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- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
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(54) Title: END CAP ASSEMBLY

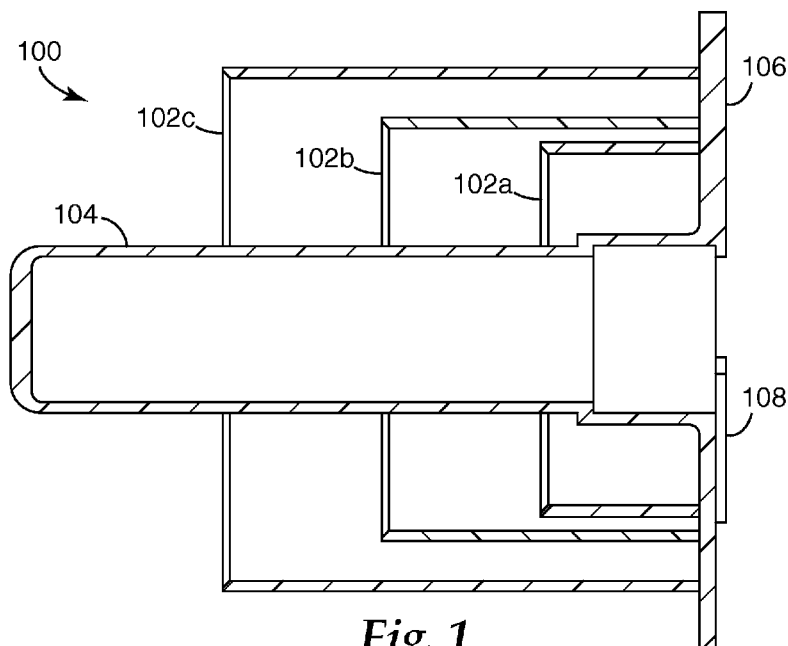


Fig. 1

(57) **Abstract:** Various embodiments of the invention provide an end cap assembly for housing a marker. The end cap assembly includes a protrusion capable of housing and securing a marker in close proximity to the end section of the conduit. The end cap assembly may be used to seal an end section of conduits of various diameters or sizes. One or more tabs on the end cap assembly are flexible, but provide resistance to movement and act as mechanical stops to secure the marker and provide resistance to prevent the marker from escaping the cap housing.

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END CAP ASSEMBLY

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Background of the Invention

The present invention generally relates to an end cap assembly for sealing an end section of a conduit. More specifically, the present invention relates to an end cap assembly for housing a marker in close proximity to the end section of a conduit.

Conduits of varying sizes are typically employed to house and route utility cables, including cables for electrical power and telephone utilities. Telephony cables may consist of copper strands or optical fibers. Conduits are often buried underground, and cables may be installed at the time of burial or at some later date. A buried conduit may be exposed to various environmental forces, such as soil erosion or movement and water intrusion.

Once conduits are buried, it may be necessary to locate the end sections of the buried conduits to install fiber or copper cables, connect them to other conduits, terminate one or more cables, extend the cables passing through the conduits or the like. It is therefore important to identify with as much accuracy as possible the vicinity of an end section of a buried conduit to reduce excavating cost and efforts. Accurately locating the end section of a buried conduit can avoid inadvertently digging up or damaging other utility lines buried in close proximity to the conduit.

Various types of marking devices (commonly referred to as "markers") can be used to locate the end sections of a buried conduit. Visual markers, for example, may be placed over the ground, metal objects may be placed next to the conduit or electronic markers may be buried at or near the conduit end. Markers may also be placed inside the conduit near the end sections. Several drawbacks attend the use of such markers. Visual markers may become displaced, while metal objects along the ground may reduce accuracy in detecting the end sections of the conduit. Electronic markers may be displaced during backfilling, soil erosion, movement or the like. Markers loosely placed inside conduits may be get displaced and come to rest far from the end sections of the conduits. As a result, it can often be difficult to accurately locate the end sections of the conduits.

FIGs. 2a, 2b, and 2c depict cross sectional views of an end cap assembly capable of fitting three different sizes of conduit outside diameters in accordance with one embodiment of the invention.

FIG. 3 depicts a cross sectional view of a marker installed in an integral housing of the end cap assembly in accordance with an embodiment of the invention.

FIG. 4a depicts an isometric view of an end cap assembly that installs on the inside diameter of three different sizes of conduit in accordance with another embodiment of the invention.

FIG. 4b depicts a cross sectional view of an end cap assembly that installs on the inside diameter of three different sizes of conduit in accordance with still another embodiment of the invention.

FIG. 5 depicts a top view of an end cap assembly indicating the position of tabs for securing a marker in accordance with one embodiment of the invention.

FIG. 6 depicts a perspective view of the end cap assembly with an attachment point for a pull-tape in accordance with an embodiment of the invention.

Detailed Description of Preferred Embodiments

Various embodiments of the invention provide an end cap assembly capable of housing a marker. The end cap assembly includes a protrusion for housing and securing a marker in close proximity to the end section of the conduit. Preferably, the marker is housed within the inside diameter of the conduit. The end cap assembly may be employed to seal conduits of one or more diameters against the inside or the outside diameters of the conduits.

