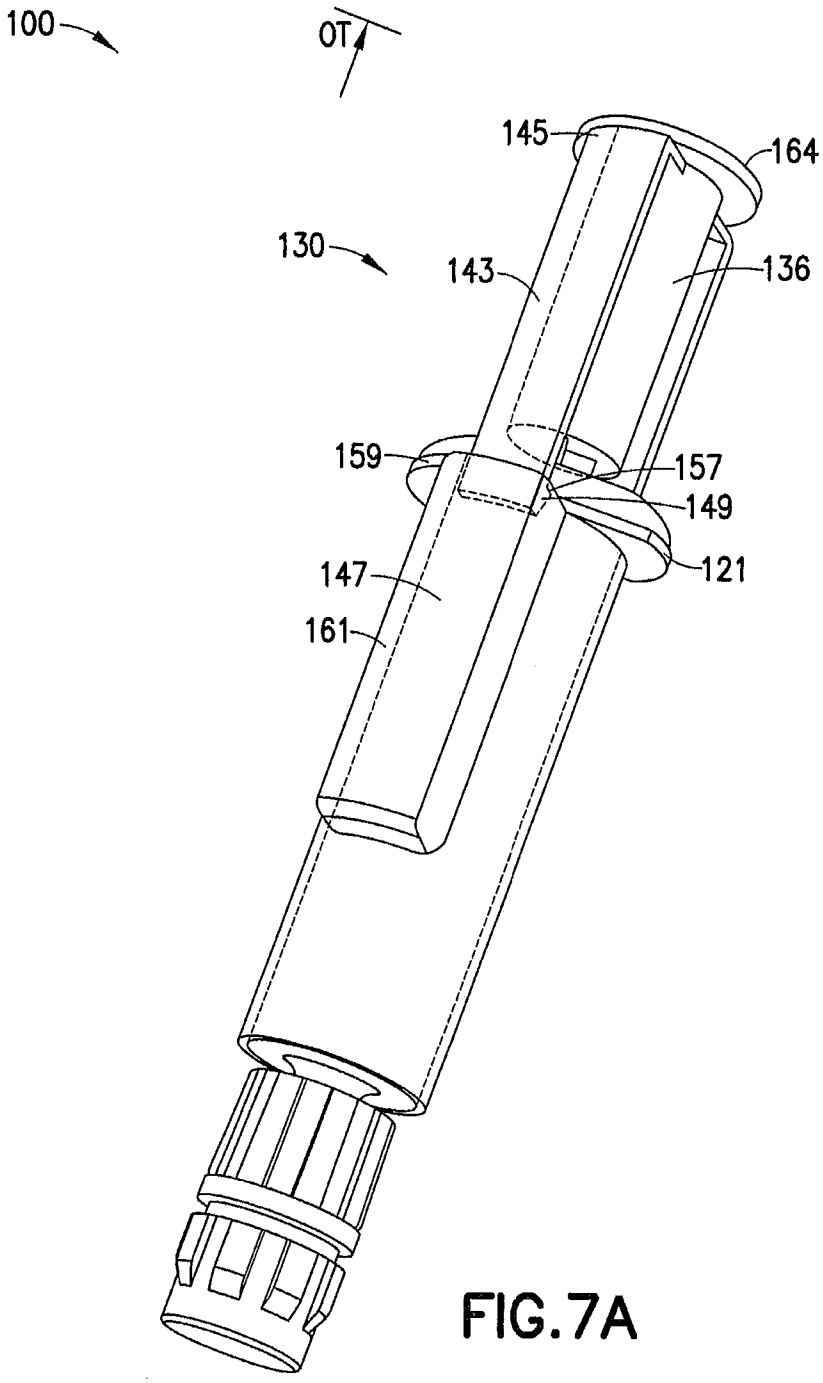


FIG.7A

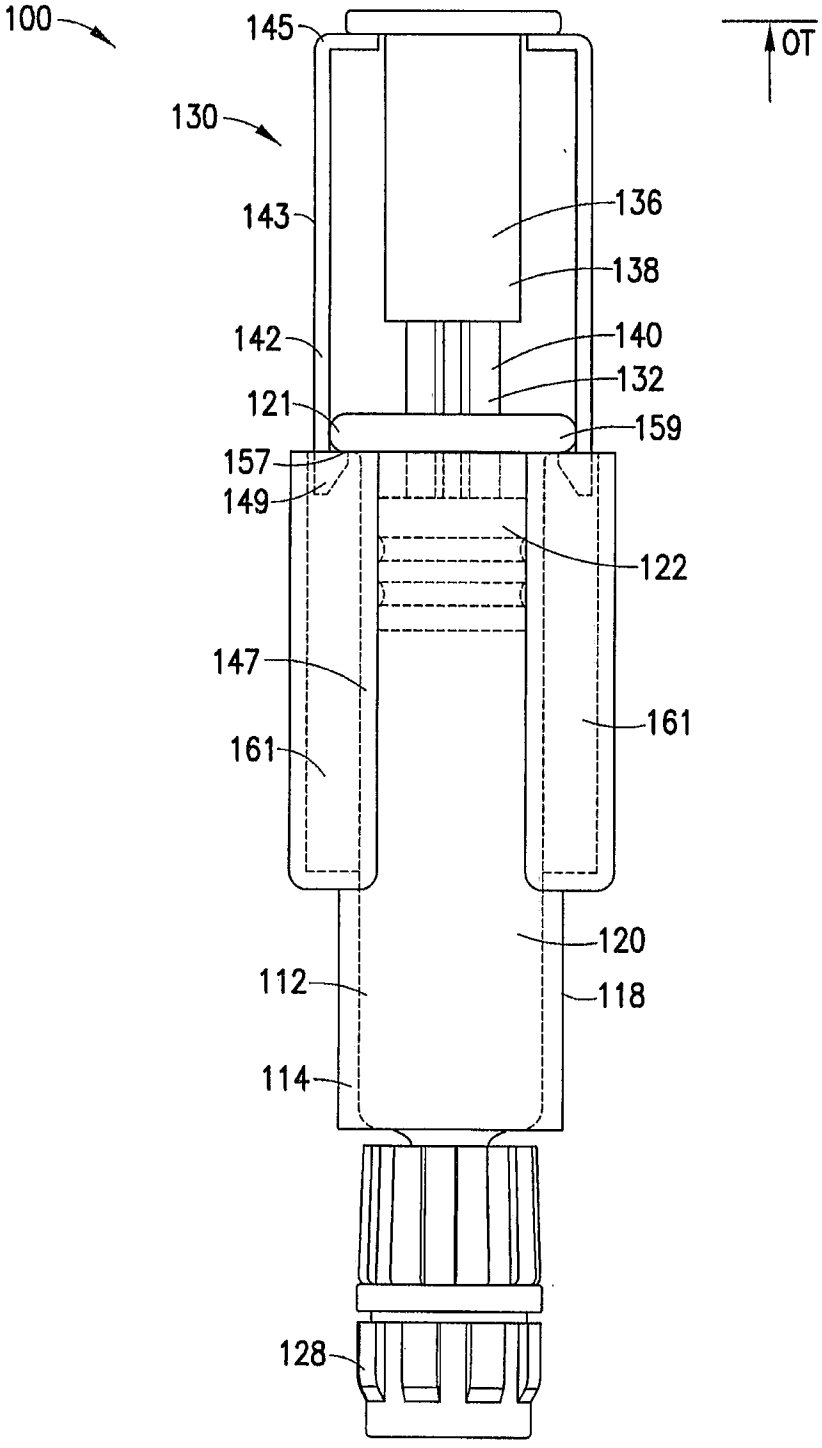

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FIG.7B

