



(22) Date de dépôt/Filing Date: 2013/07/09

(41) Mise à la disp. pub./Open to Public Insp.: 2014/02/02

(45) Date de délivrance/Issue Date: 2016/02/02

(30) Priorité/Priority: 2012/08/02 (US13/564,784)

(51) Cl.Int./Int.Cl. *A61M 25/09* (2006.01)

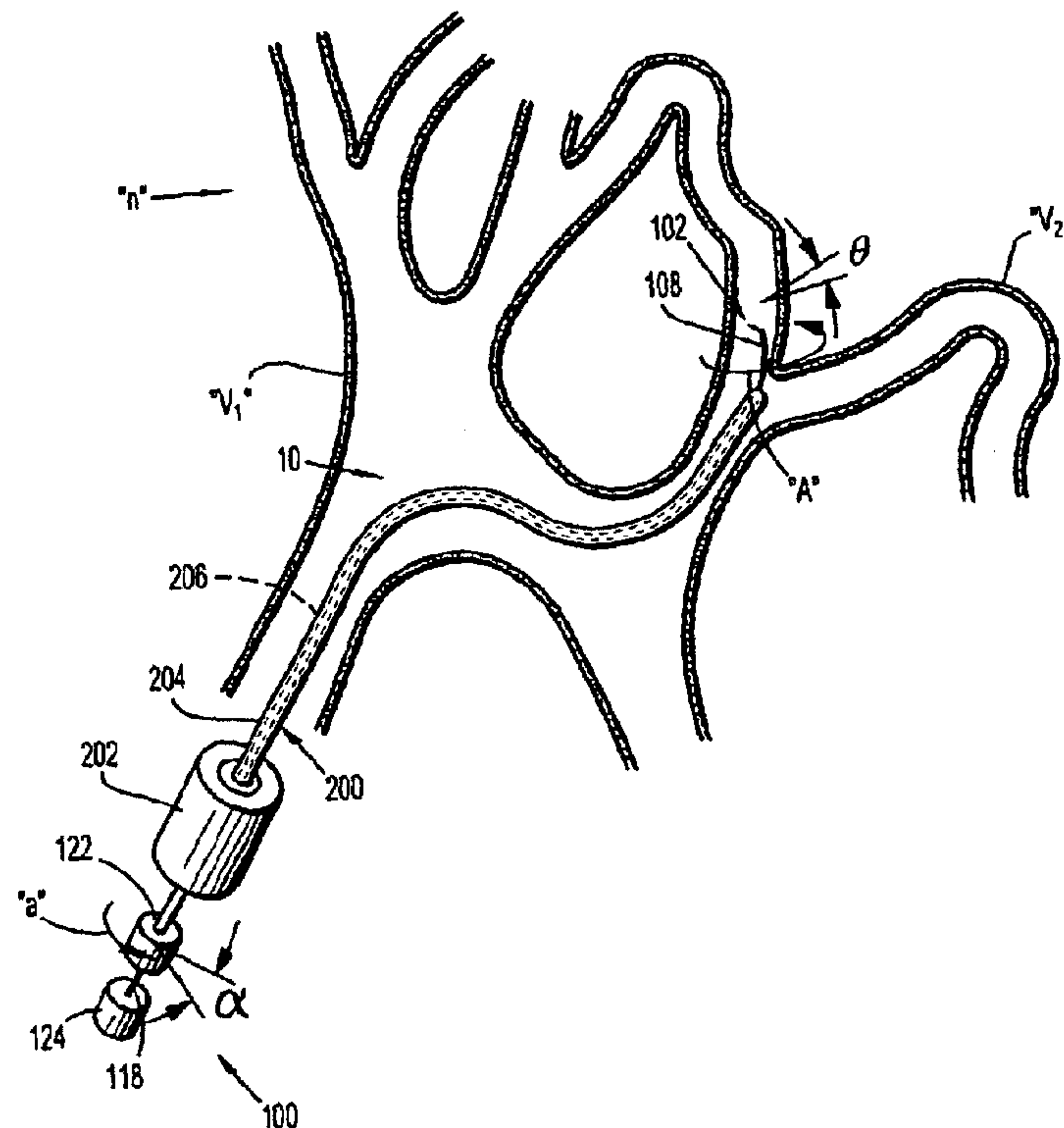
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(54) Titre : FIL-GUIDE

(54) Title: GUIDEWIRE



(57) Abrégé/Abstract:

A guidewire for use in a medical procedure includes an elongate guide member dimensioned for insertion within a body vessel of a subject. The guide member includes an elongate body segment and a leading tip segment. The elongate body segment defines a longitudinal opening, and the leading tip segment is adapted and dimensioned to articulate relative to the elongate body segment about a single axis. A control element extends through the longitudinal opening of the elongate body segment and is longitudinally movable through manual manipulation of a clinician to cause corresponding articulating movement of the leading tip segment.



ABSTRACT

A guidewire for use in a medical procedure includes an elongate guide member dimensioned for insertion within a body vessel of a subject. The guide member includes an elongate body segment and a leading tip segment. The elongate body segment defines a longitudinal opening, and the leading tip segment is adapted and dimensioned to articulate relative to the elongate body segment about a single axis. A control element extends through the longitudinal opening of the elongate body segment and is longitudinally movable through manual manipulation of a clinician to cause corresponding articulating movement of the leading tip segment.

GUIDEWIRE

BACKGROUND

1. Technical Field

[0001] The present disclosure generally relates to medical devices for facilitating diagnostic and/or therapeutic procedures. In particular, the disclosure relates to a guidewire for assisting in placement of an intravascular device within the neurovasculature.

2. Description of Related Art

[0002] Guidewires are commonly used in medical procedures to assist in the advance and proper positioning of a catheter or other medical device in lumens, vessels, or other cavities of the body. Neurovascular procedures utilizing guidewires include the imaging and treatment of aneurysms, arteriovenous malformations (AVM), and ischemic stroke. The effectiveness of an intravascular guidewire in advancing through tortuous neurovasculature without undesired deformation or kinking is dependent upon a number of factors and design considerations. These factors include, *inter-alia*, the material(s) of fabrication of the guidewire, guidewire dimensions and intended use. Generally, a balance must be achieved to provide the required torsional, lateral, tensile and/or column strengths to enable easy and precise manipulation and steerability in the tortuous vasculature. Guidewires for neurovascular intravascular procedures face additional challenges due to the relatively small diameter required to navigate through the narrow and remote locations of the neurovasculature. As a result, the movements of the

guidewire induced by a clinician may not always result in the positioning of the guidewire at a desired orientation relative to the vascular tissue.

SUMMARY

[0003] Accordingly, the present disclosure is directed to a guidewire capable of accessing distal reaches of the vasculature, including the neurovasculature. The guidewire includes a leading tip segment at a leading end thereof, which may be selectively controlled by a clinician to facilitate steering the guidewire through these tortuous regions.

[0004] An example guidewire for use in a medical procedure comprises: an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the elongate body segment defining a longitudinal opening and the leading tip segment being adapted and dimensioned to articulate relative to the elongate body segment about a single axis of articulation; a control element extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control element longitudinally movable to cause corresponding articulating movement of the leading tip segment about the single axis of articulation; a first actuator coupled to the guide member for imparting at least rotational movement to the guide member; and a second actuator coupled to the control element, the second actuator adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis and independently movable relative to the first actuator to cause corresponding movement to

the control element and articulating movement of the leading tip segment about the single axis of articulation.

[0005] The guide member may include an articulation joint for coupling the leading tip segment to the elongate body segment. The articulation joint may include a base coupled to the elongate body segment and a pivoting member mounted to the base. The pivoting member may be coupled to the leading tip segment and to the control element, and the pivoting member may be adapted to pivot relative to the base and about the single axis in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment. The control element may be connected to the pivoting member at a location spaced from the single axis. The pivoting member may define an off-center bore spaced from the single axis for receiving a leading end of the control element. The pivoting member may be mounted to a pivot boss, and the pivot boss may extend generally along the single axis and be coupled to the base.

[0005a] Another example guidewire comprises: an elongate guide member dimensioned for insertion within vasculature of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the elongate body segment defining a longitudinal opening and the leading tip segment being adapted and dimensioned to articulate relative to the elongate body segment about a single axis; a control element extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control element longitudinally

movable through manual manipulation of a clinician; a base coupled to the elongate body segment; a pivoting member is mounted to a pivot boss, the pivot boss extending generally along the single axis, and coupled to the base, the pivoting member coupled to the leading end segment and to the control element, the pivoting member adapted to pivot relative to the base via the pivot boss and about the single axis in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment about the single axis; a first actuator coupled to the guide member for imparting at least rotational movement to the guide member; and a second actuator coupled to the control element, the second actuator adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis and relative to the first actuator to cause corresponding movement to the control element and articulating movement of the leading tip segment relative to the base and about the single axis.

[0006] An example system comprises: an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the leading tip segment being adapted and dimensioned to pivot relative to the elongate body segment; a control element operatively coupled to the leading tip segment, the control element longitudinally movable through manual manipulation of a clinician to cause corresponding pivoting movement of the leading tip segment; a handle connected to the control element, the handle adapted for longitudinal movement in a direction generally parallel to the

longitudinal axis to cause corresponding longitudinal movement of the control element; and a microcatheter defining a lumen configured to receive the elongate guide member.

[0007] The leading tip segment may be adapted to pivot about a single pivot axis. The control element may be operatively coupled to the leading tip segment at a location radially spaced from the single pivot axis.