FIG. 1 depicts a cross section of an end cap assembly 100 for housing a marker in accordance with one embodiment of the invention. End cap assembly 100 includes concentric rings 102a, 102b, and 102c, a protrusion 104 and a cap top 106. Cap top 106 includes a tab 108.

Concentric rings 102a, 102b, and 102c are sized to seal an end section of conduits with specific outside diameters. Protrusion 104 extends into the end section of a sealed conduit and is capable of housing a marker inside the conduit. Tab 108 is capable of locking and retaining a marker in protrusion 104. Tab 108 protrudes slightly over the open end of the marker housing, creating interference with the marker as it is inserted into the housing.

The tab or tabs (where multiple tabs are employed) are generally flexible, allowing the marker to be inserted but providing resistance to the marker exiting the housing 104.

In various embodiments of the invention, concentric rings 102a, 102b and 102c are capable of sealing an end section of conduits having an outside diameter ranging between about 0.02 meters and about 0.3 meters. End cap assembly 100 may include one or more concentric rings to seal the end section of one or more conduits. The one or more concentric rings are sized to create interference fits with conduit diameters and may have inside diameters between about 0.02 meters and about 0.3 meters. In various embodiments of the invention, cap top 106 may be flat. Cap top 106 may also include one or more tabs.

Protrusion 104 may extend into the end section of a sealed conduit, or may be designed to extend outwards with respect to end cap assembly 100. As a result, protrusion 104 is capable of housing and securing a marker inside or outside a sealed conduit, but always in close proximity to the end section of the sealed conduit.

End cap assembly 100 may be constructed from plastic materials such as polyethylene, polypropylene, vinyls, poly vinyl chloride, and combinations thereof. Materials such as metals, and composites would also be suitable for this purpose.

FIG. 2a, 2b, and 2c depict cross sectional view of an end cap assembly 100 capable of fitting three different sizes of conduit outside diameters in accordance with an embodiment of this invention.

Concentric rings 102a, 102b, and 102c are sized to seal an end section of conduits with specific outside diameters. Protrusion 104 extends into the end section of a sealed conduit and is capable of housing a marker inside the conduit. Tab 108 protrudes slightly over the open end of the marker housing, creating interference with the marker as it is inserted into the housing. The tab(s) 108 is flexible, allowing the marker to be inserted, but providing resistance to the marker exiting the housing 104.

FIG. 2a depicts a cross-sectional view of end cap assembly 100 being used to seal the end section of conduit 202. In the illustrated embodiment, conduit 202 has an outside diameter of approximately 0.03 meters.

Concentric ring 102a serves as an interface for sealing conduit 202 against the outside diameter of conduit 202. Protrusion 104 extends into conduit 202. A marker may

be placed in protrusion 104. Protrusion 104 may house the marker, while tab 108 may secure and retain the marker in protrusion 104.

FIG. 2b depicts a cross-sectional view of end cap assembly 100 being used to seal the end section of conduit 204. In the illustrated embodiment, conduit 204 has an outside diameter of approximately 0.04 meters. Concentric ring 102b serves as an interface for sealing conduit 204 against the outside diameters of conduit 204. Protrusion 104 extends into conduit 204. A marker may be placed in protrusion 104. Protrusion 104 may house the marker, while tab 108 may retain and secure the marker in protrusion 104.

FIG. 2c depicts a cross-sectional view of end cap assembly 100 being used to seal the end section of conduit 206. In the embodiment depicted, conduit 206 has an outside diameter of approximately 0.05 meters. Concentric ring 102c serves as an interface for sealing conduit 206 against the outside diameter of conduit 206. Protrusion 104 extends into conduit 206. A marker may be placed in protrusion 104. Protrusion 104 may house the marker, while tab 108 may retain and secure the marker in protrusion 104.

In various embodiments of the invention, concentric rings 102a, 102b, and 102c may be designed to seal the end section of conduits of outside diameters ranging between about 0.02 meters and about 0.3 meters.

FIG. 3 depicts a cross-sectional view of a marker installed into protrusion 104 of end cap assembly 100. FIG. 3 includes end cap assembly 100, conduit 302 and marker 304. End cap assembly 100 is used to seal an end cap section of conduit 302. Concentric ring 102a serves as an interface for sealing against the outside diameter of conduit 302. Marker 304 is placed in protrusion 104 by flexing tab 108 inward.

In an embodiment of the invention, conduit 302 may have an outside diameter of about 0.03 meters. Tab 108 may provide resistance to movement of marker 304 outwards with respect to end cap assembly 100, thereby securing marker 304 in protrusion 104.

In various embodiments of the invention, marker 304 may be a Near Surface Marker, an electronic marker, a marker with a Radio Frequency Identification (RFID) tag, an electronic Ball Marker or the like. In one embodiment of the invention, marker 304 may be a small form factor electronic marker.

