

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 November 2006 (09.11.2006)

PCT

(10) International Publication Number
WO 2006/118747 A1

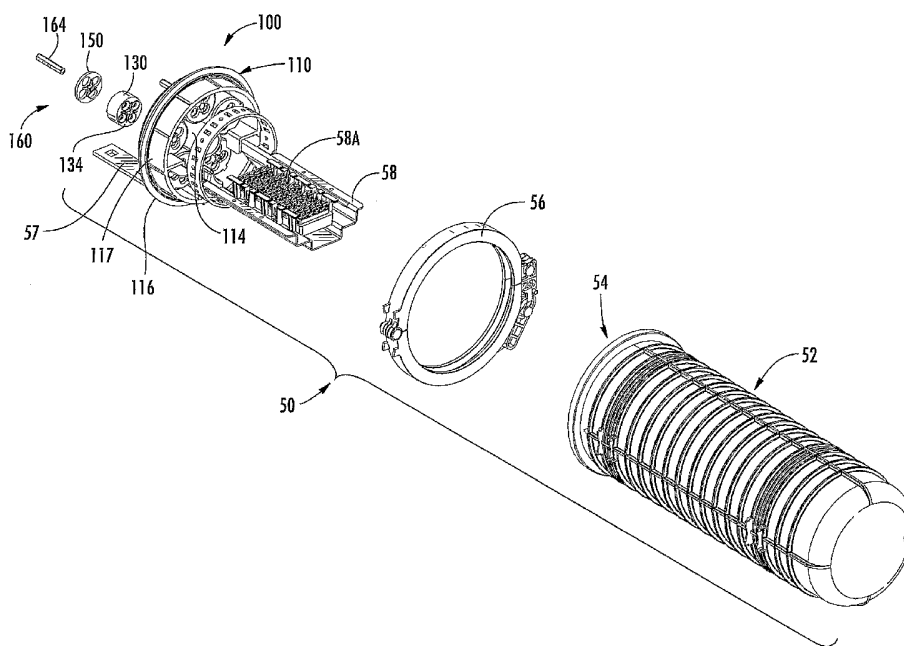
- (51) **International Patent Classification:**
F16L 5/08 (2006.01)
- (21) **International Application Number:**
PCT/US2006/012992
- (22) **International Filing Date:** 6 April 2006 (06.04.2006)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
11/119,998 2 May 2005 (02.05.2005) US
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** SEALING ASSEMBLIES AND METHODS FOR SEALING AN ELONGATE MEMBER



(57) **Abstract:** A sealing assembly (100) for forming a seal about an elongate object (10) includes a resilient seal member (130) and a loading mechanism (160). The seal member includes an inner wall surface defining a channel (140) to receive the elongate object. The inner wall surface includes at least one annular rib (144) extending into the channel to engage the elongate object. The loading mechanism is adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

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SEALING ASSEMBLIES AND METHODS FOR SEALING AN ELONGATE MEMBER

Field of the Invention

[001] The present invention relates to sealing devices and, more particularly, to sealing devices for providing a seal between an opening in an object and an elongate article such as a cable.

Background of the Invention

[002] It is often necessary to form a seal between an elongate object such as a cable and an opening in an object such as a pipe or splice enclosure. For example, in a telecommunications infrastructure, electrical connectors or splices may be housed in enclosures to protect them from harsh environments. It may be necessary or desirable to seal the enclosure against the ingress of water or the like. In particular, the enclosure may be provided with a sealing device to form a seal about each cable or wire at its entry into the enclosure.

Summary of the Invention

[003] According to embodiments of the present invention, a sealing assembly for forming a seal about an elongate object includes a resilient seal member and a loading mechanism. The seal member includes an inner wall surface defining a channel to receive the elongate object. The inner wall surface includes at least one annular rib extending into the channel to engage the elongate object. The loading mechanism is adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

[004] According to further embodiments of the present invention, an enclosure assembly for use with an elongate object includes a housing and a sealing assembly for forming a seal about an elongate object. The sealing assembly includes a resilient seal member and a loading mechanism. The seal member includes an inner wall surface

defining a channel to receive the elongate object. The inner wall surface includes at least one annular rib extending into the channel to engage the elongate object. The loading mechanism is adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object. The housing member is mountable on the sealing assembly to form an enclosed chamber.

[005] According to further embodiments of the present invention, a method for forming a seal about an elongate object includes inserting the elongate object into a channel of a resilient seal member, the seal member including an inner wall surface defining the channel and including at least one annular rib extending into the channel; and selectively applying a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

[006] According to further embodiments of the present invention, a sealing assembly for forming a seal about an elongate object includes a resilient seal member and a loading mechanism. The seal member includes an inner wall surface defining a channel to receive the elongate object. The seal member is formed of a material having a durometer of no harder than about 30 Shore A. The loading mechanism is adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

[007] Further features, advantages and details of the present invention will be appreciated by those of ordinary skill in the art from a reading of the figures and the detailed description of the preferred embodiments that follow, such description being merely illustrative of the present invention.

Brief Description of the Drawings

[008] **Figure 1** is an exploded, rear perspective view of an enclosure assembly according to embodiments of the present invention;

[009] **Figure 2** is a fragmentary, front perspective view of the enclosure assembly of **Figure 1**;

[010] **Figure 3** is a front plan view of a seal member forming a part of the enclosure assembly of **Figure 1**;

[011] **Figure 4** is a cross-sectional view of the seal member of **Figure 3** taken along the line 4-4 of **Figure 3**;

[012] **Figure 5** is a rear, perspective view of a pressure member forming a part of the enclosure assembly of **Figure 1**;

[013] **Figure 6** is a fragmentary, cross-sectional view of the enclosure assembly of **Figure 1** taken along the line 6-6 of **Figure 2**;

[014] **Figure 7** is a fragmentary, cross-sectional view of the enclosure assembly of **Figure 1** taken along the same line as **Figure 6** and wherein a cable is inserted through a sealing channel thereof;

[015] **Figure 8** is a fragmentary, cross-sectional view of the enclosure assembly of **Figure 1** taken along the same line as **Figures 6** and **7** and wherein a loading mechanism forming a part of the enclosure assembly has been adjusted to compress the seal member about the cable;

[016] **Figure 9** is a fragmentary, cross-sectional view of an enclosure assembly according to further embodiments of the present invention; and

[017] **Figure 10** is a rear, perspective view of a sealing assembly according to further embodiments of the present invention.

[018] **Figure 11** is an exploded, perspective view of a sealing assembly according to further embodiments of the present invention.

Detailed Description of Embodiments of the Invention

[019] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which illustrative embodiments of the invention are shown. In the drawings, the relative sizes of regions or features may be exaggerated for clarity. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[020] It will be understood that when an element is referred to as being "coupled" or "connected" to another element, it can be directly coupled or connected to the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly coupled" or "directly connected" to another element, there are no intervening elements present. Like numbers refer to like elements throughout. As used herein the term "and/or" includes any and all combinations of one or more of the associated listed items.

[021] In addition, spatially relative terms, such as "under", "below", "lower", "over", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "under" or "beneath" other elements or features would then be oriented "over" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[022] Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[023] As used herein the expression "and/or" includes any and all combinations of one or more of the associated listed items.

[024] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[025] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[026] With reference to **Figures 1-8**, a sealing assembly **100** according to embodiments of the present invention is shown therein. The sealing assembly **100** may form a part of an enclosure assembly **50** to form a seal or seals between one or more elongate objects, such as a cable **10** (**Figure 6**), and the enclosure assembly **50**. As

discussed in more detail below, the sealing assembly **100** may serve to provide a consistent, reliable and effective seal against ingress of water and other contaminants into the enclosure assembly **50**. Moreover, the sealing assembly **100** may be adapted to accept and effectively seal about an expanded range of sizes of cables **10**, and may be customizable to fit a variety of cable sizes.

[027] The sealing assembly **100** includes a base member **110**, a plurality of resilient seal members **130**, and a plurality of loading mechanisms **160**. The base member **110**, the seal members **130** and the loading mechanisms **160** form five sealing subassemblies **101** (**Figure 2**).

[028] With reference to **Figures 1** and **2**, the base member **110** includes a body **111** having a front side **112** (**Figure 2**) and a rear side **114** (**Figure 1**). Five cavities **118** (**Figure 2**) are defined in the front side **112** and each forms a part of a respective one of the sealing subassemblies **101**. Each cavity **118** is defined by a bottom wall **118B** and a cylindrical side wall **118C**. Four openings **118A** are formed in each bottom wall **118B**. A further opening **120** is also defined in the body **111**. An X-shaped rib **118D** is formed on the bottom wall **118B**. An annular flange **116** (**Figure 1**) extends radially outwardly from the body **111** and an annular flange **117** (**Figure 1**) extends forwardly from the body **111**.

[029] The base member **110** may be formed of any suitable material. According to some embodiments, the base member **110** is a molded polymeric material. Suitable polymeric materials include polyolefins (*e.g.*, polyethylene, polypropylene and copolymers thereof), acrylonitrile butadiene styrene copolymers (ABS), polybutylene terephthalate, nylon, polycarbonate, polyvinyl chloride and alloys or combinations of the aforementioned polymers or similar engineering polymers.

