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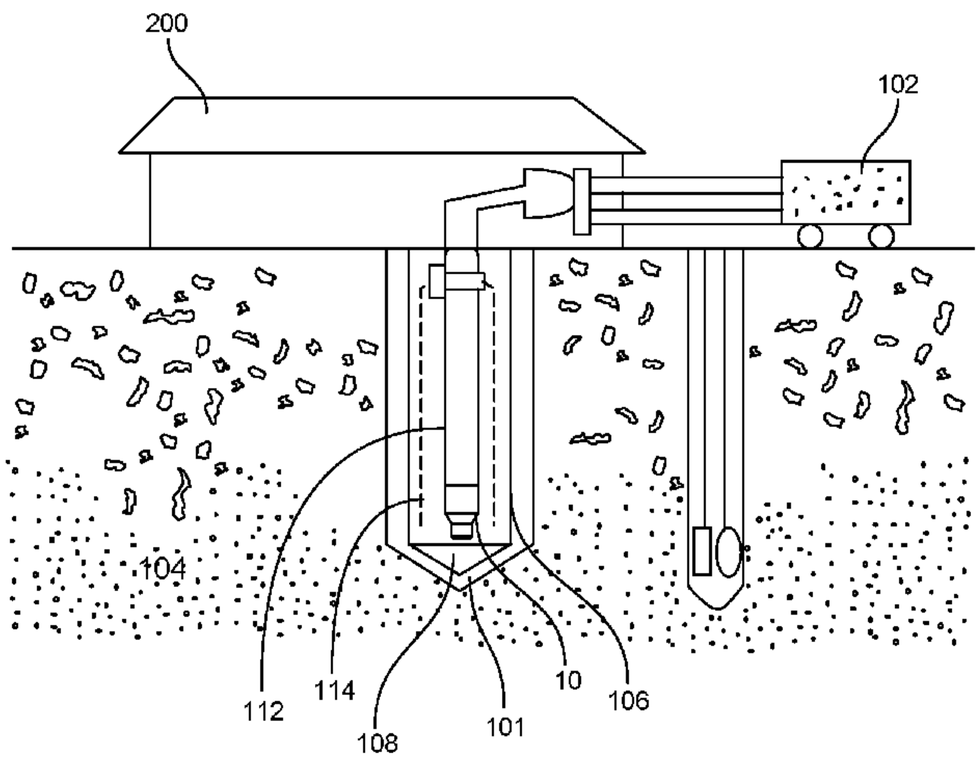
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FIG. 1



(57) Abstract: The present invention is directed to an apparatus for mixing two or more materials underground. The apparatus includes at least one hose in fluid communication with containers of the materials that are to be mixed. The apparatus further includes a mixer in which the at least one hose is terminated. The mixer has at least one aperture for receiving the at least one hose. The mixer further defines a mixing chamber in fluid communication with the at least one aperture to receive the materials entering into each aperture through each hose for facilitating mixing thereof in the mixing chamber. The mixer further includes an outlet for discharging the mixture.

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I. TITLE: *"MIXING DEVICE FOR SILT FINE SOIL"*

II. BACKGROUND OF THE INVENTION

1. Field of the Invention.

[001] The present disclosure relates to the field of mixers. In particular, the present disclosure relates to an apparatus to be used for facilitating mixing of materials underground.

2. Description of the Related Art.

[002] It is known to reinforce the soil by injection of structurally resistant material that improve the foundation strength of existing structures such as houses and buildings. To achieve this, one method is to introduce raw materials underground, whose reaction provides stability to the soil, thereby increasing the strength of the foundation. Hence, there is need of a mixer to facilitate this underground mixing and reaction between the raw materials or compositions.

[003] Several designs for mixers have been designed in the past. None of them, however, are known to be usable for underground mixing while having a compact and easy to use configuration.

[004] Applicant believes that a related reference corresponds to U.S. Patent Publication No. 5,104,233 filed by HISAO KOJIMA. The *Kojima* reference discloses a mixing element that comprises a passage tube through which fluids to be mixed pass and a fluid structure providing a plurality of fluid passage in the interior of the passage tube. However, the *Kojima* reference fails to disclose any means to facilitate underground mixing of materials.

[005] Another related application is U.S. Pat. No. 7,040,802 filed by ALFRED FÜGLISTER. The *Füglister* reference discloses static mixer for a high-viscosity flowing fluid, which includes mixing elements which are made as monoliths and sleeve elements in the form of tube pieces by means of which the mixing elements are positioned as well as a housing into

which the sleeve elements are inserted together with the mixing elements. However, the *Füglister* reference fails to disclose any means to facilitate underground mixing of materials.

[006] Other documents describing the closest subject matter provide for a number of more or less complicated features that fail to solve the problem in an efficient and economical way. None of these patents suggest the novel features of the present invention.

III. SUMMARY OF THE INVENTION

[007] It is an object of the present invention to provide a mixer for facilitating underground mixing of materials.

[008] It is yet another object of the present invention to provide a mixer for facilitating underground mixing of materials, which has simple configuration.

[009] Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing any limitations thereon.

IV. BRIEF DESCRIPTION OF THE DRAWINGS

[010] With the above and other related objects in view, the invention consists in the details of construction and combination of parts as will be more fully understood from the following description, when read in conjunction with the accompanying drawings in which:

Figure 1 illustrates a system **100** for improving soil condition, in accordance with one embodiment of the present disclosure. Specifically, cap **108** is shown at a distal end of first pipe **106**, both of which have already been inserted a predetermined distance into soil **104**, and the composition is injected into the expansion element **114**.

Figure 2 demonstrates a view of expansion element **114** and filler tubes **112** used to transport the composition underground and towards a mixer **10**.

Figure 3A demonstrates an exploded view of an apparatus **20**, for facilitating underground mixing of materials, comprising a base **24** and an extension assembly **28**.

Figure 3B demonstrates a view of the extension segments **28A** of the extension assembly **28** being connectable via loop and clip formations **28D**.

Figure 3C demonstrates a view of attachment **28B** having a hexagonal opening **28C** that is connectable to a hexagonal protrusion **10D** on the mixer **10**.

Figure 4 demonstrates a view of filler tubes **112** being terminated into the mixer **10**.

Figure 5 illustrates the different components that facilitate the proper placement of the filler tubes **112** and the expansion element **114** underground.

Figure 6A illustrates a top view of the bottom bushing **14**.

Figure 6B illustrates an isometric view of the bottom bushing **14**.

Figure 6C illustrates a front view of the bottom bushing **14**.

Figure 7A illustrates a schematic view of flexible hose **34** used to guide the filler tubes in the first pipe **106**.

Figure 7B illustrates a schematic view of the filler tubes **112** being connected to the mixer **10** within the first pipe **106**.

Figure 8A illustrates a top view of mixer **10**, in accordance with one embodiment of the present invention.

Figure 8B illustrates an isometric view of mixer **10**, in accordance with one embodiment of the present invention.

Figure 8C illustrates a front view of mixer **10**, in accordance with one embodiment of the present invention.

Figure 9A illustrates a top view of mixer **10**, in accordance with another embodiment of the present invention.

Figure 9B illustrates an isometric view of mixer **10**, in accordance with another embodiment of the present invention.

Figure 9C illustrates a front view of mixer **10**, in accordance with another embodiment of the present invention.

Figure 10A illustrates a top view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 10B illustrates a front view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 10C illustrates a cross-sectional view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 10D illustrates an isometric view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 11A illustrates a top view of mixer **10**, in accordance with still another embodiment of the present invention.

Figure 11B illustrates an isometric of mixer **10**, in accordance with still another embodiment of the present invention.

Figure 11C illustrates a front view of mixer **10**, in accordance with still another embodiment of the present invention.

Figure 12A illustrates a schematic view of mixer **10**, in accordance with one embodiment of the present invention.

Figure 12B illustrates a schematic view of mixer **10**, in accordance with one other embodiment of the present invention.

Figure 13A illustrates a front view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 13B illustrates an isometric view of mixer **10**, in accordance with yet another embodiment of the present invention.

Figure 13C illustrates a top view of mixer **10**, in accordance with yet another embodiment of the present invention.

V. DETAILED DESCRIPTION OF THE EMBODIMENTS OF THE INVENTION

[011] Referring now to the drawings, Figures **1-13**, where the present invention is generally referred to with numeral **10**, it can be observed that a mixer **10**, in accordance with the present invention, is provided on at the bottom ends of hoses carrying the raw materials or compositions that need to be mixed underground.

[012] **Fig. 1** illustrates a system **100** for reinforcing the soil or foundation of the house **200**. The system **100** comprises a container **102** containing the composition or the raw material that needs to be mixed into the soil **104** to reinforce the soil and any type of foundation, which

includes but not limited to a foundation of the house or any other type of construction. The composition can also be added to the soil to fill voids and thereby stabilizing the soil and associated foundations. The system further comprises a first pipe **106** disposed within a first hole **101** that is drilled in the soil **104**. The distal end of the first pipe **106** is covered by means of a cap **108**. The system further comprises one or more filler tubes **112** in fluid communication with the container **102**. The system further comprises a mixer **10** provided at the operative bottom end of the filler tubes **112** for facilitating the mixing of two or more compositions entering the mixer **10**.

[013] Optionally, the system **100** can include an expansion element **114**. The mixture of the compositions exiting the mixer **10** is collected inside the expansion element **114**. At times, the compositions can be such that upon mixing the compositions in the mixer **10**, chemical reaction between the compositions causes the mixture to expand. The expansion can be accommodated by the expansion element **114**. After expansion, the mixture can get converted to a hard block, which provides strength to the foundation of the house **200**.

[014] Referring to **Fig. 2**, the ducting as well as the changes in the expansion element **114** can be seen. In the example illustrated in **Fig. 2**, there are two filler tubes **112** that terminate into the mixer **10**. After the formation of the mixture in mixer **10**, the mixture is discharged into the expansion element **114**, subsequent to which expansion of the mixture occurs in the expansion element **114**, as discussed previously. A top bushing **12** allows holding the filler tubes **112** and the expansion element **114** together. A bottom bushing **14** is provided at the operative bottom end of the expansion element **114** for holding the filler tubes **112** and the expansion element **114.** **Fig. 5** illustrates the different components that facilitate the proper placement of the filler tubes **112** and the expansion element **114** underground, namely, the top bushing **12**, the bottom bushing **14**, a metallic ring **16** to tie the filler tubes **112** and the expansion element **114** to the top bushing **12**, and metallic cover **18** the filler tubes **112** and the expansion element **114** to the bottom bushing **14**. **Fig. 6A** through **Fig. 6C** illustrate the views of the bottom bushing **14**. It is to be noted that the configuration of the bottom bushing illustrated in **Fig. 6A** through **Fig. 6C** are only exemplary. Other profiles of the bottom bushing, per the application requirements, are well within the scope of the present invention.

[015] Referring to **Fig. 3A through Fig. 3C**, an apparatus **20** for mixing two or more materials underground is seen. The apparatus **20** comprises at least one hose **112** in fluid communication with containers **102** of the materials or compositions that are to be mixed. The apparatus **20** further comprises a mixer **10** in which the at least one hose **112** is terminated. The mixer **10** has at least one aperture **10A** for receiving the at least one hose **112**. The mixer **10** defines a mixing chamber **18** that is in fluid communication with the at least one aperture **10A** to receive the materials entering into each aperture **10A** through each hose **112** for facilitating mixing thereof in the mixing chamber **18**. The mixer **10** further defines an outlet **22** for discharging the mixture.

[016] The apparatus **20** further comprises base **24** that is configured to be fitted to the outlet **22** of the mixer **10**. The base **24** has an opening **24A** to securely receive the mixer **10**. More specifically, the opening **24A** can be provided with threads or other means to securely receive or to fit with the outlet **22** of the mixer **10**.

[017] The mixer **10**, in accordance with the present invention, has an aperture **26** provided on an operative top surface of the mixer **10**. The apparatus **20** further comprises an extension assembly **28**. The extension assembly **28** includes a plurality of extension segments **28A**, wherein one of the extension segments **28A** includes a handle **30**, while another one of the extension segments **28A** includes a protrusion **32**. The extension assembly **28** facilitates the fitment of the mixer **10** onto the base **24**. The base **24** is provided at the operative bottom end of the expansion element **114**, which is underground. The extension assembly **28** facilitates the maneuvering of the mixer **10** through the first pipe **106** towards the base **24** to facilitate the fitment of the mixer **10** to the base **24**. To this end, the handle **30** helps in maneuvering the mixer down the first pipe **106**, while the protrusion **32** is configured to mate with the aperture **26** for facilitating the mechanical coupling between the extension segment **28A** and the mixer **10** to facilitate the rotation of the mixer **10** when the handle **30** is rotated. In one embodiment, the protrusion **32** and the aperture **26** have a square profile. Other polygonal profiles are also within the ambit of the present invention.

