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Berkely

(54) **SEAMLESS AIR/WATER DENTAL SYRINGE TIP ADAPTER SYSTEMS AND CONVERSION METHODS**

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(60) Provisional application No. 61/619,578, filed on Apr. 3, 2012.

Publication Classification

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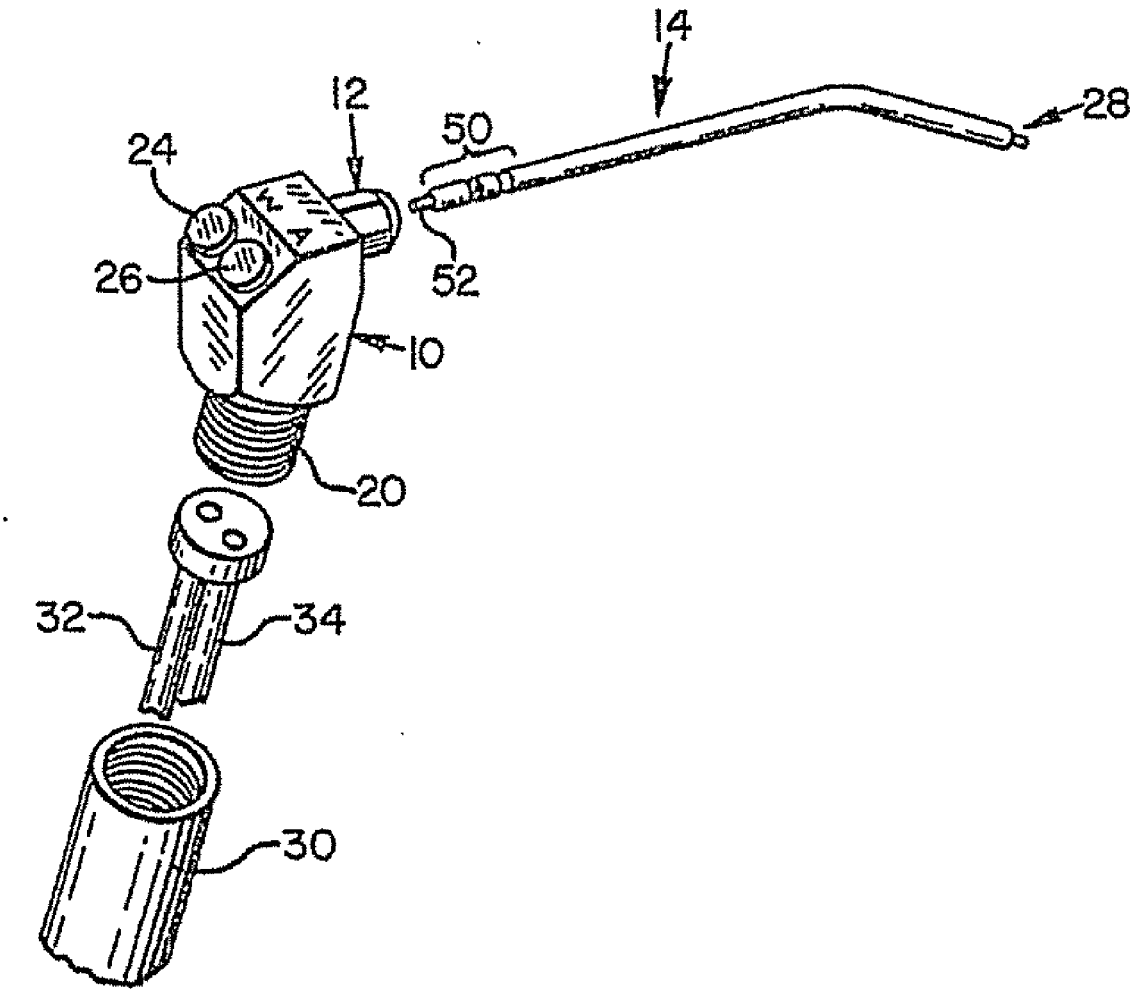
(52) **U.S. Cl.**
CPC *A61C 17/0217* (2013.01)
USPC **433/80**

(57) **ABSTRACT**

Conversion assemblies enable a disposable tip to connect to an existing air/water dental syringe configured to receive a non-disposable tip. A conversion kit enabling an air/water syringe body to receive a disposable tip includes a retainer body having a distal opening into which the proximal end of the elongated disposable tip is inserted, and one or more internal components with cut-outs, grooves or channels to direct air and water from the syringe body to the air-carrying channels and water-carrying tube of the disposable tip. All of the components internal to the retainer are installed through the proximal opening in the retainer, enabling the proximal end of the retainer to be adjacent to the syringe body, such that there are no seams in the outer surface of the retainer from the syringe body to the distal end of the retainer that might collect pathogens or dirt.



