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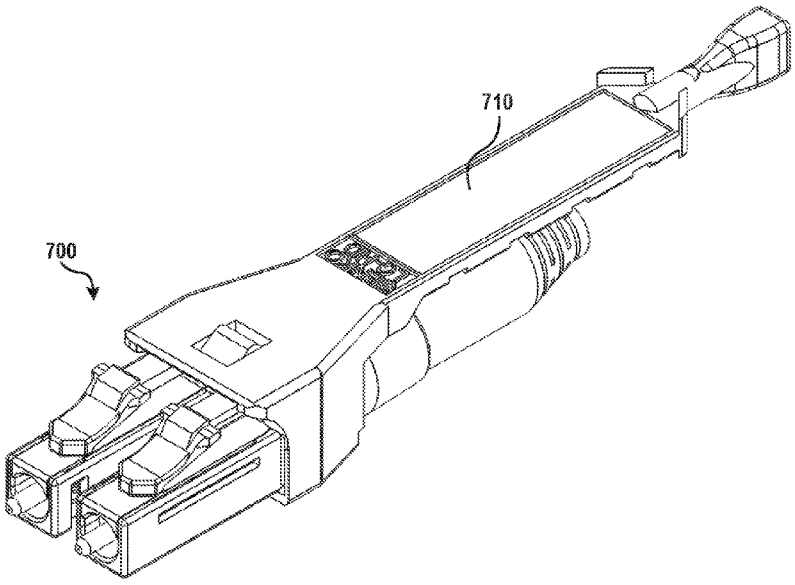


FIG. 7A

(57) Abstract: Connector assemblies are described herein. For example, a connector assembly including: a housing configured to accept a first ferrule and a second ferrule. The connector assembly may also have a latch component that is removably connected to the housing, wherein the latch component is configured to rotate around the housing. The latch component may have a first locking element configured to engage a second locking element to prevent rotation of the latch component in at least one of a first polarity position to a second polarity position. The connector may further more include a push-pull tab removably connected to the housing and configured to move vertically along the housing when a biasing force is applied in at least one of a forward direction and a rearward direction. Accordingly, the push-pull tab can compress the latch component when moving vertically along the housing.

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ADJUSTABLE POLARITY FIBER OPTIC CONNECTOR ASSEMBLIES WITH PUSH-PULL TABS

BACKGROUND

[0001] The present disclosure relates generally to fiber optic connectors. The prevalence of the Internet has led to unprecedented growth in communication networks. Consumer demand for service and increased competition has caused network providers to continuously find ways to improve quality of service while reducing cost. Certain solutions have included deployment of high-density interconnect panels. High-density interconnect panels may be designed to consolidate the increasing volume of interconnections necessary to support the fast-growing networks into a compacted form factor, thereby increasing quality of service and decreasing costs such as floor space and support overhead.

[0002] In communication networks, such as data centers and switching networks, numerous interconnections between mating connectors may be compacted into high-density panels. Panel and connector producers may optimize for such high densities by shrinking the connector size and/or the spacing between adjacent connectors on the panel. While both approaches may be effective to increase the panel connector density, shrinking the connector size and/or spacing may also increase the support cost and diminish the quality of service.

[0003] In a high-density panel configuration, adjacent connectors and cable assemblies may obstruct access to the individual release mechanisms. Such physical obstructions may impede the ability of an operator to minimize the stresses applied to the cables and the connectors. For example, these stresses may be applied when the user reaches into a dense group of connectors and pushes aside surrounding optical fibers and connectors to access an individual connector release mechanism with his/her thumb and forefinger. Overstressing the cables and connectors may produce latent defects, compromise the integrity and/or reliability of the terminations, and potentially cause serious disruptions to network performance.

[0004] Accordingly, there is a need for fiber optic connectors that will meet the needs of future developments allowing for smaller footprints, easier implementation, and easy field modification.

SUMMARY

[0005] This disclosure is not limited to the particular systems, devices and methods described, as these may vary. The terminology used in the description is for the purpose of describing the particular versions or embodiments only, and is not intended to limit the scope.

[0006] As used in this document, the singular forms "a," "an," and "the" include plural references unless the context clearly dictates otherwise. Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art. Nothing in this disclosure is to be construed as an admission that the embodiments described in this disclosure are not entitled to antedate such disclosure by virtue of prior invention. As used in this document, the term "comprising" means "including, but not limited to."

[0007] In an embodiment, a connector assembly may have a housing configured to accept a first ferrule and a second ferrule. The connector assembly may also have a latch component that is removably connected to the housing, wherein the latch component is configured to rotate around the housing. The latch component may have a first locking element configured to engage a second locking element to prevent rotation of the latch component in at least one of a first polarity position to a second polarity position. The connector may further more include a push-pull tab removably connected to the housing and configured to move vertically along the housing when a biasing force is applied, to the push-pull tab, in at least one of a forward direction and a rearward direction. Accordingly, the push-pull tab can compress the latch component when moving longitudinally along the housing.

[0008] In an embodiment, a connector assembly having an adjustable polarity may include a first plug frame and a second plug frame that are independent from each other, a first ferrule disposed within the first plug frame and a second ferrule disposed within the second plug frame that are each coupled to a terminal end of an optical fiber cable; and a housing that may include a top housing component configured to be removably coupled to a bottom housing component. The top and bottom housing coupled together to form a configured to secure the first plug frame and the second plug frame within the connector assembly. In one aspect, removal of the top housing component from the bottom housing component may provide access to the first plug frame and the second plug frame to allow for changing a location of the first plug frame and the second plug frame within the housing to change polarity of the connector assembly.

[0009] In a further embodiment, a connector assembly may have an adjustable polarity comprising: a polymer uni-body base frame comprising a plug frame portion, a body portion, and a back post portion; a top cover; and an independent latch; wherein the independent latching component is removable connected to the distal end (D) of the base frame; and wherein the independent latch component is configured to rotate substantially concentric about the base frame to change polarity of the connector assembly from a first polarity to a second polarity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above and other objects of the present invention will become more readily apparent from the following detailed description taken in connection with the accompanying drawings.

[0011] FIG. 1 depicts an exploded view of a connector assembly according to an embodiment.

[0012] FIGS. 2A-2C depict an illustrative connector assembly according to an embodiment.

[0013] FIG. 3A depicts an exploded view of a connector assembly according to an embodiment.

[0014] FIG. 3B depicts a cross-sectional view of a connector assembly according to an embodiment.

[0015] FIG. 3C depicts a detailed view of a latch component of a connector assembly according to an embodiment.

[0016] FIGS. 3D-3F depict a change in polarity of an illustrative connector assembly according to an embodiment.

[0017] FIG. 4A depicts a top-down view of a connector assembly according to an embodiment.

[0018] FIG. 4B depicts a cross-sectional view of a connector assembly according to an embodiment.

[0019] FIG. 4C depicts a side view of a connector assembly according to an embodiment.

[0020] FIG. 4D depicts a perspective view of a connector assembly according to an embodiment.

[0021] FIG. 4E depicts a side view of a latch component of a connector assembly according to an embodiment.

[0022] FIG. 4F depicts a top view of a latch component of a connector assembly according to an embodiment.

[0023] FIGS. 4G-4I depict a change in polarity of an illustrative connector assembly according to an embodiment.

[0024] FIG. 5 depicts an exploded view of a connector assembly according to an embodiment.

[0025] FIG. 6A depicts an illustrative example of connector assembly according to an embodiment.

[0026] FIG. 6B depicts an illustrative example of push-pull tab according to an embodiment.

[0027] FIG. 6C depicts an illustrative example of the push-pull tab connected to the connector assembly according to an embodiment.

[0028] FIG. 7A depicts a perspective view of the push-pull tab connected to the connector assembly according to an embodiment.

[0029] FIG. 7B depicts another perspective view of the push-pull tab connected to the connector assembly according to an embodiment.

[0030] FIG. 8A depicts a detailed view of a portion of the connector assembly according to an embodiment.

[0031] FIG. 8B depicts a side view of a portion of the connector assembly according to an embodiment.

[0032] FIG. 9A depicts a potential polarity change of the connector assembly according to an embodiment.

[0033] FIG. 9B depicts a recess on the housing of the connector assembly according to an embodiment.

[0034] FIG. 9C depicts a protrusion on the latching component according to an embodiment.

[0035] FIG. 10A depicts an underside view of a push-pull tab according to an embodiment.

[0036] FIG. 10B depicts a topside view of a push-pull tab according to an embodiment.

[0037] FIG. 10C depicts a perspective view of a connector assembly according to an embodiment.

[0038] FIG. 11 depicts a detailed view of a protrusion and window interacting according to an embodiment.

[0039] FIG. 12A depicts an illustrative view of a push-pull tab connected to a connector assembly according to an embodiment.

[0040] FIG. 12B depicts a detailed view of a portion of the illustrative view of a push-pull tab connected to a connector assembly according to an embodiment and shown in FIG. 12A.

[0041] FIG. 12C depicts a detailed view of a portion of the illustrative view of a push-pull tab connected to a connector assembly according to an embodiment and shown in FIG. 12A.

[0042] FIG. 13 depicts a cross-sectional view of a push-pull tab connected to a connector assembly according to an embodiment.

[0043] FIG. 14 depicts a perspective view of a push-pull tab connected to a connector assembly according to an embodiment.

[0044] FIG. 15A depicts a perspective view of a push-pull tab according to an embodiment.

[0045] FIG. 15B depicts a detailed view of a push-pull tab connected to a connector assembly according to an embodiment.

[0046] FIG. 16A depicts a detailed view of a small recess on the push-pull tab according to an embodiment.

[0047] FIG. 16B depicts a perspective view of the top of the latching component according to an embodiment.

[0048] FIG. 17 depicts a detailed cross-sectional view of a small protrusion interacting with a small recess according to an embodiment.

[0049] FIG. 18A depicts a perspective view of a tension bar on the push-pull tab.

[0050] FIG. 18B depicts a side view of a tension bar on the push-pull tab.

[0051] FIGS. 19A depicts a perspective view of a connector assembly with a 6.25mm pitch.

[0052] FIGS. 19B depicts a front view of a connector assembly with a 6.25mm pitch.

[0053] FIGS. 20A depicts a perspective view of a connector assembly with a 6.25mm pitch.

[0054] FIGS. 20B depicts a front view of a connector assembly with a 6.25mm pitch.

[0055] FIGS. 21A depicts a perspective view of a connector assembly with a 5.25mm pitch.

[0056] FIGS. 21B depicts a front view of a connector assembly with a 5.25mm pitch.

[0057] FIGS. 22A depicts a perspective view of a connector assembly with a 5.25mm pitch.

[0058] FIGS. 22B depicts a front view of a connector assembly with a 5.25mm pitch.

[0059] FIGS. 23A depicts a perspective view of a connector assembly with a 3.4mm pitch.

[0060] FIGS. 23B depicts a front view of a connector assembly with a 3.4mm pitch.

DETAILED DESCRIPTION

[0061] The reliability of communication infrastructure depends on secure and accurate connections between components, such as cable segments, network equipment, and communication devices. Large-scale data communication systems use fiber optic cables for data transmission between components. The fiber optic cables may be terminated by connector assemblies. Duplex connector assemblies, such as an LC connector assembly, may include a receiving optical fiber (typically labeled as "A") and a transmitting optical fiber (typically labeled as "B"). Such duplex connector assemblies may connect with an adapter having corresponding receiving (or "A") and transmitting ("B") ports. A duplex connector assembly is generally configured such that the receiving optical fiber connects with the transmitting port of the adapter and the transmitting optical fiber connects with the receiving port of the adapter.

[0062] A duplex connector assembly has a polarity based on the relative orientation of the receiving optical fiber and the transmitting optical fiber. Similarly, a corresponding adapter may have a polarity based on the relative orientation of the receiving port and the transmitting port. If the polarity of the connector assembly corresponds to the polarity of the adapter, the connection between the connector assembly and the adapter may successfully communicate data over the fiber optic cables joined by these two components. However, particularly in large installations, the polarity of the connector often does not correspond with the polarity of the adapter, leading to cross over and other communication issues. The connector assembly cannot simply be rotated to a correct polarity, as the connector assembly includes elements configured to secure the connector assembly to the adapter which prevent rotation.

[0063] Conventional techniques for changing an incorrect polarity of a connector assembly involve difficult and time consuming methods. For example, an installer may be required to remove the existing, incorrect connector assembly and prepare a new connector assembly on site. Other methods involve the use of special tools or high-cost connector

components that may also require twisting or rotating the fiber, which may lead to damaged connections. Accordingly, telecommunication network providers would benefit from a connector assembly configured to allow for the efficient and effective changing of the polarity of the connector assembly on-site.

[0064] The described technology generally relates to connector assemblies (for example, a plug, male connector, connector, or the like) having an adjustable polarity. In general, the connector assemblies have a plurality of orientations, alignments, or other physical attributes that cause the connector assemblies to have a plurality of polarities. In some embodiments, the connector assembly may only fit into and/or correctly connect with an adapter (for instance, a receptacle, female connector, adapter, or the like) in one or more of the polarities. The polarity of the connector assembly may be based on the relative orientation of components of the connector assembly, such as ferrules, a housing, a latch, a frame, or the like. For example, a connector assembly configured according to some embodiments may include two ferrules, a transmission ferrule and a receiving ferrule that may be arranged in one of a first polarity and a second polarity in order to form a successful connection with a corresponding adapter.

[0065] The connector assemblies and other data transmission elements described according to some embodiments herein may be connected within a network, which may include any type of network capable of transmitting signals, electricity, or any other type of transmission medium. For instance, the network may include, without limitation, a communication network, a telecommunication network, an electrical network, a data network, a computer network, and any combination thereof. In some embodiments, the network may include a communication network using various signal transmission mediums, including, without limitation, fiber optic networks, Ethernet networks, cable and/or satellite television networks, and any other type of communication network now known or developed in the future. In some embodiments, the

sealable connector assemblies may be configured to connect cable segments and/or devices within a fiber optic network using various standard connector types and/or adaptors, including, but not limited to, LC, ST, SC, FC, DIN, D4, SMA, E2000, Biconic, FullAXS, OCD, small form-factor pluggable (SFP), MPO and/or copper-type network connections, such as RJ-45 type connectors. In some embodiments, the connector assembly may include a duplex LC-type connector and the connector assembly adaptor may include an SFP adaptor. In some embodiments the connector assembly may include a LC-type uniboot connector. In some embodiments, the connector assembly may include a unibody connector, for instance, that includes a round fiber optic cable.

[0066] FIG. 1 depicts an exploded view of an illustrative connector assembly according to a first embodiment. As shown in FIG. 1, a connector assembly **100** may include a housing **180** formed from a top housing component **105** and a bottom housing component **110**. The housing **180** may include a "closed" configuration when the top housing component **105** is coupled to the bottom housing component **110** and an "open" configuration when the top housing component **105** is not coupled to the bottom housing component **110**. The top housing component **105** and the bottom housing component **110** may be securely coupled to each other using various means, such as a snap-fit, a friction-fit, or the like.

[0067] In some embodiments, the top housing component **105** may include one or more top projections **190** configured to engage corresponding locking projections **195** on the bottom housing component **110**. As the top housing component **105** is being pushed onto the bottom housing component **110**, the top projections **190** engage the locking projections **195**, which may include a slanted top surface such that the force of the projections against the locking projections causes the side walls of the bottom housing component to extend outward to facilitate the movement of the projections past the locking projections and into the interior of the housing **180**. When the top projections **190** have passed the locking projections **195**, the side walls of the

bottom housing component **110** return to their original position and the locking projections are positioned over the top projections, preventing movement of the top housing component **105** in an upward direction. Accordingly, the top housing component **105** is securely coupled to the bottom housing component **110**. The top housing component **105** may be removed from the bottom housing component **110** using various processes, including prying on a portion of bottom housing component. For example, an installer may manually spread locking projections **195** apart and lift the top housing component **105** to remove the top housing component from the bottom housing component **110**.

[0068] A cable (not shown) may extend through a boot **115** into the connector assembly **100**. The cable may include two optical fibers (for instance, a transmitting optical fiber and a receiving optical fiber) terminating at a first ferrule **155a** and a second ferrule **155b**. For example, the first ferrule **155a** may be coupled to a terminal end of a transmitting optical fiber and the second ferrule **155b** may be coupled to a terminal end of a receiving optical fiber, or vice versa. A crimp ring and/or crimp tube **120**, which may include a material, such as a heat-shrink material, may encase a portion of the cable and a crimp ring **120** may be secured to the cable. A back post **125** may engage the crimp ring **120** at a distal (**D**) end thereof. In some embodiments, as the crimp ring **120** is secured to the cable, the crimp ring may prevent movement of the back post **125** and, therefore, the housing **180**, toward the distal (**D**) end of the connector assembly **100**. In some embodiments, the back post **125** may be molded or otherwise affixed to a portion of the top housing component **105** or the bottom housing component **110**. The back post **125** may be arranged within a channel **170** formed in the housing **180**. In some embodiments, the back post **125** may be affixed to the channel **170** within the bottom housing component **110**, such as through a snap-fit, a friction-fit, adhesive, or the like.

[0069] The first ferrule **155a** and the second ferrule **155b** may be arranged within a first plug frame **150a** and a second plug frame **150b**, respectively. The first plug frame **150a**

and the second plug frame **150b** may be independent from each other. The top housing component **105** and the bottom housing component **110** may include recesses **130**, **145** at a proximal (**P**) end thereof that are configured to engage corresponding channels **165a**, **165b** formed in the distal (**D**) end of the first plug frame **150a** and the second plug frame **150b**. In this manner, the first plug frame **150a** and the second plug frame **150b** may be secured within the connector assembly **100** when the housing **180** is in the closed configuration. In some embodiments, the first plug frame **150a** and the second plug frame **150b** may be coupled to the top housing component **105** and/or the bottom housing component **110** within the recesses **130**, **145**, such as through a snap-fit, friction-fit, or the like.

[0070] The first plug frame **150a** and the second plug frame **150b** may include a locking latch **160a**, **160b** configured to releasably couple the connector assembly **100** to a complementary adapter (not shown). The locking latches **160a**, **160b** may be depressible and may have sufficient flexibility such that the connector assembly **100** may be released from the adapter when the latch is activated with a moderate pressing force. The top housing component **105** may include a thumb latch **135** configured to engage the locking latches **160a**, **160b**. The thumb latch **135** may be positioned on the housing **180** such that individual locking latches **160a**, **160b** may be triggered by a single thumb latch **135** on the housing. The thumb latch **135** may be configured to depress the locking latches **160a**, **160b** at substantially the same time.

[0071] FIGS. 2A-2C depict an illustrative connector assembly according to the first embodiment. FIG. 2A depicts the connector assembly **100** with the housing **180** in the closed position and having a first polarity in which ferrule **155a** is located on the left and ferrule **155b** is located on the right. In FIG. 2B, the housing component **180** is in the open configuration in which the top housing component **105** has been disconnected from the bottom housing component **110** exposing the interior of the housing and allowing access to the first plug frame **150a** and the second plug frame **150b**. As shown in FIG. 2C, the first plug frame **150a** and the

second plug frame **150b** may be independently moved from the bottom housing component **110** when the housing **180** is in the open configuration. Accordingly, the position of the first plug frame **150a** and the second plug frame **150b** and, therefore, the first ferrule **155a** and the second ferrule **155b**, may be switched within the connector assembly **180**. In this manner, the connector assembly **100** may be adjusted to have a second polarity in which ferrule **155a** is located on the right and ferrule **155b** is located on the left. Once the polarity of the connector assembly **100** has been adjusted, the top housing component **105** may be coupled to the bottom housing component **110** and the connector assembly may be connected to a corresponding adapter.

[0072] FIGS. 3A-3F depict an illustrative connector assembly according to a second embodiment. In particular, FIG. 3A depicts an exploded view of an illustrative connector assembly according to the second embodiment. A connector assembly **300** may include a frame (or "housing") **380** configured to securely house a first ferrule **155a** and a second ferrule **155b**, springs **320a**, **320b**, and other internal components not shown in FIG. 3A. The frame **380** may include a top frame component **305** configured to be coupled to a bottom frame component **310**, both of which may include a back post portion **381**, **385** and a plug frame portion **315**, **325**. At least a portion of the plug frame portion **315**, **325** may be configured to engage and/or be inserted into a corresponding port of an adapter. The top frame component **305** and the bottom frame component **310** may be securely coupled to each other using various means, such as a snap-fit, a friction-fit, an adhesive, or the like.

[0073] A cable (not shown) may extend through a boot **115** into the connector assembly **300**. The cable may include two optical fibers (for instance, a transmitting optical fiber and a receiving optical fiber) terminating at the first ferrule **155a** and the second ferrule **155b**. For example, the first ferrule **155a** may be coupled to a terminal end of a transmitting optical fiber and the second ferrule **155b** may be coupled to a terminal end of a receiving optical

fiber, or vice versa. A crimp ring **120** may be secured to the cable. The post portion **381**, **385** may engage the crimp ring **120** at a distal (**D**) end thereof. As the crimp ring **120** is secured to the cable, the crimp ring may prevent movement of the post portion **381**, **385** and, therefore, the frame **380**, toward the distal (**D**) end of the connector assembly **300**.

[0074] A latch component **350** may include a ring portion **360** arranged around a distal (**D**) end of the frame **380**. The latch component may include a thumb latch **355** configured to releasably couple the connector assembly **300** to a complementary adapter (not shown). The thumb latch **355** may be depressible and may have sufficient flexibility such that the connector assembly **300** may be released from the adapter when the latch is activated with a moderate pressing force.

[0075] FIG. 3B depicts a cross-sectional view of the connector assembly **300** and FIG. 3C depicts detail **390** of FIG. 3B. As shown in FIGS. 3A-3C, an external surface of the frame **380** may include one or more locking recesses **375** configured to receive one or more corresponding locking projections **370** arranged on an inner surface of the ring portion **360**. The latch component **350** may include one or more compression sections **365b** (compression section **365a** is not visible in FIG. 3A, see FIG. 3E). As shown in FIGS. 3A and 3C, the locking projections **370** may engage the locking recesses **375** to prevent the rotation of the latch component **350** with respect to the frame **380**.