[018] **Fig. 3B** illustrates an embodiment of the extension assembly **28** wherein instead of the protrusion **32**, the extension segment **28A** is provided with an attachment **28B** defining a hexagonal opening **28C**. The hexagonal opening **28C** is configured to engage with a hexagonal protrusion **10D** provided on the mixer **10**, as seen in **Fig. 3C**. As seen in Fig. **3B**, the connection between the extension segments **28A** is facilitated by loop and clip formations **28D**.

[019] **Fig. 4** illustrates an isometric view of the mixer **10** having three filler tubes **112** terminated therewithin. The three filler tubes **112**, in accordance with one example, are used to carry a first composition in one of the filler tubes **112**, a second composition in another one of the filler tubes **112**, and air or water in the third filler tube **112**. The base **24** is also shown to have a threaded opening **24A,** which is configured to threadably receive the outlet **22** of the mixer **10**, which is provided with complementary thread formations.

[020] **Fig. 7A** illustrates the ducting in the apparatus **20**. As seen in **Fig. 7A**, the apparatus **20** comprises a flexible hose **34** that houses the filler tubes **112**. Downstream of the flexible hose **34** is the first pipe **106** that houses the filler tubes **112** underground. Drilled cases **36** is used to connect the flexible hose **34** with the first pipe **106** and for holding the filler tubes **112** as well.

[021] **Fig. 7B** illustrates the ducting in the apparatus **20,** as per another embodiment. As seen in **Fig. 7B**, the apparatus **20** comprises the filler tubes **112** that are inserted into the first pipe **106** such that the filler tubes **112** are terminated into the mixer **10**. The flexible hose **34** is absent in this embodiment. Drilled cases **36** is used to connect the flexible hose **34** with the first pipe **106** and for holding the filler tubes **112** as well.

[022] **Fig. 8A** through **Fig. 8C** illustrate the views of the mixer **10** in accordance with one embodiment of the present invention. The mixer **10** has a cylindrical top portion **10A** and the outlet **22** extending downwardly from the top portion **10B**. As described previously, the mixer **10** comprises the apertures **10A, 26**. The aperture **26** has a square profile in the present embodiment of the mixer **10**. The mixer **10** further comprises a hole **10C** that facilitates plug or needle location while the mixer **10** is being fitted into another pipe in a concentric arrangement. In the

embodiment illustrated in **Fig. 8A** through **Fig. 8C**, the outlet **22** is provided with thread formations on the outer surface thereof.

[023] **Fig. 9A** through **Fig. 9C** illustrate views of the mixer **10** in accordance with another embodiment of the present invention. This embodiment of the mixer illustrated in **Fig. 9A** through **Fig. 9C** are similar to the embodiment illustrated in **Fig. 8A** through **Fig. 8C**, the only difference being in the formations provided on the outer surface of the outlet **22** of the mixer. As such, the construction of the mixer **10** illustrated in **Fig. 9A** through **Fig. 9C** are not described again for the sake of brevity of the present disclosure. Also, like elements in **Fig. 8A** through **Fig. 8C** and **Fig. 9A** through **Fig. 9C** are referenced by like numerals for the sake of simplicity. The outlet **22** is provided with spiral protrusion **38** provided on the outer surface of the outlet **22**.

[024] **Fig. 10A** through **Fig. 10D** illustrate views of the mixer **10** in accordance with yet another embodiment of the present invention. This embodiment of the mixer illustrated in **Fig. 10A** through **Fig. 10D** are similar to the embodiment illustrated in **Fig. 8A** through **Fig. 8C**, the only difference being in the configuration of the aperture **26**. As such, the construction of the mixer **10** illustrated in **Fig. 10A** through **Fig. 10D** are not described again for the sake of brevity of the present disclosure. Also, like elements in **Fig. 8A** through **Fig. 8C** and **Fig. 10A** through **Fig. 10D** are referenced by like numerals for the sake of simplicity. The aperture **26**, in the present embodiment, has a circular shape. The circular shape of the aperture **26** allows an extension segment **28A** of a cylindrical profile to be fitted into the aperture **26** for maneuvering the mixer **10**.

[025] **Fig. 11A** through **Fig. 11C** illustrate views of the mixer **10** in accordance with another embodiment of the present invention. This embodiment of the mixer illustrated in **Fig. 11A** through **Fig. 11C** are similar to the embodiment illustrated in **Fig. 8A** through **Fig. 8C**, the only difference being in the formations provided on the outer surface of the outlet **22** of the mixer. As such, the construction of the mixer **10** illustrated in **Fig. 11A** through **Fig. 11C** are not described again for the sake of brevity of the present disclosure. Also, like elements in **Fig. 8A** through **Fig. 8C** and **Fig. 11A** through **Fig. 11C** are referenced by like numerals for the sake of simplicity. The outlet **22** is provided with protrusions **40** on the outer surface of the outlet **22.** More specifically, in this embodiment, the base **24** is provided with cavities for receiving protrusions **40** provided on the outlet **22** of the mixer **10**, wherein the cavities and the protrusions

40 have complementary configuration for facilitating snap fit of the outlet **22** into the opening of the base **24**.

[026] **Fig. 12A and Fig. 12B** illustrate views of the mixer **10** in accordance with yet another embodiments. Referring to Fig. **12A**, the mixer **10** further comprises a pair of inclined passages **42** extending from the outer periphery of the mixer **10** towards the central axis of the mixer **10.** Referring to Fig. **12B**, the mixer **10** further comprises a pair of horizontal passages **44** extending from the outer periphery of the mixer **10** towards the central axis of the mixer **10.**

[027] Referring to **Fig. 13A** through **Fig. 13C**, an embodiment of the mixer **10** is illustrated that comprises locating protrusions **46** provided on the periphery of the mixer for fitting the mixer **10** in a concentric tube. In an alternate embodiment, the mixer **10** is known as a Y-mixer and has a Y-shaped configuration. The mixer **10** can include a GPS device mounted thereon or housed therein that informs a user of the location of the mixer as it travels underground.

[028] The foregoing description conveys the best understanding of the objectives and advantages of the present invention. Different embodiments may be made of the inventive concept of this invention. It is to be understood that all matter disclosed herein is to be interpreted merely as illustrative, and not in a limiting sense.

VI. INDUSTRIAL APPLICABILITY

[029] The present invention's industrial applicability includes an apparatus for mixing two or more materials underground. The apparatus facilitates the underground mixing process with a simple configuration. The apparatus includes at least one hose which is in fluid communication with the containers of the materials needing mixing. The apparatus further includes a mixer in which the at least one hose is terminated. The mixer includes at least one aperture for receiving the at least one hose. The mixer defines a mixing chamber in fluid communication with the at least one aperture to receive the materials entering into each aperture through each hose for ease of mixing within the mixing chamber. The mixer further includes an outlet for discharging the resulting mixture.

VII. CLAIMS

What is claimed is:

1. An apparatus for mixing at least two materials underground, the apparatus comprising:
    a. at least two hoses in fluid communication with containers of the at least two materials, said at least two hoses each include a distal end that is inserted into a ground;
    b. a mixer located at said distal end, the mixer having at least two apertures for receiving the at least two hoses, the mixer further defining a mixing chamber in fluid communication with the at least two apertures to receive at least two materials that enter said at least two apertures through said at least two hoses for facilitating mixing thereof in the mixing chamber; and
    c. a base that is configured to be fitted to an at least one outlet of the mixer, the base having an opening to securely receive the mixer.

2. The apparatus as claimed in claim 1, wherein the opening of the base is a threaded opening for receiving the at least one outlet of the mixer, wherein the outer surface of the at least one outlet is provided with thread formations complementary to that provided on the opening.

3. The apparatus as claimed in claim 1, wherein the opening of the base is provided with cavities for receiving protrusions provided on the at least one outlet of the mixer, wherein the cavities and the protrusions have complementary configuration for facilitating snap fit of the at least one outlet into the opening.

4. The apparatus as claimed in claim 1, further comprising an extension assembly, wherein the extension assembly comprises at least one extension segment, wherein one of the extension segments has a protrusion complementary to the at least two apertures provided on the operative top surface of the mixer.

5. The apparatus as claimed in claim 6, wherein one of the extension segments comprises a handle, wherein the handle facilitates providing manual drive to the extension assembly for fitting the mixer into the base.

6. The apparatus as claimed in claim 6, wherein the protrusion and the at least two apertures have a square profile.

7. The apparatus as claimed in claim 1, wherein the mixer comprises locating protrusion provided on the periphery of the mixer for fitting the mixer in a concentric tube.

8. The apparatus as claimed in claim 6, wherein the extension segments are configured to be snap fitted to each other.

9. The apparatus of claim 1 wherein said at least two materials to be mixed within said mixer include any combination of: polyurethane, sand, pressurized air, and pressurized water.

10. The apparatus of claim 11 wherein the mixer includes two outlets, a first outlet for said polyurethane and a second outlet for the rest of the at least two materials.

11. The apparatus of claim 1 wherein said at least two hoses are mounted to said mixer through said at least two apertures using a quick connector or screwed on.

12. The apparatus of claim 1 including a top bushing and a bottom bushing each having at least one passage opening adapted to have said at least two hoses pass through and be guided as said at least two hoses travel underground.

13. The apparatus of claim 1, wherein the number of at least two apertures corresponds with the number of at least two hoses.