[030] With reference to **Figures 1-4**, a respective seal member **130** is positioned in each cavity **118**. The seal members **130** are formed of a resilient, pliable, deformable material. According to some embodiments, the seal members **130** are formed of a polymeric material. According to some embodiments, the seal members **130** are formed of an elastomeric material. According to some embodiments, the seal members **130** are formed of a rubber material. According to some embodiments, the seal members **130** are formed of silicone rubber. Other suitable materials may include polyurethane, chlorinated rubber, natural rubber, thermoplastic vulcanates (TPVs) nitrile rubber, ethylene propylene diene terpolymers (EPDM), silicone modified EPDM, fluoroelastomers, polyvinyl

chloride, thermoplastic elastomers (*e.g.*, polyolefins, polyesters or others), styrenic block copolymers and ethylene acrylic elastomers. The material of the seal members **130** may be self-lubricating.

[031] According to some embodiments, the material of the seal members **130** has a durometer no harder than 70 Shore A. According to some embodiments, the seal members **130** are formed of material having a durometer no harder than 30 Shore A. According to some embodiments, the durometer is between about 30 and 10 Shore A. According to some embodiments, the durometer is between about 25 and 15 Shore A.

[032] The seal members **130** may be of unitary construction as illustrated. As illustrated, the seal members **130** are substantially identical and one will be described hereinafter, it being appreciated that the description that follows applies equally to the remaining seal members **130**. However, according to further embodiments, the seal members **130** may differ from one another in material and/or configuration.

[033] Referring now to **Figures 3 and 4**, the seal member **130** has a first side **132**, an opposing rear side **134**, and a cylindrical outer surface **136**. Four spaced apart passages or channels **140** extend axially through the seal member **130** along a longitudinal axis **A-A** from the front side **132** to the rear side **134** and are defined by respective inner wall surfaces **142**. A central hole **138** also extends axially through the seal member **130** and has countersinks **138A** on either end. The channels **140** and the central hole **138** are laterally spaced apart. X-shaped grooves **139** are defined in the front surface **132** and in the rear surface **134**. The X-shaped groove **139** on the rear side **134** receives the X-shaped rib **118D** and the channels **140** align with respective ones of the openings **118A**.

[034] The outer diameter **D3** (**Figure 6**) of the seal member **130** is less than the inner diameter **D5** (**Figure 6**) of the corresponding cavity **118**. According to some embodiments, the outer diameter **D3** is between about 0.10 and 0.14 inch less than the inner diameter **D5**.

[035] The channels **140** may be substantially identical or different. Referring to **Figure 4**, each inner wall surface **142** includes a plurality of annular baffles or ribs **144** and a plurality of annular voids or troughs **146** alternatingly and serially arranged along the longitudinal axis **A-A** of the channel **140**. Thus, as shown in **Figure 4**, the inner wall surface **142** presents an undulating surface when viewed in cross-sectional profile. According to some embodiments, the profile is generally sinusoidal. According to some

embodiments, the ribs **144** and the troughs **146** are substantially mirror images of one another as illustrated.

[036] According to some embodiments, the pitch **P** (**Figure 4**) between the ribs **144** is at least about 0.15 inch. According to some embodiments, the pitch **P** is between about 0.15 and 0.30 inch.

[037] According to some embodiments, the depth **H** (**Figure 4**) of each trough **146** (which is also the height of each rib **144**) is at least about 0.05 inch. According to some embodiments, the depth **H** is between about 0.05 inch and 0.15 inch.

[038] According to some embodiments, the inner diameter **D1** (**Figure 4**) of each rib **144** is at least about 0.25 inch. According to some embodiments, the diameter **D1** of each rib **144** is between about 0.25 and 0.285 inch. According to some embodiments, the diameter **D1** of each rib **144** is less than the diameter **D4** (**Figure 7**) of the smallest cable (or other elongate object) in the prescribed range of cables for which the channel **130** is intended. In addition and in accordance with some embodiments, the diameter **D2** (**Figure 4**) of the trough **146** is larger than the diameter **D4** of the largest cable (or other elongate object) in the prescribed range of cables. According to some embodiments, the diameter **D1** is between about 0.010 and 0.020 inch smaller than the diameter **D4** of the smallest cable and the diameter **D2** is between about 0.03 and 0.05 inch larger than the diameter **D4** of the largest cable.

[039] According to some embodiments, the length **L1** (**Figure 4**) of each channel **140** is at least about 0.7 inch. According to some embodiments, the length **L1** of each passage **140** is between about 0.7 and 1.5 inch.

[040] Each of the sealing subassemblies **101** includes a loading mechanism **160** associated with the corresponding cavity **118** and seal member **130**. Each loading mechanism **160** includes a pressure plate or member **150**, a bolt **162** and a nut **164**.

[041] As shown in **Figure 6**, the bolt **162** is mounted in the base member **110** such that a head **162A** of the bolt **162** is fixedly embedded in the corresponding bottom wall **118B** and a threaded shank **162B** of the bolt **162** extends up into the cavity **118** and through and beyond the center passage **138** of the seal member **130**. The bolt head **162A** may be inserted with rotation restraint, press-fitted or insert molded, for example, into the base member **110**.

[042] The pressure member **150** (**Figure 5**) has a front side **152** and a rear side **154**. Spaced apart holes **156** and a center hole **157** extend axially through the pressure member **150**. An annular flange **158** extends rearwardly from the rear side **154** and an X-shaped rib **159** extends rearwardly from the rear side **154**. The pressure member **150** is mounted on the front side **132** of the seal member **130** such that the rear side **154** contacts the front side **132**, the X-shaped rib **159** is received in the X-shaped groove **139**, the flange **158** is received in the adjacent countersink **138**, the openings **156** align with respective ones of the channels **140**, and the shank **162B** extends up through the center hole **157**. The channels **140** and the openings **118A**, **156** are thus axially aligned to provide respective cable entry ports.

[043] The nut **164** is internally threaded and threadedly engages the shank **162B**. The diameter of the nut **164** is oversized relative to the diameter of the hole **157** such that the nut **164** can abut and apply an axially compressive load to the front side **152** of the pressure member **150**.

[044] The bolt **162** and the nut **164** may be formed of any suitable material. According to some embodiments, the bolt **162** and the nut **164** are formed of a metal such as steel. The pressure member **150** may be formed of any suitable material. According to some embodiments, the pressure member **150** is formed of a rigid polymeric material. According to some embodiments, the pressure member **150** is formed of stainless steel, aluminum, polymeric materials or glass reinforced polymeric materials such as poly (oxymethylene), polyvinylchloride, polypropylene, nylon, or polybutylene terephthalate. The pressure member **150** may be formed of a molded material.

[045] According to some embodiments, the diameters of the openings **118A** and **156** are substantially the same as or larger than the diameter **D2** (**Figure 4**) of the troughs **146** of the corresponding channels **140**.

[046] With reference to **Figures 1, 2** and **6**, the enclosure assembly **50** may include an upper, domed-shaped housing **52** mountable on the base member **110** to define an internal chamber **54**. A support **58** is mounted on the base member **110** and extends up into the chamber **54** when the enclosure assembly **50** is assembled. A bracket **57** extends through and forwardly from the base member **110** for mounting the enclosure assembly **50** on a utility box or the like and/or for connecting to electrical ground. A connector block **58A** or the like may be mounted on the support **58** for splicing or grounding wires fed into

the chamber **54** through the base member **110**. The connector block **58A** may include a wiring stub (not shown) that extends through the opening **120** and is sealed therewith by any suitable means. A clamp **56** is provided to secure the housing **52** to the base member **110**. An O-ring **53** (**Figure 6**) is provided between the housing **52** and the base member **110** (e.g., in a groove in the flange **116**) to form a seal between the housing **52** and the base member **110**.

[047] As noted above, the enclosure assembly **50** and the sealing assembly **100** may be used with any suitable elongate object, and are particularly contemplated for use with cables such as the cable **10** illustrated (**Figure 6**), which is merely exemplary. The cable **10** may be of any suitable type or configuration. For example, the cable **10** may include a plurality of conductors **12** in a jacket **14**. The outer surface of the jacket **14** serves as the outer surface of the cable **10**. The conductors **12** may be, for example, insulated copper twisted pair wires, optical fibers, a coaxial wire or wires, etc.. Alternatively, the cable may be a single insulated or uninsulated wire. The cable **10** may be a communications or power transmission cable, for example. The cable **10** has a nominal diameter **D4**.

[048] The enclosure assembly **50** may be used and assembled in the following manner. The enclosure assembly **50** may be mounted in a pressurized or non-pressurized cabinet, for example. Generally, one or more cables **10** are inserted through the base member **110** as discussed in more detail below. The inserted ends of the cables **10** are connected to a connector block or otherwise terminated or addressed, and the cover **52** is mounted on the base member **110**. The clamp **56** is applied about the cover **52** to secure the cover **52** to the base member **110**.