[0076] The compression of the compression sections **365a**, **365b** causes the shape of the ring portion **360** to become deformed. For example, the shape of the ring portion **360** may be integral to the latch component **350**. Additionally, the ring portion **360** may have a generally circular-shape when the compression sections **365a**, **365b** are not compressed and a generally oval-shape when the compression sections are compressed. When the compression sections **365a**, **365b** are compressed, the locking projections **370** move out of the locking recesses **375** and the latch component **350** may rotate with respect to the frame **380**. When the compression

sections **365a**, **365b** are not compressed, the locking projections **370** may be inserted into the locking recesses **375** and the latch component **350** may be locked in place with respect to the frame **380**. Accordingly, the latch component **350** may be rotated to the other side of the frame **380** and the connector assembly **300** may be rotated to connect with a corresponding adapter with a different polarity.

[0077] In some embodiments, sections **365a** and **365b** may become compressed when the user (e.g., via their fingers or a tool) twists the ring portion **360**. Thus, in some embodiments, the ring portion **360** impacts sections **365a** and **365b** causing compression. In a further embodiment, when a user twists a ring portion **360** it becomes compressed against an integral surface (not shown) as it is rotated surface **370**. If rotation continues surface **370** may engage a recess **375** thus allowing the connector to change polarity.

[0078] FIGS. 3D-3F depicts an illustrative polarity adjustment for the connector assembly **300**. In FIG. 3D, the connector assembly **300** is arranged in a first polarity in which the connector assembly is configured to connect with an adapter with the second ferrule **155b** on the right side and the first ferrule **155a** on the left side of the connector assembly from a top-down perspective. The latch component **350** is arranged in a first polarity position on the frame **380**, with compression section **365b** visible in FIG. 3D and the thumb latch **355** over plug frame portion **315**. In FIG. 3E, the compression sections **365a**, **365b** have been compressed and the latch component **350** has been rotated to a second polarity position, in which compression section **365a** is visible in FIG. 3E and the thumb latch **355** is under plug frame portion **325**. In FIG. 3F, the entire connection assembly **300** has been rotated such that the connection assembly may connect with an adapter in a second polarity with the second ferrule **155b** on the left side and the first ferrule **155a** on the right side of the connector assembly from a top-down perspective. Accordingly, the polarity of the connector assembly **300** may be adjusted by rotating the latch component **350** from a first polarity position to a second polarity position and

rotating the connector assembly such that the thumb latch **355** is orientated to engage a corresponding adapter.

[0079] FIGS. 4A-4I depicts an illustrative connector assembly according to a third embodiment. FIG. 4A depicts a top-down view of a connector assembly **400** having a housing and compression elements **410a**, **410b**. A latch component **350** may have a ring portion **360** disposed around a locking component **430** (not shown, see FIG. 4B). In some embodiments, the compression elements **410a**, **410b** may be resilient and biased outward. In some embodiments, compression of compression elements **410a**, **410b** may allow latch component **350** to rotate from a first polarity position to one or more other positions.

[0080] FIG. 4B depicts a cross-sectional view of the connector assembly **400** from a top-down perspective. As shown in FIG. 4B, the compression elements **410a**, **410b** may be arranged on a locking component **430**. One or more cables (not shown) may extend through the connector assembly **400**, for example, through the boot **115**, the crimp ring **125**, the locking component **430**, and the housing **405**, and terminating at the ferrules **155a**, **155b**. When the compression elements **410a**, **410b** are not compressed, locking elements **435a**, **435b** arranged on the locking component **430** may engage the latch component **350** to prevent rotation thereof. In some embodiments, the locking elements **435a**, **435b** may engage a locking recess **425a**, **425b** formed in the ring portion **360** of the latch component **350**. Compression of the compression elements **410a**, **410b** may cause the locking elements **435a**, **435b** to move inward such that they no longer engage the latch component **350**, thereby allowing the latch component to rotate about the locking component **430**. As the latch component **350** rotates around the locking component **430**, the outward bias of the locking elements **435a**, **435b** may cause the locking components to press against the inner surface of the ring portion **360**. Accordingly, when a locking recess **425a**, **425b** is located over a locking element **435a**, **435b** without the compression elements

410a, **410b** being compressed, the locking element may push outward and re-engage the locking recess **425a**, **425b**.

[0081] FIGS. 4C and 4D depict the housing (i.e., front portion) **405**, rear portion **415** locking component **430**, and latch component **350** in a side view and a perspective view, respectively. As shown in FIGS. 4C and 4D, the housing **405** may include channels configured to receive the compression elements **410a**, **410b**. In some embodiments, the housing **405** may include one or more openings **440** configured to receive a complementary projection **445** on the locking component **430** to secure the locking component in place within the connector assembly **400**. FIGS 4E and 4F depict the latch component **350** and the locking component **430** as arranged within the connector assembly **400** from a side view and a top-down view, respectively.

[0082] FIGS. 4G-4I depicts an illustrative polarity adjustment for the connector assembly **400**. In FIG. 4G, the connector assembly **400** is arranged in a first polarity in which the connector assembly is configured to connect with an adapter with the second ferrule **155b** on the right side and the first ferrule **155a** on the left side of the connector assembly from a top-down perspective. The latch component **350** is arranged in a first polarity position on the locking component **430**, with locking recess **425b** visible in FIG. 4G and the thumb latch **355** being arranged over a top (**T**) surface of the housing **405**. In FIG. 4H, the latch component **350** has been rotated to a second polarity position, in which locking recess **425b** is visible in FIG. 4H and the thumb latch **355** is arranged under a bottom (**B**) surface of the housing **405**. In FIG. 4I, the entire connection assembly **400** has been rotated such that the connection assembly may connect with an adapter in a second polarity with the second ferrule **155b** on the left side and the first ferrule **155a** on the right side of the connector assembly from a top-down perspective. Accordingly, the polarity of the connector assembly **400** may be adjusted by rotating the latch component **350** from a first polarity position to a second polarity position and rotating the

connector assembly such that the thumb latch **355** is orientated to engage a corresponding adapter.

[0083] FIG. 5 depicts an exploded view of an illustrative connector assembly according to various embodiments. As shown in FIG. 5, a connector assembly **500** may include a top housing component **501** and a bottom housing component **502**. In some embodiments, the top housing **501** and the bottom housing **502** may be joined together in a "closed" configuration when the top housing **501** being coupled to the bottom housing **502**. Alternatively, some embodiments may have an "open" configuration when the top housing component **501** is not coupled to the bottom housing component **502**. When in the closed configuration, the top housing **501** and the bottom housing **502** may be securely coupled to each other using various means, such as a snap-fit, a friction-fit, or the like.

[0084] A cable (not shown) may extend through a boot **507**, pass through a crimp ring **506** and then into the housing formed by the top housing **501** and the bottom housing **502**. The cable may include two optical fibers (for instance, a transmitting optical fiber and a receiving optical fiber) terminating at one or more ferrule(s) **503**. In some embodiments, two ferrules may be utilized, wherein a first ferrule may be coupled to a terminal end of a transmitting optical fiber and the second ferrule may be coupled to a terminal end of a receiving optical fiber, or vice versa. The crimp ring and/or crimp tube **506**, which may include a material, such as a heat-shrink material, may encase a portion of the cable and may be secured to the cable. A back post **508**, which may be made up of the combination of the top housing **501** and the bottom housing **502** may engage the crimp ring **506** at a distal end thereof.

[0085] In some embodiments, as the crimp ring **506** may be secured to the cable, thus the crimp ring may prevent movement of the back post **508** and, therefore, the main housing (**501** and **502**), toward the distal end of the connector assembly **500**. In some further

embodiments, the back post **508** may be molded or otherwise affixed to a portion of the top housing component **501** or the bottom housing component **502**.

[0086] The ferrule(s) **503** may be arranged within (**501** and **502**) in two separate channels (as shown), or in a single combined channel. a first plug frame **150a** and a second plug frame **150b**, respectively. In this manner, the ferrule(s) (and plug frame(s)) **503** may be secured within the connector assembly **500** when the top housing **501** bottom housing **502** are in the closed configuration. In further embodiments, the ferrules(s) **503** may have a biasing force applied via one or more springs **504**.

[0087] As also shown in FIG. 1, an embodiment may have a connection device **505** that allows the connector assembly to securely fasten into a receiver (e.g., adapter and/or transceiver). The connection device **505**, in some embodiments, may be placed over a portion of the connector assembly (e.g., the back post **508**). In a further embodiment, the connection device **505**, may be rotatable around the back post **508** in order to allow for easy polarity change of the connector assembly **500**. The connector assembly **500** may also comprise a push-pull tab **510**, which will be discussed at further length herein.

[0088] A fully assembled connector assembly **600**, is shown in FIG. 6A. FIG. 6B further shows a push-pull tab **610** according to a non-limiting example embodiment. In some embodiments, and as shown, the push-pull tab **610**, may be removably and/or releasably attached to the connector assembly. Accordingly, and as shown in FIG. 6C, a connector assembly **600** and push-pull tab **610** may be combined into a single unit to allow for easy insertion and removal from a receiving device. Close up perspective views of a connector assembly **700** and push-pull tab **710** are shown in FIGs. 7A and 7B.

[0089] Referring to FIGs. 8A and 8B, an embodiment is shown wherein the connector assembly **800** comprises one or more flexible latching arms **821**. The flexible latching arm **821** may have a connection device **805**. The connection device **805** is further detailed herein as it

relates to an adapter and/or transceiver. Specifically, the connection device **805** interlocks with a recess in an adapter/transceiver. The connection device **805** may also comprise one or more connector hooks **837**. In some embodiments, the connector hooks **837** may be used via a user's figures and/or tool to compress the connection device **805** in order allow for removal of a connector assembly **800** from an adapter/transceiver.

[0090] As shown, the one or more flexible latching arms **821** may contact the surface of one or more of the channels **822**. The contact of the latching arm **821** with the channel **822** provides additional support to the latching arm. In some embodiments, the latching arm **821** is used to secure the connection of the connector assembly **800** with a receiving device (e.g., and adapter and/or transceiver). Thus, the contact between the latching arms **821** and the channels **822** enables the one or more latching arms to more firmly connect and thereby better secure the connector assembly **800** within the receiving device.

[0091] As discussed herein, the connector assembly **900** may be configured such that a change in polarity of the connector is possible. As shown in FIG. 9A, the connection device may be rotated about a horizontal axis (i.e., rotated around the back post **908** (FIG. 5 at **508**). In some embodiments, and as shown in FIG. 9B, a recess **931** may be located on the back post **908**. It should be understood, the recess **931** may be located on various outer surfaces (e.g., the crimp ring (FIG. 5 at 506), the cable boot (FIG. 5 at 507), etc.). Furthermore, in some embodiments, there may be multiple recesses **931** located on the connector assembly **900**, such as, for example, one on the top and one on the bottom of the back post **908**. The connector device **905**, may comprise a protrusion **932** that is complementary (i.e., matching) to the recess **931**. Thus, in some embodiments, the protrusion **932** may securely fasten the connector device **905** to housing using the recess **931**.

[0092] Referring now to FIGs. 10A-10B, a top and bottom view of a push-pull tab **1010** is shown according to some embodiments. As shown in FIG. 10A, the push-pull tab **1010**

may comprise a window or cutout **1033** at or near the proximal end of the push-pull tab and a push-pull knob **1011** near the distal end. It should be understood that the location and dimensions of the window **1033** may vary with different embodiments, and that the dimensions and location as shown is for illustrative purposes only. In further embodiments, the push-pull tab **1010** may comprise one or more recesses **1013**.

[0093] As shown in FIG. 10C, in some embodiments, the connector device **1005** may have a protrusion **1034**. The protrusion **1034** may be configured to fit through or inside of the cutout **1033** of the push-pull tab **1010**. Referring back to FIGs. 7A and 7B, an illustrative embodiment is shown where the push-pull tab is recoverably connected to the connector assembly.

[0094] Accordingly, when the push-pull tab **1010** moved longitudinally along the connector assembly **1000**, the protrusion **1034** impacts the side of the window **1033**. In some embodiments, when the protrusion **1034** impacts the edge of the window **1033**, the ramp portion of the protrusion slides along the edge of the window and forces the connection device **1005** closer to the top housing component **1001**. When the connection device **1005** is compressed (i.e., forced closer to the top housing component **1001**) the connector assembly **1000**, can be easily removed from a receiver (e.g., adapter and/or transceiver).

[0095] A further example embodiment is shown in FIG. 11, which specifically shows a cross section of the connector assembly and the push-pull tab **1110**. As shown, the protrusion **1134** is placed through the window **1133**. Additionally, the small protrusion (not shown) resides in the recess (not shown) of the connector body. FIG. 11 also illustrates an example embodiment that has a connection device **1105** with connector hooks **1137**. As depicted, the connector assembly may be inserted into an adapter and/or transceiver. It should be understood, that various alternative embodiments may exist, and that those discussed herein and illustrated in the figures are simply for explanatory purposes.

[0096] For example, an as shown in FIG. 12A-12C, some embodiments may have more than one protrusion **1234** and more than one window **1233**. Thus, when the push-pull tab **1210** moved horizontally along the connector assembly **1200**, the protrusion(s) **1234** impact the side of the window(s) **1233**. In some embodiments, when the protrusions **1234** impact the edge of the windows **1233**, the ramp portion of the protrusions slides along the edge of the windows and forces the connection device **1205** closer to the top housing component (not shown). When the connection device **1205** is compressed (i.e., forced closer to the top housing component) the connector assembly **1200**, can be easily removed from a receiver (e.g., adapter and/or transceiver).

[0097] As shown in FIG. 12D, some embodiment may utilize identification tabs **1237** to identify a connector as inserted into an adapter/transceiver, via a connection device **1205** as shown. The identification tabs **1237** may be made of various materials and have various properties (i.e., color, etc.)

[0098] An alternative embodiment of a connector assembly **1300** is shown in FIG. 13 in a cross-sectional view. Accordingly, some embodiments, such as that shown in FIG. 13, may not utilize a protrusion/window arrangement as discussed herein. Instead, a push-pull tab **1310** may have an inverted ramp **1337** at the proximal end of the push-pull tab. Thus, when the push-pull tab **1310** is moved (e.g., horizontally to the connector assembly **1300**) the inverted ramp **1337** impacts the connection device **1305** forcing the connection device down towards the top housing component **1301**. When the connection device **1305** is compressed (i.e., forced closer to the top housing component **1301**) the connector assembly **1300**, can be easily removed from a receiver (e.g., adapter and/or transceiver).

[0099] A further alternative embodiment of a connector assembly **1400** is shown in FIG. 14. Accordingly, some embodiments, such as that shown in FIG. 15, may utilize both a protrusion **1434** and window **1433** arrangement as well as an inverted ramp **1437** at the proximal

end of the push-pull tab. Thus, when the push-pull tab **1410** is moved (e.g., horizontally to the connector assembly **1400**) the inverted ramp **1437** impacts the front connection device **1405** and the protrusion **1434** impact the edge of the window **1433** thus, similar to embodiments discussed previously, forcing the connection device down towards the top housing component **1401**. When the connection device **1405** is compressed (i.e., forced closer to the top housing component **1401**) the connector assembly **1400**, can be easily removed from a receiver (e.g., adapter and/or transceiver). Detailed views of the push-pull tab **1410** and a cross-sectional view of the connector assembly **1400** are presented in FIGs. 15A and 15B.

[0100] In a further embodiment, such as that shown in FIGs. 16A-16C, a push-pull tab **1610**, may have a small protrusion **1635** on the underside of the push-pull tab. FIG. 16B shows a detailed view of the small protrusion **1635** on the push-pull tab **1610**. In some embodiments, the small protrusion **1635** is inserted into a recess **1636** on the connection device **1605**. In some embodiments, this restricts the horizontal movement of the push-pull tab along the connector assembly (not shown). As shown in FIG. 17, the small protrusion **1735** easily fits into the recess **1736**.

[0101] As shown in FIG. 17, the small protrusion **1735** is impacting the front wall of the recess **1736**. This impact limits the forward movement of the push-pull tab **1710**. This serves multiple functions in various embodiments. For example, the impact of the small protrusion **1735** with the recess **1736** allows a user to apply substantial forward force to the connector assembly (not shown) via the push-pull tab **1710**.

[0102] Referring now to FIGs. 18A and 18B, as discussed herein, the push-pull tab **1810** may move in relation to the connector assembly (e.g., move horizontally with respect to the connector assembly). In some embodiments, the push-pull tab **1810** may have a tension member **1840** which applies a biasing force against a portion of the connector assembly thus forcing the push-pull tab in one direction. The non-limiting example illustrated in FIGs. 18A and

18B show the tension member **1840** applying a biasing force to move the push-pull tab **1810** toward the front of the connector assembly (i.e., the location of the ferrules). It should be understood that this is a non-limiting example, and that one or more tension members may be used, and that the biasing may be in different directions. Moreover, there may be tension members applying a biasing force in more than one direction or opposing directions. Additionally, as discussed herein, a spring system or any method of applying a biasing force may be utilized for the embodiments discussed herein.

[0103] Referring now to FIGs. 19A and 19B, a connector is shown according to an embodiment. In some embodiments, such as that shown in FIGs. 19A and 19B, a connector may have a ferrule to ferrule pitch of 6.25mm. In a further embodiment, the outer dimensions of the ferrule housing may be 10.82mm, and the overall width dimension of the connector may be 12mm.

[0104] In an alternative embodiment, such as that shown in FIGs. 20A and 20B, some embodiments may keep the 6.25mm pitch between the ferrules, and even the 10.82 dimensions of the ferrule housing components, in order to remain within existing standards. However, the overall width dimension of the connector may be reduced to the existing dimension of the ferrule housing (e.g., 10.82mm) instead of the 12mm of FIGs. 19A and 19B.

[0105] Referring now to FIGs. 21A and 21B, a connector is shown according to an embodiment. In some embodiments, such as that shown in FIGs. 21A and 21B, a connector may have a ferrule to ferrule pitch of 5.25mm (i.e., 1mm smaller than that of FIGs. 19A, 19B, 20A, and 20B). In a further embodiment, the outer dimensions of the ferrule housing may be 9.82mm, and the overall width dimension of the connector may be 11mm.

[0106] In an alternative embodiment, such as that shown in FIGs. 22A and 22B, some embodiments may keep the 5.25mm pitch between the ferrules, and even the 9.82 dimensions of the ferrule housing components, in order to remain within existing standards. However, the

overall width dimension of the connector may be reduced to the existing dimension of the ferrule housing (e.g., 9.82mm) instead of the 11mm of FIGs. 21A and 21B.

[0107] Referring now to FIGs. 23A and 23B, a connector is shown according to an embodiment. In some embodiments, such as that shown in FIGs. 23A and 23B, a miniature footprint connector may have a ferrule to ferrule pitch of 3.4mm. In a further embodiment, the outer dimensions of the ferrule housing may be 7.97mm.

[0108] Although a fiber optic connector has been used as an illustrative embodiment, this detailed description is not so limited, as any type of electrical and/or communication connector may be used according to some embodiments. The connectors, adapters, and connection assemblies formed therefrom may be used in combination with other connection elements and/or materials, such as crimpers, bands, straps, ferrules, locking materials, fluids, gels, or the like.

[0109] In the above detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be used, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are explicitly contemplated herein.

[0110] The present disclosure is not to be limited in terms of the particular embodiments described in this application, which are intended as illustrations of various aspects. Many modifications and variations can be made without departing from its spirit and scope, as will be apparent to those skilled in the art. Functionally equivalent methods and apparatuses

within the scope of the disclosure, in addition to those enumerated herein, will be apparent to those skilled in the art from the foregoing descriptions. Such modifications and variations are intended to fall within the scope of the appended claims. The present disclosure is to be limited only by the terms of the appended claims, along with the full scope of equivalents to which such claims are entitled. It is to be understood that this disclosure is not limited to particular methods, reagents, compounds, compositions or biological systems, which can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting.

[0111] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0112] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (for example, bodies of the appended claims) are generally intended as "open" terms (for example, the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to"). While various compositions, methods, and devices are described in terms of "comprising" various components or steps (interpreted as meaning "including, but not limited to"), the compositions, methods, and devices can also "consist essentially of" or "consist of" the various components and steps, and such terminology should be interpreted as defining essentially closed-member groups. It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more"

to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to embodiments containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (for example, “a” and/or “an” should be interpreted to mean “at least one” or “one or more”); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should be interpreted to mean at least the recited number (for example), the bare recitation of "two recitations," without other modifiers, means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to “at least one of A, B, and C, et cetera” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (for example, “ a system having at least one of A, B, and C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, et cetera). In those instances where a convention analogous to “at least one of A, B, or C, et cetera” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (for example, “ a system having at least one of A, B, or C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, et cetera). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0113] In addition, where features or aspects of the disclosure are described in terms of Markush groups, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the Markush group.

[0114] As will be understood by one skilled in the art, for any and all purposes, such as in terms of providing a written description, all ranges disclosed herein also encompass any and all possible subranges and combinations of subranges thereof. Any listed range can be easily recognized as sufficiently describing and enabling the same range being broken down into at least equal halves, thirds, quarters, fifths, tenths, or the like. As a non-limiting example, each range discussed herein can be readily broken down into a lower third, a middle third, and an upper third. As will also be understood by one skilled in the art all language such as "up to," "at least," and the like include the number recited and refer to ranges which can be subsequently broken down into subranges as discussed above. Finally, as will be understood by one skilled in the art, a range includes each individual member. Thus, for example, a group having 1-3 cells refers to groups having 1, 2, or 3 cells. Similarly, a group having 1-5 cells refers to groups having 1, 2, 3, 4, or 5 cells, and so forth.

[0115] Various of the above-disclosed and other features and functions, or alternatives thereof, may be combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art, each of which is also intended to be encompassed by the disclosed embodiments.