[0008] The guidewire may include an articulation joint for coupling the leading tip segment to the elongate body segment. The articulation joint may be dimensioned and adapted to enable pivotal movement of the leading tip segment relative to the elongate body segment. The articulation joint may include a pivoting member that is coupled to the leading tip segment and to the control element. The pivoting member may be adapted to pivot about the single axis in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment. The articulation joint may also include a base that is coupled to the elongate body segment and has the pivoting member pivotally mounted thereto.

[0009] The elongate body segment may define a longitudinal opening, and the control element may be at least partially disposed within the longitudinal opening and adapted for reciprocal longitudinal movement therewithin to cause corresponding pivotal movement of the leading tip segment. The guidewire may further include a handle coupled to a trailing end of the control element for selectively longitudinally moving the control element.

[0009a] Another example guidewire comprises: an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the elongate body segment defining a longitudinal opening, the leading tip segment being adapted and dimensioned for articulating movement consistent of pivotal movement about a single axis of articulation; a control extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control longitudinally movable to cause corresponding articulating movement of the leading tip segment; and a handle coupled to the control, the handle adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis of the guide member to cause corresponding movement to the control element and articulating movement of the leading tip segment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Embodiments of the present disclosure will be readily appreciated by reference to the drawings wherein:

[0011] **FIG. 1** is a perspective view of a guidewire and catheter in use within the vasculature of a patient in accordance with the principles of the present disclosure;

[0012] **FIG. 2** is an enlarged perspective view of the guidewire of **FIG. 1** illustrating an elongate guide member and an actuator assembly;

[0013] **FIG. 3** is an enlarged perspective view of the elongate guide member of **FIG. 2**;

[0014] **FIGS. 4A-4F** are perspective views of the elongate guide member of **FIG. 2** in various stages of assembly;

[0015] **FIG. 5A** is a schematic view of the guidewire of **FIG. 2** illustrating a leading tip segment of the guidewire in an aligned configuration;

[0016] **FIG. 5B** is a schematic view of the guidewire of **FIG. 2** illustrating the leading tip segment of the guidewire in an articulated configuration; and

[0017] **FIG. 6** is a flow chart illustrating a methodology for performing a medical procedure with the guidewire.

DESCRIPTION

[0018] In the following description, the terms “proximal” and “distal” as used herein refer to the relative position of the guidewire in a lumen. The “proximal” or “trailing” end of the guidewire is the guidewire segment extending outside the body closest to the clinician. The “distal” or “leading” end of the guidewire is the guidewire segment placed farthest into a body lumen from the entrance site.

[0019] The guidewire of the present disclosure has particular application in neurovascular procedures, but may be used in any interventional, diagnostic, and/or therapeutic procedure including coronary vascular, peripheral vascular, and gastrointestinal applications in addition to a neurovascular application. The guidewire may be used in a variety of procedures including guiding other devices, such as catheters, stents, and/or balloons to target sites within a patient's body.

[0020] In the figures below, the full length of the guidewire is not shown. The length of the guidewire can vary depending on the type of interventional procedure, though typically it ranges in length from 30 to 400 centimeters (cm). Common lengths of guidewires for coronary, peripheral and neurovascular interventions may range from 170 to 300 cm. These lengths permit the use of the guidewire with standardized rapid exchange or over-the-wire catheter systems.

[0021] In accordance with one application of the present disclosure, the maximum outer diameter of the guidewire ranges from about 0.008 inches to about 0.018 inches. These diameters are standard for guidewires used in neurovascular procedures. The diameter of the guidewire may remain relatively constant over a major body portion or length of the guidewire; however, the leading or distal end may exhibit a generally tapered or narrowed configuration with respect to the major body portion.

[0022] The various embodiments of the disclosure will now be described in connection with the drawing figures. It should be understood that for purposes of better describing

the disclosure, the drawings may not be to scale. Further, some of the figures include enlarged or distorted portions for the purpose of showing features that would not otherwise be apparent.

[0023] Referring now to **FIG. 1**, a tortuous vasculature such as within the neurovascular space “**n**” is illustrated. For illustrative purposes, a tortuous path or a tortuous region within, e.g., the neurovascular space “**n**”, includes large vasculature “**v1**” and smaller branch vessels “**v2**” which branch or extend from more proximal vessels at various angles, including up to 90 degrees or even greater than 90 degrees.

[0024] In **FIG. 1**, a medical instrument **10** of the present disclosure includes a guidewire **100** illustrated as being positioned within a conventional access or microcatheter **200**. Such microcatheters are known in the art. Commercially available microcatheters include the EchelonTM, MarathonTM, and NauticaTM microcatheters sold by Tyco Healthcare Group, LP, dba Covidien, Irvine, CA. In general, microcatheter **200** includes a handle **202** and an elongate flexible catheter member **204** extending from the handle **202**. The catheter member **204** may be constructed of a cylindrical stock of one or more polymers, such as GrilamidTM brand polyamide/nylon from EMS Chemie, Switzerland, PebaxTM brand polyether/polyamide, from Actinofina Chemicals, France and the like. Microcatheter **200** defines a longitudinal opening or lumen **206** extending at least through the catheter member **204** for at least partial passage or reception of the guidewire **100**.

[0025] With reference to **FIG. 2**, guidewire **100** will be discussed. Guidewire **100** includes an elongate guide member **102** and an actuator assembly **104**. The elongate guide member **102** is dimensioned for insertion within a body vessel of a subject, and defines a longitudinal axis “**k**.” The elongate guide member **102** includes a leading tip segment **106** at a distal or leading end **108** thereof, an elongate body segment **110** extending to a proximal or trailing end **114** thereof, and an articulation joint **116** coupling the leading tip segment **106** to the elongate body segment **110**. The articulation joint **116** defines a single axis “**p**” about which the leading tip segment **106** may be induced to articulate relative to the elongate body segment **110**. A single elongate control element **118** extends through a longitudinal opening **120** of the elongate body segment **110**, and is operatively coupled to the leading tip segment **106** and the actuator assembly **104**. The control element **118** is longitudinally movable through manual manipulation of a clinician to cause corresponding articulating movement of the leading tip segment **106**.

[0026] Since the leading tip segment **106** is pivotally connected to the elongate body segment **110** about the single axis “**p**,” and since the leading tip segment **106** is operatively coupled to the single control element **118**, the clinician is provided with a degree of certainty with respect to the manner in which the leading tip segment **106** will respond to manipulation of the actuator assembly **104**.

[0027] The actuator assembly **104** of the guidewire **100** includes a first actuator **122** from which the elongate body segment **110** extends. First actuator **122** may incorporate various features (not depicted) including handles, slides or the like, to facilitate handling

and/or movement of elongate guide member **102**. Translational or longitudinal motion of the first actuator **122** may be transmitted to the elongate guide member **102**. Also, rotational motion of the first actuator **122**, e.g., rotational motion about the longitudinal axis “k” (see **FIG. 2**), may be transmitted to the elongate guide member **102**.

[0028] The actuator assembly **104** also includes a second actuator **124** from which the control element **118** extends. As indicated above, the control element **118** extends from the second actuator **124** through the longitudinal opening **120** defined through the elongate body segment **110**, and is operatively associated with the leading tip segment **106** of the elongate guide member **102**. The second actuator **124** may be displaced longitudinally with respect to the first actuator **122** to impart a tensile or compressive force to the control element **118** and to impart a longitudinal displacement to the control element **118**. The control element **118** may be constructed to transmit tensile and compressive loads from the second actuator **124** to the articulation joint **116**. The control element **118** may exhibit an outer diameter in the range of about 0.001 inches to about 0.002 inches. The control element **118** may be a rod or shaft formed of a flexible material having sufficient rigidity to impart the articulating movement to the leading tip segment **106** as will be discussed. Suitable materials for the construction of the control element include metals such as stainless steel, tungsten, or nitinol, or non-metallic materials such as carbon fibers or polymeric materials.

[0029] Referring now to **FIG. 3**, particulars of the elongate body segment **110**, the articulation joint **116** and the leading tip segment **106** of the elongate guide member **102**

will be discussed in greater detail. The leading tip segment **106**, the articulation joint **116** and elongate body segment **110** are dimensioned for insertion within the vasculature and through the lumen **206** of the microcatheter **200** (**FIG. 1**). The elongate body segment **110** extends a substantial length of the elongate guide member **102** and may have a length ranging from about 20 cm to about 240 cm. The elongate body segment **110** may be generally circular in cross section with the longitudinal opening **120** extending at least along a major portion of the length of the elongate body segment **110**. The elongate body segment **110** may be constructed of stainless steel, Nitinol, or another suitable alloy, which may provide the elongate body segment **110** with sufficient flexibility to navigate the vasculature. In other embodiments, longitudinal opening **120** may be constructed as a fold or tuck (not shown) formed in the elongate body segment **110** such that the longitudinal opening is disposed at least partially on an exterior of the elongate body segment **110**.

[0030] A base **128** of the articulation joint **116** may be bonded to the elongate body segment **110** at bonding location **130**. The elongate body segment **110** may exhibit an outer diameter in the range of about 0.011 inches to about 0.014 along a substantial length thereof, and the base **128** may exhibit a maximum lateral dimension no greater than the outer diameter of the elongate body segment **110** thus generally maintaining or corresponding to the profile of the elongated body segment **110**. The entire elongate guide member **102** may be received in the lumen **206** of the microcatheter **200** (**FIG. 1**).