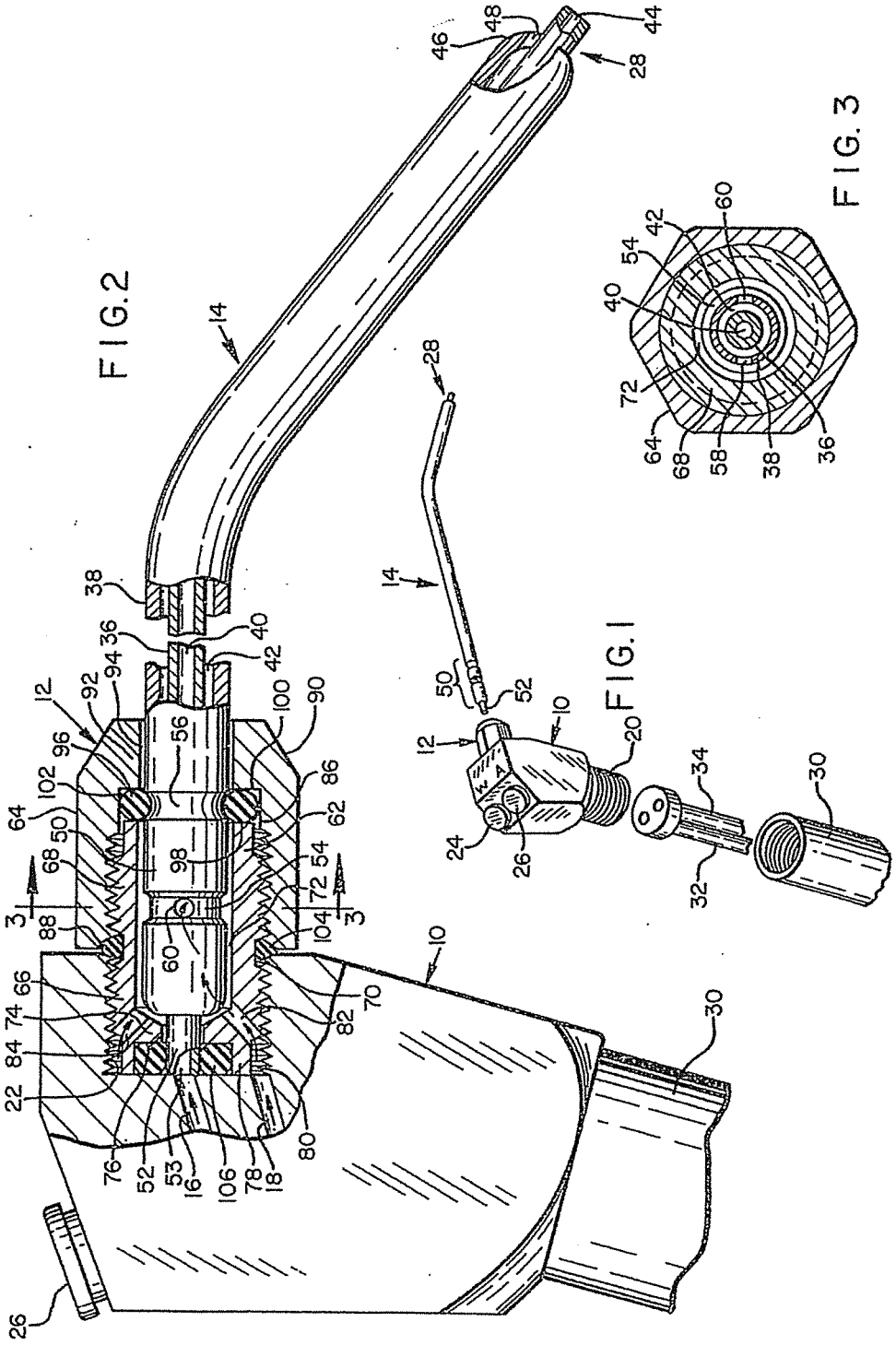


FIG. 2
FIG. 3
FIG. 1

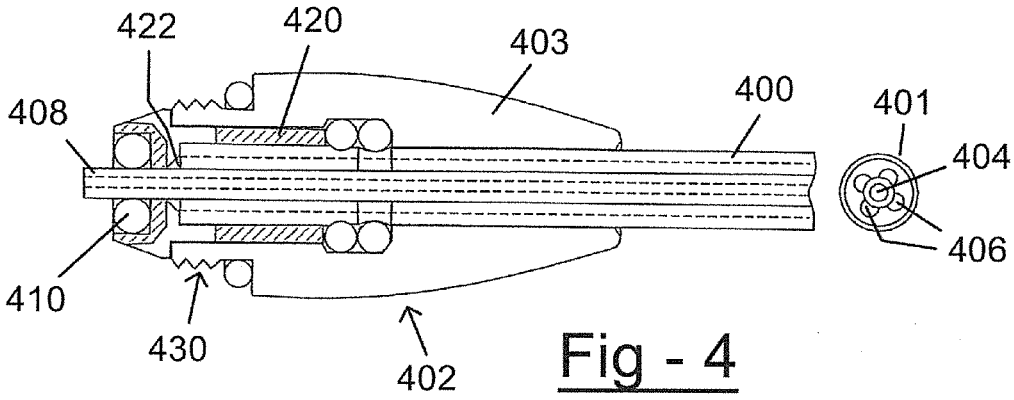


Fig - 4

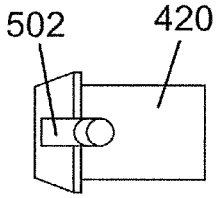


Fig - 5

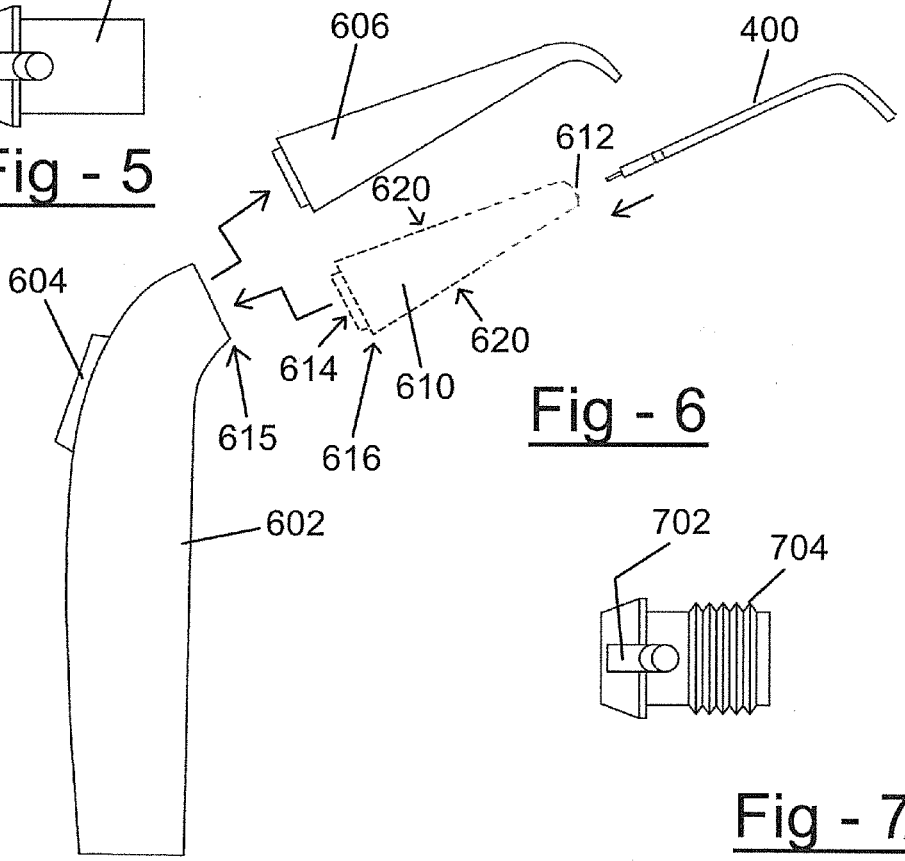


Fig - 6

Fig - 7A

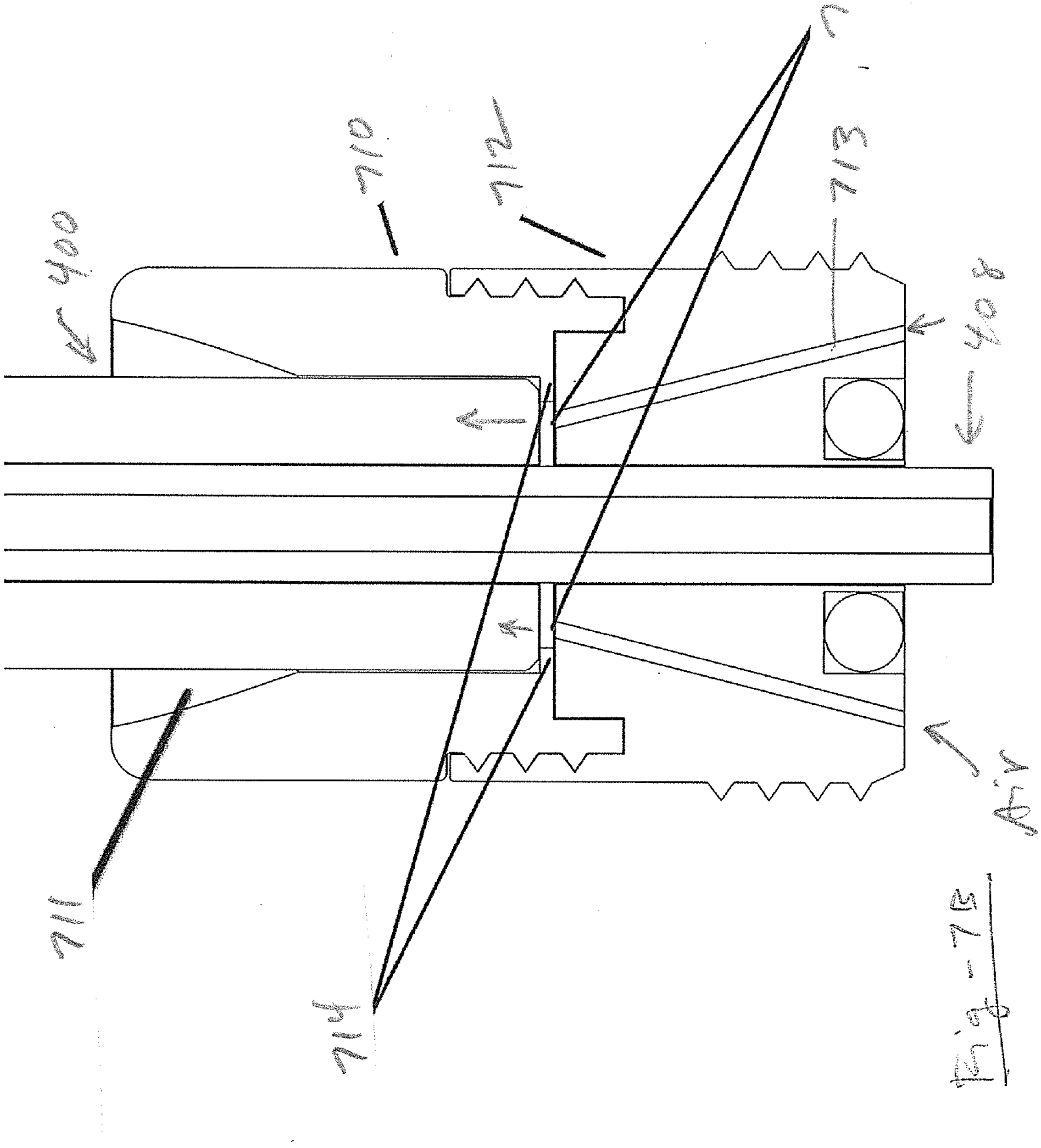


Fig - 7B

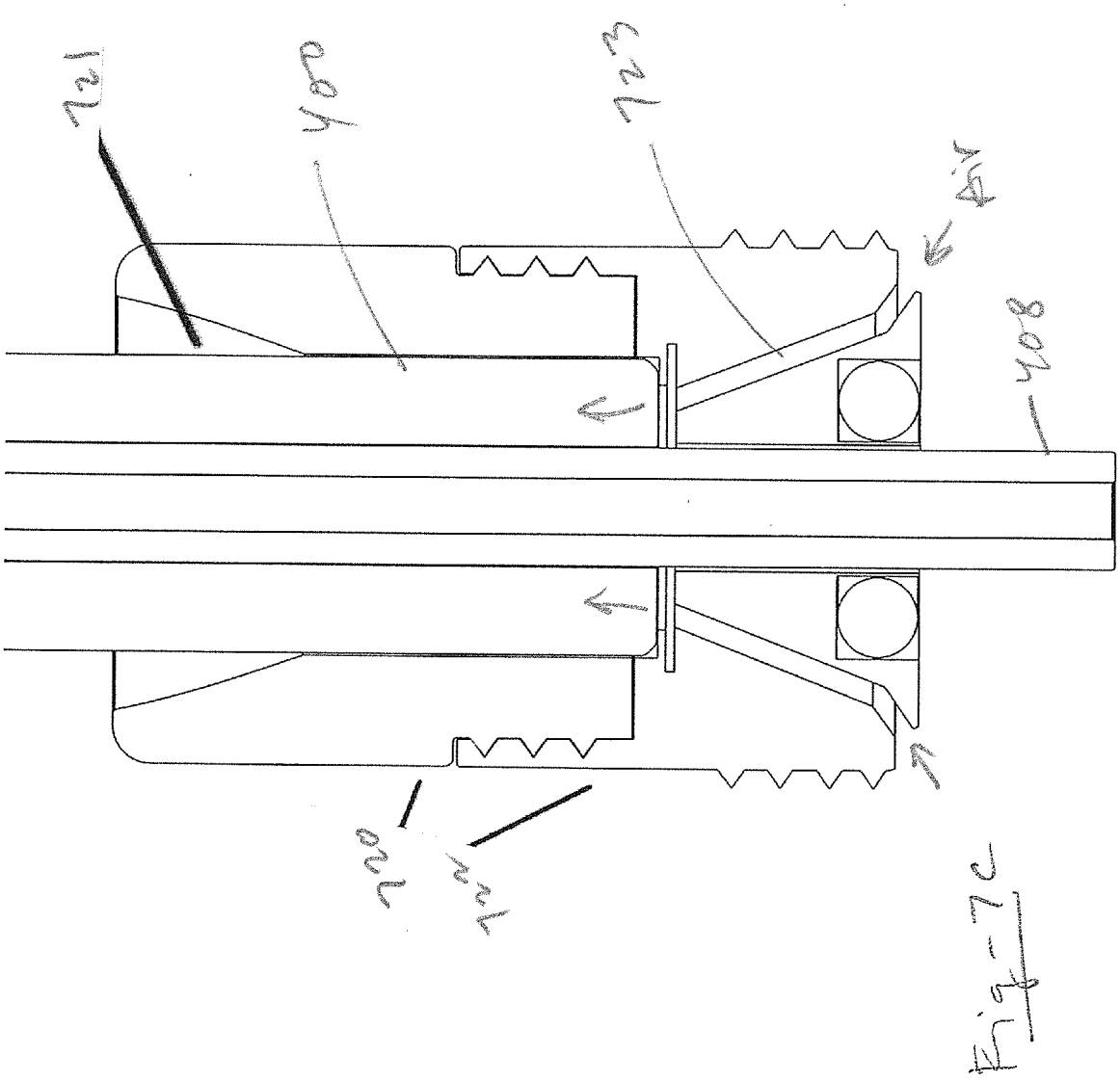


Fig. 7c

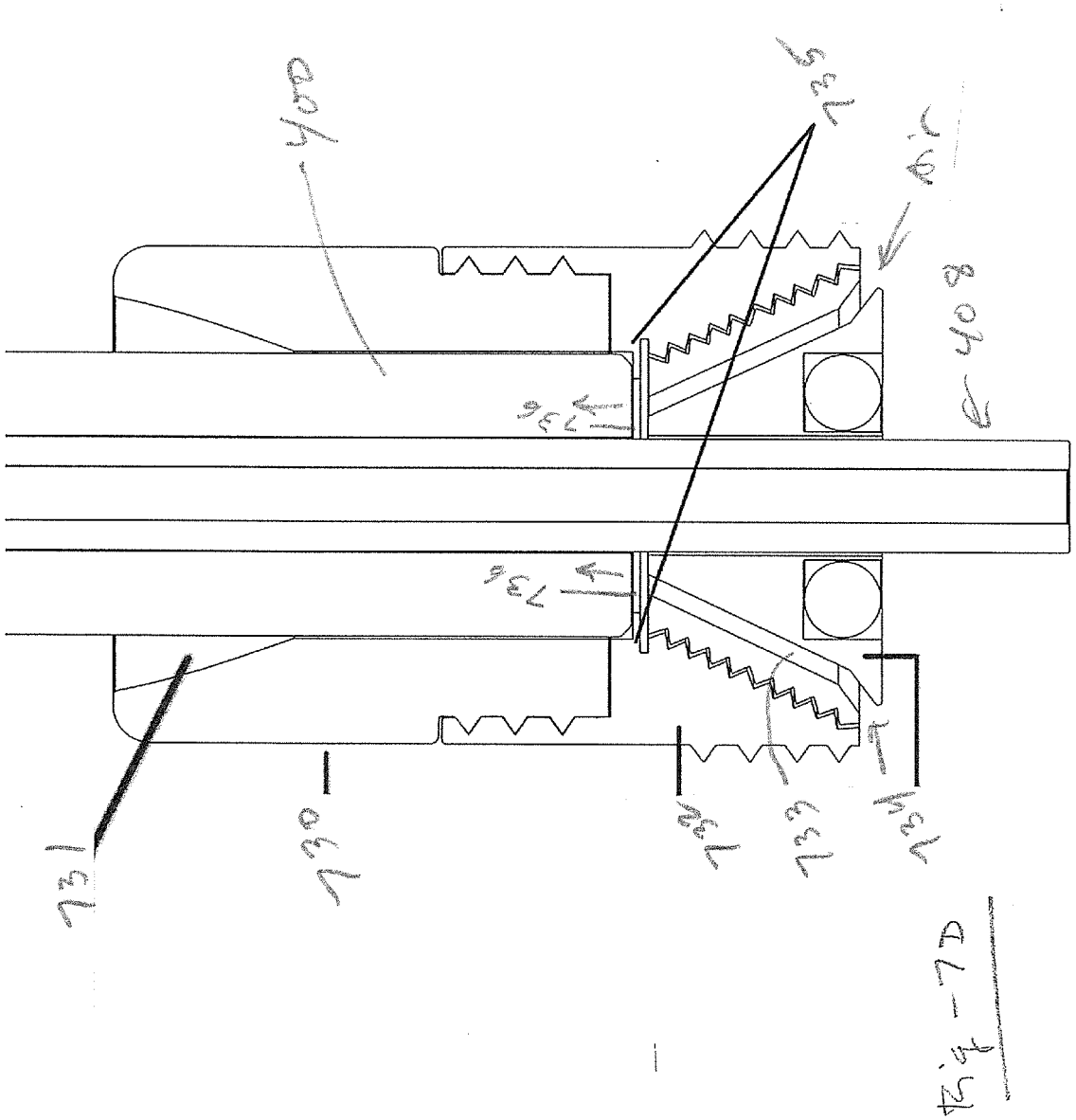


Fig. 7D

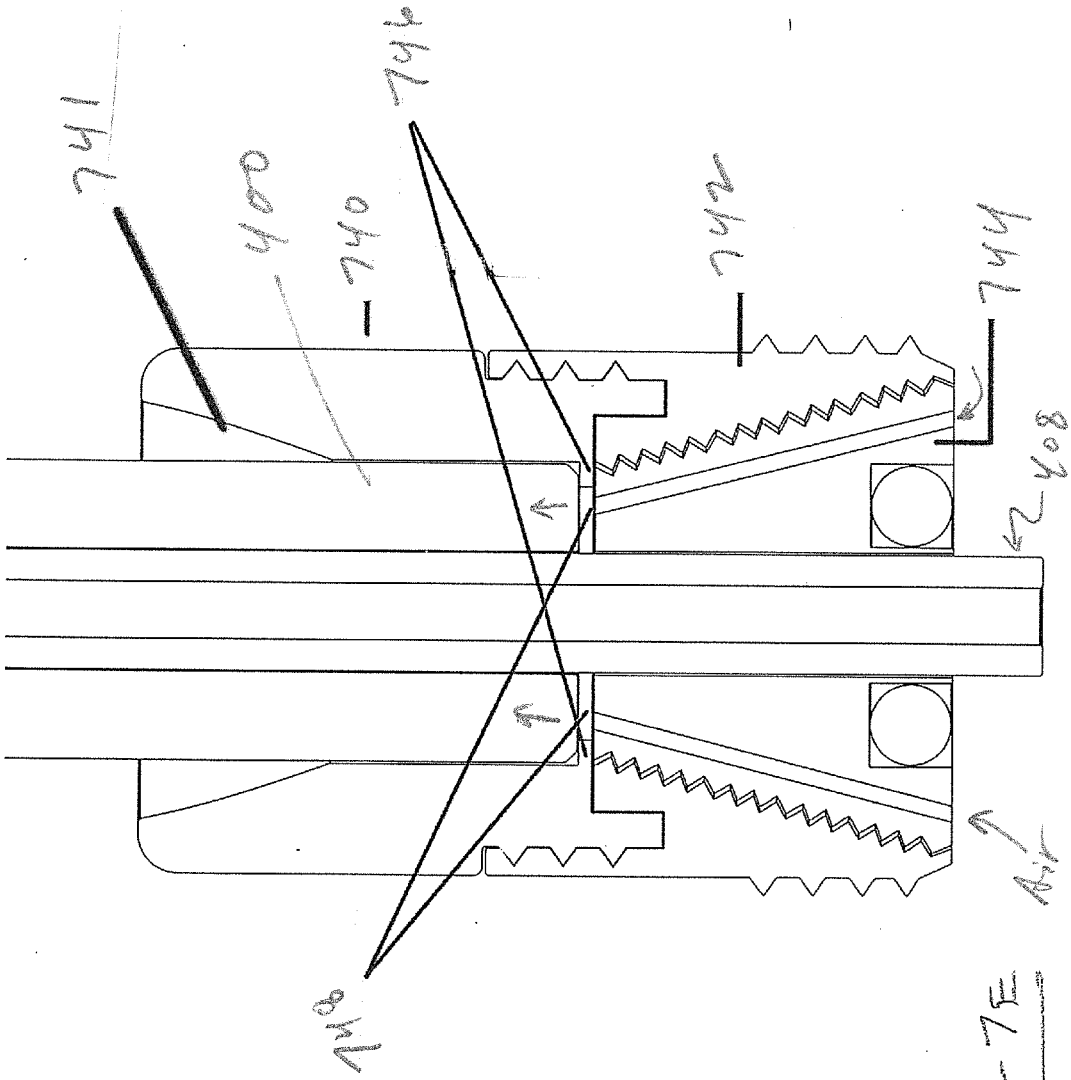


Fig. 7E

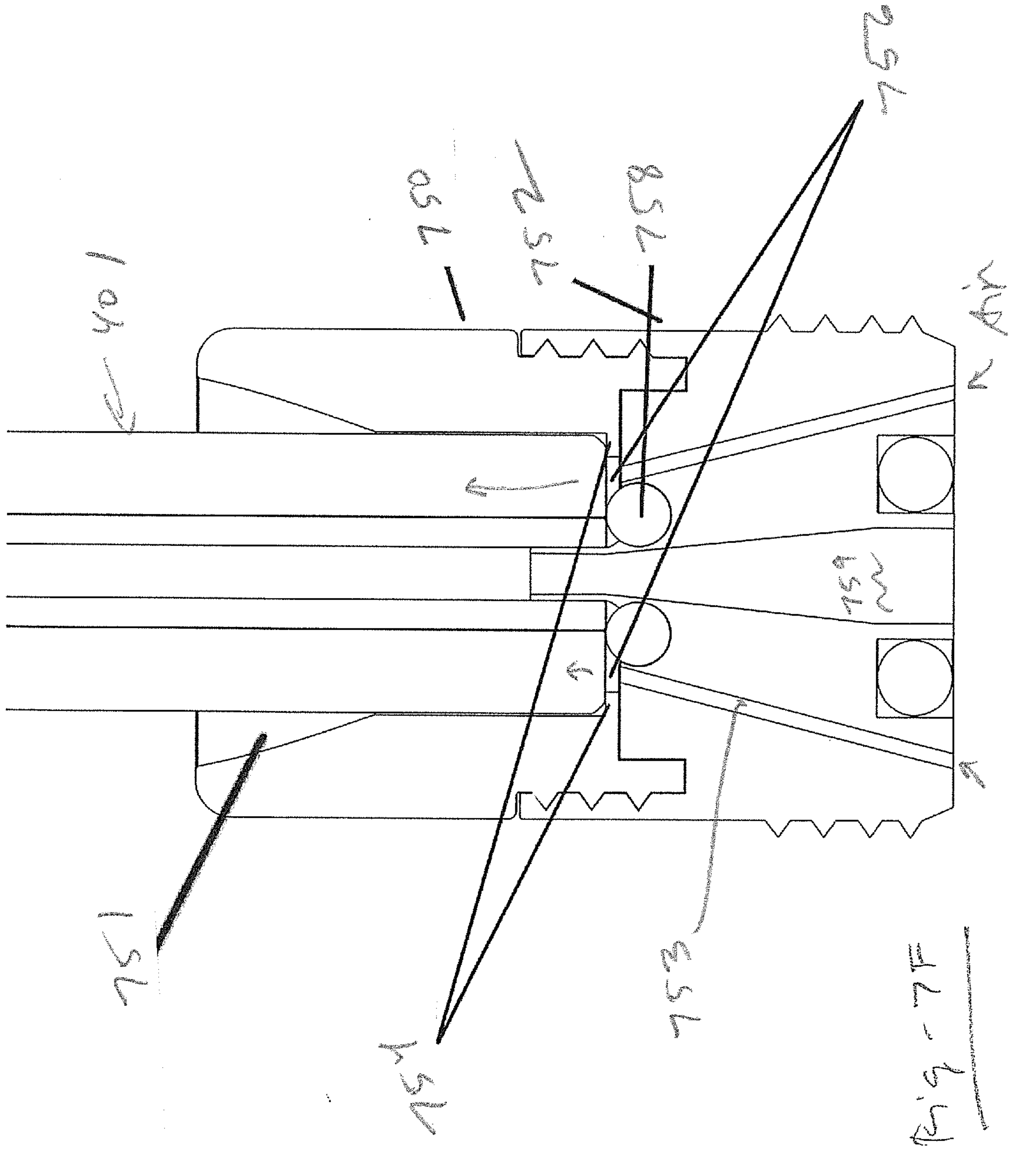


Fig - 7F

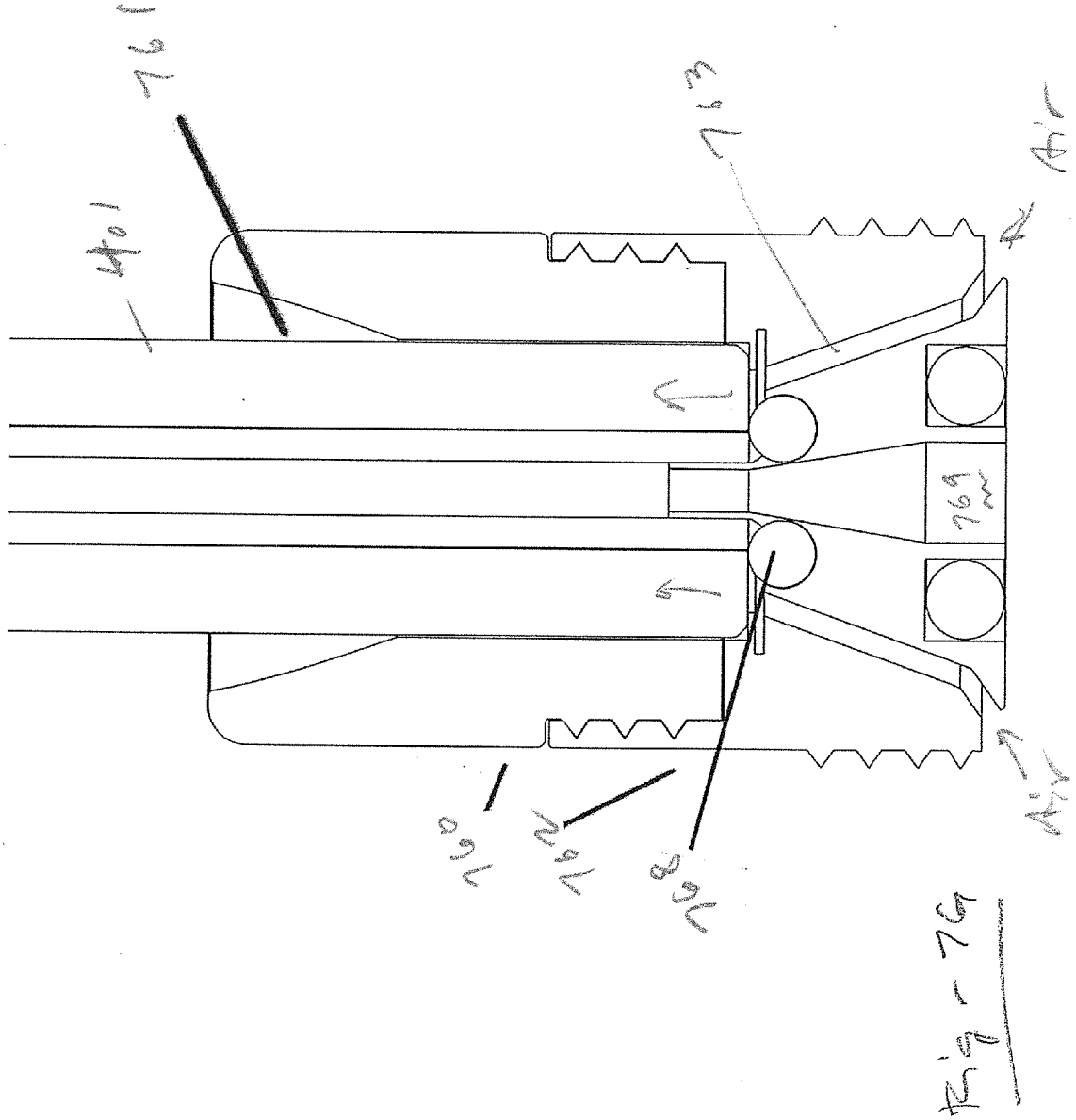


Fig. 7

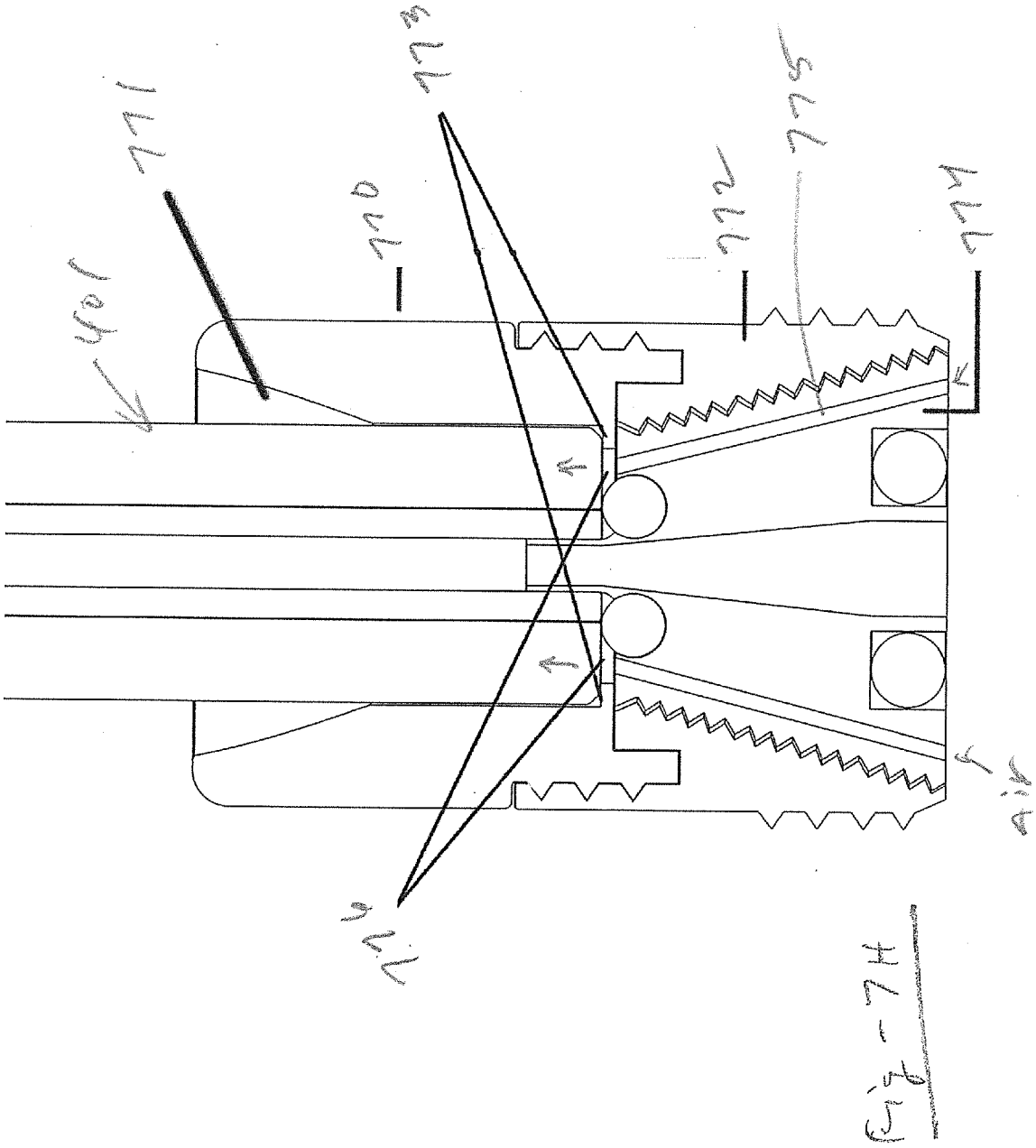


FIG. 7H

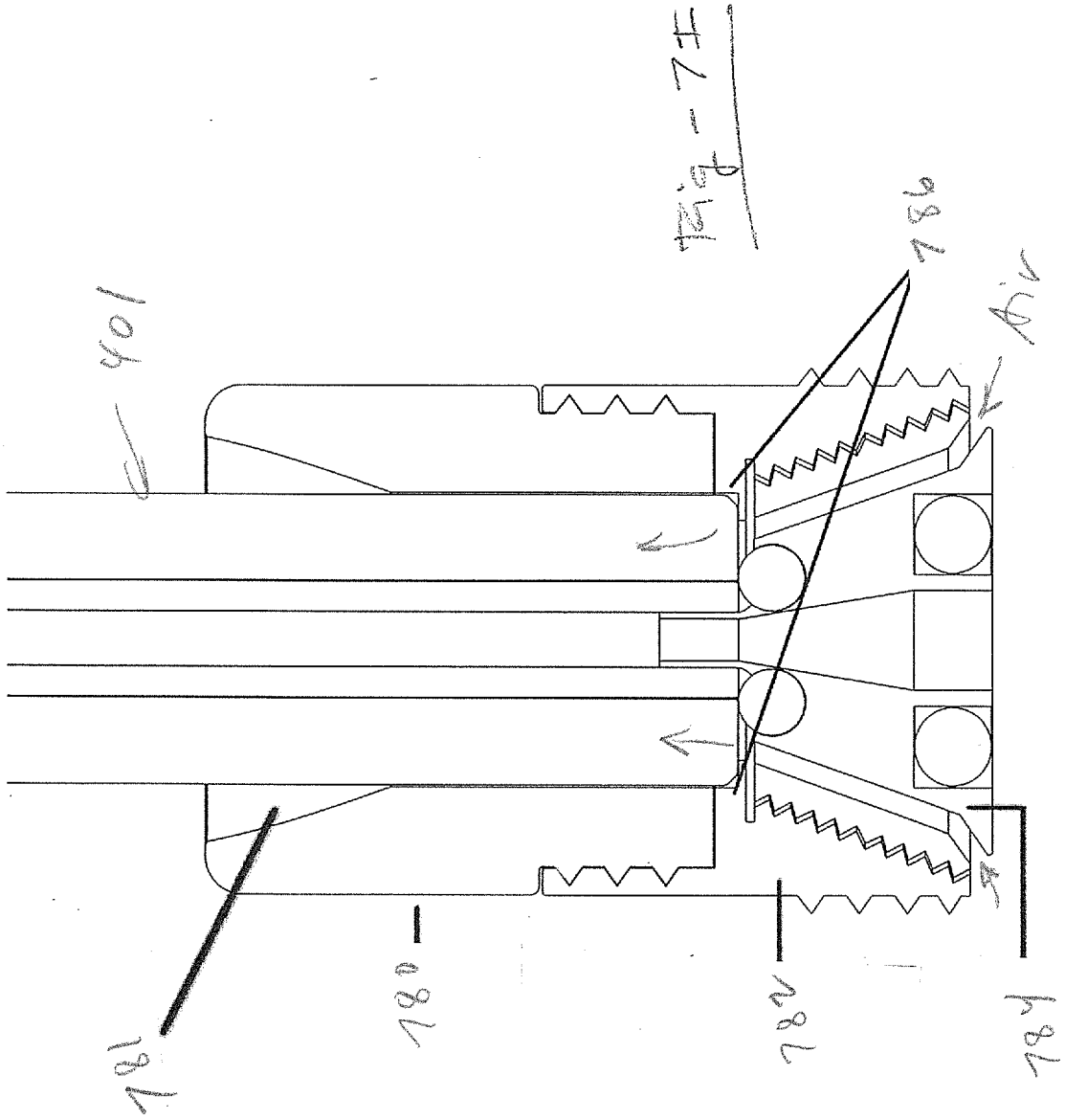


Fig. 7H
130
Air
101
180
182
184
186

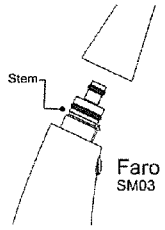


Fig - 8A

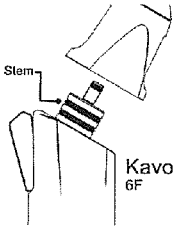


Fig - 8B

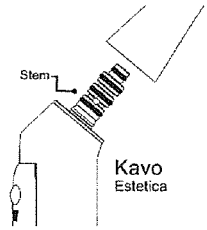


Fig - 8C

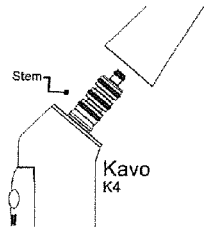


Fig - 8D

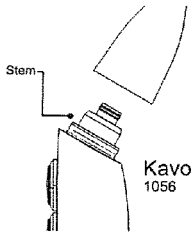


Fig - 8E

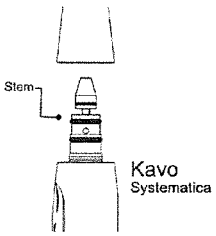


Fig - 8F