CLAIMS

What Is Claimed Is:

1. A connector assembly comprising:

a housing configured to accept a first ferrule and a second ferrule;

a latch component that is removably connected to the housing, wherein the latch component is configured to rotate around the housing;

the latch component comprising a first locking element configured to engage a second locking element to prevent rotation of the latch component in at least one of a first polarity position to a second polarity position;

a push-pull tab removably connected to the housing and configured to move along the housing when a biasing force is applied in at least one of a forward direction and a rearward direction;

wherein the push-pull tab is configured to compress the latch component when moving along the housing; further wherein the latch component comprises a top with at least one protrusion;

wherein the at least one protrusion extends through the at least one window when the push-pull tab is removably connected to the housing; and

wherein the latch component is compressed when the push-pull tab moves along the housing causing an edge of the window to impact the at least one protrusion.

2. The connector assembly of claim 1, wherein the push-pull tab further comprises a bottom portion having an inverted ramp; and

wherein the latch component is compressed when the push-pull tab moves along the housing causing at least one of:

an edge of the window to impact the at least one protrusion; and

a portion of the inverted ramp to impact a portion of the latch component.

3. The connector assembly of claim 1, wherein the push-pull tab further comprises a bottom portion having an inverted ramp; and

wherein the latch component is compressed when the push-pull tab moves along the housing causing a portion of the inverted ramp to impact a portion of the latch component.

4. The connector assembly of claim 1, wherein the push-pull tab comprises an underside having a small protrusion;

wherein the housing comprises a top having a small recess;

wherein the small protrusion fits within the small recess when the push-pull tab is removably connected to the housing; and

wherein the small protrusion limits the movement distance of the push-pull tab based on the size of the small recess.

5. The connector assembly of claim 1, wherein the push-pull tab comprises a tension member; and

wherein the tension member applies a biasing force against a portion of the housing.

6. The connector assembly of claim 1, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 6.25mm; and

an overall width is 10.82mm.

7. The connector assembly of claim 1, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 5.25mm; and

an overall width is 9.82mm.

8. The connector assembly of claim 1, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 3.40mm; and

an overall width is 7.97mm.

9. A connector assembly having an adjustable polarity comprising :

a polymer uni-body base frame comprising a plug frame portion, a body portion, and a back post portion;

a top cover; and

an independent latch;

wherein the independent latching component is removable connected to the distal end (D) of the base frame; and

wherein the independent latch component is configured to rotate substantially concentric about the base frame to change polarity of the connector assembly from a first polarity to a second polarity.

10. The connector assembly of claim 8, further comprising a push-pull tab having at least one window, wherein the independent latch component comprises a top with at least one protrusion.

11. The connector assembly of claim 9, wherein the at least one protrusion extends through the at least one window when the push-pull tab is removably connected to the base frame; and

wherein the independent latch component is compressed when the push-pull tab moves along the base frame causing an edge of the window to impact the at least one protrusion.

12. The connector assembly of claim 9, wherein the push-pull tab further comprises a bottom portion having an inverted ramp; and

wherein the independent latch component is compressed when the push-pull tab moves along the base frame causing at least one of:

an edge of the window to impact the at least one protrusion; and

a portion of the inverted ramp to impact a portion of the independent latch component.

13. The connector assembly of claim 8, further comprising a push-pull tab having a bottom portion having an inverted ramp, wherein the independent latch component is compressed when the push-pull tab moves along the base frame causing a portion of the inverted ramp to impact a portion of the independent latch component.

14. The connector assembly of claim 8 further comprising a push-pull tab having an underside having small protrusion;

wherein the base frame comprises a top having a small recess;

wherein the small protrusion fits within the small recess when the push-pull tab is removably connected to the base frame; and

wherein the small protrusion limits the movement distance of the push-pull tab based on the size of the small recess.

15. The connector assembly of claim 8, further comprising a push-pull tab having a tension member, wherein the tension member applies a biasing force against a portion of the base frame.

16. The connector assembly of claim 8, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 6.25mm; and

an overall width is 10.82mm.

17. The connector assembly of claim 8, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 5.25mm; and

an overall width is 9.82mm.

18. The connector assembly of claim 8, wherein the housing is sized and shaped to accept the first and second ferrules where:

a pitch between the first ferrule and the second ferrule is 3.40mm; and

an overall width is 7.97mm.

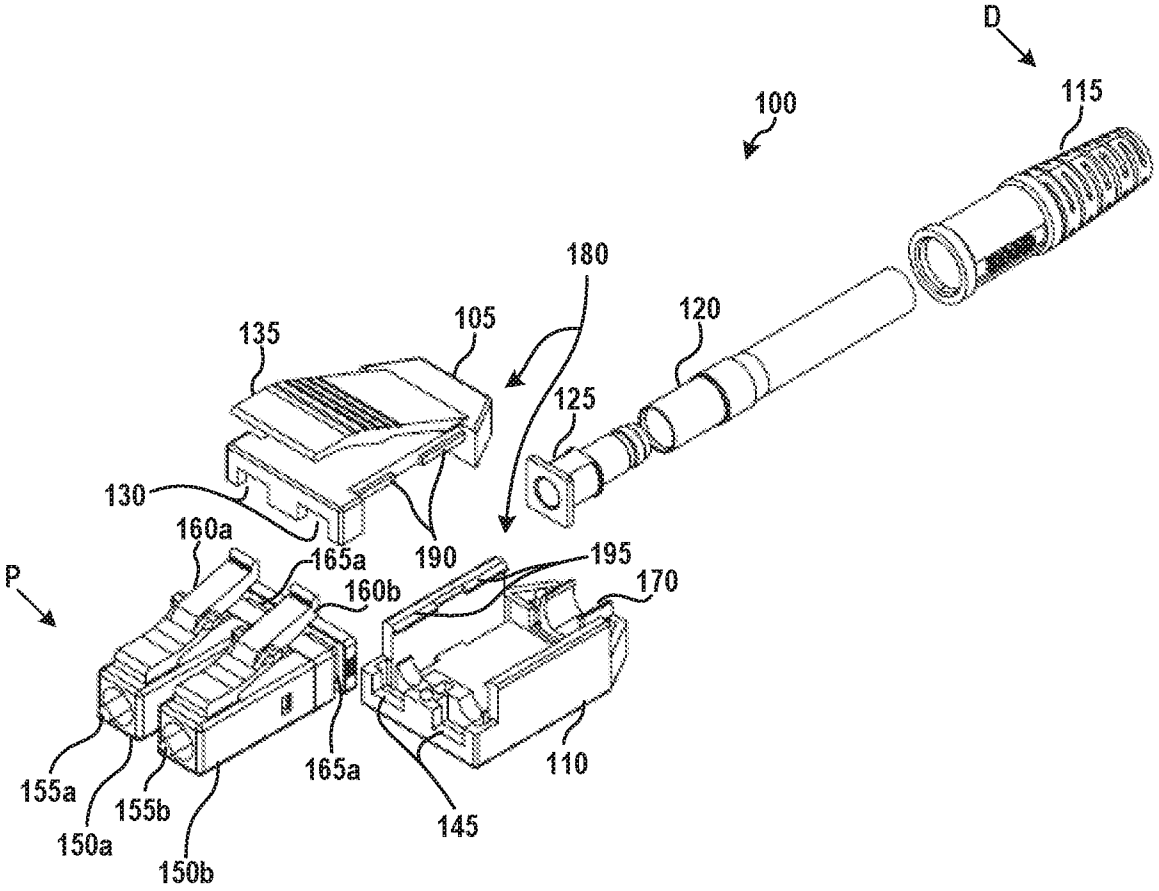

D
115
100
180
135
105
120
125
130
160a
165a
190
195
160b
170
P
155a
155b
150a
150b
165a
145
110

FIG. 1

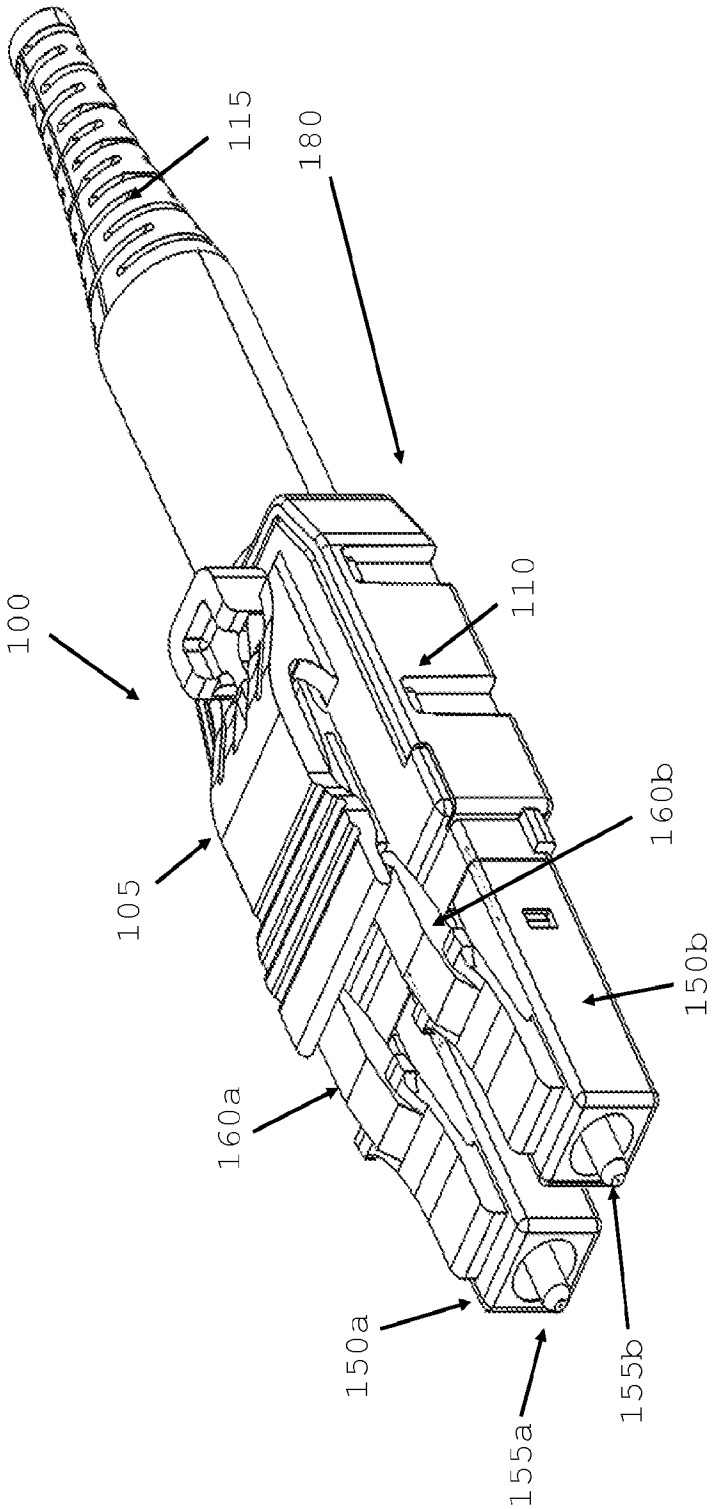


FIG. 2A

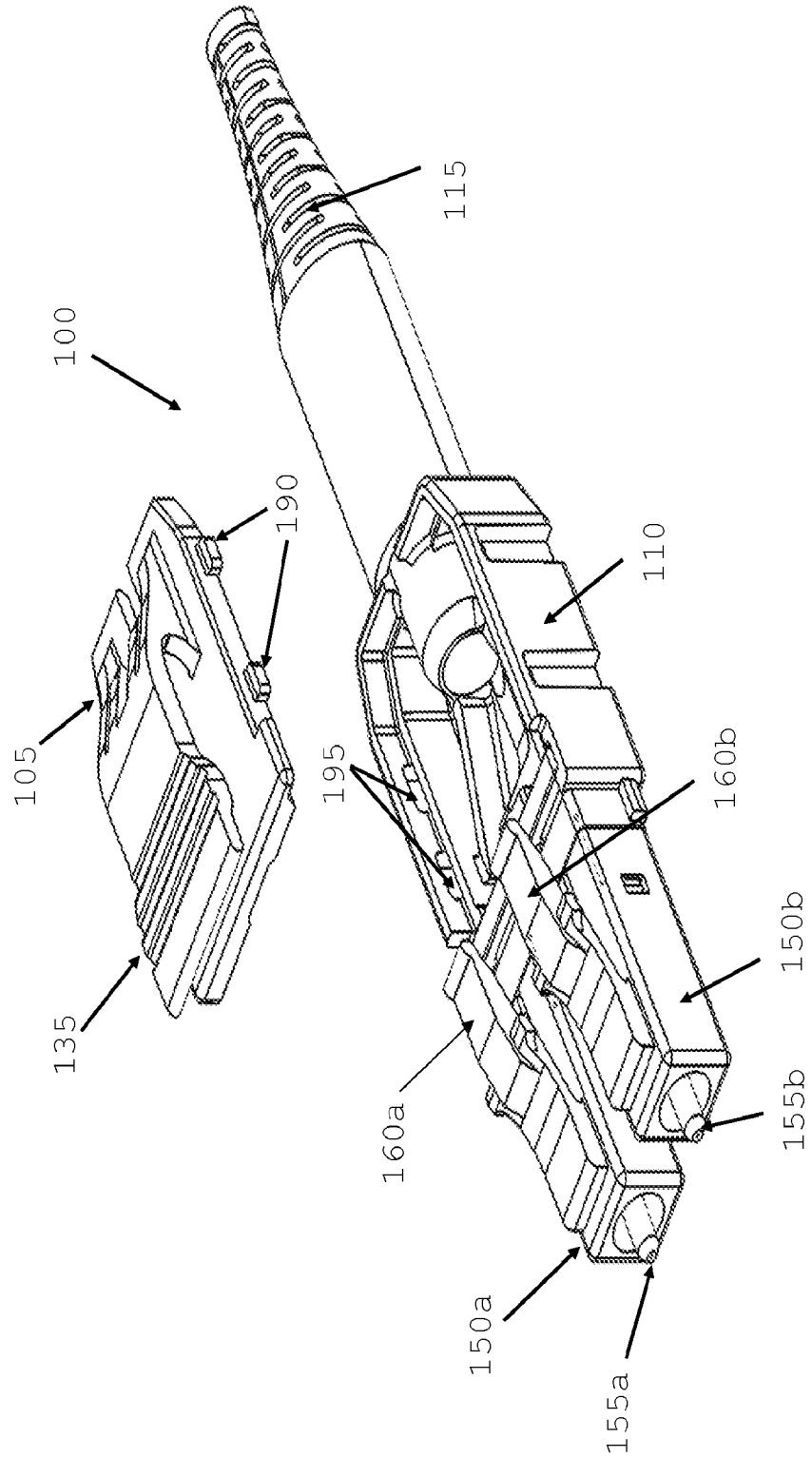


FIG. 2B

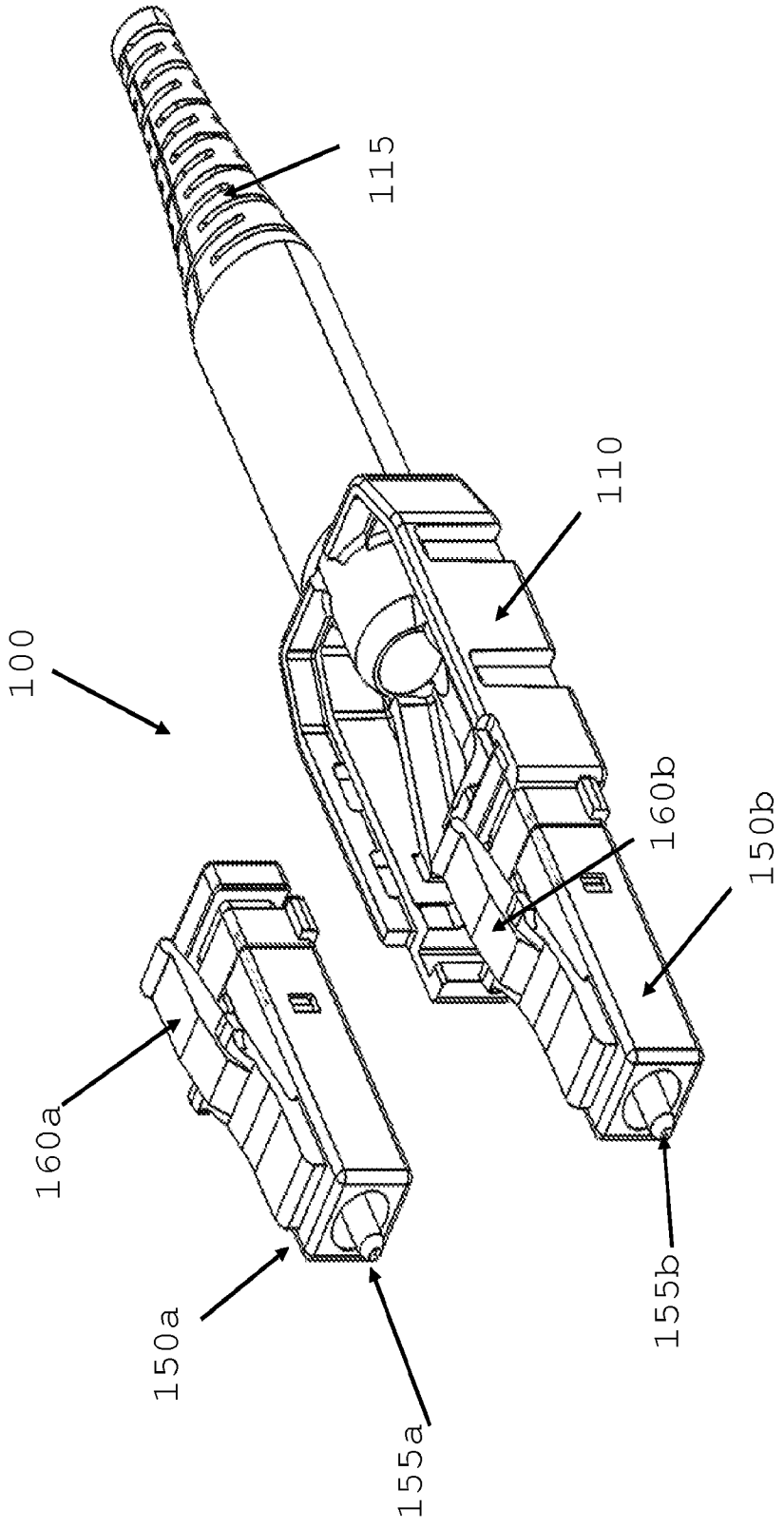


FIG. 2C

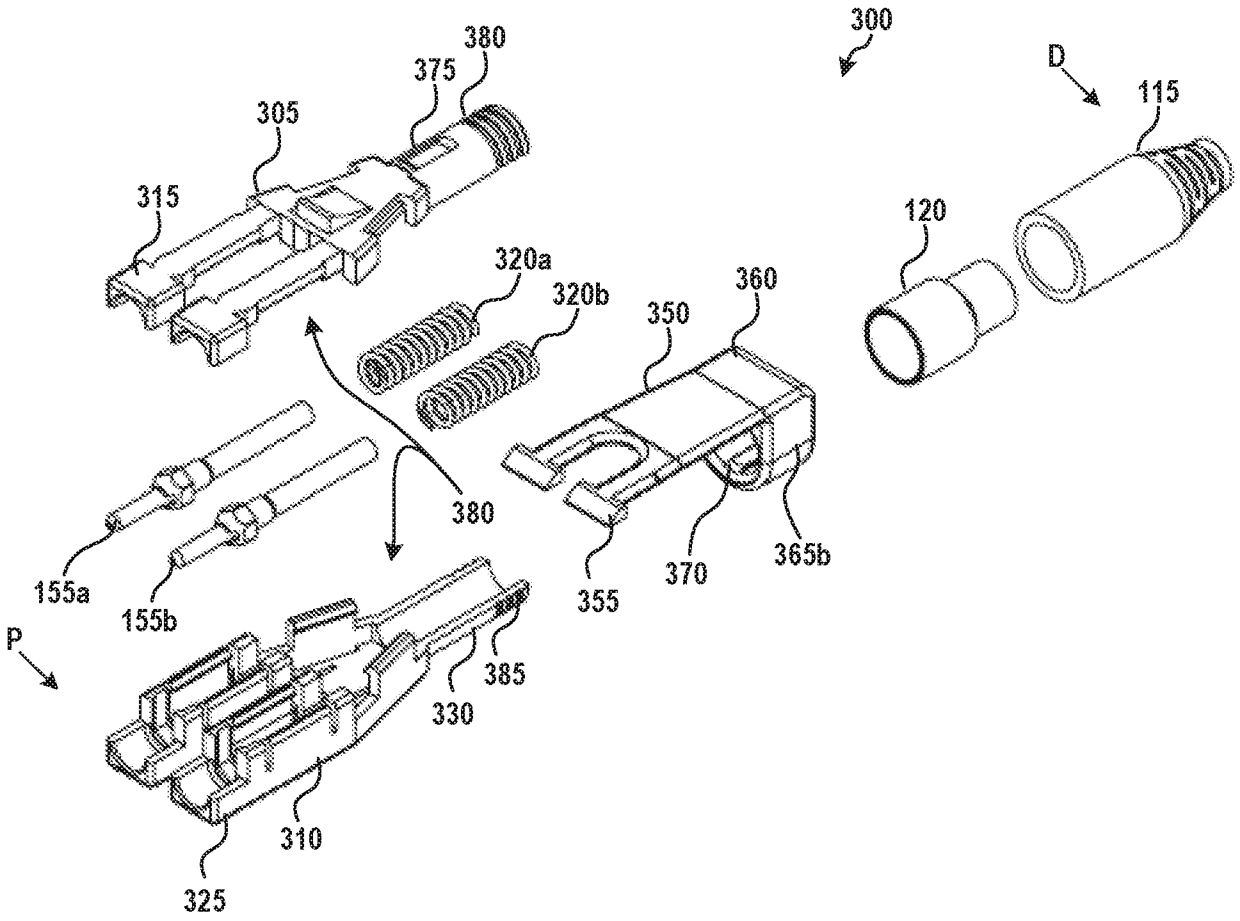

300
D
115
120
380
375
305
315
320a
320b
360
350
380
155a
155b
355
370
365b
P
385
330
310
325

FIG. 3A

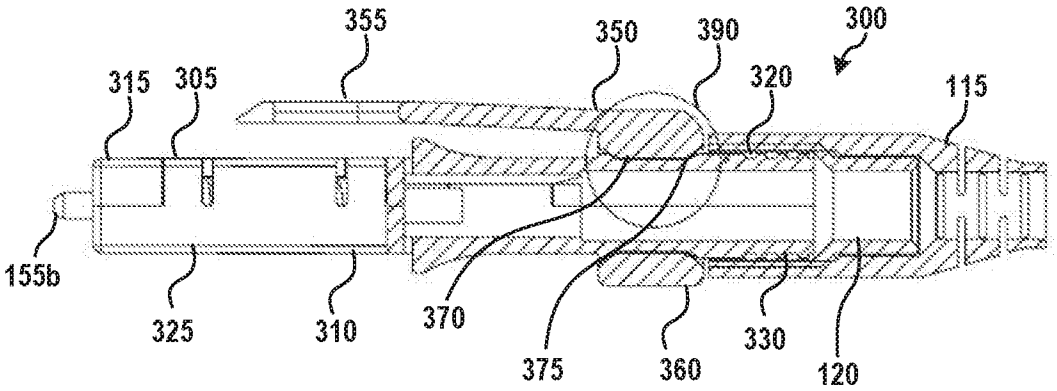

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155b
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330
120