[0031] The articulation joint **116** pivotally connects the leading tip segment **106** to the elongate body segment **110** about the single pivot axis “**p**,” which is transverse to the longitudinal axis “**k**.” The base **128** maintains the pivot axis “**p**” in a stationary relationship with a leading end of the elongate body segment **110**. The articulation joint **116** includes a pivoting member **134**, which supports the leading tip segment **106** and is coupled to the control element **118**. The leading tip segment **106** protrudes distally with respect to the elongate body segment **110** and the base **128**, and defines a leading end of the elongate guide member **102**. The pivoting member **134** is mounted to a pair of pivot bosses **140** extending into the base **128**. In some embodiments, the pivoting member **134** and the pivot bosses **140** may be constructed monolithically as a single component. The pivot bosses **140** extend generally along the pivot axis “**p**,” and, thus, the pivoting member **134** and the leading tip segment **106** are pivotally coupled to the base **128** about the pivot axis “**p**.”

[0032] As depicted in **FIG. 3**, the leading tip segment **106** is constructed to exhibit a blunt, conical shape, but other atraumatic constructions may be provided such as coils, circular or oval cross section wire segments, or a flattened, planar or ribbon tips. As a further alternative (not shown), a leading tip segment may be heat set into a variety of configurations including a linear arrangement or a bent “j-hook” as is known in the art, or, may be bent into a “j-hook” design by the clinician prior to the interventional procedure. For example, the leading tip segment **106** may range from about 5 cms to about 50 cms. The greatest cross-sectional lateral dimension or diameter of the leading tip segment **106** may be less than the lateral dimension of the articulation joint **116**, or, in

embodiments may approximate the lateral dimension of the articulation joint 116 to provide a smooth transition between the leading tip segment 106 and the articulation joint 116.

[0033] Referring now to **FIGS. 4A to 4F**, a method for manufacturing or assembling the elongate guide member 102 is described. Initially a stock material 144 (**FIG. 4A**) is provided with a pair of generally flat lateral faces 146 and a pair of curved faces 148. A curved surface 150 (**FIG. 4B**) may be micro-machined onto the stock material 144 on a leading side thereof. Next, an annular channel 152 (**FIG. 4C**) may be cut into each of the generally flat lateral faces 146. The annular channels 152 define the pivot bosses 140. A bore 154 may be drilled into the curved surface 150 to provide a connector for receiving leading tip segment 106. In other embodiments, a protrusion or snap-fit connector (not shown) may be provided to receive the leading tip segment 106. A cavity 156 may be cut out of a trailing side of the stock material 144 to provide passage of the control element 118, and an off-center bore 158 may be cut into a trailing surface of the cavity 156 to receive the control element 118. The off-center bore 158 is spaced radially with respect to the pivot axis “p” such that a torque may be generated about the pivot axis “p” by applying a longitudinal force to the pivoting member 134 at the off-center bore 158.

[0034] Next, parallel slots 160 (**FIG. 4D**) and a transverse slot 162 may be cut into stock material 146. The parallel slots 160 intersect the annular channels 152 and extend to the transverse slot 162. The transverse slot 162 extends through the stock material 146, and thus, the slots 160, 162 serve to separate the pivoting member 134 from the base 128.

The base **128** retains the pivoting member **134** since the pivot bosses **140** protrude into the lateral faces **146** of the base **128**. By micromachining the base **128** and the pivoting member **134** from the same stock material **146**, no additional assembly of these two these components **128**, **134** to one another is required. Thus, the pivot bosses **140** of the pivoting member **134** may extend to a full width of the base **128**, and may be flush with the lateral faces **146**. This construction provides a structurally strong articulation joint **116**. This is particularly beneficial when for the relatively small diameter guidewires dimensioned for use within the neurovascular systems.

[0035] As indicated in **FIG. 4E**, the leading tip segment **106** may be received within the bore **154** and affixed to the pivoting member **134**. Thus, the pivoting member **134** and the leading tip segment **106** may articulate together. The control element **118** may be received within the off-center bore **158** and may also be affixed to the pivoting member **134**. Affixing the leading tip segment **106** and the control element **118** to the pivoting member **134** may be effected though the use of adhesives, welding, soldering or the like.

[0036] The base **128** may then be bonded to the elongate body segment **110** (**FIG. 4F**) coupling the articulation joint **116** to the elongate body segment **110**. In other embodiments, the base **128** may be formed monolithically with a leading end of the elongate body segment **110**.

[0037] The elongate guide member **102** including at least the elongate body segment **110** and/or the leading tip segment **106** may comprise a shape memory or superelastic alloy or

polymer. One suitable shape memory alloy (SMA) or superelastic metal is Nitinol (NiTi), a nickel/titanium alloy, which is commercially available in various diameters or sizes. Superelastic alloys such as NiTi are relatively flexible capable of effectively tracking tortuous vasculature encountered while exhibiting advantageous restoration capabilities. Shape memory or superelastic metal or polymer such as NiTi may also be suitable for applications in which it is desired that leading tip segment **106** have a pre-determined curvature. Shape memory alloys including NiTi can be heat set into a desired shape, straightened for delivery to a site, and then released to resume the heat-set shape. Other materials for the elongate guide member **102** may include an alloy consisting of Nickel, Titanium, and Cobalt commercially available from SAES Smart Materials, Inc, of New Hartford, N.Y.

[0038] It is further envisioned that a lubricious coating may be disposed over components of elongate guide member **102**. Suitable lubricious coatings include hydrophilic materials such as polyvinylpyrrolidone (PVP), polyethylene oxide, polyethylene glycol, cellulosic polymers, and hydrophilic maleic anhydride, or hydrophobic materials such as silicone, PTFE, or FEP. These coatings are typically applied by dip coating or spray methods, and heat curing may be used. For example, cure temperatures up to about 70 degrees C. are used for silicone coatings, and several hundred degrees may be required for PTFE coatings. In addition to the lubricious coating, bioactive coatings may be applied over all or part of the guidewire. Such coatings also may incorporate materials such as heparin, hirudin and its analogs, or other drugs. These coatings typically are

applied by dip coating. Bioactive coatings are desirable to prevent blood clotting or for delivery of drugs to a specific site.

[0039] Referring now to **FIGS. 1, 5A and 5B**, in conjunction with the flow chart of **FIG. 6**, usage of the guidewire **100** in connection with performing a medical procedure **300** (**FIG. 6**) will be described. The actuator assembly **104** may be operated to position the elongate guide member **102** in the neurovascular space “**n**” (**FIG. 1**). A clinician may translate the first actuator **122** to advance the elongate guide member **102** to a target location, e.g., a juncture in the vasculature. (**STEP 302**) The clinician may rotate the first actuator **122** to orient the leading end **108** of the elongate guide member **102** with respect to the neurovascular space “**n**.” For example, a clinician may rotate the first actuator **122** in the direction of arrow “**a**” (**FIG. 1**) through an angle “ α ” to cause a corresponding rotation of the leading end **108** of the elongate guide member **102** in the direction of arrow “**A**” through an angle θ within the vasculature.

[0040] Also, if necessary, the clinician may operate the second actuator **124** to articulate the leading tip segment **106** (**STEP 304**) with respect to the elongate body segment **110** (**FIGS. 5A and 5B**) such that further translation of the elongate guide member **102** will direct the leading end **108** of the elongate guide member **102** into the intended vessel, e.g., vessel “**v2**” (**STEP 306**). For example, a clinician may pull the second actuator **124** in the direction of arrow “**b**” to apply a tensile force to the control element **118**. Since the control element **118** is coupled to the pivoting member **134** at a location offset from the pivot axis “**p**,” the tensile force in the control element **118** causes the pivoting

member **134** and the leading tip segment **106** to pivot in the direction of arrow “**B**.” In some embodiments, the control element **118** may be sufficiently rigid such that a compressive force may be imparted thereto to induce pivotal movement of the pivoting member **134** and the leading tip segment **106** in a direction opposite the direction of arrow “**B**.” This articulating motion may be effected without translating the leading end **108** of the elongate guide member **102**. For example, the second actuator **124** may longitudinally move or translate relative to the first actuator **122** to effect angulation of the leading tip segment **106**. The independency of these motions may facilitate predictability with respect to placement and positioning of the leading tip segment **106** relative to vessel “**v2**”, and assist the clinician in achieving the intended orientation of the leading tip segment **106**.

[0041] The size of the articulation joint **116** may be relatively small with respect to the second actuator **124**. Thus, second actuator **124** may be extremely sensitive. For example, a very small movement of the second actuator **124** in the direction of arrow “**b**” may be sufficient to move the pivoting member **134** and the leading tip segment **106** in the direction of arrow “**B**.” Since the leading tip segment **106** is pivotally connected to the elongate body segment **110** about the single axis “**p**” and the pivot bosses **140**, the clinician is provided with a degree of certainty with respect to the manner in which the leading tip segment **106** will respond to manipulation of the actuators **122**, **124**.

[0042] Once the guidewire **100** is positioned as desired relative to the target location within the neurovascular space “**n**,” the catheter member **204** of the microcatheter **200**

may be advanced over the elongate guide member **102** of the guidewire **100** to position the microcatheter **200** within the neurovascular space “**n**” adjacent the target location (**STEP 308**). The microcatheter **200** may then be used to perform a medical procedure (**STEP 310**) including treatment of an aneurysm or an arterio-venous malformation, performing an angioplasty or stenting. In some other procedures, the catheter member **204** or another device (not shown) may be initially positioned on the elongate guide member **102**, and positioned within the neurovascular space “**n**” along with the guidewire **100**.