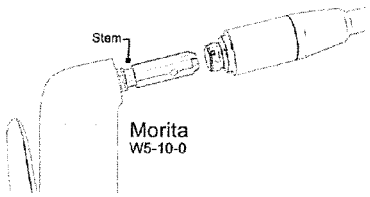


Fig - 8G

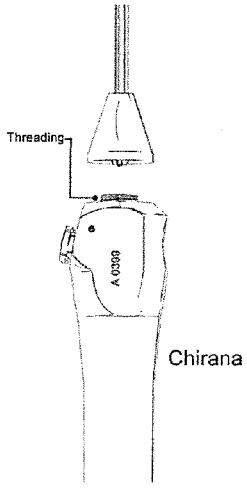


Fig - 9A

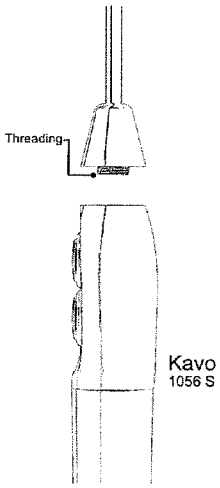


Fig - 9B

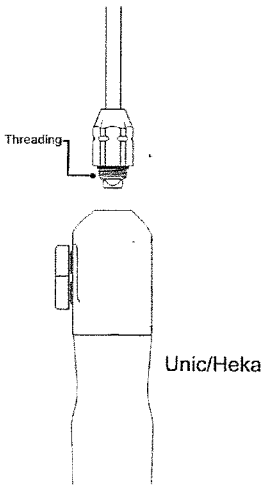


Fig - 9C

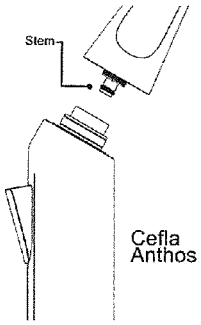


Fig - 10A

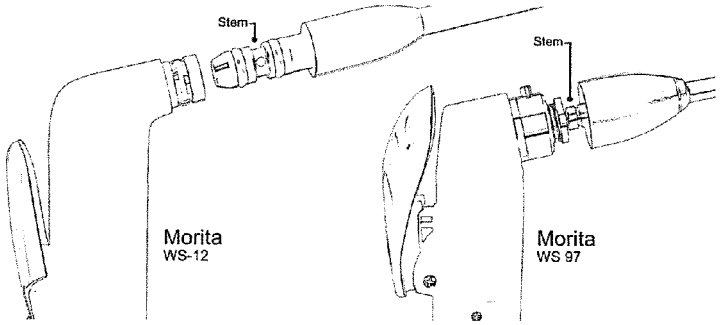
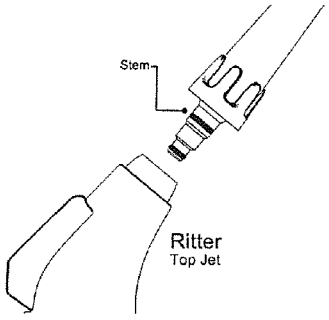


Fig - 10B

Fig - 10C



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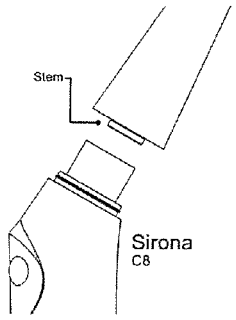

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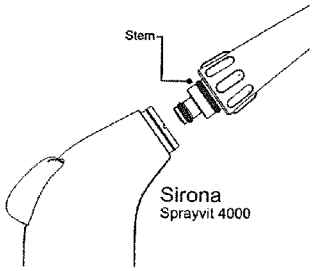

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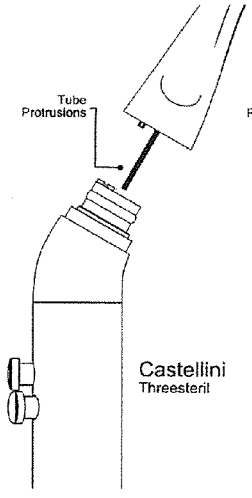


Fig - 11A

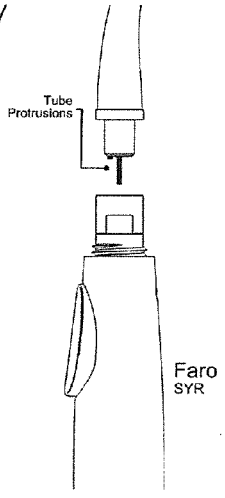


Fig - 11B

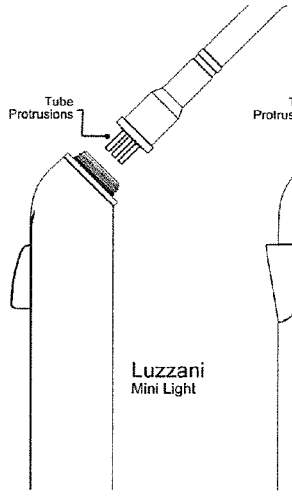


Fig - 11C

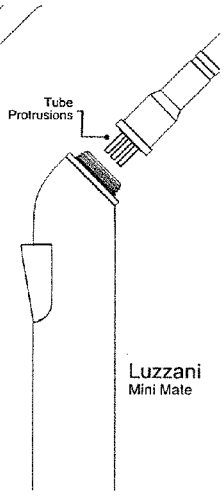


Fig - 11D

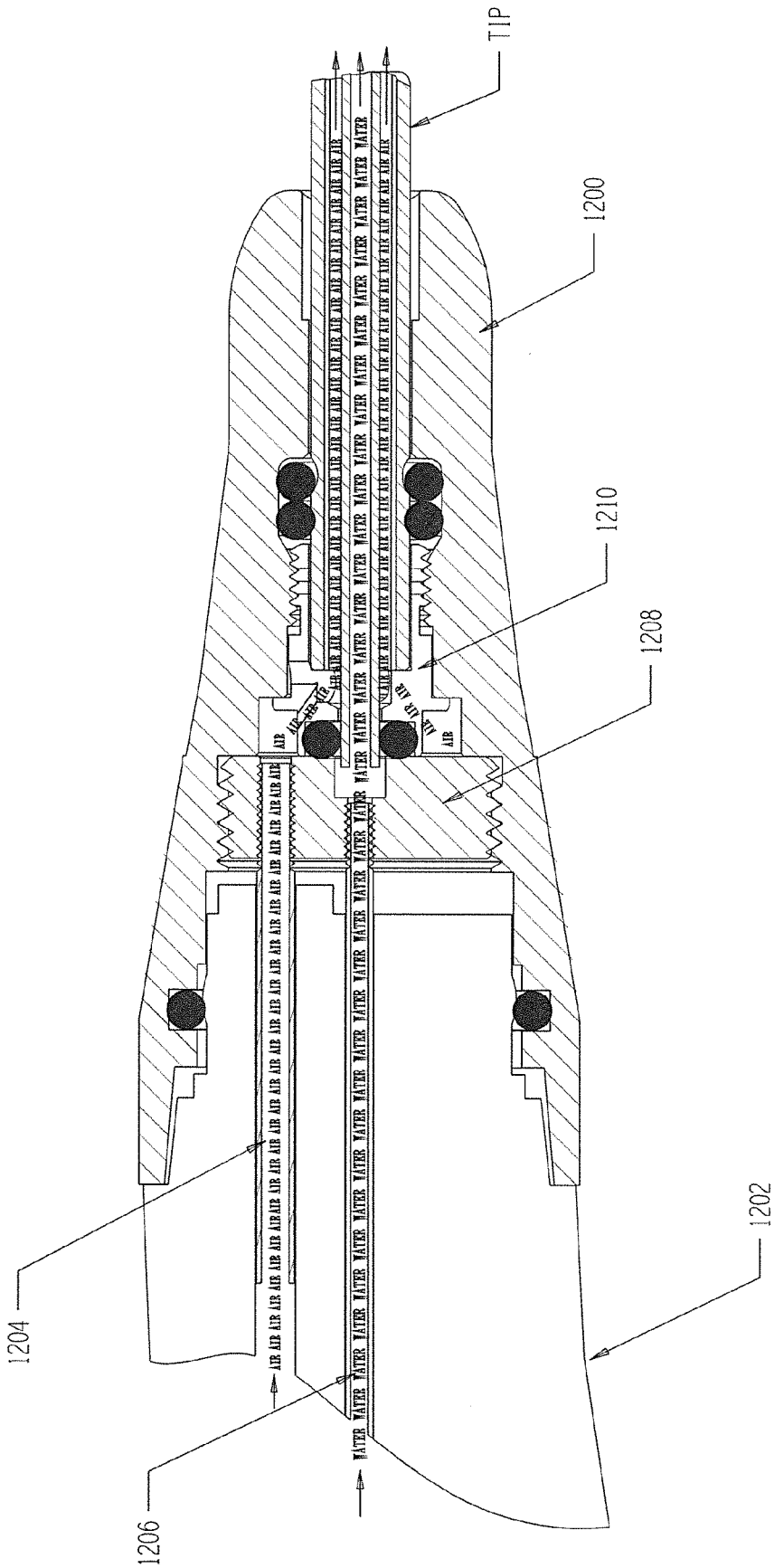


Fig -12

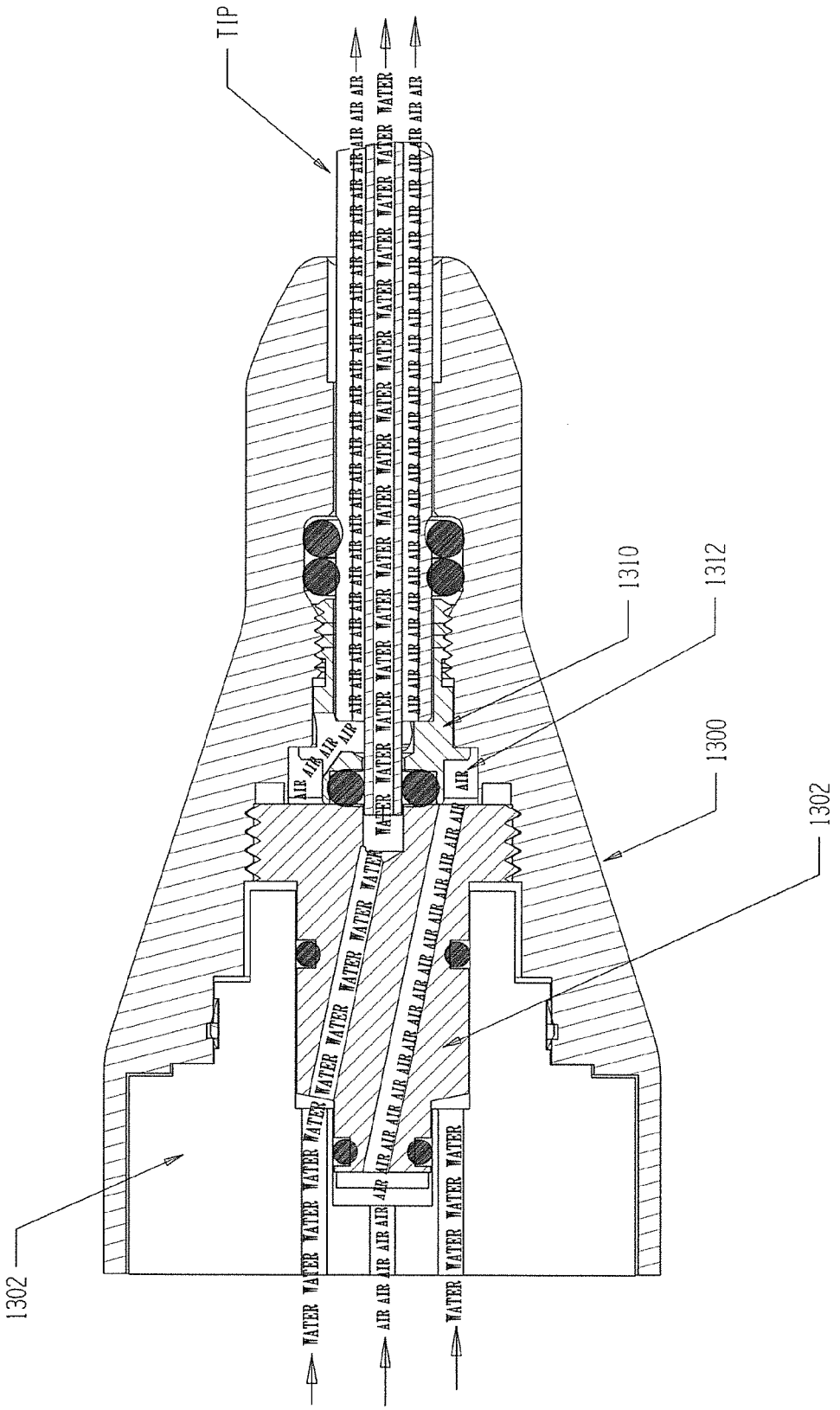


FIG -13

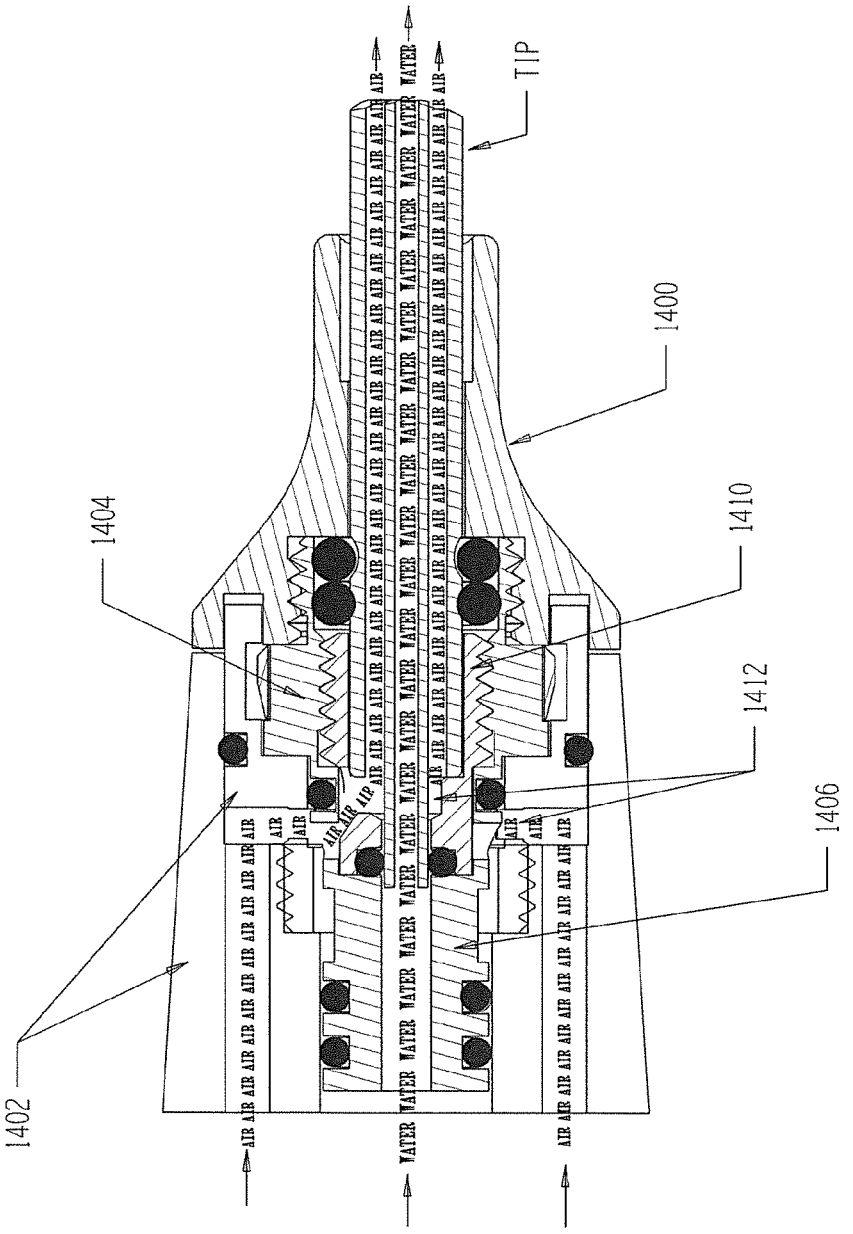
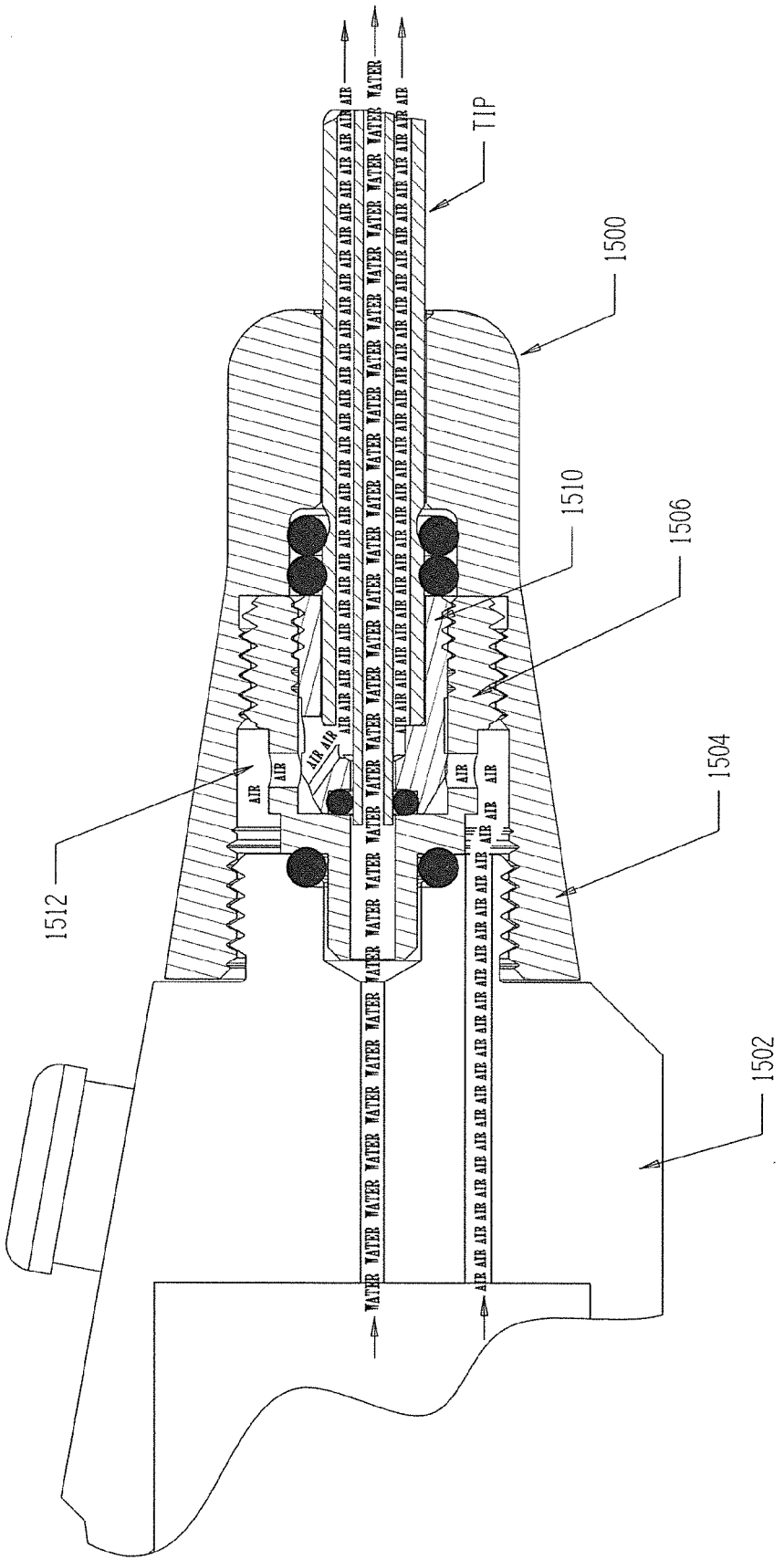