[049] **Figure 6** shows a representative sealing member **100** prior to installation of a cable **10**. The cable **10** is inserted along the axis **A-A** through a channel **140** of the seal member **130** of the sealing assembly **100**, the aligned pressure member opening **156** and the aligned base member opening **118A** as shown in **Figure 7**. Because the diameter **D4** of the cable **10** is greater than the diameter **D1** of the ribs **144** and the seal member **130** is relatively soft and deformable, the cable **10** contacts the ribs **144** and elastically deforms the seal member **130** into a partly compressed seal member **130A**. The ribs **144** are deformed to partially fill the adjacent troughs **146** and the outer diameter of the seal member **130** may be expanded. The cable contact and the seal member deformation may

serve to form a sealing engagement or contact between the outer surface **14A** of the cable **10** and to retain the cable **10** in place during the subsequent loading operation and/or insertion of additional cables (or other elongate objects) into the seal member **130**.

[050] According to some embodiments, the seal member **130** is not loaded by the loading mechanism **160** while the cable **10** is being inserted. Alternatively, the seal member **130** may be partially axially compressed by the loading mechanism **160** while the cable **10** is being inserted.

[051] Once the cable **10** is in place, the user can rotate the nut **164** to axially displace or push the pressure member **150** toward the bottom wall **118B** as shown in **Figure 8**, thereby applying an axially compressive load to the seal member **130A** which is interposed or sandwiched therebetween. In this manner, the seal member **130A** is further deformed such that the outer surface **136** expands laterally or radially outwardly into sealing engagement with the side wall **118C** and the inner surface **142** deforms inwardly to seal about outer surface of the cable **10**, thereby forming a seal member **130B** that is further axially compressed. In this manner, the sealing member **130** is axially compressed and laterally expanded to exert a sealing pressure around the cable **10**. The total sealing pressure exerted may include the sealing pressure attributable to the oversized cable diameter (as discussed above) as well as the supplemental sealing pressure caused by the axial compression of the seal member **130**. The amount of loading of the seal member **130** and thereby the cable **10** by the loading mechanism **160** can be selectively adjusted by operation of the nut **164**. The engagements between the X-shaped ribs **118D**, **159** and the grooves **139** may serve as a limiting or anchoring mechanism to prevent or inhibit rotation of the seal member **130** and the pressure member **150** relative to one another and the base member **110**.

[052] One or more additional cables **10** may be inserted through the other channels **140** of the seal member **130** before tightening the loading mechanism **160**. When the nut **164** is rotated, each of the channels **140** will simultaneously contract to form a seal about the respective cable **10**.

[053] The channels **140** that are not used to receive cables may be plugged with plug rods, stoppers or the like, which may form seals with the seal member **130** in the same manner as with a cable. Additionally or alternatively, the seal member **130** may

include an integral wall, skin, or other feature that extends across each channel **140** to seal the channel **140** until the wall, etc., is cut or pierced.

[054] According to some embodiments, the loading mechanism **160** is adapted to provide a load on the seal member **130** of at least about 40 pounds. According to some embodiments, the loading mechanism **160** is adapted to provide a load of between about 40 and 80 pounds. According to some embodiments, the loading mechanism **160** is adapted to axially compress the seal member **130** to a length **L2** (**Figure 8**) that is less than 90% of the seal member's relaxed length **L1** (**Figure 4**) and, according to some embodiments, less than 60%.

[055] The threaded arrangement of the bolt **162** and nut **164** may allow for a continuous range of adjustment of the compressive load within a prescribed range. A positive stop may be provided to limit the adjustment of the loading mechanism **160**. For example, the shank **162B** may be only partly threaded.

[056] The sealing assembly **100** may provide a number of advantages. Because the seal member **130** can be subsequently compressed, the channels **140** can be formed of large enough diameter to allow for relatively easy insertion of the cables **10**. Cable insertion may also be facilitated by the self-lubricating material of the seal member **130**.

[057] A good seal can be formed about each cable **10** and between the seal member **130** and the base member **110** for an extended range of cable sizes. The quality of the seal can be made substantially consistent without regard for the size of the cable (within the prescribed range). The loading mechanism **160** allows for the seal member **130** to be customized to fit the cable **10**. It is not necessary to mount a bushing, spacer or the like on the cable **10** in order to properly fit the diameter of the cable to the channel **140**. Cables of different sizes can be mounted in respective channels **140** of the seal member **130**.

[058] The security of the seal provided between the cable **10** and the seal member **130** can be augmented by the supplemental sealing pressure induced by the loading mechanism **160**. Accordingly, an improved seal can be provided to withstand greater pressures (*e.g.*, water level).

[059] The pressure applied to the cable **10** can be selectively set so that a good seal is provided, but the cable **10** is not overloaded or overcompressed. Such overloading may damage the cable **10**, particularly in the case of optical fibers.

[060] Cables can be inserted, removed, and re-inserted (the same or a different cable) into the channels 140. The loading mechanism 160 can be loosened to facilitate removal and re-insertion. Once re-inserted, the loading mechanism can be used to form an improved seal about the cable as described above.

[061] With reference to **Figure 9**, a sealing assembly 200 according to further embodiments of the present invention is shown therein. The sealing assembly 200 differs from the sealing assembly 100 only in the further provision of a biasing member 270. The biasing member 270 may be a spring. According to some embodiments, the biasing member 270 is a coil spring mounted around the bolt shank 262B between the lower end of the nut 264 and the front side of the pressure member 250.

[062] When the loading mechanism 260 of the sealing assembly 200 is in the compressing position as shown in **Figure 9**, the biasing member 270 will continue to apply an axial load to the pressure member 250 and thereby to the seal member 230B. In this way, the biasing member 270 may serve to compensate for any relaxation, contraction, etc., in the sealing assembly 200 or the cable 10.

[063] Other types of biasing members may be used. For example, the biasing member may include a Belleville washer, an elastomeric spring member, or a movable containment structure (*e.g.*, a bladder) filled with a compressible gas.

[064] With reference to **Figure 10**, a sealing assembly 300 according to further embodiments of the present invention is shown therein. The sealing assembly 300 differs from the sealing assembly 100 in that the base member 110 is replaced with a reduced base 310. The sealing assembly 300 may be placed in an opening of a duct (*e.g.*, a tube), box or the like and used to seal about a cable or other elongate object as described above, and also to form a seal between the sealing assembly 300 and the opening of the structure. More particularly, as the loading mechanism 360 is operated to axially compress the seal member 330, the outer surface 336 of the seal member 330 will bulge radially or laterally outwardly to form a seal with the opening of the receiving structure. A head projection 314 is formed on the base 310 for engaging a tool.

[065] With reference to **Figure 11**, a sealing assembly 400 according to further embodiments of the present invention is shown therein in an exploded view. The sealing assembly 400 may be formed in the same manner as the sealing assembly 300 except that axially extending slits 433 are formed in the sealing member 430, radially opening side

edge slots **413** are formed in the base member **410**, and radially opening side edge slots **453** are formed in the pressure member **450**. Each slit **433** extends radially through the seal member (including the inner wall surface **442**) to the channel **440**.

[066] When the sealing assembly **400** is assembled, a cable **10** can be placed in a selected one of the channels **440** by pushing or inserting the cable **10** in a laterally or radially inward direction **E** as indicated in **Figure 11** through the chosen slit **433** and the associated slots **413**, **453**. The cable **10** is inserted laterally until the cable **10** seats in the channel **440** and the portions **431** on either side of the slit **433** close fully or partially about the cable **10**. The insertion of the cable **10** in the channel **440** through the slit **433** can be facilitated by lifting one or both of the portions **431** out of the way to allow lateral insertion of the cable. Once the cable **10** is seated in the channel **440**, the sealing assembly **430** can be compressed in the same manner as discussed above. The slits **433** and slots **413**, **453** may be advantageously employed when it is not practicable or desirable to insert an end of the cable **10** axially through a channel **440**.

[067] While a cable **10** has been described above for the purposes of illustration, it will be appreciated that other elongate articles or objects may be sealed as well. For example, the sealing assemblies **100** may be used to form seals about mini tubes.

[068] Various modifications may be made to the devices and methods described above. For example, the base member **110** may include more or fewer sealing subassemblies **101**. Each sealing subassembly **101** may be provided with more or fewer passages to receive more or fewer cables or other elongate objects. The shapes of the passages **140** may be changed to complement cables or other elongate objects of other cross-sectional shapes (*e.g.*, square, oval, etc.).

[069] Other arrangements of threaded members may be employed to selectively displace the pressure member **150**. For example, the bolt **162** may be replaced with an integrally and unitarily molded post. The bolt **162** may be replaced with a nut and the nut **164** with a threaded bolt. Other mechanisms, including non-threaded mechanisms, may be used to adjustably load the pressure member **150**.

[070] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing

from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the invention.