[0043] The above description and the drawings are provided for the purpose of describing embodiments of the present disclosure and are not intended to limit the scope of the disclosure in any way. It will be apparent to those skilled in the art that various modifications and variations can be made without departing from the spirit or scope of the disclosure. Thus, it is intended that the present disclosure cover the modifications and variations of this disclosure provided they come within the scope of the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A guidewire for use in a medical procedure, which comprises:
 - an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the elongate body segment defining a longitudinal opening and the leading tip segment being adapted and dimensioned to articulate relative to the elongate body segment about a single axis of articulation;
 - a control element extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control element longitudinally movable to cause corresponding articulating movement of the leading tip segment about the single axis of articulation;
 - a first actuator coupled to the guide member for imparting at least rotational movement to the guide member; and
 - a second actuator coupled to the control element, the second actuator adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis and independently movable relative to the first actuator to cause corresponding movement to the control element and articulating movement of the leading tip segment about the single axis of articulation.
2. The guidewire according to claim 1 wherein the guide member includes an articulation joint for coupling the leading tip segment to the elongate body segment.

3. The guidewire according to claim 2 wherein the articulation joint includes:
a base coupled to the elongate body segment; and
a pivoting member mounted to the base, the pivoting member coupled to the leading tip segment and to the control element, the pivoting member adapted to pivot relative to the base and about the single axis of articulation in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment.

4. The guidewire according to claim 3 wherein the control element is connected to the pivoting member at a location spaced from the single axis of articulation.

5. The guidewire according to claim 4 wherein the pivoting member defines an off-center bore spaced from the single axis of articulation for receiving a leading end of the control element.

6. A guidewire comprising:
an elongate guide member dimensioned for insertion within vasculature of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a leading tip segment, the elongate body segment defining a longitudinal opening and the leading tip segment being adapted and dimensioned to articulate relative to the elongate body segment about a single axis;

a control element extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control element longitudinally movable through manual manipulation of a clinician;

a base coupled to the elongate body segment;

a pivoting member mounted to a pivot boss, the pivot boss extending generally along the single axis, and coupled to the base, the pivoting member coupled to the leading end segment and to the control element, the pivoting member adapted to pivot relative to the base via the pivot boss and about the single axis in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment about the single axis;

a first actuator coupled to the guide member for imparting at least rotational movement to the guide member; and

a second actuator coupled to the control element, the second actuator adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis and relative to the first actuator to cause corresponding movement to the control element and articulating movement of the leading tip segment relative to the base and about the single axis.

7. A system comprising:

an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a

leading tip segment, the leading tip segment being adapted and dimensioned to pivot relative to the elongate body segment;

a control element operatively coupled to the leading tip segment, the control element longitudinally movable through manual manipulation of a clinician to cause corresponding pivoting movement of the leading tip segment;

a handle connected to the control element, the handle adapted for longitudinal movement in a direction generally parallel to the longitudinal axis to cause corresponding longitudinal movement of the control element; and

a microcatheter defining a lumen configured to receive the elongate guide member.

8. The system according to claim 7 wherein the leading tip segment is adapted to pivot about a single pivot axis.

9. The system according to claim 8 wherein the control element is operatively coupled to the leading tip segment at a location radially spaced from the single pivot axis.

10. The system according to claim 8 further including an articulation joint for coupling the leading tip segment to the elongate body segment, the articulation joint dimensioned and adapted to enable pivotal movement of the leading tip segment relative to the elongate body segment.

11. The system according to claim 10 wherein the articulation joint includes a pivoting member, the pivoting member coupled to the leading tip segment and to the control element, the pivoting member adapted to pivot about the single pivot axis in response to longitudinal movement of the control element to thereby cause corresponding pivoting movement of the leading tip segment.

12. The system according to claim 11 wherein the articulation joint includes a base, the base coupled to the elongate body segment and having the pivoting member pivotally mounted thereto.

13. The system according to claim 7 wherein the elongate body segment defines a longitudinal opening, the control element being at least partially disposed within the longitudinal opening and adapted for reciprocal longitudinal movement therewithin to cause corresponding pivotal movement of the leading tip segment.

14. The system according to claim 13 wherein the handle is coupled to a trailing end of the control element.

15. The guidewire according to claim 1 wherein the control element is a single control element.

16. The guidewire according to claim 15 wherein the second actuator is coupled to the single control element such that longitudinal movement of the second

actuator in a first direction applies a tensile force to the single control element causing the leading tip segment to pivot in a second direction and longitudinal movement of the second actuator in a third direction applies a compressive force to the single control element causing the leading tip segment to pivot in a fourth direction opposite the second direction.

17. The guidewire according to claim 6 wherein the elongate body segment of the elongate guide member and the control element are generally flexible.

18. The guidewire according to claim 6 wherein the control element is a single control element.

19. The guidewire according to claim 7 further including an actuator coupled to the guide member for imparting at least rotational movement to the guide member, the handle being movable independent of the actuator.

20. The guidewire according to claim 7 wherein the control element is a single control element.

21. A guidewire comprising:
an elongate guide member dimensioned for insertion within a body vessel of a subject, the elongate guide member defining a longitudinal axis and having leading and trailing ends, the elongate guide member including an elongate body segment and a

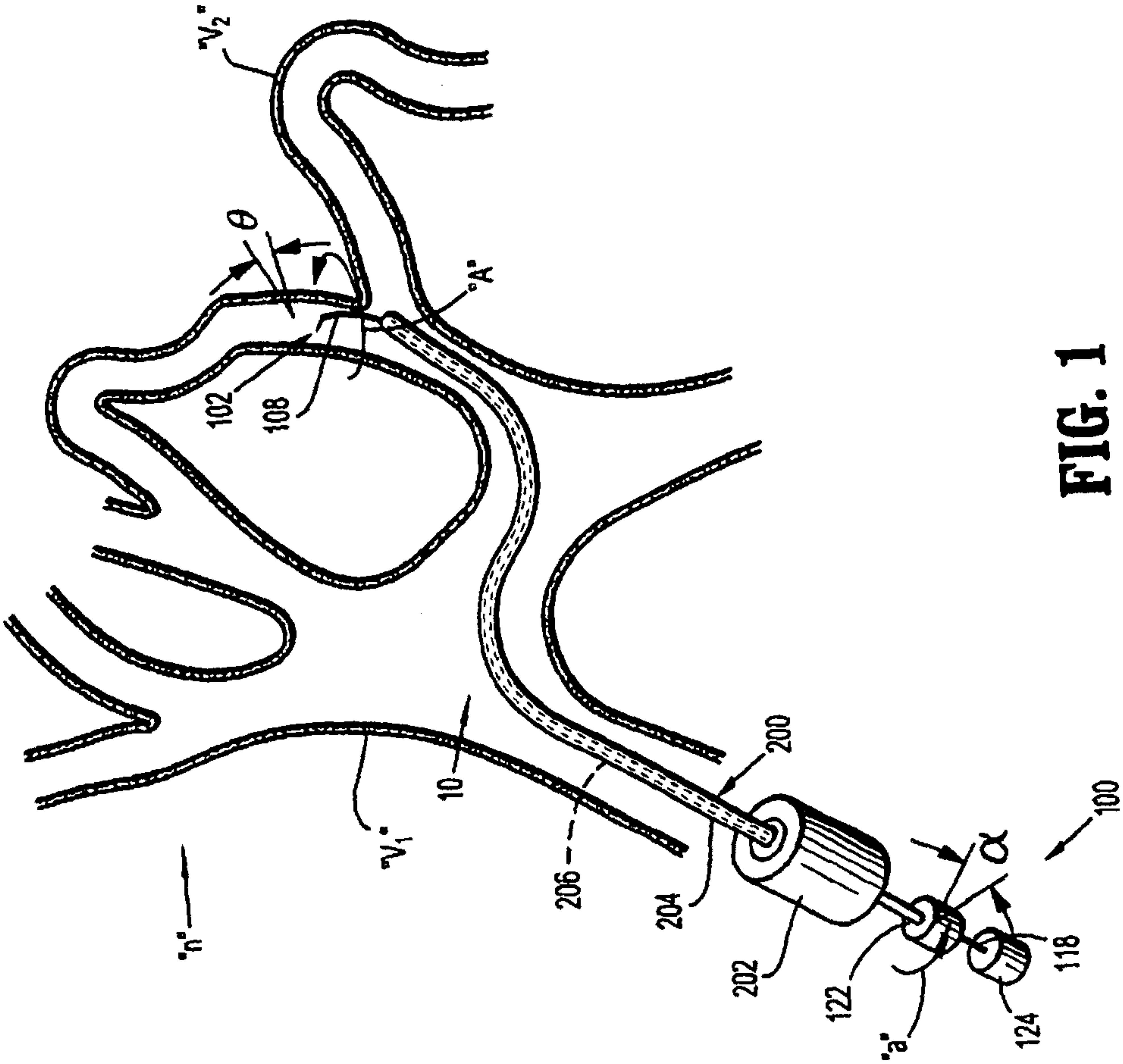
leading tip segment, the elongate body segment defining a longitudinal opening, the leading tip segment being adapted and dimensioned for articulating movement consistent of pivotal movement about a single axis of articulation;

a control extending through the longitudinal opening of the elongate body segment and operatively coupled to the leading tip segment, the control longitudinally movable to cause corresponding articulating movement of the leading tip segment; and

a handle coupled to the control, the handle adapted for sliding longitudinal movement in a direction generally parallel to the longitudinal axis of the guide member to cause corresponding movement to the control element and articulating movement of the leading tip segment.

