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(54) **Title:** COAXIAL CABLE CONNECTORS HAVING GROUND CONTINUITY

(57) **Abstract:** A coaxial cable connector includes a body configured to engage a coaxial cable having a conductive electrical grounding property, a post configured to engage the body and the coaxial cable when the connector is installed on the coaxial cable, a nut configured to engage an interface port at a retention force, and a retention adding element configured to increase the retention force between the nut and the interface port so as to maintain ground continuity between the interface port and the nut when the nut is in a loosely tightened position on the interface port.

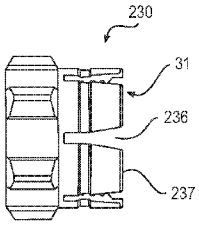


FIG. 2A

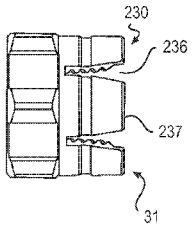


FIG. 2B

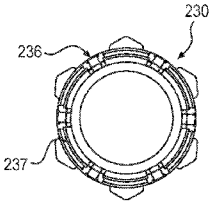


FIG. 2C

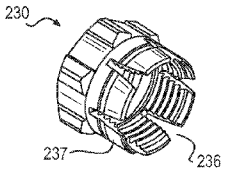


FIG. 2D

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COAXIAL CABLE CONNECTORS HAVING GROUND CONTINUITY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This nonprovisional application claims the benefit of U.S. Provisional Application No. 62/377,476, filed August 19, 2016; U.S. Provisional Application No. 62/407,483, filed October 12, 2016; and U.S. Provisional Application No. 62/410,370, filed October 19, 2016, the disclosures of which are incorporated herein by reference in their entirety.

[0002] In addition, the present application is related to the subject matter of U.S. Design Patent Application No. 29/580,627, filed October 11, 2016; U.S. Design Patent Application No. 29/580,628, filed October 11, 2016; U.S. Design Patent Application No. 29/587,518, filed December 13, 2016; and U.S. Design Patent Application No. 29/587,519, filed December 13, 2016, the disclosures of which are incorporated herein by reference in their entirety.

BACKGROUND

[0003] Broadband communications have become an increasingly prevalent form of electromagnetic information exchange and coaxial cables are common conduits for transmission of broadband communications. Coaxial cables are typically designed so that an electromagnetic field carrying communications signals exists only in the space between inner and outer coaxial conductors of the cables. This allows coaxial cable runs to be installed next to metal objects without the power losses that occur in other transmission lines, and provides protection of the communications signals from external electromagnetic interference.

[0004] Connectors for coaxial cables are typically connected onto complementary interface ports to electrically integrate coaxial cables to various electronic devices and cable communication equipment. Connection is often made through rotatable operation of an

internally threaded nut of the connector about a corresponding externally threaded interface port. Fully tightening the threaded connection of the coaxial cable connector to the interface port helps to ensure a ground connection between the connector and the corresponding interface port.

[0005] However, often connectors are not fully and/or properly tightened or otherwise installed to the interface port and proper electrical mating of the connector with the interface port does not occur. Moreover, typical component elements and structures of common connectors may permit loss of ground and discontinuity of the electromagnetic shielding that is intended to be extended from the cable, through the connector, and to the corresponding coaxial cable interface port. In particular, in order to allow the threaded nut of a connector to rotate relative to the threaded interface port, sufficient clearance must exist between the matching male and female threads. When the connector is left loose on the interface port (i.e., not fully and/or properly tightened), gaps may still exist between surfaces of the mating male and female threads, thus creating a break in the electrical connection of ground.

[0006] Lack of continuous port grounding in a conventional threaded connector, for example, when the conventional threaded connector is loosely coupled with an interface port (i.e., when in a loose state relative to the interface port), introduces noise and ultimately performance degradation in conventional RF systems. Furthermore, lack of ground contact prior to the center conductor contacting the interface port may also introduce an undesirable "burst" of noise upon insertion of the center conductor into the interface port.

[0007] In some conventional connectors having "finger" connectors, the formed finger connectors traditionally will lose their shape or "spring back" with repeated use or when stressed beyond a point of deformation. When the finger connectors lose their shape, the connector may not provide a tight coupling with an interface port.

[0008] Accordingly, there is a need to overcome, or otherwise lessen the effects of, the disadvantages and shortcomings described above. Hence a need exists for a coaxial cable connector having improved ground continuity between the coaxial cable, the connector, and the coaxial cable connector interface port.

SUMMARY

[0009] According to various aspects of the disclosure, coaxial cable connector includes a body configured to engage a coaxial cable having a conductive electrical grounding property, a post configured to engage the body and the coaxial cable when the connector is installed on the coaxial cable, a nut configured to engage an interface port at a retention force, and a retention adding element configured to increase the retention force between the nut and the interface port so as to maintain ground continuity between the interface port and the nut when the nut is in a loosely tightened position on the interface port.

[0010] In some aspects of the disclosure, the nut may include internal threads configured to engage the interface port at the retention force.

[0011] According to various aspects, the retention adding element may comprise a plurality of resilient fingers formed in a forward portion of the nut, and the fingers may be configured to define an inner diameter smaller than an outer diameter of the interface port. In some aspects, at least one of the plurality of resilient fingers is configured to taper from a first diameter at a rearward end portion to a second smaller diameter at a middle portion. The at least one finger may be configured to flare out from the middle portion to a front end portion. In some aspects, the at least one finger may be configured define a bend point at the middle portion, and the bend point may be configured to further increase the retention force between the nut and the interface port.

[0012] According to some aspects, the coaxial cable connector may further comprise a cap extending about the plurality of resilient fingers. The cap may be configured to further increase the retention force between the nut and the interface port.

[0013] In some aspects, the retention adding element may include a pair of offset slots defining a finger configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

[0014] According to various aspects, the retention adding element may include a longitudinal slot extending through an entire length of the nut. The slot may be configured to permit the nut to be configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

[0015] In accordance with some aspects, the retention adding element may include a deformed portion along a portion of a circumference of the nut. The deformed portion may be configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

[0016] According to some aspects, the retention adding element may include a grounding member extending about the nut. The grounding member may be configured to extend beyond a forward end of the nut and engage the interface port. In some aspects, the grounding member may include at least one resilient finger configured to define an inner diameter of the grounding member that is smaller than an outer diameter of the interface port. According to some aspects, the grounding member may include an engagement feature configured to couple the grounding member to the nut. In some aspects, the engagement feature may include at least one resilient figure configured to couple the grounding member to the nut.

[0017] According to various aspects, the retention adding element may include a clip configured to engage the interface port through a cross-cut extending radially through the nut.

[0018] In some aspects, the retention adding element may include an offset creating feature configured to offset a center conductor of the coaxial cable relative to an axial center of the connector such that when the nut coupled with the interface port. The interface port may urge the center conductor in a direction opposite to the offset and a side of the nut of the connector is urged toward the interface port.

[0019] According to some aspects of the disclosure, the offset creating feature may include an insert configured to be received by the coupler.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Features and advantages of the present disclosure are described in, and will be apparent from, the following Brief Description of the Drawings and Detailed Description.

[0021] FIG. 1 is an exploded perspective cut-away view of a conventional coaxial cable connector.

[0022] FIGS. 2A-2D are side, top, front, and perspective views of an exemplary nut in accordance with various aspects of the disclosure.

[0023] FIGS. 3A-3D are side, top, front, and perspective views of an exemplary nut in accordance with various aspects of the disclosure.

[0024] FIGS. 4A-4D are side, top, front, and perspective views of an exemplary nut in accordance with various aspects of the disclosure.

[0025] FIGS. 5A-5D are side, top, front, and perspective views of an exemplary nut in accordance with various aspects of the disclosure.

[0026] FIG. 6A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0027] FIG. 6B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0028] FIG. 7A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0029] FIG. 7B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0030] FIG. 8A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0031] FIG. 8B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0032] FIG. 9A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0033] FIG. 9B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0034] FIG. 10A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0035] FIG. 10B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0036] FIG. 11A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0037] FIG. 11B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0038] FIG. 12A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0039] FIG. 12B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0040] FIG. 13A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0041] FIG. 13B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0042] FIG. 14A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0043] FIG. 14B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0044] FIG. 15A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0045] FIG. 15B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0046] FIG. 16A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0047] FIG. 16B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0048] FIG. 17A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0049] FIG. 17B is a perspective view of an exemplary grounding member in accordance with various aspects of the disclosure.

[0050] FIG. 18 is a perspective view of an exemplary connector in accordance with various aspects of the disclosure.

[0051] FIG. 19A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0052] FIG. 19B is a perspective view of an exemplary clip in accordance with various aspects of the disclosure.

[0053] FIG. 20A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0054] FIG. 20B is a perspective view of an exemplary clip in accordance with various aspects of the disclosure.

[0055] FIG. 21A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0056] FIG. 21B is a perspective view of an exemplary clip in accordance with various aspects of the disclosure.

[0057] FIG. 22A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0058] FIG. 22B is a perspective view of an exemplary clip in accordance with various aspects of the disclosure.

[0059] FIG. 23A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0060] FIG. 23B is a perspective view of an exemplary clip in accordance with various aspects of the disclosure.

[0061] FIG. 24 is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0062] FIG. 25A is a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0063] FIGS. 25B and 25C are a perspective view and a side cross-sectional view of an exemplary nut in accordance with various aspects of the disclosure.

[0064] FIGS. 26A and 26B are a perspective view and a side cross-sectional view of the exemplary connector of FIG. 25A coupled with an interface port.

[0065] FIGS. 27A and 27B are a perspective view and a side cross-sectional view of an exemplary connector in accordance with various aspects of the disclosure.

[0066] FIGS. 28A and 28B are a perspective view and a side cross-sectional view of an exemplary cap in accordance with various aspects of the disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0067] The accompanying figures illustrate various exemplary embodiments of coaxial cable connectors that provide improved ground continuity between the coaxial cable, the connector, and the coaxial cable connector interface port. Although certain embodiments of the present invention are shown and described in detail, it should be understood that various changes and modifications may be made without departing from the scope of the appended claims. The scope of the present invention will in no way be limited to the number of constituting

components, the materials thereof, the shapes thereof, the relative arrangement thereof, etc., and are disclosed simply as an example of embodiments of the present invention.

[0068] As a preface to the detailed description, it should be noted that, as used in this specification and the appended claims, the singular forms "a", "an" and "the" include plural referents, unless the context clearly dictates otherwise.

[0069] Referring to the drawings, FIG. 1 depicts a conventional coaxial cable connector 100. The coaxial cable connector 100 may be operably affixed, or otherwise functionally attached, to a coaxial cable 10 having a protective outer jacket 12, a conductive grounding shield 14, an interior dielectric 16 and a center conductor 18. The coaxial cable 10 may be prepared as embodied in FIG. 1 by removing the protective outer jacket 12 and drawing back the conductive grounding shield 14 to expose a portion of the interior dielectric 16. Further preparation of the embodied coaxial cable 10 may include stripping the dielectric 16 to expose a portion of the center conductor 18. The protective outer jacket 12 is intended to protect the various components of the coaxial cable 10 from damage which may result from exposure to dirt or moisture and from corrosion. Moreover, the protective outer jacket 12 may serve in some measure to secure the various components of the coaxial cable 10 in a contained cable design that protects the cable 10 from damage related to movement during cable installation. The conductive grounding shield 14 may be comprised of conductive materials suitable for providing an electrical ground connection, such as cuprous braided material, aluminum foils, thin metallic elements, or other like structures. Various embodiments of the shield 14 may be employed to screen unwanted noise. For instance, the shield 14 may comprise a metal foil wrapped around the dielectric 16, or several conductive strands formed in a continuous braid around the dielectric 16. Combinations of foil and/or braided strands may be utilized wherein the conductive shield

14 may comprise a foil layer, then a braided layer, and then a foil layer. Those in the art will appreciate that various layer combinations may be implemented in order for the conductive grounding shield 14 to effectuate an electromagnetic buffer helping to prevent ingress of environmental noise that may disrupt broadband communications. The dielectric 16 may be comprised of materials suitable for electrical insulation, such as plastic foam material, paper materials, rubber-like polymers, or other functional insulating materials. It should be noted that the various materials of which all the various components of the coaxial cable 10 are comprised should have some degree of elasticity allowing the cable 10 to flex or bend in accordance with traditional broadband communication standards, installation methods and/or equipment. It should further be recognized that the radial thickness of the coaxial cable 10, protective outer jacket 12, conductive grounding shield 14, interior dielectric 16 and/or center conductor 18 may vary based upon generally recognized parameters corresponding to broadband communication standards and/or equipment.

[0070] Referring further to FIG. 1, the connector 100 may be configured to be coupled with a coaxial cable interface port 20. The coaxial cable interface port 20 includes a conductive receptacle for receiving a portion of a coaxial cable center conductor 18 sufficient to make adequate electrical contact. The coaxial cable interface port 20 may further comprise a threaded exterior surface 23. It should be recognized that the radial thickness and/or the length of the coaxial cable interface port 20 and/or the conductive receptacle of the port 20 may vary based upon generally recognized parameters corresponding to broadband communication standards and/or equipment. Moreover, the pitch and height of threads which may be formed upon the threaded exterior surface 23 of the coaxial cable interface port 20 may also vary based upon generally recognized parameters corresponding to broadband communication standards

and/or equipment. Furthermore, it should be noted that the interface port 20 may be formed of a single conductive material, multiple conductive materials, or may be configured with both conductive and non-conductive materials corresponding to the port's operable electrical interface with the connector 100. However, the receptacle of the port 20 should be formed of a conductive material, such as a metal, like brass, copper, or aluminum. Further still, it will be understood by those of ordinary skill that the interface port 20 may be embodied by a connective interface component of a coaxial cable communications device, a television, a modem, a computer port, a network receiver, or other communications modifying devices such as a signal splitter, a cable line extender, a cable network module and/or the like.

[0071] Referring still further to FIG. 1, the conventional coaxial cable connector 100 may include a coupler, for example, threaded nut 30, a post 40, a connector body 50, a fastener member 60, a continuity member 70 formed of conductive material, and a connector body sealing member 80, such as, for example, a body O-ring configured to fit around a portion of the connector body 50. The nut 30 at the front end of the post 40 serves to attach the connector 100 to an interface port.

[0072] The threaded nut 30 of the coaxial cable connector 100 has a first forward end 31 and opposing second rearward end 32. The threaded nut 30 may comprise internal threading 33 extending axially from the edge of first forward end 31 a distance sufficient to provide operably effective threadable contact with the external threads 23 of the standard coaxial cable interface port 20. The threaded nut 30 includes an internal lip 34, such as an annular protrusion, located proximate the second rearward end 32 of the nut. The internal lip 34 includes a surface 35 facing the first forward end 31 of the nut 30. The forward facing surface 35 of the lip 34 may be a tapered surface or side facing the first forward end 31 of the nut 30. The

structural configuration of the nut 30 may vary according to differing connector design parameters to accommodate different functionality of a coaxial cable connector 100. For instance, the first forward end 31 of the nut 30 may include internal and/or external structures such as ridges, grooves, curves, detents, slots, openings, chamfers, or other structural features, etc., which may facilitate the operable joining of an environmental sealing member, such a water-tight seal or other attachable component element, that may help prevent ingress of environmental contaminants, such as moisture, oils, and dirt, at the first forward end 31 of a nut 30, when mated with the interface port 20. Moreover, the second rearward end 32 of the nut 30 may extend a significant axial distance to reside radially extent, or otherwise partially surround, a portion of the connector body 50, although the extended portion of the nut 30 need not contact the connector body 50. The threaded nut 30 may be formed of conductive materials, such as copper, brass, aluminum, or other metals or metal alloys, facilitating grounding through the nut 30. Accordingly, the nut 30 may be configured to extend an electromagnetic buffer by electrically contacting conductive surfaces of an interface port 20 when a connector 100 is advanced onto the port 20. In addition, the threaded nut 30 may be formed of both conductive and non-conductive materials. For example, the external surface of the nut 30 may be formed of a polymer, while the remainder of the nut 30 may be comprised of a metal or other conductive material. The threaded nut 30 may be formed of metals or polymers or other materials that would facilitate a rigidly formed nut body. Manufacture of the threaded nut 30 may include casting, extruding, cutting, knurling, turning, tapping, drilling, injection molding, blow molding, combinations thereof, or other fabrication methods that may provide efficient production of the component. The forward facing surface 35 of the nut 30 faces a flange 44 of the post 40 when

operably assembled in a connector 100, so as to allow the nut to rotate with respect to the other component elements, such as the post 40 and the connector body 50, of the connector 100.