Protrusion 104 may extend into the end section of a sealed conduit or may be designed to extend outwardly with respect to end cap assembly 100. As a result,

protrusion 104 is capable of housing and securing a marker inside or outside the sealed conduit in close proximity to the end section of the sealed conduit.

In various embodiments of the invention, marker 304 may be removable from end cap assembly 100. In other embodiments, marker 304 may be permanently attached to
5 end cap assembly 100, by welding, employing adhesives or the like.

End cap assembly 100 may include one or more tabs. The one or more tabs can form an integral part of housing 100 and thus constructed of the same material as the cap assembly.

FIG. 4a depicts an isometric view of an end cap assembly that installs on the inside
10 diameter of three different sizes of conduit. FIG. 4a includes tabs 108a, 108b and 108c three concentric rings 102a, 102b, 102c, a protrusion 104, attachment point 402 and pull-tape eye 404.

FIG. 4b depicts a cross-sectional view of an end cap assembly that installs on the inside diameter of three different sizes of conduit in accordance with another embodiment
15 of the invention. End cap assembly 400 includes concentric rings 408a, 408b, 408c, a protrusion 104 and a cap top 406.

Concentric rings 408a, 408b, and 408c are sized to be able to seal an end section of conduits with specific inside diameters. Concentric rings 408a, 408b, and 408c may be used to seal an end section of conduits against the inside diameter of the conduits.

In various embodiments of the invention, end cap assembly 400 further includes
20 one or more tabs, for locking and retaining a marker in protrusion 104. Tab 108 protrudes slightly over the open end of the marker housing creating interference with the marker as it is inserted into the housing. Tab(s) 108 are flexible, allowing the marker to be inserted but providing resistance to the marker exiting the housing 104. In various embodiments of the
25 invention, concentric rings 408a, 408b and 408c are capable of sealing an end section of conduits having an inside diameter ranging between about 0.02 meters and about 0.3 meters.

End cap assembly 400 may include one or more concentric rings to seal the end section of one or more conduits. The one or more concentric rings may have an inside
30 diameter between about 0.02 meters and about 0.3 meters. In various embodiments of the invention, protrusion 104 may extend into the end section of a sealed conduit or may be designed to extend outwardly with respect to end cap assembly 400. As a result,

protrusion 104 is capable of housing and securing a marker inside or outside a sealed conduit in close proximity to the end section of the conduit.

FIG. 5 depicts a top-view of end cap assembly 100 in accordance with another embodiment of the invention. FIG. 5 includes concentric rings 408a, 408b, 408c,
5 protrusion 104, cap top 106 and tabs 108a, 108b, 108c.

Concentric rings 408a, 408b, and 408c are sized to seal an end section of conduits with specific inside diameters. Protrusion 104 extends into the end section of a sealed conduit and is capable of housing a marker inside the conduit. Tabs 108a, 108b, and 108c may be flexed for marker insertion, thereby provisioning the insertion of a marker in
10 protrusion 104 and providing resistance to prevent the marker from being displaced out of protrusion 104.

In various embodiments of the invention, end cap assembly 100 may include one or more tabs. End cap assembly 100 may be constructed from plastic materials such as polyethylene, polypropylene, vinyls, poly vinyl chloride, and combinations thereof.
15 Materials such as metals, and composites would also be suitable for this purpose.

FIG. 6 depicts a perspective view of end cap assembly 100 with an attachment point for a pull-tape. FIG. 6 includes end cap assembly 100 and attachment point 602. Attachment point 602 includes a pull-tape eye 604. Attachment point 602 is fitted to protrusion 104. When end cap assembly 100 is used to seal the end section of a buried
20 conduit, a pull-tape may be left inside the buried conduit for installing cables at a later time. The pull-tape is attached to the end section of the conduit through attachment point 602. During the installation of a cable, the pull-tape is detached from eye 604 and may be attached to the cable to pull it through the conduit and terminate or extend the cable.

Various embodiments of the present invention provide one or more of the
25 following advantages.

The end cap assembly allows for a marker to be effectively housed within the conduit, thereby protecting the marker from mechanical damage during conduit installation or during recovery of the cable for fiber installation or the like. Attaching the marker to the cap assembly further assures that the marker will not be displaced from the end
30 of the conduit.

The marker is secured in the protrusion of the end cap assembly and will remain in close proximity to the conduit end. The end section of a buried conduit may therefore be

accurately located. This avoids excessive exploratory digging around a buried conduit, reducing cost and avoiding accidental digging of adjacent utilities.

The marker can be removable from the end cap assembly, allowing the marker to be reused.

5 An attachment point at the end of the protrusion provides a convenient way of securing a pull tape, thereby preventing it from accidentally withdrawing down the conduit and becoming unreachable. As a result, by removing the end cap, a cable can easily be tied to the pull-tape for drawing it through a section of conduit. This reduces the effort needed to extend the cable, terminate the cable or the like.

10 The end cap assembly requires no tools for installation, and may be installed manually. Additionally, no tools are required to install a marker in a cap housing/protrusion.