FIG. 3B

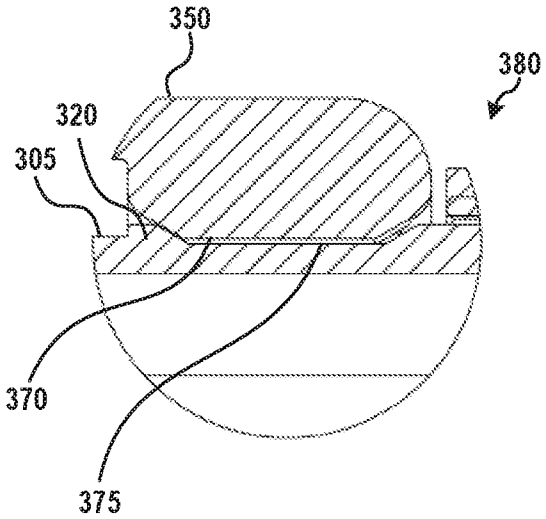

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370
375

FIG. 3C

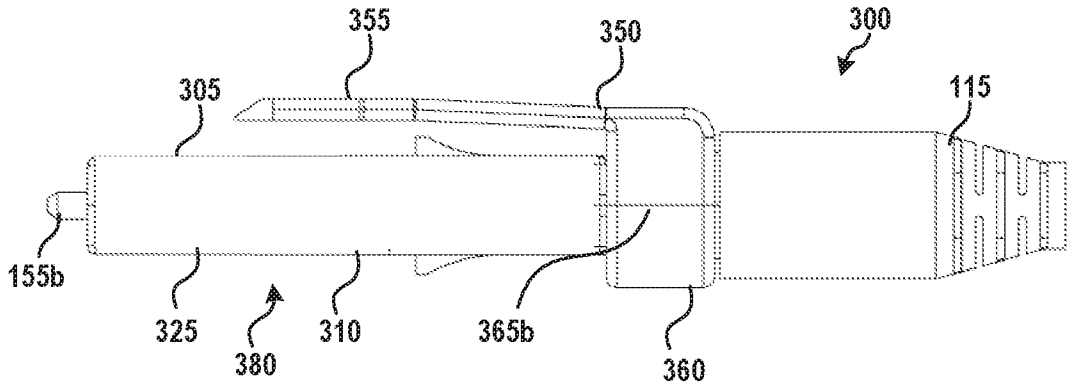


FIG. 3D

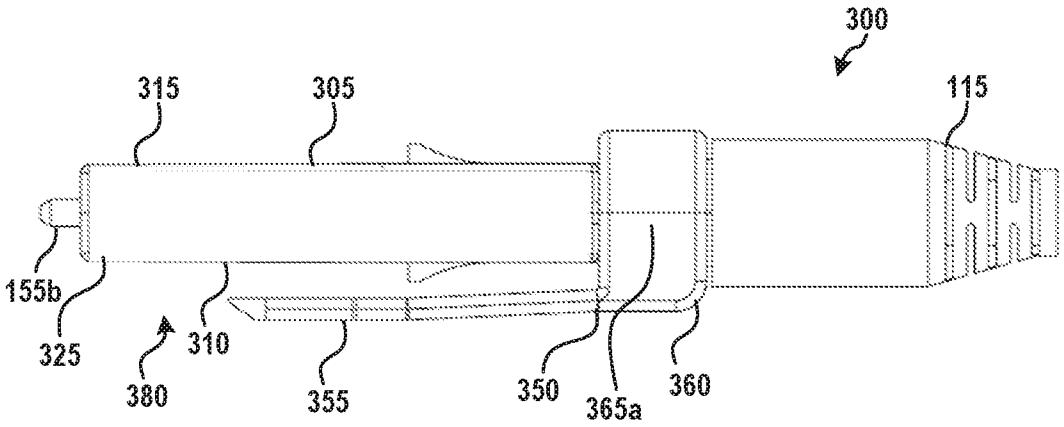


FIG. 3E

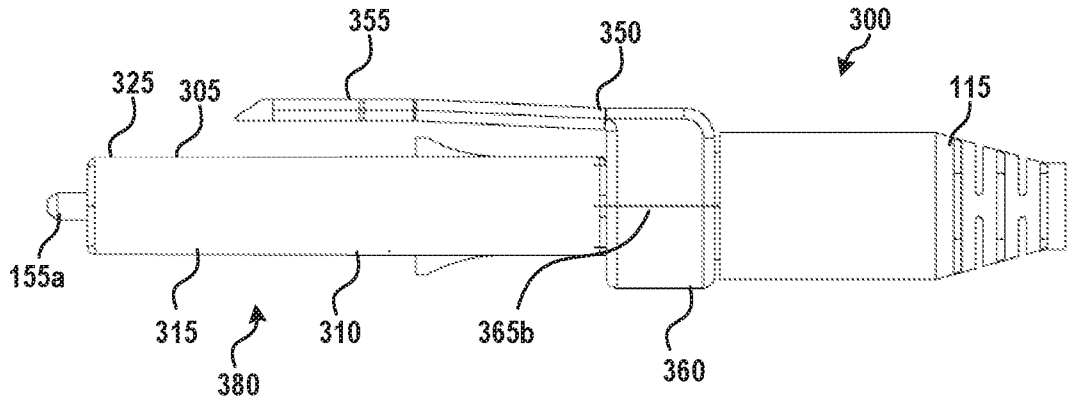


FIG. 3F

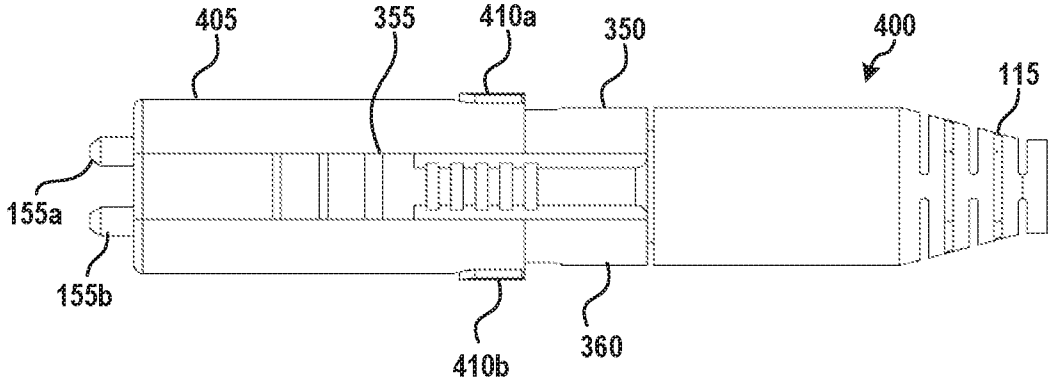

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355
410a
350
400
115
155a
155b
410b
360

FIG. 4A

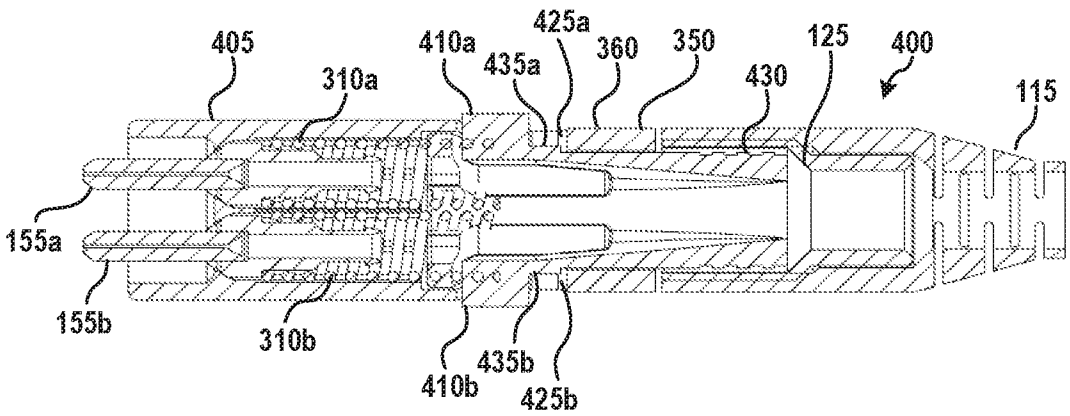

405
310a
410a
435a
425a
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125
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155a
155b
310b
410b
435b
425b

FIG. 4B

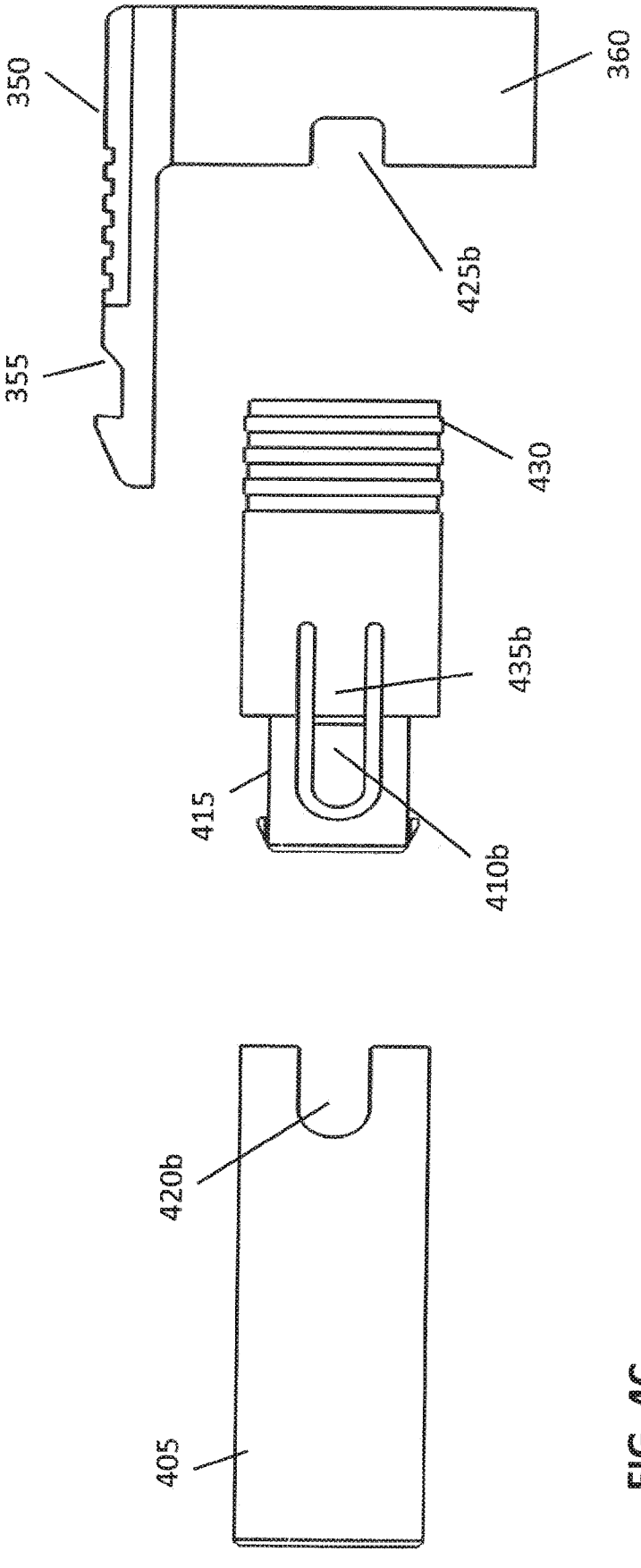


FIG. 4C

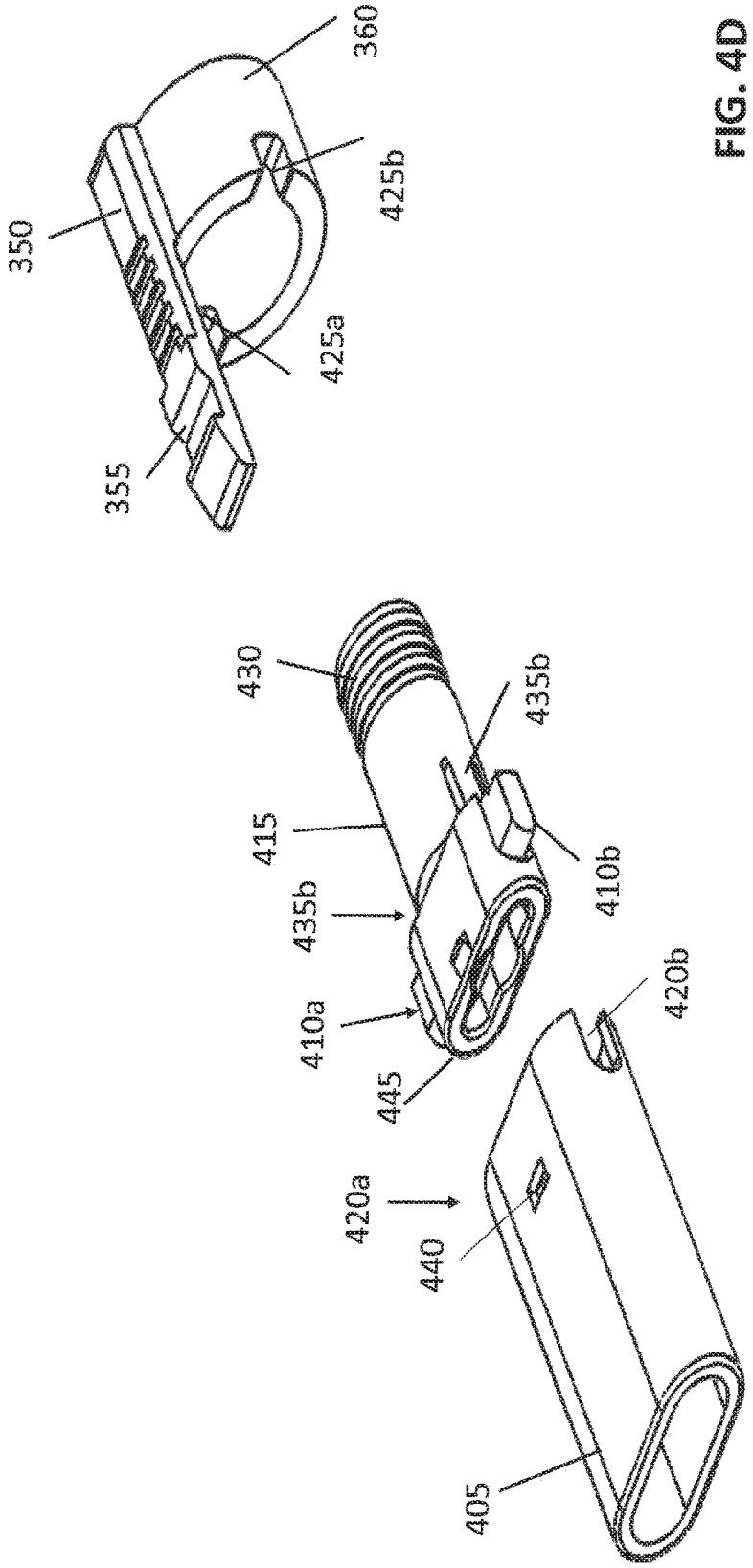

360
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435b
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410a
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420a
440
405