That which is claimed is:

1. A sealing assembly for forming a seal about an elongate object, the sealing assembly comprising:
 - a resilient seal member including an inner wall surface defining a channel to receive the elongate object, the inner wall surface including at least one annular rib extending into the channel to engage the elongate object; and
 - a loading mechanism adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.
2. The sealing mechanism of Claim 1 wherein the inner wall surface includes a plurality of annular ribs extending into the channel to engage the elongate object, the annular ribs being arranged in series along an axis of the channel and defining at least one trough therebetween.
3. The sealing assembly of Claim 1 wherein:
 - the channel extends axially; and
 - the loading mechanism is adapted to selectively axially compress the seal member such that the inner wall surface is expanded radially inwardly.
4. The sealing assembly of Claim 1 wherein the seal member is formed of an elastomeric material.
5. The sealing assembly of Claim 4 wherein the seal member is formed of silicone rubber.
6. The sealing assembly of Claim 1 wherein the seal member is formed of a material having a durometer of no harder than about 30 Shore A.
7. The sealing assembly of Claim 6 wherein the seal member is formed of a material having a durometer of between about 30 and 10 Shore A.

8. The sealing assembly of Claim 1 wherein:
 - the seal member includes a second inner wall surface defining a second channel to receive a second elongate object, the second inner wall surface including at least one second annular rib extending into the second channel to engage the second elongate object; and
 - when the loading mechanism applies the compressive load to the seal member, the second inner wall surface is expanded inwardly to exert a sealing pressure on the second elongate object.
9. The sealing assembly of Claim 1 wherein the loading mechanism includes a pressure member that contacts the seal member and is displaceable to apply the compressive load to the seal member.
10. The sealing assembly of Claim 9 wherein an opening is defined in the pressure member and is configured to receive the elongate object therethrough.
11. The sealing assembly of Claim 9 wherein the loading mechanism further includes at least one threaded member that is rotatable to axially displace the pressure member to apply the compressive load to the seal member.
12. The sealing assembly of Claim 11 wherein the at least one threaded member includes a nut and a threaded shank.
13. The sealing assembly of Claim 9 including a base member, wherein the seal member is interposed between the pressure member and the base member such that, when the loading mechanism applies the compressive load to the seal member, the seal member is compressed between the pressure member and the base member.
14. The sealing assembly of Claim 13 wherein:
 - the base member defines a cavity having a side wall; and
 - when the loading mechanism applies the compressive load to the seal member, an outer surface of the seal member expands outwardly to form a seal with the side wall of the base member.

15. The sealing assembly of Claim 13 wherein the seal member includes an outer surface that is exposed between the pressure member and the base member and, when the loading mechanism applies the compressive load to the seal member, the outer surface of the seal member expands outwardly.

16. The sealing assembly of Claim 1 including a biasing mechanism adapted to apply a compressive biasing load to the seal member.

17. The sealing assembly of Claim 1 including a slit formed in the seal member and extending therethrough to permit lateral insertion of the elongate object into the channel.

18. The sealing assembly of Claim 1 including an anchoring mechanism adapted to inhibit rotation of the seal member relative to the loading mechanism as the loading mechanism is adjusted to apply the compressive load to the seal member.

19. An enclosure assembly for use with an elongate object, the enclosure assembly comprising:

a) a sealing assembly for forming a seal about an elongate object, the sealing assembly including:

a resilient seal member including an inner wall surface defining a channel to receive the elongate object, the inner wall surface including at least one annular rib extending into the channel to engage the elongate object; and

a loading mechanism adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object; and

b) a housing member mountable on the sealing assembly to form an enclosed chamber.

20. A method for forming a seal about an elongate object, the method comprising:

inserting the elongate object into a channel of a resilient seal member, the seal member including an inner wall surface defining the channel and including at least one annular rib extending into the channel; and

selectively applying a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

21. The method of Claim 20 wherein inserting the elongate object into the channel of the seal member includes engaging the elongate object with the at least one annular rib such that the at least one annular rib is elastically deformed by the elongate object.

22. The method of Claim 20 wherein the inner wall surface includes a plurality of annular ribs extending into the channel to engage the elongate object, the annular ribs being arranged in series along an axis of the channel and defining at least one trough therebetween.

23. The method of Claim 20 wherein the seal member is formed of an elastomeric material.

24. The method of Claim 23 wherein the seal member is formed of silicone rubber.

25. The method of Claim 20 wherein the seal member is formed of a material having a durometer of no harder than about 30 Shore A.

26. The method of Claim 20 including:

inserting a second elongate object into a second channel of the resilient seal member, the seal member including a second inner wall surface defining the second channel and including at least one second annular rib extending into the second channel; and

wherein selectively applying the compressive load to the seal member also expands the second inner wall surface inwardly to exert a sealing pressure on the

second elongate object.

27. The method of Claim 20 wherein selectively applying the compressive load to the seal member includes displacing a pressure member in contact with the seal member to apply the compressive load to the seal member.

28. The method of Claim 20 including:
placing the seal member in an opening defined in a receiving object;
wherein selectively applying the compressive load to the seal member expands an exposed outer surface of the seal member outwardly to form a seal with the opening of the receiving object.

29. The method of Claim 20 including applying a compressive spring biasing load to the seal member while the elongate object is disposed in the channel.

30. A sealing assembly for forming a seal about an elongate object, the sealing assembly comprising:

a resilient seal member including an inner wall surface defining a channel to receive the elongate object, wherein the seal member is formed of a material having a durometer of no harder than about 30 Shore A; and

a loading mechanism adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object.

31. A sealing assembly for forming a seal about an elongate object, the sealing assembly comprising:

a resilient seal member including an inner wall surface defining a channel to receive the elongate object, wherein the seal member is formed of silicone rubber; and

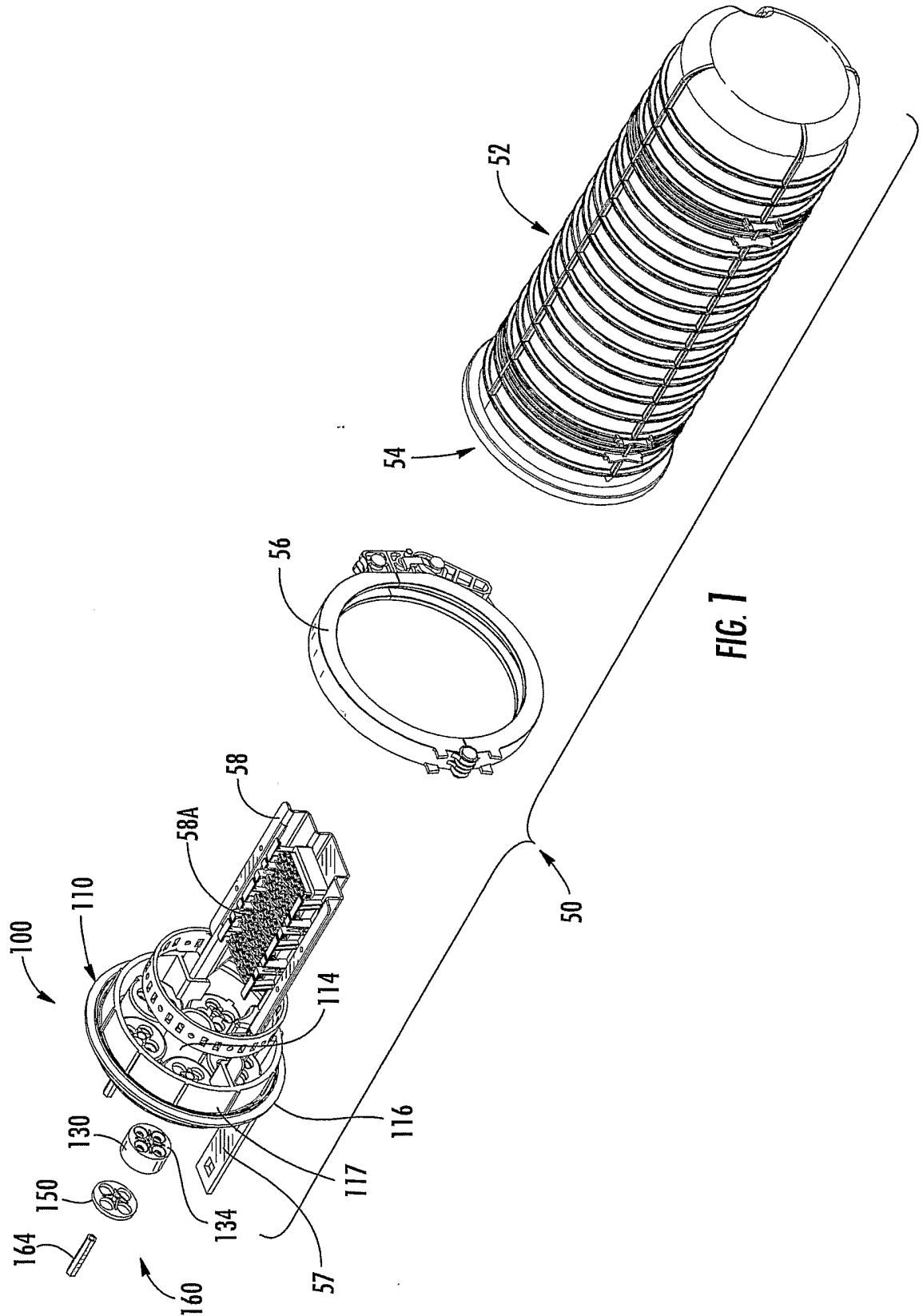
a loading mechanism adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object, the loading mechanism including a biasing mechanism adapted to apply a compressive biasing load to the seal member.