[0073] Referring still to FIG. 1, the connector 100 may include a post 40. The post 40 may include a first forward end 41 and an opposing second rearward end 42. Furthermore, the post 40 may include a flange 44, such as an externally extending annular protrusion, located at the first end 41 of the post 40. The flange 44 includes a rearward facing surface 45 that faces the forward facing surface 35 of the nut 30, when operably assembled in a coaxial cable connector 100, so as to allow the nut to rotate with respect to the other component elements, such as the post 40 and the connector body 50, of the connector 100. The rearward facing surface 45 of flange 44 may be a tapered surface facing the second rearward end 42 of the post 40. Further still, an embodiment of the post 40 may include a surface feature 47 such as a lip or protrusion that may engage a portion of a connector body 50 to secure axial movement of the post 40 relative to the connector body 50. However, the post need not include such a surface feature 47, and the coaxial cable connector 100 may rely on press-fitting and friction-fitting forces and/or other component structures having features and geometries to help retain the post 40 in secure location both axially and rotationally relative to the connector body 50. The location proximate or near where the connector body is secured relative to the post 40 may include surface features 43, such as ridges, grooves, protrusions, or knurling, which may enhance the secure attachment and locating of the post 40 with respect to the connector body 50. Moreover, the portion of the post 40 that contacts embodiments of a continuity member 70 may be of a different diameter than a portion of the nut 30 that contacts the connector body 50. Such diameter variance may facilitate assembly processes. For instance, various components having larger or smaller diameters can be readily press-fit or otherwise secured into connection with

each other. Additionally, the post 40 may include a mating edge 46, which may be configured to make physical and electrical contact with a corresponding mating edge 26 of the interface port 20. The post 40 should be formed such that portions of a prepared coaxial cable 10 including the dielectric 16 and center conductor 18 may pass axially into the second end 42 and/or through a portion of the tube-like body of the post 40. Moreover, the post 40 should be dimensioned, or otherwise sized, such that the post 40 may be inserted into an end of the prepared coaxial cable 10, around the dielectric 16 and under the protective outer jacket 12 and conductive grounding shield 14. Accordingly, where an embodiment of the post 40 may be inserted into an end of the prepared coaxial cable 10 under the drawn back conductive grounding shield 14, substantial physical and/or electrical contact with the shield 14 may be accomplished thereby facilitating grounding through the post 40. The post 40 should be conductive and may be formed of metals or may be formed of other conductive materials that would facilitate a rigidly formed post body. In addition, the post may be formed of a combination of both conductive and non-conductive materials. For example, a metal coating or layer may be applied to a polymer of other non-conductive material. Manufacture of the post 40 may include casting, extruding, cutting, turning, drilling, knurling, injection molding, spraying, blow molding, component overmolding, combinations thereof, or other fabrication methods that may provide efficient production of the component.

[0074] The coaxial cable connector 100 may include a connector body 50. The connector body 50 may comprise a first end 51 and opposing second end 52. Moreover, the connector body may include a post mounting portion 57 proximate or otherwise near the first end 51 of the body 50, the post mounting portion 57 configured to securely locate the body 50 relative to a portion of the outer surface of post 40, so that the connector body 50 is axially

secured with respect to the post 40, in a manner that prevents the two components from moving with respect to each other in a direction parallel to the axis of the connector 100. The internal surface of the post mounting portion 57 may include an engagement feature 54 that facilitates the secure location of the continuity member 70 with respect to the connector body 50 and/or the post 40, by physically engaging the continuity member 70 when assembled within the connector 100. The engagement feature 54 may simply be an annular detent or ridge having a different diameter than the rest of the post mounting portion 57. However other features such as grooves, ridges, protrusions, slots, holes, keyways, bumps, nubs, dimples, crests, rims, or other like structural features may be included to facilitate or possibly assist the positional retention of embodiments of the electrical continuity member 70 with respect to the connector body 50. Nevertheless, embodiments of the continuity member 70 may also reside in a secure position with respect to the connector body 50 simply through press-fitting and friction-fitting forces engendered by corresponding tolerances, when the various coaxial cable connector 100 components are operably assembled, or otherwise physically aligned and attached together. Various exemplary continuity members 70 are illustrated and described in U.S. Patent No. ___, the disclosure of which is incorporated herein by reference. In addition, the connector body 50 may include an outer annular recess 58 located proximate or near the first end 51 of the connector body 50. Furthermore, the connector body 50 may include a semi-rigid, yet compliant outer surface 55, wherein an inner surface opposing the outer surface 55 may be configured to form an annular seal when the second end 52 is deformably compressed against a received coaxial cable 10 by operation of a fastener member 60. The connector body 50 may include an external annular detent 53 located proximate or close to the second end 52 of the connector body 50. Further still, the connector body 50 may include internal surface features 59, such as annular

serrations formed near or proximate the internal surface of the second end 52 of the connector body 50 and configured to enhance frictional restraint and gripping of an inserted and received coaxial cable 10, through tooth-like interaction with the cable. The connector body 50 may be formed of materials such as plastics, polymers, bendable metals or composite materials that facilitate a semi-rigid, yet compliant outer surface 55. Further, the connector body 50 may be formed of conductive or non-conductive materials or a combination thereof. Manufacture of the connector body 50 may include casting, extruding, cutting, turning, drilling, knurling, injection molding, spraying, blow molding, component overmolding, combinations thereof, or other fabrication methods that may provide efficient production of the component.

[0075] With further reference to FIG. 1, the coaxial cable connector 100 may include a fastener member 60. The fastener member 60 may have a first end 61 and opposing second end 62. In addition, the fastener member 60 may include an internal annular protrusion 63 located proximate the first end 61 of the fastener member 60 and configured to mate and achieve purchase with the annular detent 53 on the outer surface 55 of connector body 50. Moreover, the fastener member 60 may comprise a central passageway 65 defined between the first end 61 and second end 62 and extending axially through the fastener member 60. The central passageway 65 may comprise a ramped surface 66 which may be positioned between a first opening or inner bore 67 having a first diameter positioned proximate with the first end 61 of the fastener member 60 and a second opening or inner bore 68 having a second diameter positioned proximate with the second end 62 of the fastener member 60. The ramped surface 66 may act to deformably compress the outer surface 55 of a connector body 50 when the fastener member 60 is operated to secure a coaxial cable 10. For example, the narrowing geometry will compress squeeze against the cable, when the fastener member is compressed into a tight and

secured position on the connector body. Additionally, the fastener member 60 may comprise an exterior surface feature 69 positioned proximate with or close to the second end 62 of the fastener member 60. The surface feature 69 may facilitate gripping of the fastener member 60 during operation of the connector 100. Although the surface feature 69 is shown as an annular detent, it may have various shapes and sizes such as a ridge, notch, protrusion, knurling, or other friction or gripping type arrangements. The first end 61 of the fastener member 60 may extend an axial distance so that, when the fastener member 60 is compressed into sealing position on the coaxial cable 100, the fastener member 60 touches or resides substantially proximate significantly close to the nut 30. It should be recognized, by those skilled in the requisite art, that the fastener member 60 may be formed of rigid materials such as metals, hard plastics, polymers, composites and the like, and/or combinations thereof. Furthermore, the fastener member 60 may be manufactured via casting, extruding, cutting, turning, drilling, knurling, injection molding, spraying, blow molding, component overmolding, combinations thereof, or other fabrication methods that may provide efficient production of the component.

[0076] The manner in which the coaxial cable connector 100 may be fastened to a received coaxial cable 10 may also be similar to the way a cable is fastened to a common CMP-type connector having an insertable compression sleeve that is pushed into the connector body 50 to squeeze against and secure the cable 10. The coaxial cable connector 100 includes an outer connector body 50 having a first end 51 and a second end 52. The body 50 at least partially surrounds a tubular inner post 40. The tubular inner post 40 has a first end 41 including a flange 44 and a second end 42 configured to mate with a coaxial cable 10 and contact a portion of the outer conductive grounding shield or sheath 14 of the cable 10. The connector body 50 is secured relative to a portion of the tubular post 40 proximate or close to the first end 41 of the

tubular post 40 and cooperates, or otherwise is functionally located in a radially spaced relationship with the inner post 40 to define an annular chamber with a rear opening. A tubular locking compression member may protrude axially into the annular chamber through its rear opening. The tubular locking compression member may be slidably coupled or otherwise movably affixed to the connector body 50 to compress into the connector body and retain the cable 10 and may be displaceable or movable axially or in the general direction of the axis of the connector 100 between a first open position (accommodating insertion of the tubular inner post 40 into a prepared cable 10 end to contact the grounding shield 14), and a second clamped position compressibly fixing the cable 10 within the chamber of the connector 100, because the compression sleeve is squeezed into retraining contact with the cable 10 within the connector body 50.

[0077] Referring now to FIGS. 2A-2D, an exemplary nut 230 in accordance with various aspects of the disclosure is illustrated. The nut 230 can be used with the coaxial cable connector 100 in place of the conventional nut 30. The nut 230 includes a plurality of slots 236 extending rearward in the axial direction of the nut 230 from the first forward end 31. As illustrated, the plurality of slots 236 define a corresponding plurality of fingers 237. Before being coupled with the interface port 20, the plurality of fingers 237 are crimped radially inward such that the resulting inside diameter of the first forward end 31 of the nut 230 is smaller than the outside diameter of the interface port 20. The fingers 237 are constructed of a material having sufficient resiliency such that the fingers 237 are configured to deflect radially outward to receive the interface port 20 therein when the nut 230 is coupled with the interface port 20, while remaining biased radially inward. The fingers 237 remain biased radially inward to maintain constant contact with the threaded exterior surface 23 of the interface port 20 at all times, for

example, even when the nut 230 is not fully tightened to the interface port 20. Thus, even when the nut 230 is loosely coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 230 and the interface port 20 is maintained.

[0078] As shown in FIGS. 2A-2D, an exemplary nut 230 may six slots 236 and six fingers 237. However, nuts according to this disclosure could have more than six slots and fingers or less than six slots and fingers. Of course, at a minimum, two slots are needed to define a pair of fingers. Also, although FIG. 1 shows six slots and fingers that are symmetrically arranged, the slots and fingers can also be asymmetrically arranged. Exemplary nuts can include an even number of fingers or an odd number of fingers.

[0079] As shown in FIGS. 2A-2D, the slots 236 that are cut into the nut 230 in the axial direction of the nut 230 can be tapered such that the forward end of the slot 236 is wider than the rearward end of the slot 236. With such a configuration, when the fingers 237 are crimped before attaching to the interface post, the forward ends assume a position relative to one another that is at least closer to parallel.

[0080] Referring to FIGS. 3A-3D, another exemplary nut 330 in accordance with various aspects of the disclosure is illustrated. The nut 330 can be used with the coaxial cable connector 100 in place of the conventional nut 30. The nut 330 includes two off-center slots 336 cut into first forward end 31 of the nut 330 to create a smaller finger 337 and a larger region 338. Before being coupled with the interface port 20, the finger 337 is crimped radially inward such that the resulting inside diameter of the first forward end 31 of the nut 330 is smaller than the outside diameter of the interface port 20. The larger region 338 can remain uncrimped. The finger 337 is constructed of a material having sufficient resiliency such that the finger 337 is configured to deflect radially outward to receive the interface port 20 therein when the nut 330 is

coupled with the interface port 20, while remaining biased radially inward. The finger 337 remains biased radially inward to maintain constant contact with the threaded exterior surface 23 of the interface port 20 at all times, for example, even when the nut 330 is not fully tightened to the interface port 20. Thus, even when the nut 330 is loosely coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 330 and the interface port 20 is maintained. As shown in FIGS. 3A-3D, the slots can be cut in a direction that is not radially aligned with the center of the nut. Also, as shown in FIGS. 3A-3D, the slots can be cut in a non-tapered manner. Of course, the slots can be cut in a radial direction and can be tapered.

[0081] Referring to FIGS. 4A-4D, another exemplary nut 430 in accordance with various aspects of the disclosure is illustrated. The nut 430 can be used with the coaxial cable connector 100 in place of the conventional nut 30. The nut 430 includes a single slot 436 that is cut through the entire length of the nut 430 in the axial direction, as illustrated in FIGS. 4A, 4C, and 4D. The first forward end 31 of the nut 430 can be crimped about its entire periphery or about a portion of the periphery prior to mounting on the interface port 20. For example, the first forward end 31 may be crimped at either or both sides of slot 436. The resulting inside diameter of the first forward end 31 of the nut 430 is smaller than the outside diameter of the interface port 20. The nut 430 is constructed of a material having sufficient resiliency such that the first forward end 31 is configured to deflect radially outward to receive the interface port 20 therein when the nut 430 is coupled with the interface port 20, while remaining biased radially inward. The first forward end 31 remains biased radially inward to maintain constant contact with the threaded exterior surface 23 of the interface port 20 at all times, for example, even when the nut 430 is not fully tightened to the interface port 20. Thus, even when the nut 430 is loosely

coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 430 and the interface port 20 is maintained.

[0082] Referring to FIGS. 5A-5D, another exemplary nut 530 in accordance with various aspects of the disclosure is illustrated. The nut 530 can be used with the coaxial cable connector 100 in place of the conventional nut 30. As best shown in FIGS. 5A and 5C, the nut 530 may include a deformed portion 539 of the periphery of the first forward end 31 of the nut 530. As illustrated in FIG. 5C, the deformed portion 539 of the circumference of the forward end of the nut is deformed to form an inwardly-directed portion. The deformed portion 539 of the first forward end 31 of the nut 530 is thus configured to maintain a desired amount of interference with the interface port 20 when mounted thereon. The size of the deformed portion 539 of the circumference and the degree of inward deformation may be varied to achieve a desired amount of interference with the interface port 20 when the nut 530 is mounted thereon. The deformed portion 539is constructed of a material having sufficient resiliency such that the deformed portion 539 is configured to deflect radially outward to receive the interface port 20 therein when the nut 530 is coupled with the interface port 20, while remaining biased radially inward. The deformed portion 539 remains biased radially inward to maintain constant contact with the threaded exterior surface 23 of the interface port 20 at all times, for example, even when the nut 530 is not fully tightened to the interface port 20. Thus, even when the nut 530 is loosely coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 530 and the interface port 20 is maintained.

[0083] In accordance with various aspects of the disclosure, as shown in FIGS. 6A and 6B, an exemplary embodiment of a coaxial cable connector 600 may include a nut 630 and a grounding member 690 connected with the nut 630. As shown in FIG. 6, the

grounding member 690 may extend about a periphery of the nut 630. The grounding member 690 may be connected with the nut 630 in any manner that ensures a ground path between the nut 630 and the grounding member 690, such as, for example, a snap fit, interference fit, press fit, or the like. For example, as shown in FIGS. 6A and 6B, the grounding member 690 may include one or more fingers 691 formed by cuts in the grounding member 690. The fingers 691 are configured to project radially inward such that the resulting inside diameter of the fingers 691 is smaller than the outside diameter of the nut 630. The fingers 691 are constructed of a material having sufficient resiliency such that the fingers 691 are configured to deflect radially outward to receive the nut 630 therein when the nut 630 is coupled with the grounding member 690, while remaining biased radially inward. As shown in FIGS. 6A and 6B, the fingers 691 may be configured such that a free end of the each finger extends in a rearward direction. Additionally or alternatively, the grounding member 690 may include one or more fixed protrusions 691' extending inwardly from an inner surface of the grounding member 690.

[0084] The nut 630 may include a circumferential groove 692 extending about the outer surface 693 of the nut 630. Alternatively, the nut 630 may include one or more arcuate grooves (not shown) spaced apart circumferentially about the outer surface 693 of the nut 630, wherein the one or more arcuate grooves correspond with the one or more fingers 692. When the nut 630 is received by the grounding member 690, for example, by sliding the nut 630 and the grounding member 690 relative to one another in the axial direction, the bias of the fingers 691 urges the fingers 691 into the groove 692 to couple the grounding member 690 with the nut 630. It should be appreciated that, in some embodiments, the nut 630 and the grounding member 690 may be configured as a single piece.

[0085] The grounding member 690 may include one or more continuity fingers 694 formed by cuts in the grounding member 690. The continuity fingers 694 are configured to project radially inward such that the resulting inside diameter of the continuity fingers 694 is smaller than the outside diameter of the interface port 20. The continuity fingers 694 are constructed of a material having sufficient resiliency such that the fingers 694 are configured to deflect radially outward to receive the interface port 20 therein when the nut 630 is coupled with the interface port 20, while remaining biased radially inward. As shown in FIGS. 6A and 6B, the fingers 694 may be configured such that a free end 695 of the each finger 694 extends in a forward direction. In some embodiments, the free end 695 may have a squared-off shape. The fingers 694 remain biased radially inward to maintain constant contact with the threaded exterior surface 23 of the interface port 20 at all times, for example, even when the nut 630 is not fully tightened to the interface port 20. Thus, even when the nut 630 is loosely coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 630 and the interface port 20 is maintained.

[0086] Although FIGS. 6A and 6B illustrate a grounding member 690 having a plurality of fingers 691, the grounding member 690 may have a single finger 694 that maintains contact between the grounding member 690 and the interface port 20. For example, if the grounding member 690 includes a single finger 694 on one side of the grounding member 690, the single finger 694 will push the internal thread 73 of the nut 630 against the threaded exterior surface 23 on that same side of the interface port 20 by creating a torque force about a point that is between the single finger 694 and the internal thread 73, thus maintaining electrical continuity between the nut 630 and the port 20 through the grounding member 690.

[0087] As shown in FIGS. 6A and 6B, the connector 600 may include a sleeve 99, such as, for example, a torque sleeve or a gripping sleeve. In some embodiments, the sleeve 99 may be constructed of rubber, plastic, an elastomer, or the like. In some embodiments, the sleeve 99 may be overmolded onto the grounding member 690. Alternatively, the sleeve 99 may be coupled with the grounding member 690 through a press-fit, snap-fit, interference-fit, or any other coupling relationship.