FIG. 4D

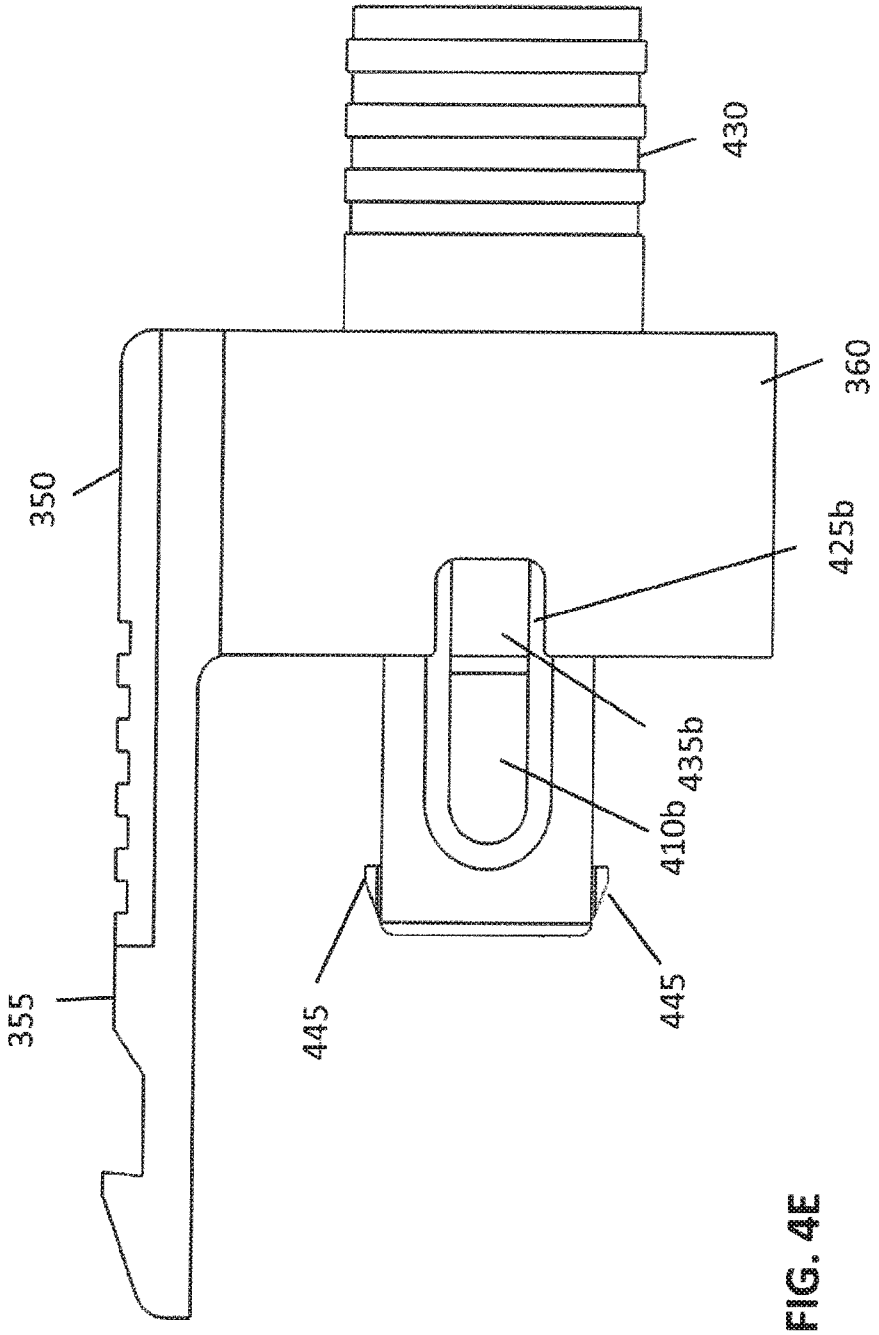


FIG. 4E

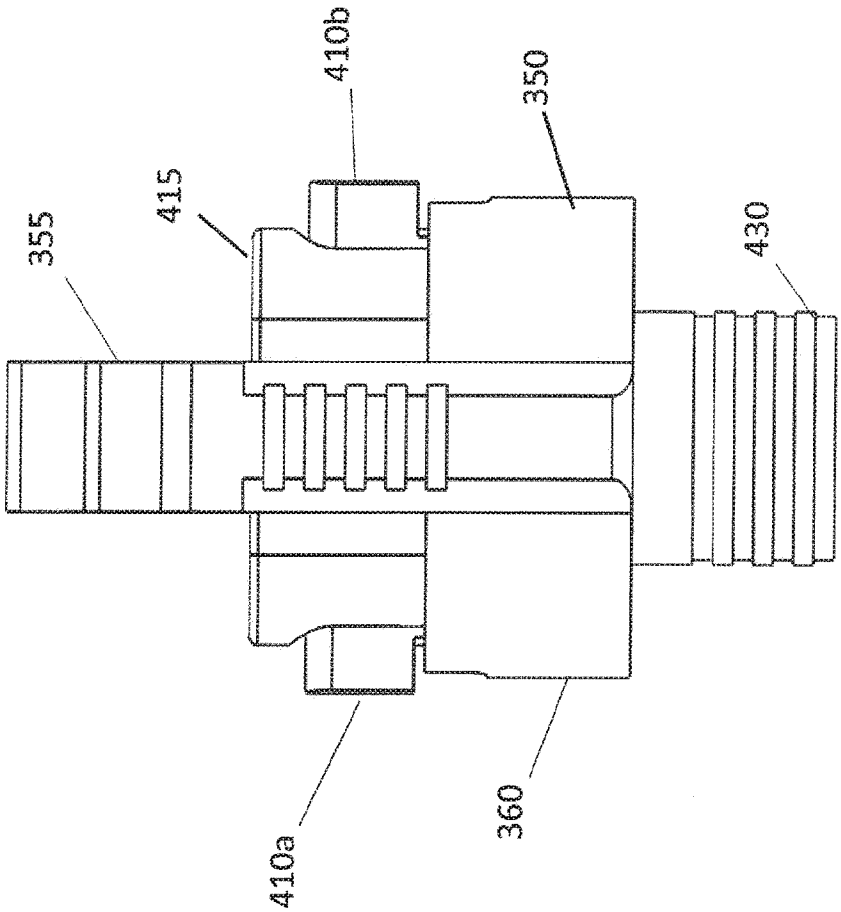


FIG. 4F

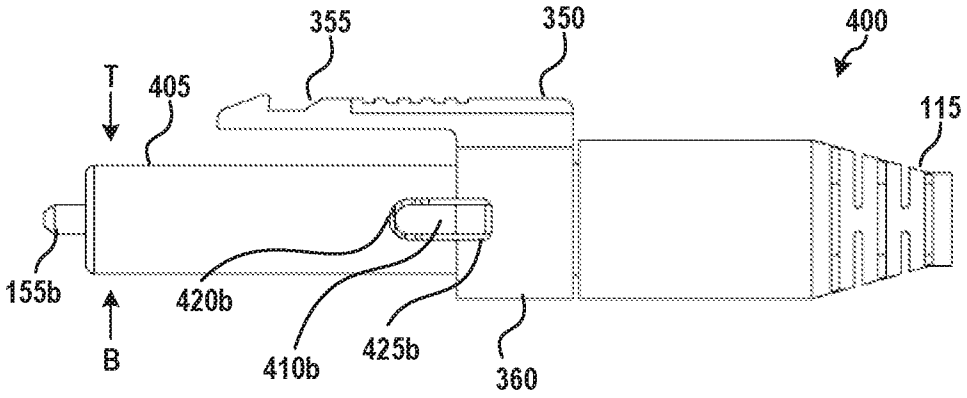


FIG. 4G

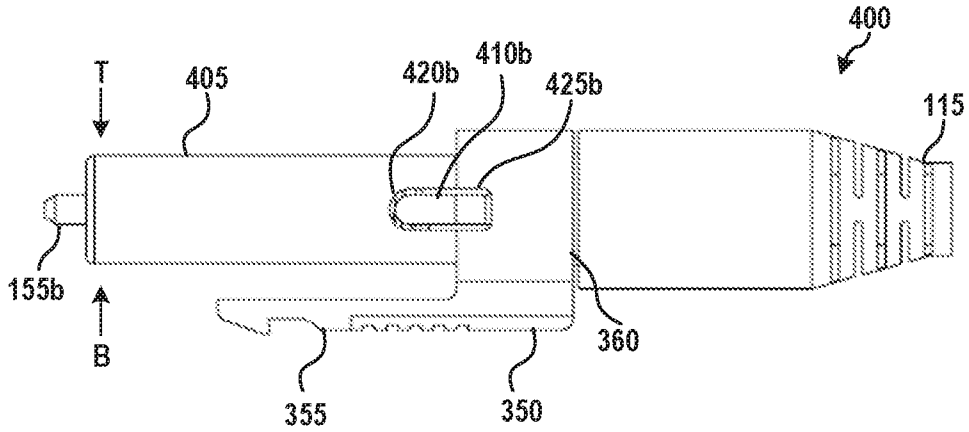


FIG. 4H

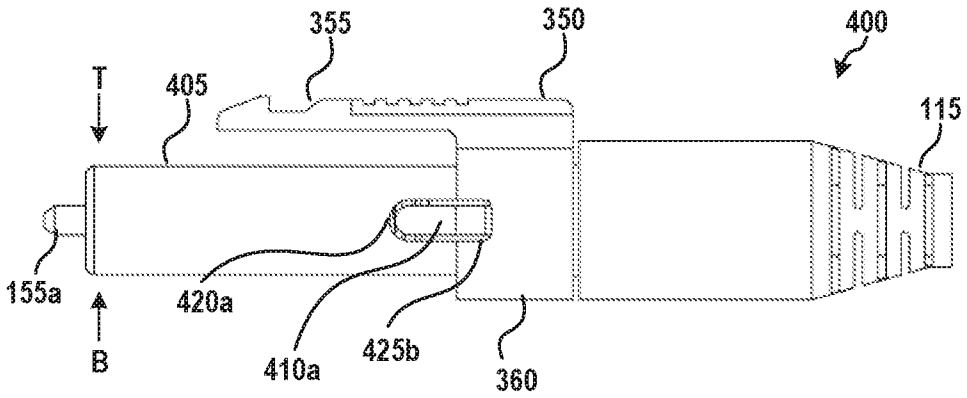


FIG. 4I

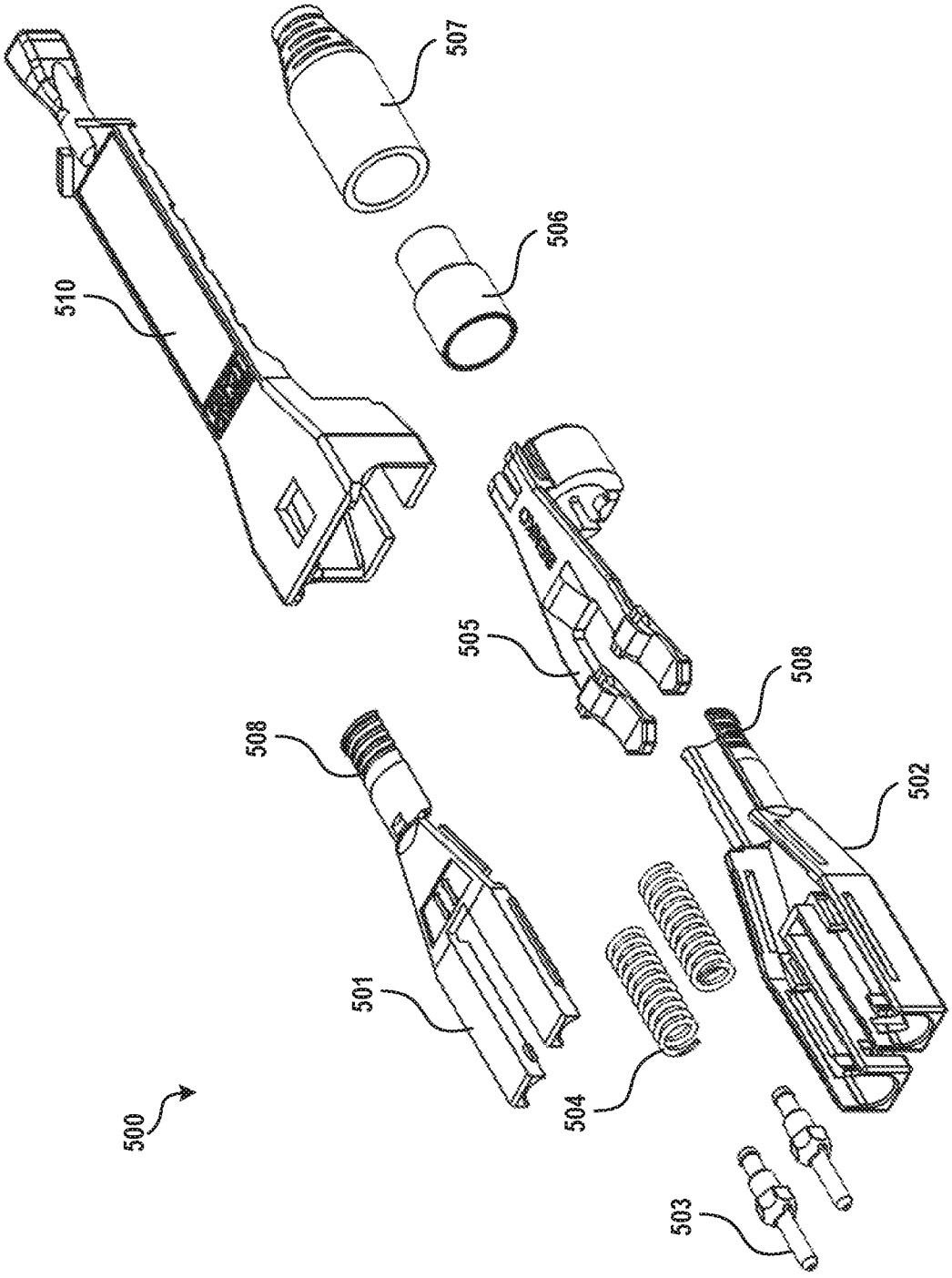


FIG. 5

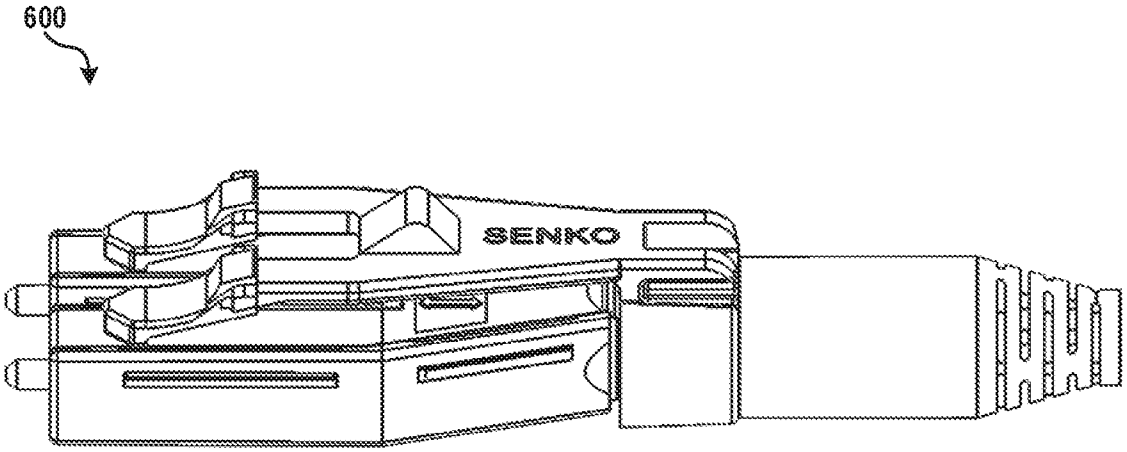


FIG. 6A

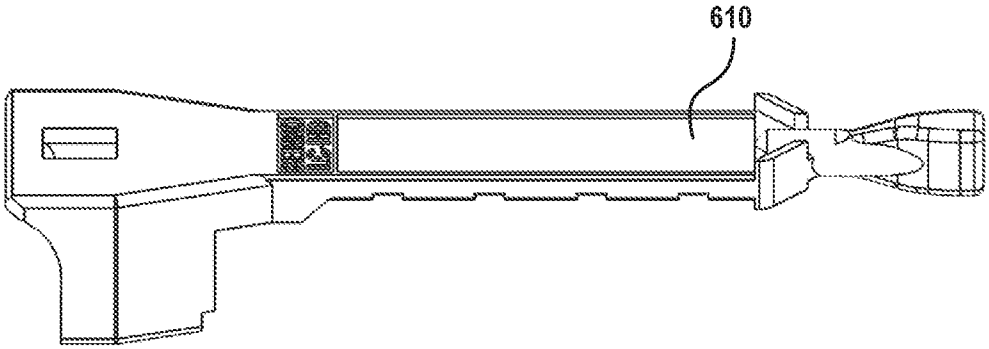


FIG. 6B

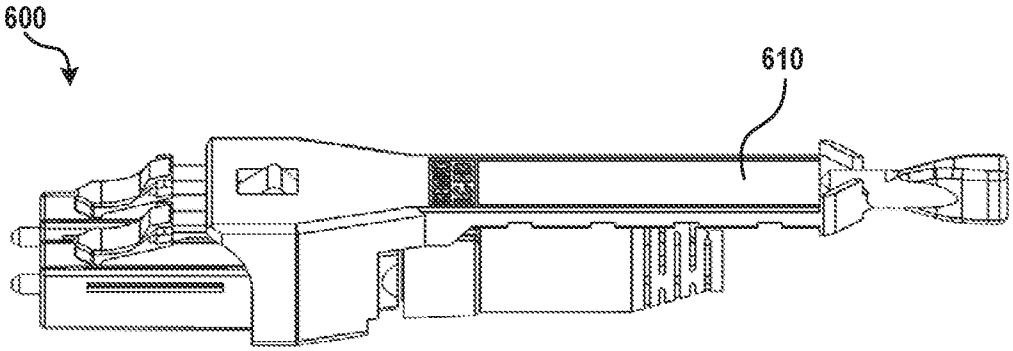


FIG. 6C

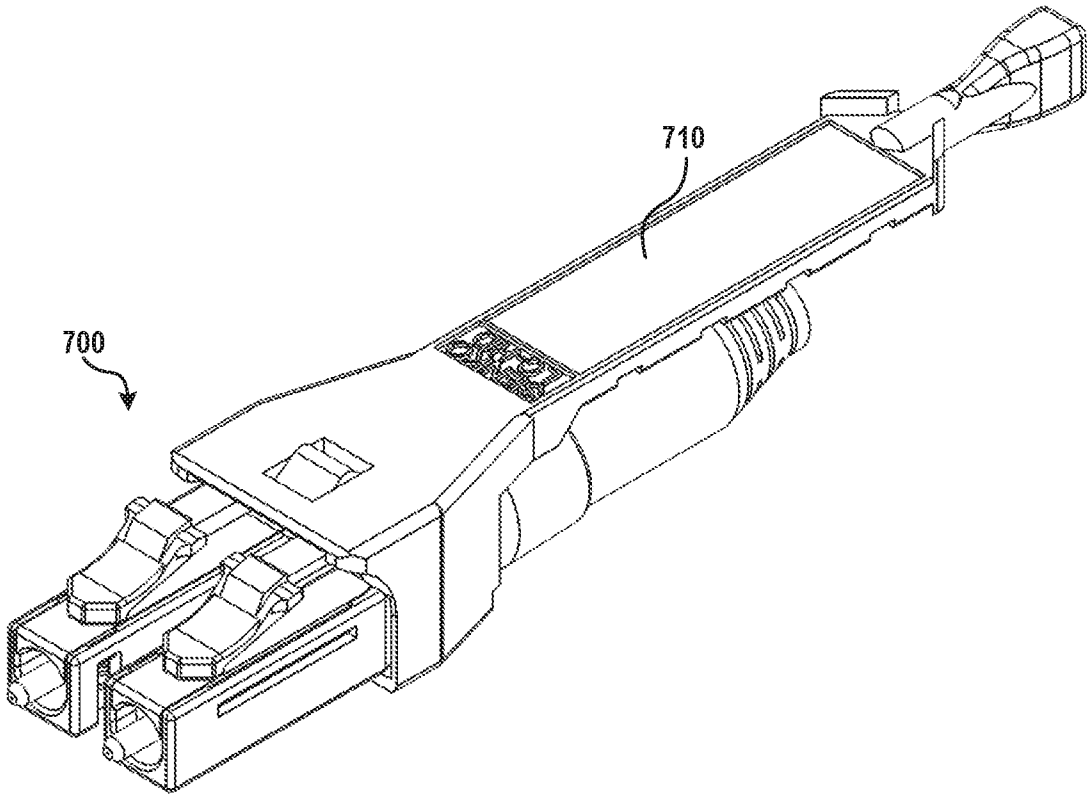


FIG. 7A

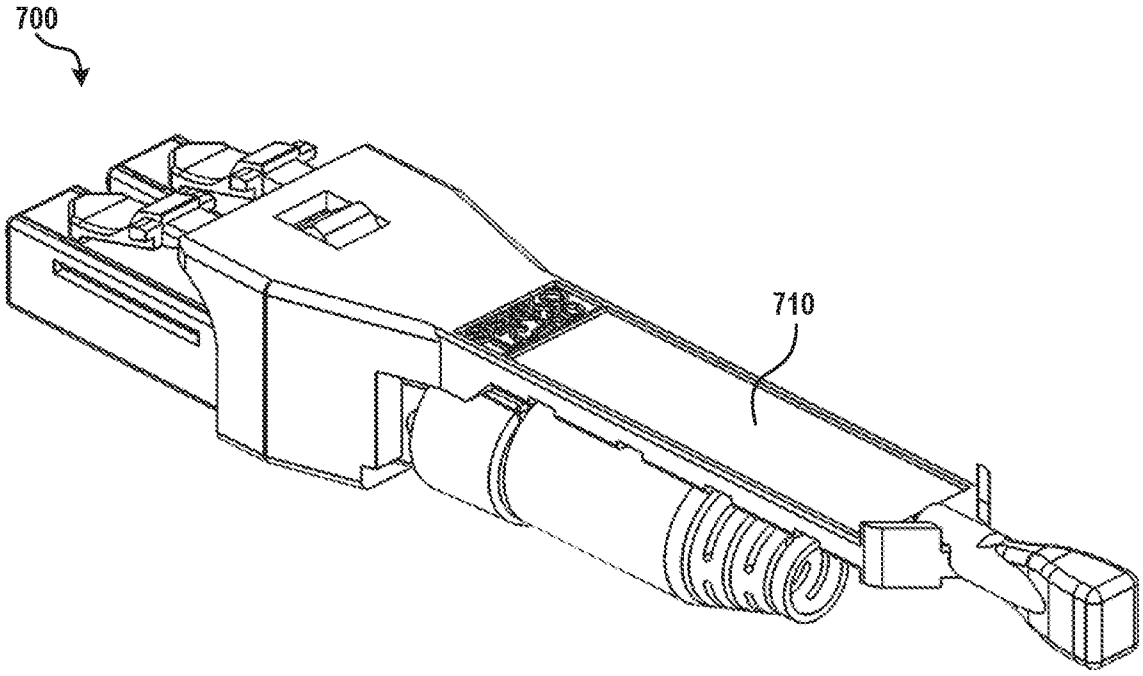


FIG. 7B

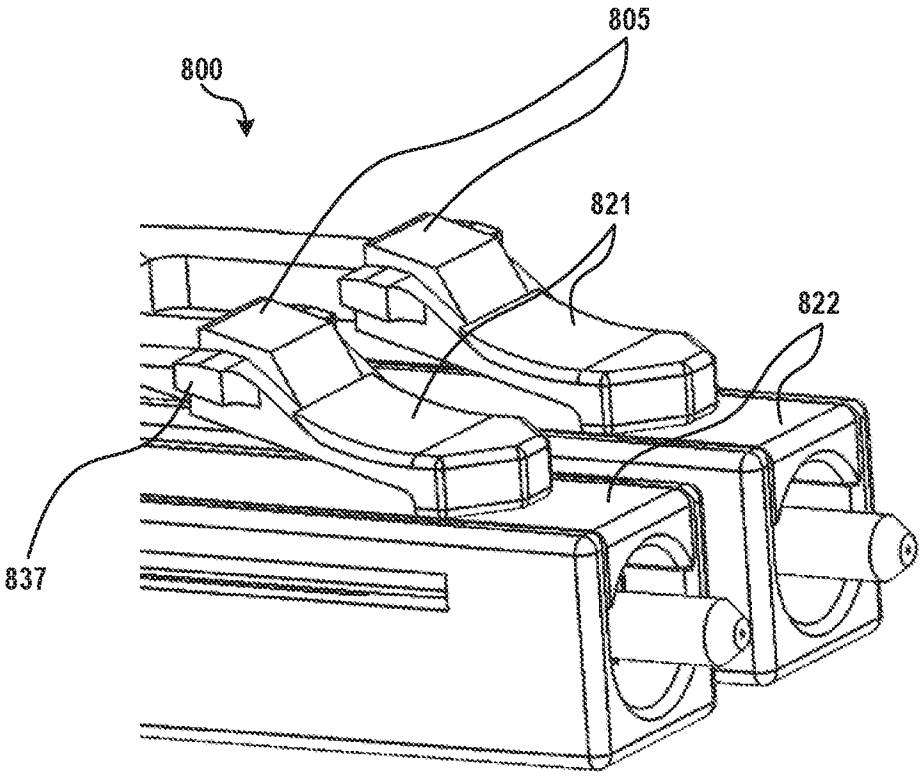


FIG. 8A

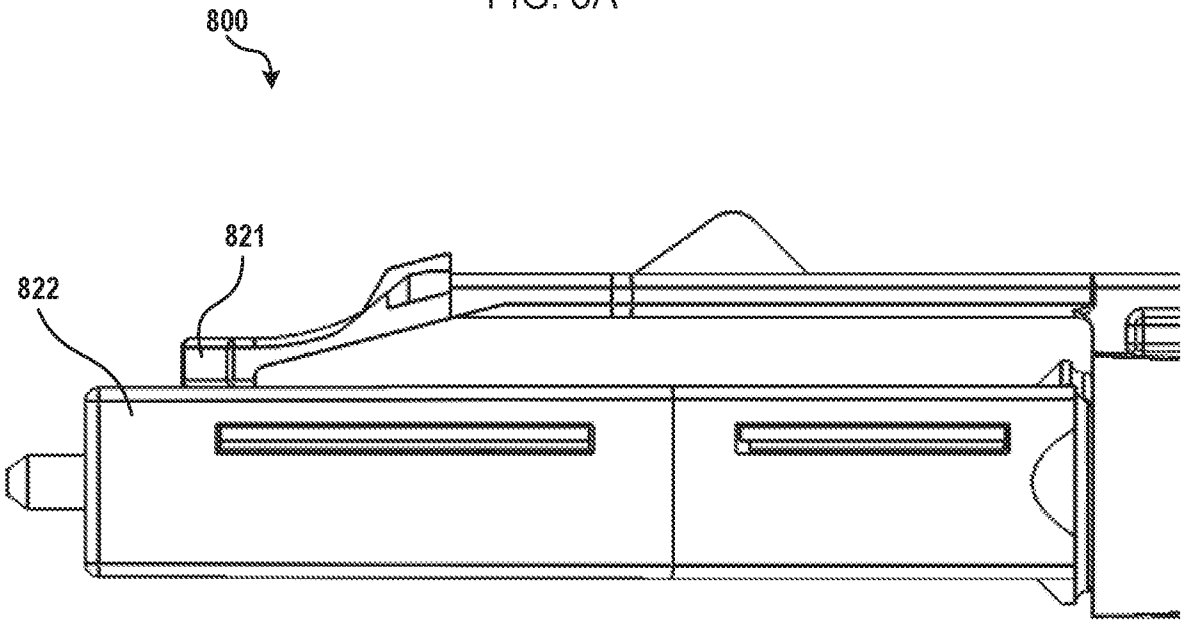


FIG. 8B

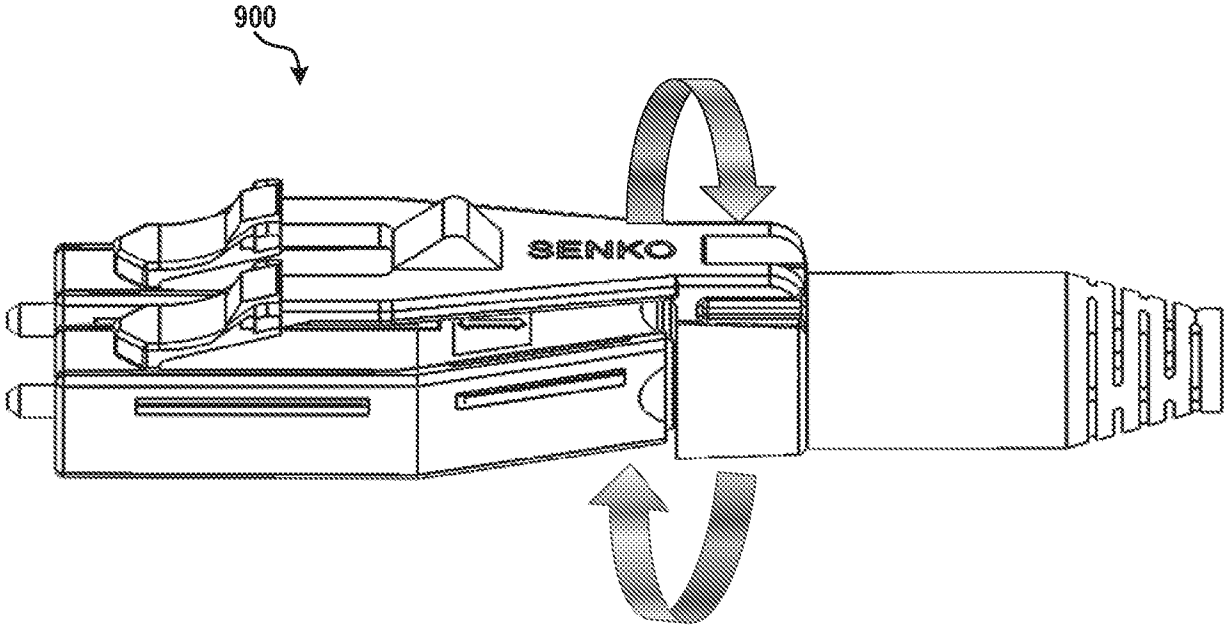


FIG. 9A

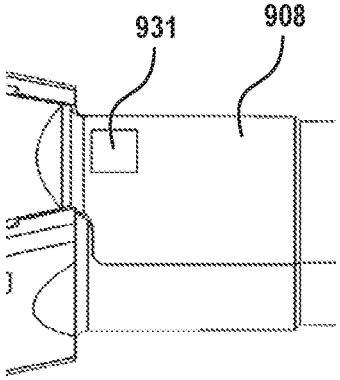


FIG. 9B

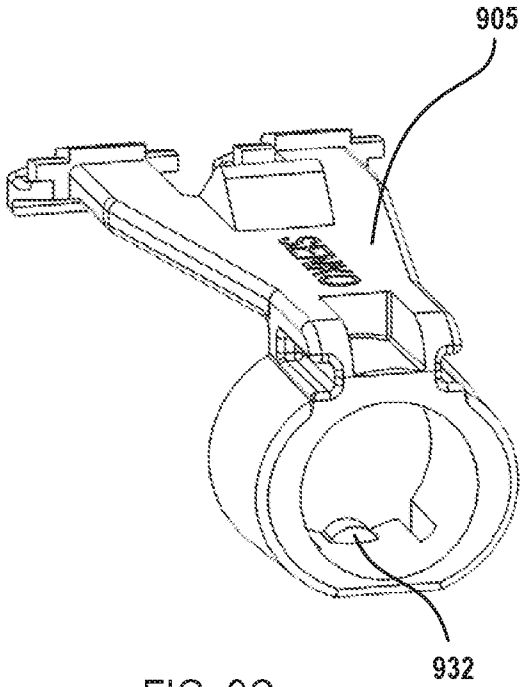


FIG. 9C

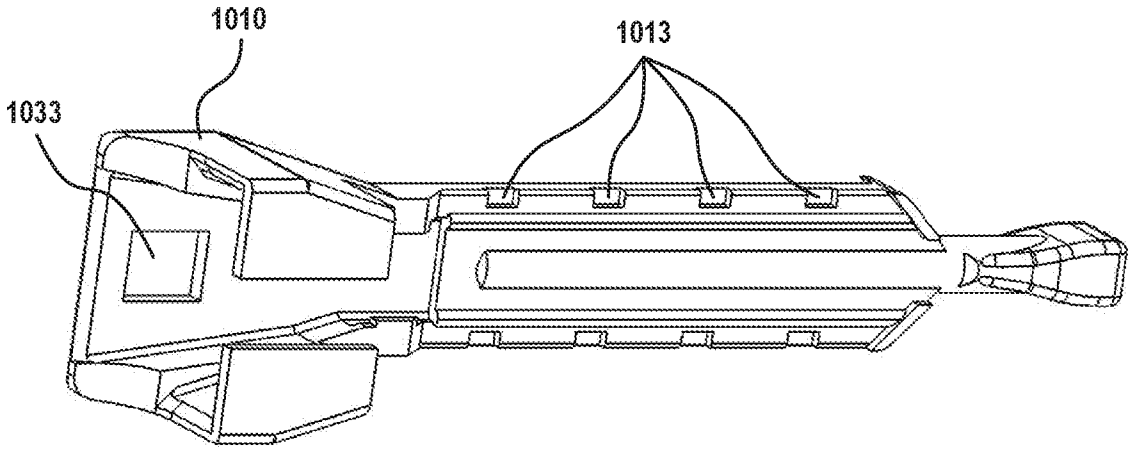


FIG. 10A

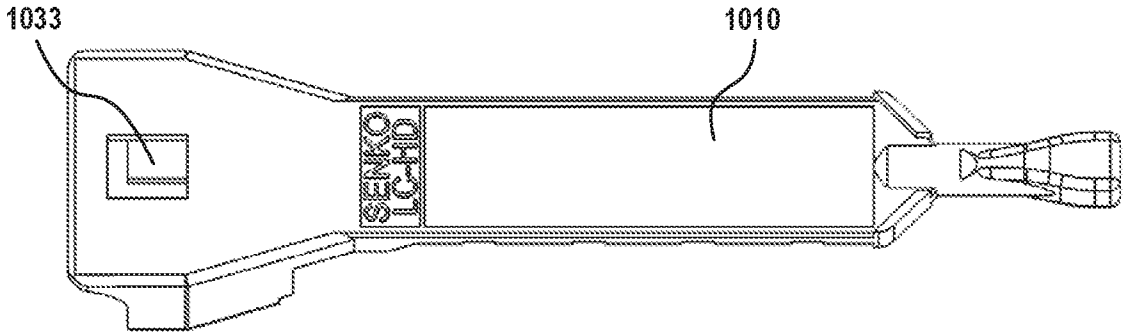


FIG. 10B

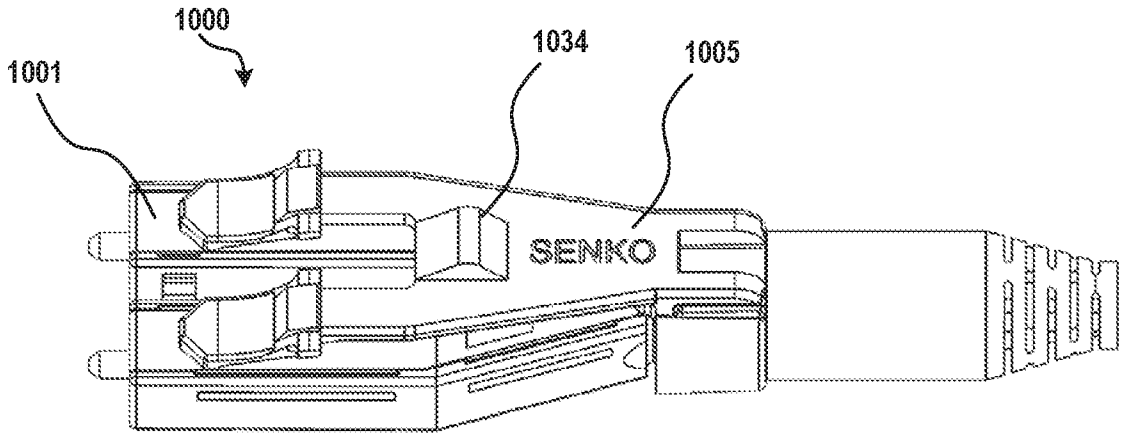


FIG. 10C

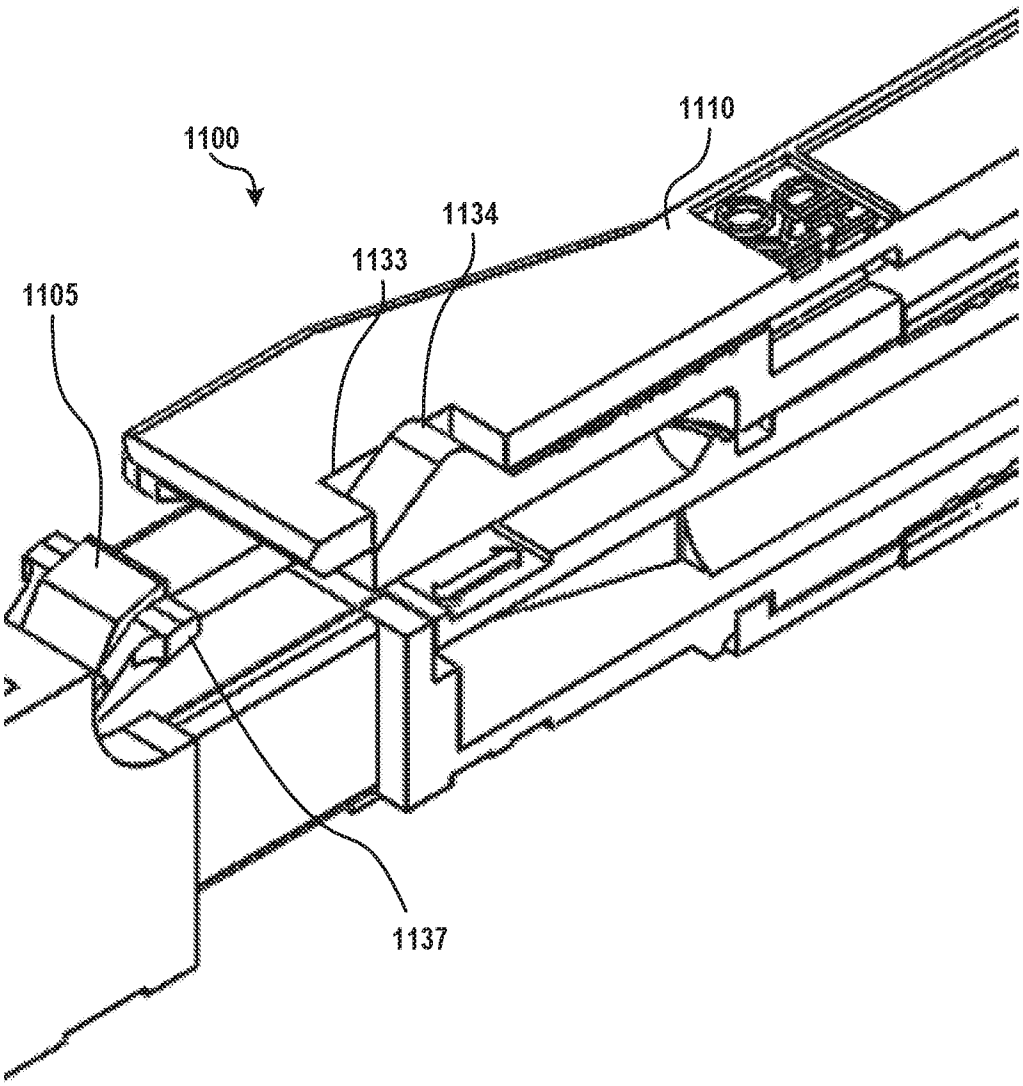


FIG. 11

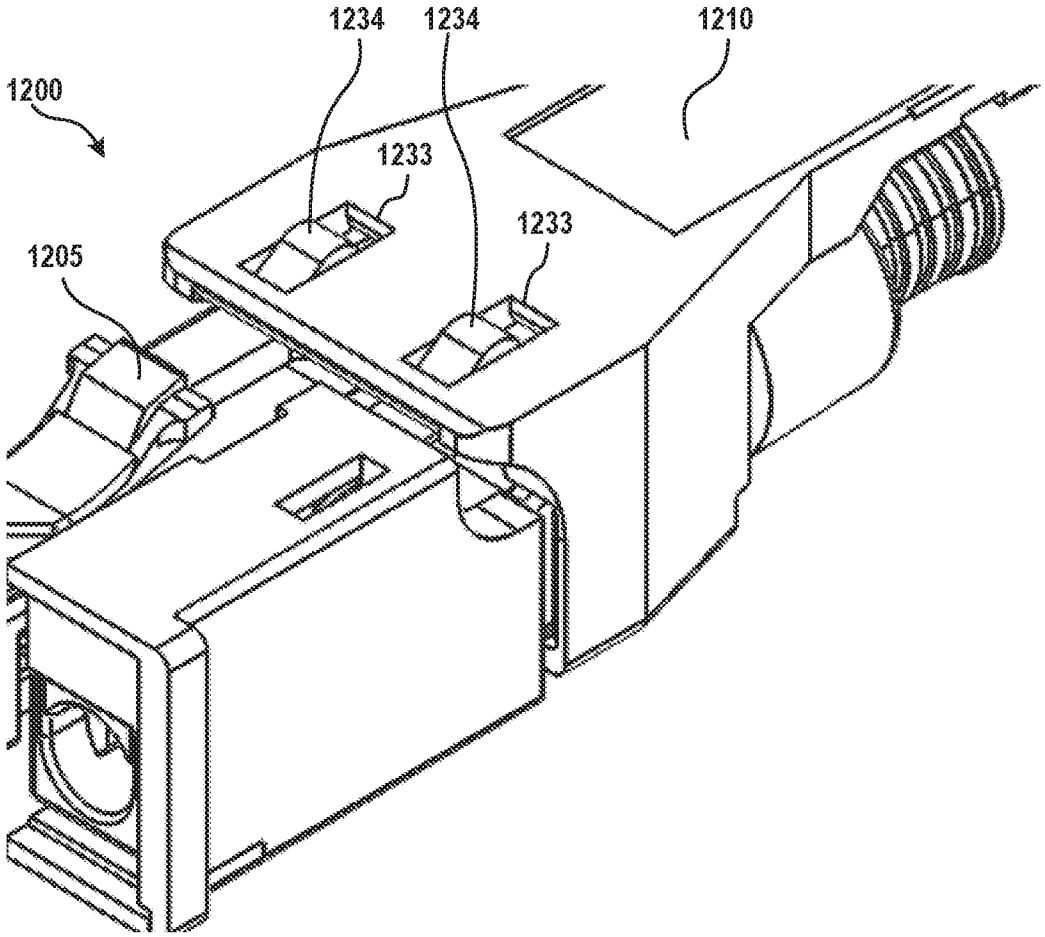


FIG. 12A

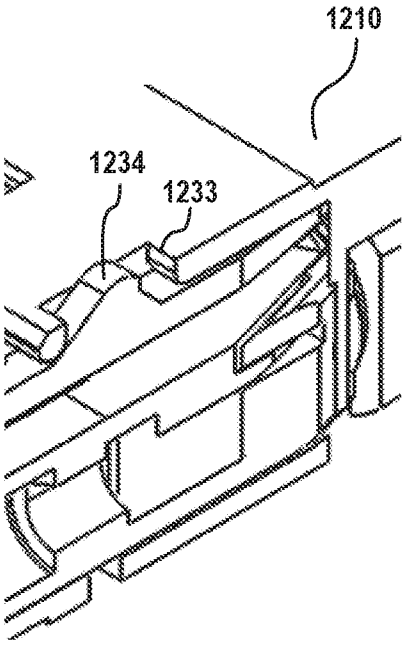


FIG. 12B

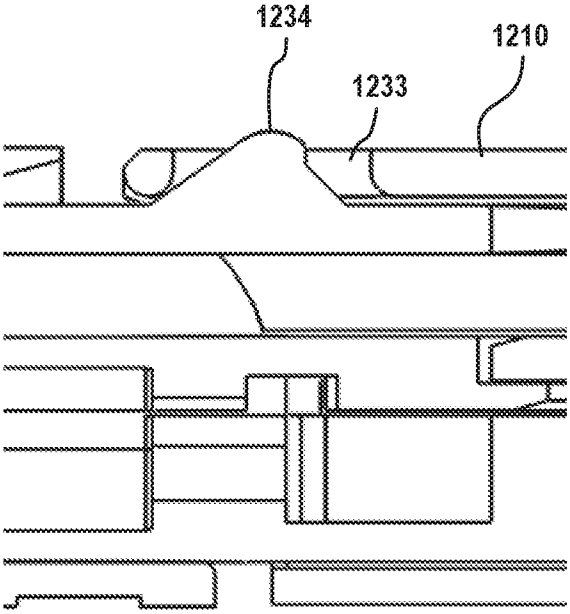


FIG. 12C

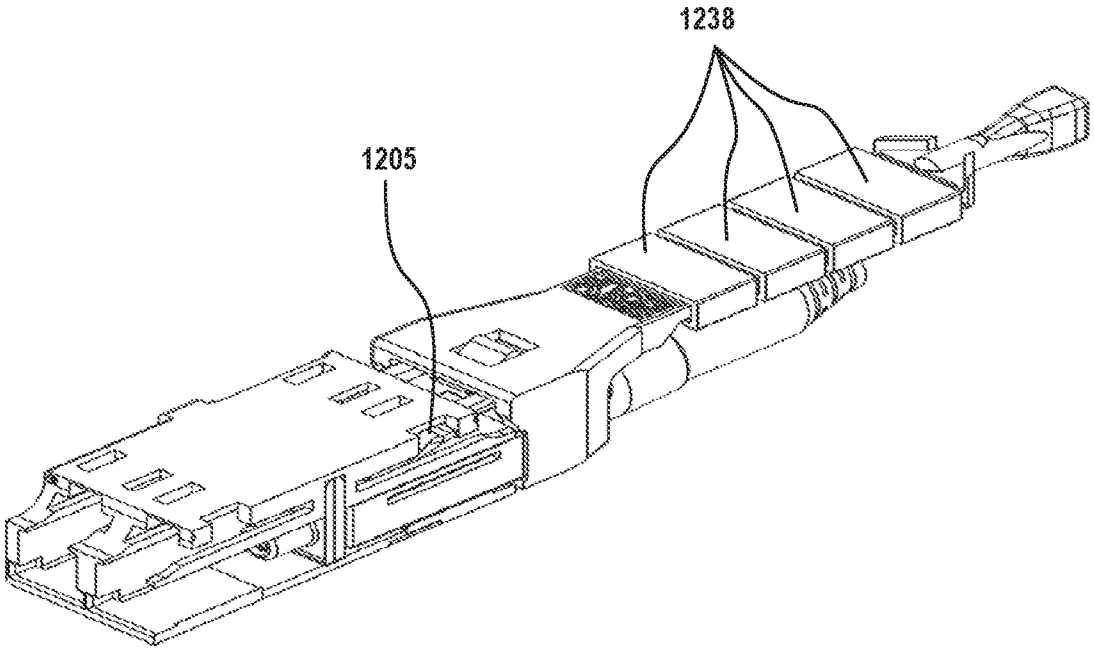


FIG. 12D

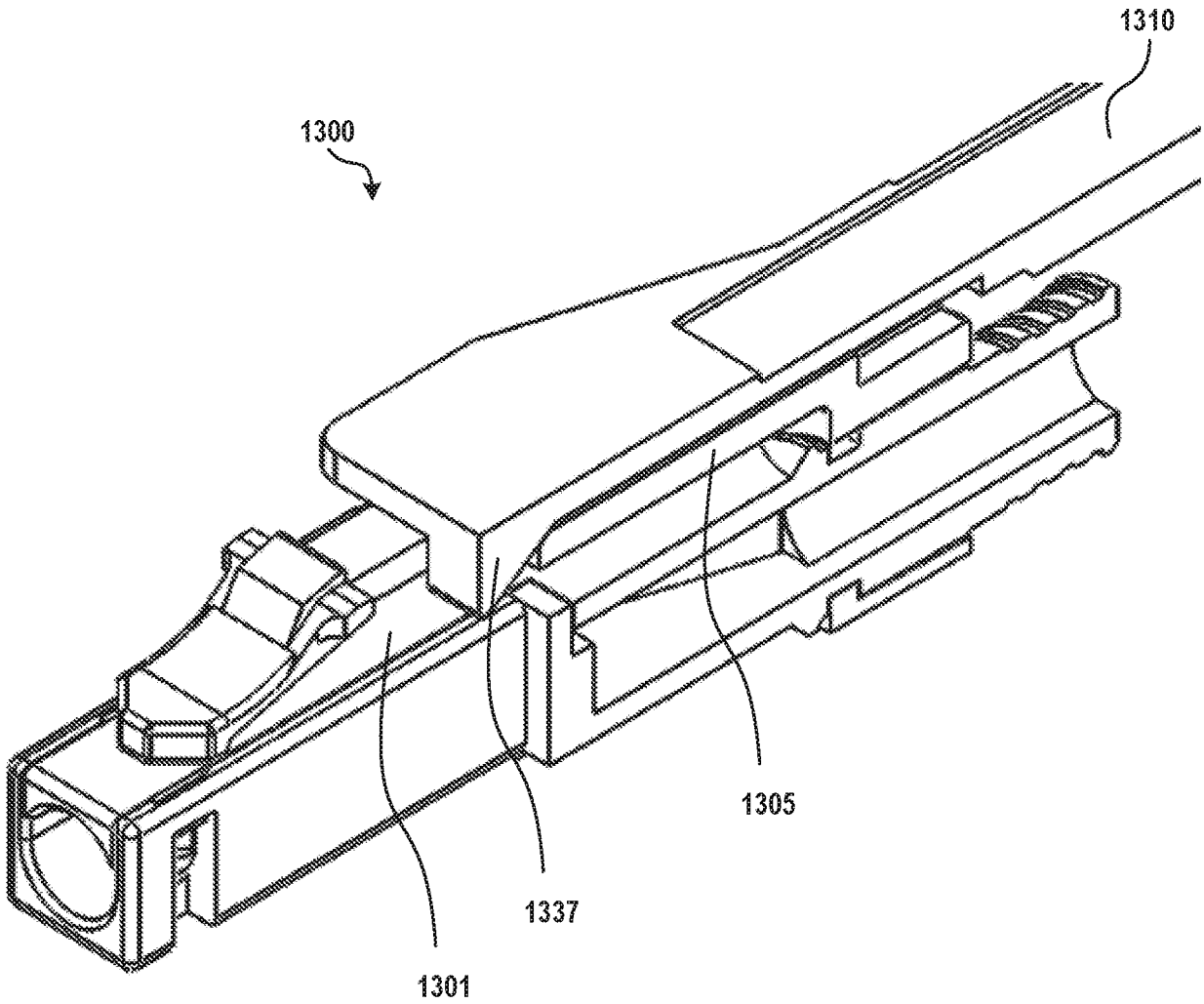


FIG. 13

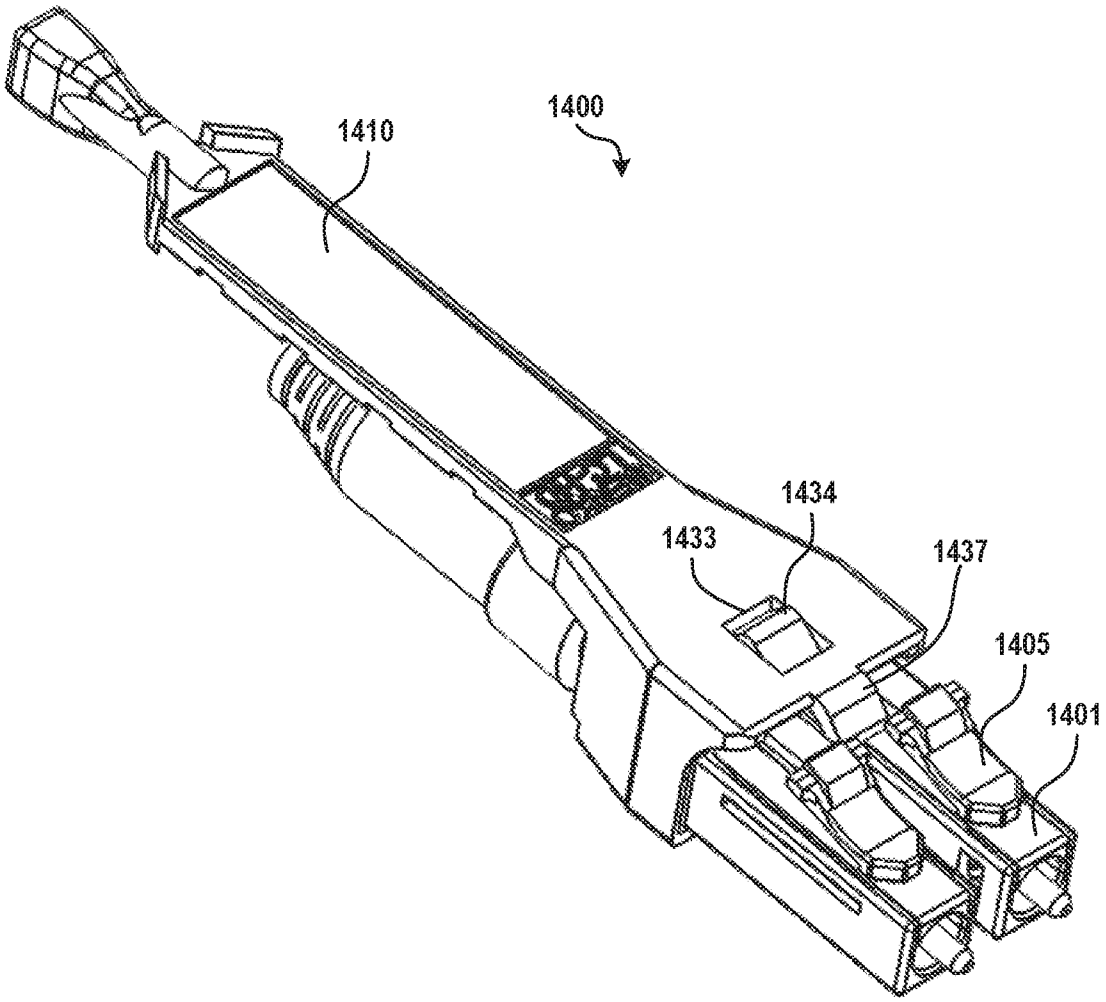


FIG. 14

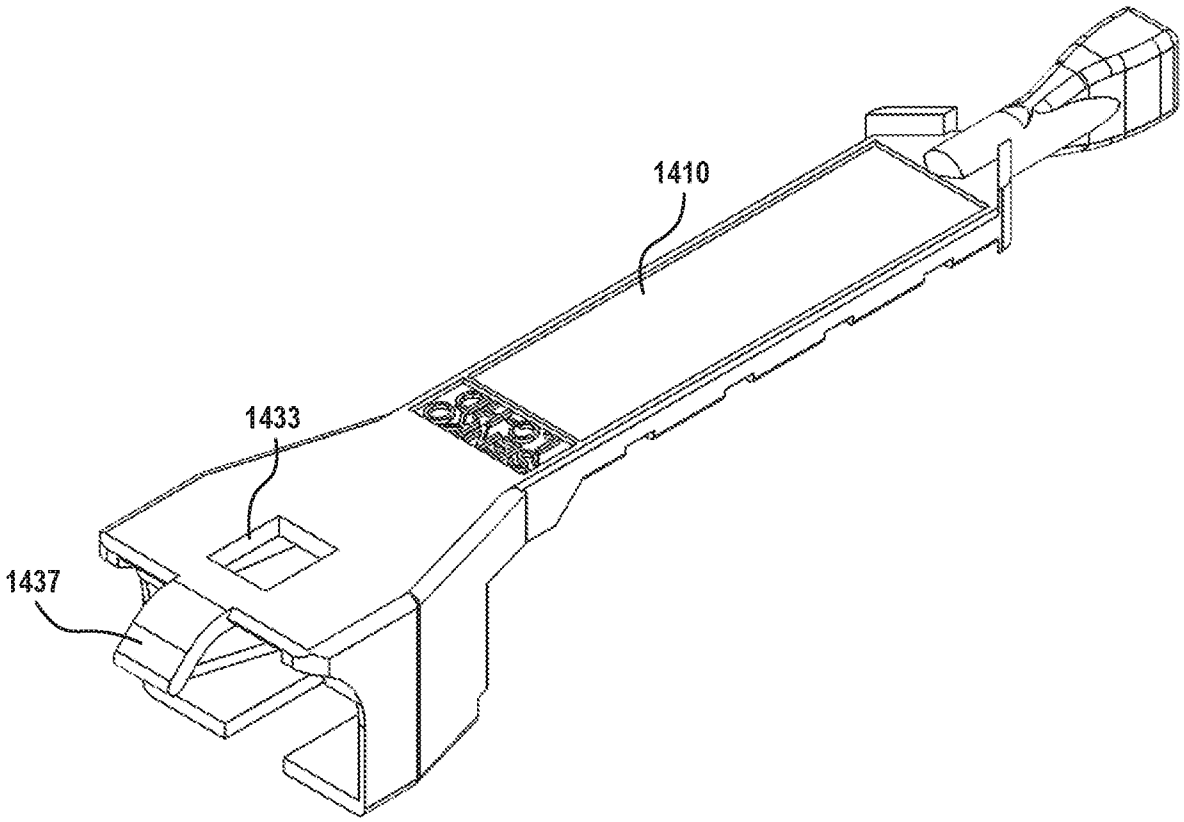


FIG. 15A

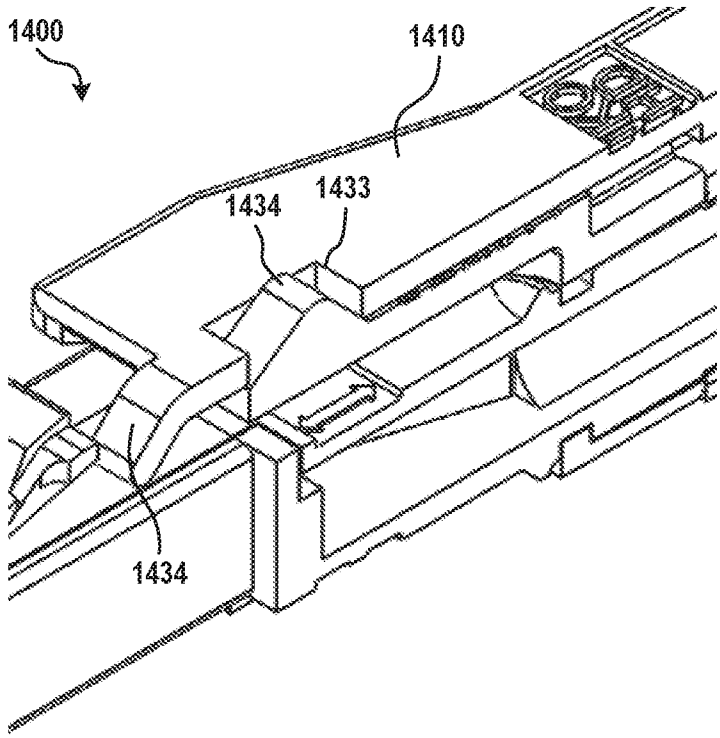


FIG. 15B

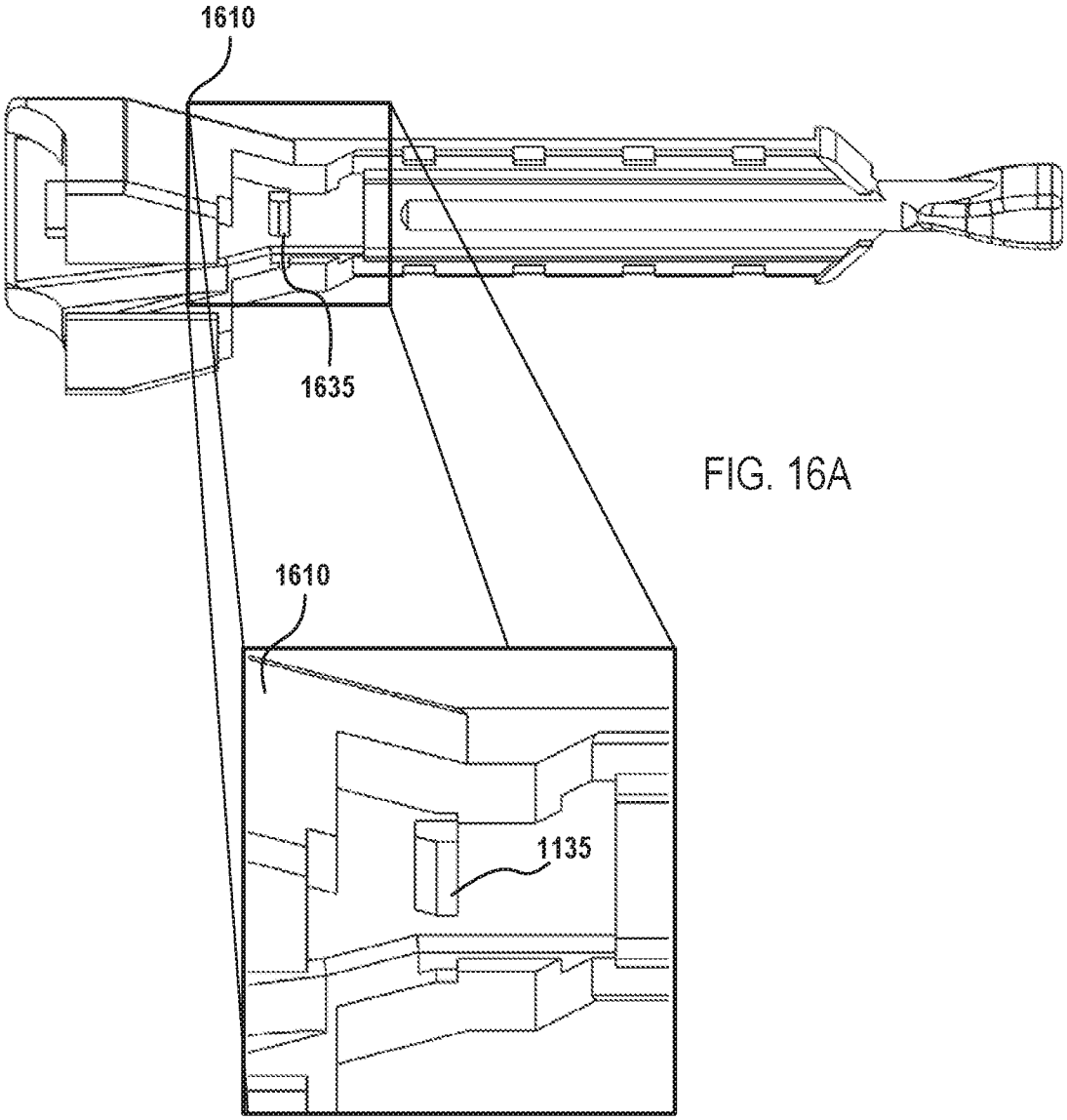


FIG. 16A

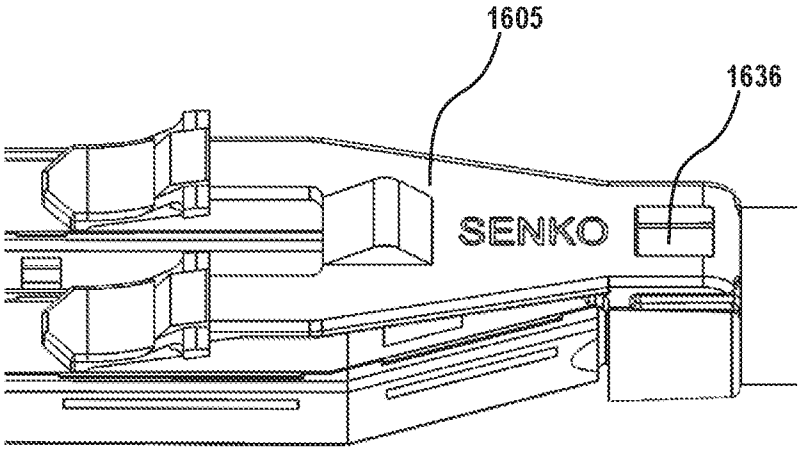


FIG. 16B

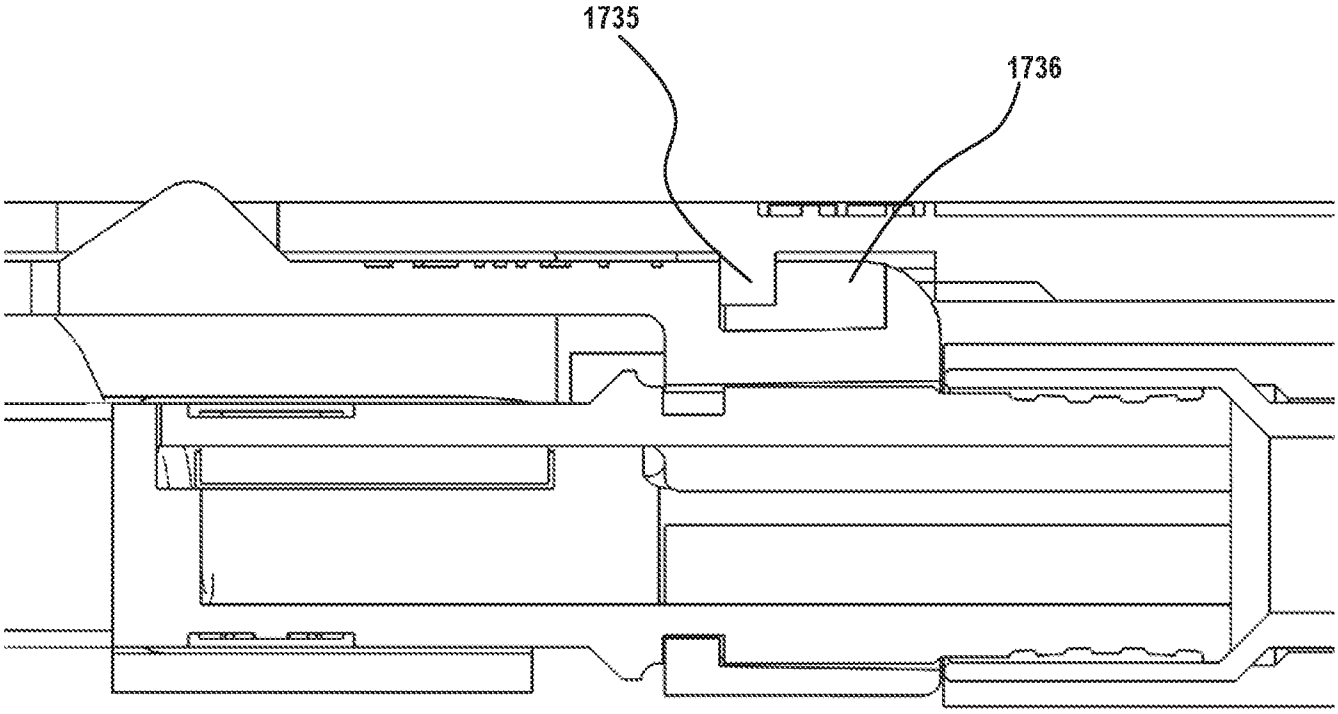


FIG. 17

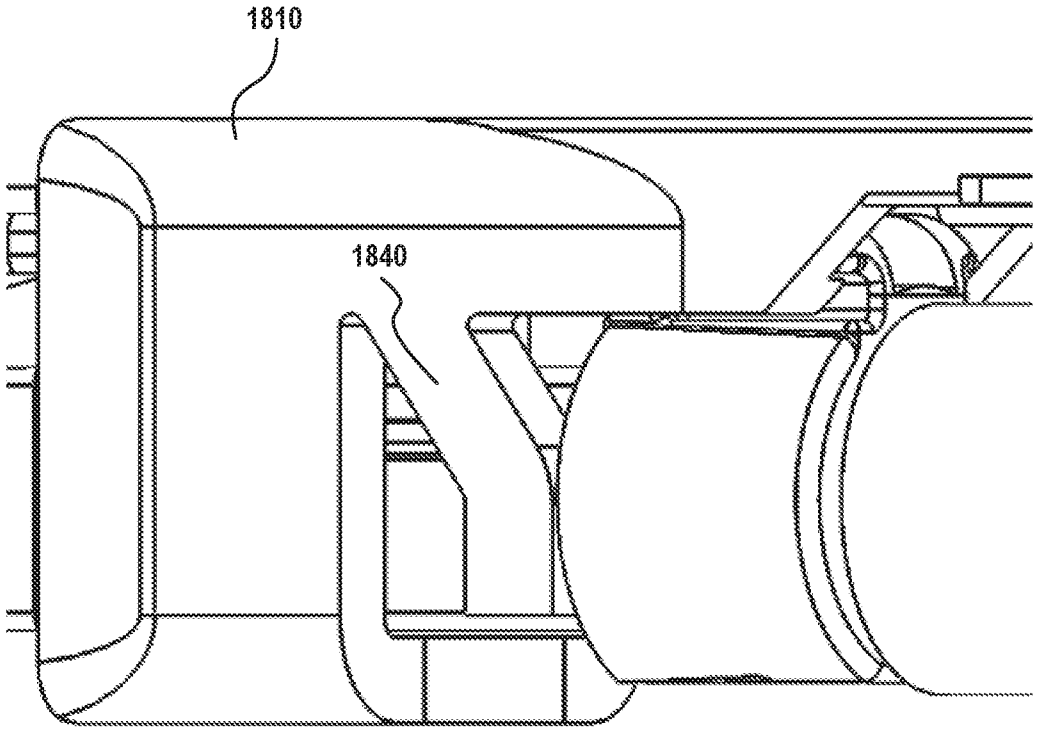


FIG. 18A