22. The guidewire according to claim 21 wherein the control is a single control element.

23. The guidewire according to claim 22 wherein the single axis of articulation is a fixed axis.



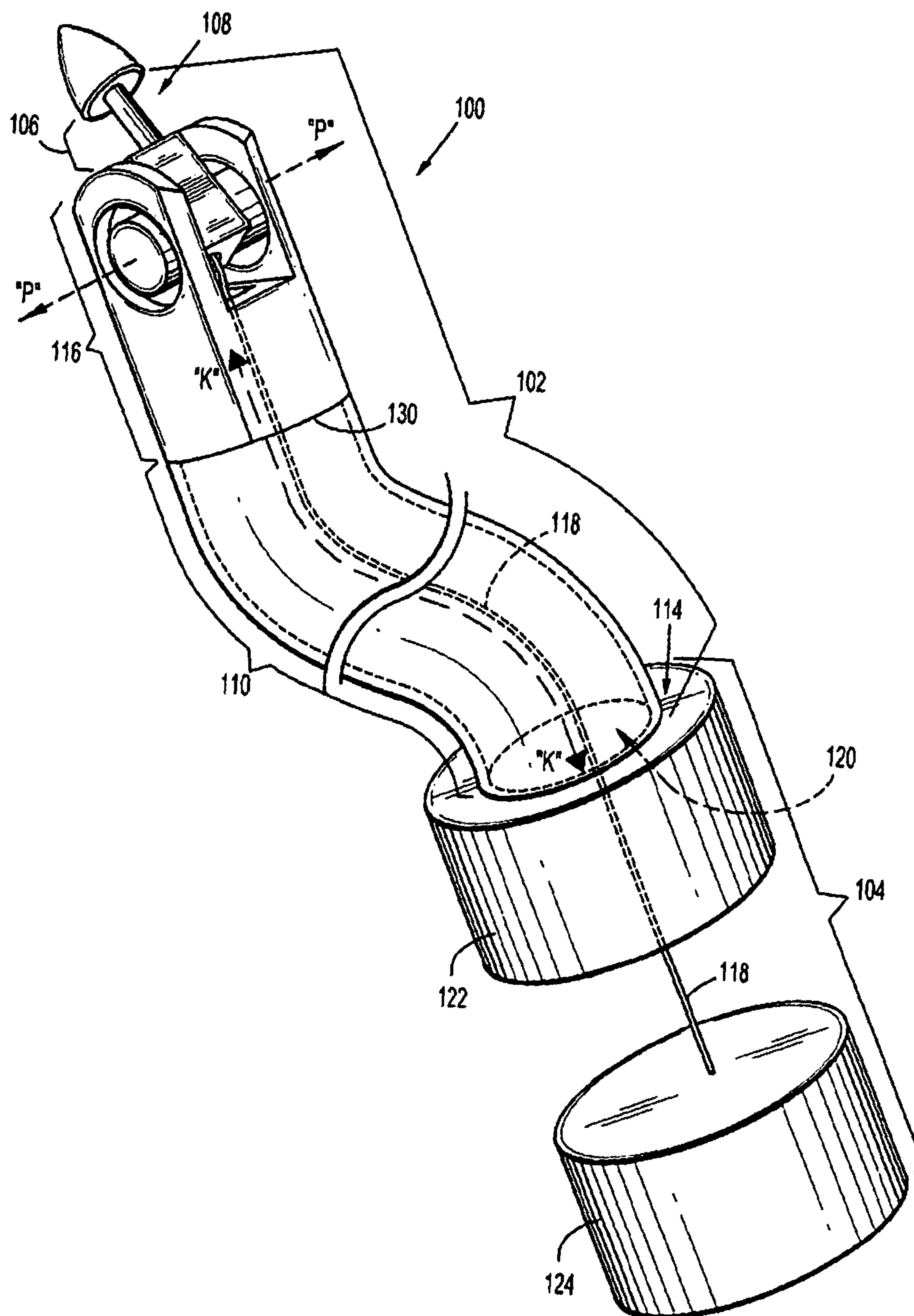
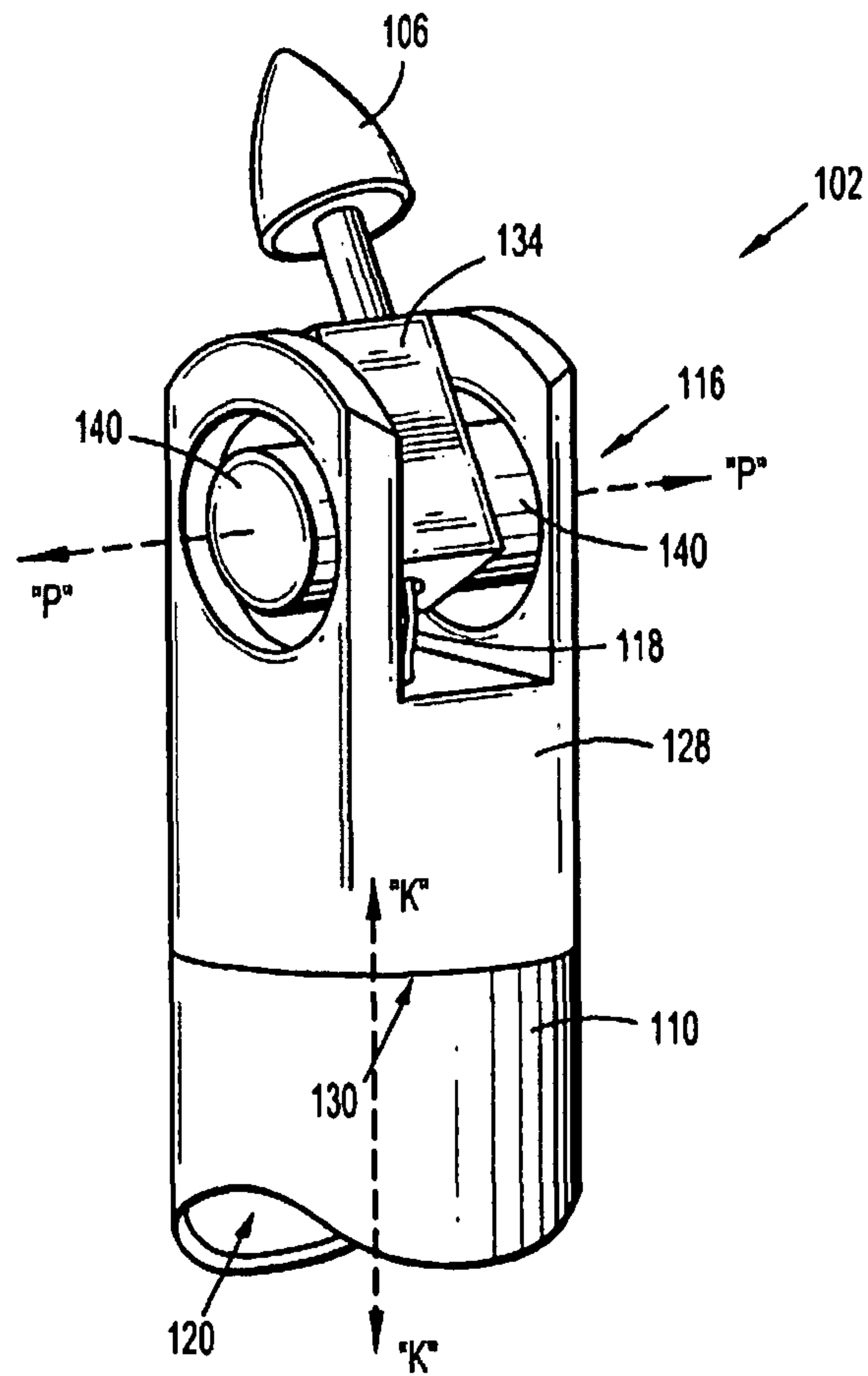
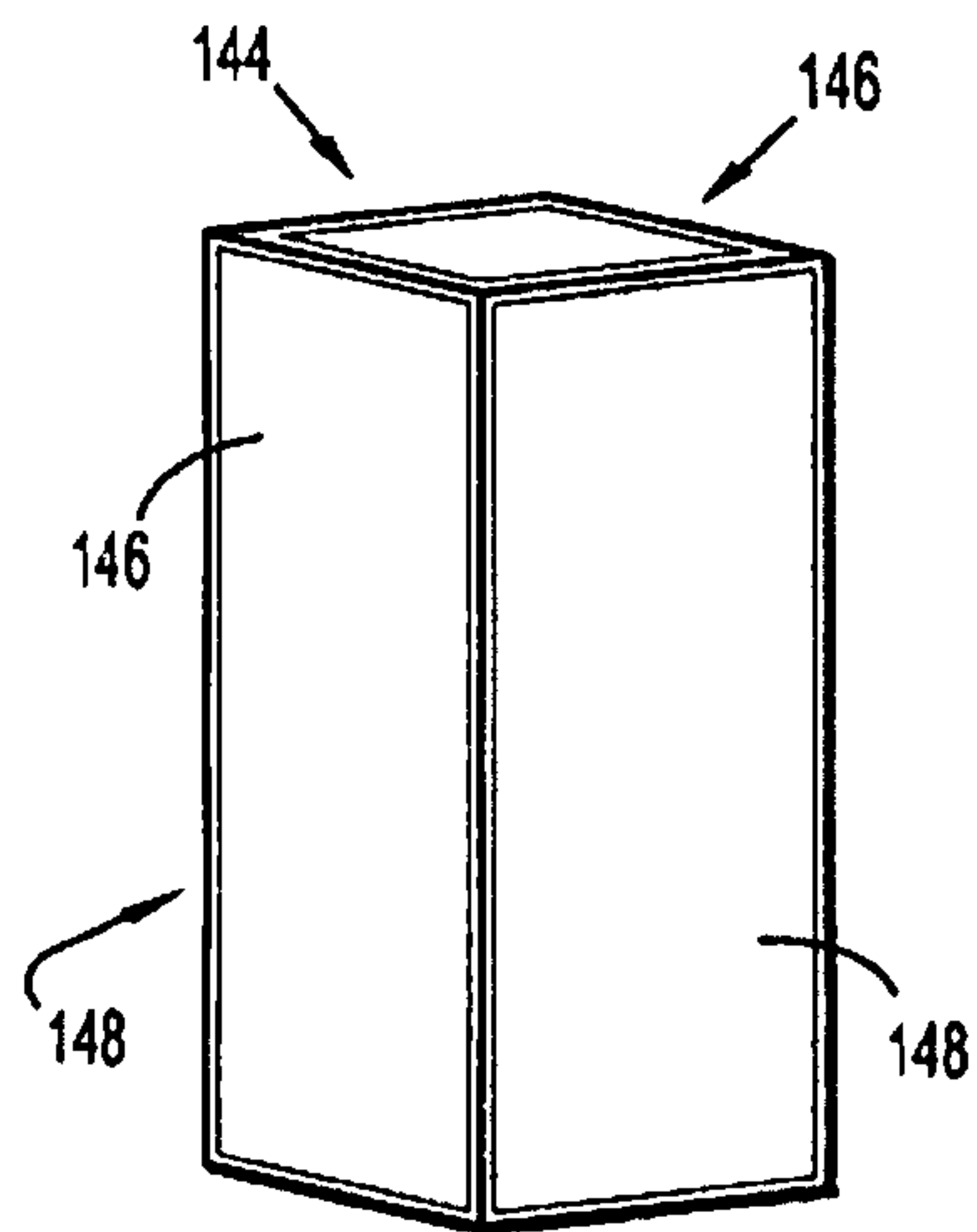
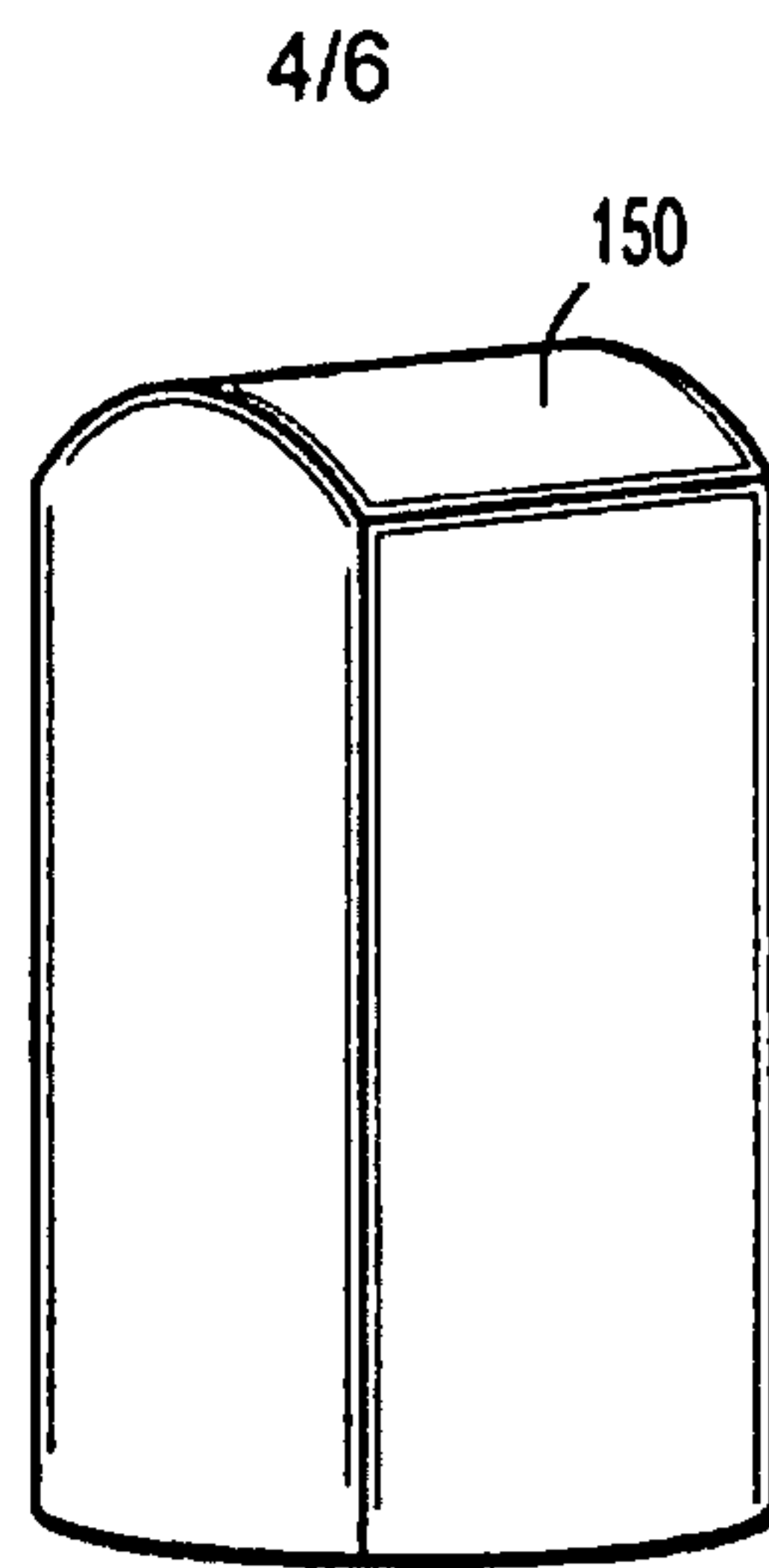
