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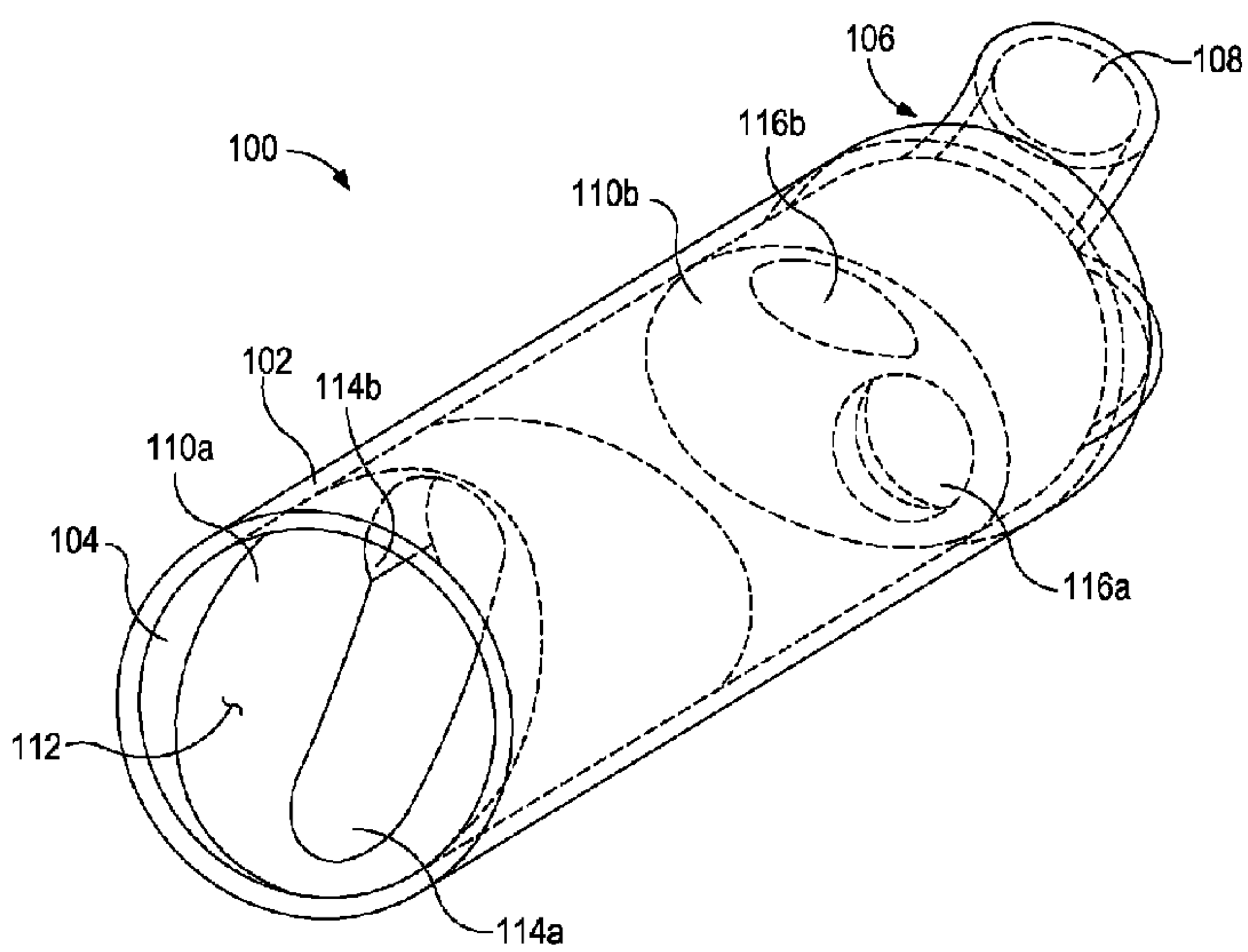
(54) **Titre : ENSEMBLE DEFLECTEUR POUR PUITS DE FORAGE LATERAL**
(54) **Title: DEFLECTOR ASSEMBLY FOR A LATERAL WELLBORE**



(57) **Abrégé/Abstract:**
Disclosed is a multi-deflector assembly for guiding a bullnose assembly into a selected borehole within a wellbore. One deflector assembly includes an upper deflector arranged within a main bore of a wellbore and defining first and second channels that extend longitudinally through the upper deflector, wherein the second channel exhibits a width greater than that of the first channel, and a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore, wherein the upper and lower deflectors are configured to direct a bullnose assembly into one of the lateral bore and the lower portion of the main bore based on a length of a bullnose tip of the bullnose assembly as compared to the predetermined distance.

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(54) **Title**: DEFLECTOR ASSEMBLY FOR A LATERAL WELLBORE

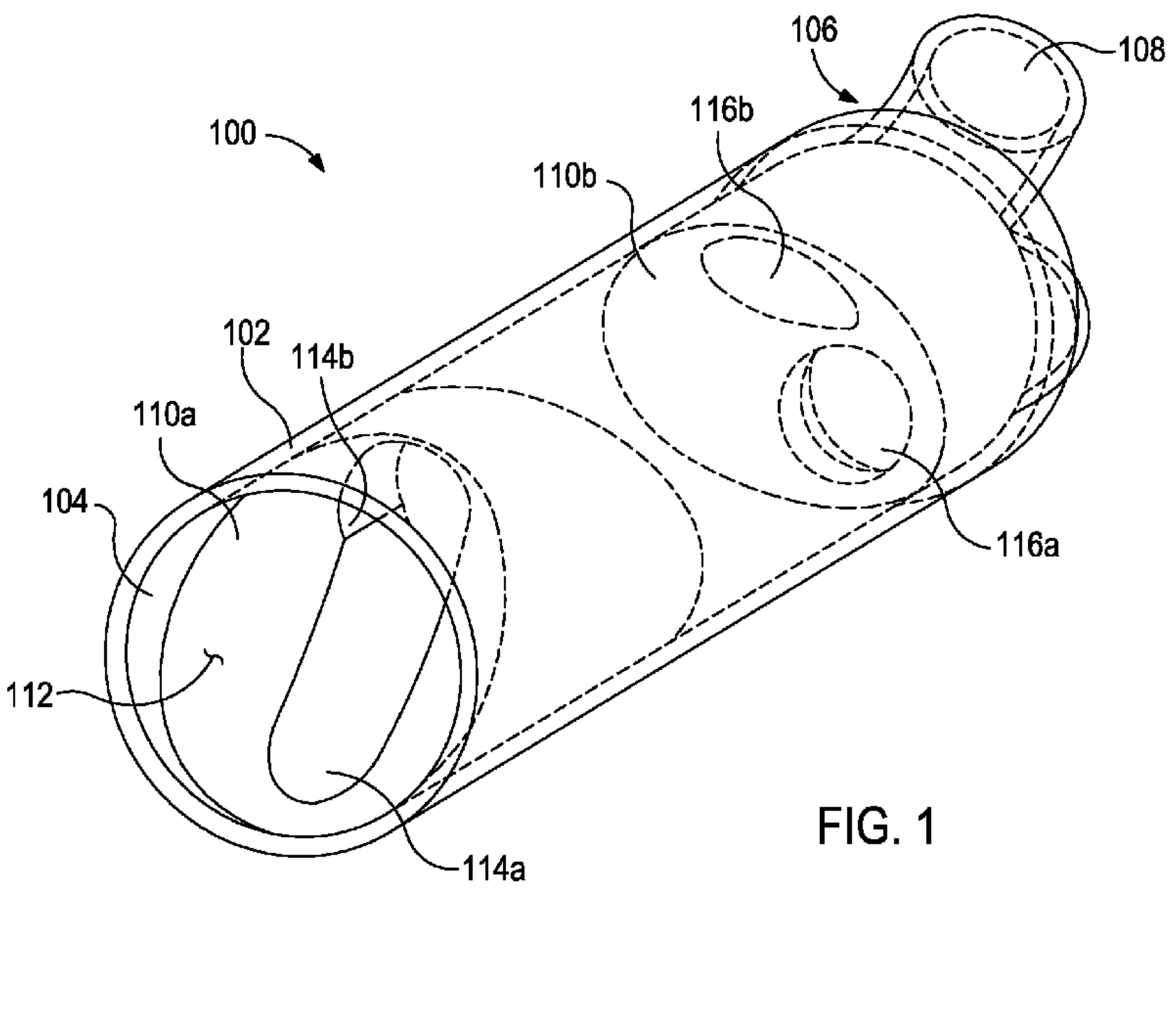

FIG. 1

(57) **Abstract**: Disclosed is a multi-deflector assembly for guiding a bullnose assembly into a selected borehole within a wellbore. One deflector assembly includes an upper deflector arranged within a main bore of a wellbore and defining first and second channels that extend longitudinally through the upper deflector, wherein the second channel exhibits a width greater than that of the first channel, and a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore, wherein the upper and lower deflectors are configured to direct a bullnose assembly into one of the lateral bore and the lower portion of the main bore based on a length of a bullnose tip of the bullnose assembly as compared to the predetermined distance.

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DEFLECTOR ASSEMBLY FOR A LATERAL WELLBORE

BACKGROUND

[0001] The present disclosure relates generally to a wellbore selector assembly and, more particularly, to a multi-deflector assembly for guiding a bullnose assembly into a selected borehole within a wellbore.

[0002] Hydrocarbons can be produced through relatively complex wellbores traversing a subterranean formation. Some wellbores include one or more lateral wellbores that extend at an angle from a parent or main wellbore. Such wellbores are commonly called multilateral wellbores. Various devices and downhole tools can be installed in a multilateral wellbore in order to direct assemblies towards a particular lateral wellbore. A deflector, for example, is a device that can be positioned in the main wellbore at a junction and configured to direct a bullnose assembly conveyed downhole toward a lateral wellbore. Depending on various parameters of the bullnose assembly, some deflectors also allow the bullnose assembly to remain within the main wellbore and otherwise bypass the junction without being directed into the lateral wellbore.

[0003] Accurately directing the bullnose assembly into the main wellbore or the lateral wellbore can often be a difficult undertaking. For instance, accurate selection between wellbores commonly requires that both the deflector and the bullnose assembly be correctly orientated within the well. Even with correct orientation, however, causing the bullnose assembly to be deflected or directed toward the proper bore can further be challenging since typical deflectors require a diameter reduction before being able to pass into lower portions of a stacked multilateral well system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The following figures are included to illustrate certain aspects of the present disclosure, and should not be viewed as exclusive embodiments. The subject matter disclosed is capable of considerable modifications, alterations, combinations, and equivalents in form and function, without departing from the scope of this disclosure.

[0005] FIG. 1 depicts an isometric view of an exemplary deflector assembly, according to one or more embodiments of the disclosure.

[0006] FIG. 2 depicts a cross-sectional side view of the deflector assembly of FIG. 1.

[0007] FIGS. 3A and 3B illustrate cross-sectional end views of upper and lower deflectors, respectively, of the deflector assembly of FIG. 1, according to one or more embodiments.

[0008] FIGS. 4A and 4B depict exemplary first and second bullnose assemblies, respectively, according to one or more embodiments.

[0009] FIGS. 5A-5C illustrate cross-sectional progressive views of the deflector assembly of FIGS. 1 and 2 in exemplary operation with bullnose assembly of FIG. 4A, according to one or more embodiments.

[0010] FIGS. 6A-6D illustrate cross-sectional progressive views of the deflector assembly of FIGS. 1 and 2 in exemplary operation with bullnose assembly of FIG. 4B, according to one or more embodiments.

[0011] FIG. 7 illustrates an exemplary multilateral wellbore system that may implement the principles of the present disclosure.

[0012] FIG. 8 illustrates a cross-sectional side view of another deflector assembly of FIG. 1, according to one or more embodiments.

[0013] FIG. 9 illustrates another exemplary bullnose assembly, according to one or more embodiments

[0014] FIGS. 10A-10D illustrate cross-sectional progressive views of the deflector assembly of FIGS. 1 and 2 in exemplary operation with the bullnose assembly of FIG. 9, according to one or more embodiments.