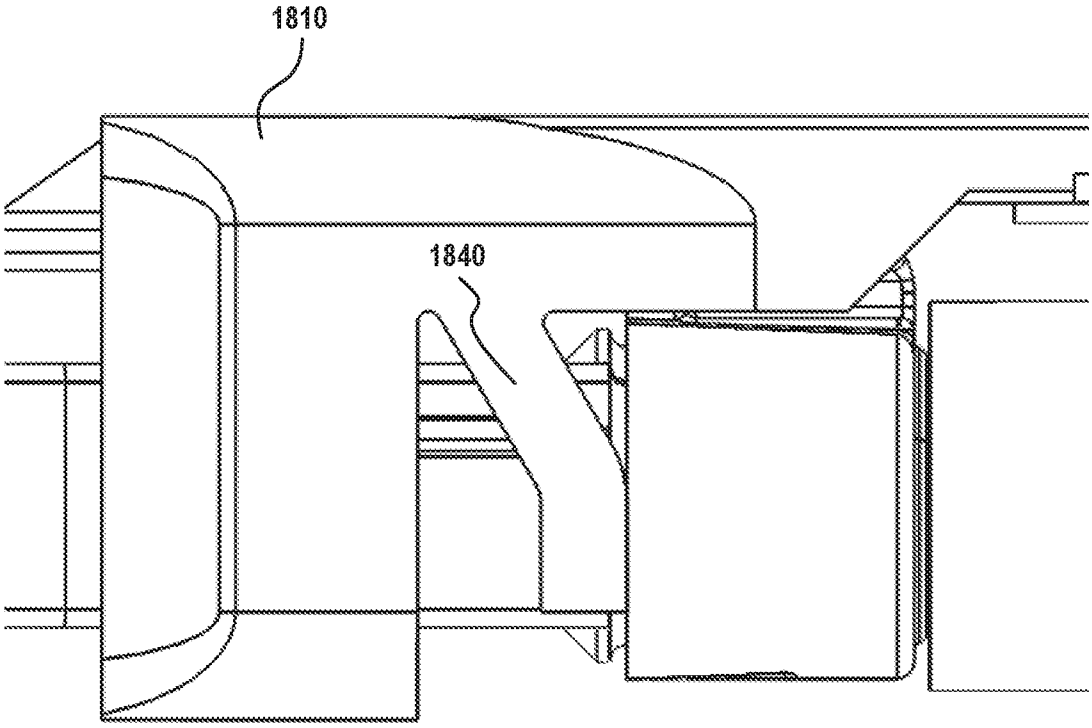


FIG. 18B

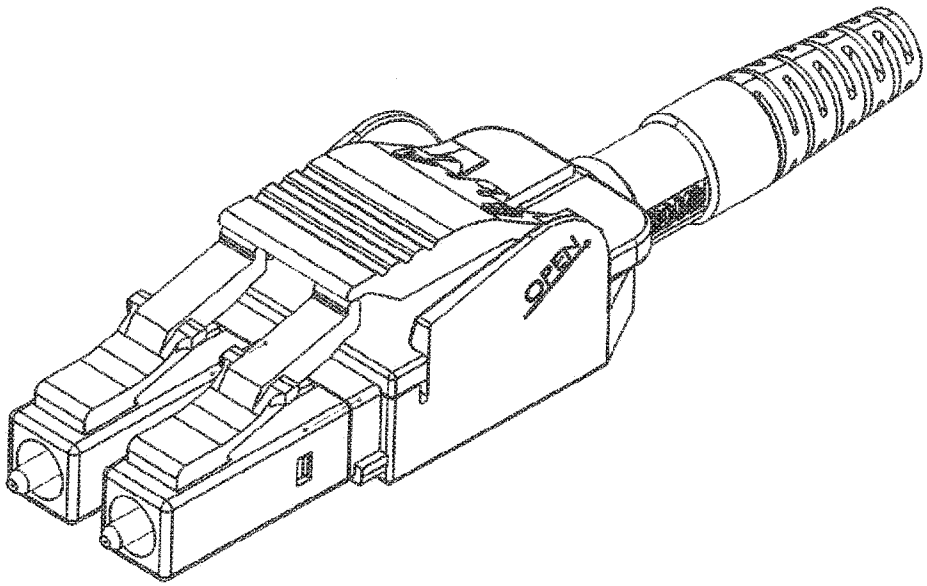


FIG. 19A

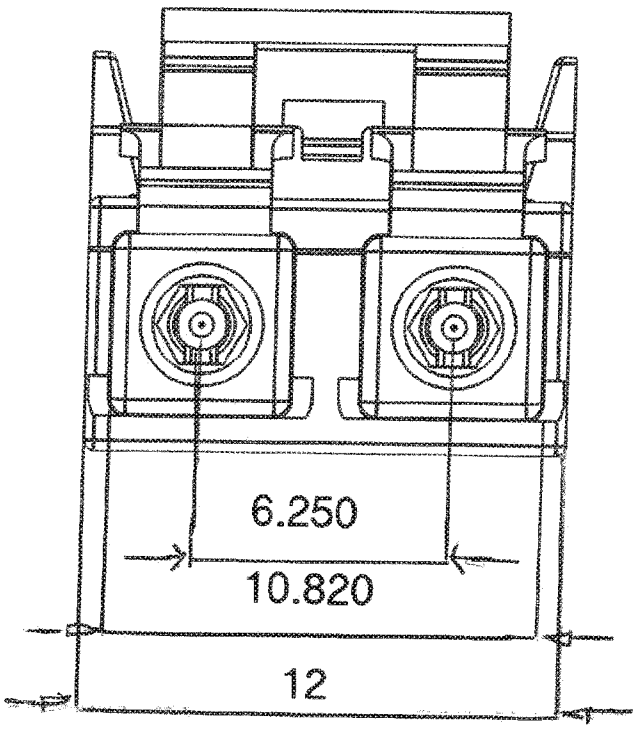


FIG. 19B

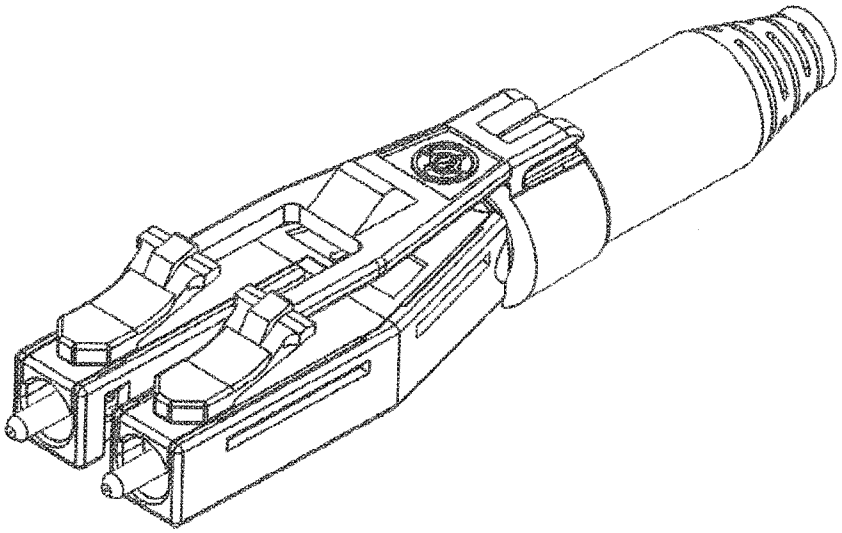


FIG. 20A

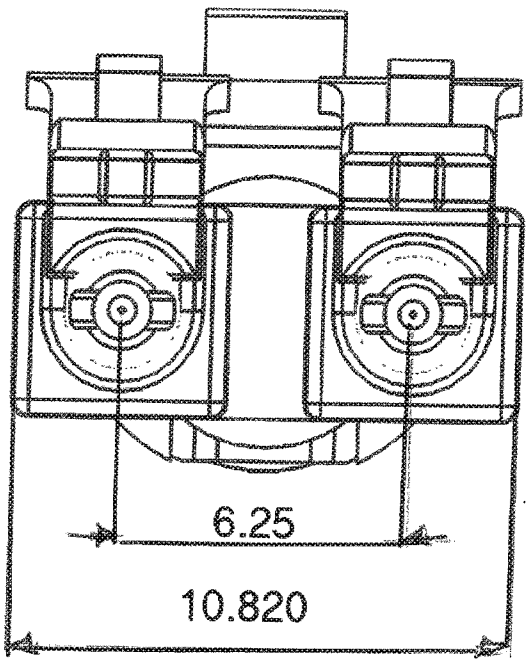


FIG. 20B

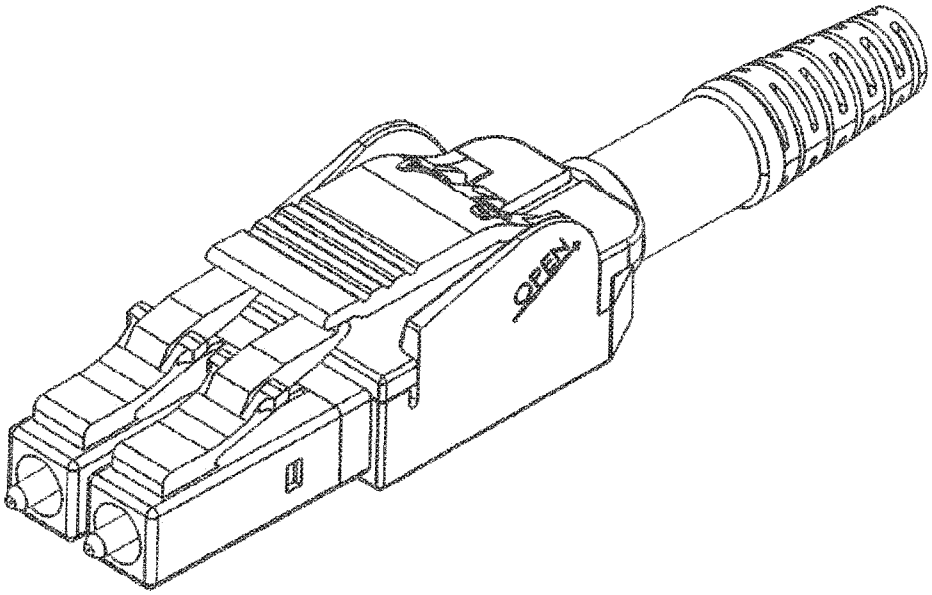


FIG. 21A

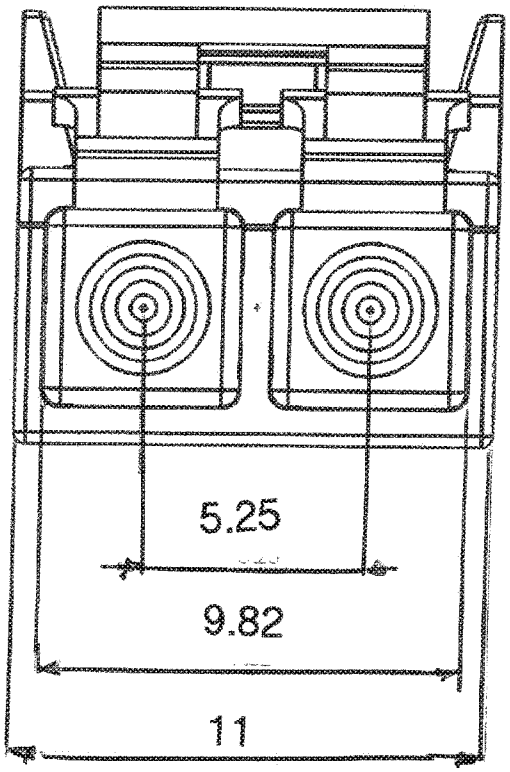


FIG. 21B

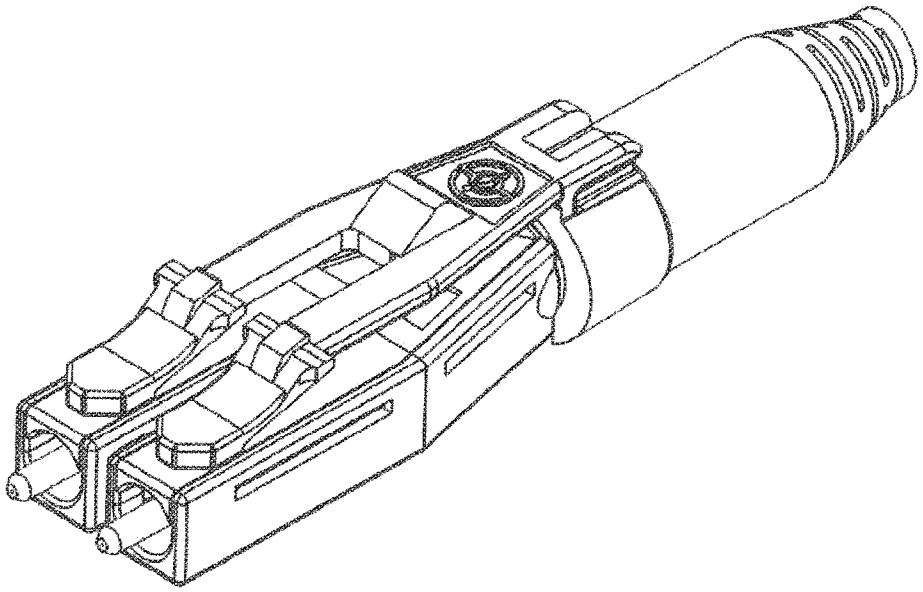


FIG. 22A

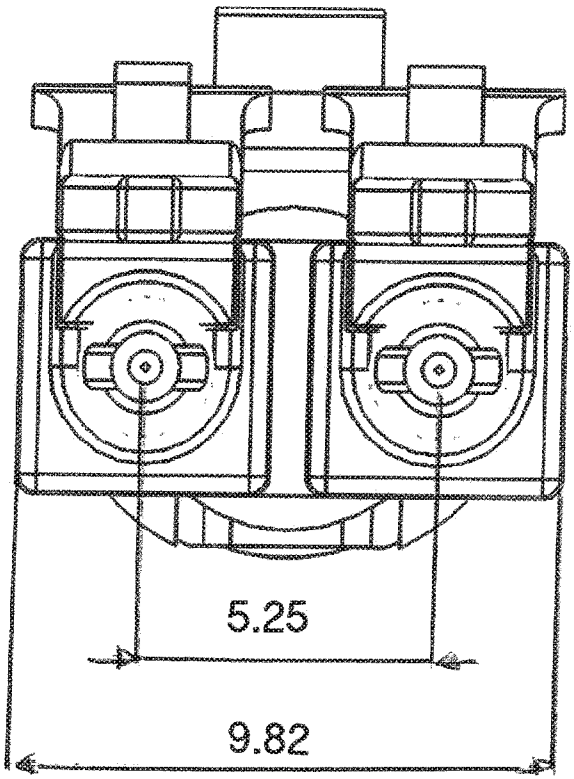


FIG. 22B

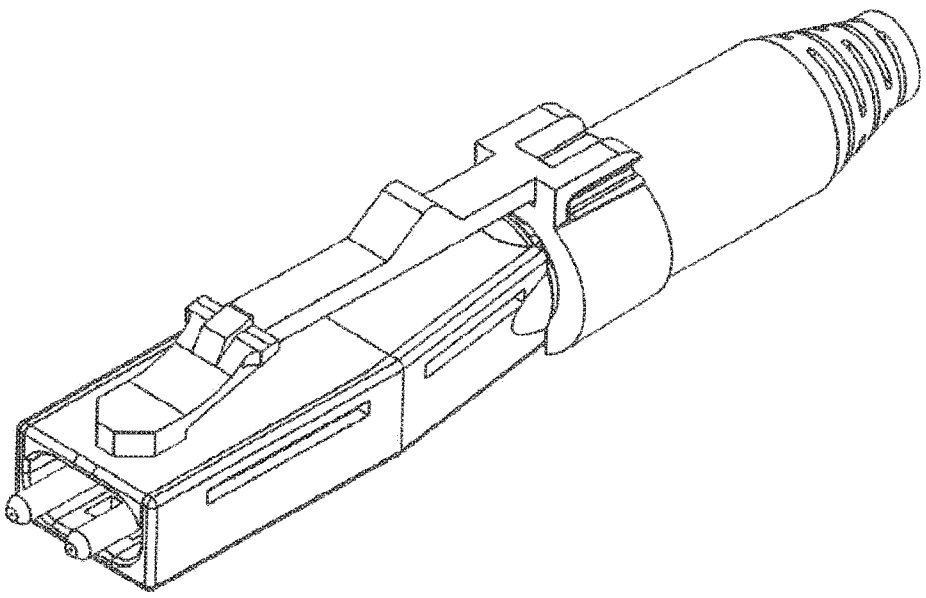


FIG. 23A

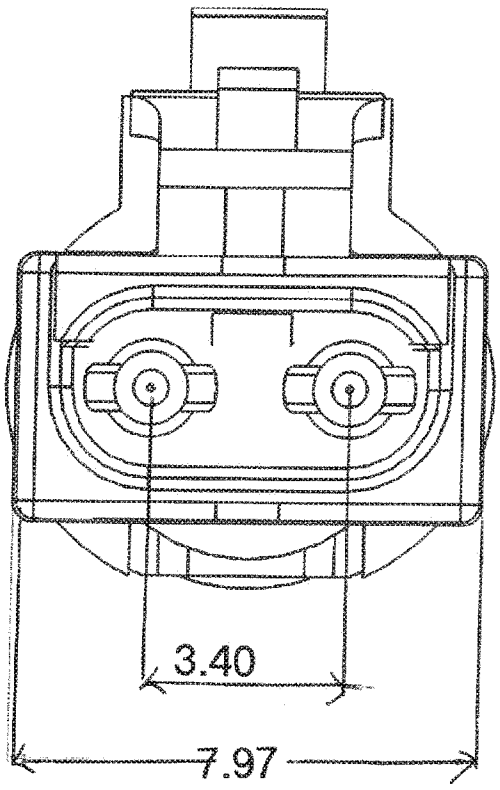


FIG. 23B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/34658

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G02B 6/00, G02B 6/24, G02B 6/36, G02B 6/38 (2018.01)

CPC - G02B 6/00, G02B 6/24, G02B 6/241, G02B 6/2726, G02B 6/36, G02B 6/3604, G02B 6/38, G02B 6/3801, G02B 6/3806, G02B 6/3807, G02B 6/381, G02B 6/3821, G02B 6/3825, G02B 6/383, G02B 6/3831, G02B 6/3869, G02B 6/387, G02B 6/3871, G02B 6/3873, G02B 6/3875, G02B 6/3879, G02B 6/389, G02B 6/3893

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 ----- Y	US 2016/0327756 A1 (FIBREFAB LIMITED) 10 November 2016 (10.11.2016), entire document, especially Figs. 1-7, paras [0013], [0093], [0111]-[0112], [0119]-[0124]	1-3 ---------- 4-8
Y	US 9,595,786 B1 (SENKO ADVANCED COMPONENTS, INC.) 14 March 2017 (14.03.2017), entire document, especially Figs. 5, 6A, 8, 12B; col 3, ln 1-11; col 5; ln 27-30, ln 47-52; col 6, ln 35-40; col 7, ln 11-21	4-8
A	US 2014/0169727 A1 (VEATCH et al.) 19 June 2014 (19.06.2014), entire document	1-8
A	US 2013/0163934 A1 (LEE et al.) 27 June 2013 (27.06.2013), entire document	1-8