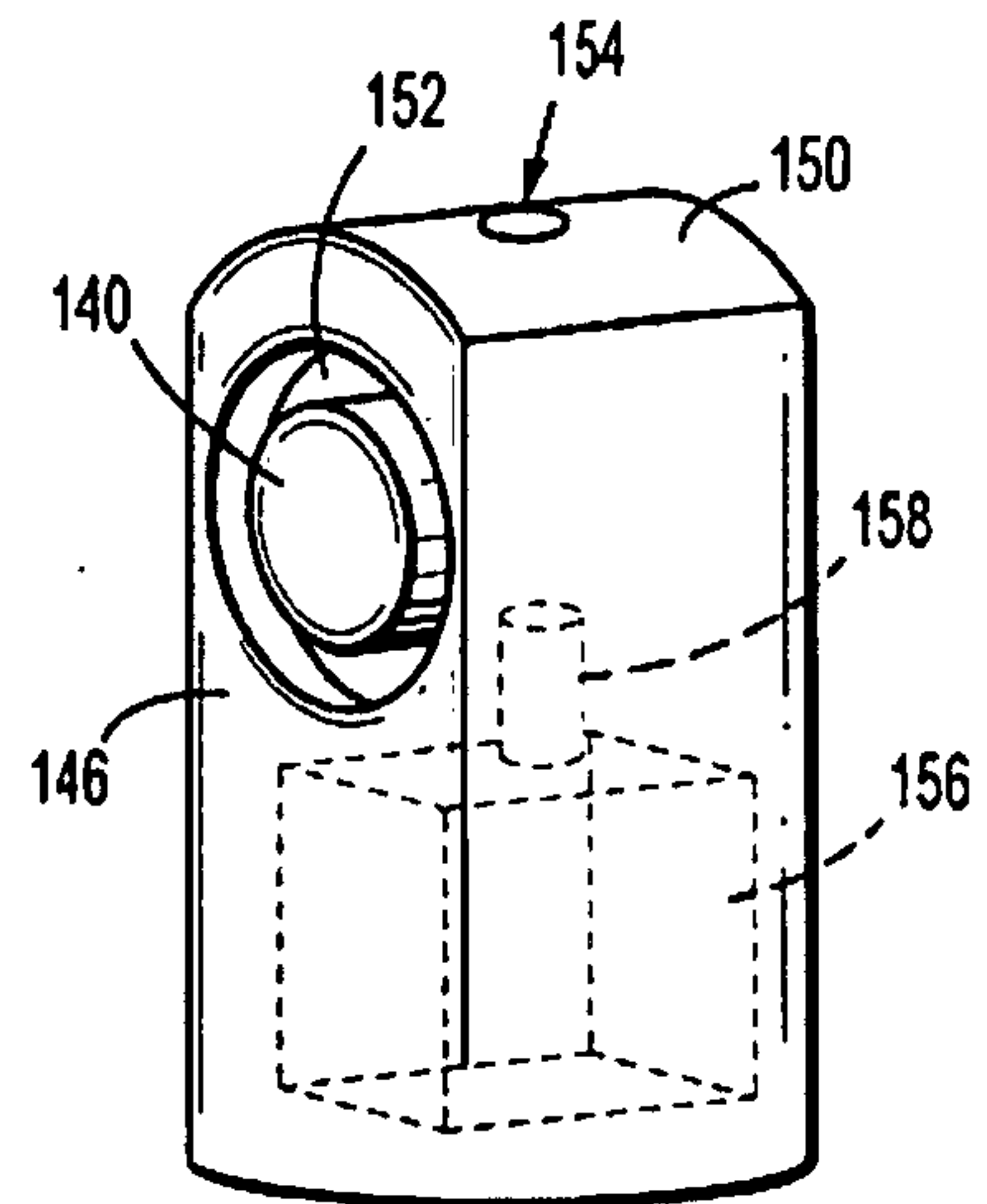
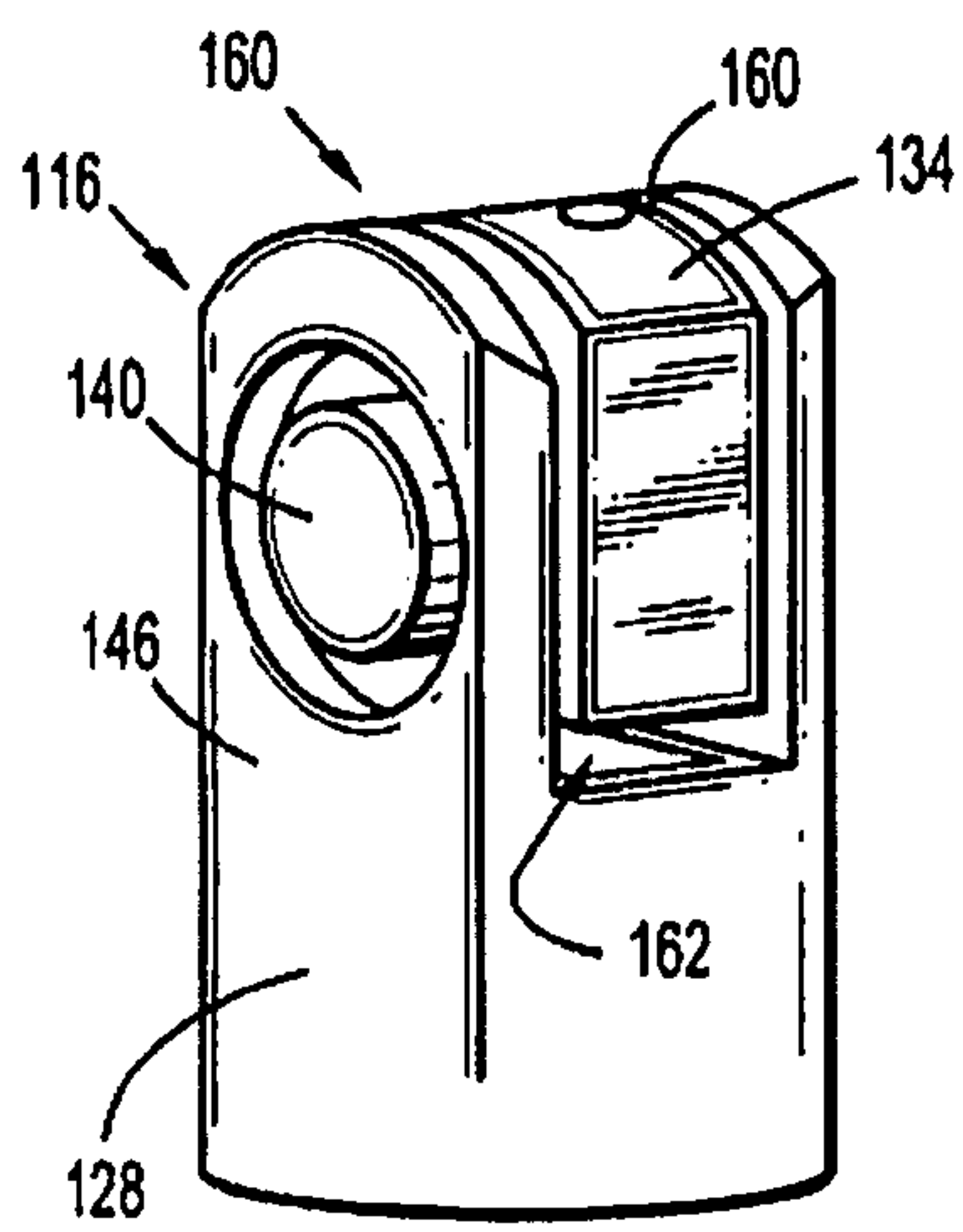
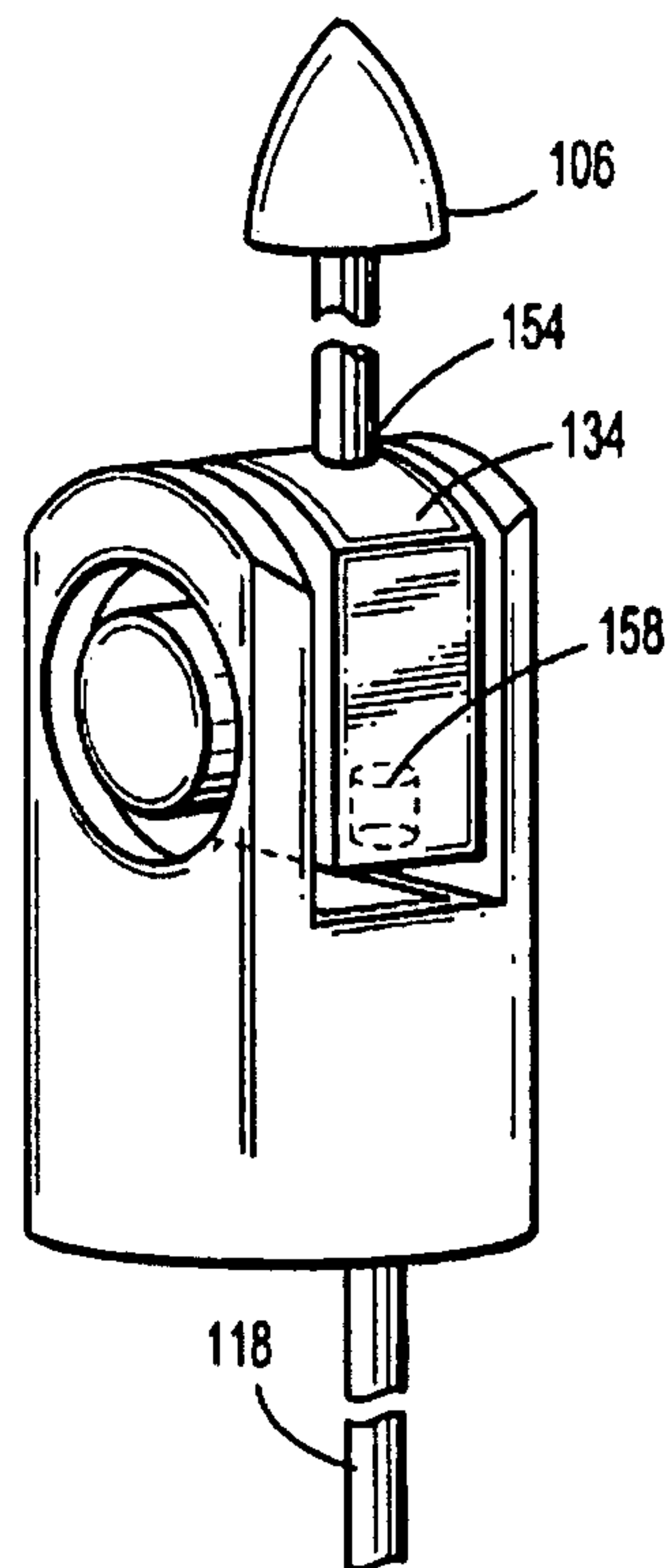
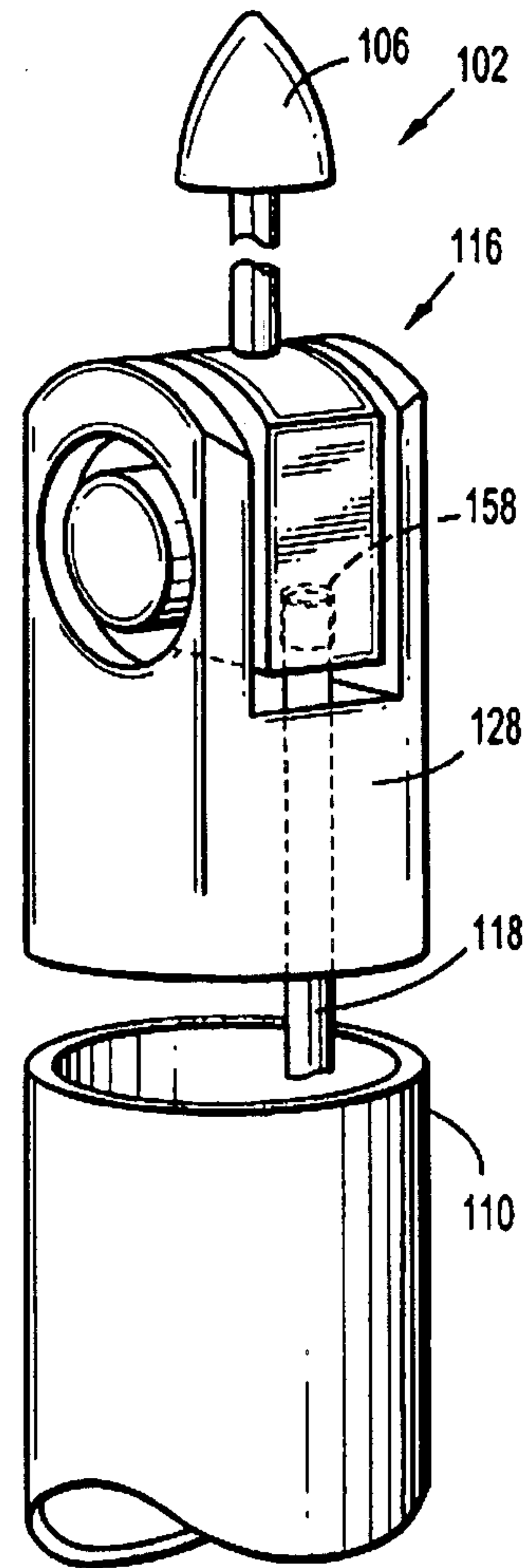