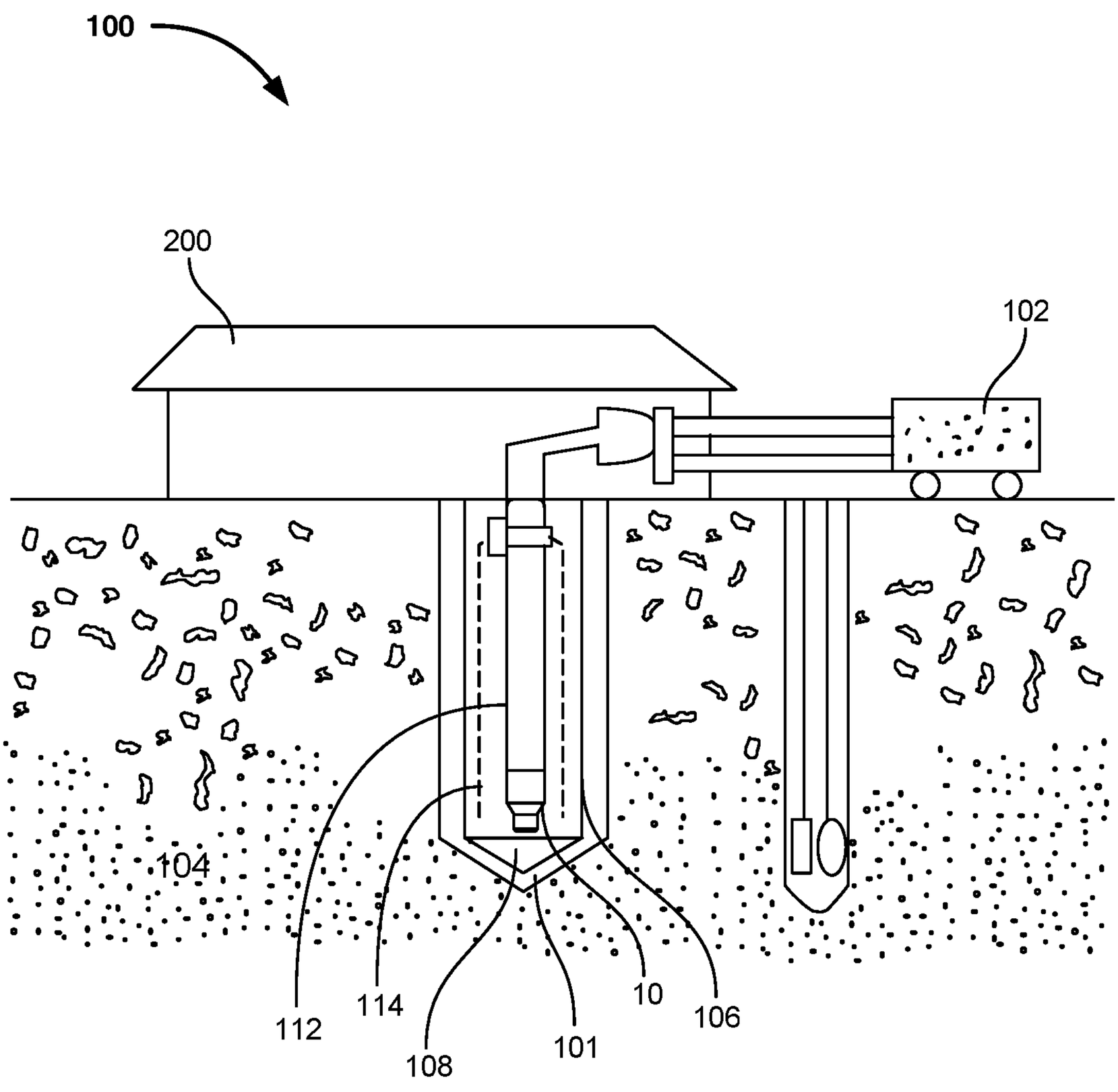


FIG. 1

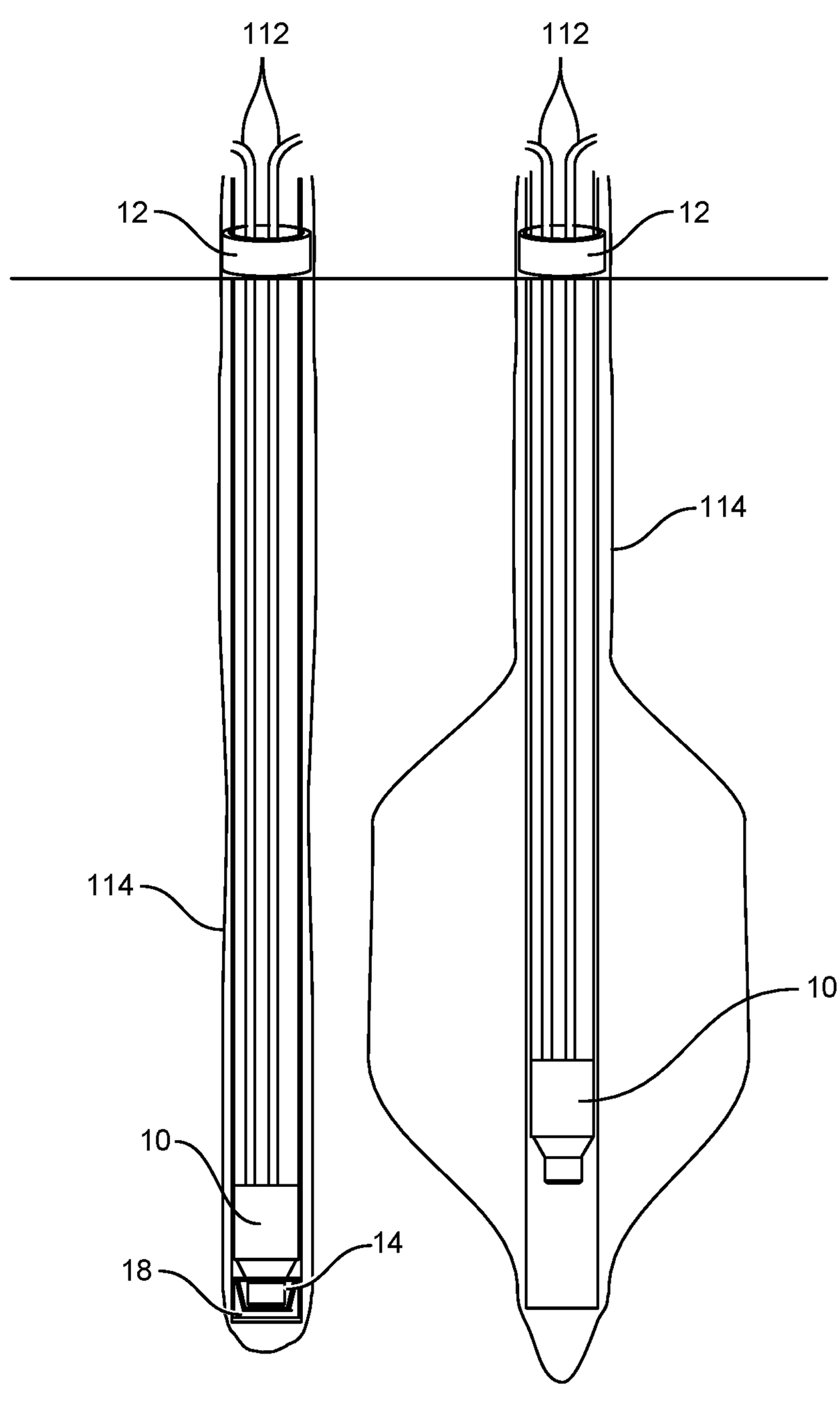


FIG. 2

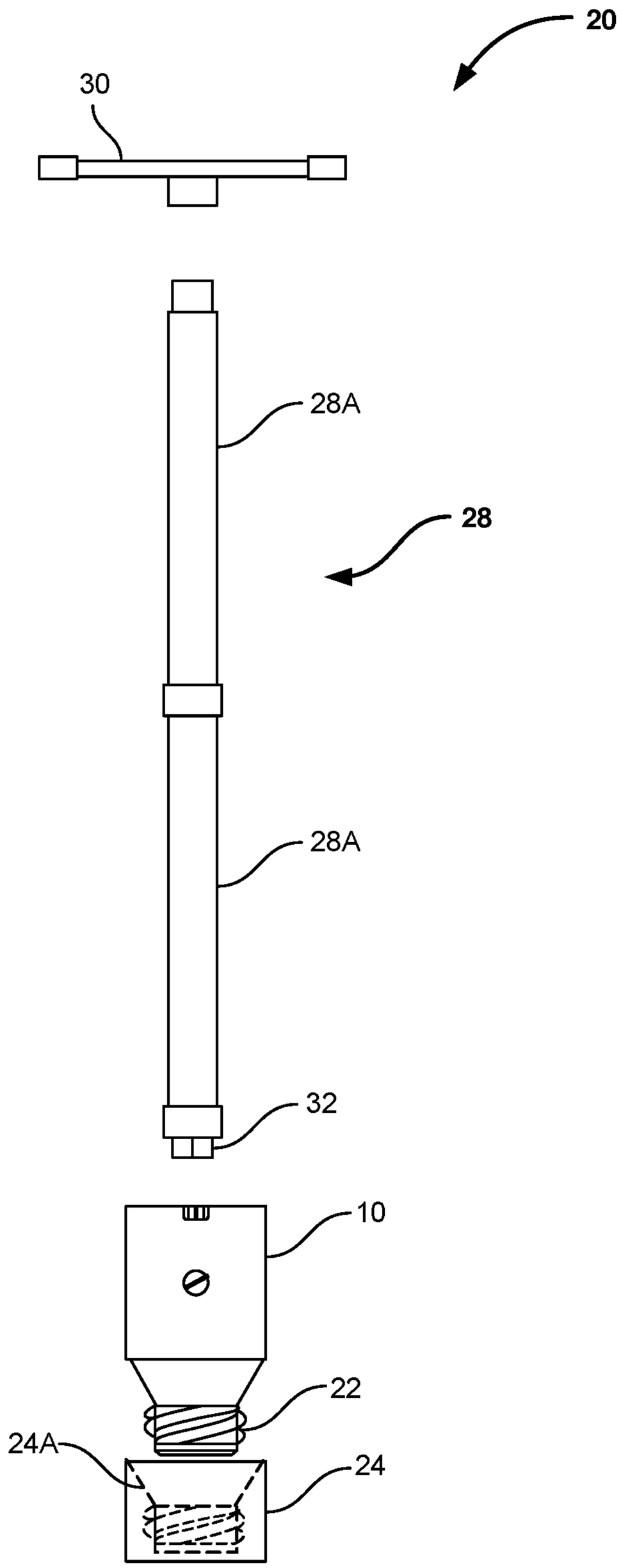


FIG. 3A

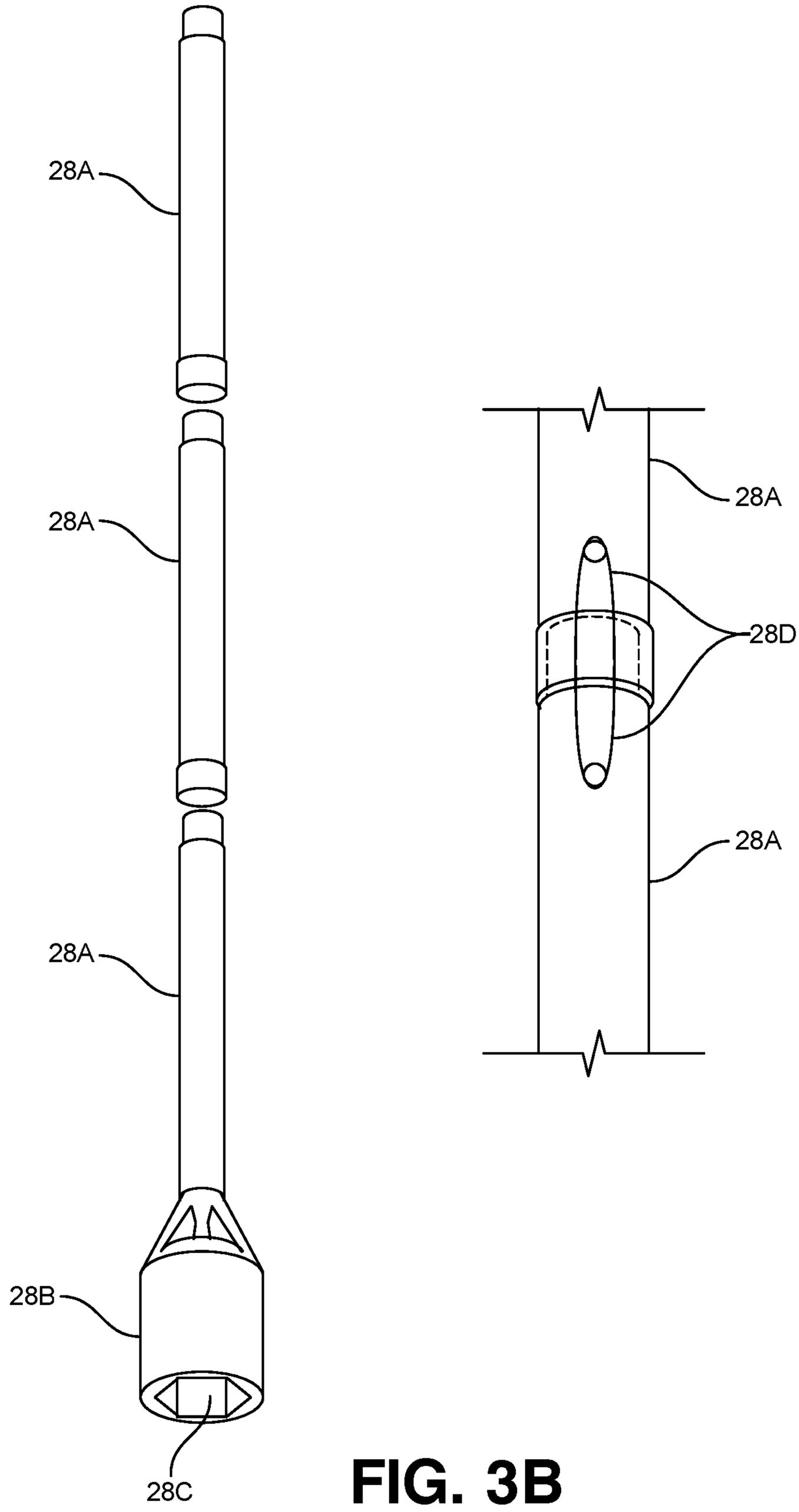
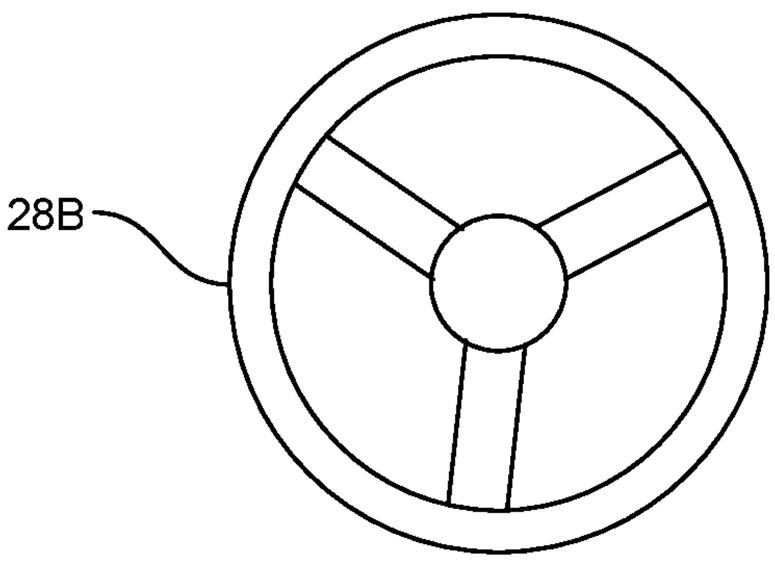