32. A sealing assembly for forming a seal about an elongate object, the sealing assembly comprising:

a resilient seal member including an inner wall surface defining a channel to receive the elongate object, wherein the seal member is formed of a material having a durometer of between about 30 and 10 Shore A; and

a loading mechanism adapted to selectively apply a compressive load to the seal member such that the inner wall surface is expanded inwardly to exert a sealing pressure on the elongate object, the loading mechanism including a biasing mechanism adapted to apply a compressive biasing load to the seal member.

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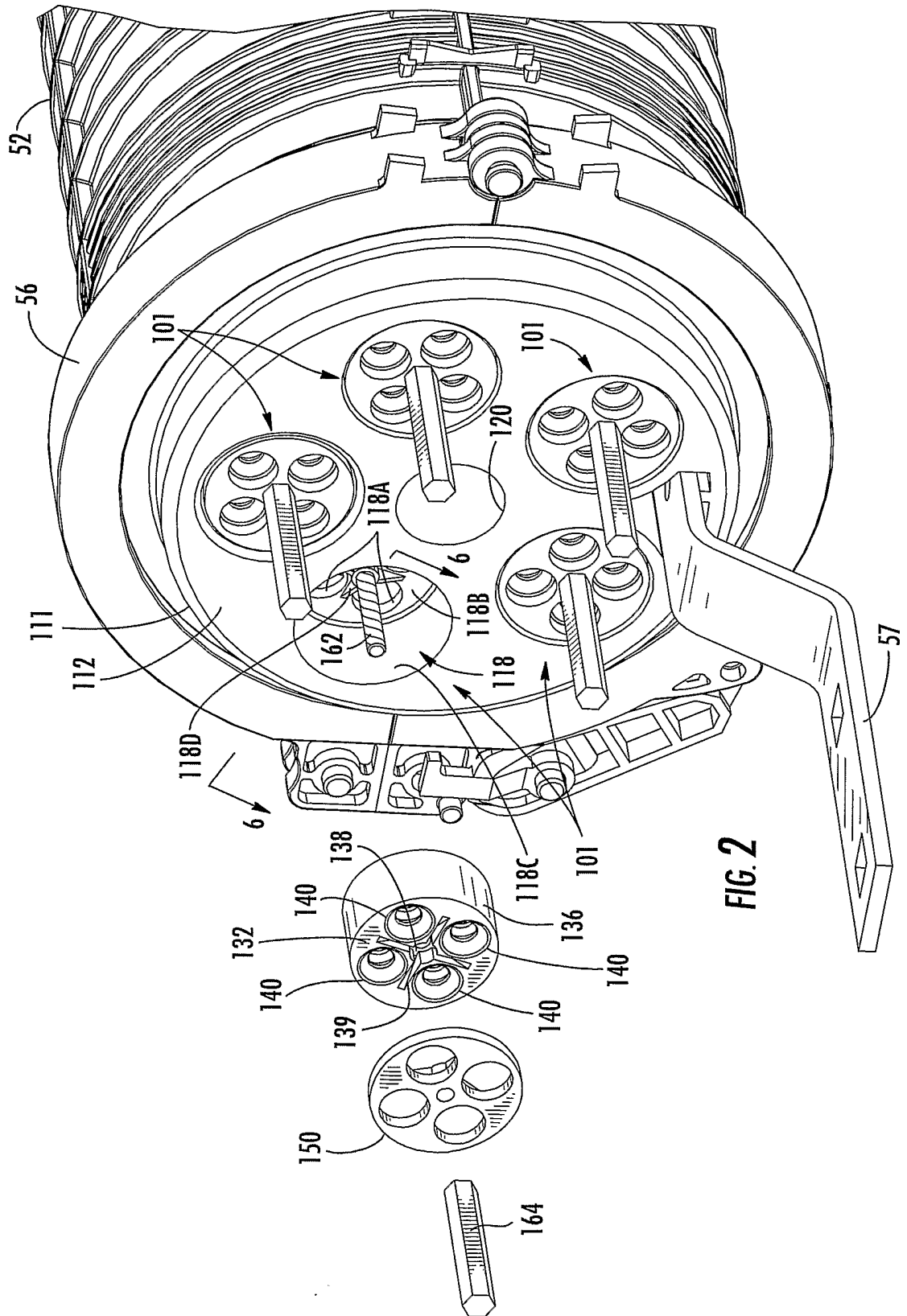