[0088] In addition to the embodiment shown in FIGS. 6A and 6B, one or more continuity fingers may be configured to contact the port threads at different circumferential, longitudinal, and/or radial (i.e., helical or spiral) locations when the nut/sleeve is pushed (or rotated) toward the post, such as by configuring them to follow a helical path to helically contact the port threads. One way to do this would be to configure the fingers to have different lengths or to keep the same length but locate them so as to be at different longitudinal and/or radial locations so as to match the helix angle of standard port threads. Such a configuration may allow the nut or torque sleeve 99 to be more easily installed on the interface port by causing the fingers to engage different thread portions in a staggered fashion. Helically spaced port thread contact points may also result in a more reliable ground contact path (e.g., since such helix contact point may create a biasing force between different port thread portions or surfaces in the longitudinal direction when the nut/sleeve is in the installed position on the port. Alternatively, the inner surface of the one or more continuity fingers that contacts the port threads could be shaped to fit the port threads (e.g., include a set of helical threads or discontiguous segments that match the helix structure of the port threads). FIGS. 7A-17B illustrate a number of alternative embodiments similar to the connector 600 and grounding member 690 of FIGS. 6A and B.

[0089] For example, FIGS. 7A and 7B illustrate an exemplary coaxial cable connector 700 and grounding member 790 similar to connector 600 and grounding member 690, but having continuity fingers 794 with free ends 795 that are rounded. FIGS. 8A and 8B illustrate an exemplary connector 800 and grounding member 890 similar to connector 600 and grounding member 690, but having continuity fingers 894 with free ends 895 that are alternatingly extending in the forward and rearward directions. FIGS. 9A and 9B illustrate an exemplary connector 900 and grounding member 990 similar to connector 600 and grounding member 690, but having trapezoidal continuity fingers 994 with triangular free ends 995 that include an inwardly directed barb 996. FIGS. 10A and 10B illustrate an exemplary connector 1000 and grounding member 1090 similar to connector 600 and grounding member 690, but having trapezoidal continuity fingers 1094 with triangular free ends 1095. FIGS. 11A and 11B illustrate an exemplary connector 1100 and grounding member 1190 similar to connector 600 and grounding member 690, but having triangular continuity fingers 1194 with free ends 1195. FIGS. 12A and 12B illustrate an exemplary connector 1200 and grounding member 1290 similar to connector 600 and grounding member 690, but include a plastic finger insert 1297. FIGS. 13A and 13B illustrate an exemplary connector 1300 and grounding member 1390 similar to connector 600 and grounding member 690, but include a reverse finger 1398 extending radially inward from an internal surface of the continuity fingers 1394. FIGS. 14A and 14B illustrate an exemplary connector 1400 and grounding member 1490 similar to connector 600 and grounding member 690, but having continuity fingers 1494 with free ends 1495 that extend in the rearward direction. FIGS. 15A and 15B illustrate an exemplary connector 1500 and grounding member 1590 similar to connector 600 and grounding member 690, but having continuity fingers 1594 that are helically arranged relative to the axial direction of the connector 1500 and have free ends

1595 that are angled to correspond with the helical arrangement. FIGS. 16A and 16B illustrate an exemplary connector 1600 and grounding member 1690 similar to connector 600 and grounding member 690, but having continuity fingers 1694, 1694' having different lengths. FIGS. 17A and 17B illustrate an exemplary connector 1700 and grounding member 1790 similar to connector 600 and grounding member 690, but having continuity fingers 1794 that are spaced unevenly about the circumference of the grounding member 1790.

[0090] Referring now to FIGS. 18, 19A, and 19B, an exemplary coaxial cable connector 1800 and nut 1830 are illustrated. The nut 1830 may include a cross-cut 1881 through the wall 1182 of the nut 1830. The cross-cut 1881 may be disposed near to, but spaced from, the first forward end 31 of the nut 1830. For example, as shown in FIG. 19A, the cross-cut 1881 is at a middle region 1883 of the internal thread 73 along the axial direction. The cross-cut 1881 is configured to expose a portion of the threaded exterior surface 23of the interface port 20 when the nut 1830 is coupled with the interface port 20. A clip 1884, such as, for example, a wire form, C-ring, or the like, can be coupled with the nut 1830 so as to extend through the cross-cut 1881 and into the interior of the nut 1830. For example, the clip 1884 may include a C-shaped region 1885 with straighten portions 1886 extending from both ends of the C-shaped region 1885. When the clip 1884 is coupled with the nut 1830, the straighten portions 1886 are aligned with the cross-cut 1881 such that the straighten portions 1886 maintain contact with the threaded exterior surface 23 of the port 20. In various aspects, the clip 1884 may be a metal stamping or a plastic finger that acts tangential to the mating interface port 20 and provides a force in the radial direction to maintain electrical ground between the nut 1830 and the threaded exterior surface 23 of the interface port 20. In the case of wire form or metal stamping, such a member can provide electrical continuity.

[0091] FIGS. 20A-23B illustrate a number of alternative embodiments similar to the connector 1800 and the clip 1884 of FIGS. 18-19B. For example, FIGS. 20A and 20B illustrate an exemplary connector 2000 having a clip 2084 configured as a locking clip, wherein the ends 2087 of the straightened portions 2086 are angled complementary to one another. FIGS. 21A and 21B illustrate an exemplary connector 2100 having a clip 2184 configured to have multiple points of contact with the interface port 20. For example, the clip 2184 includes two arcuate regions 2185A extending from opposite ends of a straight region 2185B. The two straighten portions 1886 extend from ends of the arcuate regions 2185A. In addition, the nut 2130 includes two cross-cuts 1881, 1881' configured to receive the straight portions 1886 and the straight region 2185B, respectively. FIGS. 22A and 22B illustrate an exemplary connector 2200 having a spiral or helical clip 2284 configured to have multiple points of contact with the interface port 20 staggered in the axial direction. For example, the clip 2284 includes two staggered ends 2286, and the nut 2130 includes two cross-cuts 1881, 1881' staggered in the axial direction of the connector 2200. The two cross-cuts 1881, 1881' are configured to receive the two respective staggered ends 2286. FIGS. 23A and 23B illustrate an exemplary connector 2300 having a clip 2384 similar to the connector 1800 and clip 1884. However, as shown in FIG. 23A, the cross-cut 1881 is disposed closer to the first forward end 31 of the connector 2300 compared to the cross-cut shown in FIG. 19A.

[0092] Referring to FIG. 24, an exemplary coaxial cable connector 2400 may be configured to align the coaxial cable off-center relative to the center of the mating interface port 20 to ensure that the nut 2430 of the connector 2400 will be biased toward one side and thus maintain ground between the nut 2430 and the interface port 20. For example, as shown in FIG. 24, an insert 2448, such as a plastic insert, may be placed inside the post 2440. The insert 2448

includes a though hole 2449 extending the longitudinal direction and configured to received the center conductor 18 of the coaxial cable 10. As illustrated in FIG.24, axis X1 is the center axis of the connector 2400 (i.e., nut 2430, post 2440, and body 2450) extending in the longitudinal direction, while axis X2 is the center axis of the through hole 2449 of the insert 2448. Axis X1 and axis X2 are not concentric, but are offset by a distance X. Axis X1 and axis X2 may be parallel to one another or non-parallel, as long as they are not concentric. Of course, if axis X1 and axis X2 are non-parallel, the axes may intersect at a point.

[0093] As a result of the above configuration, the insert 2448, in particular, the off-center through hole 2449 urges at least the center conductor 18 of the coaxial cable 10 to the off-center position of axis X2. Thus, when the connector 2400 is coupled with the interface port 20, the center conductor 18 of the coaxial cable 10 is received by a female end of the interface port 20, while nut 2430 receives the interface port 20. Because the center conductor 18 is offset by distance X, the interface port 20 urges the cable 10, via the center conductor 18, in a direction from axis X2 toward axis X1. Thus, the side 2447 of the nut 2430 of the connector 2400 is urged toward the exterior threaded surface 23 at an adjacent side of the interface port 20 by the cable 10 being urged from axis X2 toward axis X1 via the center conductor 18. As a result of the off-center coaxial cable, or at least the center conductor 18 of the coaxial cable 10, the nut 2430 of the connector 2400 is biased to one side relative to the interface port 20 and creates radial interference between the nut 2430 and the interface port 20. Thus, the nut 2430 makes constant contact with the interface port 20 when mounted thereon, thus maintaining electrical continuity between the nut 2430 and the port 20 at all times, for example, even when the nut 2430 is not fully tightened to the interface port 20. Thus, even when the nut 2430 is loosely coupled (i.e., partially or loosely tightened) with the interface port 20, electrical ground between the nut 2430

and the interface port 20 can be maintained. In other embodiments according to the disclosure, the center conductor 18 may be offset by the nut 2430 or the post 2440, rather than by the plastic insert 2448.

[0094] Referring now to FIGS. 25A through 26B, an exemplary coaxial cable connector 2500 is illustrated. The connector 2500 may include redundant port grounding contacts in addition to threads. For example, a nut 2530 may be provided with extended contact fingers formed in a way that promotes redundant contact, higher retention forces, and continuous port grounding even when loosely connected to an interface port. As shown in FIGS. 25A-25C, the connector 2500 includes the nut 2530 having internal threading 2533 spaced axially from the edge of first forward end 31 and configured to provide operably effective threadable contact with the external threads 23 of the standard coaxial cable interface port 20.

[0095] As illustrated is FIGS. 25A through 26B, the nut 2530 may include a front portion 2536, for example, forward of the internal threading 2533 in the axial direction, that tapers from a first diameter at a rearward end portion 2537 to a second smaller diameter at a middle portion 2538. The front portion 2536 may then flare out from the middle portion 2538, thereby defining a bend point 2538', to a front end portion 2539 at the first forward end 31. The front portion 2536 may include a tooth 2539a having a curved front end 2539b with a predetermined radius and flat angle at the rear end 2539c. The front portion 2536 is crimped down to a final desired diameter. In some embodiments, the front portion 2536 may be slotted to form a plurality of fingers 2539'. The one or more fingers 2539' have sufficient resiliency to radially deflect outward to receive the interface port therein. However, the bent fingers 2539' remain biased radially inward to maintain constant contact with the interface port 20 at all times, for example, even when the nut 2530 is not fully tightened to the interface port 20. Thus, even

when the nut 2530 is loosely coupled (i.e., partially tightened) with the interface port 20, electrical ground between the nut 2530 and the interface port 20 is maintained.

[0096] As shown in FIG. 26B, when the nut 2530 is coupled with the interface port 20, the front portion 2536 provides a first contact point with the external threads 23 of the port 20, the bend point 2538' at the middle portion 2538 of the fingers 2539' provides a second contact point (midway along the contact fingers 2539') with the external threads 23 of the port 20, and the internal threading 2533 provides a third contact point with the external threads 23 of the port 20. The first and second contact point may further reduce the chance of losing ground contact, even when the connector 2500 is only loosely or partially coupled with the interface port 20 (i.e., when the internal threading 2533 is not coupled with the external threads 23 or is only loosely or partially coupled with the external threads 23).

[0097] The curved front end 2539b of the front contact tooth 2539a is configured to allow the tooth 2539a to ride over the threads 23 of the interface port 20 when installed on the port 20. Thus, the connector 2500 facilitates easy insertion of the port 20 into the front portion 2536 of the connector 2500. On the other hand, the flat angle at the rear end 2539c of the tooth 2539a is configured to engage a surface of the thread 23 of the port 20, thereby making removal of the connector 2500 from the interface port 20 (e.g., by pulling off) more difficult. It should be appreciated that the nut 2530 may be a brass plus nut machined at a longer length with the front portion 2536.

[0098] Referring now to FIGS. 27A through 28B, an exemplary coaxial cable connector 2700 is illustrated. The connector 2700 may be similar to the connector 2500 described with reference to FIGS. 25A through 26B, but may include a cap 2730', for example, a tapered cap, that assembles over the nut 2530 having extended contact fingers 2539'. The cap

2730' may be configured to provide added spring force and protection for coupling with the interface port 20.

[0099] As illustrated in FIGS. 27A through 28B, the cap 2730' may be configured as a nose-cone/tapered cap and assembled over the nut 2530 that has the extended contact fingers 2539'. The one or more fingers 2539' have sufficient resiliency to radially deflect outward to receive the interface port 20 therein. However, the bent fingers 2539' remain biased radially inward to maintain constant contact with the interface port 20 at all times, for example, even when the nut 2530 is not fully tightened to the interface port 20. Thus, even when the nut 2530 is loosely coupled (i.e., partially tightened) with the interface port 20, electrical ground between the nut 2530 and the interface port 20 is maintained. The cap 2730' may be, for example, an injection molded sleeve with tapered front members 2730". The tapered front members 2730" overlie the fingers 2539' of the nut 2530 and thereby compound the radial inward force of the fingers 2539'. The cap 2730' may also serve to protect the fingers 2539' of the nut 2530.

[00100] In some aspects, mechanical engagement of the cap 2730' to the connector 2700 may use, but is not limited to, inner diameter snap tabs 2730"' that are molded into the cap 2730' and fall into one or more grooves 2530a on the outer diameter of the nut 2530. The cap 2730' may also be attached by a press fit, with or without knurls, to the nut 2530 and/or to an existing torque member 99 so that the cap 2730' and the nut 2530 rotate uniformly. Other methods of attachment may include threads or the displacement of material to pinch the cap 2730' in place, such as a rolled edge.

[00101] While a metal snap spring may be provided to add spring pressure to the nut 2530, a nose cone style cap 2530' may provide additional benefits in a more aesthetical manner and may be incorporated with an existing torque sleeve 99. For example, a plastic

support finger may be molded as part of the torque sleeve 99. Consequently, a more ergonomic look and feel may be achieved, while simplifying assembly.

[00102] It should be appreciated that, despite the number of slots and fingers that are illustrated in FIGS. 25A though 28B, connectors according to this disclosure could have any number of slots and fingers as desired. Of course, at a minimum, two slots are needed to create at least one finger. Also, the slots and fingers may be symmetrically arranged or asymmetrically arranged. Exemplary connectors can include an even number of fingers or an odd number of fingers. Also the depth and width of the slots and fingers, as well as the cross-sectional thickness and taper of the fingers may be varied as desired.

[00103] While conventional "RCA style" contact fingers do not have any retention adders, and rely solely on friction between the port and a smooth surface, the connectors 2500, 2700 described above with reference to FIGS. 25A through 28B provide a higher retention force while keeping insertion force low. As a result, these connectors 2500, 2700 help to keep the connector on the interface port 20 in the case that no threads are engaged or in the case that the threads are only loosely or partially engaged.

[00104] It should be understood that when a connector is being installed to a mating port and the center conductor makes contact with the ground path of the port, there may be a signal burst that can make its way into the network and cause speed issues and other network issues. However, in any of the aforementioned connectors, if the nut and/or the grounding member is configured with an axial length such that the grounding member and/or nut can make contact with the external threads of the port before the center conductor makes contact with the port, the signal burst can be prevented, and the signal from the center conductor will be transferred to the interface port.

[00105] It should be understood that various changes and modifications to the embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present disclosure and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

[00106] Although several embodiments of the disclosure have been disclosed in the foregoing specification, it is understood by those skilled in the art that many modifications and other embodiments of the disclosure will come to mind to which the disclosure pertains, having the benefit of the teaching presented in the foregoing description and associated drawings. It is thus understood that the disclosure is not limited to the specific embodiments disclosed herein above, and that many modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although specific terms are employed herein, as well as in the claims which follow, they are used only in a generic and descriptive sense, and not for the purposes of limiting the present disclosure, nor the claims which follow.

CLAIMS

What is claimed is:

1. A coaxial cable connector comprising:

a body configured to engage a coaxial cable having a conductive electrical grounding property;

a post configured to engage the body and the coaxial cable when the connector is installed on the coaxial cable;

a nut configured to engage an interface port at a retention force; and

a retention adding element configured to increase the retention force between the nut and the interface port so as to maintain ground continuity between the interface port and the nut when the nut is in a loosely tightened position on the interface port.

2. The coaxial cable connector of claim 1, wherein the nut includes internal threads configured to engage the interface port at the retention force.

3. The coaxial cable connector of claim 2, wherein the retention adding element comprises a plurality of resilient fingers formed in a forward portion of the nut, the fingers being configured to define an inner diameter smaller than an outer diameter of the interface port.

4. The coaxial cable connector of claim 3, wherein at least one of the plurality of resilient fingers is configured to taper from a first diameter at a rearward end portion to a second smaller diameter at a middle portion.

5. The coaxial cable connector of claim 4, wherein the at least one finger is configured to flare out from the middle portion to a front end portion.

6. The coaxial cable connector of claim 5, wherein the at least one finger is configured define a bend point at the middle portion, the bend point being configured to further increase the retention force between the nut and the interface port.

7. The coaxial cable connector of claim 3, further comprising cap extending about the plurality of resilient fingers, the cap being configured to further increase the retention force between the nut and the interface port.

8. The coaxial cable connector of claim 2, wherein the retention adding element comprises a pair of offset slots defining a finger configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

9. The coaxial cable connector of claim 2, wherein the retention adding element comprises a longitudinal slot extending through an entire length of the nut, the slot being configured to permit the nut to be configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

10. The coaxial cable connector of claim 2, wherein the retention adding element comprises a deformed portion along a portion of a circumference of the nut, the deformed

portion configured to define an inner diameter of the nut that is smaller than an outer diameter of the interface port.

11. The coaxial cable connector of claim 2, wherein the retention adding element comprises a grounding member extending about the nut, the grounding member being configured to extend beyond a forward end of the nut and engage the interface port.