[0015] FIGS. 11A-11C illustrate cross-sectional views of the deflector assembly of FIG. 8 in exemplary operation with the bullnose assembly of FIG. 9, according to one or more embodiments.

DETAILED DESCRIPTION

[0016] The present disclosure relates generally to a wellbore selector assembly and, more particularly, to a multi-deflector assembly for guiding a bullnose assembly into a selected borehole within a wellbore.

[0017] The disclosure describes exemplary deflector assemblies that are able to accurately deflect a bullnose assembly into either a main wellbore or a lateral wellbore based on a length of the bullnose assembly. More particularly, the deflector assemblies have upper and lower deflectors that are separated by a predetermined distance and have channels and conduits of predetermined sizes.

Depending on its length, the bullnose assembly may interact with the upper and lower deflectors and be deflected into a lateral wellbore or remain within the main wellbore and continue downhole. The disclosed embodiments may prove advantageous for well operators in being able to accurately access particular lateral wellbores by running downhole bullnose assemblies of known parameters.

[0018] Referring to FIGS. 1 and 2, illustrated are isometric and cross-sectional side views, respectively, of an exemplary deflector assembly 100, according to one or more embodiments of the disclosure. As illustrated, the deflector assembly 100 may be arranged within or otherwise form an integral part of a tubular string 102. In some embodiments, the tubular string 102 may be a casing string used to line the inner wall of a wellbore drilled into a subterranean formation. In other embodiments, the tubular string 102 may be a work string extended downhole within the wellbore or the casing that lines the wellbore. In either case, the deflector assembly 100 may be generally arranged within a parent or main bore 104 at or otherwise uphole from a junction 106 where a lateral bore 108 extends from the main bore 104. The lateral bore 108 may extend into a lateral wellbore (not shown) drilled at an angle away from the parent or main bore 104.

[0019] The deflector assembly 100 may include a first or upper deflector 110a and a second or lower deflector 110b. In some embodiments, the upper and lower deflectors 110a,b may be secured within the tubular string 102 using one or more mechanical fasteners (not shown) and the like. In other embodiments, the upper and lower deflectors 110a,b may be welded into place within the tubular string 102, without departing from the scope of the disclosure. In yet other embodiments, the upper and lower deflectors 110a,b may form an integral part of the tubular string 102, such as being machined out of bar stock and threaded into the tubular string 102. The upper deflector 110a may be arranged closer to the surface (not shown) than the lower deflector 110b, and the lower deflector 110b may be generally arranged at or adjacent the junction 106.

[0020] The upper deflector 110a may define or otherwise provide a ramped surface 112 facing toward the uphole direction within the main bore 104. The upper deflector 110a may further define a first channel 114a and a second channel 114b, where both the first and second channels 114a,b extend longitudinally through the upper deflector 110a. The lower deflector 110b may define a first conduit 116a and a second conduit 116b, where both the first and second conduits 116a,b extend longitudinally through the lower deflector 110b. The second conduit 116b extends into and otherwise communicates with the lateral bore 108 while the first conduit 116a extends downhole and otherwise communicates with a lower or downhole portion of the parent or main bore 104 past the junction 106. Accordingly, in at least one embodiment, the deflector assembly 100 may be arranged in a multilateral wellbore system where the lateral bore 108 is only one of several lateral bores that are accessible from the main bore 104 via a corresponding number of deflector assemblies 100 arranged at multiple junctions.

[0021] The deflector assembly 100 may be useful in directing a bullnose assembly (not shown) into the lateral bore 108 via the second conduit 116b based on a length of the bullnose assembly. If the length of the bullnose assembly does not meet particular length requirements or parameters, it will instead be directed further downhole in the main bore 104 via the first conduit 116a. For example, with reference to FIG. 2, the upper deflector 110a may be separated from the lower deflector 110b within the main bore 104 by a distance 202. The distance 202 may be a predetermined distance that allows a bullnose assembly that is as long as or longer than the distance 202 to be directed into the lateral bore 108 via the second conduit 116b. If the length of the bullnose assembly is shorter than the distance 202, however, the bullnose assembly will remain in the main bore 104 and be directed further downhole via the first conduit 116a.

[0022] Referring now to FIGS. 3A and 3B, with continued reference to FIGS. 1 and 2, illustrated are cross-sectional end views of the upper and lower deflectors 110a,b, respectively, according to one or more embodiments. In FIG. 3A, the first channel 114a and the second channel 114b are shown as extending longitudinally through the upper deflector 110a. The first channel 114a may exhibit a first width 302a and the second channel 114b may exhibit a second width 302b, where the second width 302b is also equivalent to a diameter of the second channel 114b.

[0023] As depicted, the first width 302a is less than the second width 302b. As a result, bullnose assemblies exhibiting a diameter larger than the first width 302a but smaller than the second width 302b may be able to extend through the upper deflector 110a via the second channel 114b and otherwise bypass the first channel 114a. In such embodiments, the ramped surface 112 (FIGS. 1 and 2) may slidingly engage the bullnose assembly and otherwise direct it to the second channel 114b. Alternatively, bullnose assemblies exhibiting a diameter smaller than the first width 302a may be able to pass through the upper deflector 110a via the first channel 114a.

[0024] In FIG. 3B, the first and second conduits 116a,b are shown as extending longitudinally through the lower deflector 110b. While shown in FIG. 3B as being separate from each other, in some embodiments the conduits 116a,b may overlap with each other a short distance, without departing from the scope of the disclosure. The first conduit 116a may exhibit a first diameter 304a and the second conduit 116b may exhibit a second diameter 304b. In some embodiments, the first and second diameters 304a,b may be the same or substantially the same. In other embodiments, the first and second diameters 304a,b may be different. In either case, the first and second diameters 304a,b may be large enough and otherwise configured to receive a bullnose assembly therethrough after the bullnose assembly has passed through the upper deflector 110a (FIG. 3A).

[0025] Referring now to FIGS. 4A and 4B, illustrated are exemplary first and second bullnose assemblies 402a and 402b, respectively, according to one or more embodiments. The bullnose assemblies 402a,b may constitute the distal end of a tool string (not shown), such as a bottom hole assembly or the like, that is conveyed downhole within the main wellbore 104 (FIGS. 1-2). In some embodiments, the bullnose assemblies 402a,b and related tool strings are conveyed downhole using coiled tubing (not shown). In other embodiments, the bullnose assemblies 402a,b and related tool strings may be conveyed downhole using other types of conveyances such as, but not limited to, drill pipe, production tubulars, wireline, slickline, electric line, etc. The tool string may include various downhole tools and devices configured to perform or otherwise undertake various wellbore operations once accurately placed in the downhole environment. The bullnose assemblies 402a,b may be configured to accurately guide the tool string downhole such that it reaches its target destination, *e.g.*, the lateral bore 108 of FIGS. 1-2 or further downhole within the main bore 104.

[0026] To accomplish this, each bullnose assembly 402a,b may include a body 404 and a bullnose tip 406 coupled or otherwise attached to the distal end of the body 404. In some embodiments, the bullnose tip 406 may form an integral part of the body 404 as an integral extension thereof. As illustrated, the bullnose tip 406 may be rounded off at its end or otherwise angled or arcuate such that the bullnose tip 406 does not present sharp corners or angled edges that might catch on portions of the main bore 104 as it is extended downhole.

[0027] The bullnose tip 406 of the first bullnose assembly 402a exhibits a first length 408a and the bullnose tip 406 of the second bullnose assembly 402b exhibits a second length 408b. As depicted, the first length 408a is greater than the second length 408b. Moreover, the bullnose tip 406 of the first bullnose assembly 402a exhibits a first diameter 410a and the bullnose tip 406 of the second bullnose assembly 402b exhibits a second diameter 410b. In some embodiments, the first and second diameters 410a,b may be the same or substantially the same. In other embodiments, the first and second diameters 410a,b may be different. In either case, the first and second diameters 410a,b may be small enough and otherwise able to extend through the second width 302b (FIG. 3A) of the upper deflector 110a and the first and second diameters 304a,b (FIG. 3B) of the lower deflector 110b.

[0028] Still referring to FIGS. 4A and 4B, the body 404 of the first bullnose assembly 402a exhibits a third diameter 412a and the body 404 of the second bullnose assembly 402b exhibits a fourth diameter 412b. In some embodiments, the third and fourth diameters 412a,b may be the same or substantially the same. In other embodiments, the third and fourth diameters 412a,b may be different. In either case, the third and fourth diameters 412a,b may be smaller than the first and second diameters 410a,b. Moreover, the third and fourth diameters 412a,b may be smaller than the first width 302a (FIG. 3A) of the upper deflector 110a and otherwise able to be received therein, as will be discussed in greater detail below.

[0029] Referring now to FIGS. 5A-5C, with continued reference to the preceding figures, illustrated are cross-sectional views of the deflector assembly 100 as used in exemplary operation, according to one or more embodiments. More particularly, FIGS. 5A-5C illustrate progressive views of the first bullnose assembly 402a of FIG. 4A interacting with and otherwise being deflected by the deflector assembly 100 based on the parameters of the first bullnose assembly 402a. Furthermore, each of FIGS. 5A-5C provides a cross-sectional end view (on the left of each figure) and a corresponding cross-sectional side view (on the right of each figure) of the exemplary operation as it progresses.

[0030] In FIG. 5A, the first bullnose assembly 402a is extended downhole within the main bore 104 and engages the upper deflector 110a. More specifically, the diameter 410a (FIG. 4A) of the bullnose tip 406 may be larger than the first width 302a (FIG. 3A) such that the bullnose tip 406 is unable to extend through the upper deflector 110a via the first channel 114a. Instead, the bullnose tip 406 may be configured to slidingly engage the ramped surface 112 until locating the second channel 114b. Since the diameter 410a (FIG. 4A) of the bullnose tip 406 is smaller than the second width 302b (FIG. 3A), the bullnose assembly 402a is able to extend through the upper deflector 110a via the second channel 114b. This is shown in FIG. 5B as the bullnose assembly 402a is advanced in the main bore 104 and otherwise extended at least partially through the upper deflector 110a.

[0031] In FIG. 5C, the bullnose assembly 402a is advanced further in the main bore 104 and directed into the second conduit 116b of the lower deflector 110b. This is possible since the length 408a (FIG. 4A) of the bullnose tip 406 is greater than the distance 202 (FIG. 2) that separates the upper and lower deflectors 110a,b. In other words, since the distance 202 is less than the length 408a of the bullnose tip 406, the bullnose assembly 402a is generally prevented from moving laterally within the main bore 104 and toward the first conduit 116a of the lower deflector 110b. Rather, the bullnose tip 406 is received by the second conduit 116b while at least a portion of the bullnose tip 406 remains supported in the second channel 114b of the upper deflector 110a. Moreover, the second conduit 116b exhibits a diameter 304b (FIG. 3B) that is greater than the diameter 410a (FIG. 4A) of the bullnose tip 406 and can therefore guide the bullnose assembly 402a toward the lateral bore 108.

[0032] Referring now to FIGS. 6A-6D, with continued reference to the preceding figures, illustrated are cross-sectional views of the deflector assembly 100 as used in exemplary operation, according to one or more embodiments. More particularly, FIGS. 6A-6D illustrate progressive views of the second bullnose assembly 402b interacting with and otherwise being deflected by the deflector assembly 100. Furthermore, similar to FIGS. 5A-5C, each of FIGS. 6A-6D provides a cross-sectional end view (on the left of each figure) and a corresponding cross-sectional side view (on the right of each figure) of the exemplary operation as it progresses.