FIG. 3B



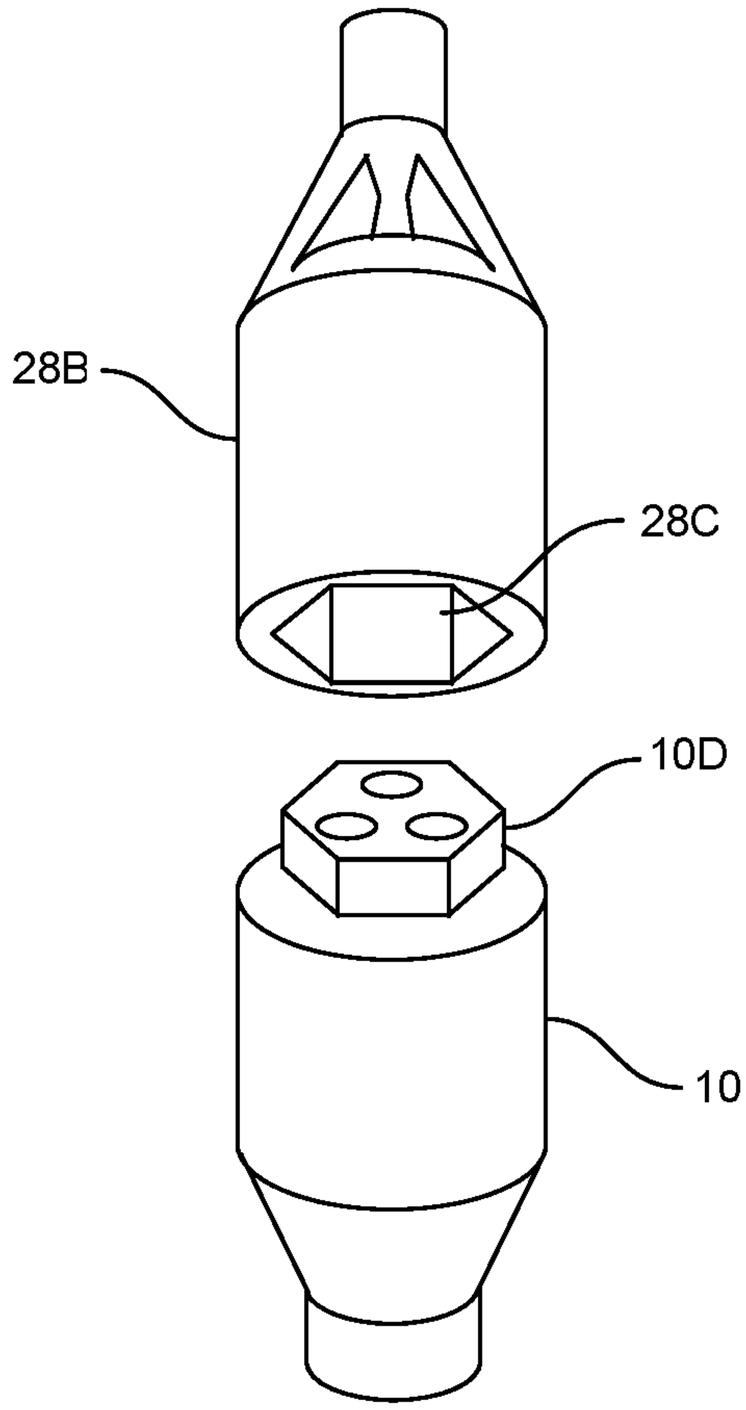


FIG. 3C

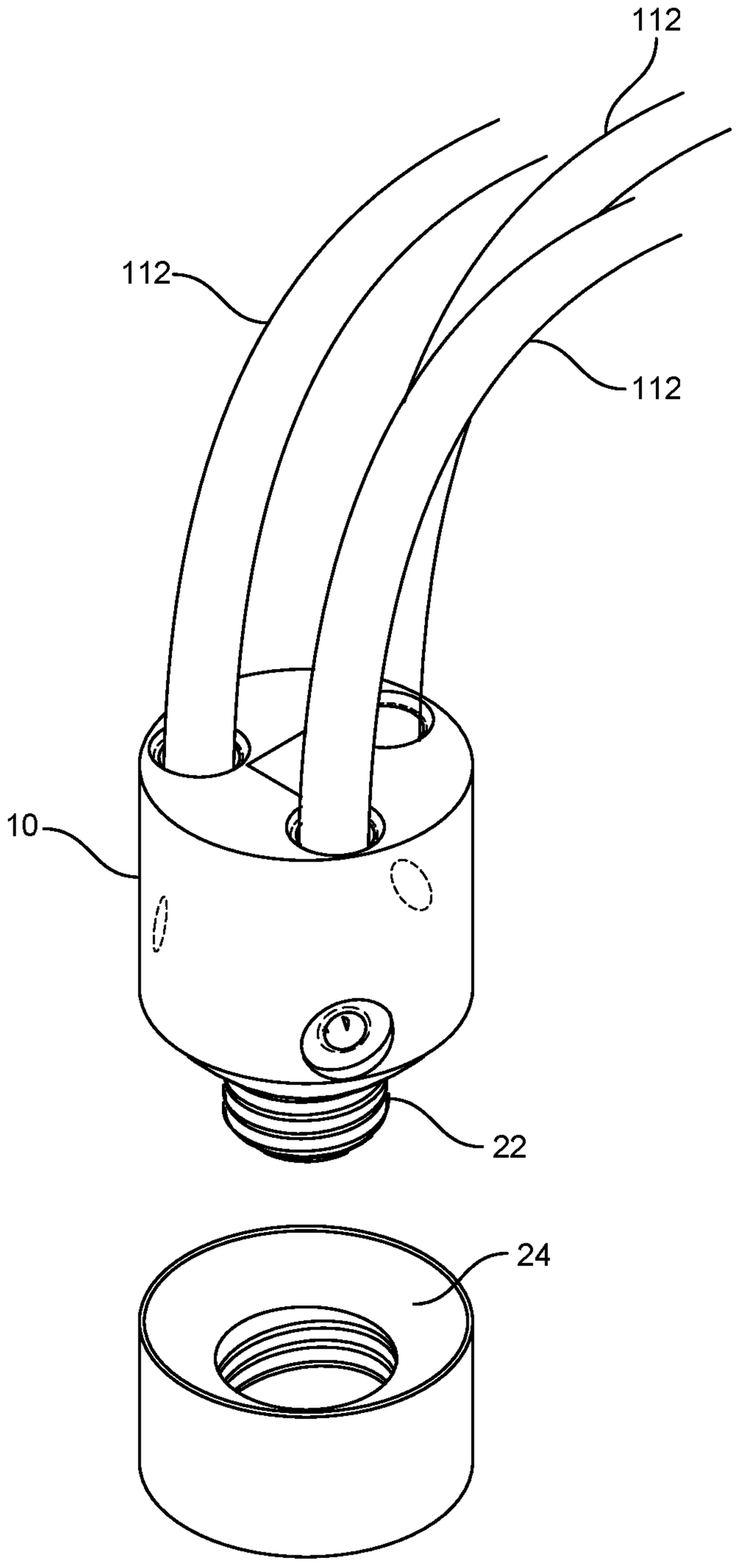


FIG. 4

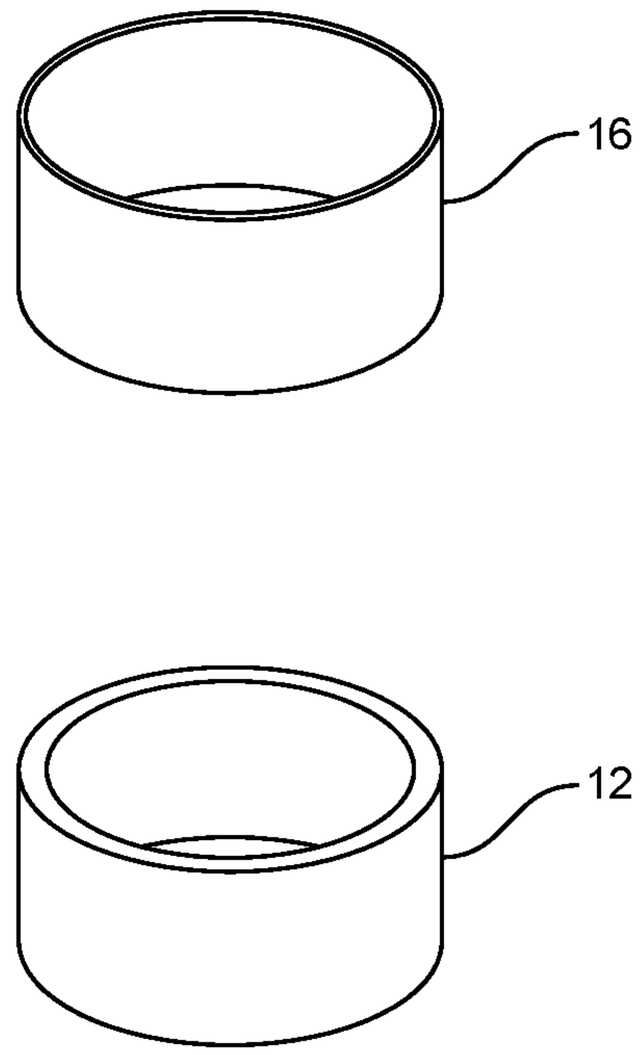


FIG. 5

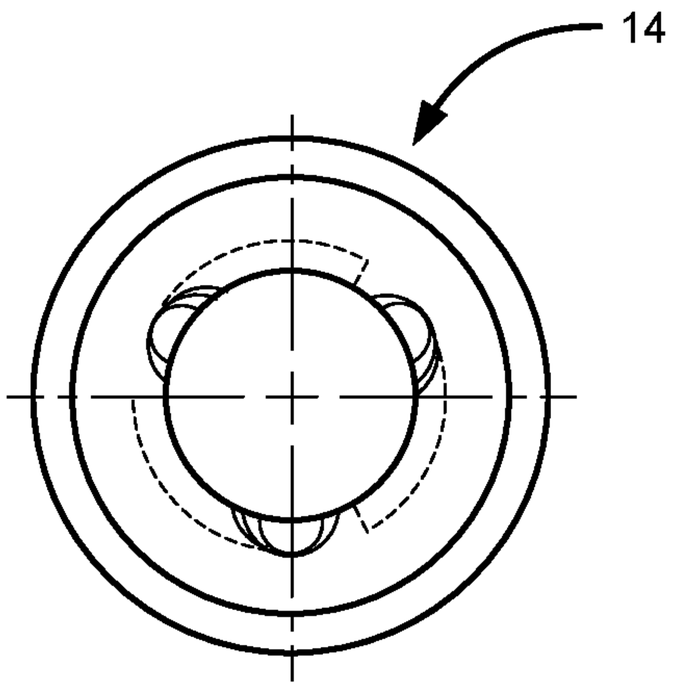


FIG. 6A

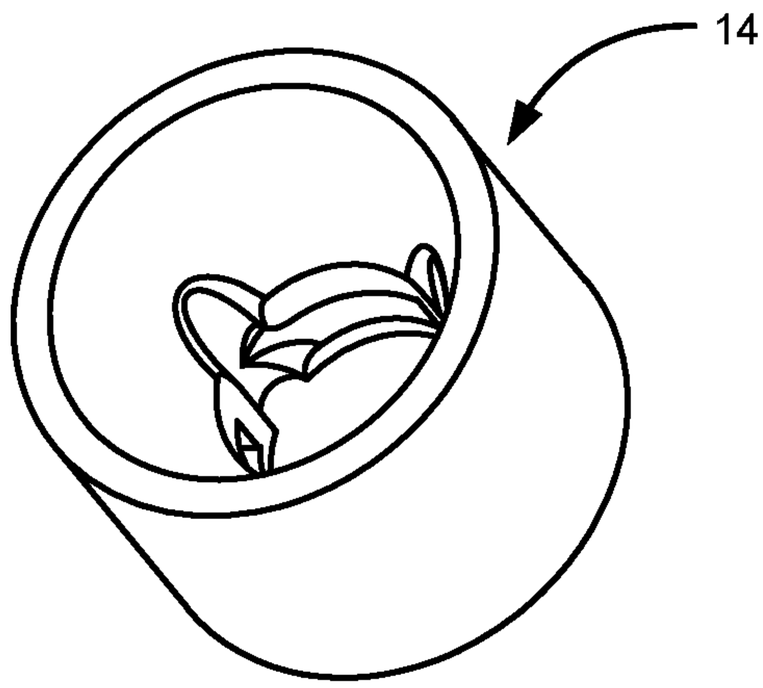