FIG-14



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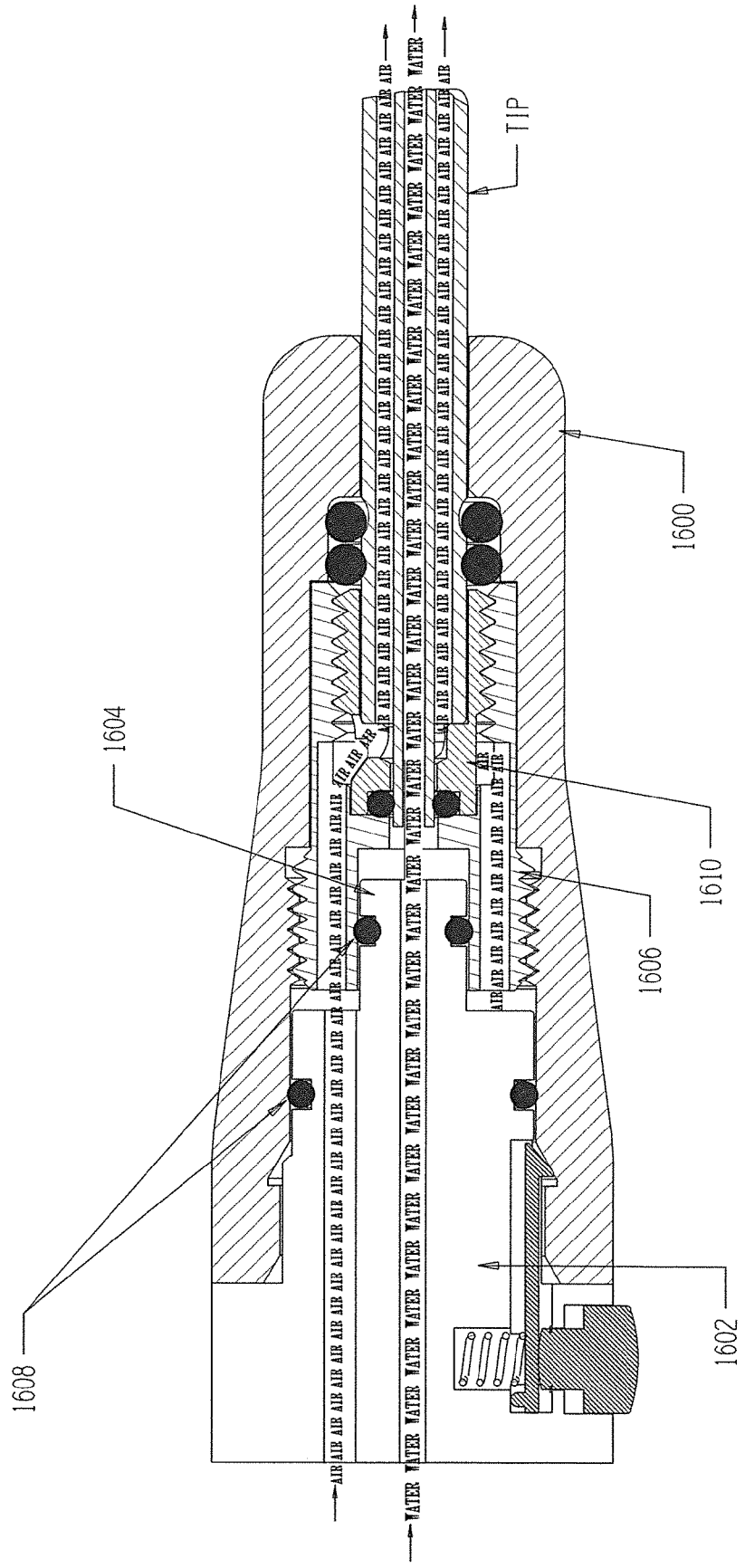


FIG-16

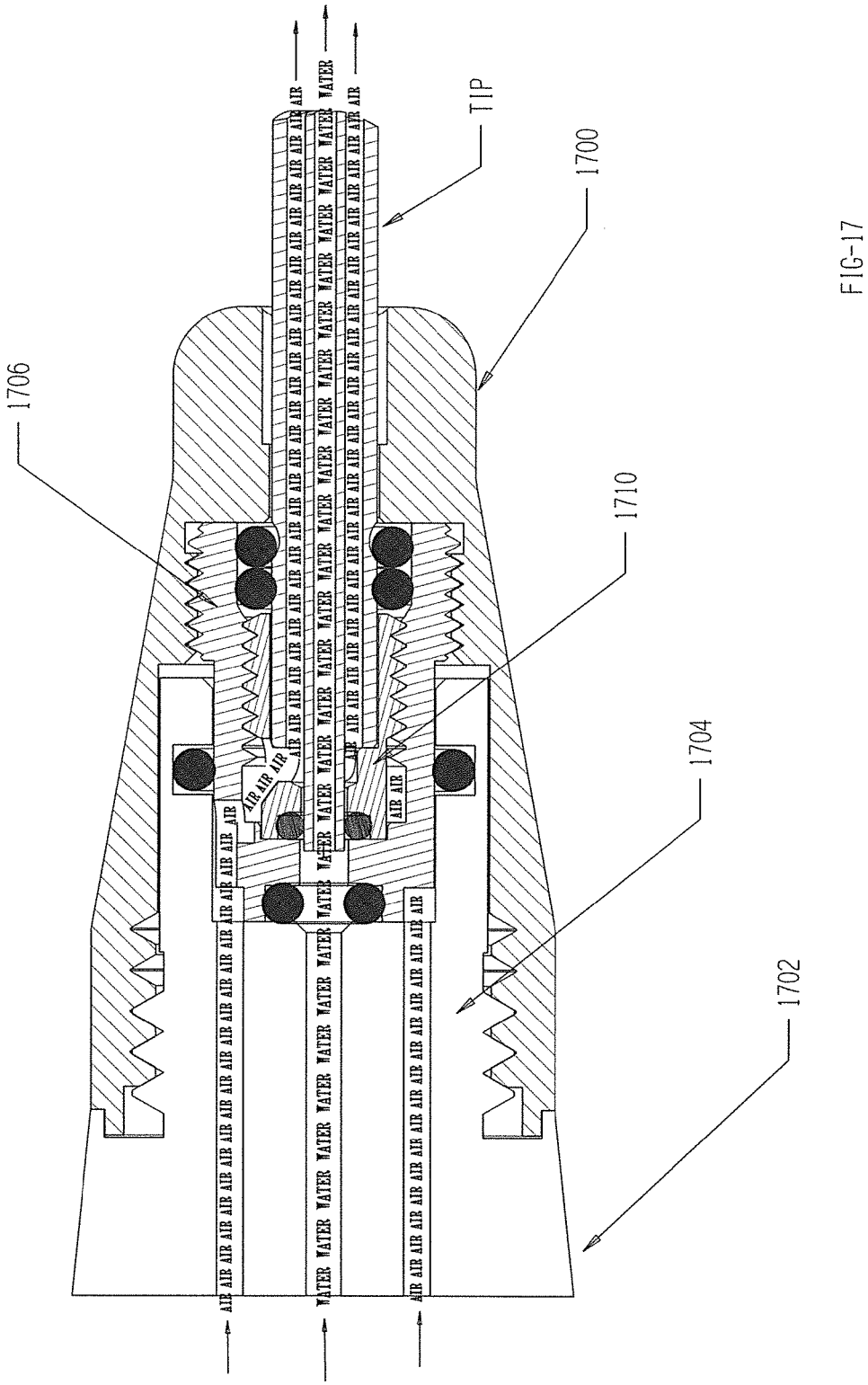


FIG-17

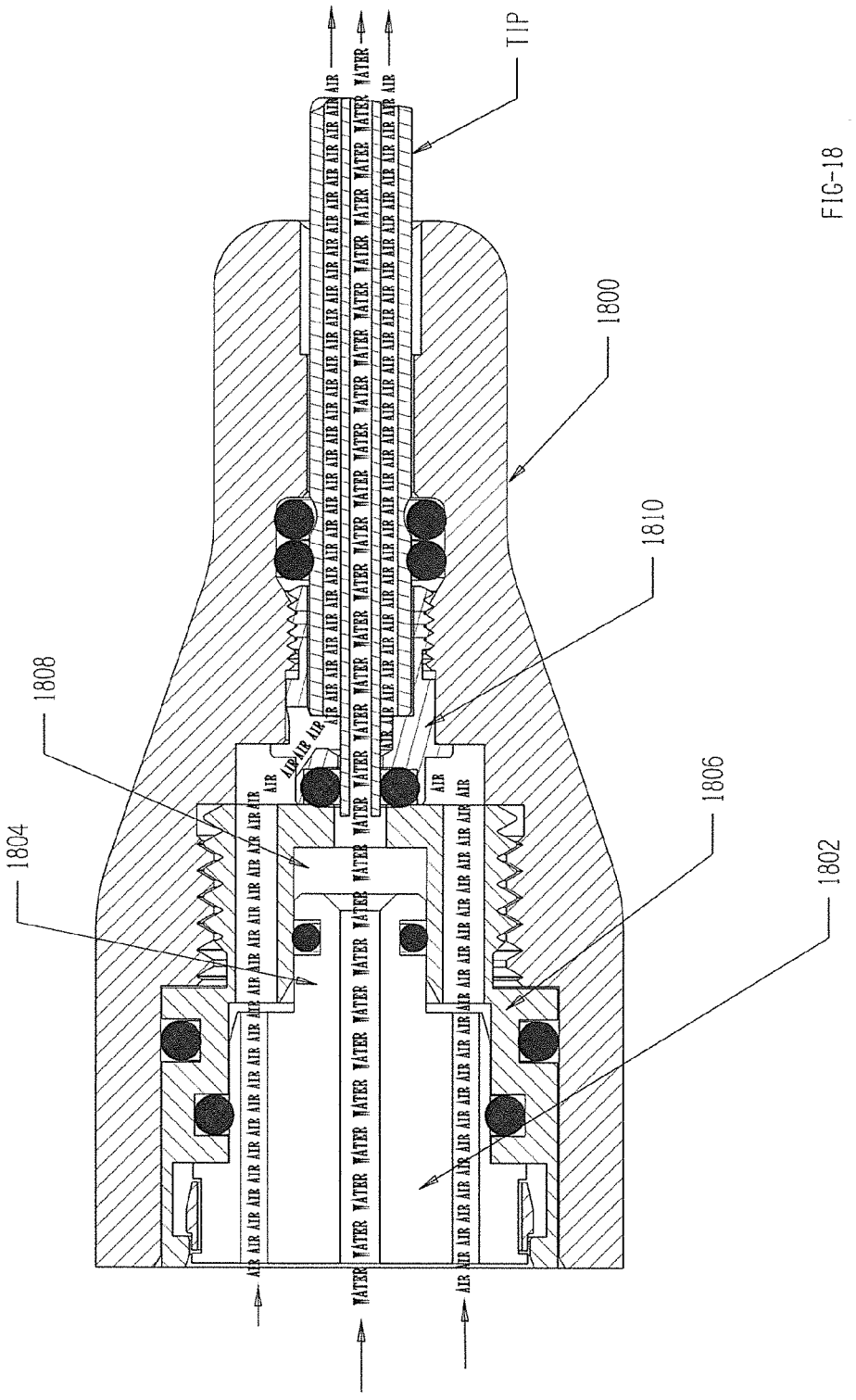
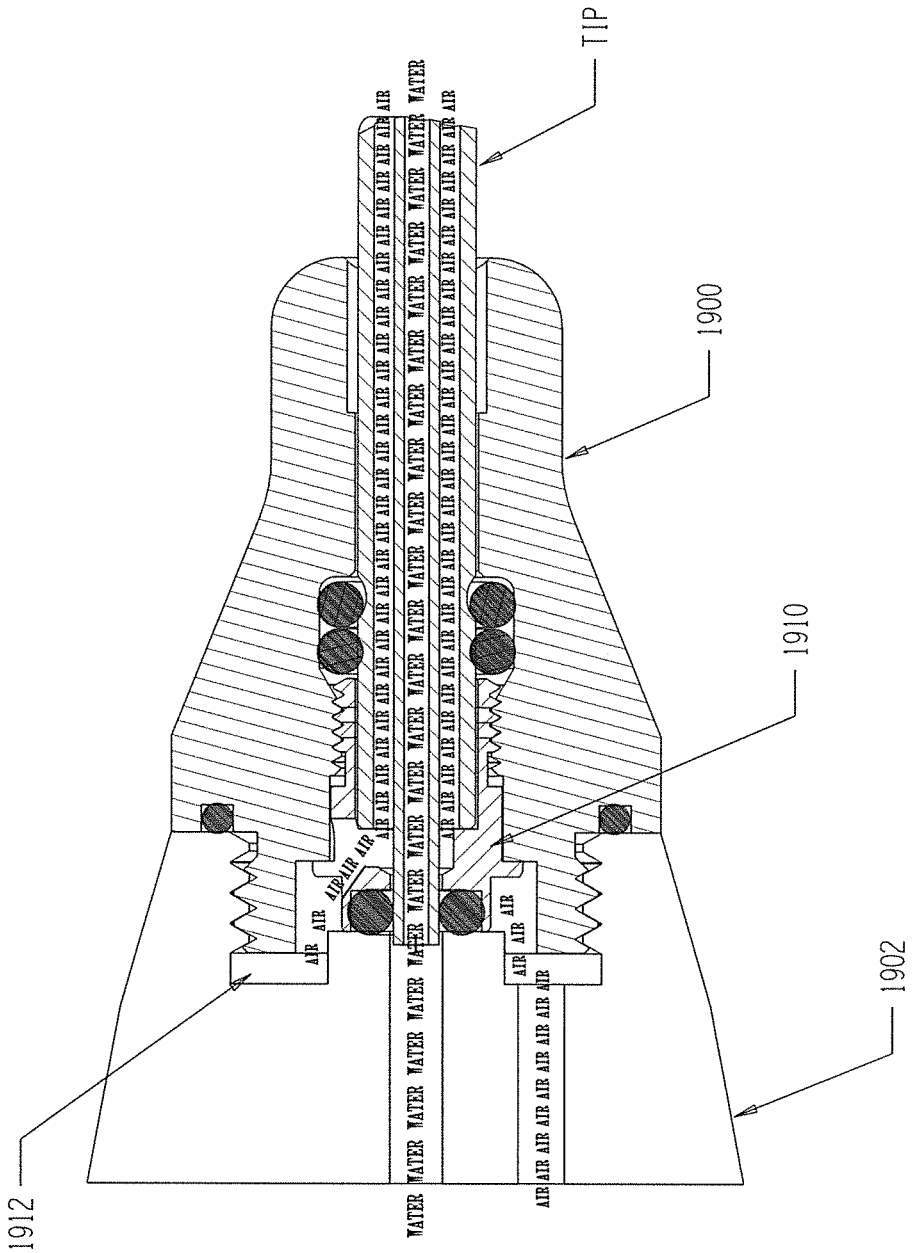


FIG-18



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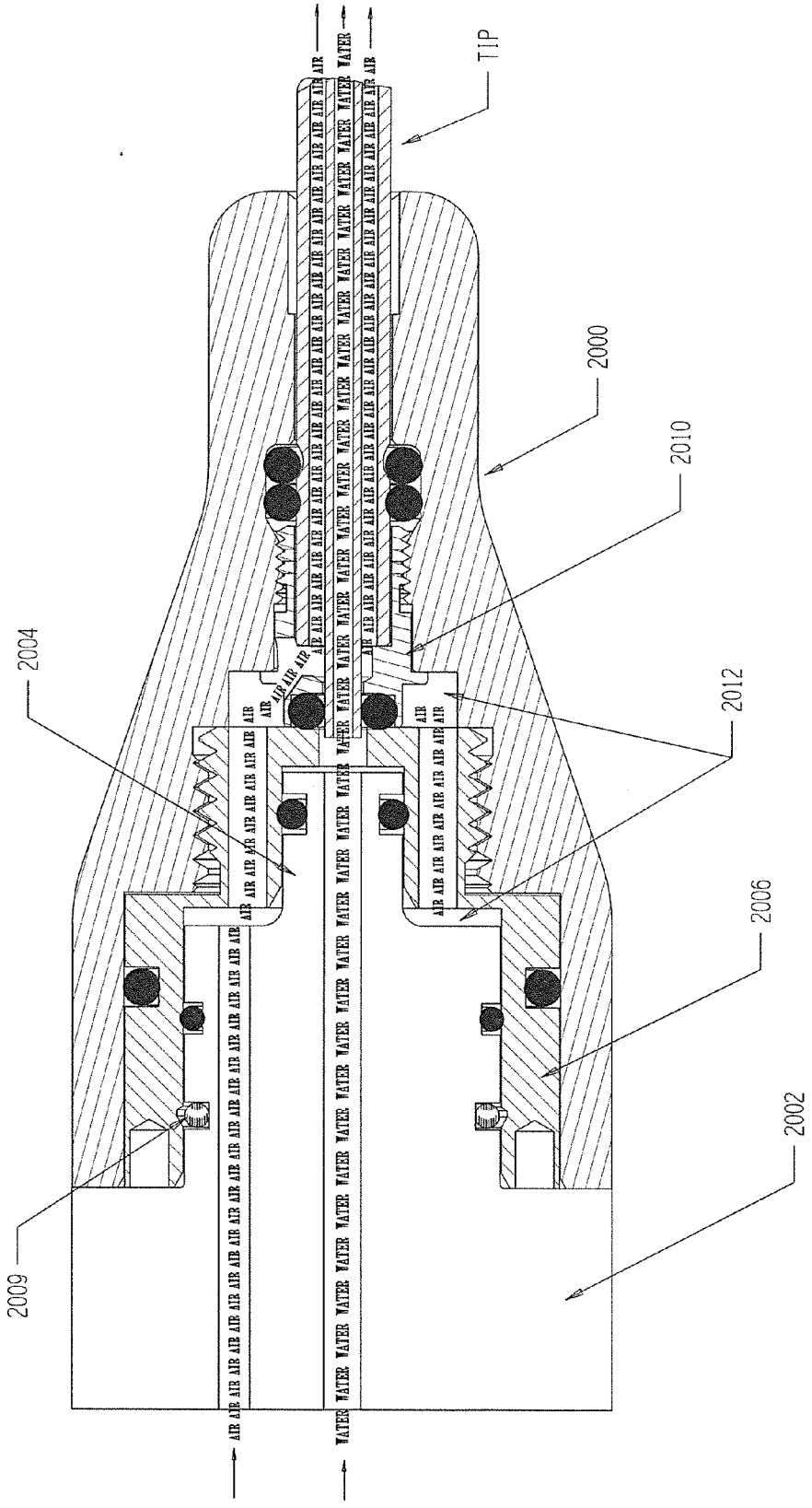