[0033] In FIG. 6A, the second bullnose assembly 402b is shown engaging the upper deflector 110a after having been extended downhole within the main bore 104. More specifically, and similar to the first bullnose assembly 402a, the diameter 410b (FIG. 4B) of the bullnose tip 406 may be larger than the first width 302a (FIG. 3A) such that the bullnose tip 406 is unable to extend through the upper deflector 110a via the first channel 114a. Instead, the bullnose tip 406 may be configured to slidingly engage the ramped surface 112 until locating the second channel 114b. Since the diameter 410b (FIG. 4B) of the bullnose tip 406 is smaller than the second width 302b (FIG. 3A), the bullnose assembly 402b may be able to extend through the upper deflector 110a via the second channel 114b. This is shown in FIG. 6B as the bullnose assembly 402b is advanced in the main bore 104 and otherwise extended at least partially through the upper deflector 110a.

[0034] In FIG. 6C, the bullnose assembly 402b is advanced further in the main bore 104 until the bullnose tip 406 exits the second channel 114b. Upon the exit of the bullnose tip 406 from the second channel 114b, the bullnose assembly 402b may no longer be supported within the second channel 114b and may instead fall into or otherwise be received by the first channel 114a. This is possible since the diameter 412b (FIG. 4B) of the body 404 of the bullnose assembly 402b is smaller than the first width 302a (FIG. 3A), and the length 408b (FIG. 4B) of the bullnose tip 406 is less than the distance 202 (FIG. 2) that separates the upper and lower deflectors 110a,b. Accordingly, gravity may act on the bullnose assembly 402b and allow it to fall into the first channel 114a once the bullnose tip 406 exits the second channel 114b and no longer supports the bullnose assembly 402b.

[0035] In FIG. 6D, the bullnose assembly 402b is advanced even further in the main bore 104 until the bullnose tip 406 enters or is otherwise received within the first conduit 116a. The first conduit 116a exhibits a diameter 304a (FIG. 3B) that is greater than the diameter 410b (FIG. 4B) of the bullnose tip 406 and can therefore guide the bullnose assembly 402b further down the main bore 104 and otherwise not into the lateral bore 108.

[0036] Accordingly, which bore (*e.g.*, the main bore 104 or the lateral bore 108) a bullnose assembly enters is primarily determined by the relationship between the length 408a, 408b of the bullnose tip 406 and the distance 202 between the upper and lower deflectors 110a,b. As a result, it becomes possible to "stack" multiple junctions 106 (FIGS. 1 and 2) in one well and thereby facilitate re-entry into every lateral bore of the well by predetermining the spacing (*i.e.*, distance 202) between the deflectors 110a,b at each junction 106 and selecting the appropriate bullnose assembly for the desired lateral bore.

[0037] Referring to FIG. 7, illustrated is an exemplary multilateral wellbore system 700 that may implement the principles of the present disclosure. The wellbore system 700 may include a main bore 104 that extends from a surface location (not shown) and passes through at least two junctions 106 (shown as a first junction 106a and a second junction 106b). While two junctions 106a,b are shown in the wellbore system 700, it will be appreciated that more than two junctions 106a,b may be utilized, without departing from the scope of the disclosure. At each junction 106a,b, a lateral bore 108 (shown as first and second lateral bores 108a and 108b, respectively) extends from the main bore 104.

[0038] The deflector assembly 100 of FIGS. 1 and 2 may be arranged at the first junction 106a and a second deflector assembly 702 may be arranged at the second junction 106b. Each deflector assembly 100, 702 may be configured to deflect a bullnose assembly either into its corresponding lateral bore 108a,b or further downhole within the main bore 104, depending on the length of the bullnose tip of a particular bullnose assembly and the spacing between the upper and lower deflectors of the particular deflector assembly 100, 702.

[0039] Referring to FIG. 8, with continued reference to FIGS. 2 and 7, illustrated is a cross-sectional side view of the second deflector assembly 702, according to one or more embodiments. The second deflector assembly 702 may be similar in some respects to the deflector assembly 100 of FIGS. 1 and 2 (and now FIG. 7) and therefore may be best understood with reference thereto, where like numerals represent like elements not described again in detail. In the second deflector assembly 702, the upper deflector 110a may be separated from the lower deflector 110b within the main bore 104 by a distance 802. The distance 802 may be less than the distance 202 in the first deflector assembly 100 of FIG. 2.

[0040] Accordingly, the first and second deflector assemblies 100, 702 may be configured to deflect bullnose assemblies into different lateral bores 108a,b based on the length of the bullnose tip. If a bullnose tip is as long as or longer than the distances 202 and 802, the corresponding bullnose assembly will be directed into the respective lateral bore 108a,b. If, however, the length of the bullnose tip is shorter than the distances 202 and 802, the bullnose assembly will remain in the main bore 104 and be directed further downhole.

[0041] Referring now to FIG. 9, with additional reference to FIGS. 4A and 4B, illustrated is another exemplary bullnose assembly 902, according to one or more embodiments. The bullnose assembly 902 may be substantially similar to the bullnose assemblies 402a,b of FIGS. 4A and 4B and therefore may be best understood with reference thereto, where like numerals correspond to like elements not described again. Similar to the bullnose assemblies 402a,b, of FIGS. 4A and 4B, the bullnose assembly 902 may include a body 404 and a bullnose tip 406 coupled to or otherwise forming an integral part of the distal end of the body 404.

[0042] The bullnose tip 406 of the bullnose assembly 902, however, exhibits a third length 408c that is shorter than the first length 408a (FIG. 4A) but longer than the second length 408b (FIG. 4B). Moreover, the bullnose tip 406 of the bullnose assembly 902 exhibits a fifth diameter 410c that may be the same as or different than the first and second diameters 410a,b (FIGS. 4A and 4B). In any event, the fifth diameter 410c may be small enough and otherwise able to extend through the second width 302b (FIG. 3A) of the upper deflector 110a and the first and second diameters 304a,b (FIG. 3B) of the lower deflector 110b of either the first or second deflector assemblies 100, 702. Lastly, the body 404 of the bullnose assembly 902 exhibits a sixth diameter 412c that may be the same as or different than the third and fourth diameters 412a,b (FIGS. 4A and 4B). In any event, the sixth diameter 412c may be smaller than the first, second, and third diameters 410a-c and also smaller than the first width 302a (FIG. 3A) of the upper deflector 110a (of either the first or second deflector assemblies 100, 702) and otherwise able to be received therein.

[0043] Referring now to FIGS. 10A-10D and FIGS. 11A-11C, with continued reference to the preceding figures, illustrated are cross-sectional views of the first deflector assembly 100 and the second deflector assembly 702 as used in exemplary operation with the third bullnose assembly 902, according to one or more embodiments. In at least one embodiment, FIGS. 10A-10D and 11A-11C may be representative progressive views of the third bullnose assembly 902 traversing the multilateral wellbore system 700 of FIG. 7. More particularly, FIGS. 10A-10D may depict the third bullnose assembly 902 at the first junction 106a (FIG. 7) and FIGS. 11A-11C may depict the third bullnose assembly 902 at the second junction 106b (FIG. 7).

[0044] More particularly, FIGS. 10A-10D illustrate progressive views of the bullnose assembly 902 interacting with and otherwise being deflected by the deflector assembly 100 based on the parameters of the bullnose assembly 902. In FIG. 10A, the bullnose assembly 902 is shown engaging the upper deflector 110a after having been extended downhole within the main bore 104. The diameter 410c (FIG. 9) of the bullnose tip 406 may be larger than the first width 302a (FIG. 3A) such that the bullnose tip 406 is unable to extend through the upper deflector 110a via the first channel 114a. Instead, the bullnose tip 406 may be configured to slidingly engage the ramped surface 112 until locating the second channel 114b. Since the diameter 410c (FIG. 9) of the bullnose tip 406 is smaller than the second width 302b (FIG. 3A), the bullnose assembly 902 may be able to extend through the upper deflector 110a via the second channel 114b. This is shown in FIG. 10B as the bullnose assembly 902 is advanced in the main bore 104 and otherwise extended at least partially through the upper deflector 110a.

[0045] In FIG. 10C, the bullnose assembly 902 is advanced further in the main bore 104 until the bullnose tip 406 exits the second channel 114b. Upon the exit of the bullnose tip 406 from the second channel 114b, the bullnose assembly 902 may no longer be supported within the second channel 114b and may instead fall into or otherwise be received by the first channel 114a. This is possible since the diameter 412c (FIG. 9) of the body 404 of the bullnose assembly 902 is smaller than the first width 302a (FIG. 3A), and the length 408c (FIG. 9) of the bullnose tip 406 is less than the distance 202 (FIG. 2) that separates the upper and lower deflectors 110a,b. Accordingly, gravity may act on the bullnose assembly 902 and allow it to fall into the first channel 114a once the bullnose tip 406 exits the second channel 114b and no longer supports the bullnose assembly 902.

[0046] In FIG. 10D, the bullnose assembly 902 is advanced even further in the main bore 104 until the bullnose tip 406 enters or is otherwise received within the first conduit 116a. The first conduit 116a exhibits a diameter 304a (FIG. 3B) that is greater than the diameter 410c (FIG. 9) of the bullnose tip 406 and can therefore guide the bullnose assembly 902 further down the main bore 104 and otherwise not into the first lateral bore 108a.

[0047] Referring now to FIGS. 11A-11C, with continued reference to FIGS. 10A-10D, illustrated are cross-sectional views of the second deflector assembly 702 as used in exemplary operation with the third bullnose assembly 902 following passage through the first deflector assembly 100. More particularly, FIGS. 11A-11C depict the third bullnose assembly 902 after having passed through the first deflector assembly 100 in the multilateral wellbore system 700 of FIG. 7 and is now advanced further within the main bore 104 until interacting with and otherwise being deflected by the second deflector assembly 702.

[0048] In FIG. 11A, the third bullnose assembly 902 is extended downhole within the main bore 104 and engages the upper deflector 110a of the second deflector assembly 702. The diameter 410c (FIG. 9) of the bullnose tip 406 may be larger than the first width 302a (FIG. 3A) such that the bullnose tip 406 is unable to extend through the upper deflector 110a via the first channel 114a. Instead, the bullnose tip 406 may be configured to slidingly engage the ramped surface 112 until locating the second channel 114b. Since the diameter 410c (FIG. 9) of the bullnose tip 406 is smaller than the second width 302b (FIG. 3A), the bullnose assembly 902 is able to extend through the upper deflector 110a via the second channel 114b. This is shown in FIG. 11B as the bullnose assembly 902 is advanced in the main bore 104 and otherwise extended at least partially through the upper deflector 110a.

[0049] In FIG. 11C, the bullnose assembly 902 is advanced further in the main bore 104 and directed into the second conduit 116b of the lower deflector 110b. This is possible since the length 408c (FIG. 9) of the bullnose tip 406 is greater than the distance 802 (FIG. 7) that separates the upper and lower deflectors 110a,b of the second deflector assembly 702. In other words, since the distance 802 is less than the length 408c of the bullnose tip 406, the bullnose assembly 902 is generally prevented from moving laterally within the main bore 104 and toward the first conduit 116a of the lower deflector 110b. Rather, the bullnose tip 406 is received by the second conduit 116b while at least a portion of the bullnose tip 406 remains supported in the second channel 114b of the upper deflector 110a. Moreover, the second conduit 116b exhibits a diameter 304b (FIG. 3B) that is greater than the diameter 410c (FIG. 9) of the bullnose tip 406 and can therefore guide the bullnose assembly 902 toward the second lateral bore 108b.

[0050] Embodiments disclosed herein include:

[0051] A. A deflector assembly that includes an upper deflector arranged within a main bore of a wellbore and defining first and second channels that extend longitudinally through the upper deflector, wherein the second channel exhibits a width greater than a width of the first channel, and a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore, wherein the upper and lower deflectors are configured to direct a bullnose assembly into either the lateral bore or the lower portion of the main bore based on a length of a bullnose tip of the bullnose assembly as compared to the predetermined distance.