12. The coaxial cable connector of claim 11, wherein the grounding member includes at least one resilient finger configured to define an inner diameter of the grounding member that is smaller than an outer diameter of the interface port.

13. The coaxial cable connector of claim 12, wherein the grounding member includes an engagement feature configured to couple the grounding member to the nut.

14. The coaxial cable connector of claim 13, wherein the engagement feature includes at least one resilient figure configured to couple the grounding member to the nut.

15. The coaxial cable connector of claim 2, wherein the retention adding element comprises a clip configured to engage the interface port through a cross-cut extending radially through the nut.

16. The coaxial cable connector of claim 2, wherein the retention adding element comprises an offset creating feature configured to offset a center conductor of the coaxial

cable relative to an axial center of the connector such that when the nut coupled with the interface port, the interface port urges the center conductor in a direction opposite to the offset and a side of the nut of the connector is urged toward the interface port.

17. The coaxial cable connector of claim 16, wherein the offset creating feature comprises an insert configured to be received by the coupler.

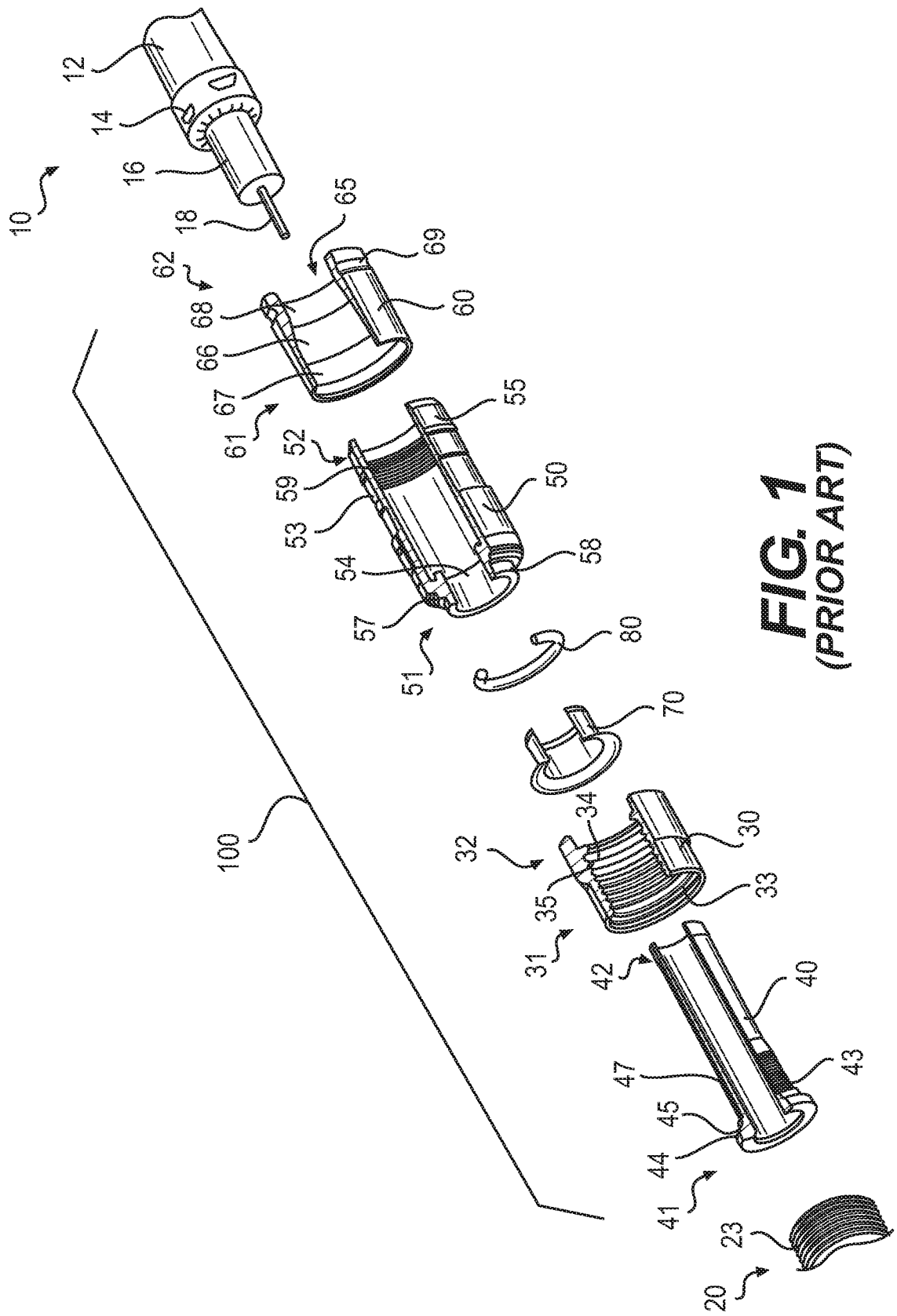


FIG. 1
(PRIOR ART)