FIG-20

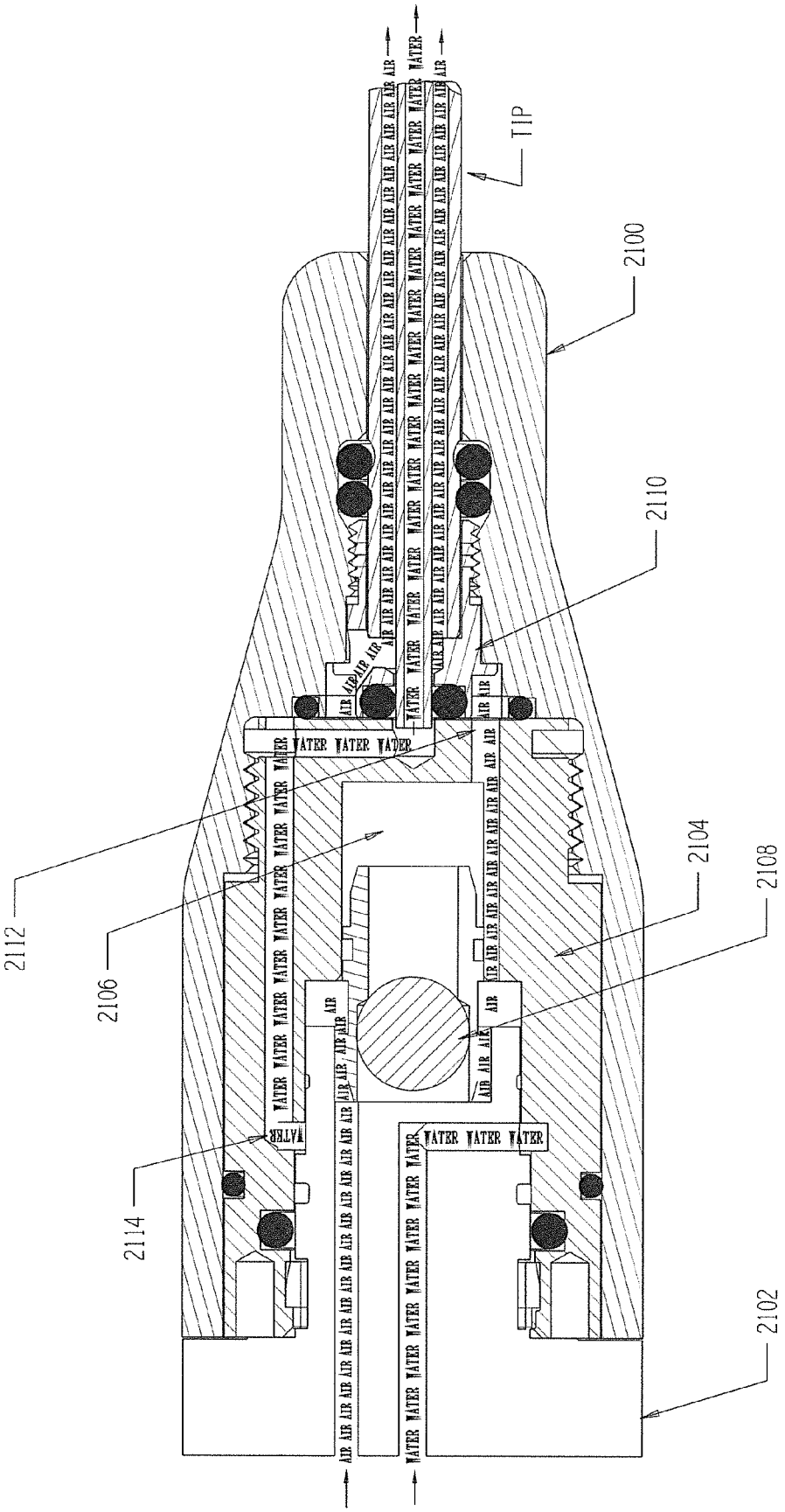


FIG-21

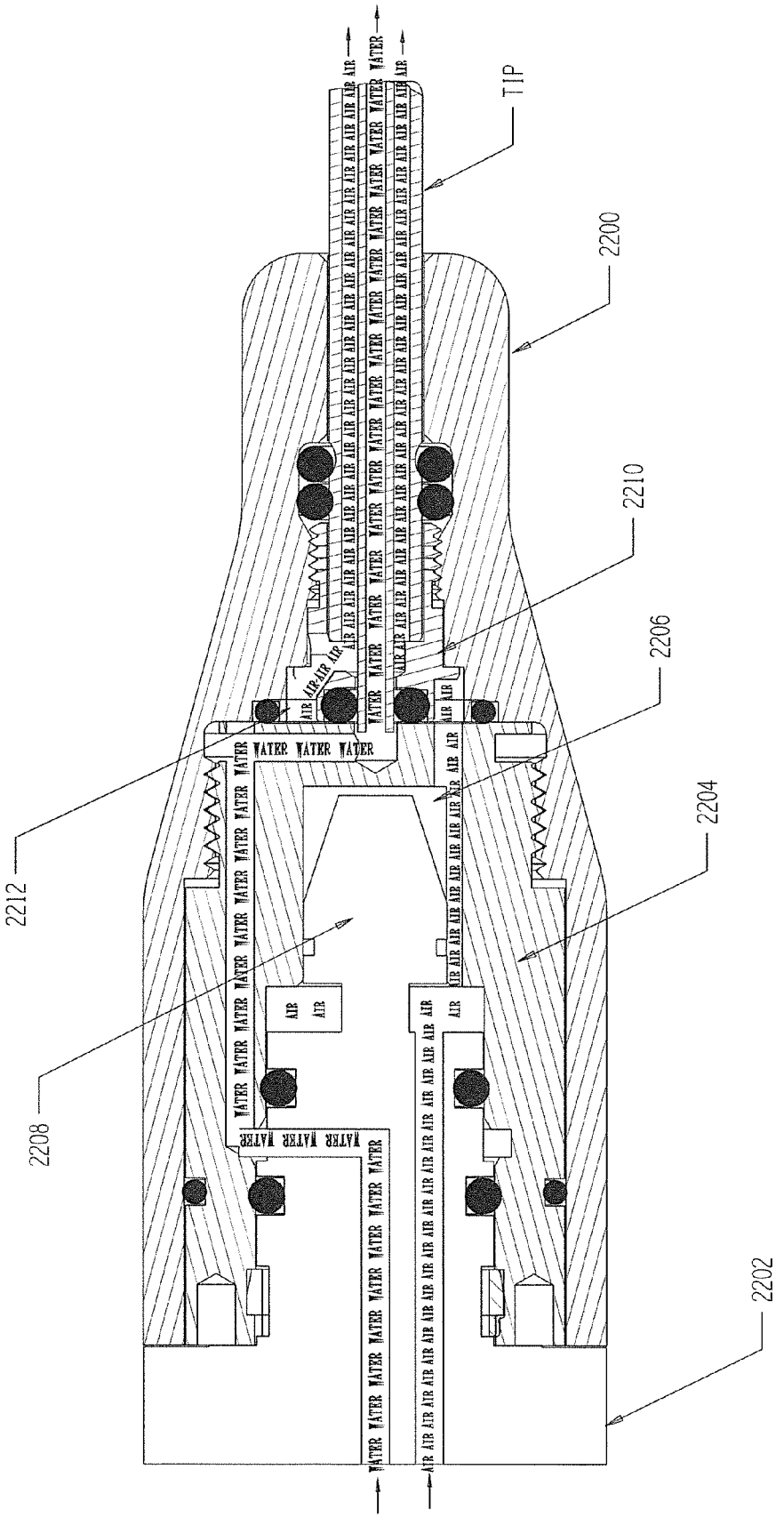
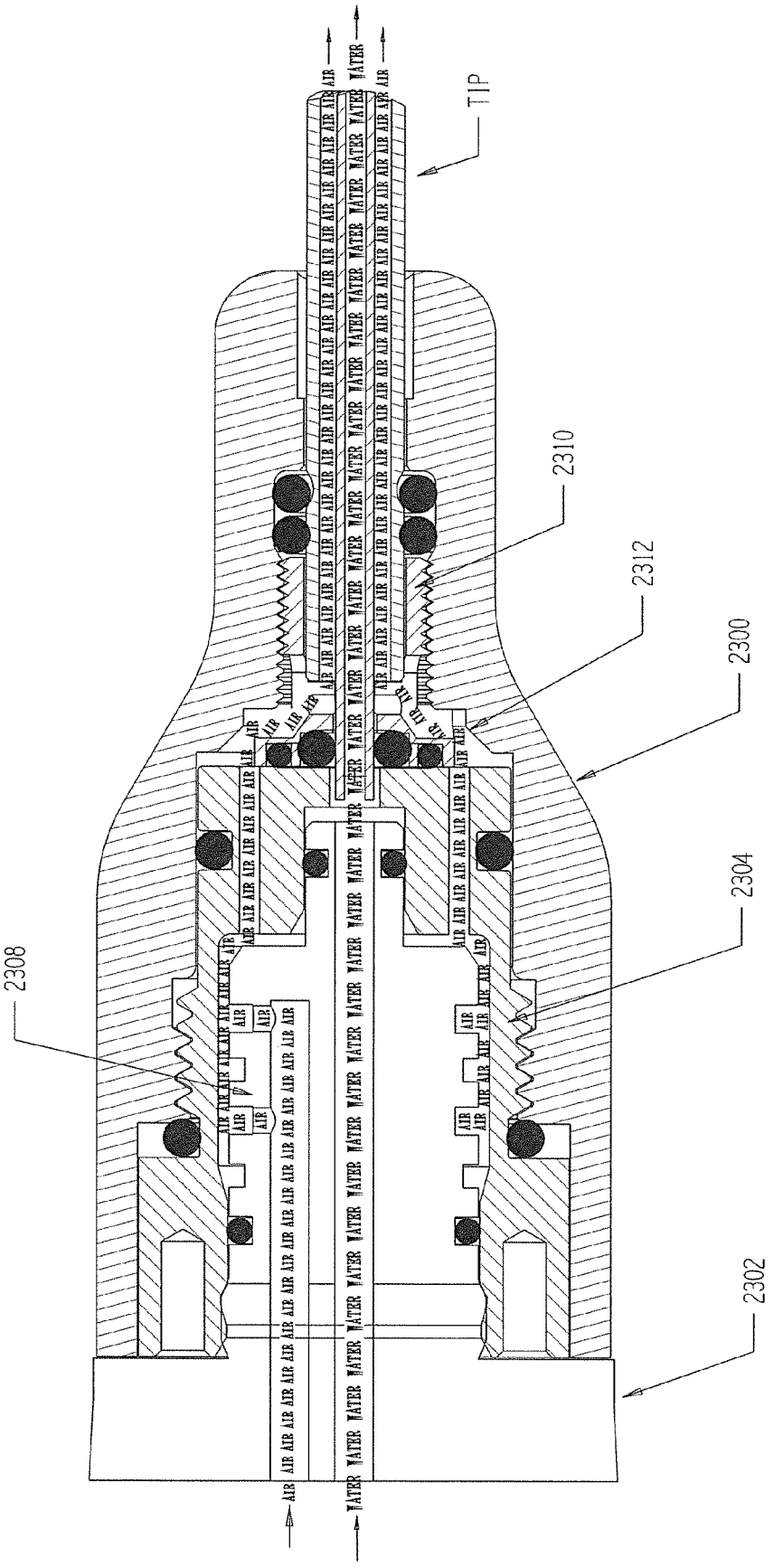


FIG-22



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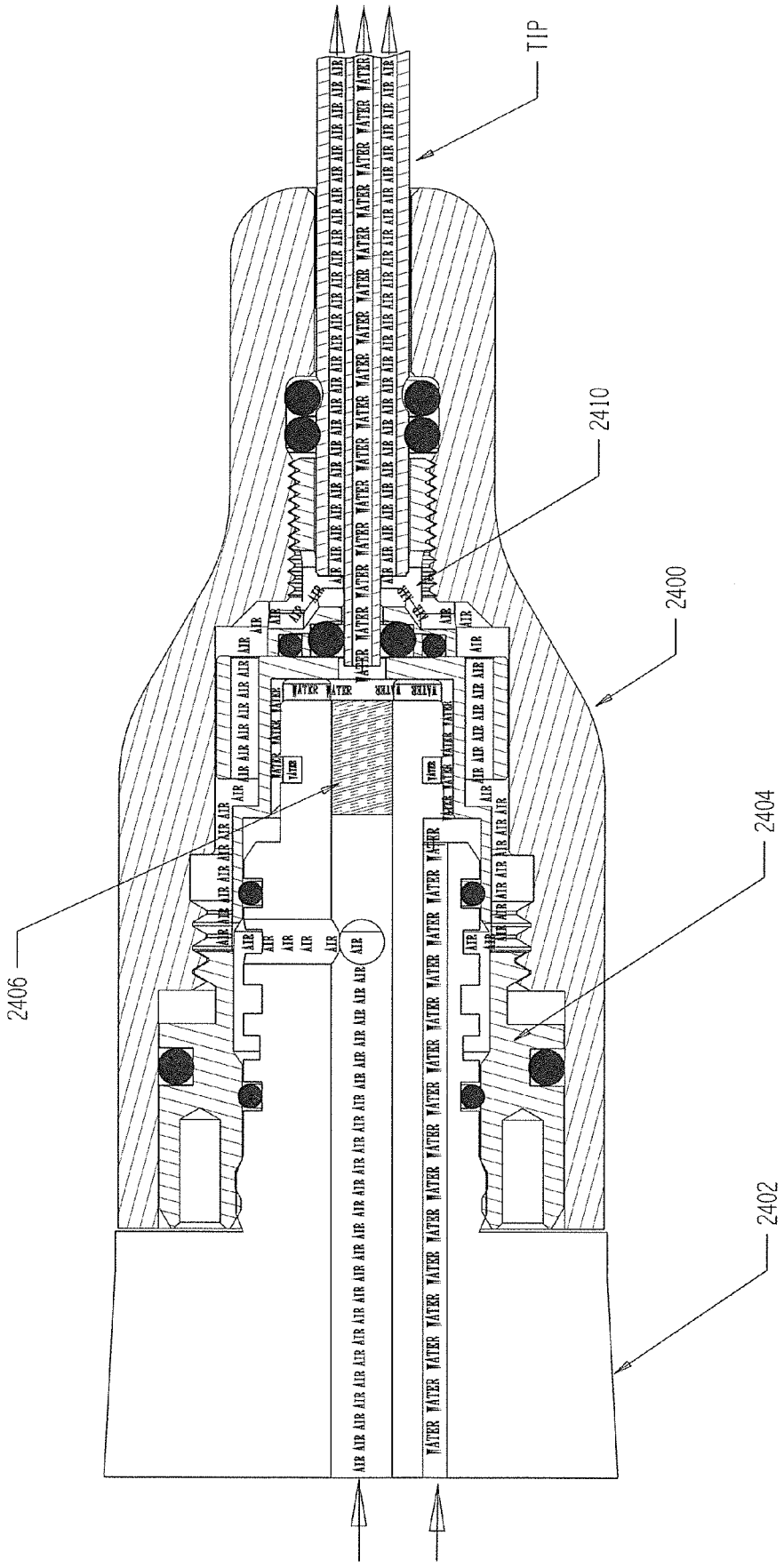