FIG. 6B

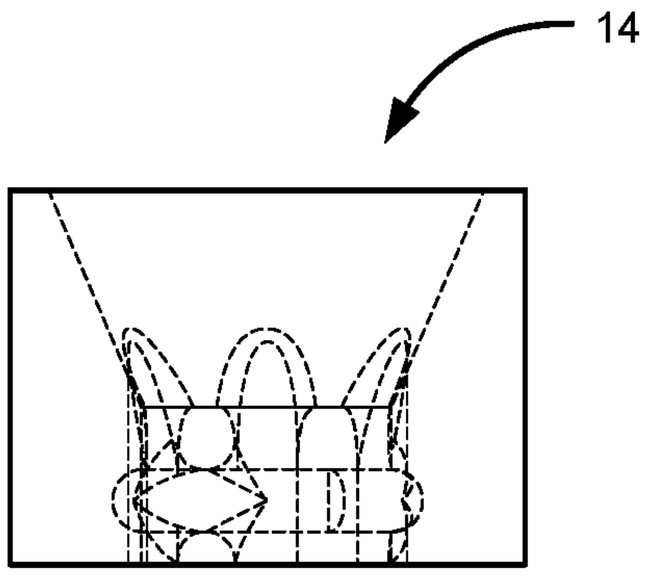


FIG. 6C

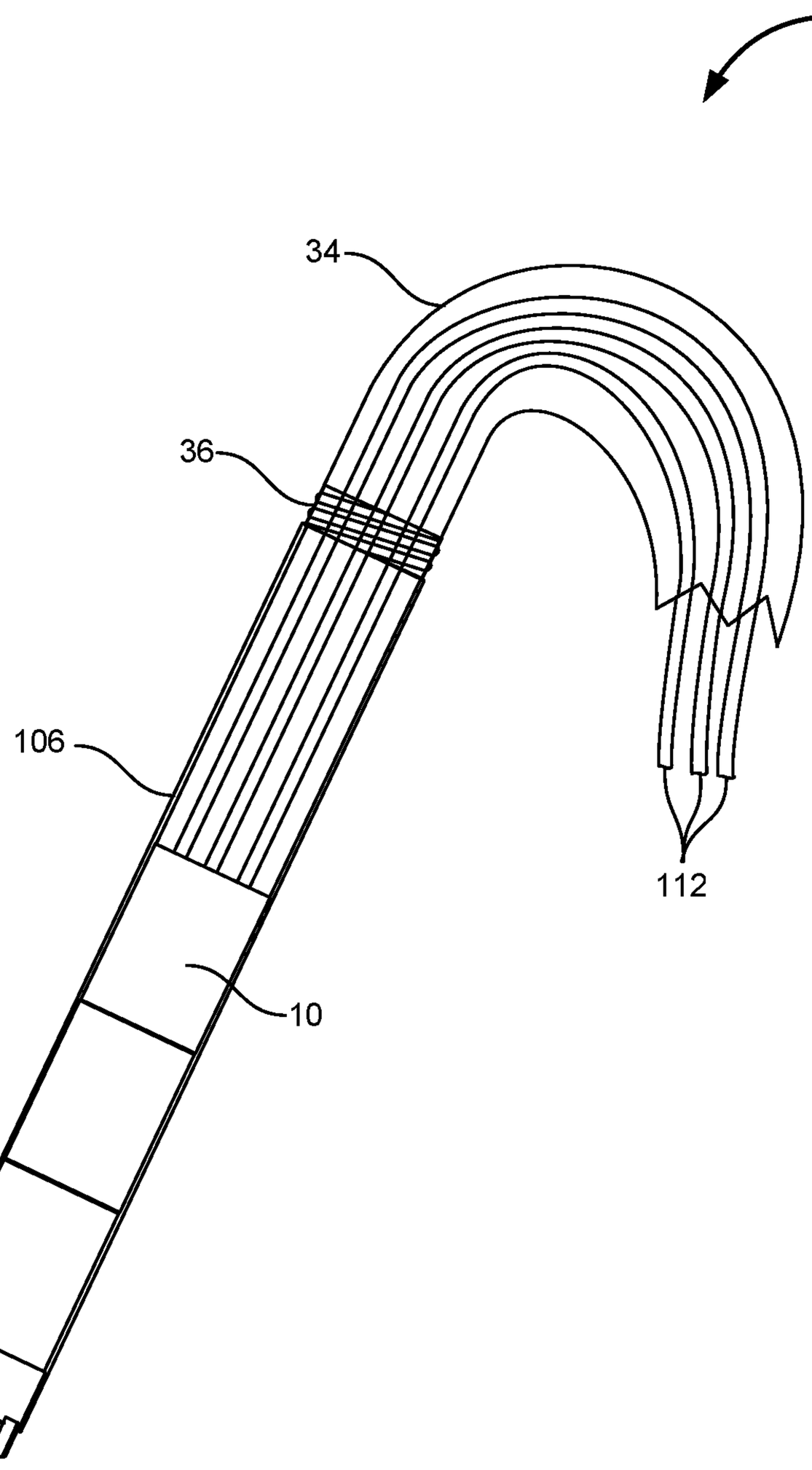


FIG. 7A

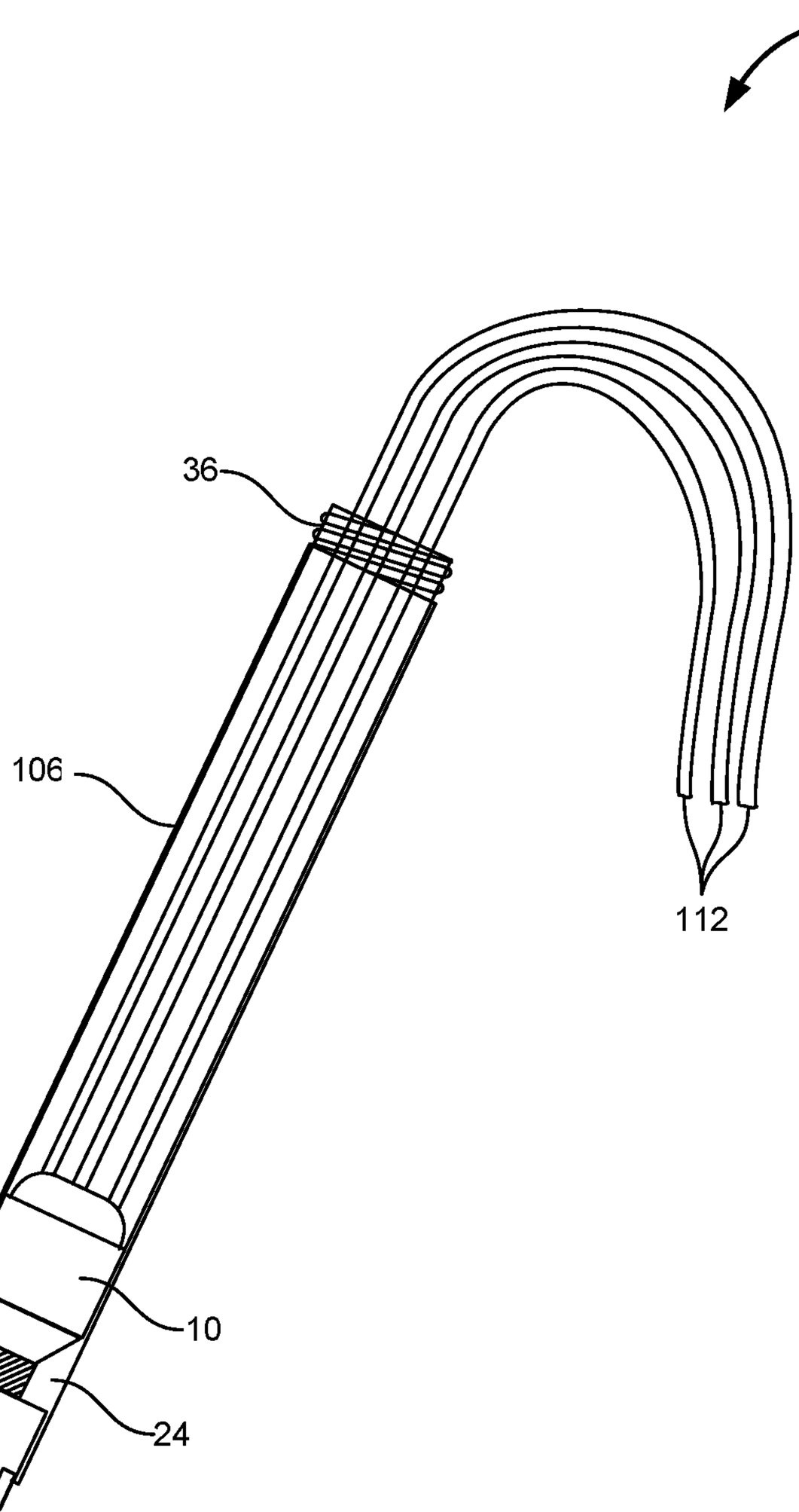


FIG. 7B

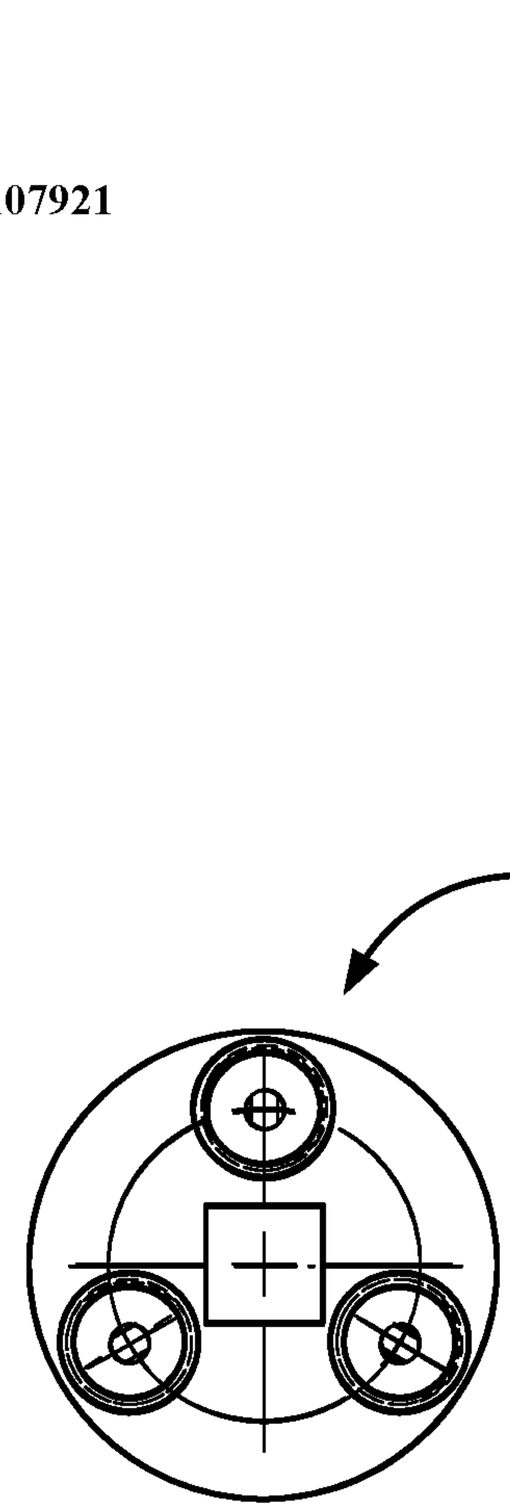
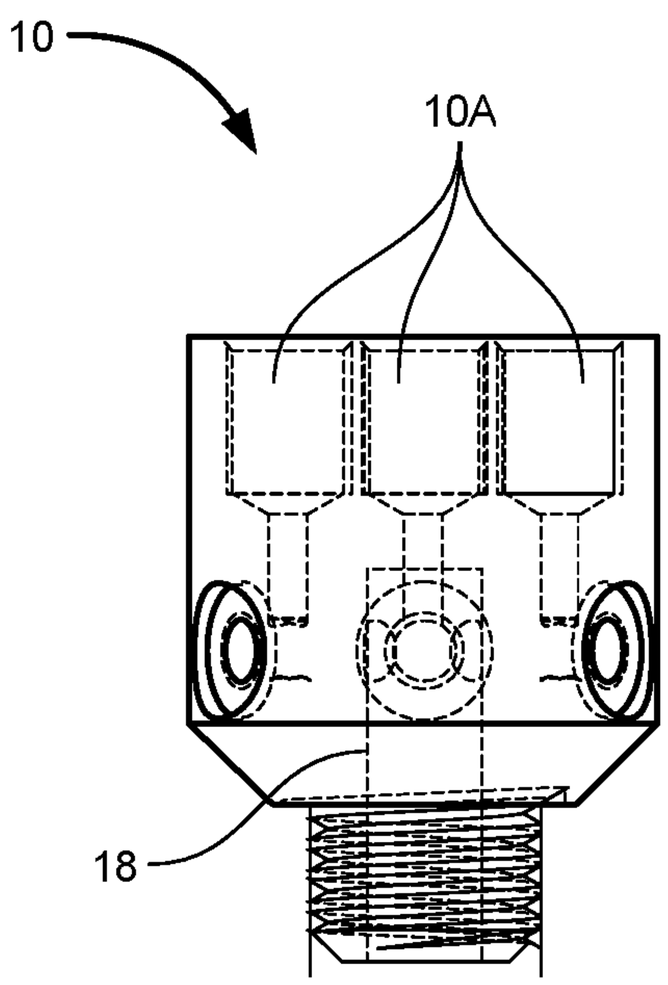