[0052] B. A method including introducing a bullnose assembly into a main bore of a wellbore, the bullnose assembly including a body and a bullnose tip arranged at a distal end of the body and exhibiting a length, directing the bullnose assembly through an upper deflector arranged within the main bore, the upper deflector defining first and second channels that extend longitudinally therethrough, wherein the second channel exhibits a width greater than a width of the first channel, advancing the bullnose assembly to a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore, and directing the bullnose assembly into either the lateral bore or the lower portion of the main bore based on the length of the bullnose tip as compared to the predetermined distance.

[0053] C. A multilateral wellbore system including a main bore having a first junction and a second junction spaced downhole form the first junction, a first deflector assembly arranged at the first junction and comprising a first upper deflector and a first lower deflector spaced from the first upper deflector by a first predetermined distance, the first lower deflector defining a first conduit that communicates with a first lower portion of the main bore and a second conduit that communicates with a first lateral bore, a second deflector assembly arranged at the second junction and comprising a second upper deflector and a second lower deflector spaced from the second upper deflector by a second predetermined distance that is shorter than the first predetermined distance, the second lower deflector defining a third conduit that communicates with a second lower portion of the main bore and a fourth conduit that communicates with a second lateral bore, and a bullnose assembly including a body and a bullnose tip arranged at a distal end of the body and exhibiting a length, wherein the first and second deflector assemblies are configured to direct the bullnose assembly into either the first and second lateral bores or the first and second lower portions of the main bore based on the length of the bullnose tip as compared to the first and second predetermined distances.

[0054] Each of embodiments A, B, and C may have one or more of the following additional elements in any combination: Element 1: wherein the upper and lower deflectors are arranged within a tubular string that extends from a surface location. Element 2: wherein the upper deflector provides a ramped surface facing toward an uphole direction within the main bore, the ramped surface being configured to direct the bullnose assembly into the second channel. Element 3: wherein the bullnose tip is coupled to a distal end of a body of the bullnose assembly, the bullnose tip exhibiting a first diameter and the body exhibiting a second diameter smaller than the first diameter and also smaller than the width of the first channel. Element 4: wherein, when the length of the bullnose tip is less than the predetermined distance, the body is configured to be received within the first channel and the bullnose assembly is directed into the first conduit. Element 5: wherein, when the length of the bullnose tip is greater than the predetermined distance, the bullnose assembly is configured to be directed into the second conduit and the lateral bore. Element 6: wherein, when the length of the bullnose tip is less than the predetermined distance, the bullnose assembly is configured to be directed into the first conduit and the lower portion of the main bore.

[0055] Element 7: wherein directing the bullnose assembly through the upper deflector includes engaging the bullnose tip on a ramped surface defined by the upper deflector, and directing the bullnose tip into and through the second channel with the ramped surface. Element 8: wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and also smaller than the width of the first channel, the method further including receiving the body within the first channel when the length of the bullnose tip is less than the predetermined distance, and directing the bullnose assembly into the first conduit. Element 9: further comprising directing the bullnose assembly into the second conduit and the lateral bore when the length of the bullnose tip is greater than the predetermined distance. Element 10: further comprising directing the bullnose assembly into the first conduit and the lower portion of the main bore when the length of the bullnose tip is less than the predetermined distance.

[0056] Element 11: wherein, when the length of the bullnose tip is shorter than the first predetermined distance but greater than the second predetermined distance, the bullnose assembly is directed into the first conduit and the first lower portion of the main bore and subsequently into the fourth conduit and the second lateral bore. Element 12: wherein, when the length of the bullnose tip is shorter than the first and second predetermined distances, the bullnose assembly is directed into the first conduit and the first lower portion of the main bore and subsequently into the third conduit and the second lower portion of the main bore. Element 13: wherein, when the length of the bullnose tip is greater than the first predetermined distance, the bullnose assembly is directed into the second conduit and the first lateral bore. Element 14: wherein the first and second upper deflectors each define first and second channels that extend longitudinally through the corresponding first and second upper deflectors, and wherein the second channel exhibits a width greater than a width of the first channel. Element 15: wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and smaller than the width of the first channel of the first upper deflector, and wherein, when the length of the bullnose tip is less than the first predetermined distance, the body is received within the first channel of the first upper deflector and the bullnose assembly is directed into the first conduit of the first lower deflector. Element 16: wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and smaller than the width of the first channel of the second upper deflector, and wherein, when the length of the bullnose tip is less than the second predetermined distance, the body is received within the first channel of the second upper deflector and the bullnose assembly is directed into the third conduit of the second lower deflector.

[0057] Therefore, the disclosed systems and methods are well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the teachings of the present disclosure may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered, combined, or modified and all such variations are considered within the scope of the present disclosure. The systems and methods illustratively disclosed herein may suitably be practiced in the absence of any element that is not specifically disclosed herein and/or any optional element disclosed herein. While compositions and methods are described in terms of "comprising," "containing," or "including" various components or steps, the compositions and methods can also "consist essentially of" or "consist of" the various components and steps. All numbers and ranges disclosed above may vary by some amount. Whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In particular, every range of values (of the form, "from about a to about b," or, equivalently, "from approximately a to b," or, equivalently, "from approximately a-b") disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. Moreover, the indefinite articles "a" or "an," as used in the claims, are defined herein to mean one or more than one of the element that it introduces. If there is any conflict in the usages of a word or term in this specification and one or more patent or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted.

CLAIMS

What is claimed is:

1. A deflector assembly, comprising:

an upper deflector arranged within a main bore of a wellbore and defining first and second channels that extend longitudinally through the upper deflector, wherein the second channel exhibits a width greater than a width of the first channel; and

a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore,

wherein the upper and lower deflectors are configured to direct a bullnose assembly into either the lateral bore or the lower portion of the main bore based on a length of a bullnose tip of the bullnose assembly as compared to the predetermined distance.

2. The deflector assembly of claim 1, wherein the upper and lower deflectors are arranged within a tubular string that extends from a surface location.

3. The deflector assembly of claim 1, wherein the upper deflector provides a ramped surface facing toward an uphole direction within the main bore, the ramped surface being configured to direct the bullnose assembly into the second channel.

4. The deflector assembly of claim 1, wherein the bullnose tip is coupled to a distal end of a body of the bullnose assembly, the bullnose tip exhibiting a first diameter and the body exhibiting a second diameter smaller than the first diameter and also smaller than the width of the first channel.

5. The deflector assembly of claim 4, wherein, when the length of the bullnose tip is less than the predetermined distance, the body is configured to be received within the first channel and the bullnose assembly is directed into the first conduit.

6. The deflector assembly of claim 1, wherein, when the length of the bullnose tip is greater than the predetermined distance, the bullnose assembly is configured to be directed into the second conduit and the lateral bore.

7. The deflector assembly of claim 1, wherein, when the length of the bullnose tip is less than the predetermined distance, the bullnose assembly is configured to be directed into the first conduit and the lower portion of the main bore.

8. A method, comprising:

introducing a bullnose assembly into a main bore of a wellbore, the bullnose assembly including a body and a bullnose tip arranged at a distal end of the body and exhibiting a length;

directing the bullnose assembly through an upper deflector arranged within the main bore, the upper deflector defining first and second channels that extend longitudinally therethrough, wherein the second channel exhibits a width greater than a width of the first channel;

advancing the bullnose assembly to a lower deflector arranged within the main bore and spaced from the upper deflector by a predetermined distance, the lower deflector defining a first conduit that communicates with a lower portion of the main bore and a second conduit that communicates with a lateral bore; and

directing the bullnose assembly into either the lateral bore or the lower portion of the main bore based on the length of the bullnose tip as compared to the predetermined distance.

9. The method of claim 8, wherein directing the bullnose assembly through the upper deflector comprises:

engaging the bullnose tip on a ramped surface defined by the upper deflector; and

directing the bullnose tip into and through the second channel with the ramped surface.

10. The method of claim 8, wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and also smaller than the width of the first channel, the method further comprising:

receiving the body within the first channel when the length of the bullnose tip is less than the predetermined distance; and

directing the bullnose assembly into the first conduit.

11. The method of claim 8, further comprising directing the bullnose assembly into the second conduit and the lateral bore when the length of the bullnose tip is greater than the predetermined distance.

12. The method of claim 8, further comprising directing the bullnose assembly into the first conduit and the lower portion of the main bore when the length of the bullnose tip is less than the predetermined distance.

13. A multilateral wellbore system, comprising:

a main bore having a first junction and a second junction spaced downhole from the first junction;

a first deflector assembly arranged at the first junction and comprising a first upper deflector and a first lower deflector spaced from the first upper deflector by a first predetermined distance, the first lower deflector defining a first conduit that communicates with a first lower portion of the main bore and a second conduit that communicates with a first lateral bore;

a second deflector assembly arranged at the second junction and comprising a second upper deflector and a second lower deflector spaced from the second upper deflector by a second predetermined distance that is shorter than the first predetermined distance, the second lower deflector defining a third conduit that communicates with a second lower portion of the main bore and a fourth conduit that communicates with a second lateral bore; and

a bullnose assembly including a body and a bullnose tip arranged at a distal end of the body and exhibiting a length,

wherein the first and second deflector assemblies are configured to direct the bullnose assembly into either the first and second lateral bores or the first and second lower portions of the main bore based on the length of the bullnose tip as compared to the first and second predetermined distances.

14. The multilateral wellbore system of claim 13, wherein, when the length of the bullnose tip is shorter than the first predetermined distance but greater than the second predetermined distance, the bullnose assembly is directed into the first conduit and the first lower portion of the main bore and subsequently into the fourth conduit and the second lateral bore.

15. The multilateral wellbore system of claim 13, wherein, when the length of the bullnose tip is shorter than the first and second predetermined distances, the bullnose assembly is directed into the first conduit and the first lower portion of the main bore and subsequently into the third conduit and the second lower portion of the main bore.

16. The multilateral wellbore system of claim 13, wherein, when the length of the bullnose tip is greater than the first predetermined distance, the bullnose assembly is directed into the second conduit and the first lateral bore.

17. The multilateral wellbore system of claim 13, wherein the first and second upper deflectors each define first and second channels that extend longitudinally through the corresponding first and second upper deflectors, and wherein the second channel exhibits a width greater than a width of the first channel.

18. The multilateral wellbore system of claim 17, wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and smaller than the width of the first channel of the first upper deflector, and wherein, when the length of the bullnose tip is less than the first predetermined distance, the body is received within the first channel of the first upper deflector and the bullnose assembly is directed into the first conduit of the first lower deflector.

19. The multilateral wellbore system of claim 17, wherein the bullnose tip exhibits a first diameter and the body exhibits a second diameter smaller than the first diameter and smaller than the width of the first channel of the second upper deflector, and wherein, when the length of the bullnose tip is less than the second predetermined distance, the body is received within the first channel of the second upper deflector and the bullnose assembly is directed into the third conduit of the second lower deflector.