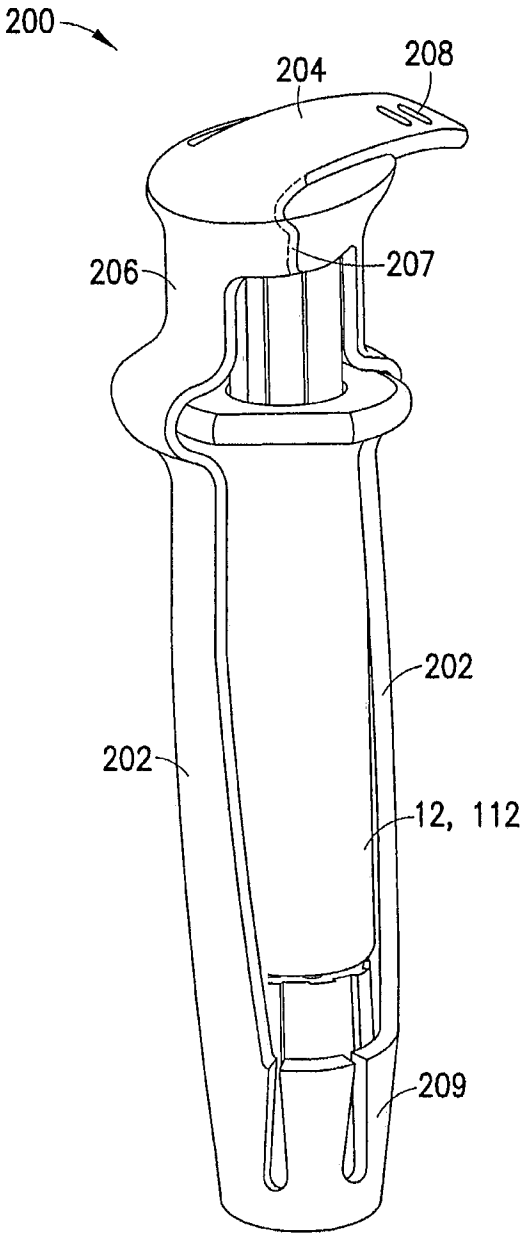

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12, 112
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FIG.8A