FIG-24

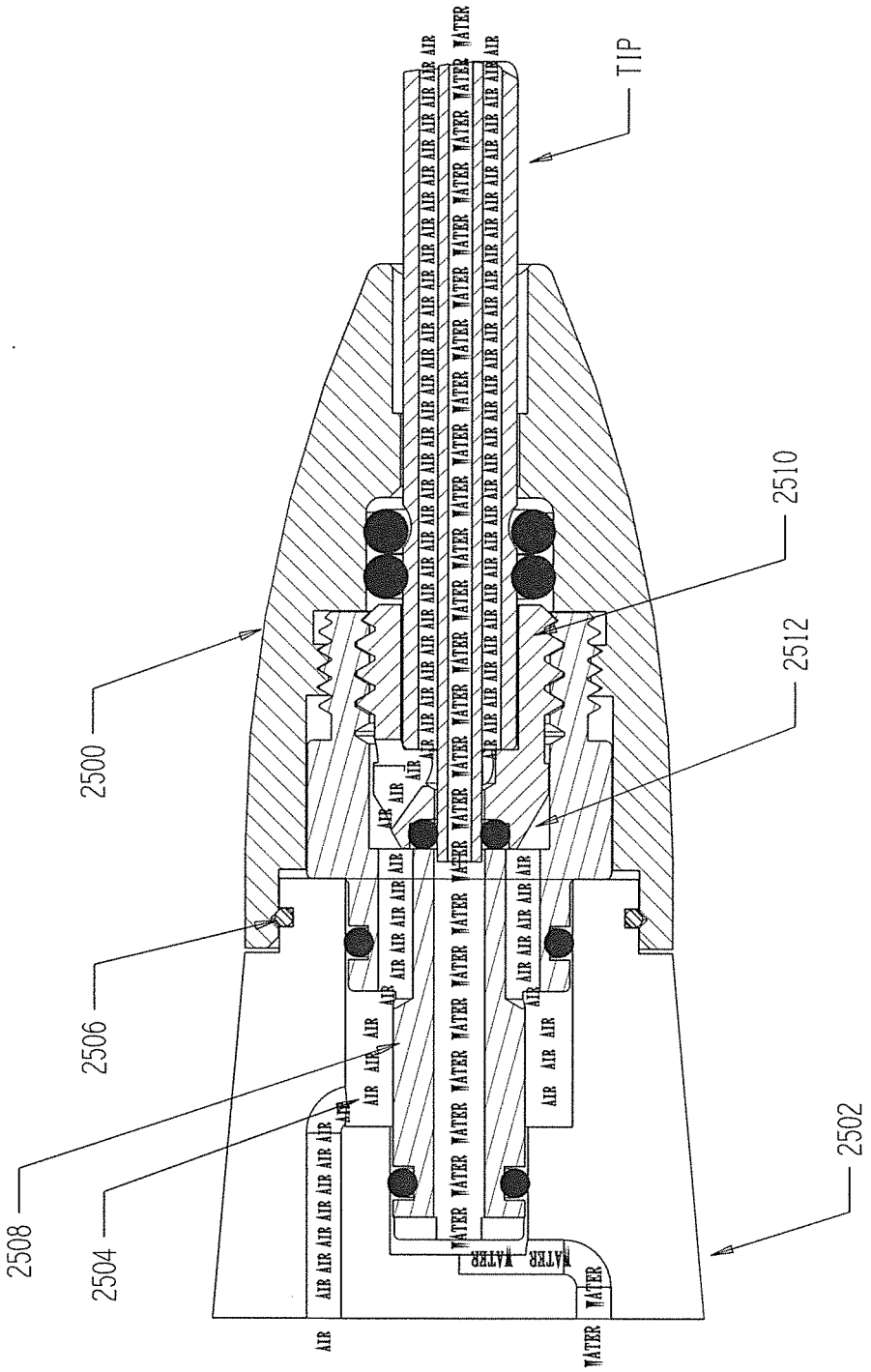

FIG-25

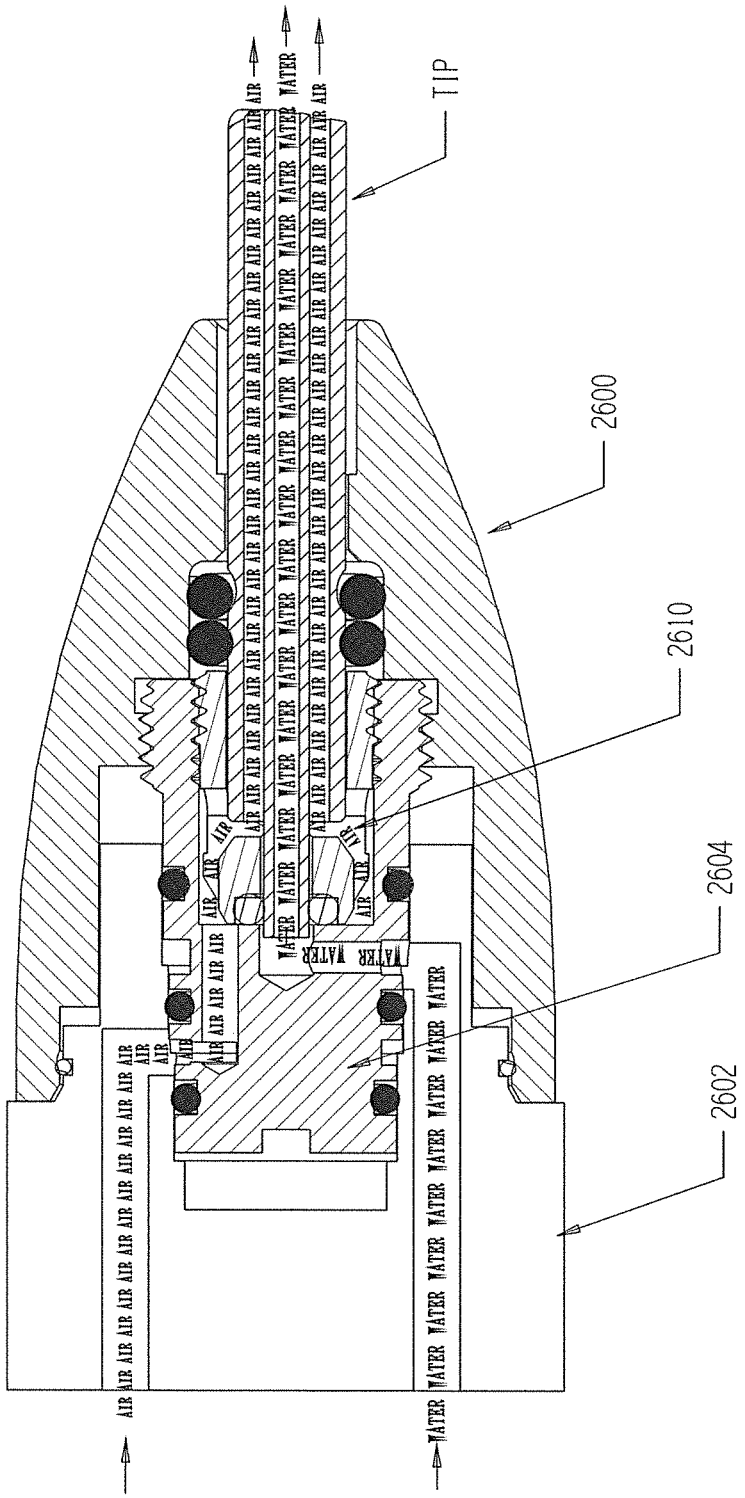

FIG-26

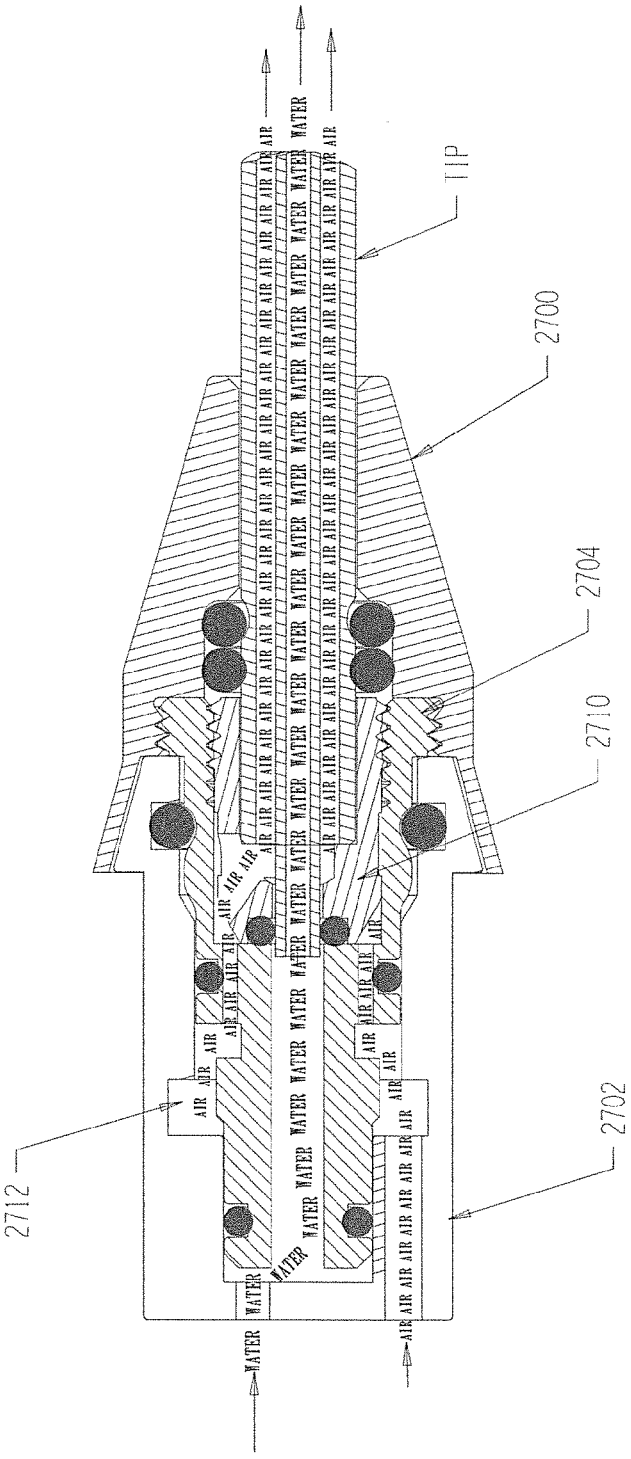

FIG-27

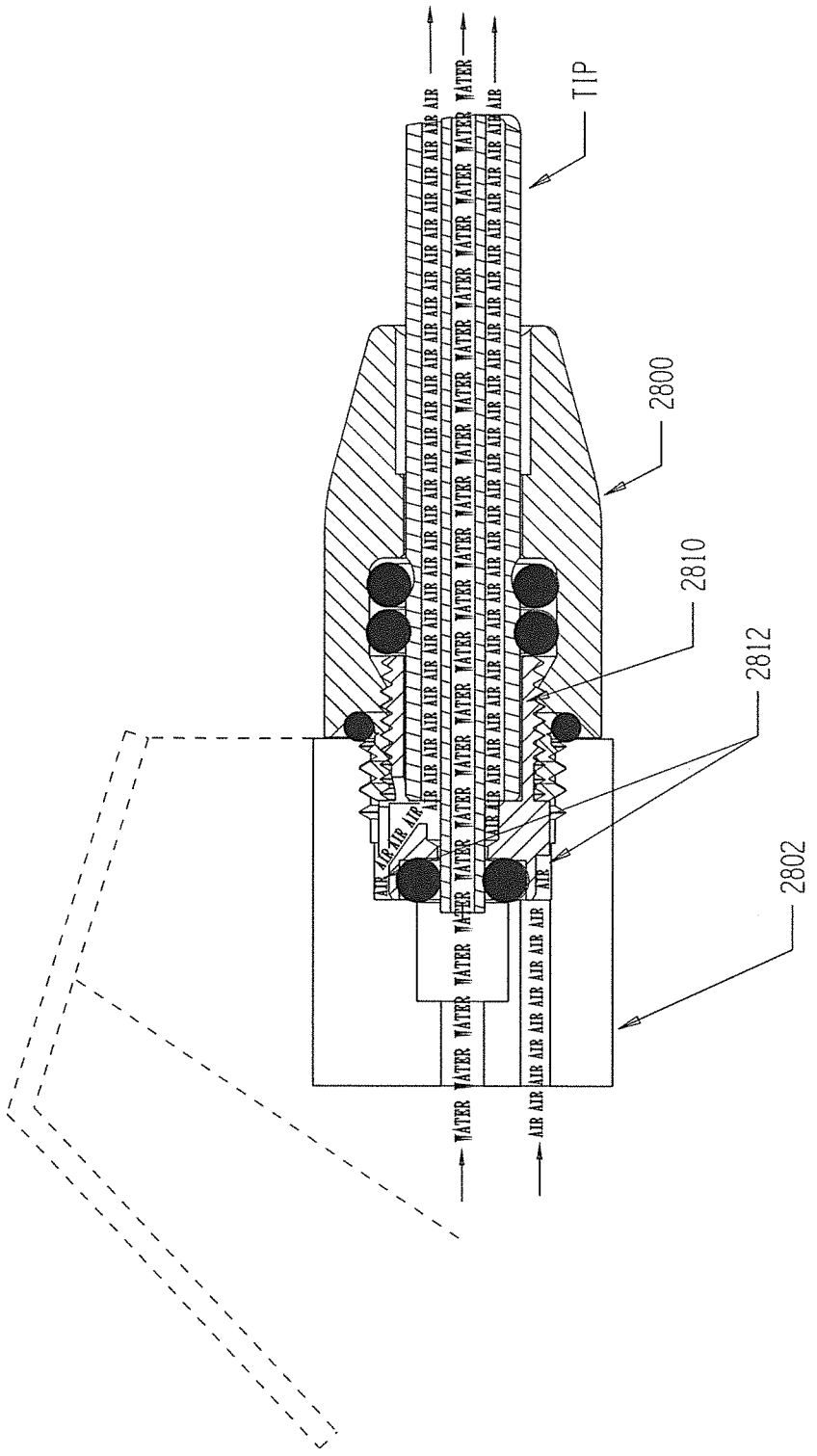

FIG-28

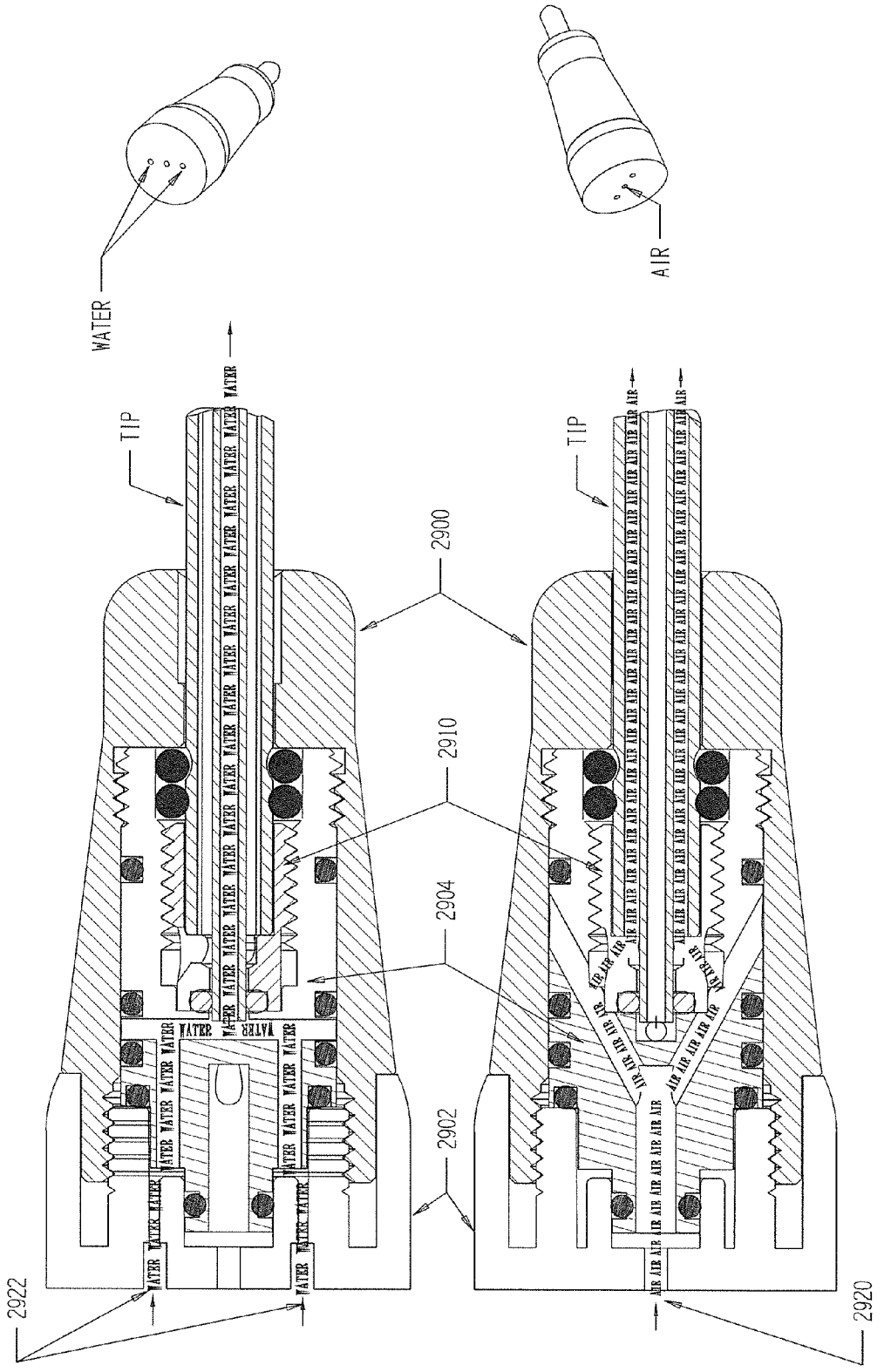

FIG-29

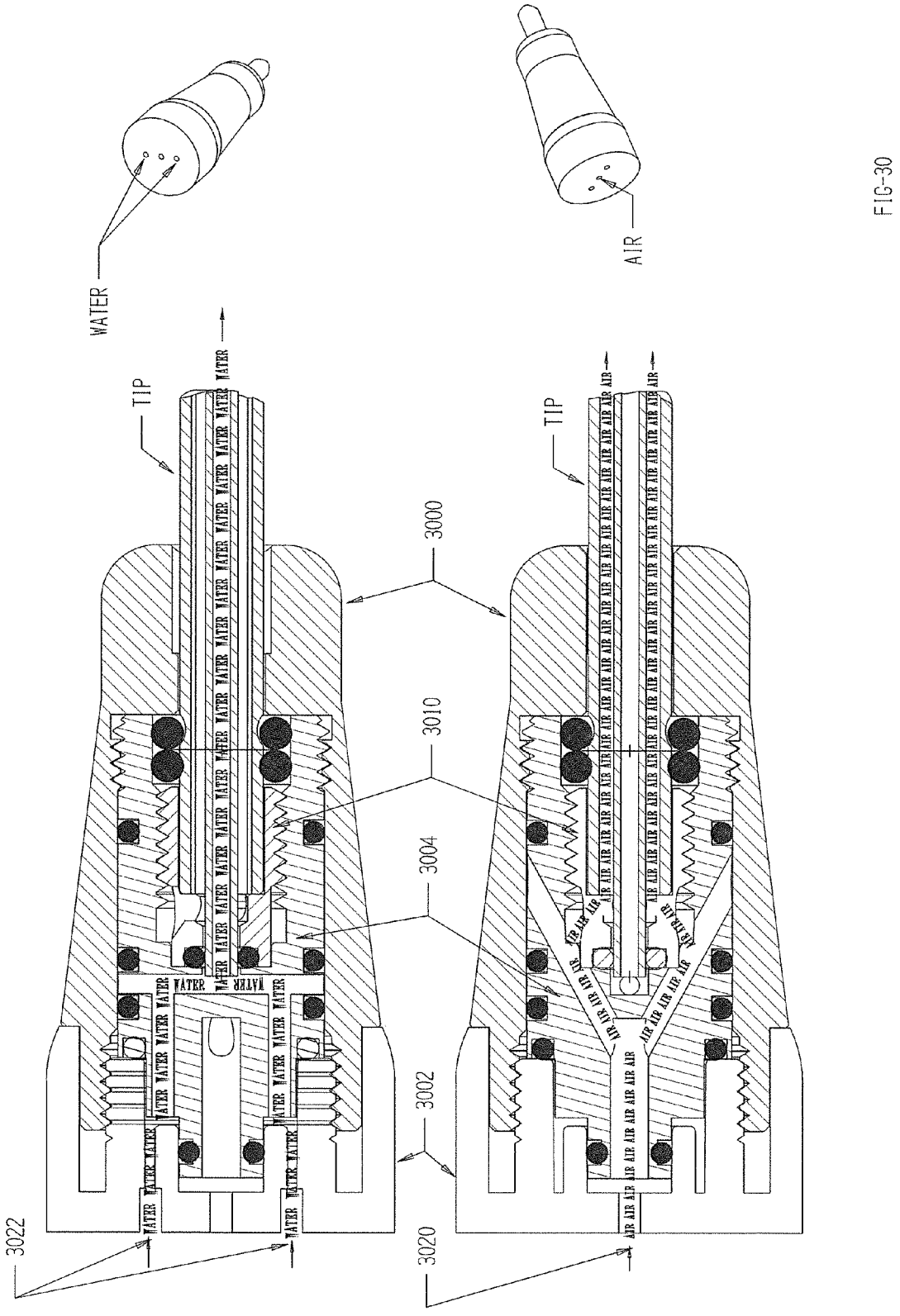

FIG-30

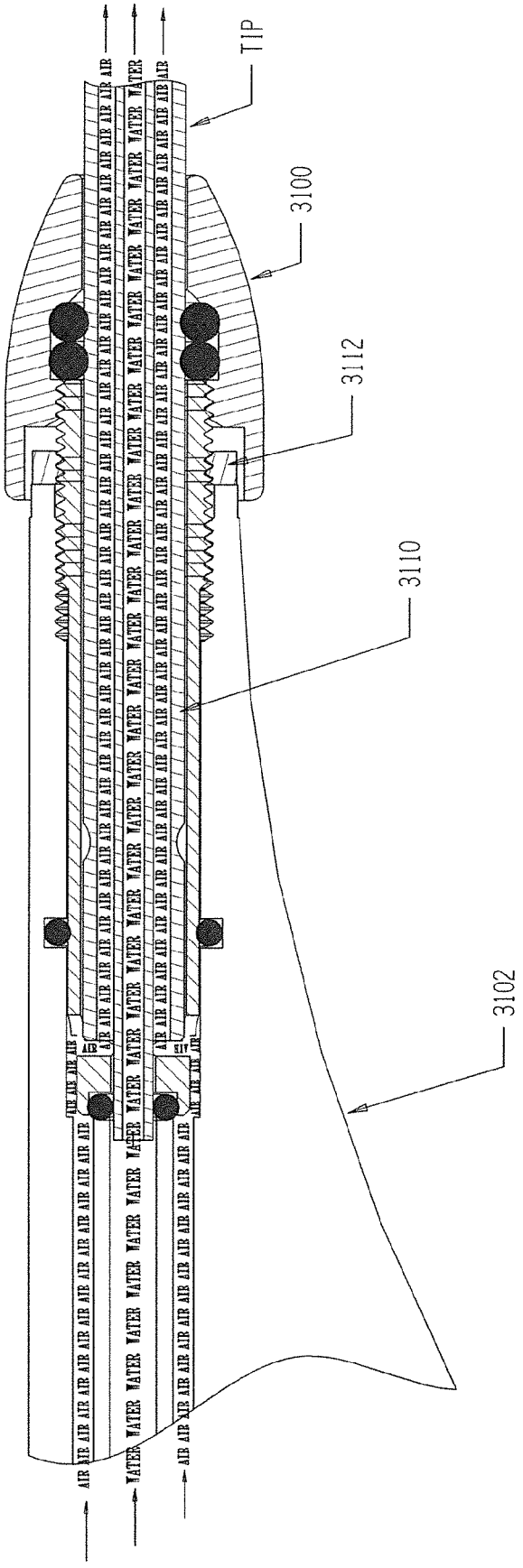

FIG-31

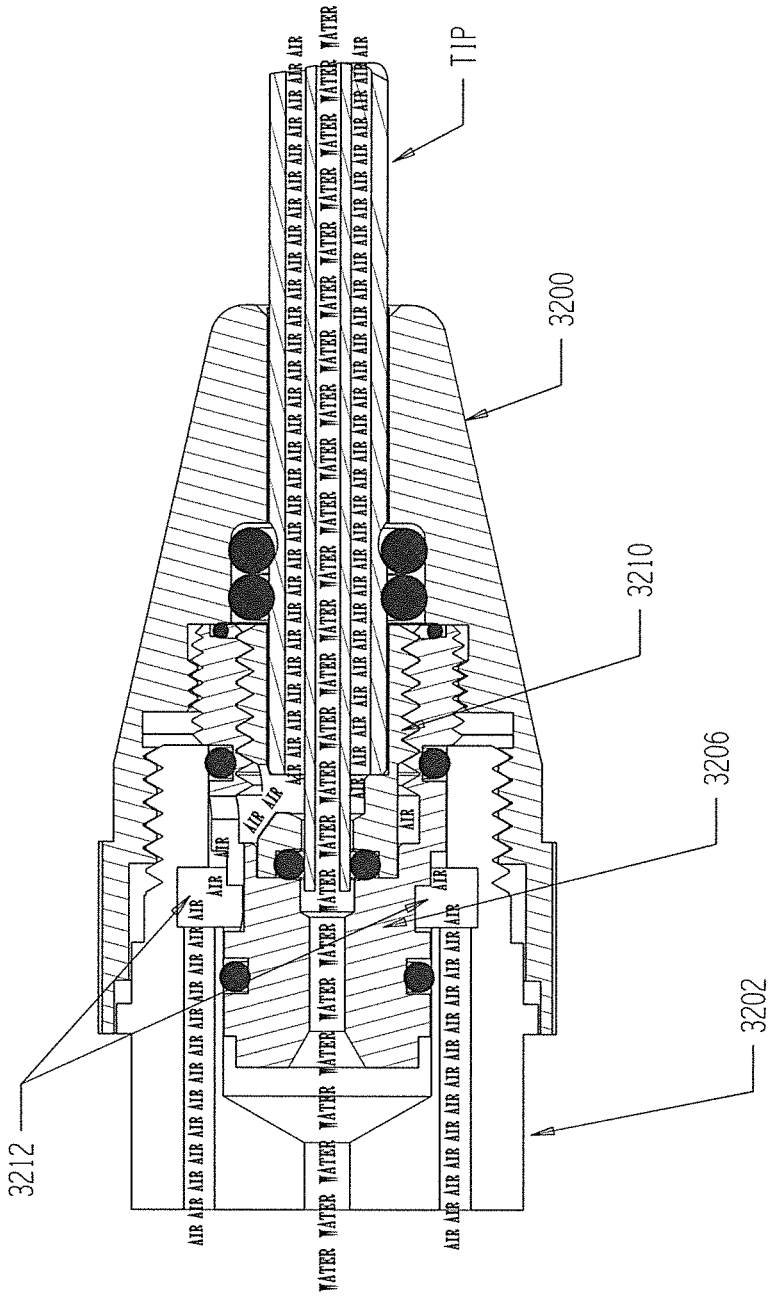

FIG-32

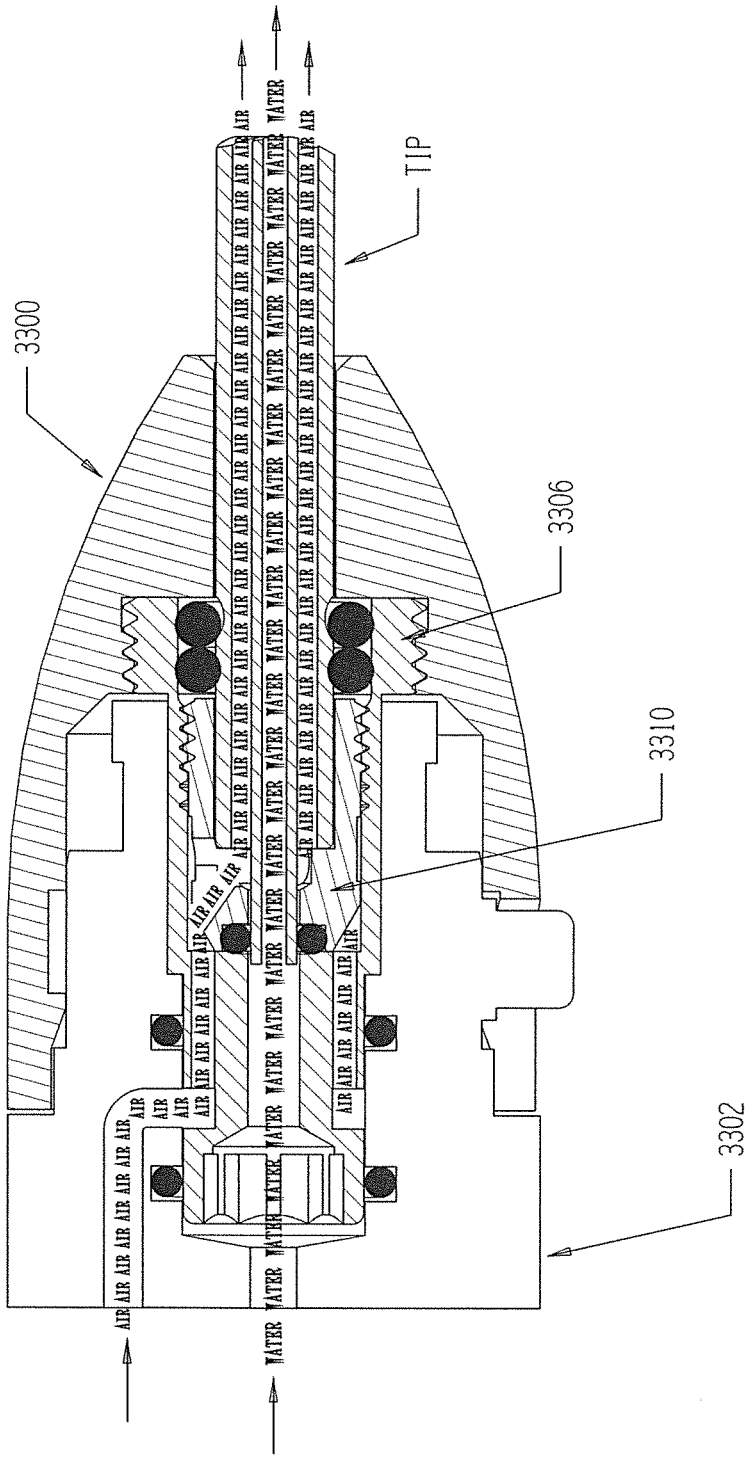

FIG-33

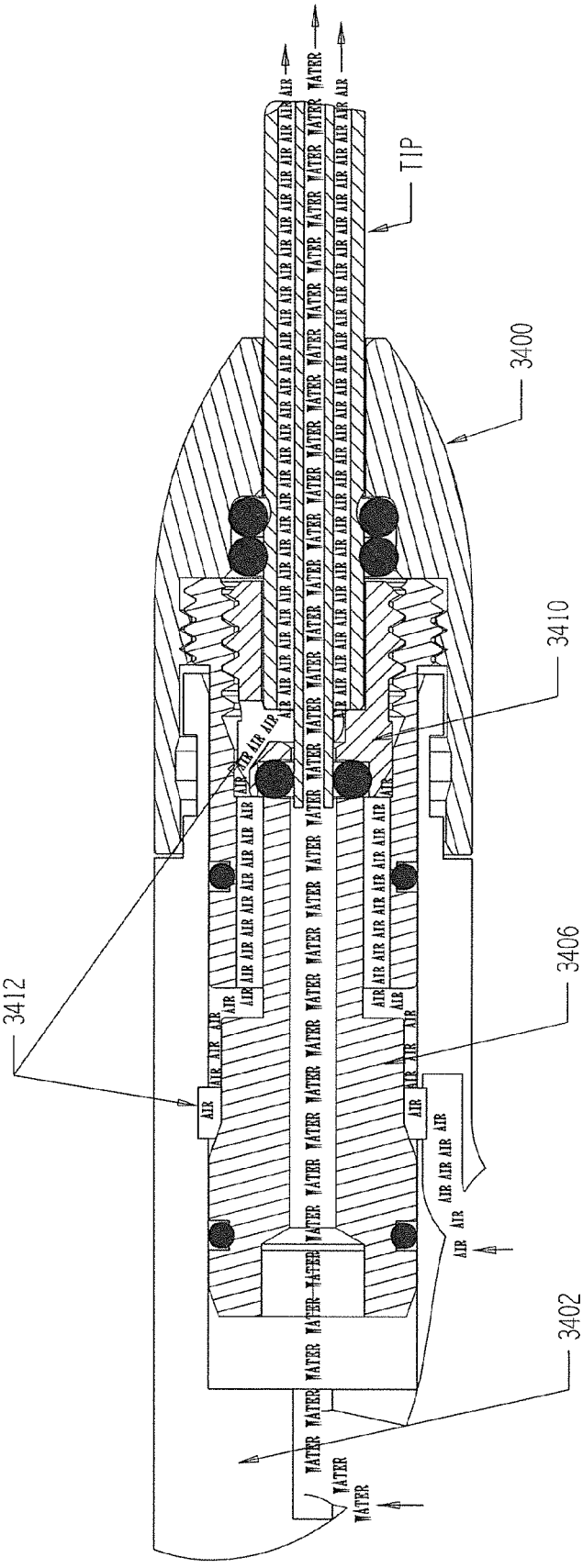

FIG-34

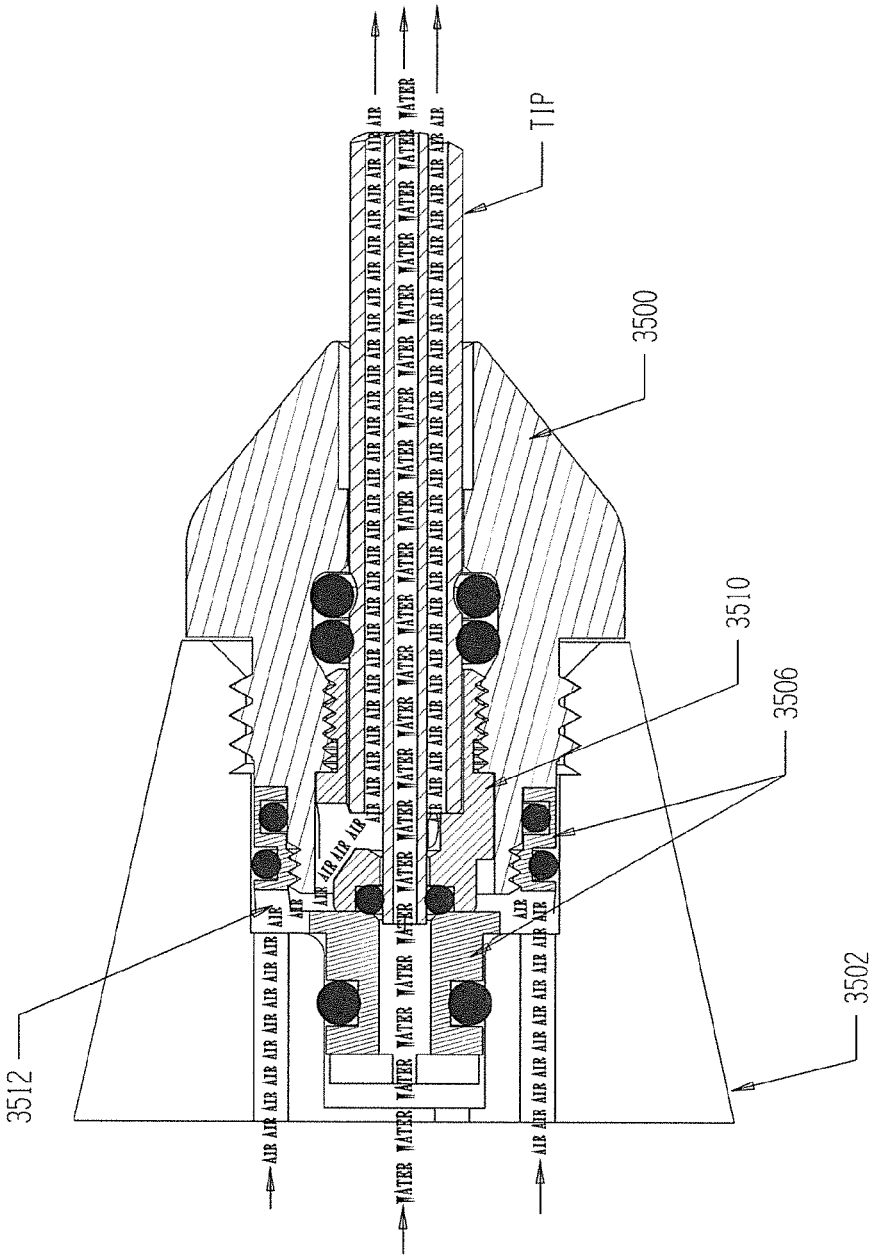

FIG-35

SEAMLESS AIR/WATER DENTAL SYRINGE TIP ADAPTER SYSTEMS AND CONVERSION METHODS

REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 13/841,280, filed Mar. 15, 2013, which claims priority from U.S. Provisional Patent Application Ser. No. 61/619,578, filed Apr. 3, 2012, the entire content of both applications being incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This invention relates generally to air/water syringes and, in particular, to adapter units that enable replaceable, disposable tips to be used with various handle assemblies including European style syringes.

BACKGROUND OF THE INVENTION

[0003] Dental syringes are hand-held instruments which deliver water and air under pressure into a patient's mouth for washing and drying purposes. Such instruments are widely used by dentists, orthodontists, oral surgeons, dental hygienists and dental assistants. A typical dental includes a head unit which is coupled to hoses that supply water at about 40 PSI and air at about 80 PSI. An elongated tip coupled to the head unit is inserted into a patient's mouth, and buttons on the head unit are operated to discharge water or air through the distal end of the tip.

[0004] Cross contamination is one of the principal problems encountered with dental syringes. Bacteria and viruses can be communicated from patient to patient unless the syringe tip is adequately sanitized. The safest and most desirable approach is to replace the syringe tip from the head after each patient treatment. In addition, it is desirable to be able to replace worn tips or change to tips of different configurations quickly and easily.

[0005] Several decades ago, dental syringe tips were not readily removable from the syringe head units. Removal often necessitated the unscrewing of a coupling from the head and the sliding of the coupling off of the tip. Around this time, the tip once removed and the associated coupling were autoclaved. A number of small elastomeric O-rings had to be removed before autoclaving because they could not withstand the heat and pressure of the autoclaving process. The entire process was a time consuming, often frustrating experience.

[0006] Around 1980, dental syringe quick-disconnect tips were invented. U.S. Pat. No. 4,248,589, the entire content of which is incorporated herein by reference, discloses a dental syringe that includes a head **10**, a coupling **12**, and a removable, replaceable tip **14** (FIG. **1**). The head **10** has internal water and air passages **16** and **18** in communication with an internally threaded cylindrical cavity **22** in the top frontal surface of the head (FIG. **2**). The head and tip include a corresponding number of fluid passages. The coupling **12** includes a cylindrical base and a lock nut which screws over the base. The base and the lock nut define an axially extending bore which communicates with the passages through the head and removably receives the rearward portion of the tip **14**. An elastomeric O-ring is positioned between the base and the lock nut and surrounds the bore. When the rearward portion of the tip is fully inserted in the bore the O-ring seats in a groove surrounding the rearward portion of the tip. When the lock nut is fully screwed over the base, deformation of the O-ring is substantially prevented and the tip cannot be withdrawn or ejected from the coupling.

[0007] The tip **14** comprises inner and outer elongate, coaxial, spaced apart pipes **36** and **38** which define water and air passages **40** and **42**, respectively. The forward portions of the pipes are angled with respect to the rearward portions. The forward end **44** of the inner pipe **36** is open and the forward end **46** of the outer pipe **38** is bent inwardly and is sealed to the inner pipe **36**. The forward end **46** has a plurality of annularly spaced nozzle apertures such as **48**.

[0008] The rearward portion **50** of the outer pipe **38** terminates short of the rearward portion **52** of the inner pipe **36** and is bent inwardly and sealed to the rearward portion **52**. The rearward end **53** of the inner pipe **36** is open and coaxial with the water passage **16** and abuts the bottom of the cavity **22** when inserted in the coupling **12**. The periphery of the rearward portion **50** is formed with a pair of axially spaced, rearward and forward annular grooves **54** and **56**. A pair of diametrically positioned inlet apertures **58** and **60** extend through the wall of the outer pipe **38** in the groove **54**, as shown in FIG. **3**.

[0009] Ducts **82** and **84** in the base **62** extend from the bore **72** in the base to a chamber **80**. When the rearward portion of the tip is fully inserted in the bore **72**, air can flow from the air passage **18** into the chamber **80**, through the ducts **82** and **84**, into the bore **72**, through the apertures **58** and **60**, into the air passage **42** and through the tip.

[0010] Push buttons **24** and **26** on the top rear surface of the head are coupled to normally closed valves and are selectively hand-operated to discharge water, air, or both through the distal end **28** of the tip **14**. A handle **30** can be threaded with the shank **20** to connect water and air supply hoses **32** and **34** to the water and air passages **16** and **18**, respectively. When the push buttons **24** and **26** are simultaneously depressed water spray mist is produced.

[0011] Since the development of the quick-release syringe tip system just described several improvements have taken place. Central to such improvements is the development of the disposable tip which is retrofittable to the older metal units which must be autoclaved to reuse. Disposable air/water syringe tips resemble bent, plastic straws with multiple cannulations to receive and deliver air and water from existing hand-held units. One leading manufacturer is Crystal Tip of Irvine, Calif.

[0012] As with the earlier, autoclavable metal syringe tips, the proximal end of the Crystal Tip includes a central, protruding tube to receive water which, like its predecessors, seals against an O-ring in the syringe body. However, as shown in FIG. **4**, the tip does not have proximal side ducts through which the air flows; rather the proximal end surrounding the water tube does not 'bottom out' within the syringe body, allowing air to enter the cannulations surrounding the central water tube. Crystal Tips are designed to be used directly on common U.S. and Canadian syringes. In particular, Crystal Tips fit syringes from Adec (Newberg, Oreg.), DCI International (Newberg, Oreg.) and Unic/Heka (Ishøj, Denmark) without the need for any so-called adapter units.

[0013] Currently in Europe, however, most syringes use autoclavable tips. As a result, there has been little attempt to upgrade to new standards that have been in place for years. As such, disposable tips, including Crystal Tips, cannot be used directly on any European syringe. Syringes with autoclavable tips use a variety of routing patterns to deliver air and water to

the tip. However, all U.S. disposable tips receive their air flow through the base of the tip that is inserted into the syringe. Autoclavable tips route air flow through a side port (hole) directly below an O-ring grove on the metal tip. As such, without some type of conversion, disposable tips are incompatible with European-style syringes that use autoclavable tips.

[0014] Given that there are numerous proprietary designs outside North America, it would be advantageous to provide these syringes with appropriate adapter kits enabling them to utilize standard, disposable quick-release air/water tips.

[0015] U.S. patent application Ser. No. 13/841,280, filed Mar. 15, 2013, discloses numerous conversion kits enabling disposable tips to be used on multiple different syringe bodies, including European designs that use autoclavable tips. However, the embodiments described in this previous application use two subassemblies—a cap subassembly that receives the disposable tip, and an adapter subassembly that couples the cap to the syringe body after the non-disposable or autoclavable tip has been removed.