 The end cap assembly helps prevent intrusion of water or dirt into a conduit. The end cap assembly is capable of sealing an end section of conduits of one or more
15 diameters or sizes against the inside or the outside diameter of the conduit. This reduces the need of a service provider to order separate stock numbers for each size of conduit or pipe employed, reducing costs and inventory space in transporting the end cap assembly to the site where conduits may be buried.

 The end cap assembly is removable and simple to use. Therefore, after removal
20 from a conduit, the end cap assembly may be reused to seal the end section of another conduit.

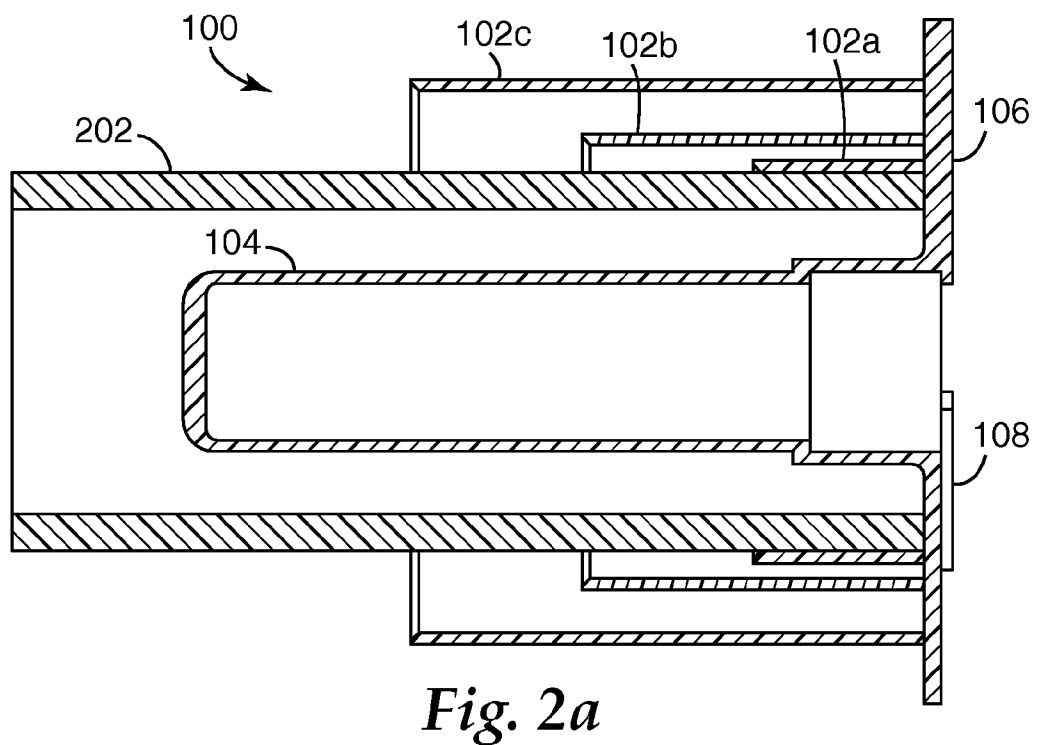
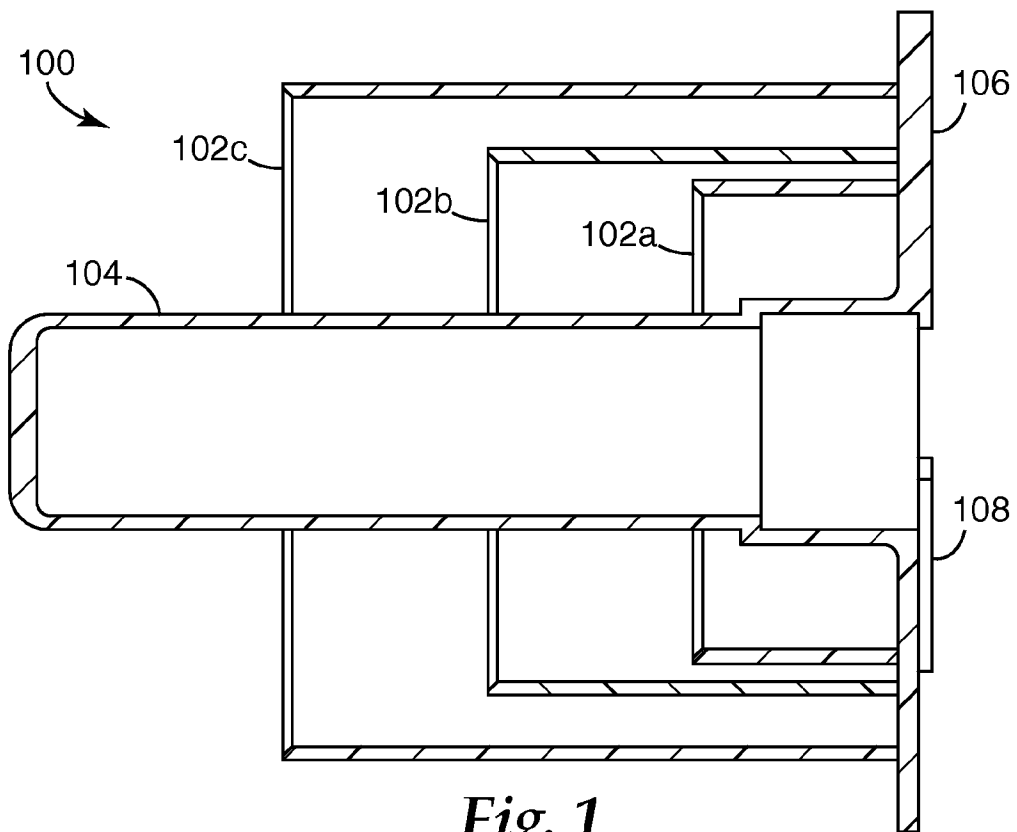
 While various embodiments of the invention have been illustrated and described, it will be clear that the invention is not limited to these embodiments only. Numerous modifications, changes, variations, substitutions and equivalents will be apparent to those
25 skilled in the art without departing from the spirit and scope of the invention as described in the claims.