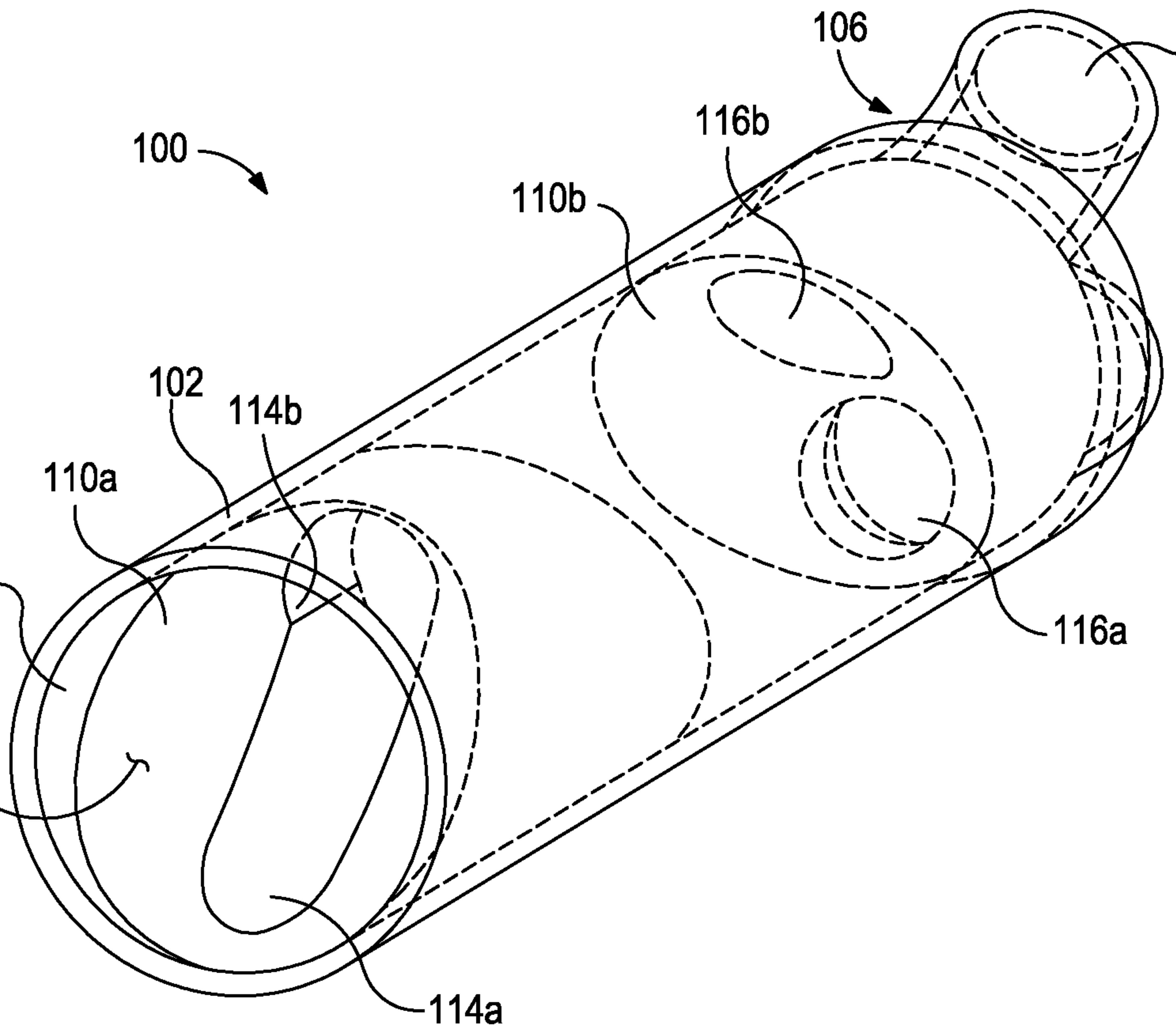
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FIG. 1

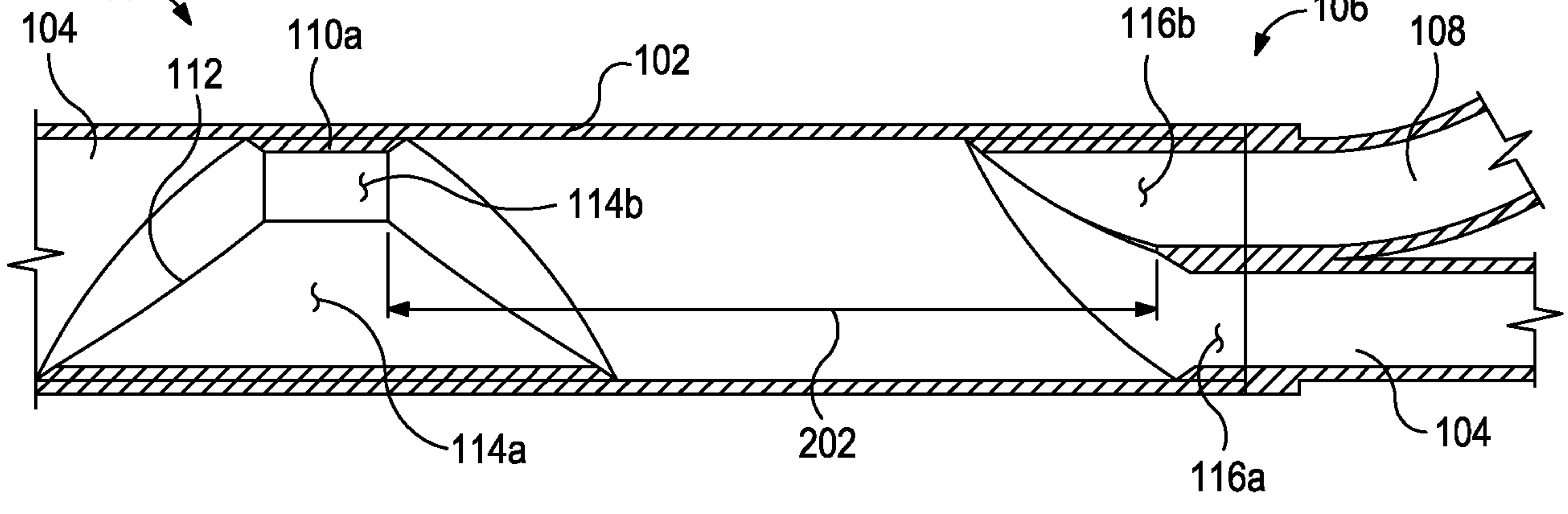
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FIG. 2