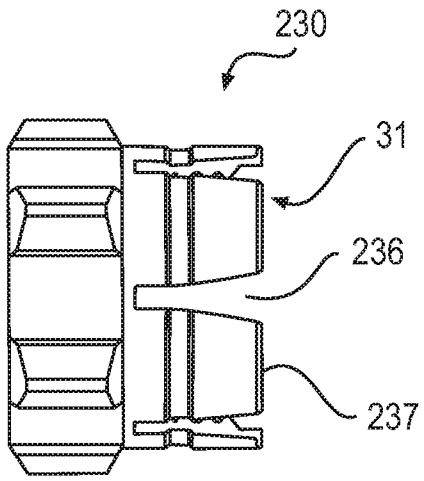


FIG. 2A

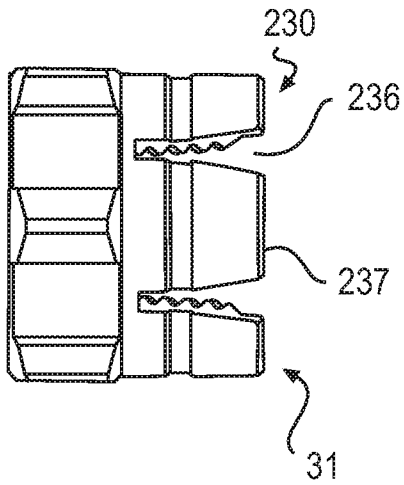


FIG. 2B

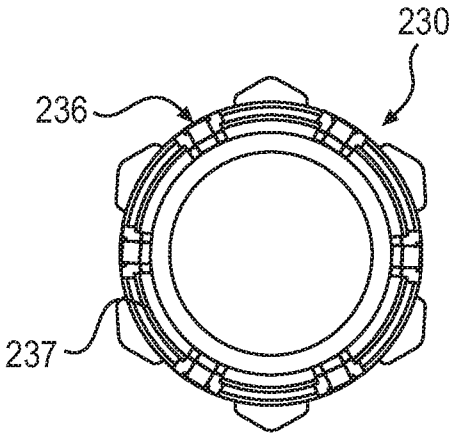


FIG. 2C

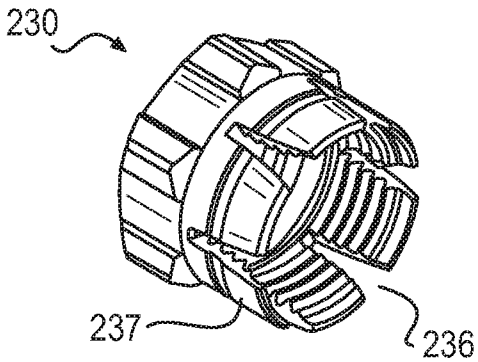


FIG. 2D

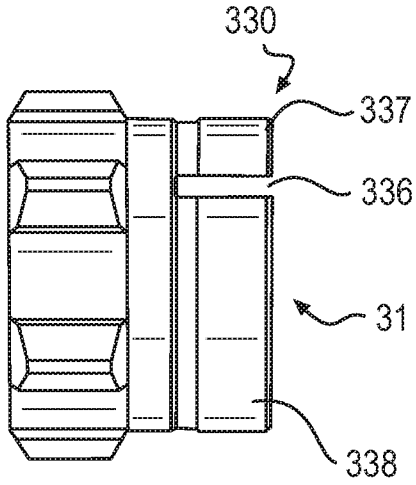


FIG. 3A

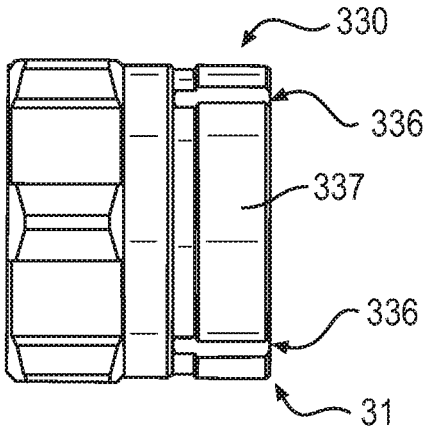


FIG. 3B

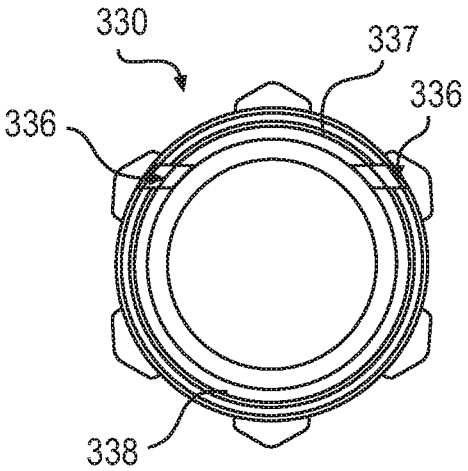


FIG. 3C

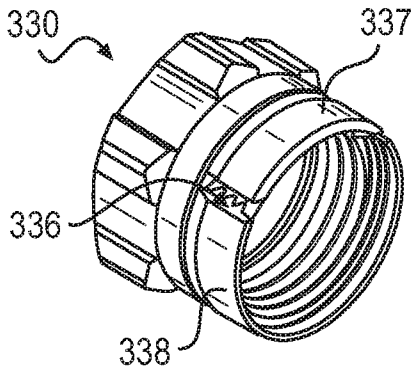


FIG. 3D

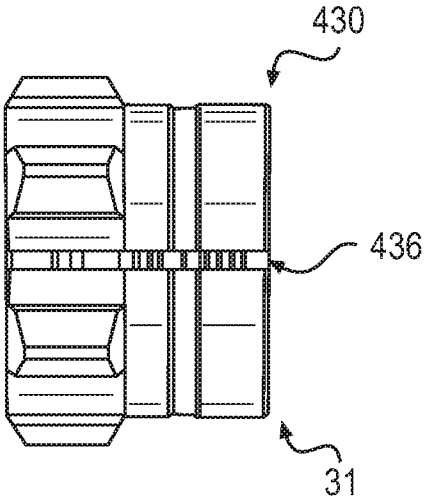


FIG. 4A

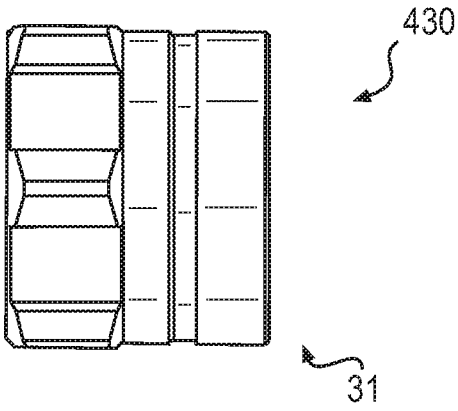


FIG. 4B

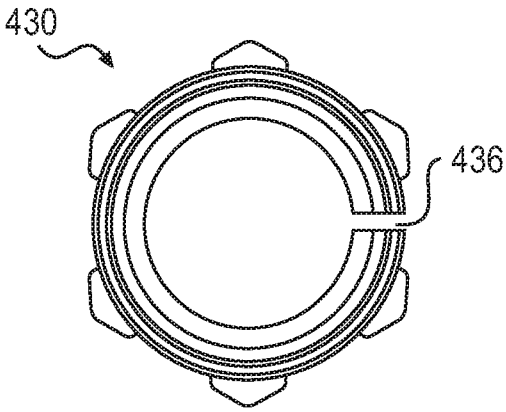


FIG. 4C

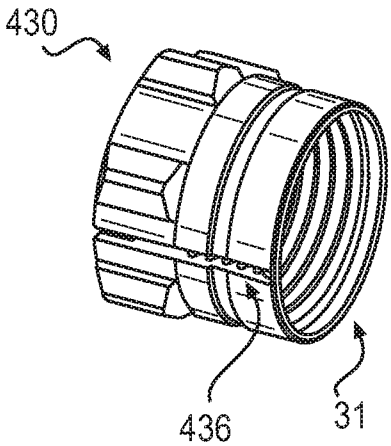


FIG. 4D

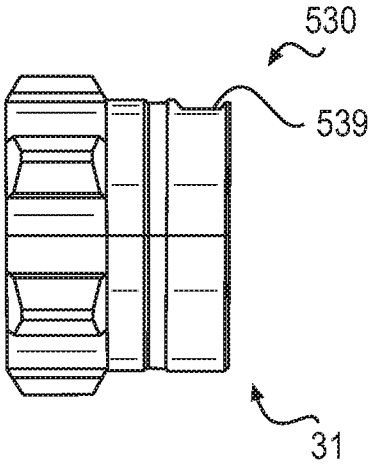


FIG. 5A

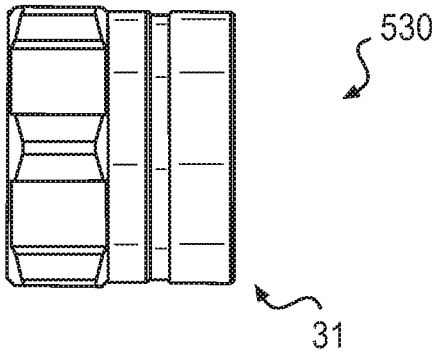


FIG. 5B

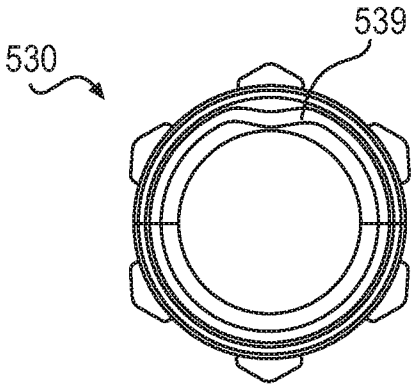


FIG. 5C

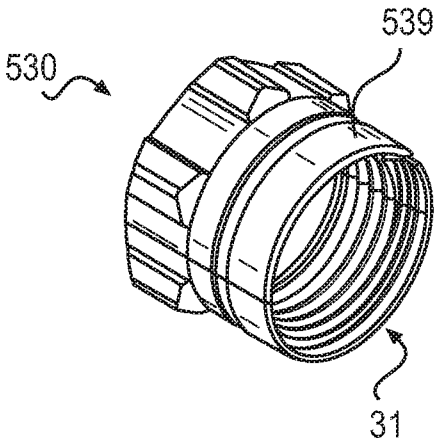


FIG. 5D

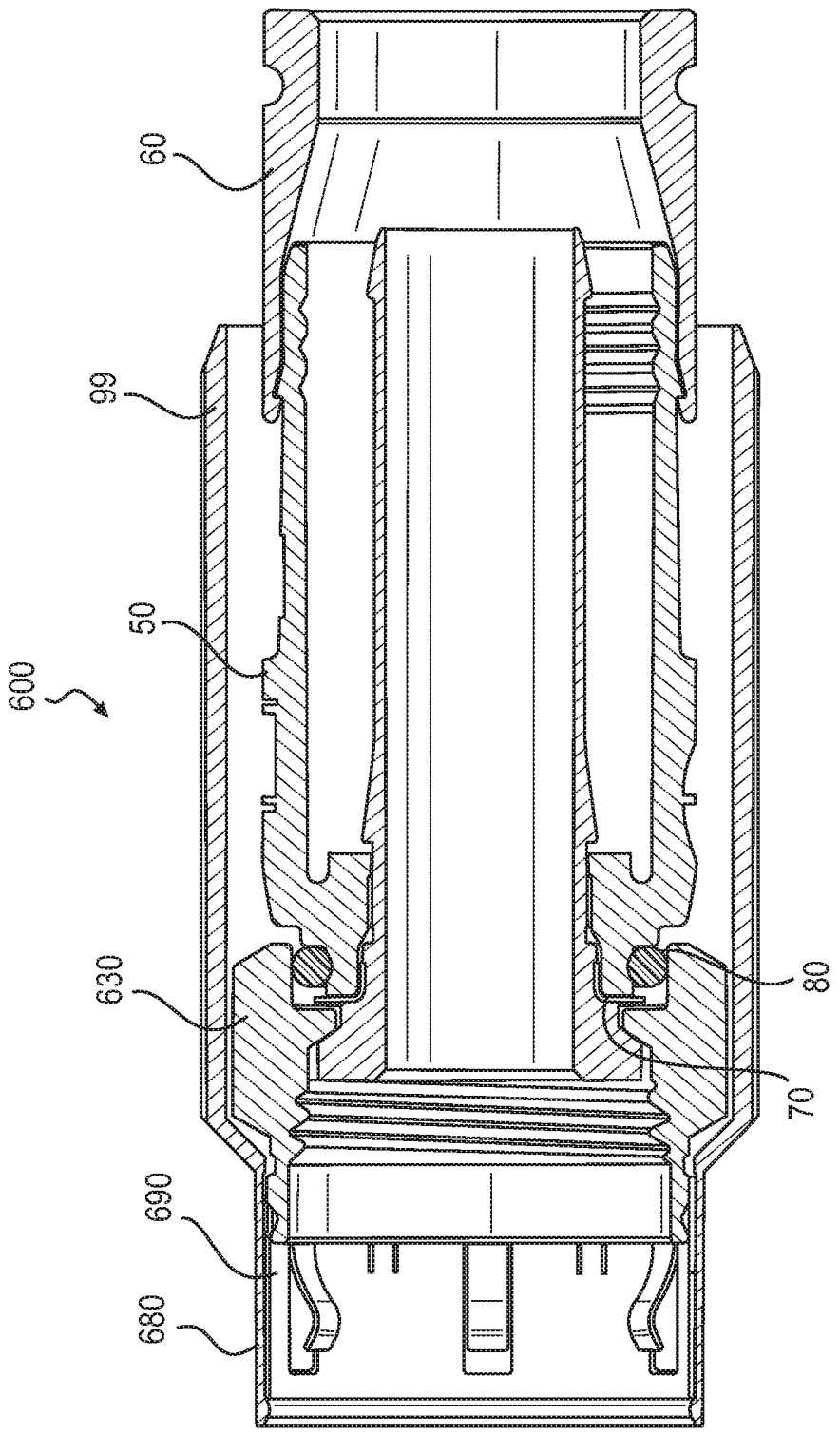


FIG. 6A

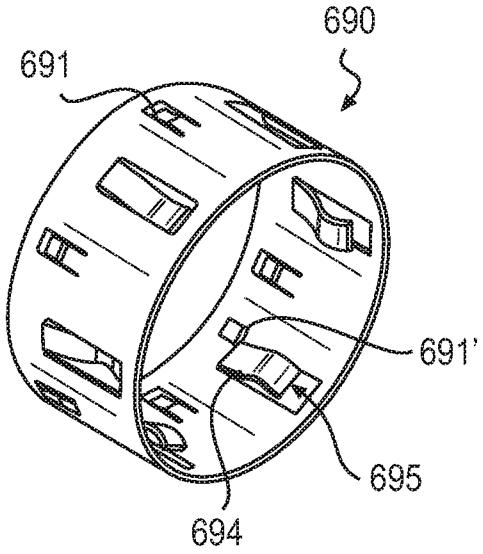


FIG. 6B

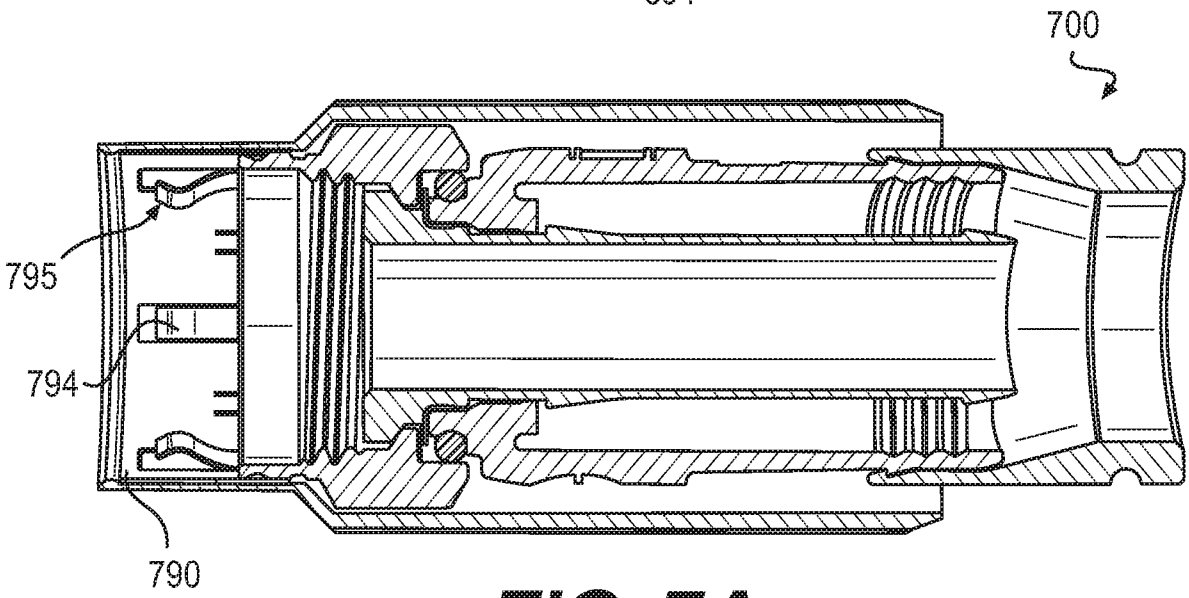


FIG. 7A

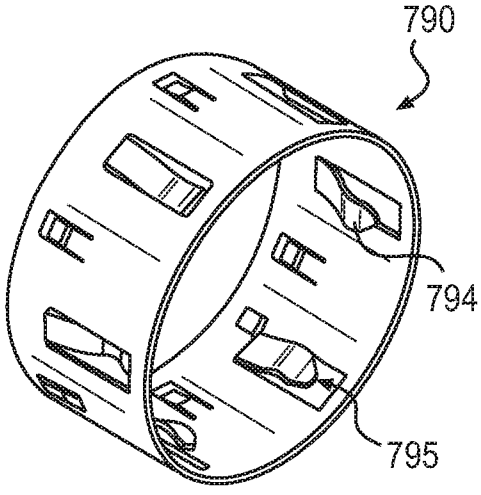


FIG. 7B

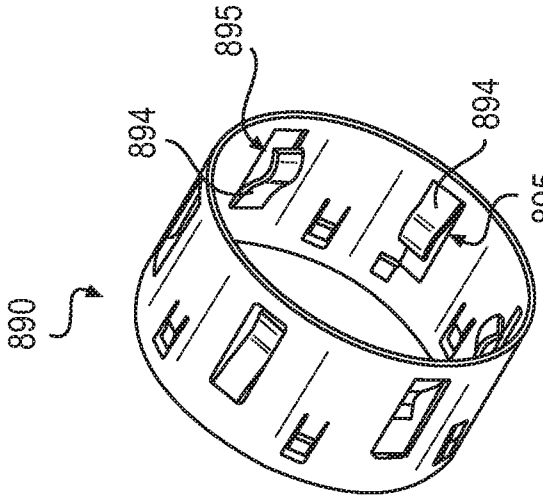


FIG. 8B