Claims

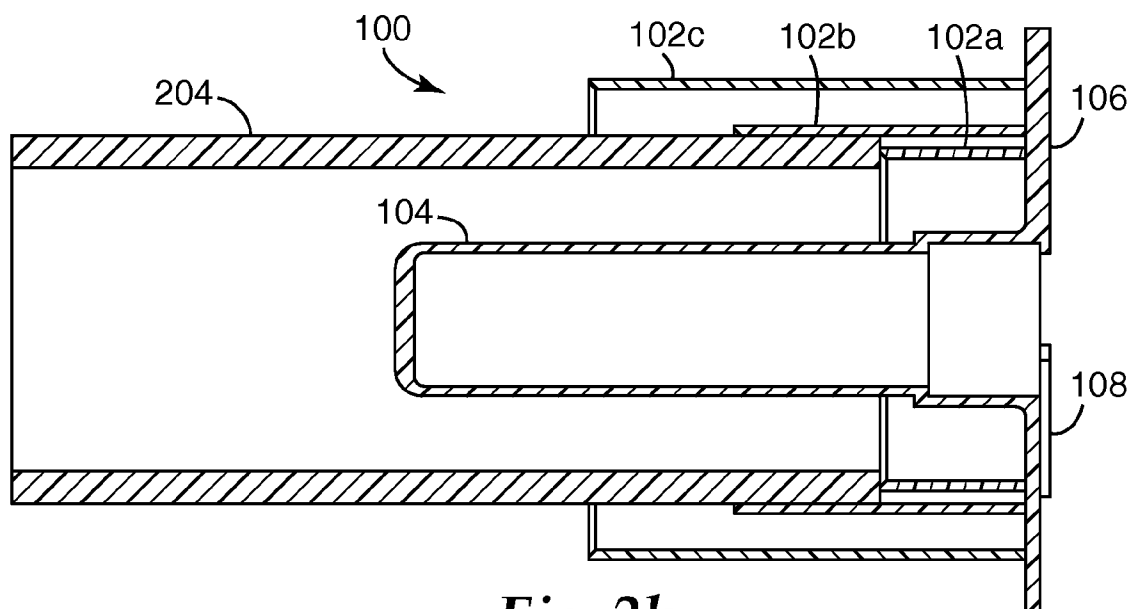
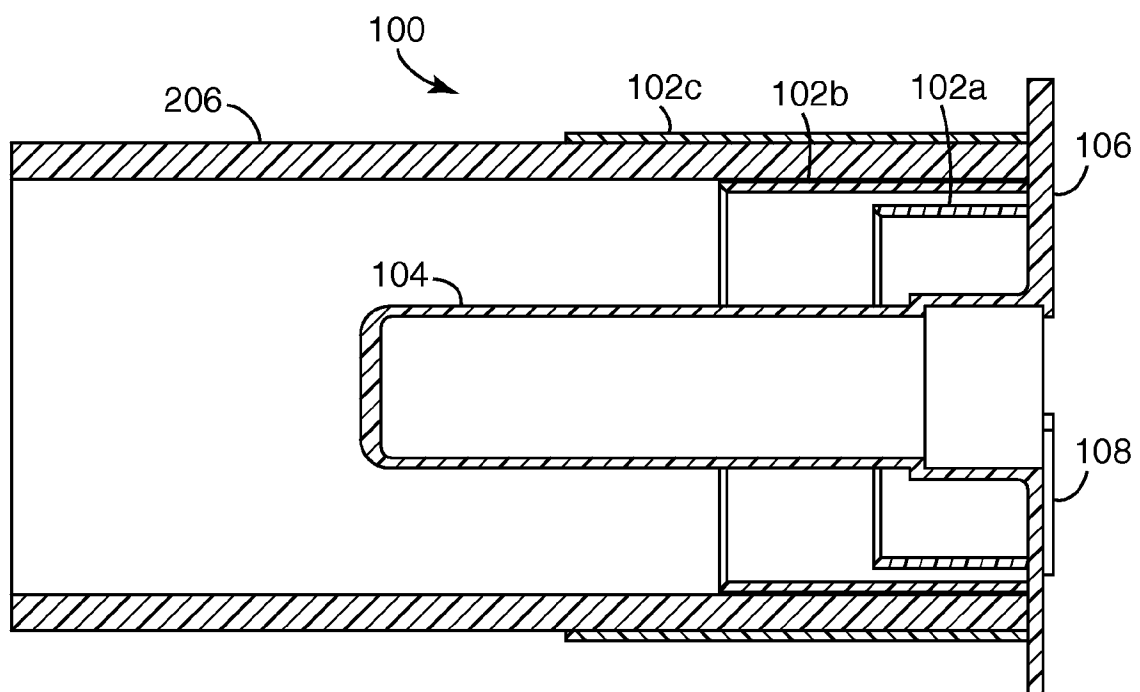
We claim:

- 5 1. An end cap for housing a marker, the end cap comprising:
 - a. at least one concentric ring, wherein the at least one concentric ring is capable of being fitted to an end section of a conduit; and
 - b. at least one protrusion capable of housing a marker.
- 10 2. The end cap of claim 1, wherein the protrusion is in close proximity to the end section of the conduit.
3. The end cap of claim 1, wherein the marker is removable from the end cap.
- 15 4. The end cap of claim 1, wherein the at least one concentric ring is capable of being fitted against the inside diameter or the outside diameter of the conduit.
5. The end cap of claim 1, wherein the outside diameter of the conduit is between about 0.02 meters and about 0.3 meters.
- 20 6. The end cap of claim 1, wherein the outside diameter of the at least one concentric ring is between about 0.02 meters and about 0.3 meters.
7. The end cap of claim 1, wherein the end cap is removable.
- 25 8. The end cap of claim 1, further comprising one or more tabs, the one or more tabs securing the marker in the protrusion.
9. The end cap of claim 1, further comprising at least one attachment point for a pull-
- 30 tape.

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*Fig. 2b**Fig. 2c*

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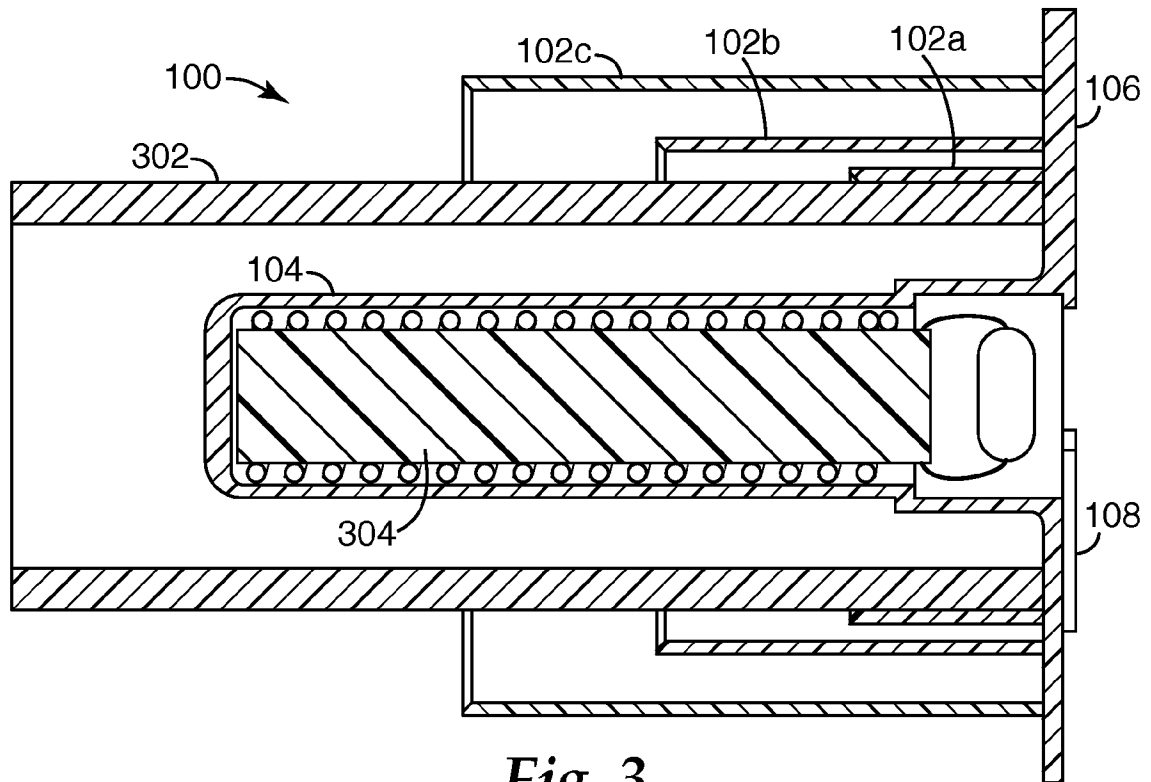