FIG. 2

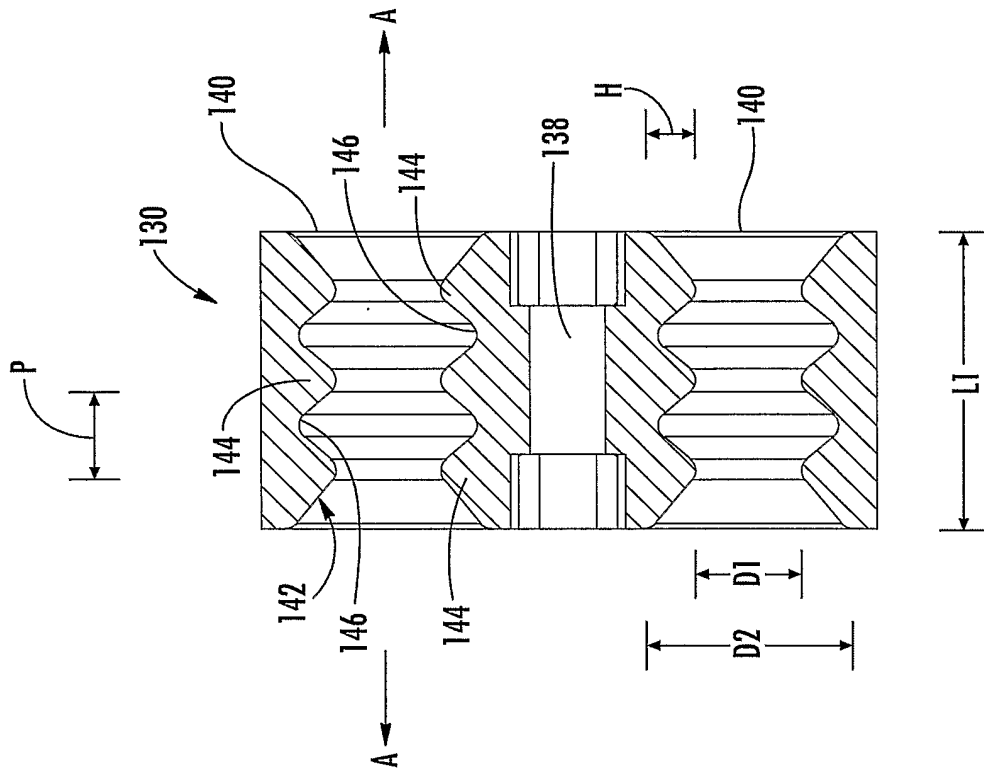


FIG. 4

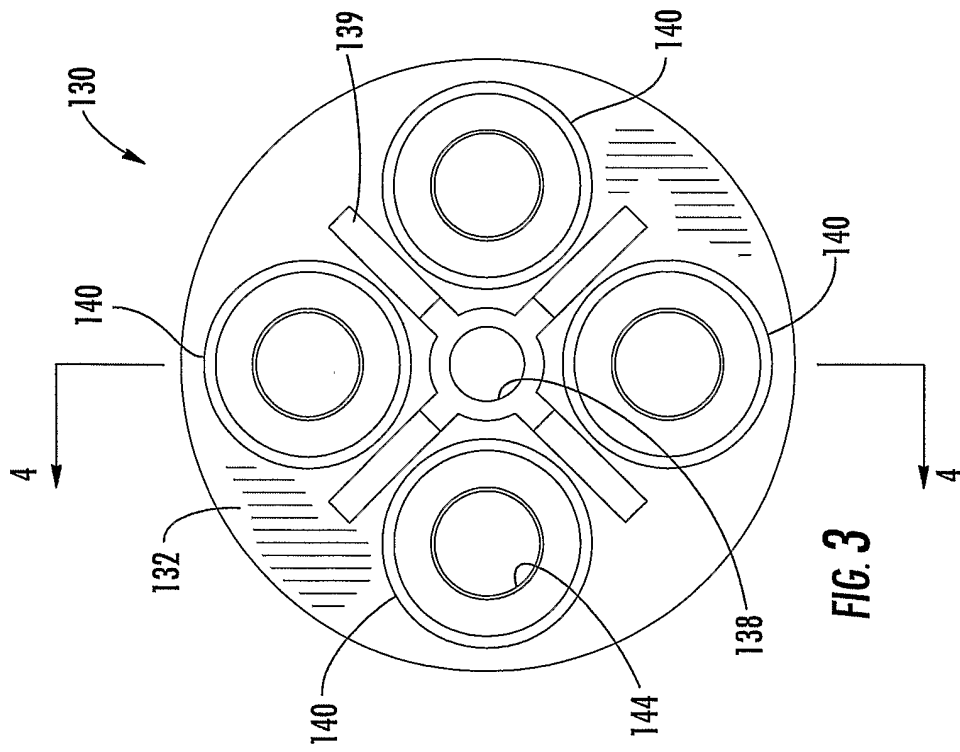
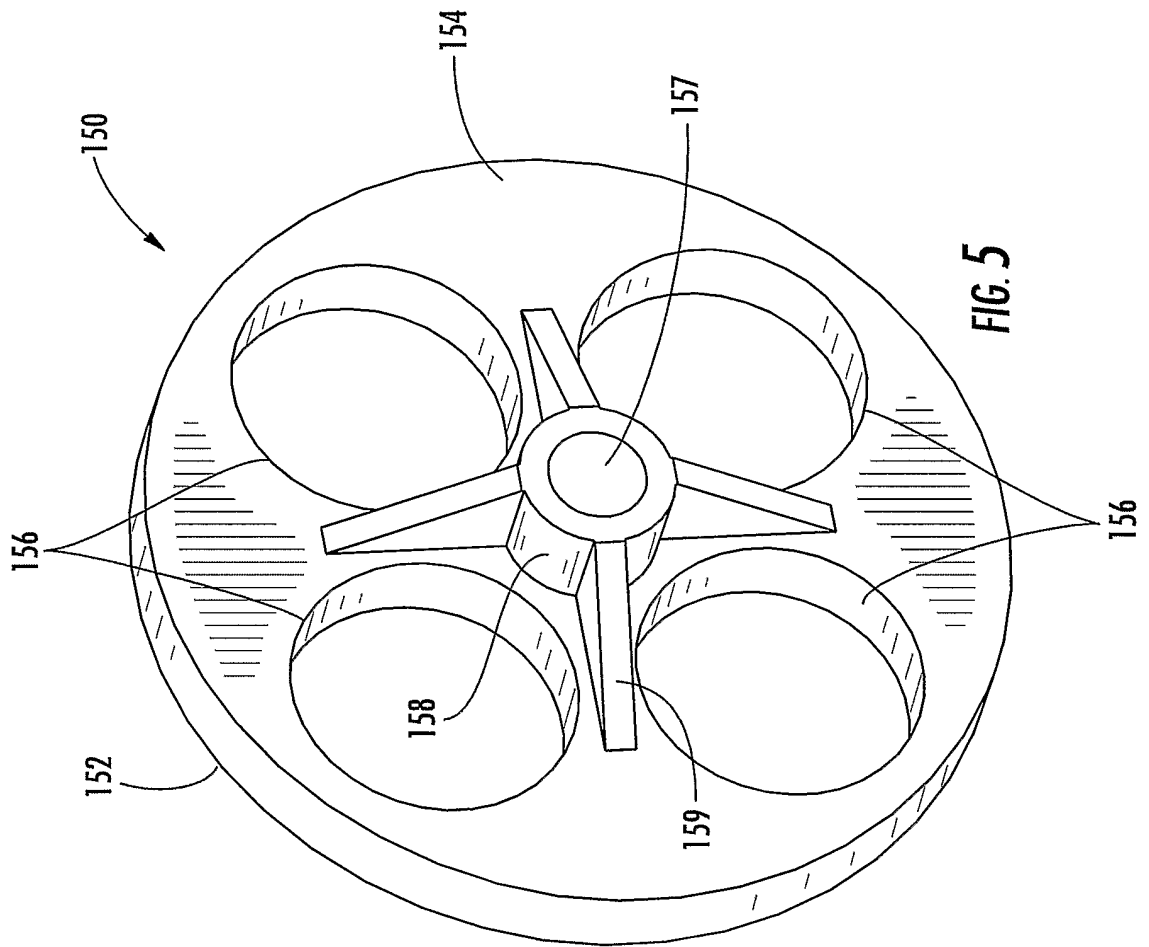
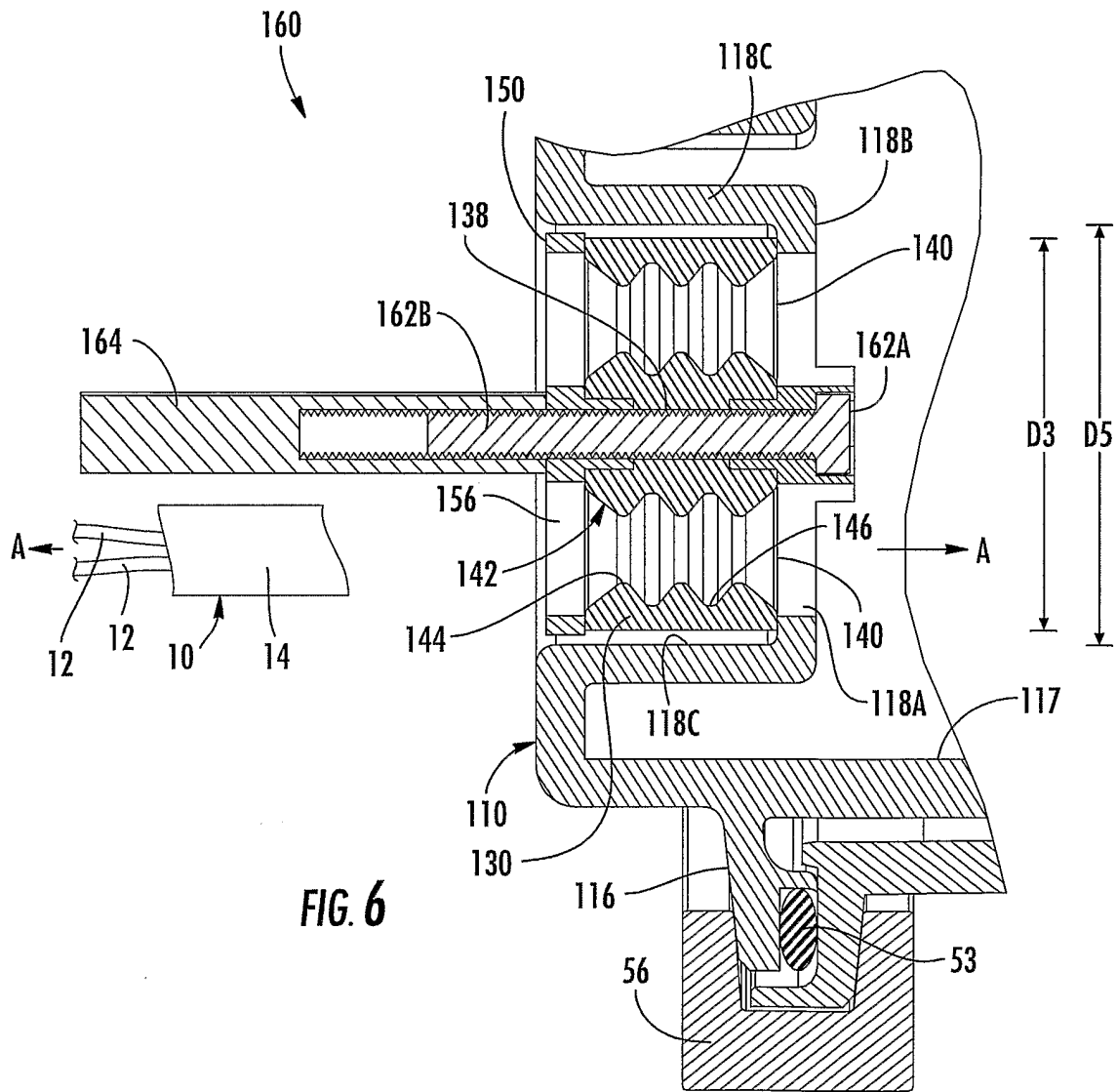