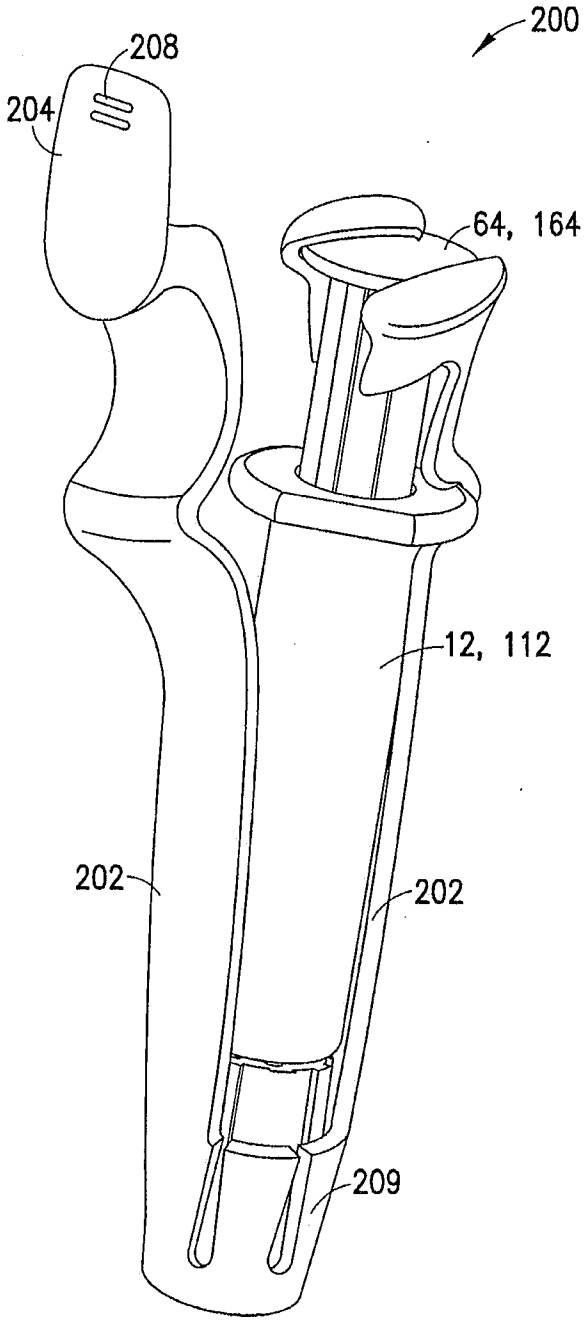

200
208
204
64, 164
12, 112