Fig. 3

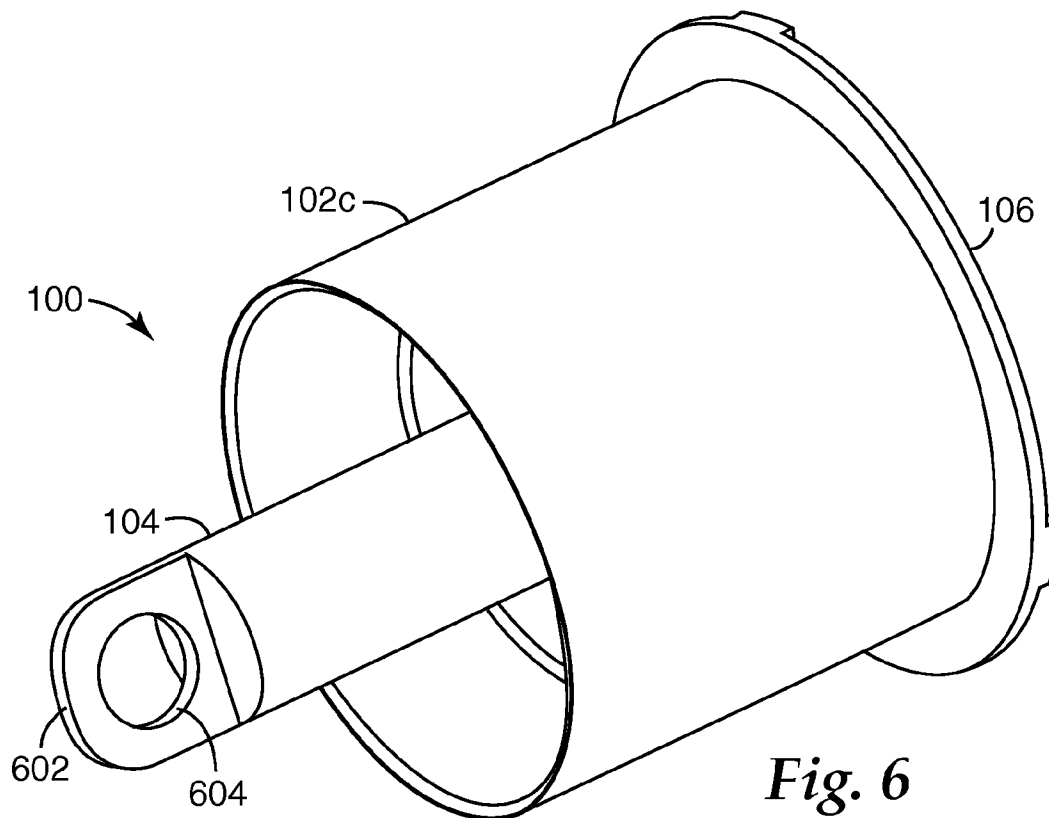


Fig. 6

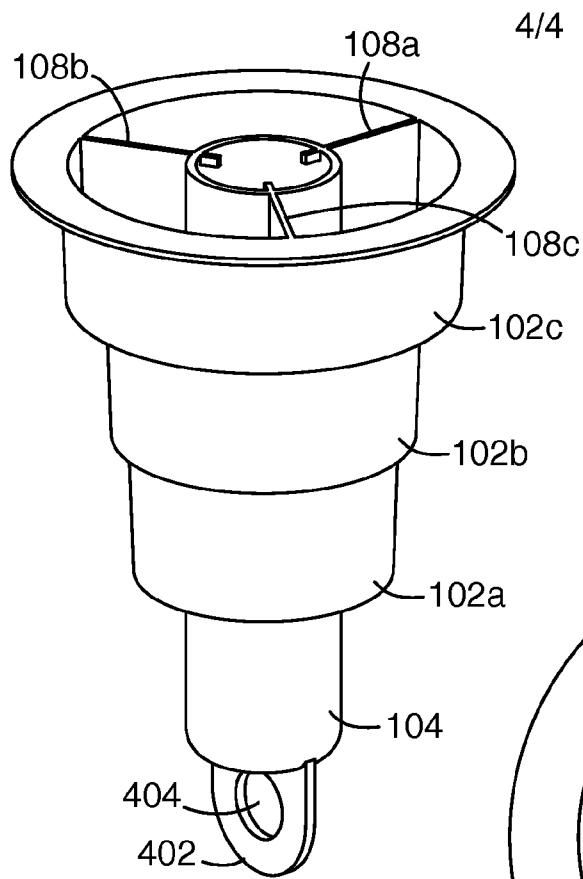


Fig. 4a

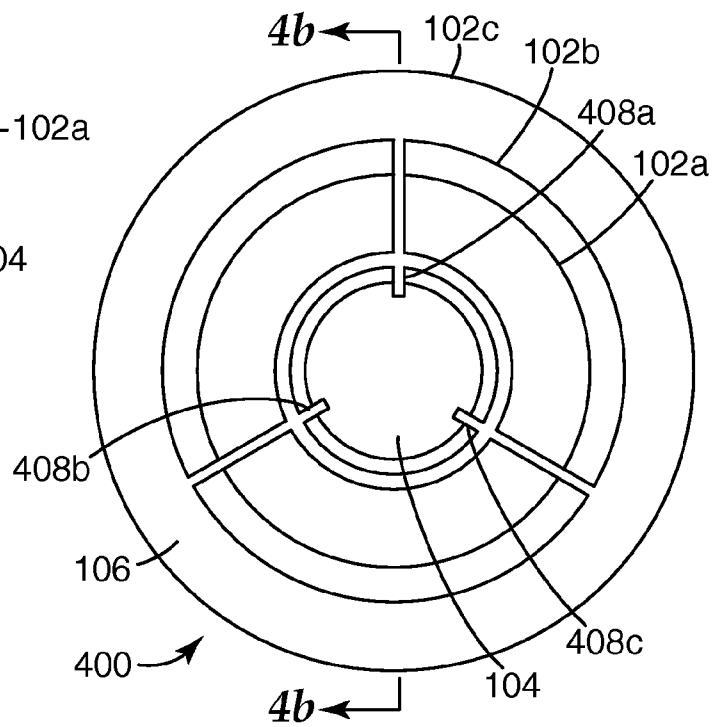


Fig. 5

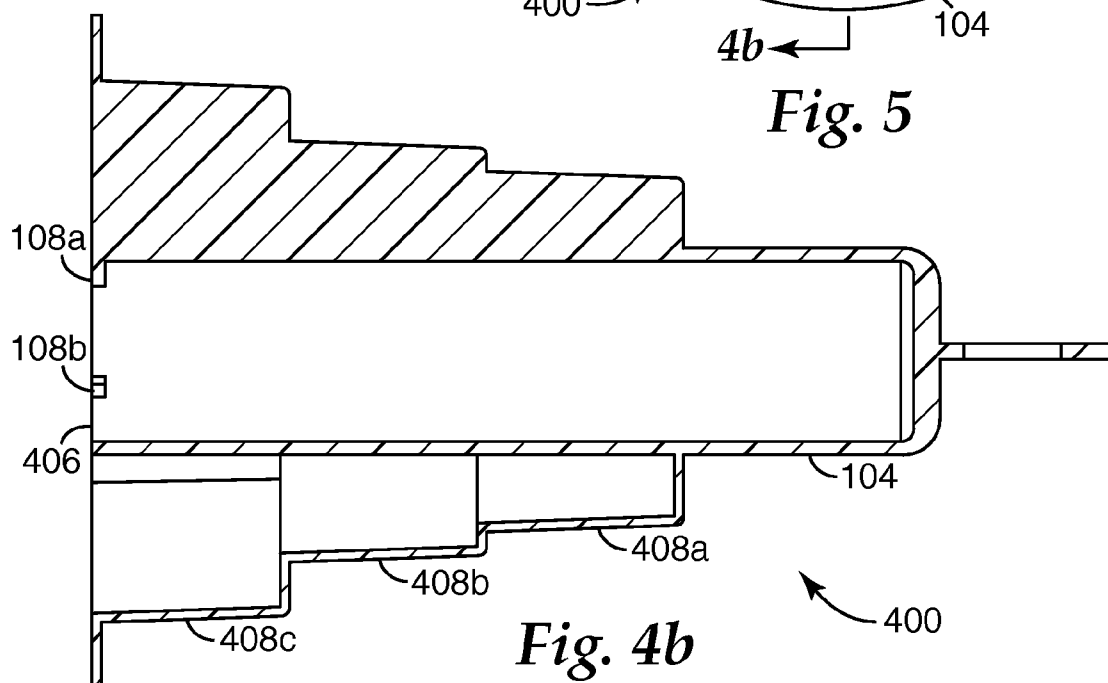


Fig. 4b

A. CLASSIFICATION OF SUBJECT MATTER***H02G 1/08(2006.01)i, H02G 9/06(2006.01)i***

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)

IPC 8 : H02G 15/02, H05G 1/08, H02G 3/04

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

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

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

eKIPASS (KIPO internal)&Keyword : "conduit", "cap", "marker"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,818,829 B1 (BRAIN MCMILLIAN et al) 16 November 2004 See abstract, claim 1 and figure 1	1-9
A	US 10-0601590 B1 (LINE ENGINEERING CO., LTD) 8 July 2007 See abstract, claim 1 and figure 1	1-9
A	US 6,998,530 B2 (DARRY L. SNYDER) 14 February 2006 See abstract, claim 1 and figure 1	1-9

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

* Special categories of cited documents:

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

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"P" document published prior to the international filing date but later than the priority date claimed

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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

13 MAY 2008 (13.05.2008)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/050741

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US6818829B1	16.11.2004	US6818829BA	16.11.2004
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		US6998530BB	14.02.2006