FIG. 3





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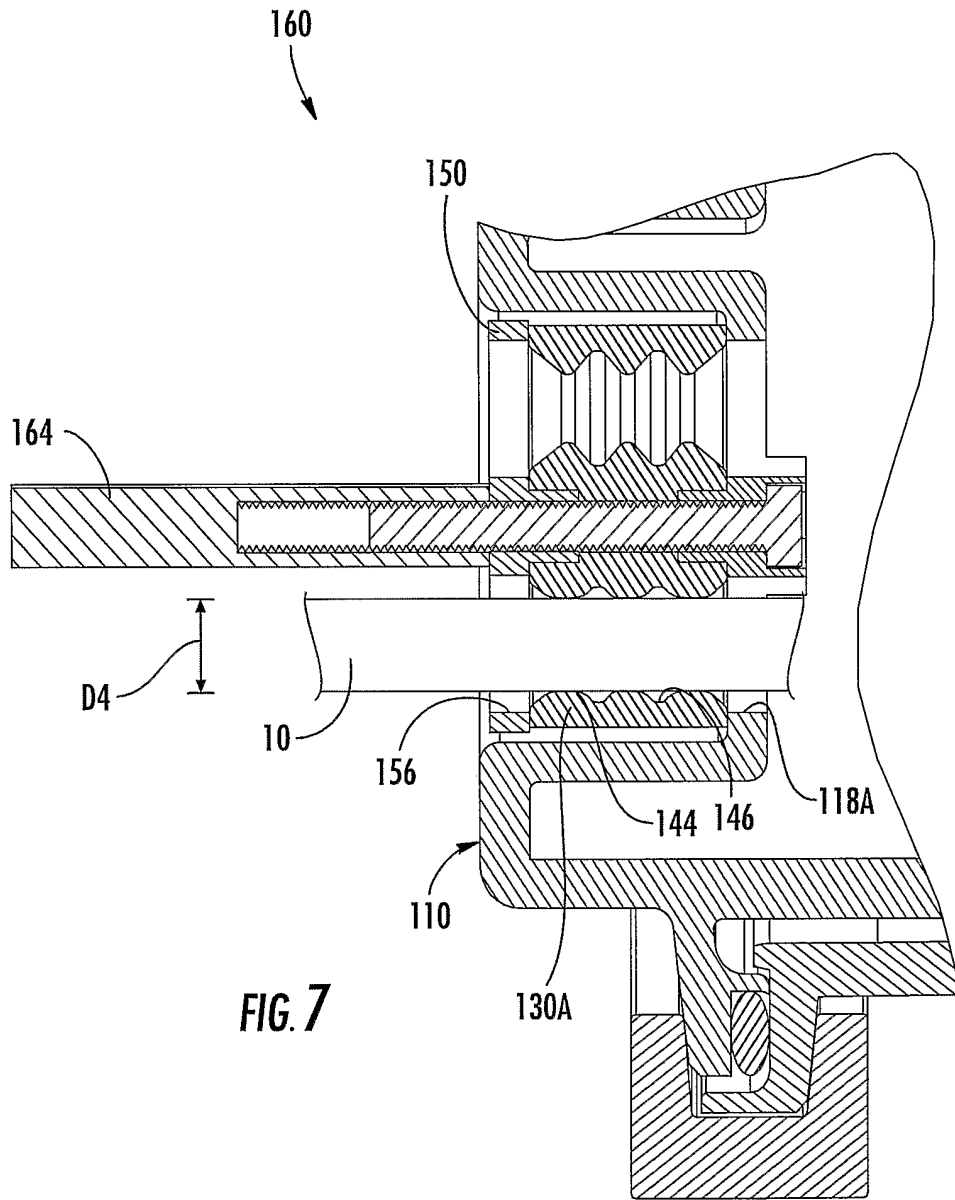
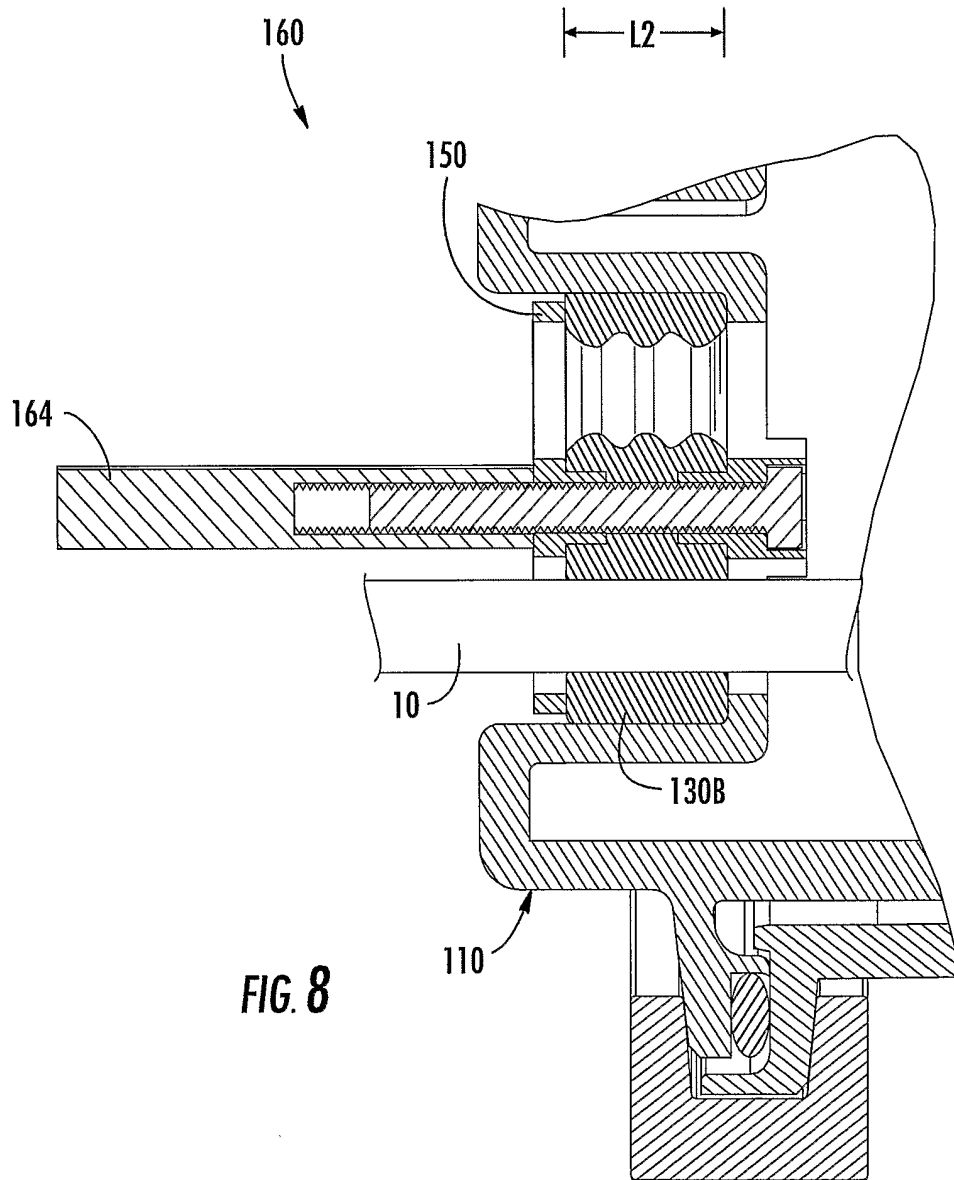
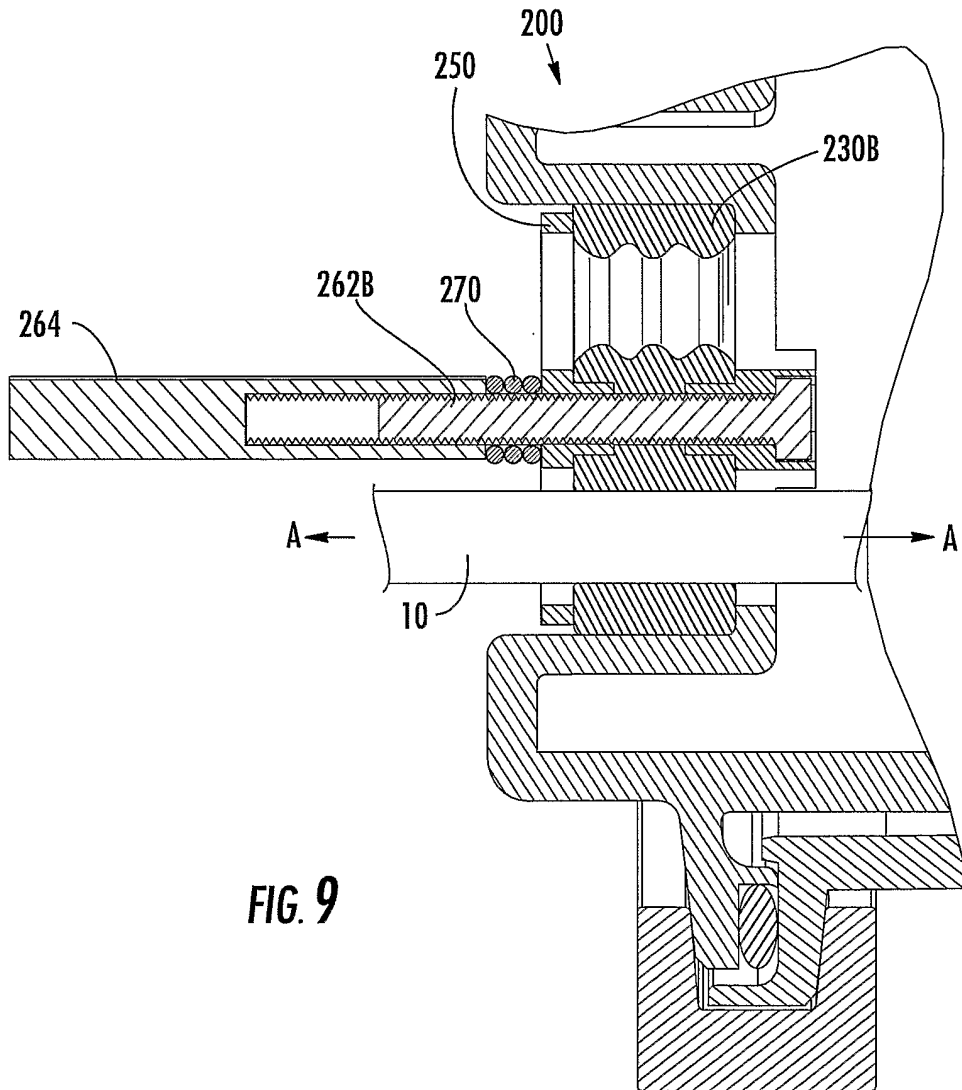
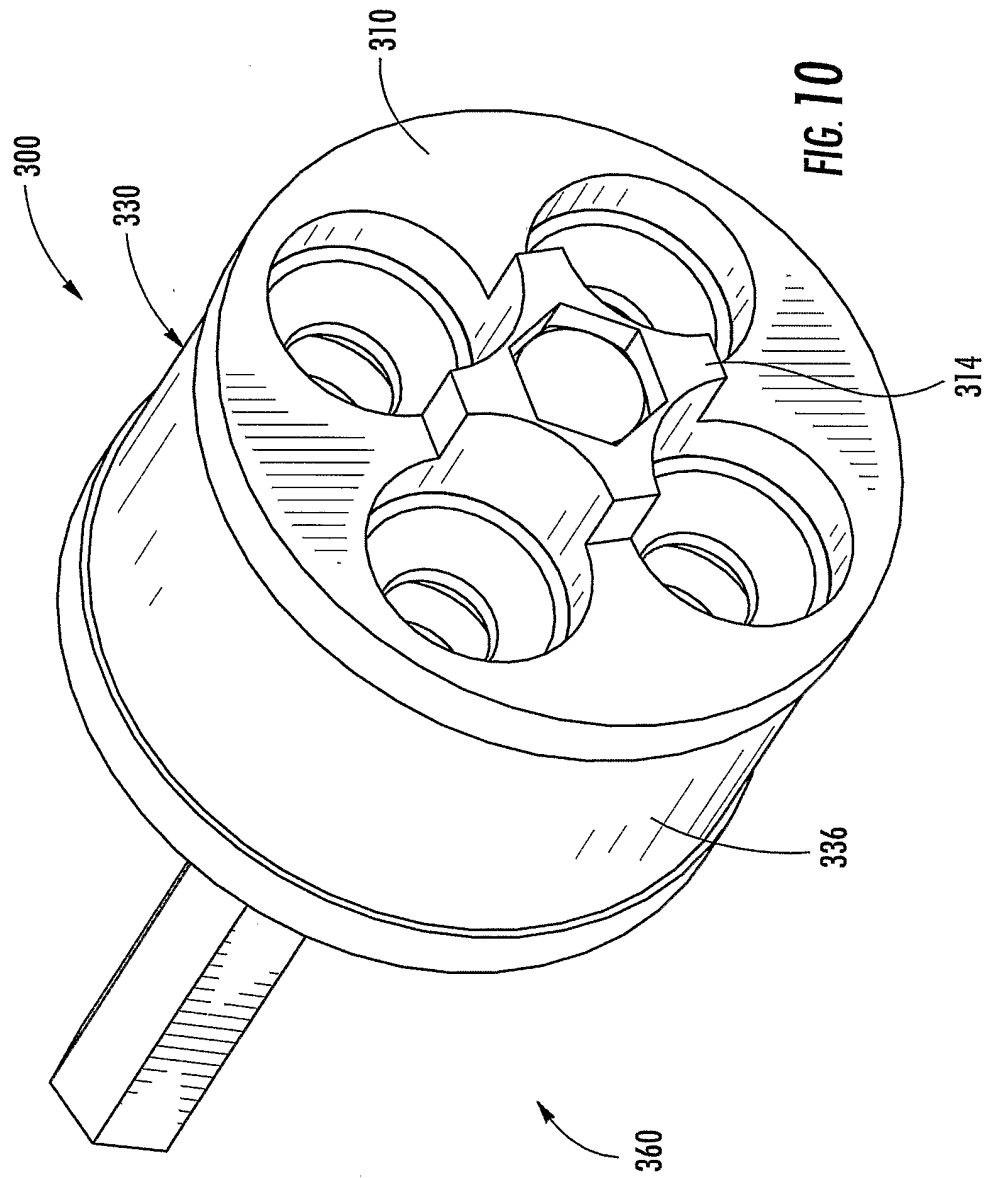