FIG. 8A



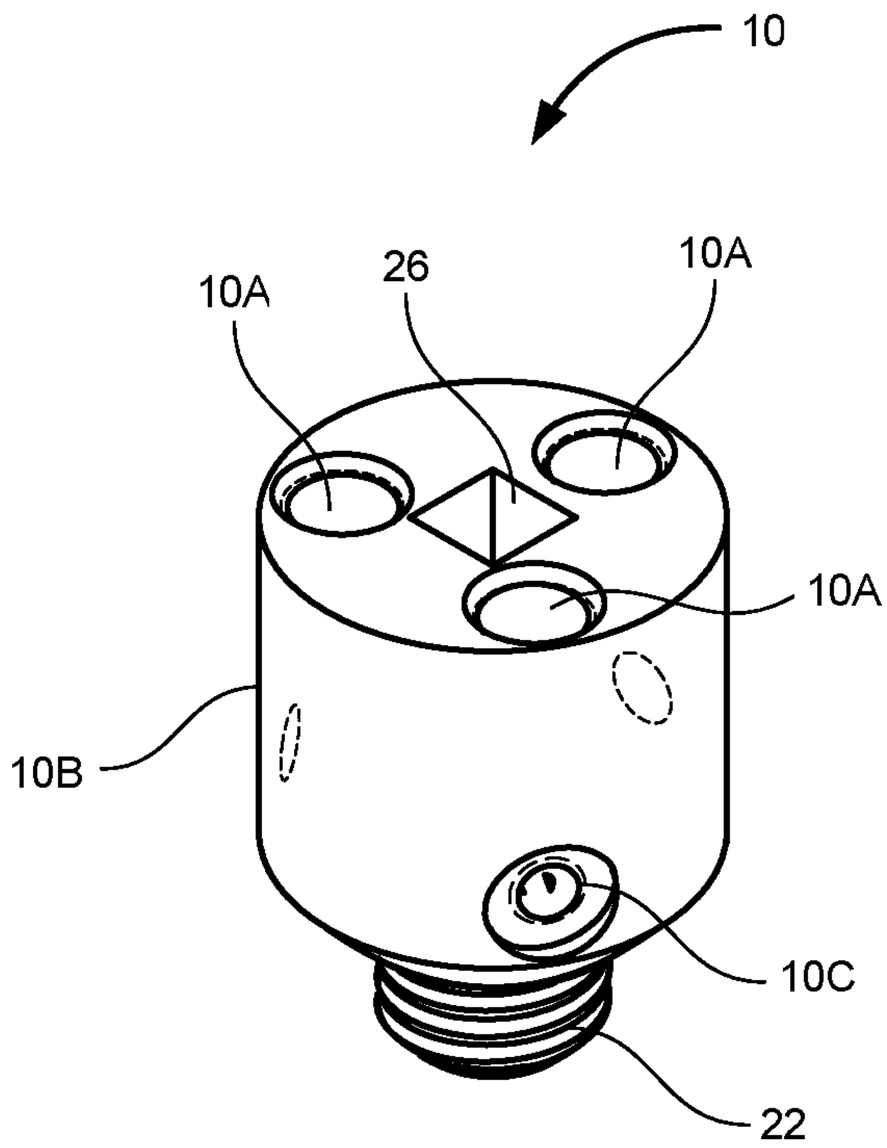


FIG. 8B

FIG. 8C

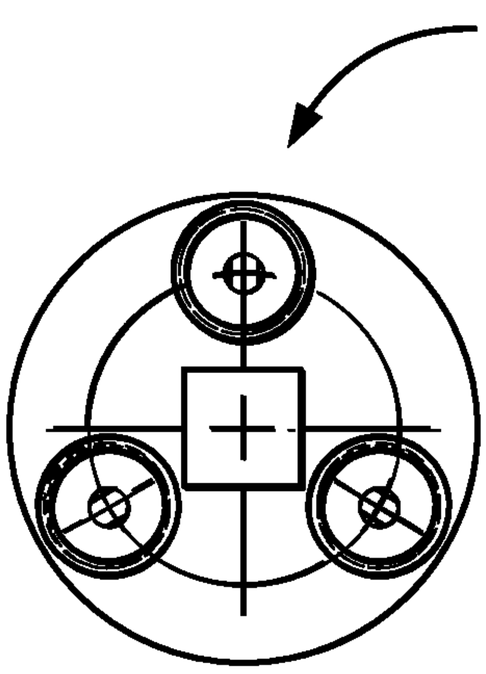


FIG. 9A

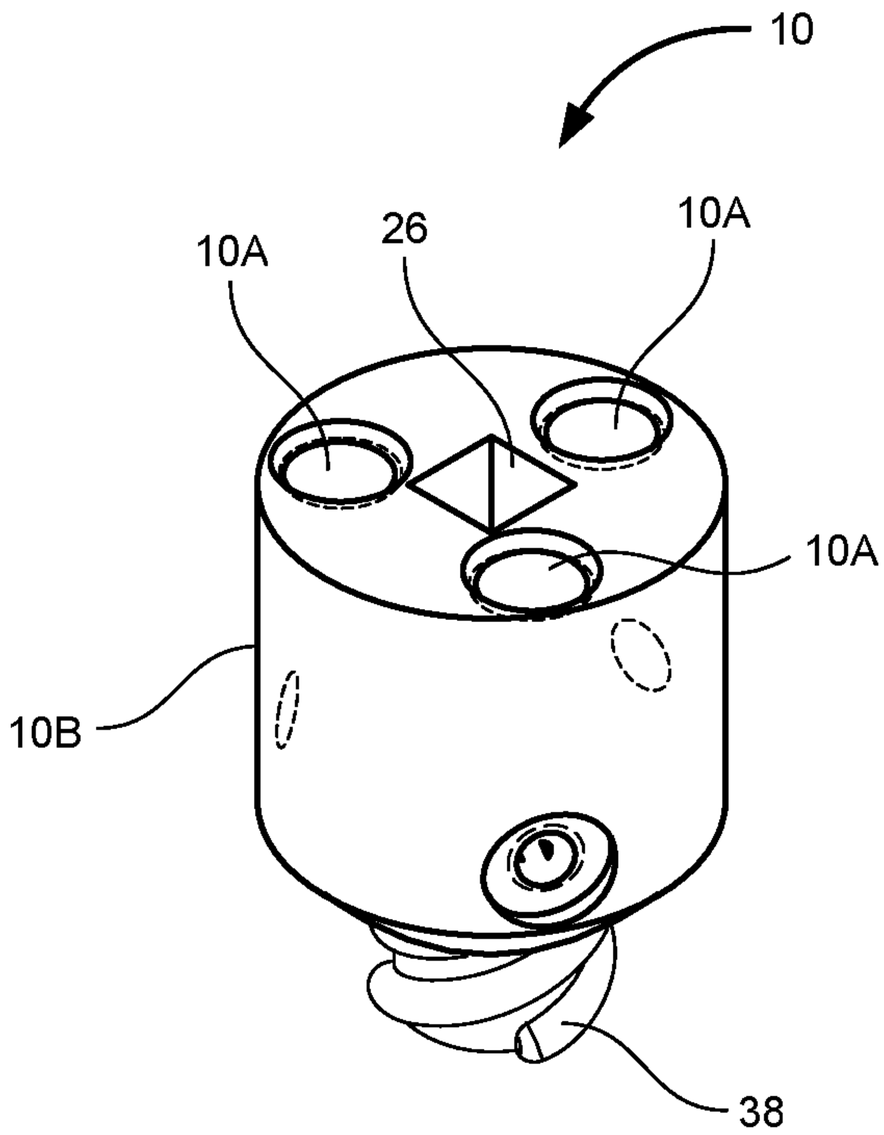


FIG. 9B

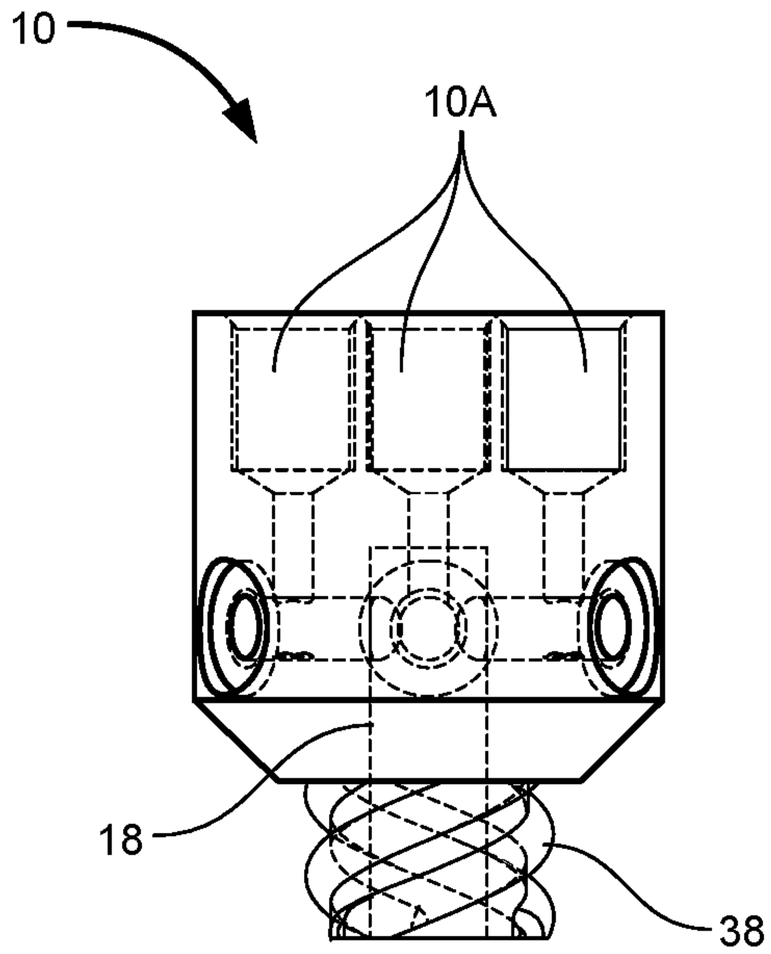


FIG. 9C

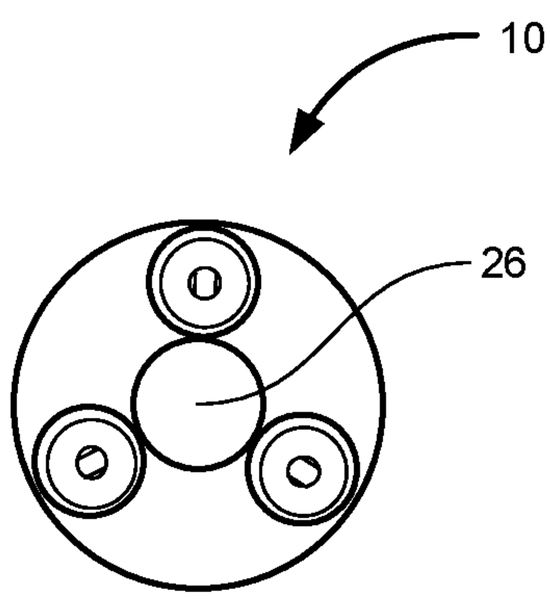


FIG. 10A

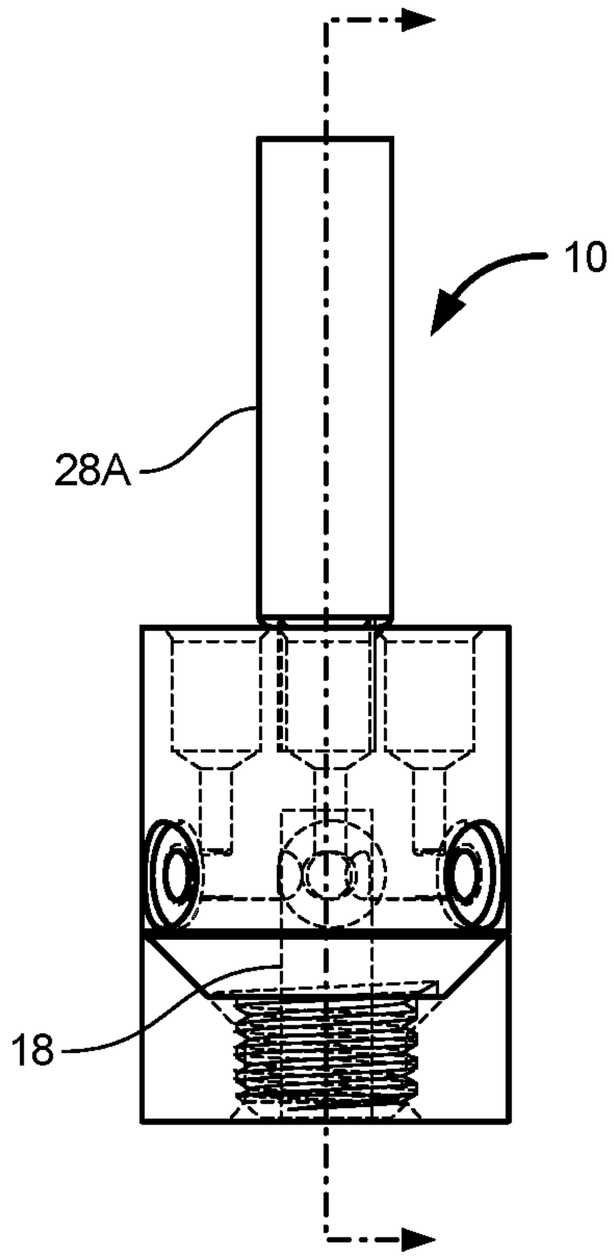


FIG. 10B

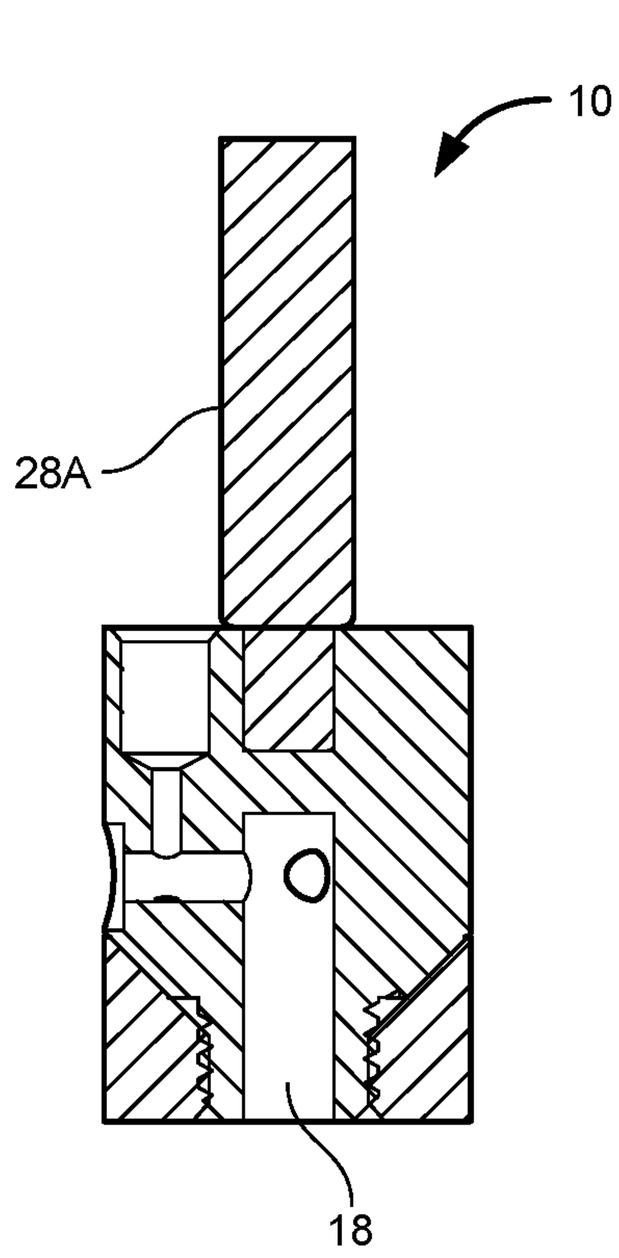


FIG. 10C

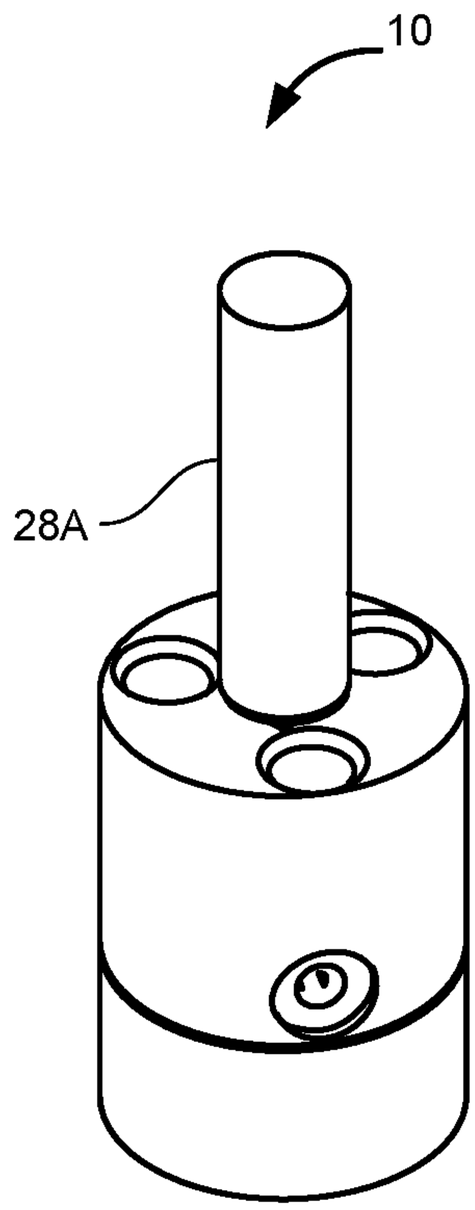


FIG. 10D

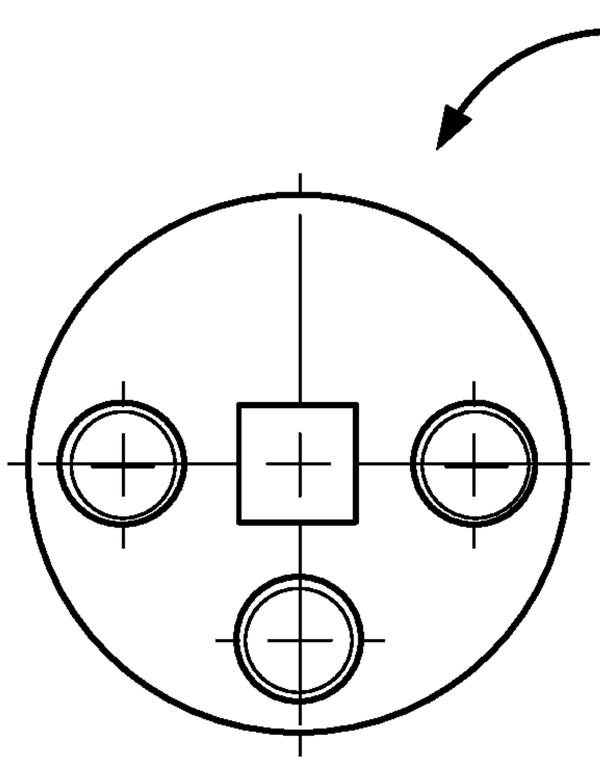


FIG. 11A

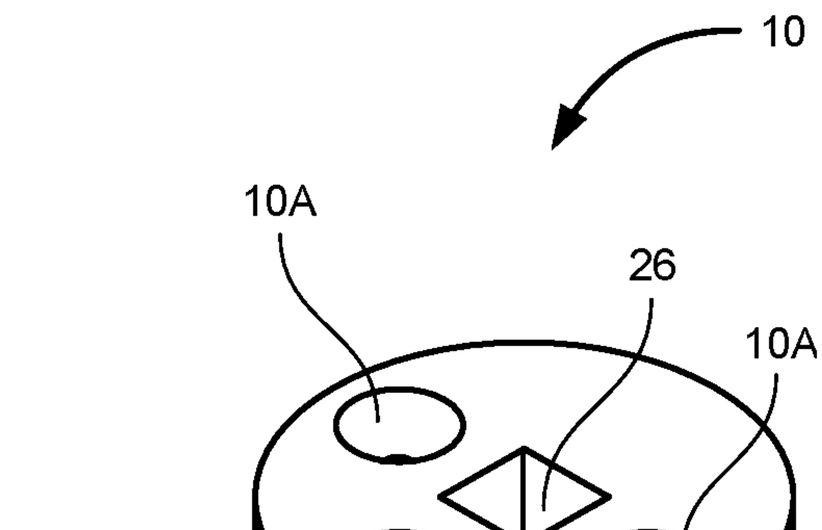


FIG. 11B

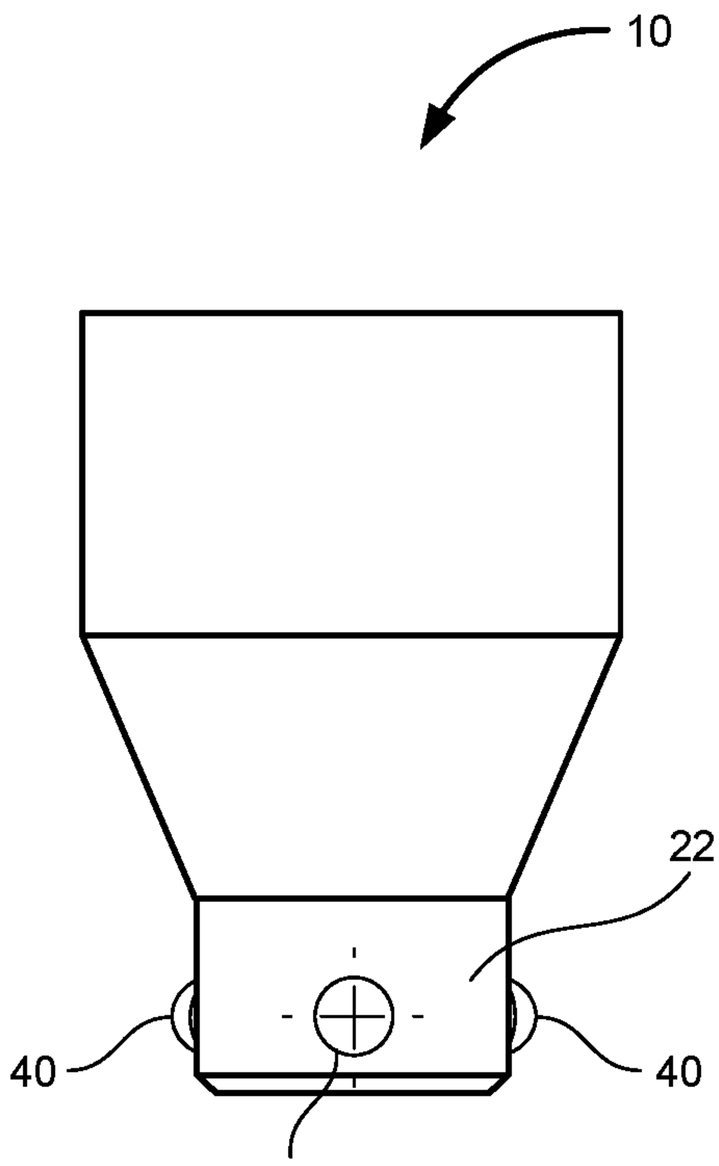


FIG. 11C

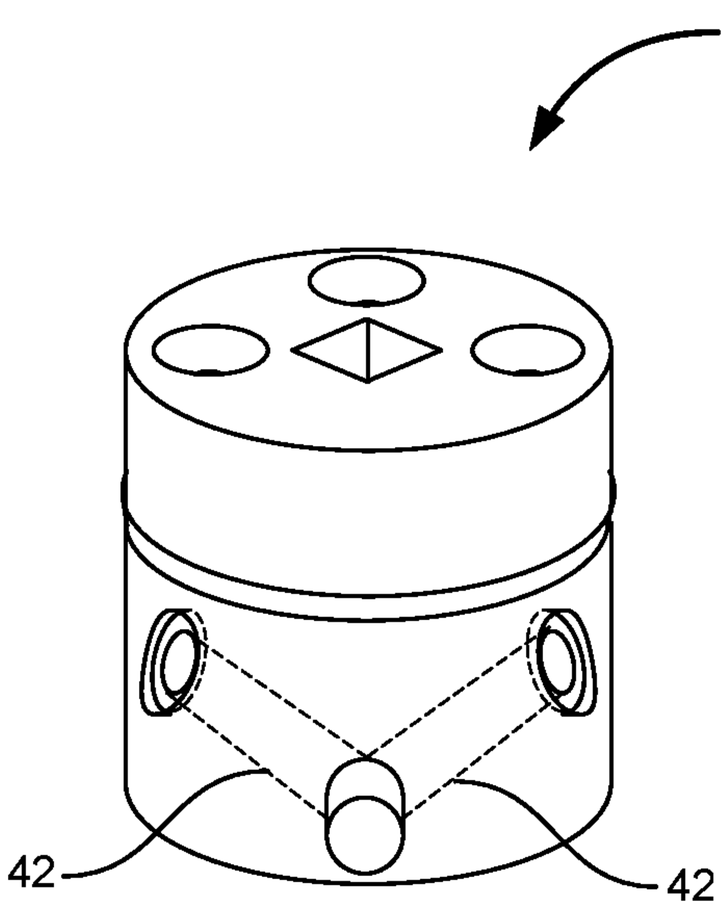


FIG. 12A

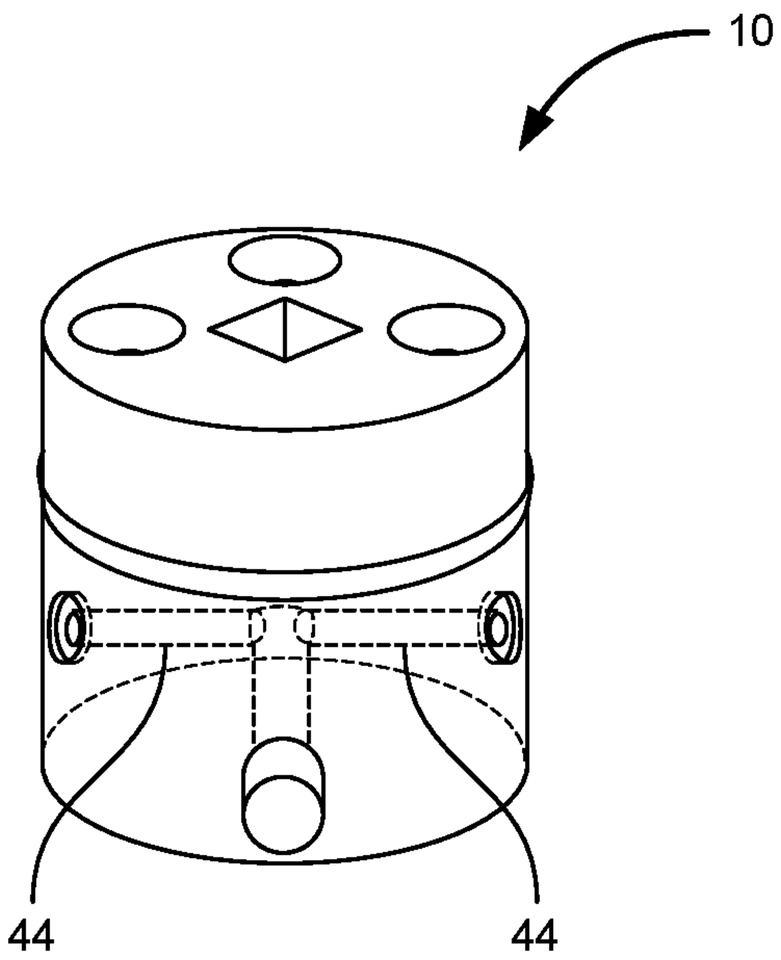


FIG. 12B

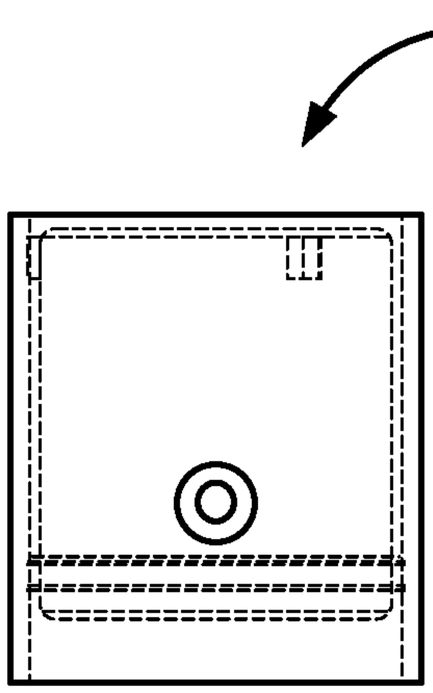


FIG. 13A

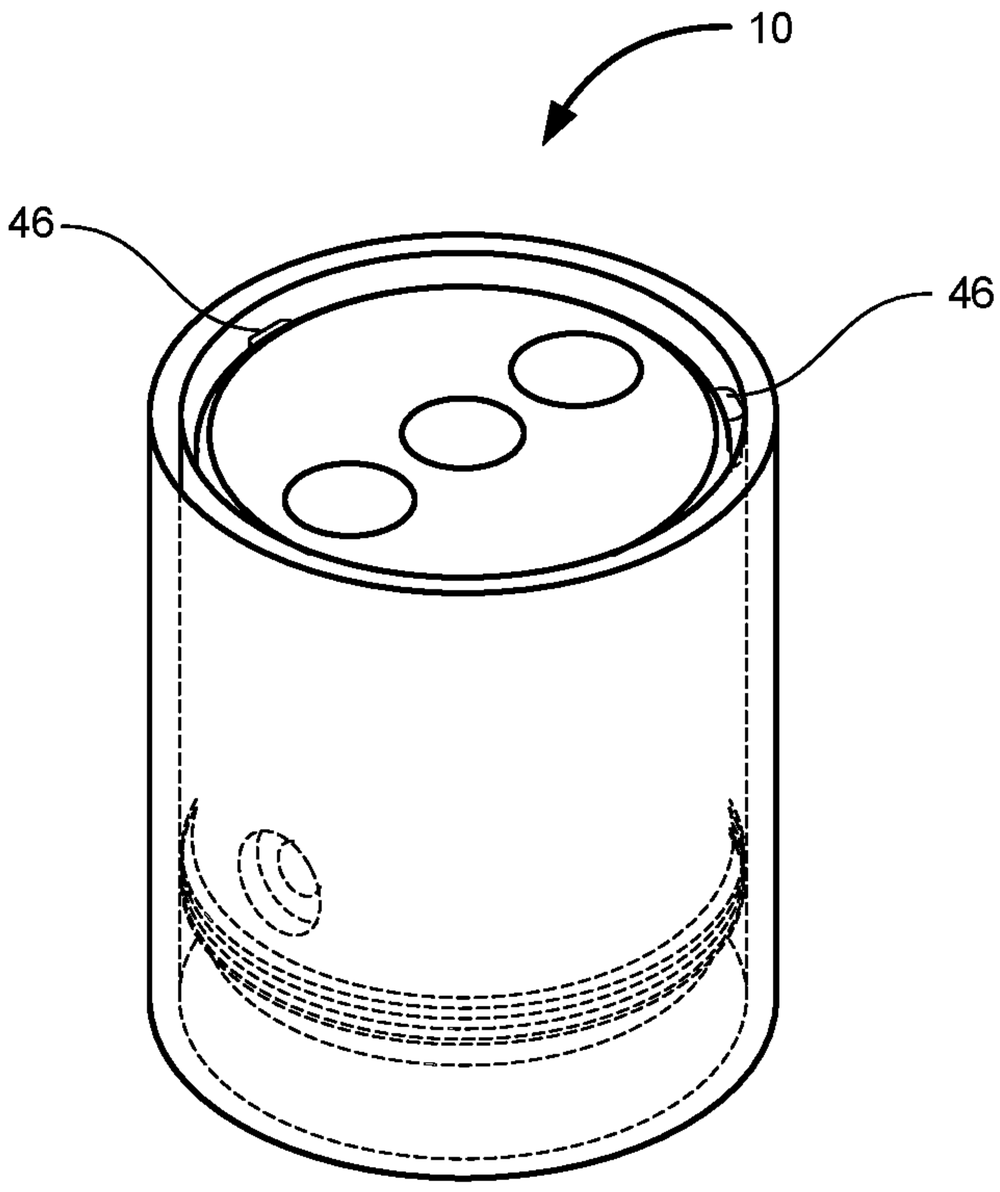


FIG. 13B

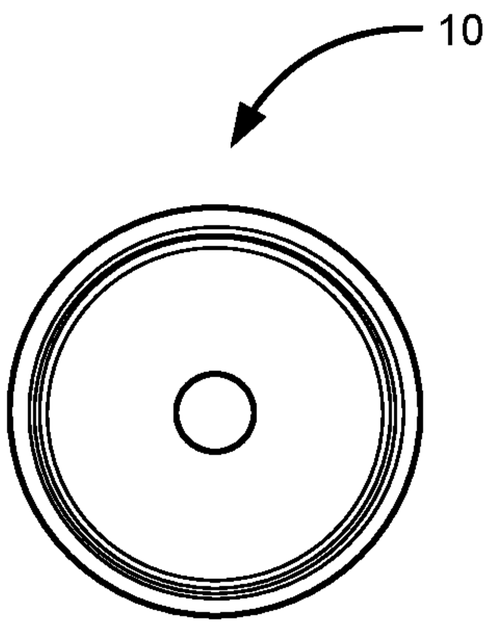


FIG. 13C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 19/63176