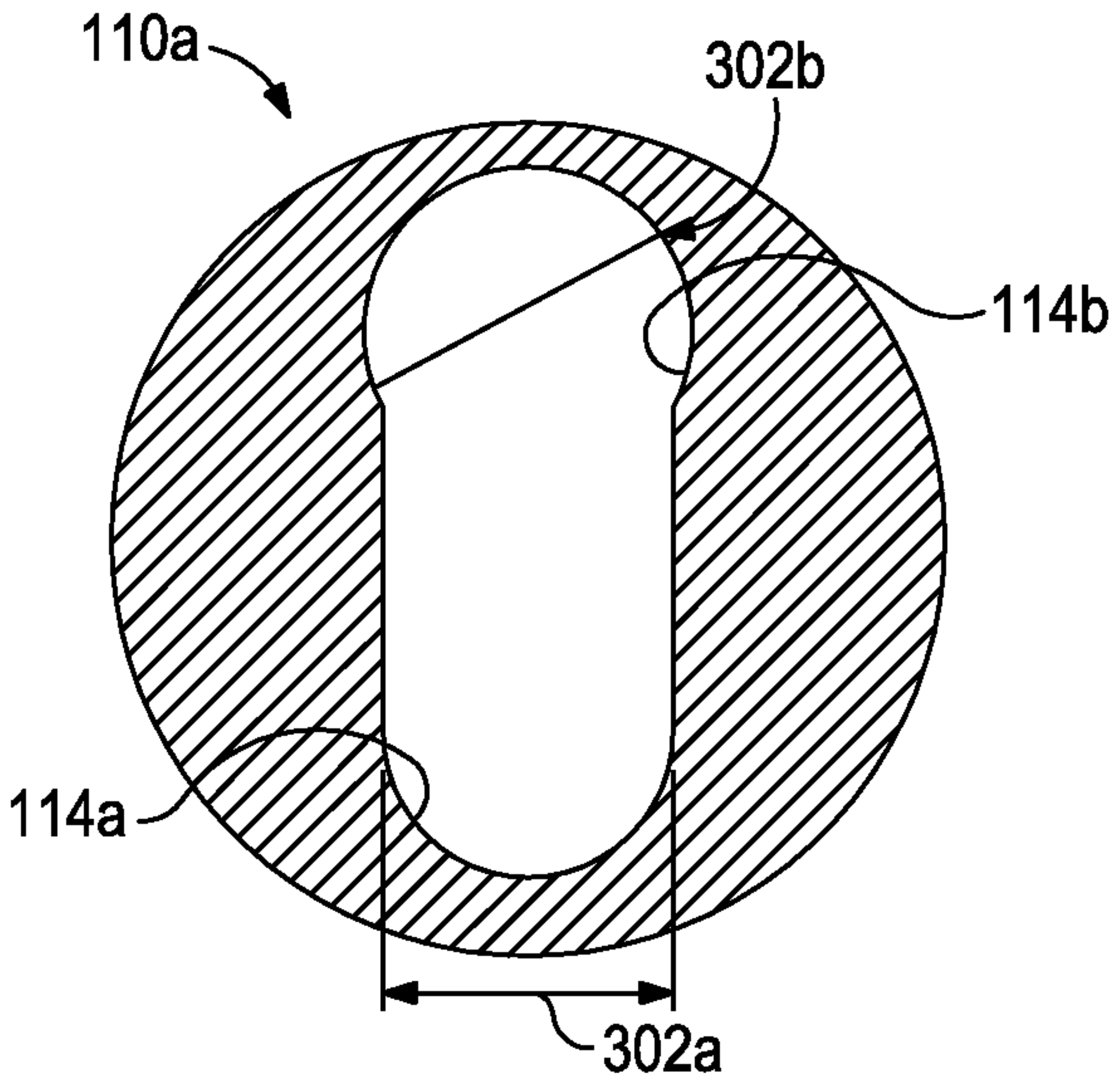


FIG. 3A

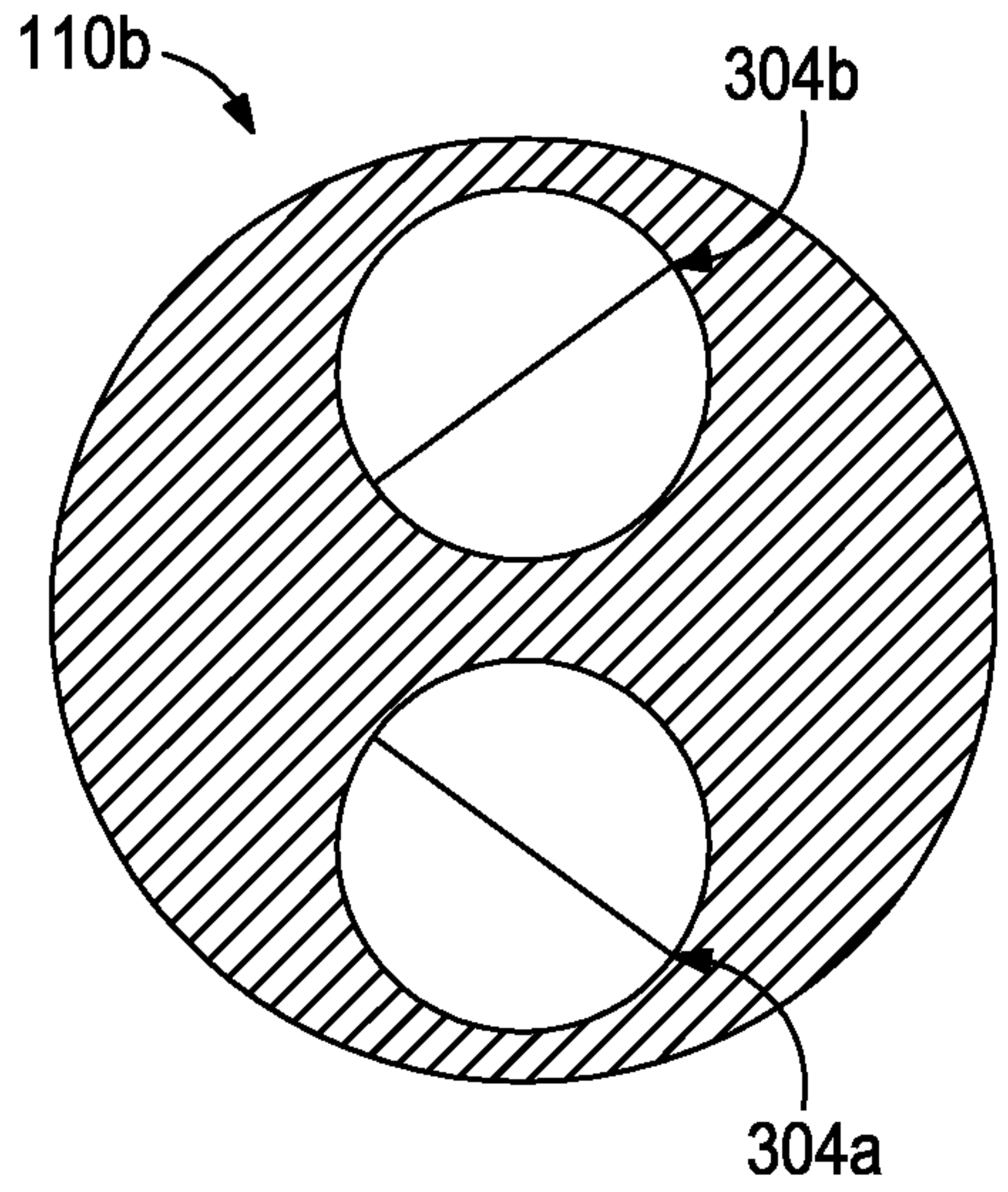


FIG. 3B

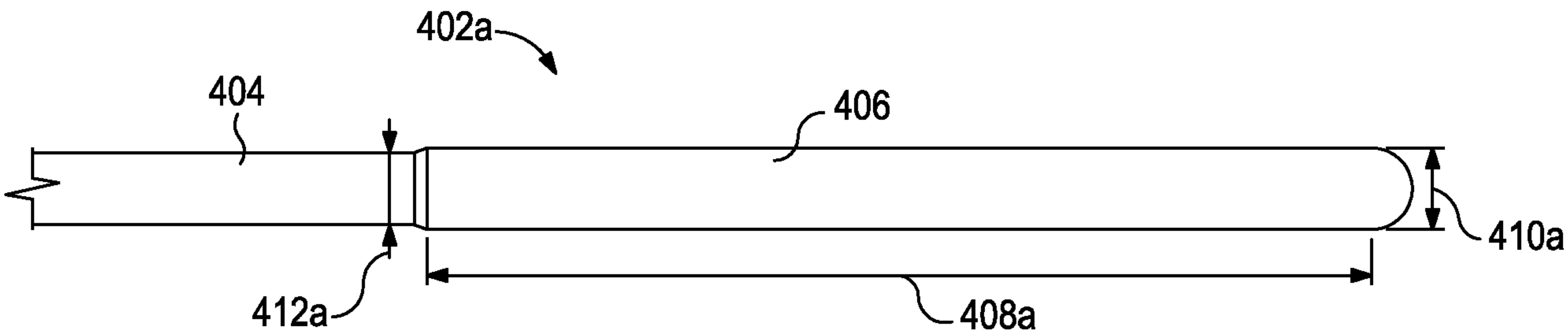


FIG. 4A

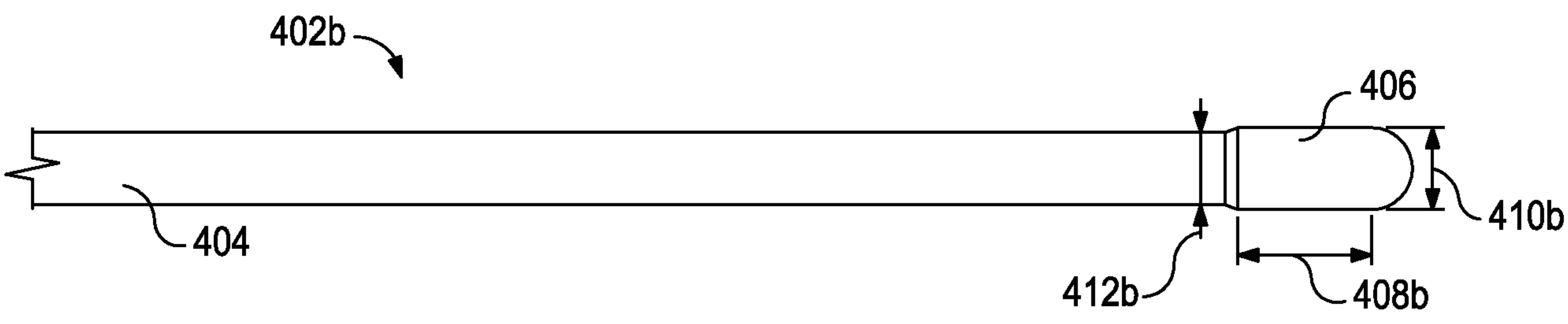


FIG. 4B

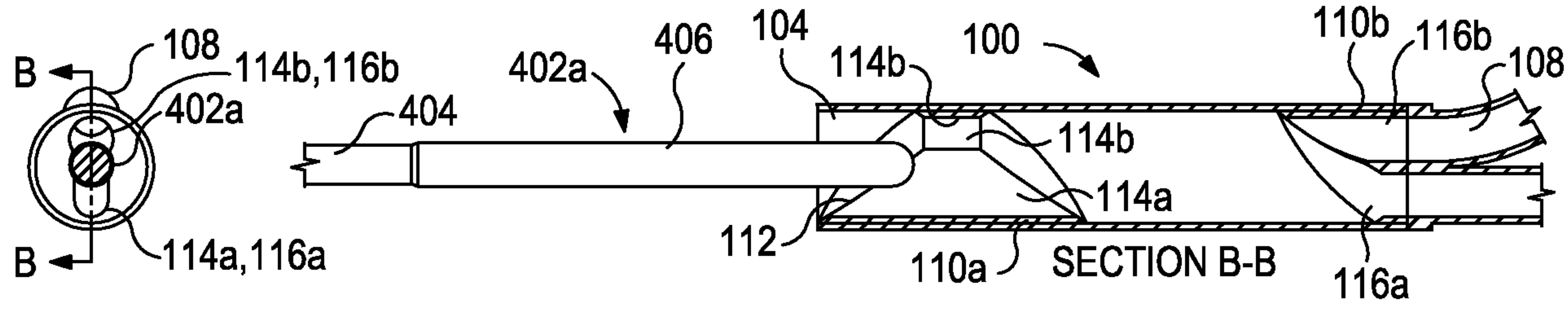


FIG. 5A

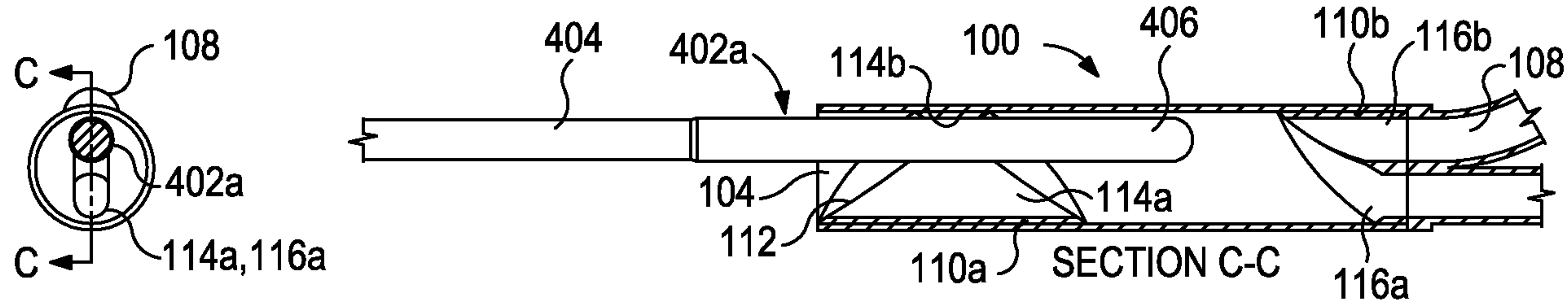


FIG. 5B

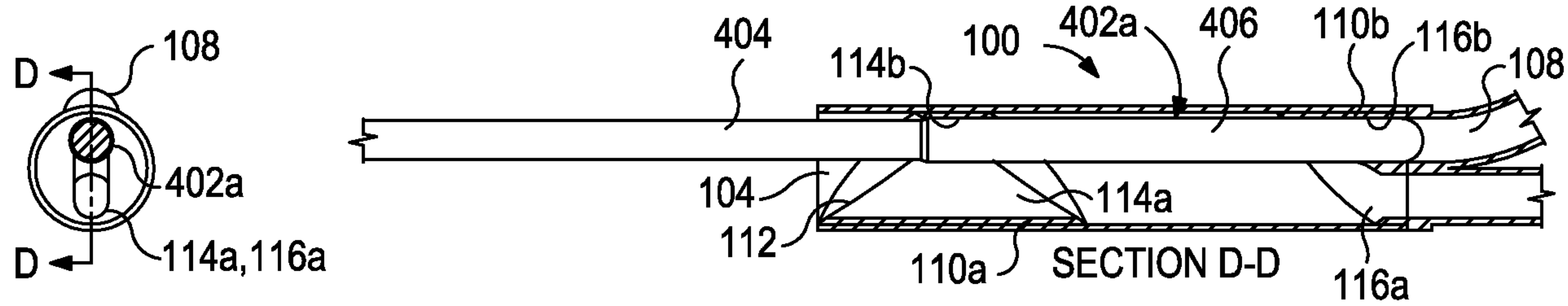


FIG. 5C