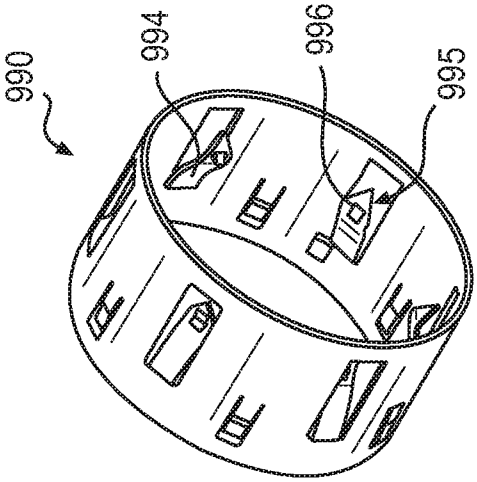


FIG. 9B

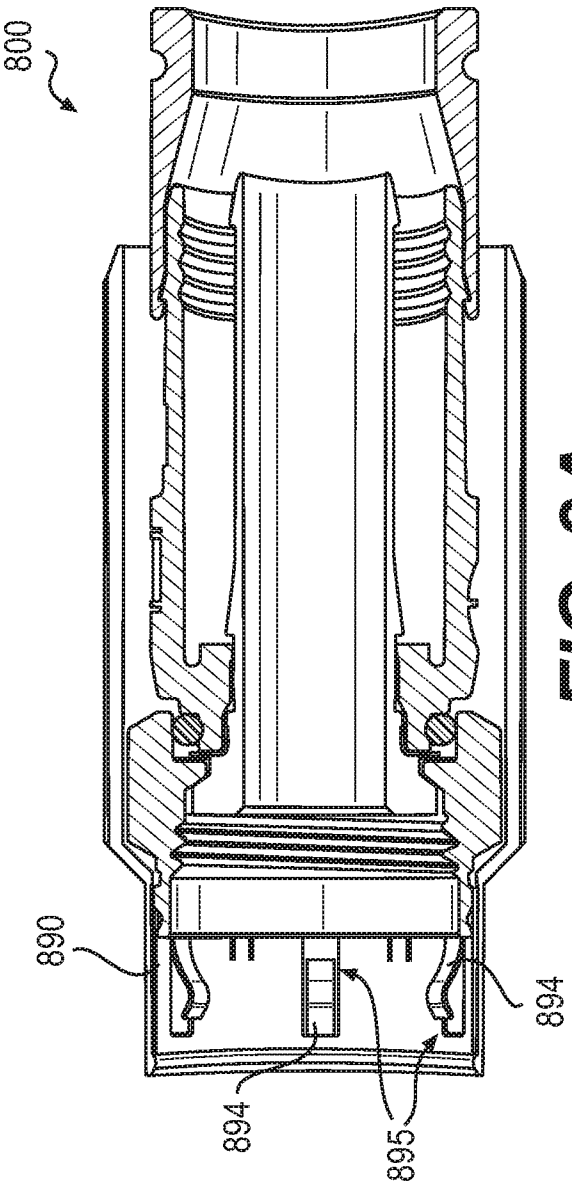


FIG. 8A

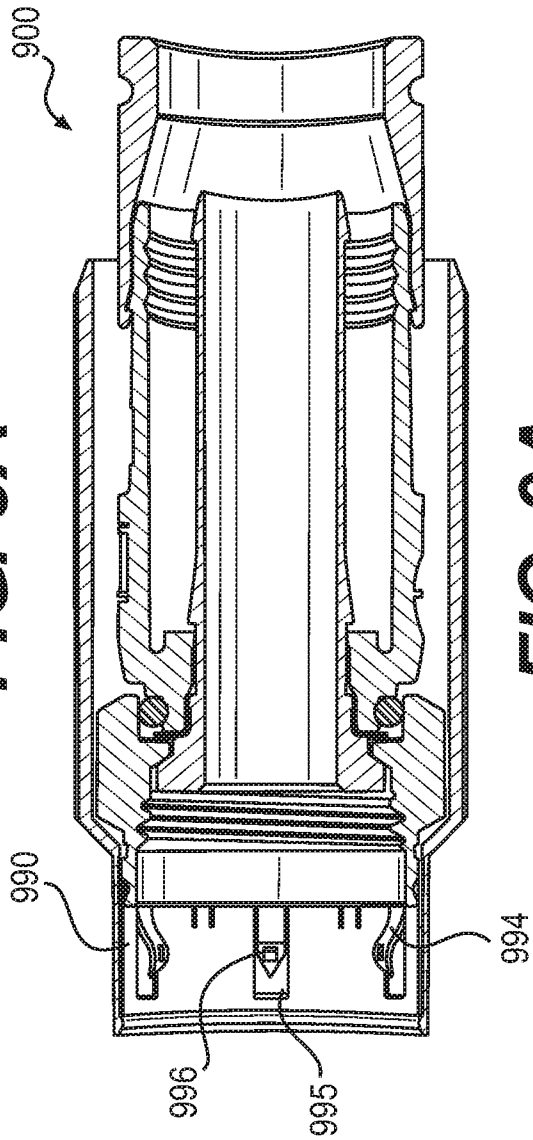


FIG. 9A

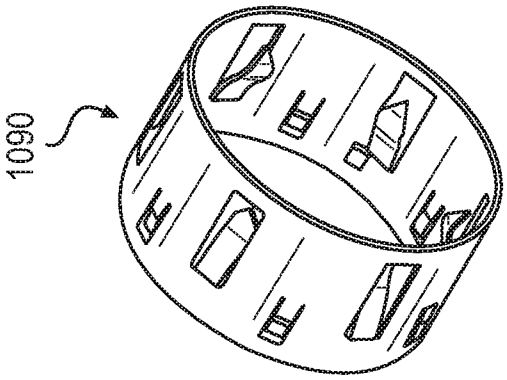


FIG. 10B

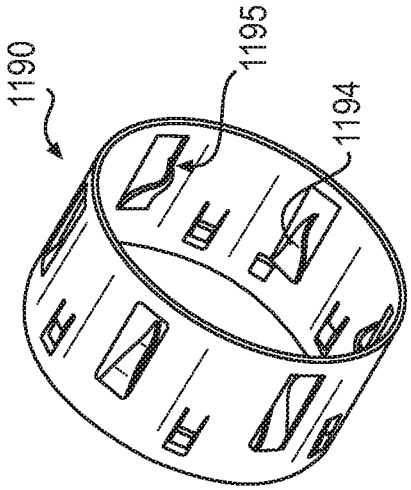


FIG. 11B

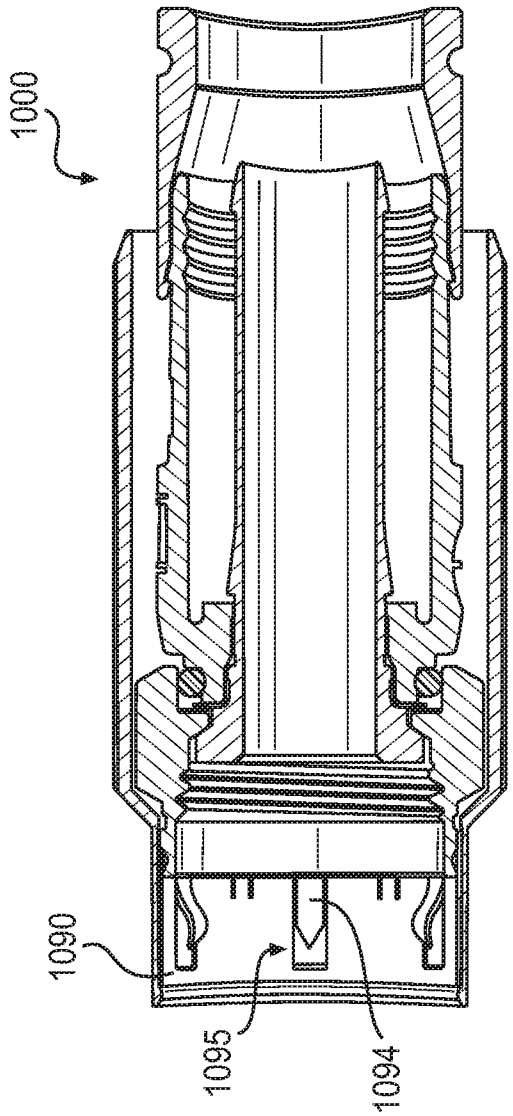


FIG. 10A

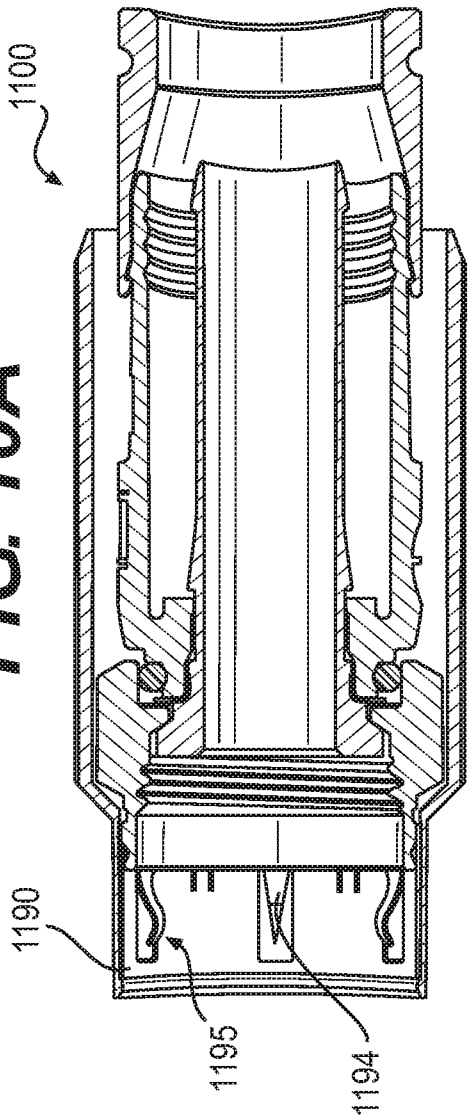


FIG. 11A

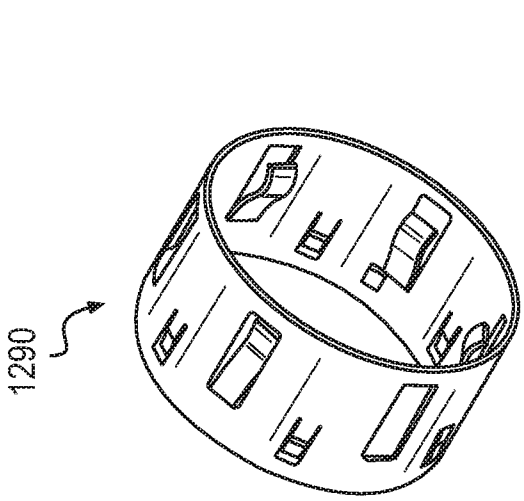


FIG. 12B

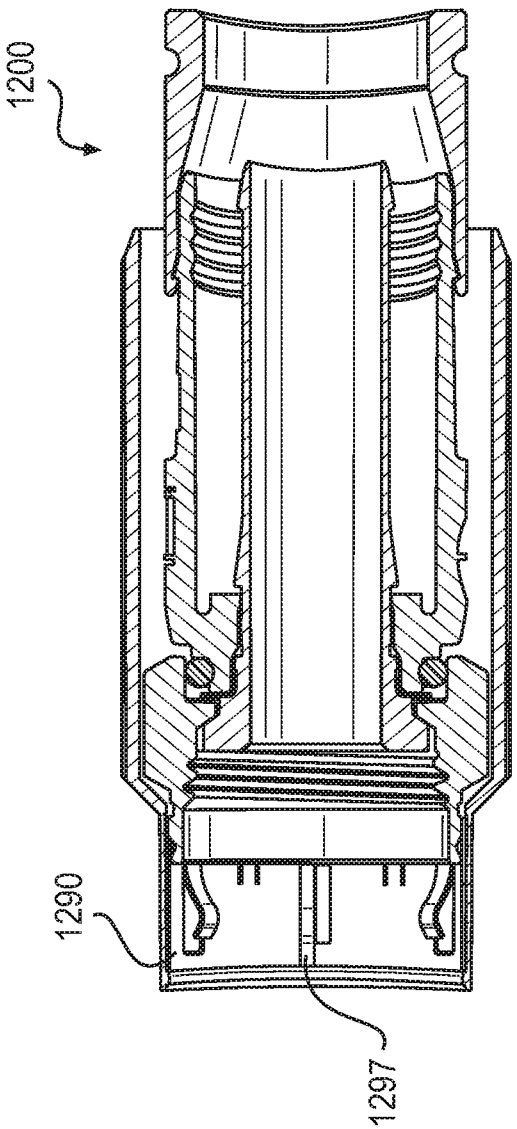


FIG. 12A

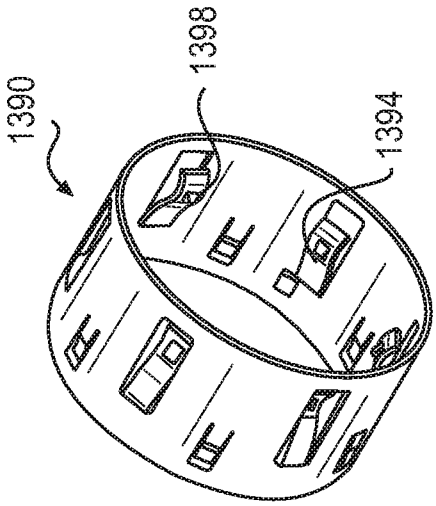


FIG. 13B

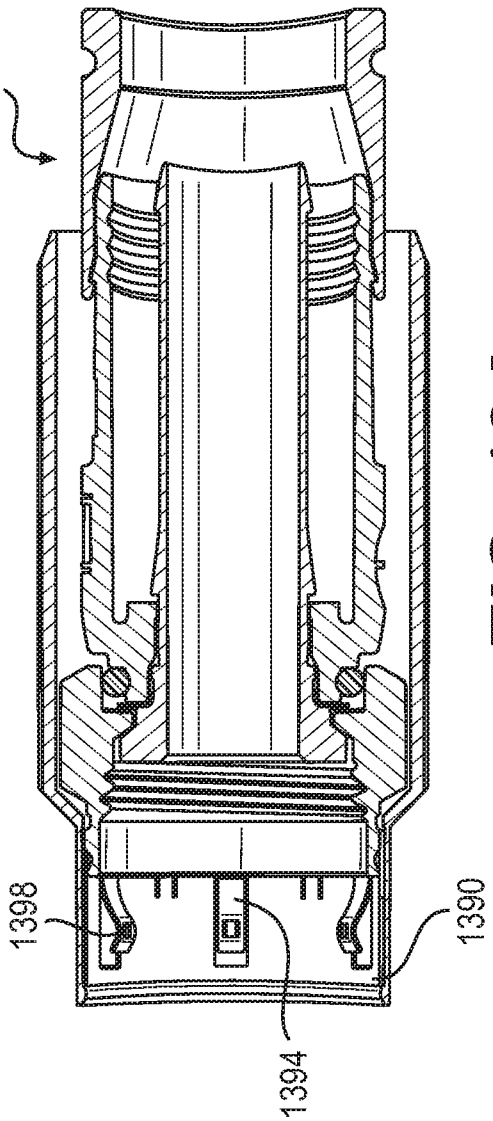


FIG. 13A

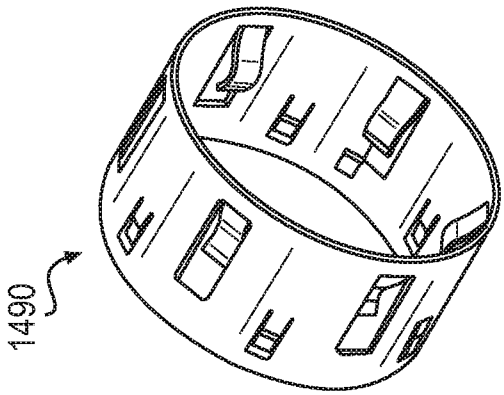


FIG. 14B

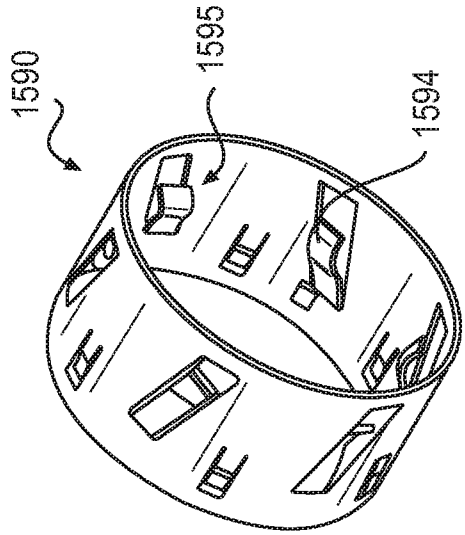


FIG. 15B

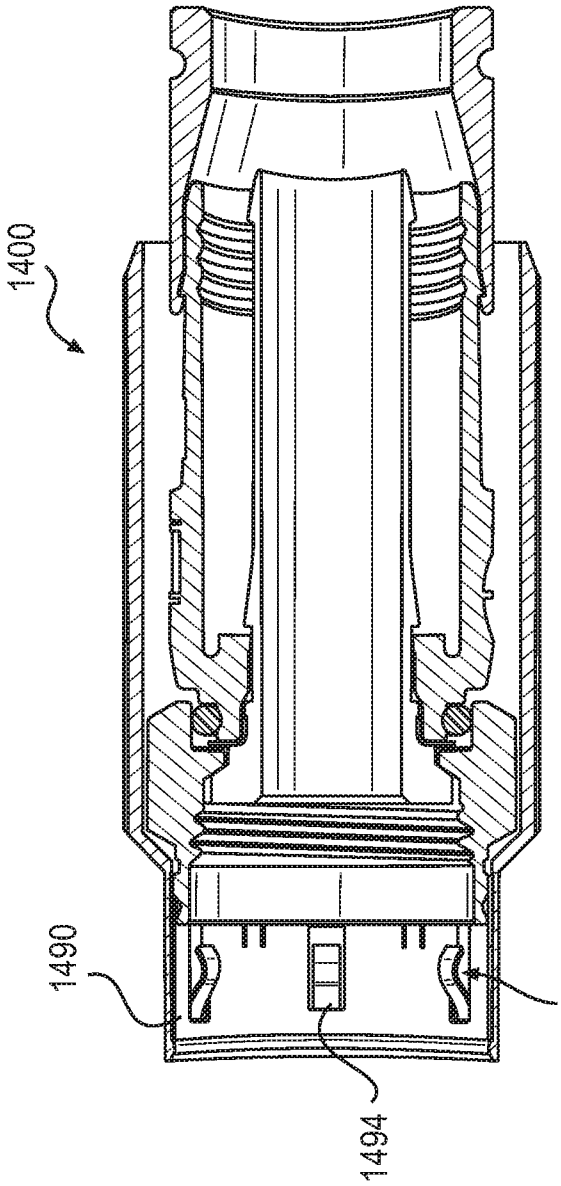


FIG. 14A

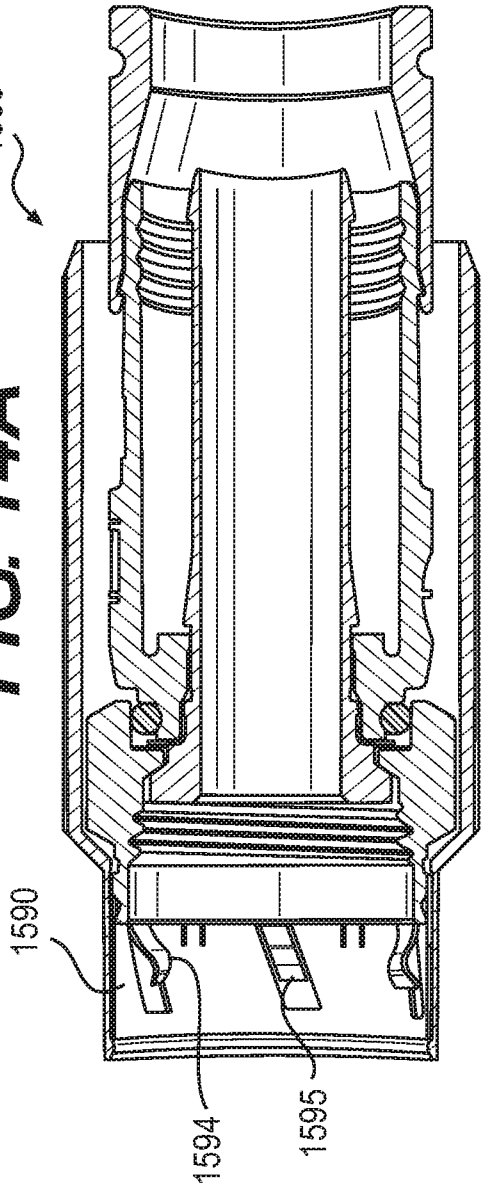


FIG. 15A

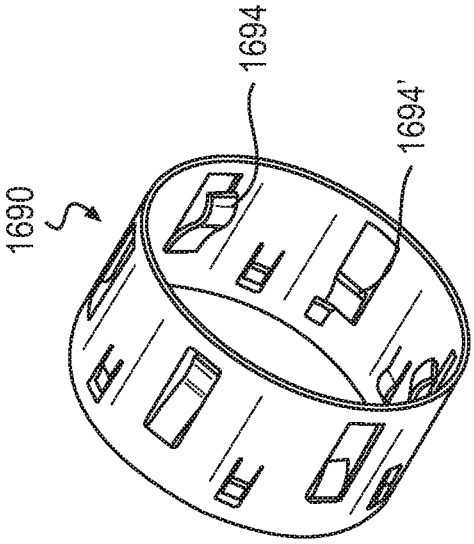


FIG. 16B

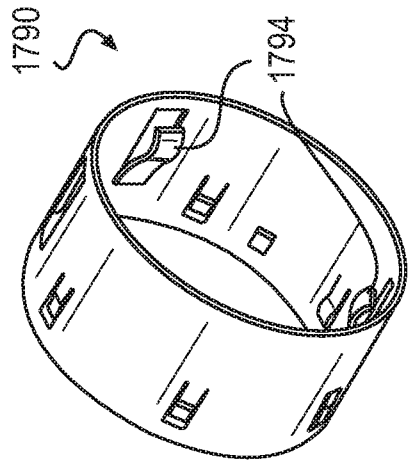


FIG. 17B

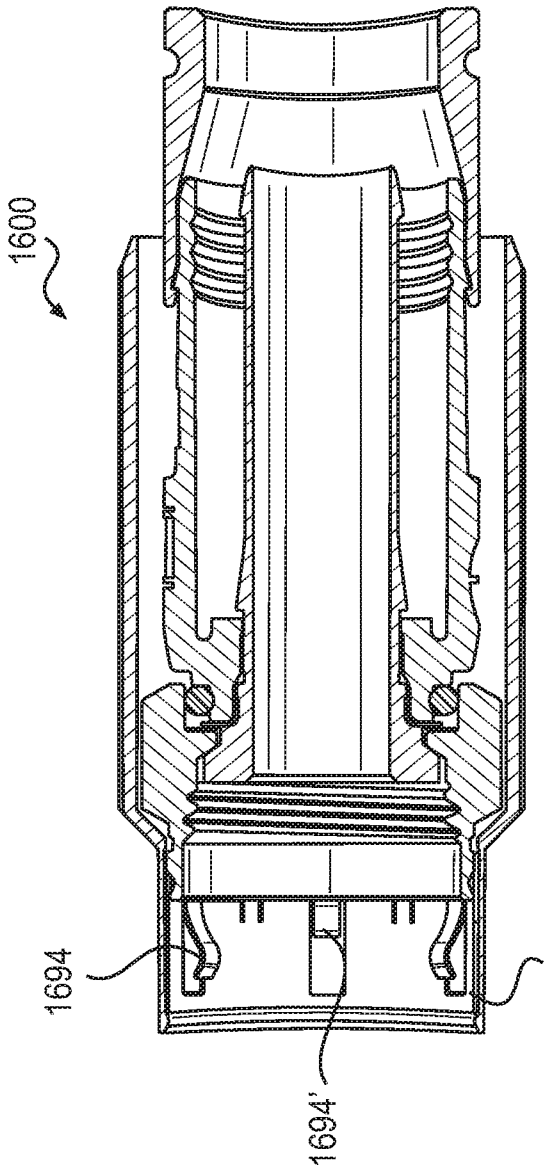


FIG. 16A

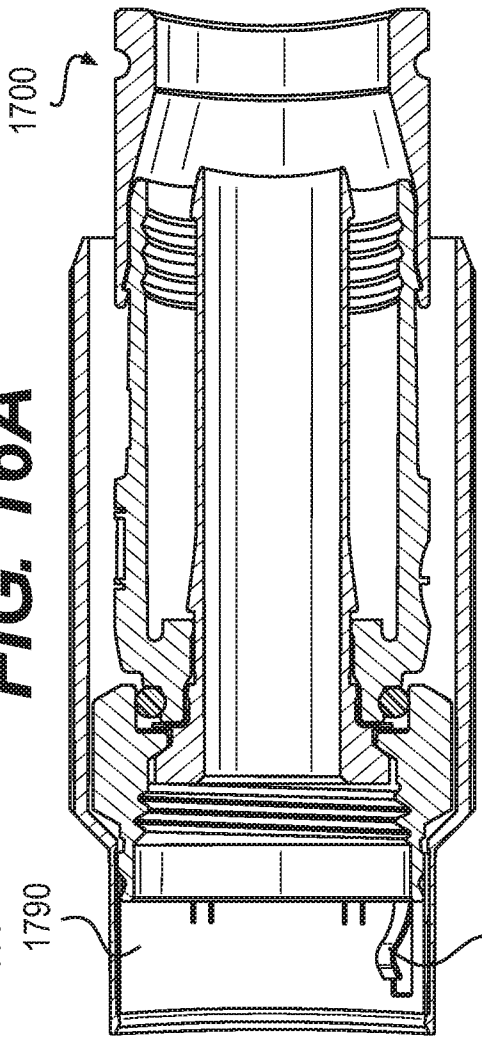


FIG. 17A

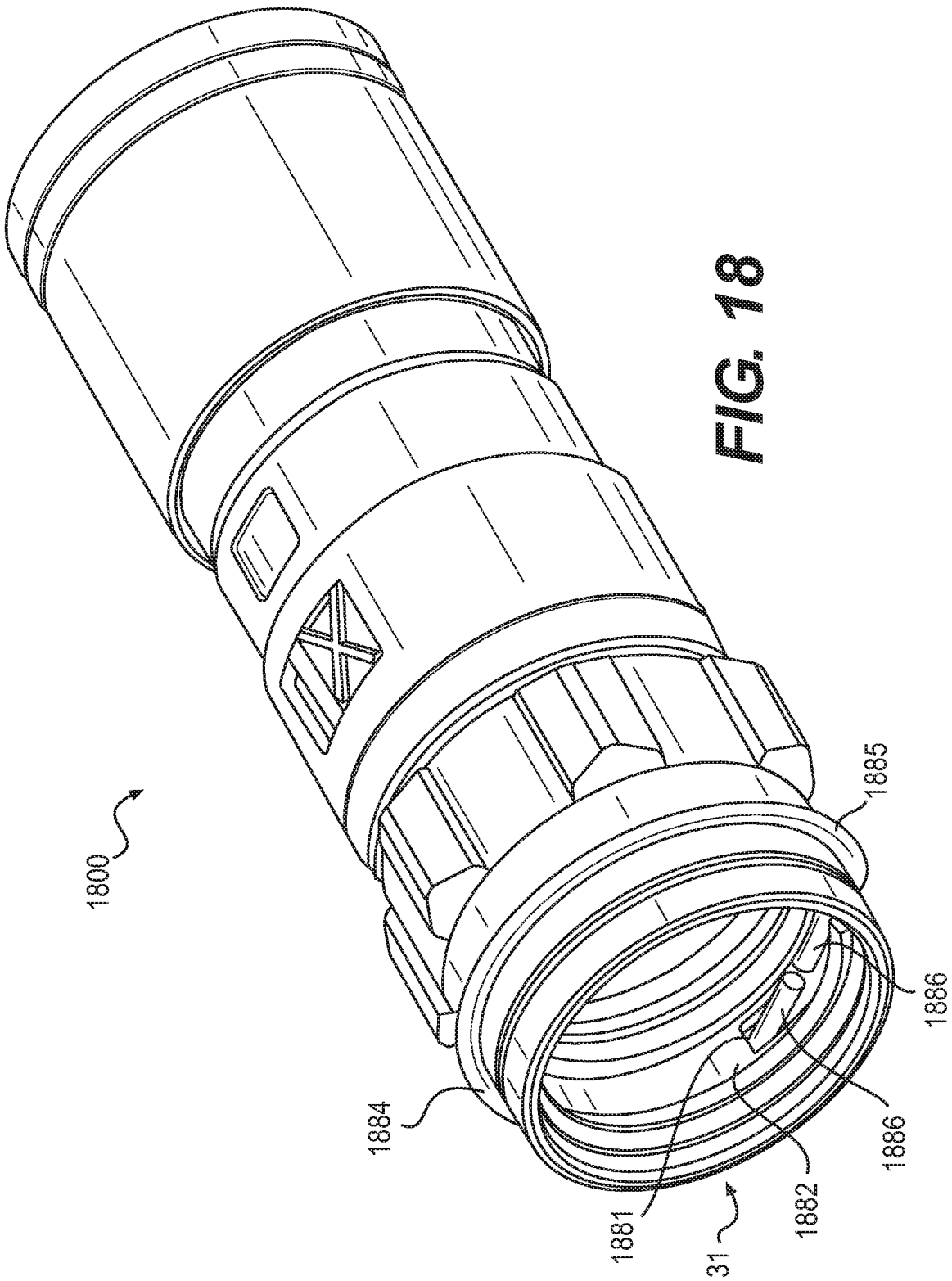


FIG. 18

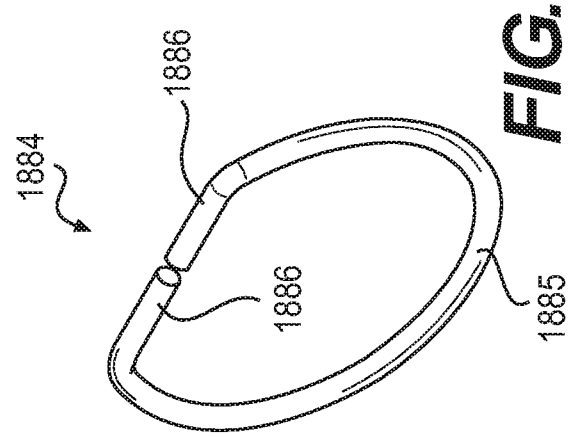