202
202
209

FIG.8B

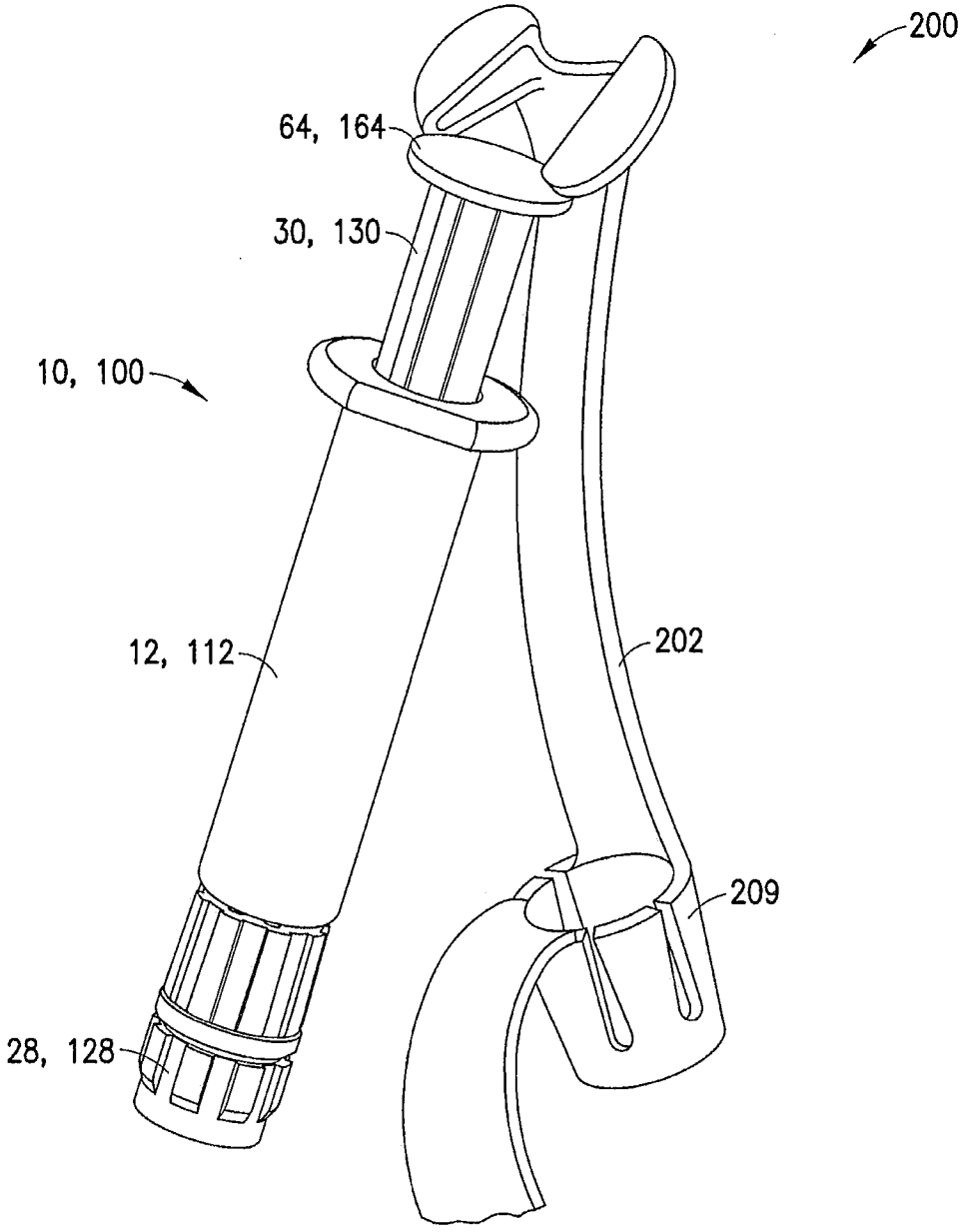


FIG.8C