[0016] The cap subassembly **402**, shown in FIG. **4**, includes an outer body **403** with a distal end to receive the tip **400** and a proximal end configured to receive a ferrule **420** shown in FIG. **5**. The ferrule includes a cup-shaped receptacle that receives the proximal end of the disposable tip once inserted into the cap body **403**. The disposable tip is shown in FIGS. **4** and **6** at **400**. View **401** is an end view showing the central water-carrying tube **404** surrounded by air-carrying channels **406**. In the tip shown, a Crystal Tip from Westside Resources of Irvine, Calif., the water tube protrudes from the proximal end of the tip at **408**, facilitating an additional O-ring seal at **410** for enhanced air/water separation. The proximal end of tip **400** includes a tapered region to ensure that the tip end does not "bottom out" against the bottom of the ferrule cup. This allows air to flow through side grooves **502** and into the air-carrying channels **406** of the tip. Again, however, as long as access to the air-carrying channels is provided, such a tapered region is not necessarily required.

[0017] While the conversion kits disclosed in the '280 Application effectively allow disposable tips to be used in conjunction with multiple different syringe systems, the use of two subassemblies including a separate cap and adapter results in a seam around the completed assembly. If this seam could be eliminated, the result would be a more streamlined solution with the potential for easier cleaning and/or sterilization.

SUMMARY OF THE INVENTION

[0018] This invention resides in conversion assemblies enabling a disposable tip to connect to an existing dental syringe configured to receive a different type of tip such as an autoclavable tip. The tip has proximal and distal ends with a central, water-carrying tube surrounded by air-carrying channels. The tip, typically constructed from extruded or molded plastic, may be straight or bent, and may have flat flush ends or a water tube that extends outwardly from the proximal end.

[0019] A conversion kit enabling an air/water syringe body to receive a disposable tip includes a retainer body having a distal opening into which the proximal end of the elongated disposable tip is inserted, and one or more internal components with cut-outs, grooves or channels to direct air and water from the syringe body to the air-carrying channels and water-carrying tube of the disposable tip.

[0020] In accordance with the invention, all of the components internal to the retainer are installed through the proximal opening in the retainer, enabling the proximal end of the retainer to be adjacent to the syringe body, such that there are no seams in the outer surface of the retainer from the syringe body to the distal end of the retainer that might collect pathogens or dirt. The completed assembly is preferably autoclavable in the absence of the disposable tip.

[0021] The configuration of the retainer and internal components are varied in alternative embodiments to accommodate a wide variety of syringe styles. As examples, the completed conversion kit may include a proximal receptacle to receive a stem on the syringe body; a proximal stem insertable into the syringe body; one or more proximal air- or water-carrying tubes insertable into the syringe body; or a threaded connection to the syringe body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. **1** is an exploded isometric view of a prior art dental syringe showing its quick-release tip withdrawn;

[0023] FIG. **2** is an enlarged side elevational view of the dental syringe of FIG. **1** with portions broken away;

[0024] FIG. **3** is a sectional view taken along line **3-3** of FIG. **2**;

[0025] FIG. **4** is a drawing in partial cross section showing an existing cap subassembly and disposable tip;

[0026] FIG. **5** is a side view of a ferrule used in the cap subassembly of FIG. **4**, showing side grooves configured for the passage of air;

[0027] FIG. **6** is an exploded view illustrating how the invention replaces an autoclavable tip on a generic, European-style with a conversion kit and disposable tip;

[0028] FIG. **7**A is a side view of a threaded ferrule constructed in accordance with the present invention, also including side grooves configured for the passage of air;

[0029] FIG. **7**B illustrates a two-piece ferrule construction applicable to disposable Crystal Tips having extended proximal water-carrying tubes;

[0030] FIG. **7**C illustrates an alternative two-piece ferrule construction applicable to disposable Crystal Tips having extended proximal water-carrying tubes;

[0031] FIG. **7**D illustrates a three-piece ferrule construction applicable to disposable Crystal Tips having extended proximal water-carrying tubes;

[0032] FIG. **7**E illustrates an alternative three-piece ferrule construction applicable to disposable Crystal Tips having extended proximal water-carrying tubes;

[0033] FIG. **7**F illustrates a two-piece ferrule construction that accommodates tips without extended water tubes such as the Sani-Tip®;

[0034] FIG. **7**G illustrates an alternative two-piece ferrule construction that accommodates tips without extended water tubes such as the Sani-Tip®;

[0035] FIG. **7**H illustrates a three-piece ferrule construction that accommodates tips without extended water tubes such as the Sani-Tip®;

[0036] FIG. **7**I illustrates an alternative three-piece ferrule construction that accommodates tips without extended water tubes such as the Sani-Tip®;

[0037] FIGS. **8**A-**8**G illustrate syringe systems to which the invention is applicable that feature stems protruding from the syringe body;

[0038] FIGS. **9**A-**9**C illustrate syringe systems to which the invention is applicable that feature threaded connections between the syringe body and the tip which is removed;

[0039] FIGS. **10**A-**10**F illustrate syringe systems to which the invention is applicable that feature stems protruding from the removed tip and into the syringe body;

[0040] FIGS. **11**A-**11**D illustrate syringe systems to which the invention is applicable that feature tube projections from the removed tip and into the syringe body;

[0041] FIG. **12** is a cross section of a Castellini syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0042] FIG. **13** is a cross section of a Cefla F3 LUZ syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0043] FIG. **14** is a cross section of a Cefla F6 Anthos syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0044] FIG. **15** is a cross section of a Chirana syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0045] FIG. **16** is a cross section of a Faro SM03 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0046] FIG. **17** is a cross section of a Faro SYR syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0047] FIG. **18** is a cross section of a Kayo 1056 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0048] FIG. **19** is a cross section of a Kayo 1056S syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0049] FIG. **20** is a cross section of a Kayo 6F syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0050] FIG. **21** is a cross section of a Kayo Systematica (with light) syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0051] FIG. **22** is a cross section of a Kayo Systematica (without light) syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0052] FIG. **23** is a cross section of a Kayo K4 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0053] FIG. **24** is a cross section of a Kayo Esthetica syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0054] FIG. **25** is a cross section of a Sirona 4000 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0055] FIG. **26** is a cross section of a Sirona C8 Teneo syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0056] FIG. **27** is a cross section of a Ritter Topjet syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0057] FIG. **28** is a cross section of a Luzzani Mini Assistant syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0058] FIG. **29** is a cross section of a Luzzani Mini Mate syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0059] FIG. **30** is a cross section of a Luzzani Mini Light syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0060] FIG. **31** is a cross section of a Luzzani Mini Brite syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0061] FIG. **32** is a cross section of a Morita WS66 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0062] FIG. **33** is a cross section of a Morita WS97 syringe body and a conversion kit enabling the syringe to accept disposable tips;

[0063] FIG. **34** is a cross section of a Morita WS 12 syringe body and a conversion kit enabling the syringe to accept disposable tips; and

[0064] FIG. **35** is an exploded view of a Takara Belmont syringe body and a conversion kit enabling the syringe to accept disposable tips

DETAILED DESCRIPTION OF THE INVENTION

[0065] This invention improves upon existing air/water syringe instrumentation by providing conversion kits that enable replaceable, disposable tips to be used with various syringe assemblies, including European-style syringes. The invention is also applicable to disposable tips with disposable tips having extended proximal water tubes as well as tips with flush air/water passages on opposing flat proximal and distal ends. Nor is the invention limited in terms of the number of air-carrying channels surrounding the central water-carrying tube.