FIG. 19B

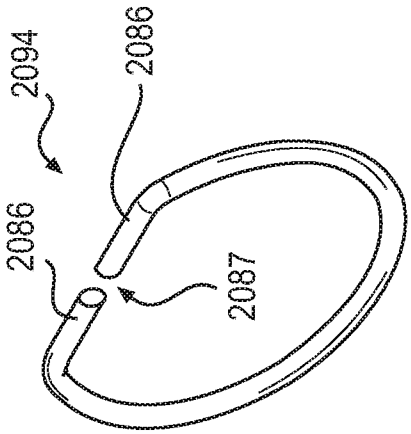


FIG. 20B

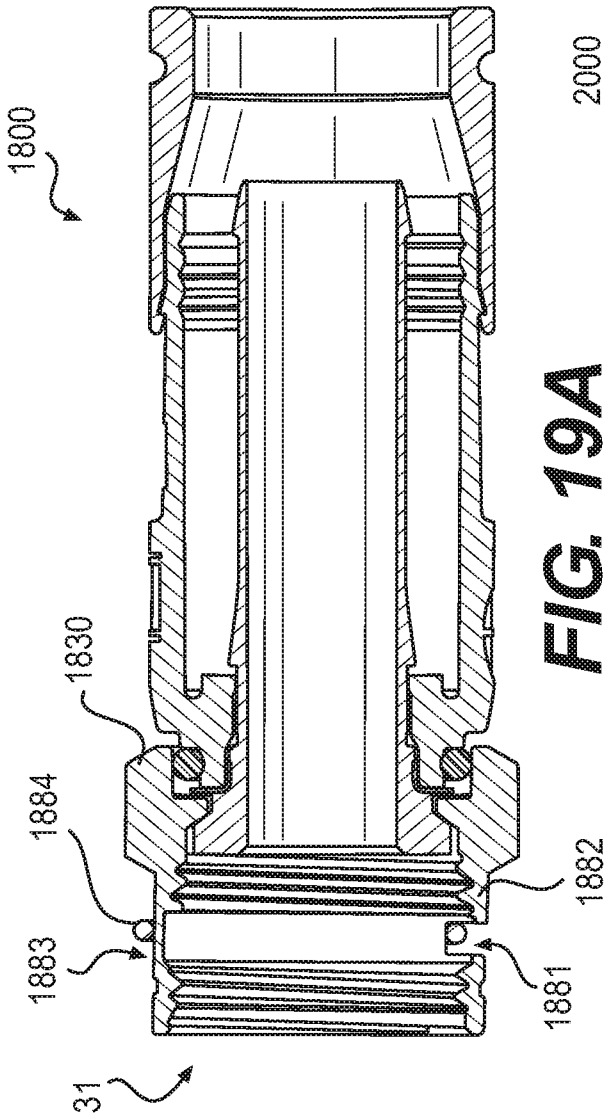


FIG. 19A

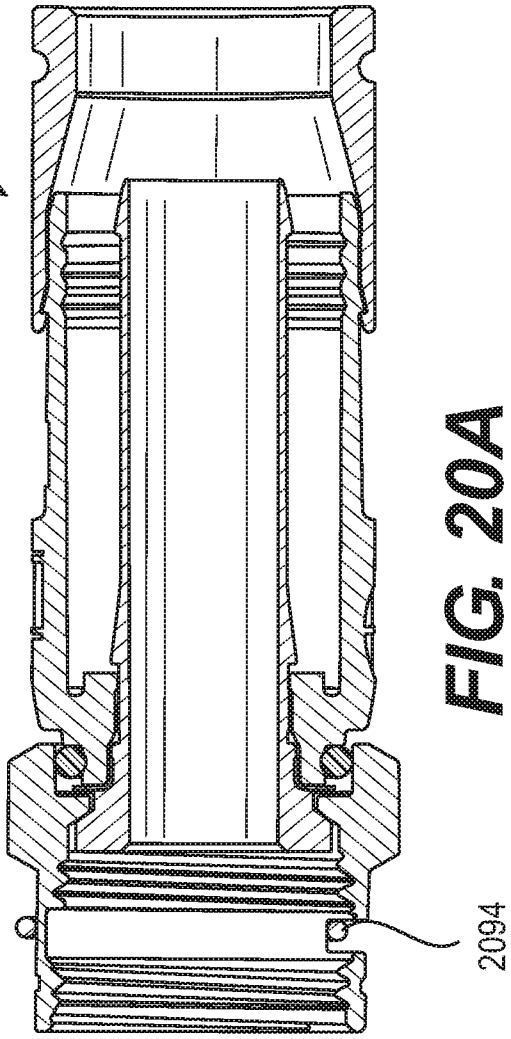


FIG. 20A

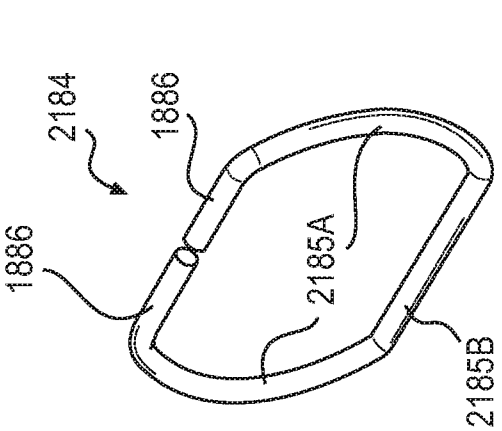


FIG. 21B

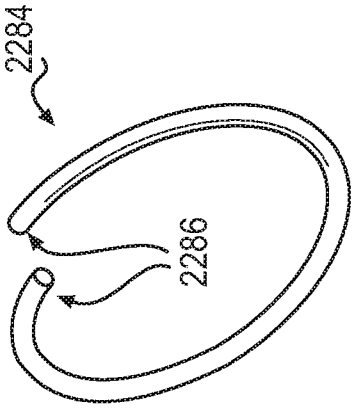


FIG. 22B

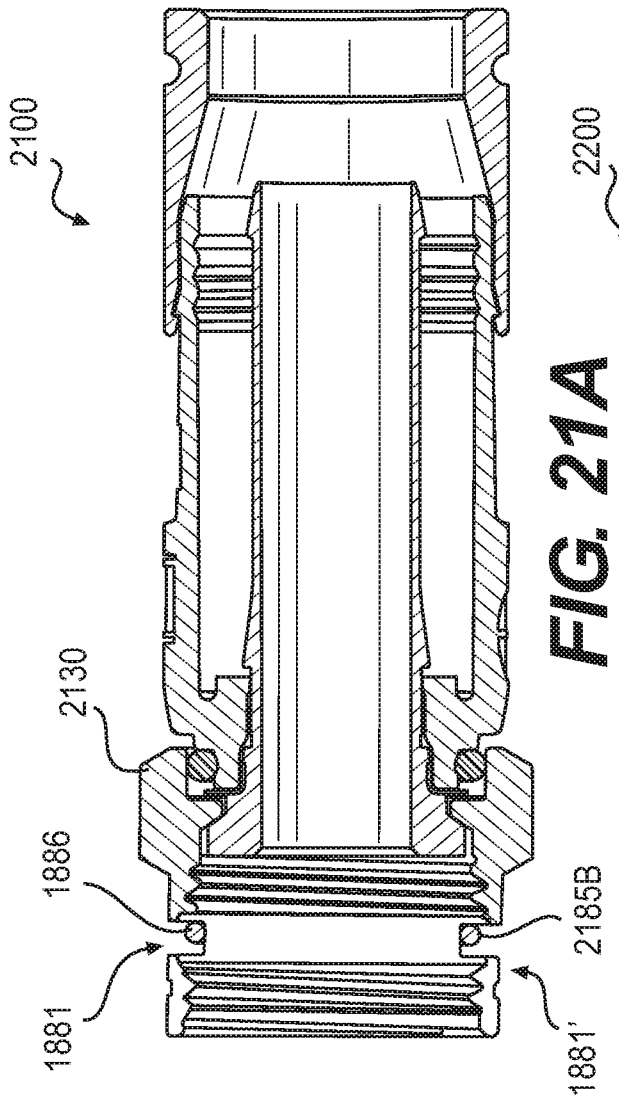


FIG. 21A

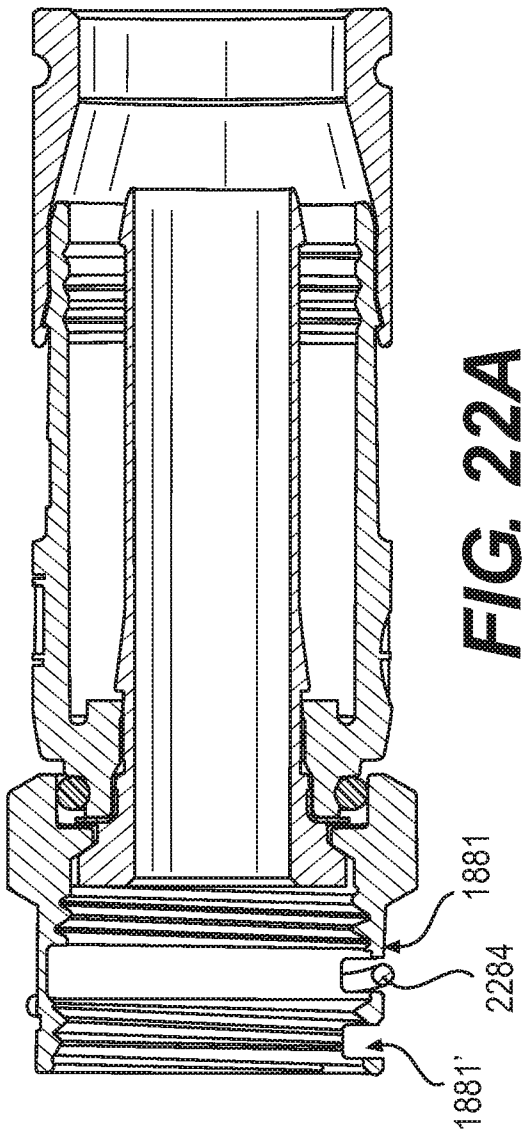


FIG. 22A

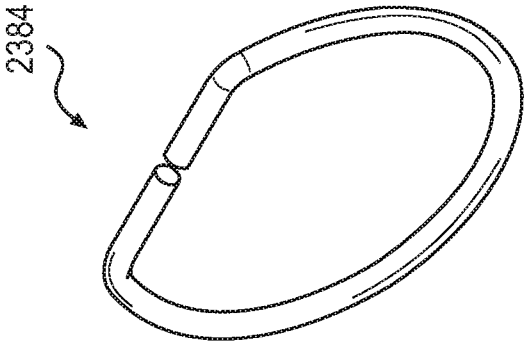


FIG. 23B

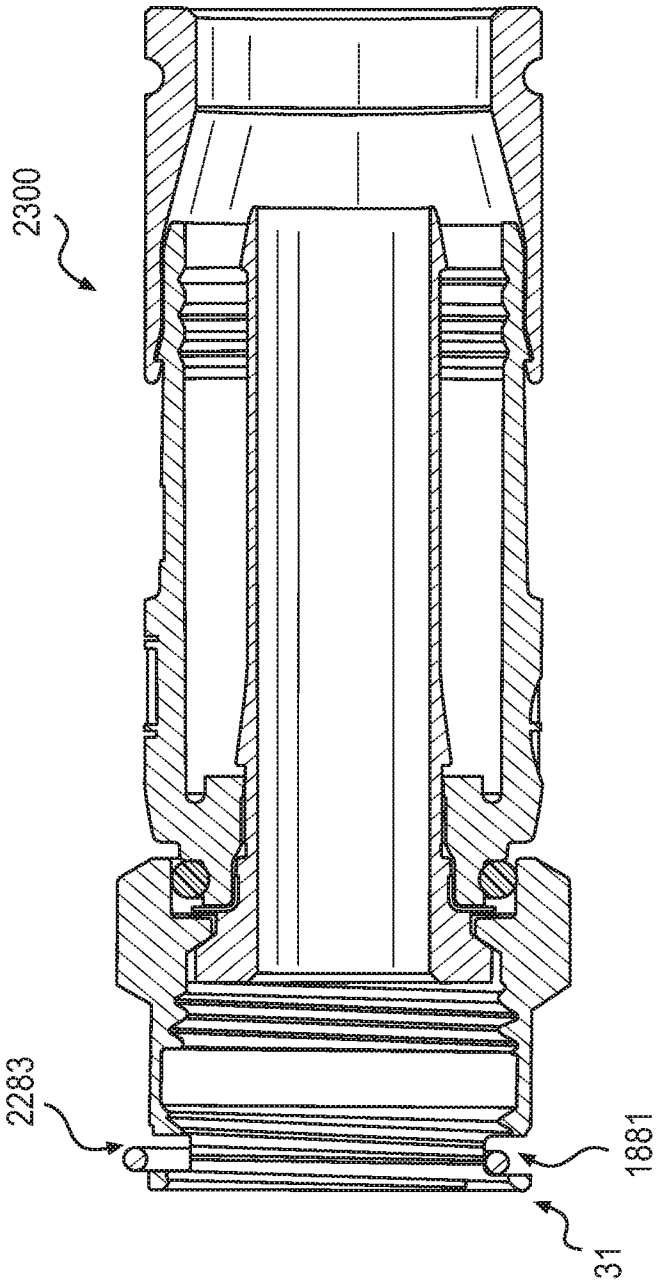


FIG. 23A

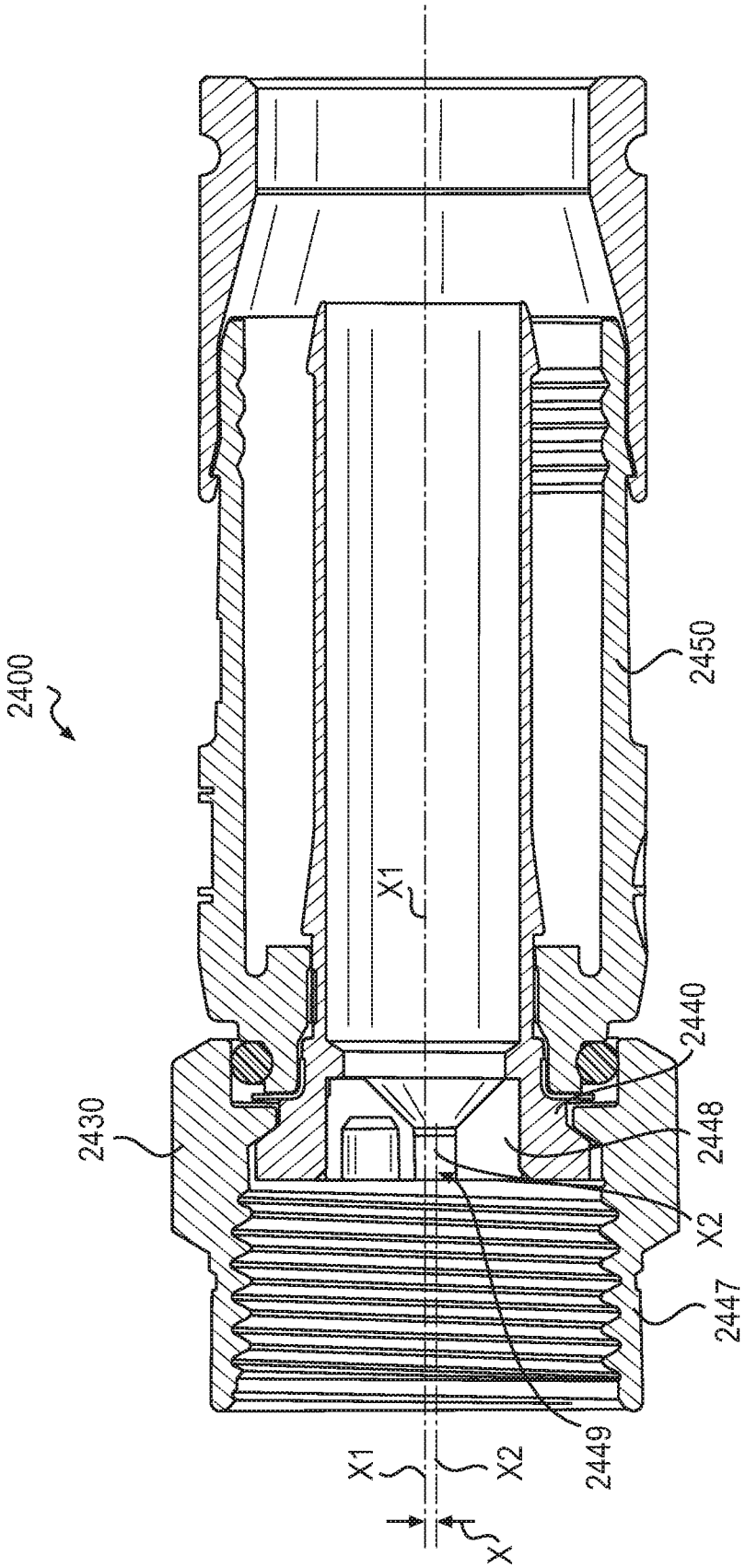


FIG. 24

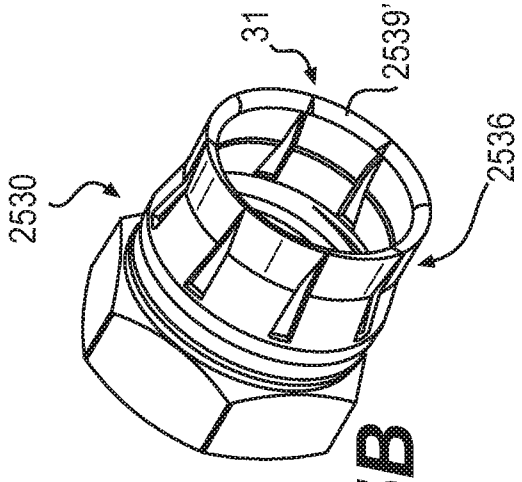


FIG. 25B

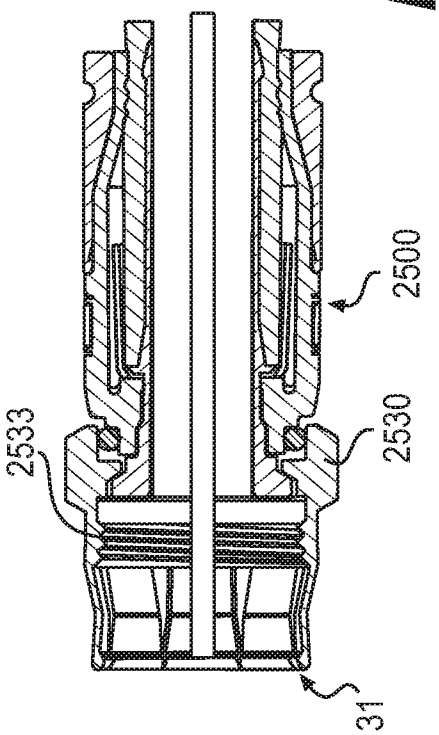


FIG. 25A

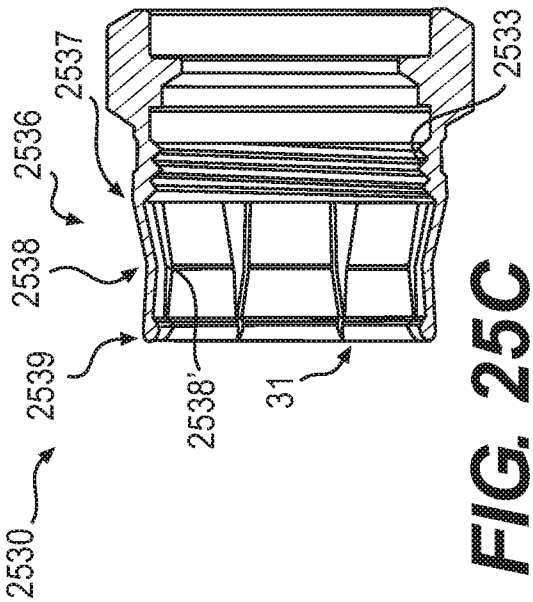


FIG. 25C

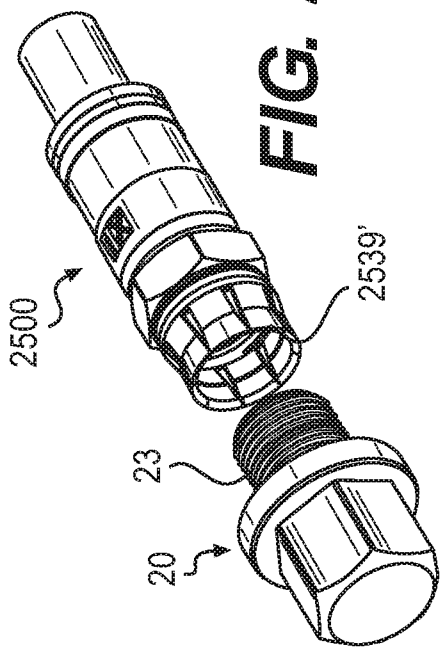


FIG. 26A

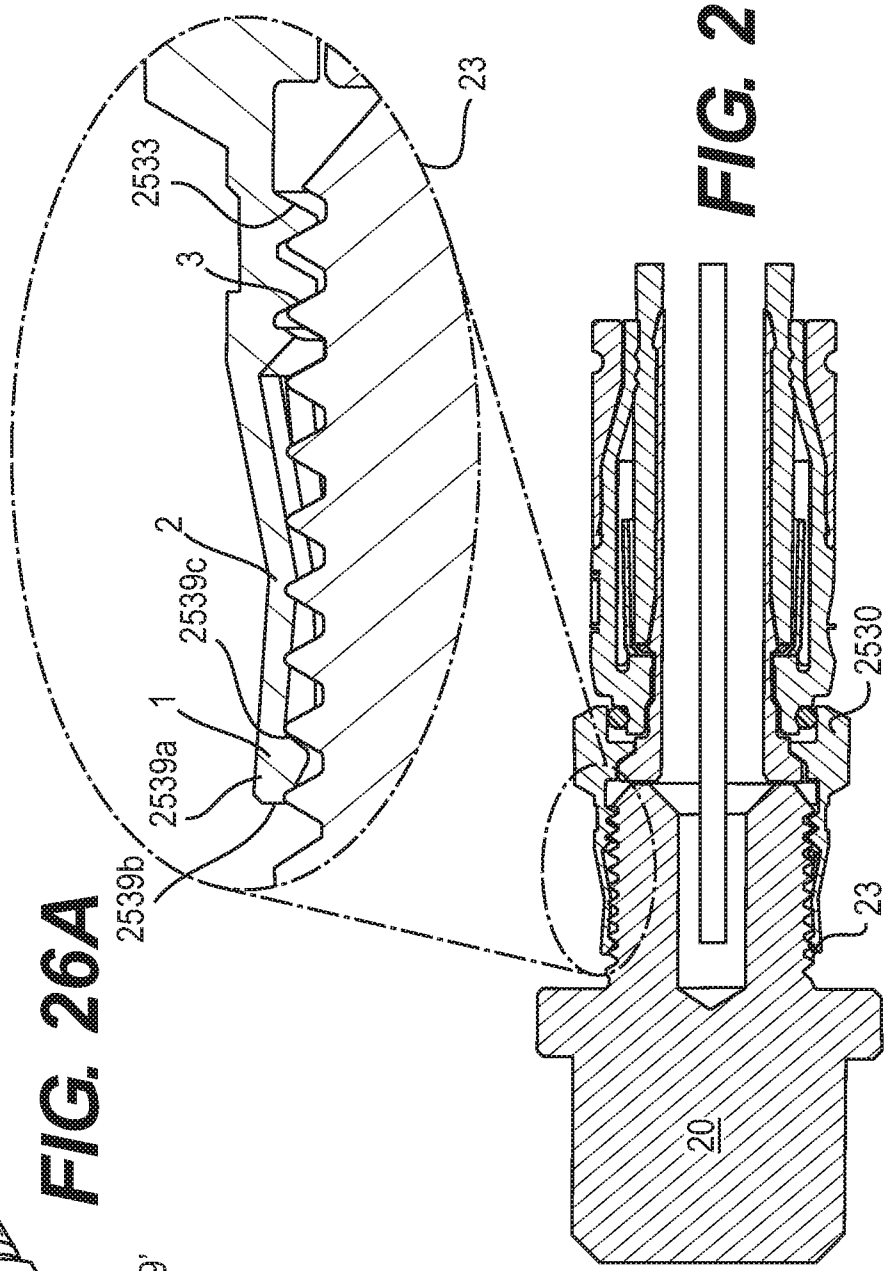


FIG. 26B

FIG. 27A

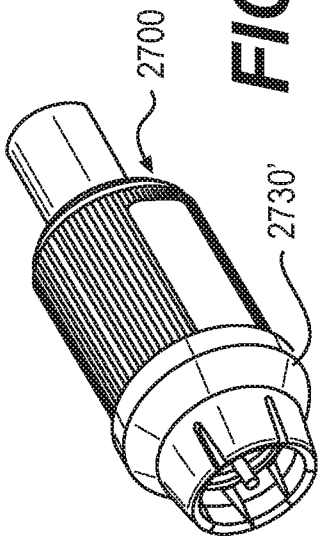
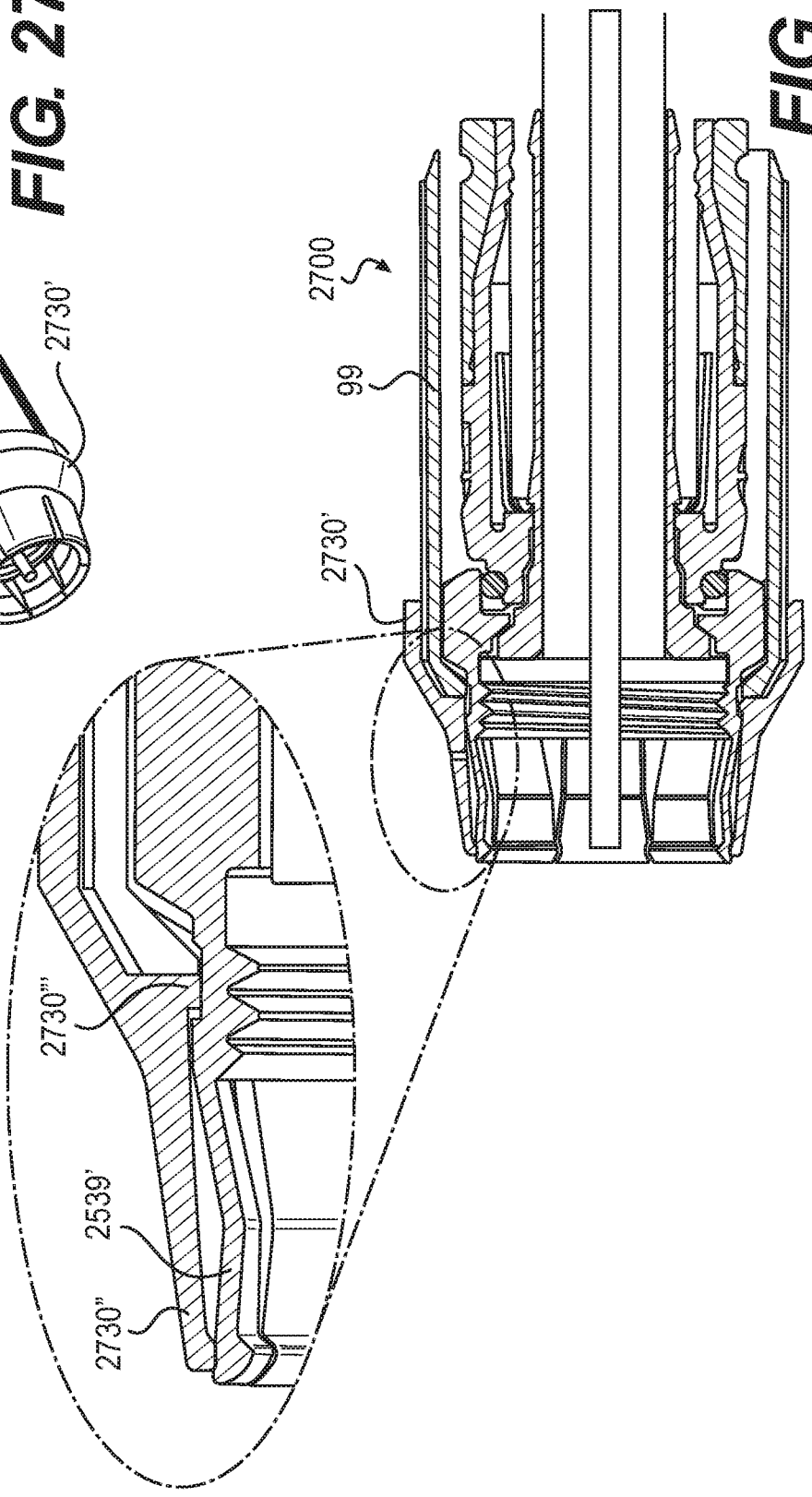


FIG. 27B



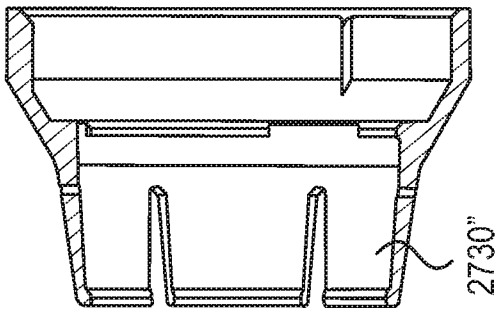


FIG. 28B

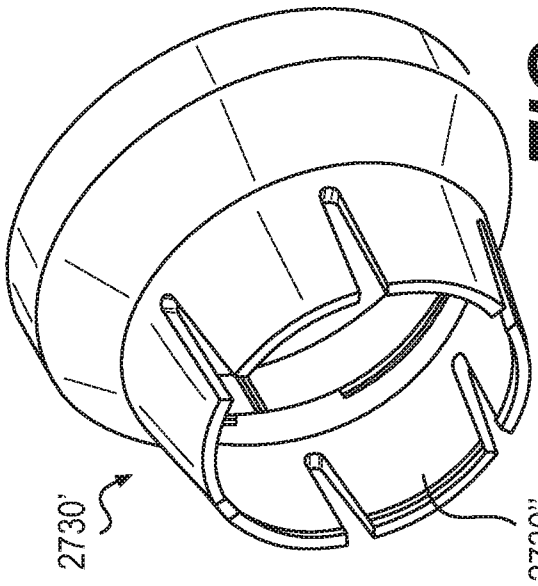


FIG. 28A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/047871

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H01R 9/05; H01R 13/62; H01R 13/622 (2017.01)
CPC - H01R 9/0524; H01R 9/05; H01R 9/0521; H01R 13/622 (2017.08)

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
USPC - 439/253; 439/578; 439/584 (keyword delimited)

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.
Y	US 2012/0094532 A1 (MONTENA) 19 April 2012 (19.04.2012) entire document	1-4, 15
Y	US 7,189,091 B1 (MONTENA) 13 March 2007 (13.03.2007) entire document	1-4, 15
Y	US 2014/0342594 A1 (PPC BROADBAND INC) 20 November 2014 (20.11.2014) entire document	15
A	US 2009/0264003 A1 (HERTZLER et al) 22 October 2009 (22.10.2009) entire document	1-17
A	US 2006/0205272 A1 (RODRIGUES) 14 September 2006 (14.09.2006) entire document	1-17
A	US 2007/0224880 A1 (WLOS et al) 27 September 2007 (27.09.2007) entire document	1-17

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

* Special categories of cited documents:
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"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
05 October 2017	27 OCT 2017
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)