A	US 2016/0216458 A1 (BAYCOM OPTO-ELECTRONICS TECHNOLOGY CO., LTD. et al.) 28 July 2016 (28.07.2016), entire document	1-8
A	US 2016/0349458 A1 (MURRAY et al.) 1 December 2016 (01.12.2016), entire document	1-8
A	US 2016/0327757 A1 (ALLIANCE FIBER OPTIC PRODUCTS, INC.) 10 November 2016 (10.11.2016), entire document	1-8
A, P	US 9,678,283 B1 (SENKO ADVANCED COMPONENTS, INC.) 13 June 2017 (13.06.2017), entire document	1-8

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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
30 July 2018	16 OCT 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/34658

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-8, directed to a connector assembly.

Group II: Claim 9-18 directed to a connector assembly having an adjustable polarity.

-*-Continued on Supplemental Page-*-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-8

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/34658

Continuation of:

-*-Box III ? Observations where unity of invention is lacking-*-

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical feature of [a housing] configured to accept a first ferrule and a second ferrule; [a] latch component comprising a first locking element configured to engage a second locking element; a push-pull tab removably connected to the housing and configured to move along the housing when a biasing force is applied in at least one of a forward direction and a rearward direction; wherein the push-pull tab is configured to compress the latch component when moving along the housing; further wherein the latch component comprises a top with at least one protrusion; wherein the at least one protrusion extends through at least one window when the push-pull tab is removably connected to the housing; and wherein the latch component is compressed when the push-pull tab moves along the housing causing an edge of the window to impact the at least one protrusion, not required by the claims of Group II.

The invention of Group II includes the special technical feature of a polymer uni-body [base frame] comprising a plug frame portion, a body portion, and a back post portion; and a top cover, not required by the claims of Group I.

COMMON TECHNICAL FEATURES

Groups I-II share the common technical features of a housing; a latch component that is removably connected to the housing, wherein the latch component is configured to rotate around the housing, and [wherein the latch component is rotated from] a first polarity position to a second polarity position. However, this shared technical feature does not represent a contribution over prior art as being anticipated by US 2016/0327756 A1 to FibreFab Limited (hereinafter "Fibre"), which discloses a housing (housing comprising housing 5 and boot 7, Figs. 1, 4); a latch component that is removably connected to the housing (connector unit 3 including latching levers 55a, 55b, Fig. 2, which is fully separable from the housing, para [0121]), wherein the latch component is configured to rotate around the housing (*connector unit 3 may be separated from housing 5, remain located around boot 7 and rotated 180 degrees about boot 7*; para [0122]), and [wherein the latch component is rotated from] a first polarity position to a second polarity position (polarity changed by changing orientation of connector unit 3 with respect to housing, paras [0119]-[0124]).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.