A. CLASSIFICATION OF SUBJECT MATTER

IPC - B01F 5/04, E02D 37/00, E02D 5/34 (2020.01)

CPC - E02D 37/00, B01F 5/0403, E02D 5/34, E02D 2250/0023, E02D 2300/0014, B01F 5/0256

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,256,004 A (GEMMI et al.) 26 October 1993 (26.10.1993), entire document	1-13
A	US 5,645,375 A (STEPHENS) 08 July 1997 (08.07.1997), entire document	1-13
A	US 9,790,655 B1 (POLYMER TECHNOLOGIES WORLDWIDE, INC. et al.) 17 October 2017 (17.10.2017), entire document	1-13
A	US 5,005,876 A (FAHL) 09 April 1991 (09.04.1991), entire document	1-13
A	US 4,395,159 A (KARUKS et al.) 26 July 1983 (26.07.1983), entire document	1-13
A	US 6,109,836 A (GRITTI) 29 August 2000 (29.08.2000), entire document	1-13
A	US 5,219,247 A (GEMMI et al.) 15 June 1993 (15.06.1993), entire document	1-13
A	US 2009/0155002 A1 (HAKKINEN et al.) 18 June 2009 (18.06.2009), entire document	1-13
A	US 2005/0199390 A1 (CURTICE et al.) 15 September 2005 (15.09.2005), entire document	1-13
A	US 6,322,292 B1 (ZENARI et al.) 27 November 2001 (27.11.2001), entire document	1-13
A	US 2009/0304457 A1 (SHIMADA et al.) 10 December 2009 (10.12.2009), entire document	1-13
A	US 5,217,327 A (Nakanishi) 08 June 1993 (08.06.1993), entire document	1-13

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

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 FEBRUARY 2020	30 MAR 2020
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee Young Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 19/63176

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 8,146,519 B2 (Bassett) 03 April 2012 (03.04.2012), entire document	1-13
A	US 5,322,222 A (Lott) 21 June 1994 (21.06.1994), entire document	1-13
X, T	US 10,538,894 B1 (Polymer Technologies Worldwide, Inc.) 21 January 2020 (21.01.2020), entire document	1-13