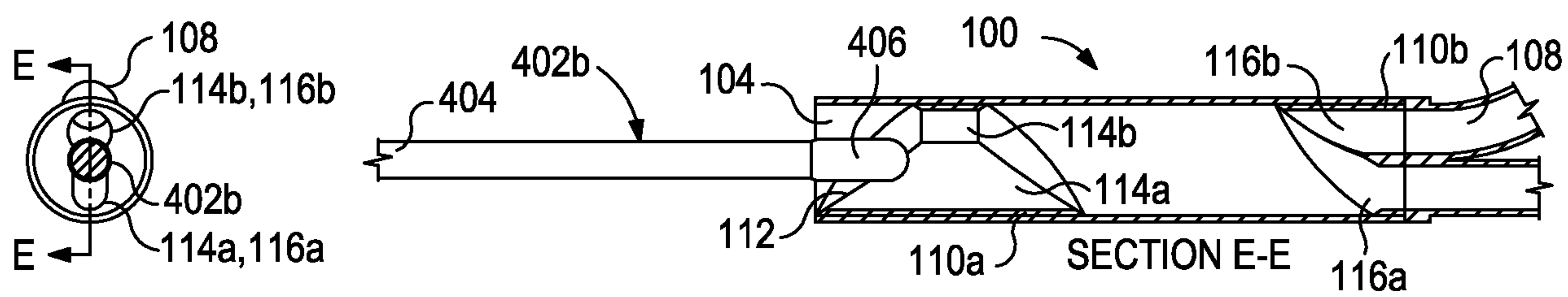


FIG. 6A

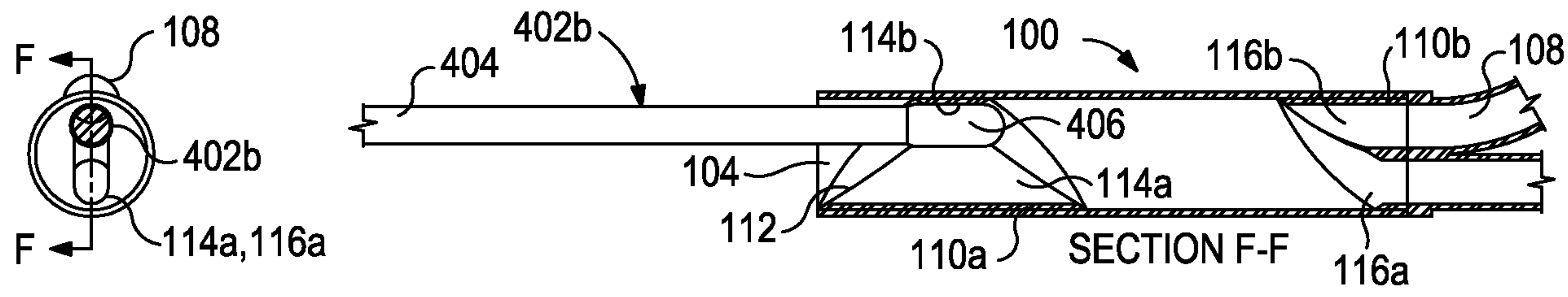


FIG. 6B

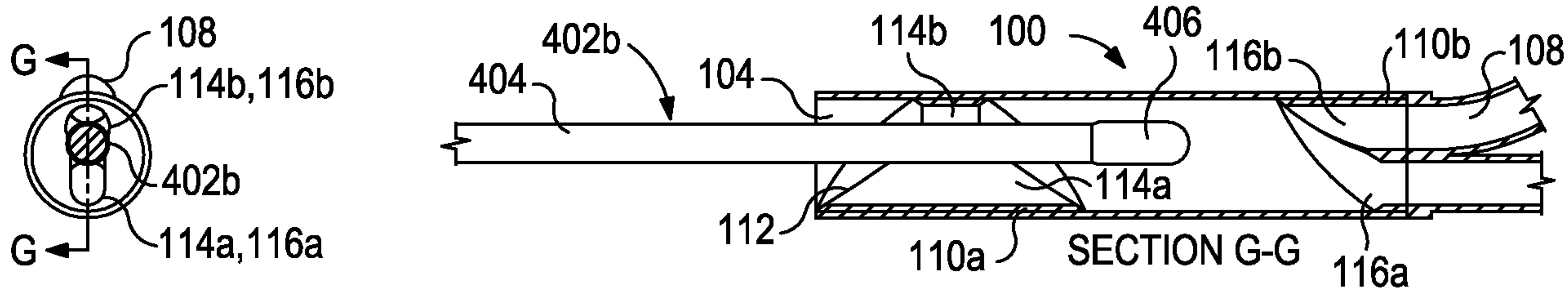


FIG. 6C

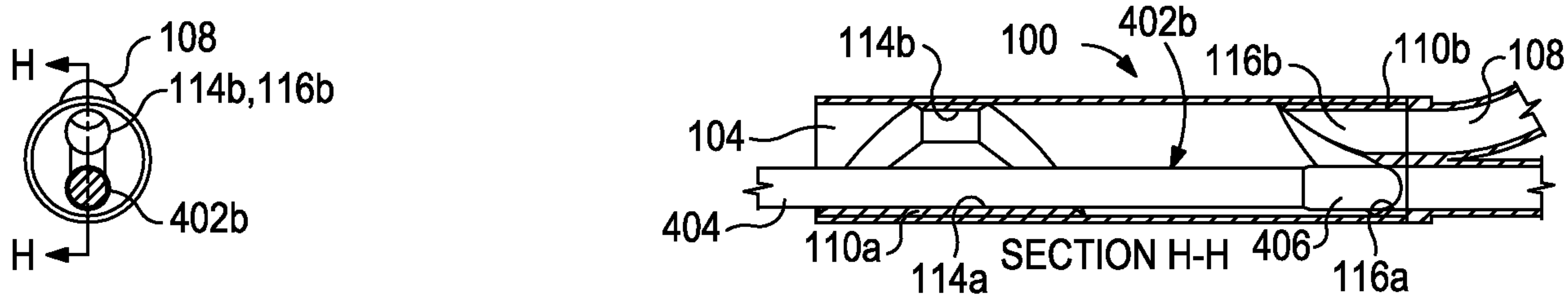


FIG. 6D

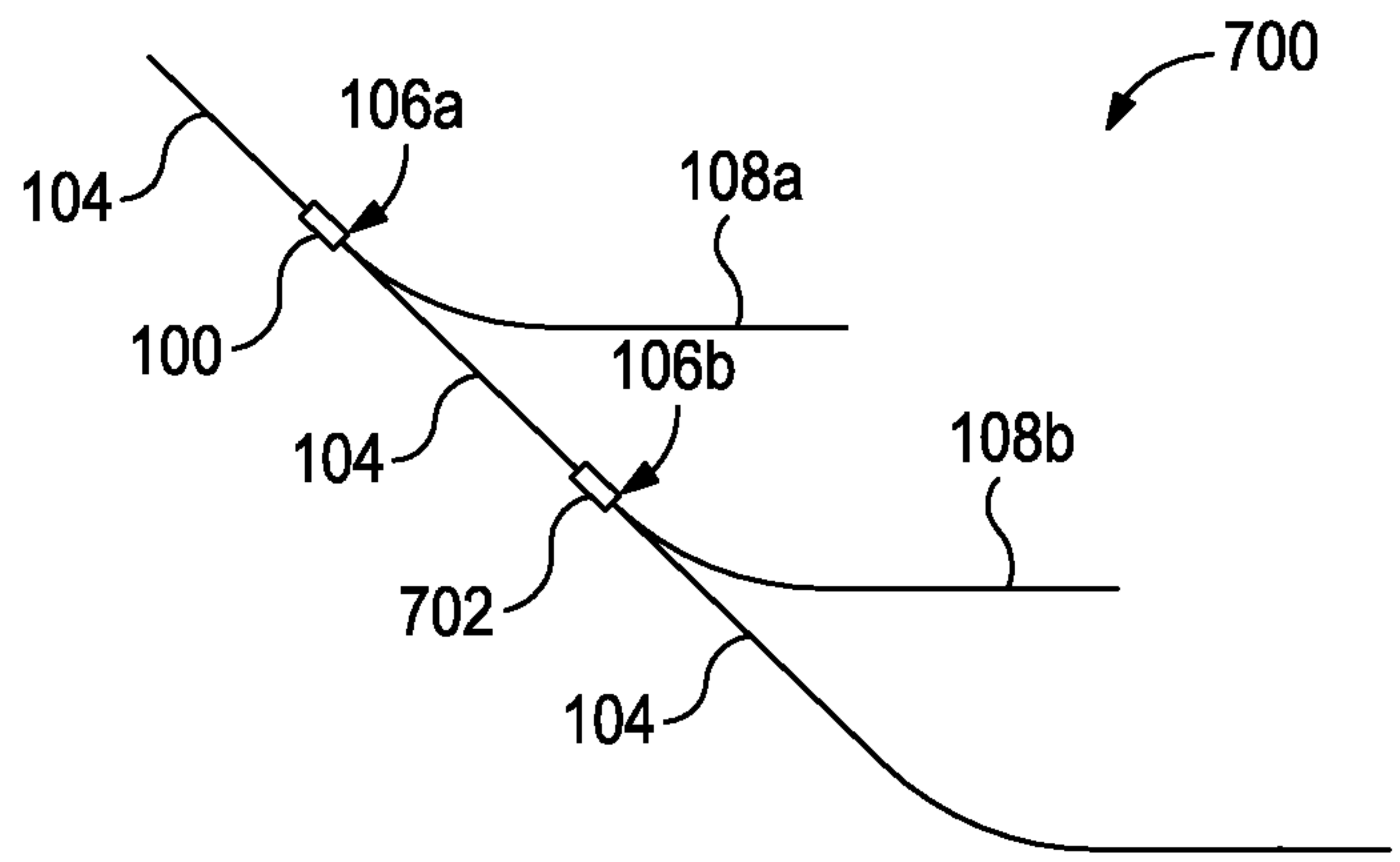


FIG. 7

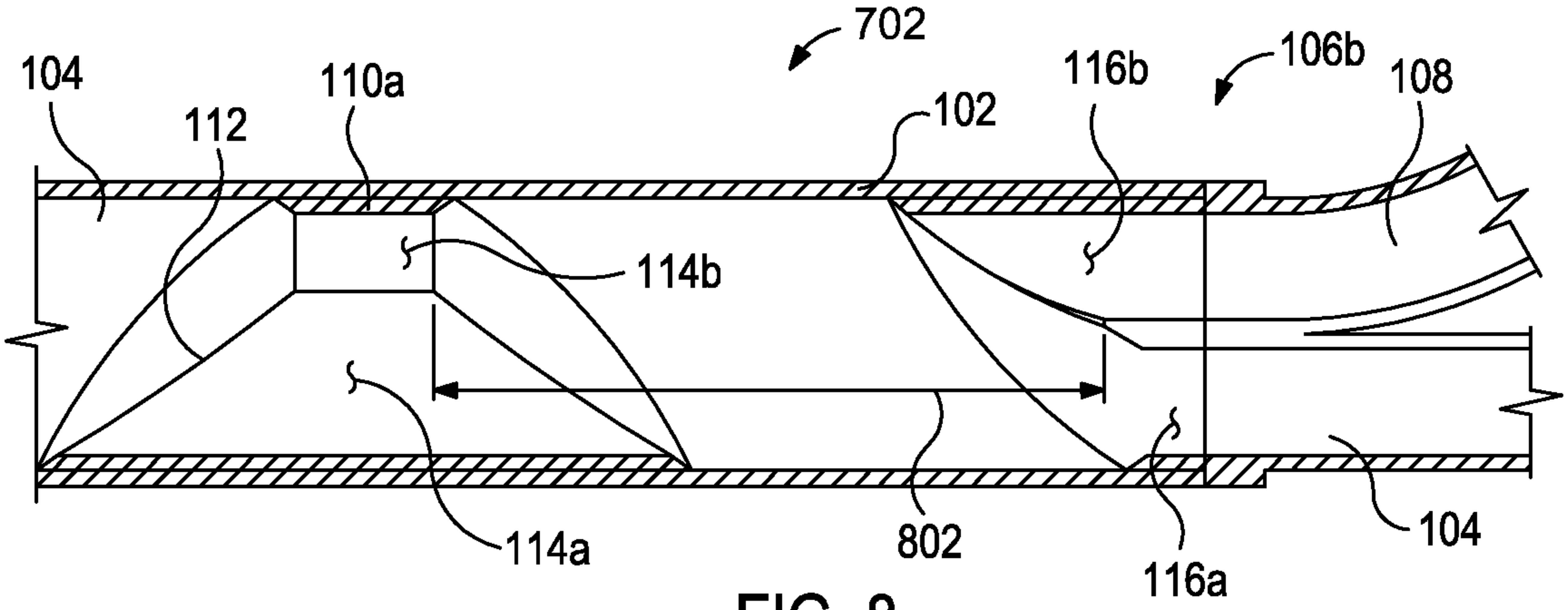


FIG. 8

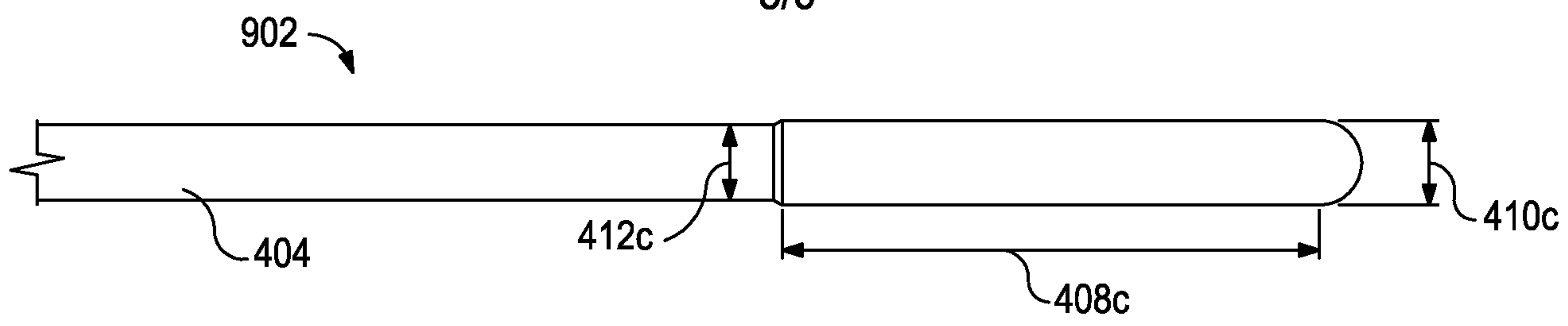


FIG. 9