[0066] FIG. **6** is a simplified drawing showing a generic syringe body **602** with air/water control buttons **604**. The figure also shows a generic autoclavable tip **606** which is removed from the body **602** and replaced with a retainer body **610** having a distal end **612** to receive disposable tip **400**. The retainer is illustrated in broken-line form because it is a generic example with specific embodiments being described below with respect to detailed cross-sectional drawings. In all embodiments, however, air/water directing components internal to the retainer are installed through a proximal opening **614** in the retainer, such that the proximal portion **616** of the retainer can be flush against a corresponding portion **618** of the syringe body so that the outer surface **620** of the retainer can be smooth and seamless from the syringe to the distal end **612**.

[0067] The components associated with the retainer body span a range of parts and complexity depending upon the type of syringe and the tip being replaced. That said, the invention accommodates all current styles and may be extended to yet-to-be developed designs with appropriate engineering modification. In particular, the invention includes conversion kits with retainers and components to accommodate syringe systems with stems that protrude from the syringe body, as exemplified in FIGS. **8**A-**8**G; syringe systems that feature threaded connections between the syringe body and the tip without any prominent protrusions, as depicted in FIGS. **9**A-**9**C; syringe systems with stems protruding from the removed tip, as shown in FIGS. **10**A-**10**F; and syringe systems that feature tube projections from the removed tip, as shown in FIGS. **11**A-**11**D.

[0068] One component internal to the retainer body is a cup-shaped ferrule to receive the proximal end of the disposable tip once inserted into the distal end of the retainer. Such a ferrule, shown in FIG. **7**A, may include a central opening

through which water passes into the water-carrying tube of the disposable tip and one or more side cut-outs **702** through which air passes into the air-carrying channels of the disposable tip. The ferrule may further include a central opening to receive a water-carrying tube extending from the proximal end of the disposable tip. As with the other components internal to the retainer body, the ferrule is installed through the proximal opening in the retainer and preferably threaded at **704** to maintain its position.

[0069] While FIG. **7**A illustrates a one-piece threaded ferrule applicable to the invention, two and three-piece designs are shown in FIGS. **7**B-**7**I. FIGS. **7**B-**7**E are applicable to disposable Crystal Tips with extended proximal water-carrying tubes, whereas FIGS. **7**F-**7**I relate to ferrules that accommodate tips without extended water tubes such as the Sani-Tip®. FIG. **7**B illustrates a two-piece ferrule comprising threaded portions **710**, **712**. Portion **710** preferably includes a tapered guide sleeve **711**. Stops **714** create air gaps **716** enabling air to flow through diagonal channels **713** and into tip **400**. The extended water-carrying tube is shown at **408**. The use of stops to create air gaps, thereby preventing the proximal end of the tip from "bottoming out" is, by itself, unique in the industry and patentably distinct. So, too, is the use of double/multiple O-ring seals as evident in certain of the ferrule designs described herein and below.

[0070] FIG. **7**C illustrates a two-piece ferrule comprising threaded portions **720**, **722**, with portion **720** preferably including a tapered guide sleeve **721**. Cuts in portion **722** enable air to flow through channels **723** and into tip **400**. FIG. **7**D illustrates a three-piece ferrule comprising threaded portions **730**, **732** and **734**. Portion **730** preferably includes a tapered guide sleeve **731**. Stops **735** create air gaps **736** enabling air to flow through diagonal channels **733** and into tip **400**. FIG. **7**E illustrates a three-piece ferrule comprising threaded portions **740**, **742** and **744**. Portion **740** preferably includes a tapered guide sleeve **741**. The spacing between components **742**, **744** create channels enabling air to flow into tip **400**. Stops **746** prevent bottom ferrule tightening.

[0071] FIG. **7**F illustrates a two-piece ferrule comprising threaded portions **750**, **752**. Portion **750** preferably includes a tapered guide sleeve **751**. Stops **754** create air gaps **756** enabling air to flow through diagonal channels **753** and into disposable tip **401** of the Sani-Tip® type. Water-carrying channel **759** carries water in the center tube of the tip **401**. Designation **758** refers to countersunk O-rings. FIG. **7**G illustrates a two-piece ferrule comprising threaded portions **760**, **762**, with portion **760** preferably including a tapered guide sleeve **761**. Cuts in portion **762** enable air to flow through channels **763** and into tip **401**. Conduit **769** carries water into the center of the tip **401**.

[0072] FIG. **7**H illustrates a three-piece ferrule comprising threaded portions **770**, **772** and **774**. Portion **770** preferably includes a tapered guide sleeve **771**. Stops **773** create air gaps **776** enabling air to flow through diagonal channels **775** and into tip **401**. FIG. **7**I illustrates a three-piece ferrule comprising threaded portions **780**, **782** and **784**. Portion **780** preferably includes a tapered guide sleeve **781**. The spacing between components **782**, **784** create channels enabling air to flow into tip **401**. Stops **786** prevent bottom ferrule tightening.

[0073] FIGS. **12** to **35** are detailed cross-sectional drawings that show conversion kits for particular syringe styles and, in some cases, modified ferrules depending upon the design requirements. In these drawings, the existing syringe body is shown without cross-hatching, whereas the cap and adapter subassemblies are cross-hatched. Air and water flows are also illustrated with text in each cross section. All conversion kits further include multiple O-rings, depicted as black circles. In terms of materials, the ferrules are preferably constructed of a brass alloy to achieve demanding tolerances, whereas the other hard components may be constructed of aluminum or hard plastic. Although certain of the conversion kits provide three or more components in addition to the O-rings, those of skill in the art will recognize that fewer pieces may be used through appropriate machining. For example, the ferrule and end cap may be formed of an integral unit by machining a single piece of brass or aluminum. While such fabrication may complicate the manufacturing process somewhat, the end result eliminates O-rings and simplifies assembly by the user.

[0074] While FIGS. **12** to **38** are well-understood and apparent to those of skill, comments will be made about incidental features and structures. FIG. **12** is a cross section of a Castellini syringe body and conversion kit. Note in this case that since the syringe body **1202** expects to receive elongated air/water tubes from the removed tip, they are provided at **1204**, **1206** extending from internal component **1208**. Threaded ferrule **1210** within retainer body **1200** receives the proximal end of the tip.

[0075] The Cefla Anthos F3 syringe body **1300** from Luzzani and conversion kit of FIG. **13** includes a stem component **1302** that guides air and water flows through angled channels to cavities around ferrule **1310**. The configuration produces a radial air flow at **1312**.

[0076] FIG. **14** is a cross section of a Cefla F6 Anthos syringe body and a conversion kit. The handpiece and screw-in insert are depicted at **1402**. A separate component **1404** threads into the retainer body **1400** which, in turn, provides threads to receive ferrule **1410**. Component **1406** provides a stem **1406** expected by the handpiece. As with the Cefla Anthos F3, a radial air flow is produced at **1412** prior to entry into the disposable tip.

[0077] The Chirana syringe body and conversion kit of FIG. **15** provides an anticipated threaded connection at **1504** with no prominent protrusions as with the tip being replaced. The radial air flow at **1512** in this case is guided to ferrule **1510** through stem component **1506** which threads into retainer **1500**. Ferrule **1510** in turn threads into the stem component **1506** as shown.

[0078] The Faro SM03 syringe of FIG. **16** qualifies as having a stem (**1604**) on the syringe body **1602**. The OEM O-rings in this case are left on the stem **1604**. Air is delivered through threaded insert **1606** to ferrule **1610**. Ferrule **1610** threads into insert **1606** which threads into the retainer body **1600**.

[0079] FIG. **17** is a cross section of a Faro SYR syringe body and a conversion kit. Retainer body **1700** makes a threaded connection to the syringe body **1702** at **1704**. Ferrule **1710** screws into insert **1706** which threads into the retainer body **1700**. The ferrule in this case includes three air slots to ensure compatibility with the design.

[0080] FIG. **18** is a cross section of a Kayo 1056 syringe body and a conversion kit. Ferrule **1810** is threaded into the retainer body **1800** as shown. A stem component **1706**, threaded over the ferrule includes a proximal cavity **1808** to receive a stem **1804** on the hand piece **1802**.

[0081] FIG. **19** is a cross section of a Kayo 1056S syringe body and a conversion kit which is quite simple, requiring

only retainer body **1900** and ferrule **1910**. The retainer is threaded onto the syringe handpiece **1902** such that a radial air flow is produced at **1912**.

[0082] The Kayo 6F syringe body **2002** of FIG. **20** also includes a stem **2004** received by the conversion kit. A component **2006**, threaded within retainer body **2000** receives the stem **2004**. An OEM retaining ring **2008** is kept for use with the conversion kit. Ferrule **2010** is threaded into the retainer **200** prior to installation of component **2006** which also produces a radial air flow at **2012**.

[0083] FIG. **21** is a cross section of a Kayo Systematica (with light) syringe system and the conversion kit for that unit. A component **2104**, threaded into the retainer body **2100**, includes a cavity **2106** to receive a stem on the syringe. The kit in this case includes a nylon plug **2108** to produce a radial air flow at **2112** and into ferrule **2110**. In this case, a radial water flow is also produced at **2114**.

[0084] The conversion kit for the Kayo Systematica (without light) syringe of FIG. **22** is similar to the lighted version depicted in FIG. **21**. Ferrule **2210** screws into the retainer body **2200**, followed by component **2204** including a cavity **2206** to receive a stem **2208** protruding from the syringe system. A radial air flow is produced at **2212** but without a radial water flow.

[0085] FIG. **23** illustrates a conversion kit applicable to the Kayo K4 syringe. Note that in this and other embodiments of the invention, not all of the OEM O-rings provided on the stem **2308** of the syringe **2302** are replaced once removed to receive the conversion components. Ferrule **2310** screws into the retainer body **2300**, followed by component **2304** including stepped cavities to receive the stepped stem protruding from the syringe system. A radial air flow is produced at **2312**.

[0086] The Kayo Esthetica syringe body shown in FIG. **24** includes an elongated stem on the syringe body **2402**, with air flowing out the side of the stem and into component **2404** which threads into retainer **2400**. Component **2404** and ferrule **2410** cooperate to guide air and water to their respective destinations into the tip as shown. The system includes an OEM plug **2406** which is retained in the design.

[0087] The Sirona 4000 system, shown in FIG. **25**, includes a cavity **2504** to receive a stem component **2508** which is threaded into retainer body **2500**. Ferrule **2510** threads into component **2508**. An OEM spring clip **2506** is retained in the design. A radial air flow is produced at **2512**.

[0088] The Sirona C8 system of FIG. **26** is somewhat similar to the 4000 system of FIG. **25**, with one exception being that both air and water are brought in through the sides of stem component **2604**. In addition a slightly modified ferrule **2610** is used in this design. The ferrule **2610** is threaded into stem component **2604** which, in turn, is threaded into retainer body **2600**.

[0089] FIG. **27** is a cross section of a Ritter Topjet syringe body **2702** and a conversion kit. Ferrule **2704** threads into a stem component **2704** which threads into retainer body **2700**. A radial air flow is produced at **2712**.

[0090] FIG. **28** relates to the Luzzani Mini Assistant syringe. The OEM receiver body less the handpiece is shown at **2802**. The conversion kit in this case is also quite simple, requiring only ferrule **2810** threaded into retainer body **2800**. The retainer body screws onto the syringe body **2802**. A radial air flow is seen at **2812**.

[0091] FIG. **29** is directed to the Luzzani Mini Mate system, with the OEM receiver indicated at **2902**. Two views are shown to provide a complete picture. The upper drawing is rotated 90 degrees from the lower drawing. Air is brought in through a central passage **2920**, while water is brought in through opposing side ports **2922**. As shown in the upper drawing, water is channeled to a central region in insert **2904** which is threaded into retainer body **2900**. As shown in the lower drawing, air is routed through diagonal channels and into ferrule **2910**. The ferrule screws into the insert **2904** which is received by threads in the retainer body **2900**.

[0092] FIG. **30** is directed to the Luzzani Mini Light syringe body with associated conversion kit. The OEM receiver is indicated at **3002**. Two views are again shown to provide a complete picture. The upper drawing is rotated 90 degrees from the lower drawing. Air is brought in through a central passage **3020**, while water is brought in through opposing side ports **3022**. As shown in the upper drawing, water is channeled to a central region in insert **3004** which is threaded into retainer body **3000**. As shown in the lower drawing, air is routed through diagonal channels and into ferrule **3010**. The ferrule screws into the insert **3004** which is received by threads in the retainer body **3000**.

[0093] The Luzzani Mini Light is very similar to the Mini Mate except that the Mini Light includes a light source. In this case, at least a portion of the disposable tip may be constructed from a plastic such as Lucite which acts as a light pipe to conduct the illumination from the distal tip of the optical fiber to the distal end of the tip. As an alternative way to retain the illumination feature, the adapter subassembly may include along its length an optical fiber or solid light to conduct the illumination from the distal tip of the optical fiber to a light-emitting port disposed on the side of the adapter unit.

[0094] FIG. **31** is a cross section of a Luzzani Mini Brite syringe body and conversion kit which includes a component **3110** an elongated stem that extends deep into the syringe body **3102**. The retainer body is shown at **3100**, which mounts to the OEM receiver body with jam nut **3112**. Note that the component **3110** amounts to an elongated ferrule in this case.

[0095] FIG. **32** depicts a conversion kit for the Morita WS66 syringe body **3202**. Ferrule **3210** threads into a stem component **3206** which threads into retainer body **3200**. A radial air flow is seen at **3212**.

[0096] FIG. **33** depicts a conversion kit for the Morita WS97 syringe body **3302**. A modified ferrule **3310** with three slots threads into a stem component **3306** which threads into retainer body **3300**. Air comes in between a set of O-rings, through component **3306** and into ferrule **3310**. Water comes up directly through the center of the assembly.

[0097] FIG. **34** depicts a conversion kit for the Morita WS97 syringe. The OEM arbor-less handpiece is shown at **3410**. Ferrule **3410** threads into stem component **3406** which threads into retainer body **3400**. Radial air flows **3412** are produced in two regions, as shown.

[0098] FIG. **35** illustrates a Takara Belmont syringe body **3502** and associated conversion kit. Ferrule **3510** threads into the retainer body **3500** which screws onto the OEM receiver. Component **3506** is trapped between the retainer and syringe bodies when the assembly is tightened. A radial air flow is produced at **3512**.

I claim:

1. A conversion kit enabling an air/water syringe body to receive an elongated, disposable tip having proximal and distal ends and a central, water-carrying tube surrounded by air-carrying channels, the kit comprising:

a retainer body having an outer surface and a distal opening into which the proximal end of an elongated disposable tip is inserted;

the retainer further including a proximal opening into the retainer body, the proximal opening being larger than the distal opening;

one or more components with cut-outs, grooves or channels to direct air and water from the syringe body to the air-carrying channels and water-carrying tube of the disposable tip; and

wherein all of the components are installed within the retainer body through the proximal opening in the retainer body, such that the outer surface of the retainer is smooth and seamless.

2. The conversion kit of claim **1**, wherein the retainer body or the components therein provide a proximal receptacle to receive a stem on the syringe body.

3. The conversion kit of claim **1**, wherein at least one component within the retainer body includes a proximal stem insertable into the syringe body.

4. The conversion kit of claim **1**, wherein at least one component within the retainer body includes one or more proximal air- or water-carrying tubes insertable into the syringe body.

5. The conversion kit of claim **1**, wherein the retainer body includes internal threads for making a threaded connection to the syringe body.

6. The conversion kit of claim **1**, wherein one of the components within the retainer body is a cup-shaped ferrule to receive the proximal end of the disposable tip once inserted into the distal opening of the retainer body.

7. The conversion kit of claim **1**, wherein one of the components within the retainer body is a cup-shaped ferrule to receive the proximal end of the disposable tip, the ferrule including a central opening through which water passes into the water-carrying tube of the disposable tip and one or more side cut-outs through which air passes into the air-carrying channels of the disposable tip.

8. The conversion kit of claim **1**, wherein one of the components within the retainer body is a cup-shaped ferrule with a central opening to receive a water-carrying tube extending from the proximal end of the disposable tip.

9. The conversion kit of claim **1**, wherein the retainer body is autoclavable in the absence of the disposable tip.

10. A conversion kit enabling a disposable tip to connect to a dental syringe that supplies air and water through separate air and water ports, the tip having a central, water-carrying tube surrounded by a plurality of air-carrying channels, the tip having a proximal base surface with openings to the air-carrying passages, with the water tube extending outwardly from the base surface, the kit comprising:

a retainer body having an outer surface and a distal opening into which the proximal end of an elongated disposable tip is inserted;

the retainer further including a proximal opening into the retainer body, the proximal opening being larger than the distal opening;

one or more components with cut-outs, grooves or channels to direct air and water from the syringe body to the air-carrying channels and water-carrying tube of the disposable tip, wherein all of the components are installed within the retainer body through the proximal opening in the retainer body, such that the outer surface of the retainer is smooth and seamless.

the components within the retainer body providing an internal structure with a first path for coupling the water port of the syringe to the water-carrying tube of the tip, and a second path for coupling the air port of the syringe to the air-carrying channels of the disposable tip;

the components including a receptacle having a bottom portion cooperating with the proximal base surface of the tip once inserted into the cap subassembly, the receptacle further including an aperture through which the water-carrying tube of the tip extends;

wherein a cavity is established between the bottom portion of the receptacle and the base surface of the tip; and

wherein the receptacle includes one or more side apertures through which air from the syringe passes into the cavity and into the air-carrying passages of the tip.

11. The conversion kit of claim **10**, wherein the receptacle is a separate component threaded into the retainer body through the proximal opening.

12. The conversion kit of claim **10**, wherein the retainer body and internal components provide a proximal receptacle to receive a stem on the syringe body.

13. The conversion kit of claim **10**, wherein one or more components internal to the retainer body provide a proximal stem insertable into the syringe body.

14. The conversion kit of claim **10**, wherein one or more components internal to the retainer body provide one or more proximal air- or water-carrying tubes insertable into the syringe body.

15. The conversion kit of claim **10**, wherein the retainer body includes a threaded connection to the syringe body.

16. The conversion kit of claim **10**, wherein the retainer body and internal components are autoclavable in the absence of the disposable tip.

17. A method enabling a dental syringe having an existing tip to instead receive a disposable tip having a central, water-carrying tube surrounded by a plurality of air-carrying channels, comprises the steps of:

removing the existing tip from the syringe;

coupling a retainer body to the syringe, the body having proximal end adapted for connection to the syringe in place of the existing tip, and a distal end with an opening to receive the proximal end of a disposable tip, the retainer body including one or more internal components providing a first path for coupling the water port of the syringe to the water-carrying tube of the tip and a second path for coupling the air port of the syringe to the air-carrying channels of the tip; and

inserting the proximal end of the tip into the distal end of the retainer body such that water is able to flow from the syringe through the water-carrying tube of the disposable tip, and air from the syringe is able to flow from the syringe through the air-carrying channels of the disposable tip.

18. The method of claim **17**, including the step of providing a retainer body with internal components providing a proximal receptacle to receive a stem on the syringe.

19. The method of claim **17**, including the step of providing a retainer body with internal components providing a proximal stem insertable into the syringe.

20. The method of claim **17**, including the step of providing a retainer body with internal components providing one or more proximal air- or water-carrying tubes insertable into the syringe.

21. The method of claim **17**, including the step of screwing the retainer body onto the syringe body.

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