FIG. 7

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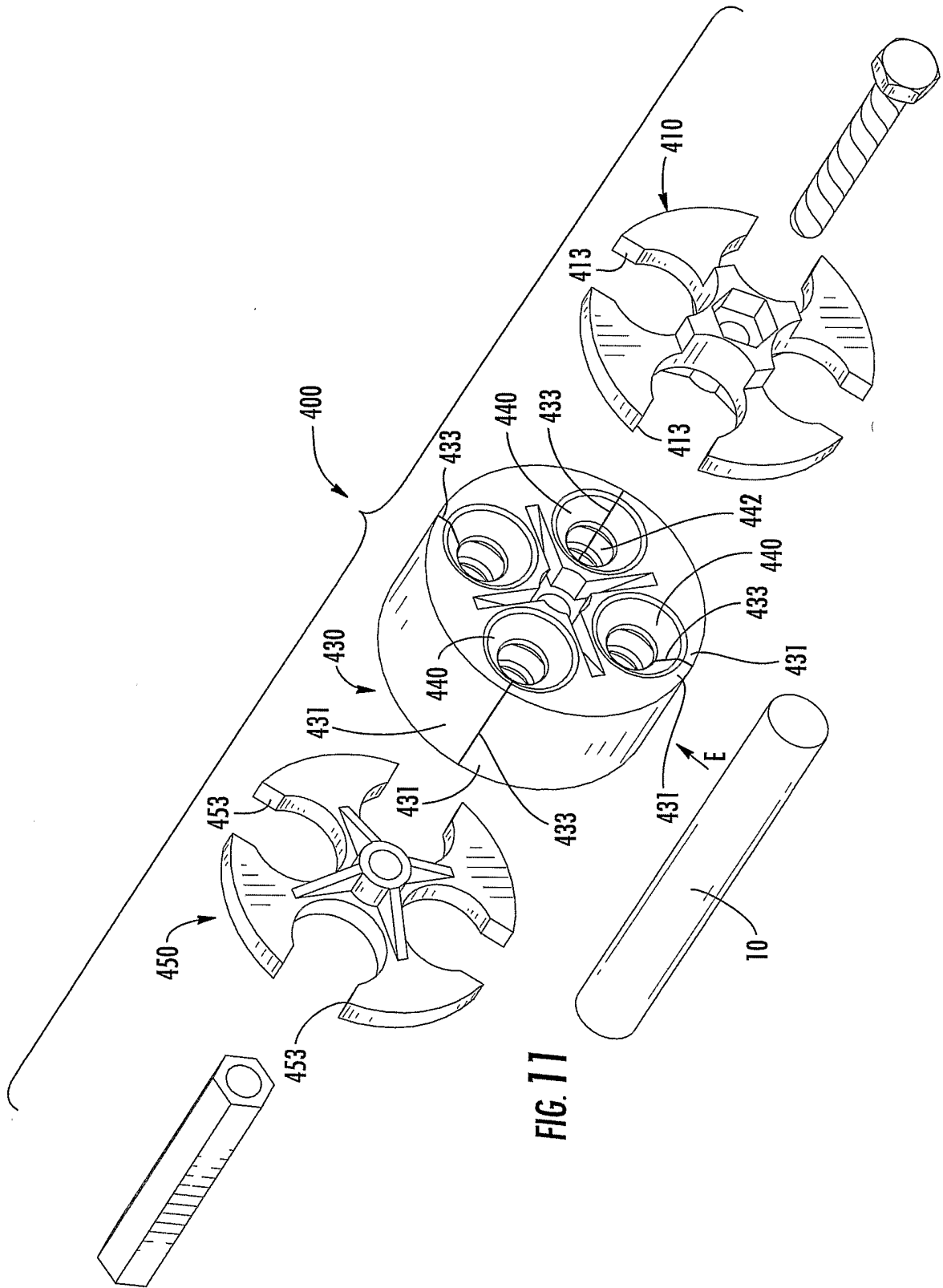


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/012992

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L5/08

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)
F16L H02G

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/080119 A1 (GOLL KEVIN) 29 April 2004 (2004-04-29)	1, 3, 4, 8-15, 19-21, 23, 26-28, 30
Y	paragraph [0032] - paragraph [0046]; figures	5-7, 16, 24, 25, 29, 31, 32
Y	EP 1 195 856 A (TYCO ELECTRONICS AMP K.K.) 10 April 2002 (2002-04-10) paragraph [0011]; figures 1A-1F	5-7, 24, 25
Y	US 5 538 261 A (MURRAY ET AL) 23 July 1996 (1996-07-23) column 3, line 60 - column 4, line 18; figures 2-4	16, 29, 31, 32
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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
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Date of the actual completion of the international search

14 August 2006

Date of mailing of the international search report

24/08/2006

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Mauriès, L

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/012992

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	----- PATENT ABSTRACTS OF JAPAN vol. 015, no. 355 (E-1109), 9 September 1991 (1991-09-09) & JP 03 139113 A (TOSHIBA CORP), 13 June 1991 (1991-06-13) abstract -----	1-3, 8-15, 20-22, 27, 28

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2006/012992

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