FIG. 2

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**FIG. 3**

**FIG. 4A****FIG. 4B****FIG. 4C****FIG. 4D****FIG. 4E****FIG. 4F**

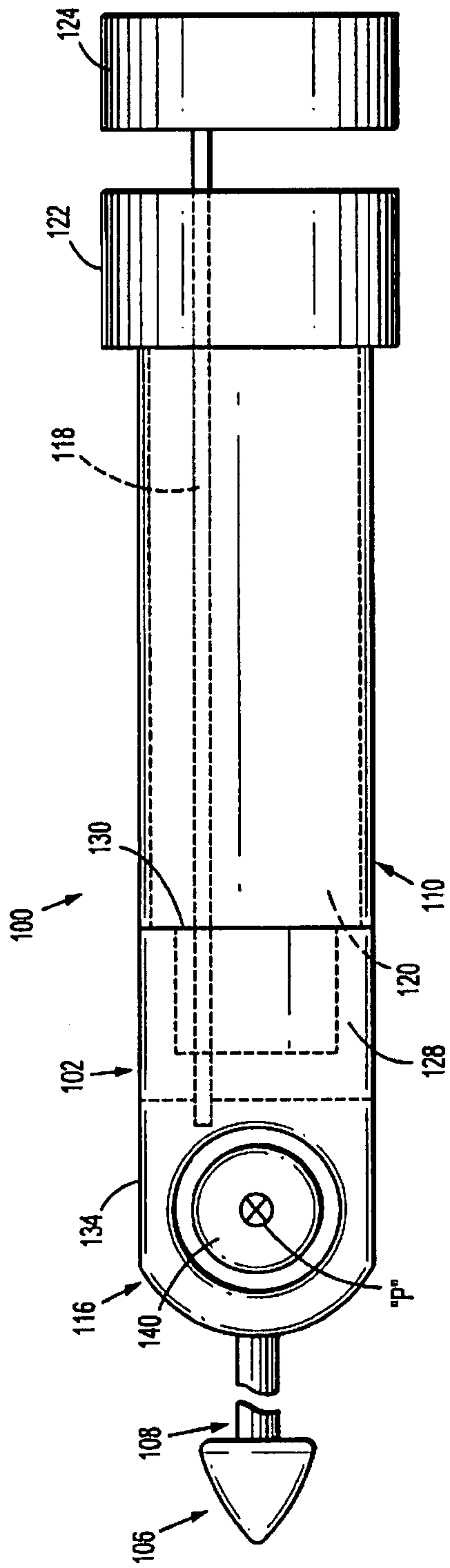


FIG. 5A

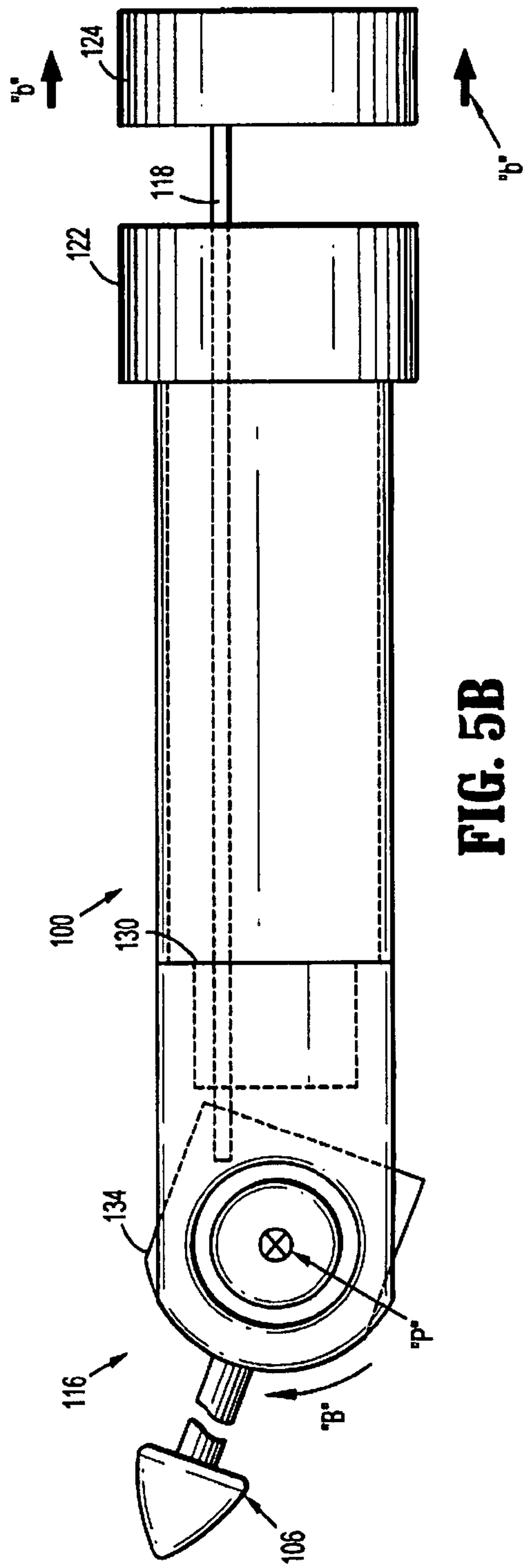
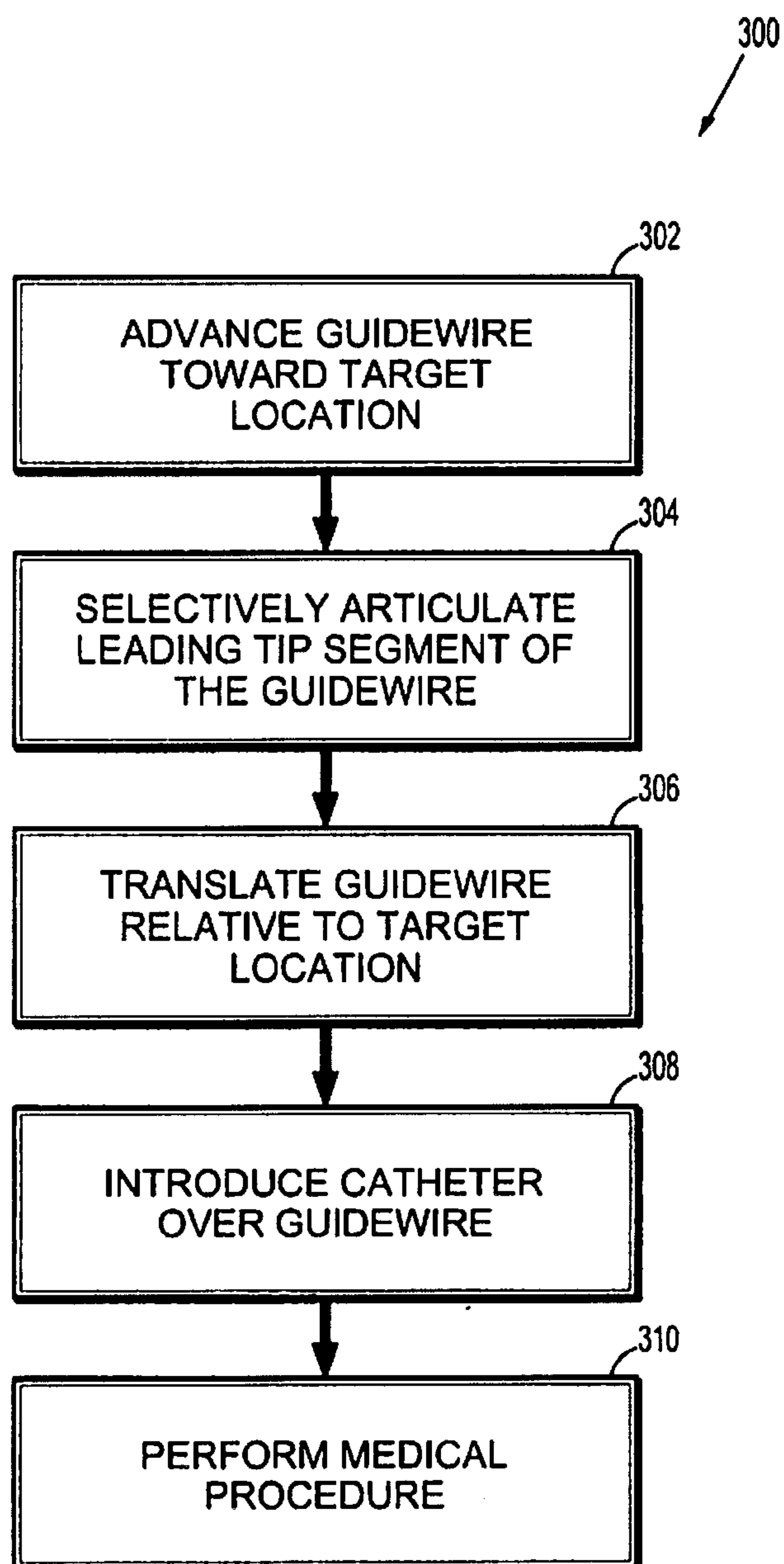


FIG. 5B

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**FIG. 6**