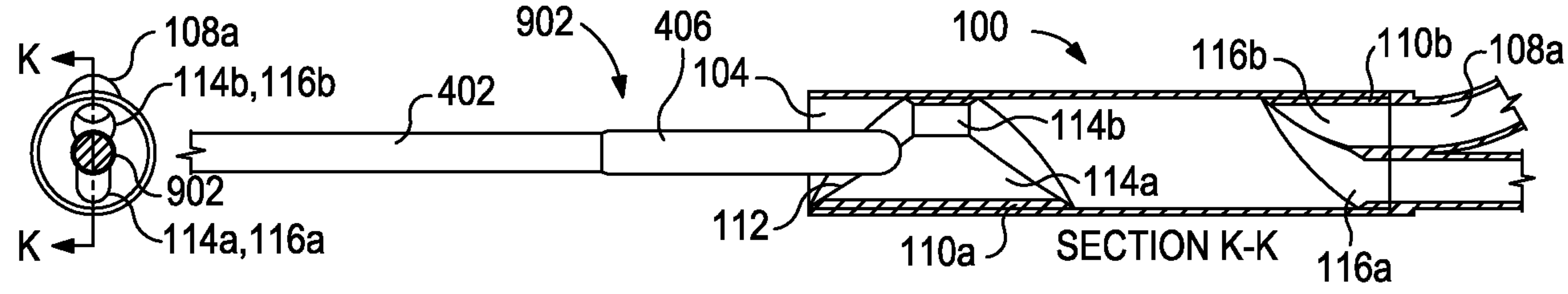


FIG. 10A

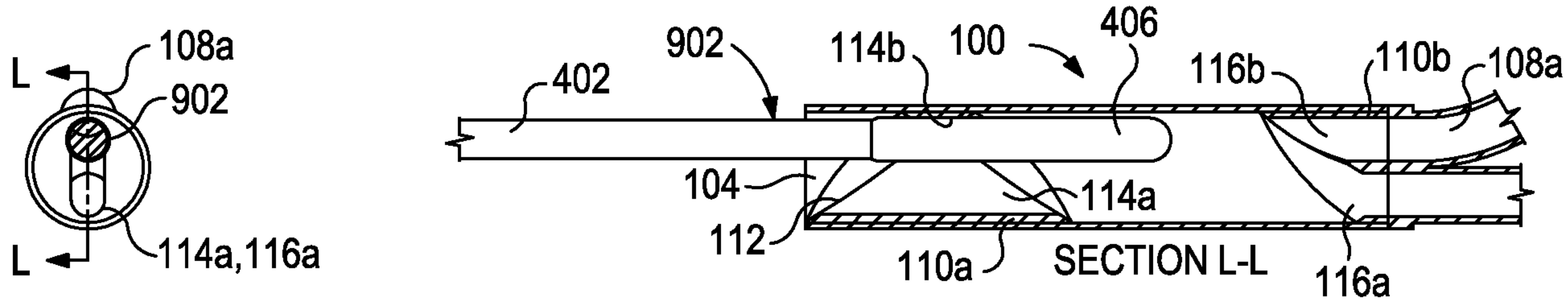


FIG. 10B

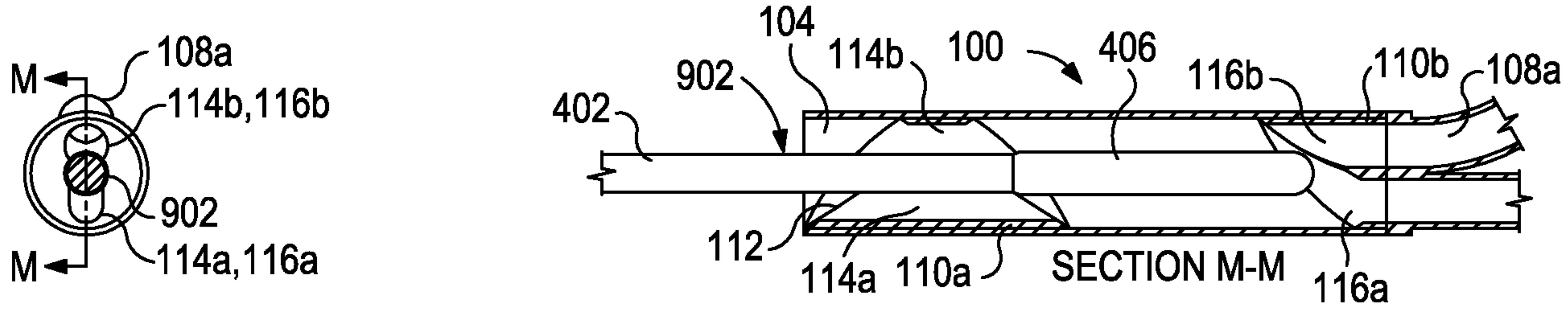


FIG. 10C

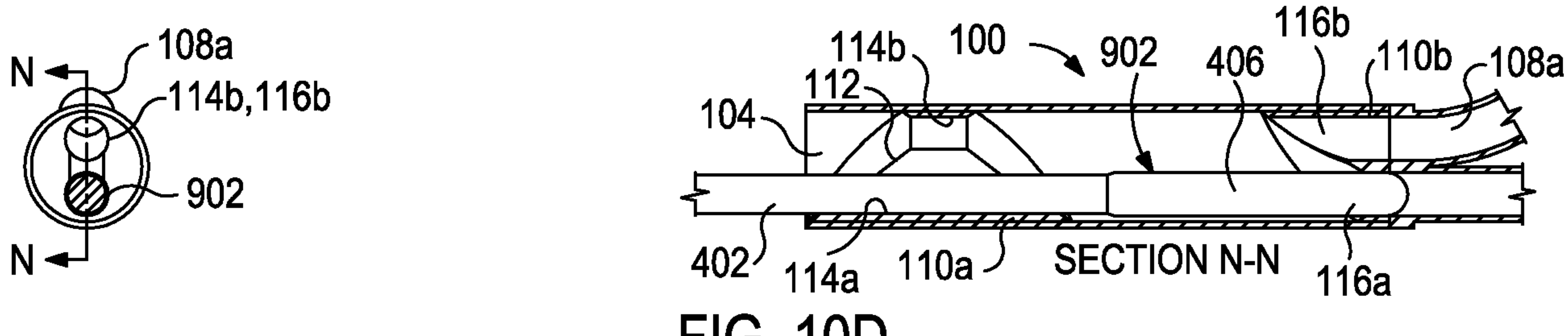


FIG. 10D

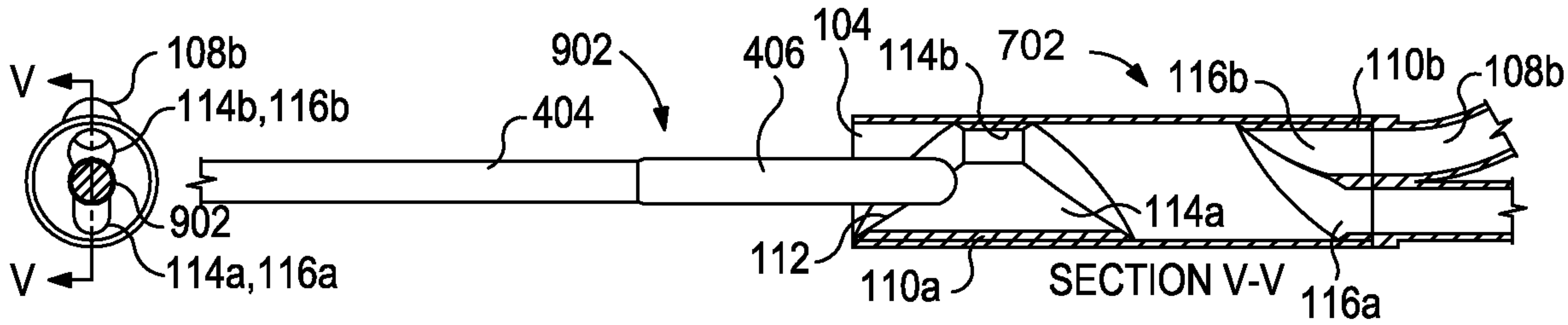


FIG. 11A

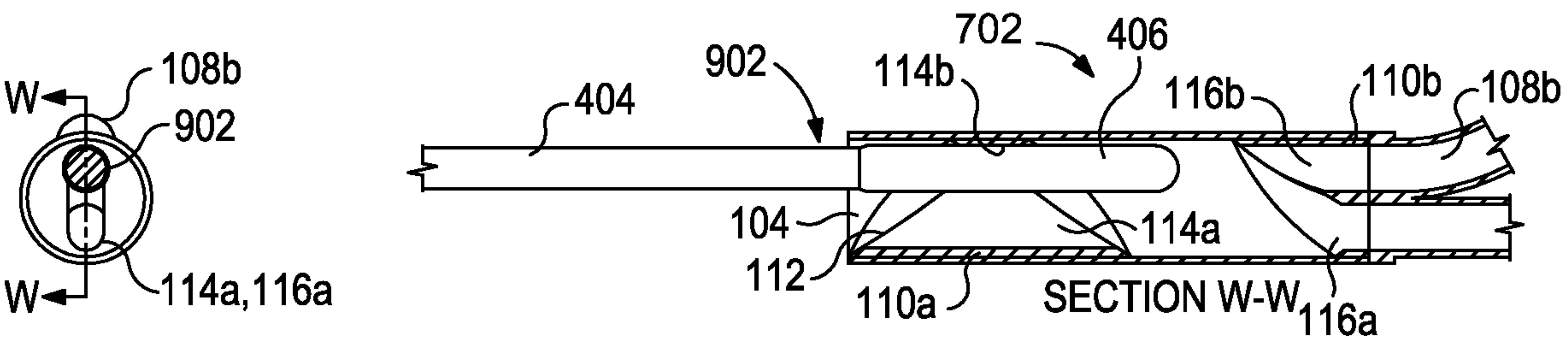


FIG. 11B

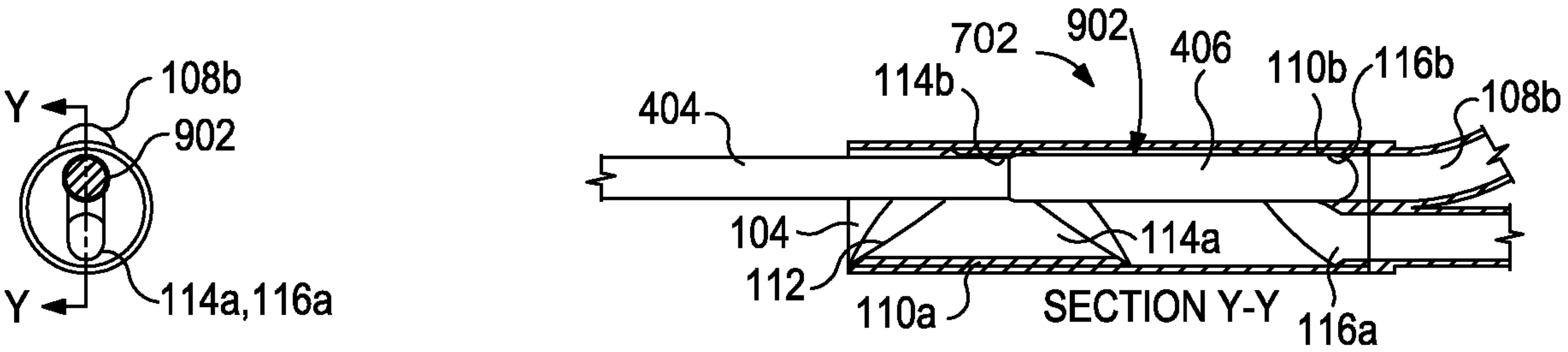
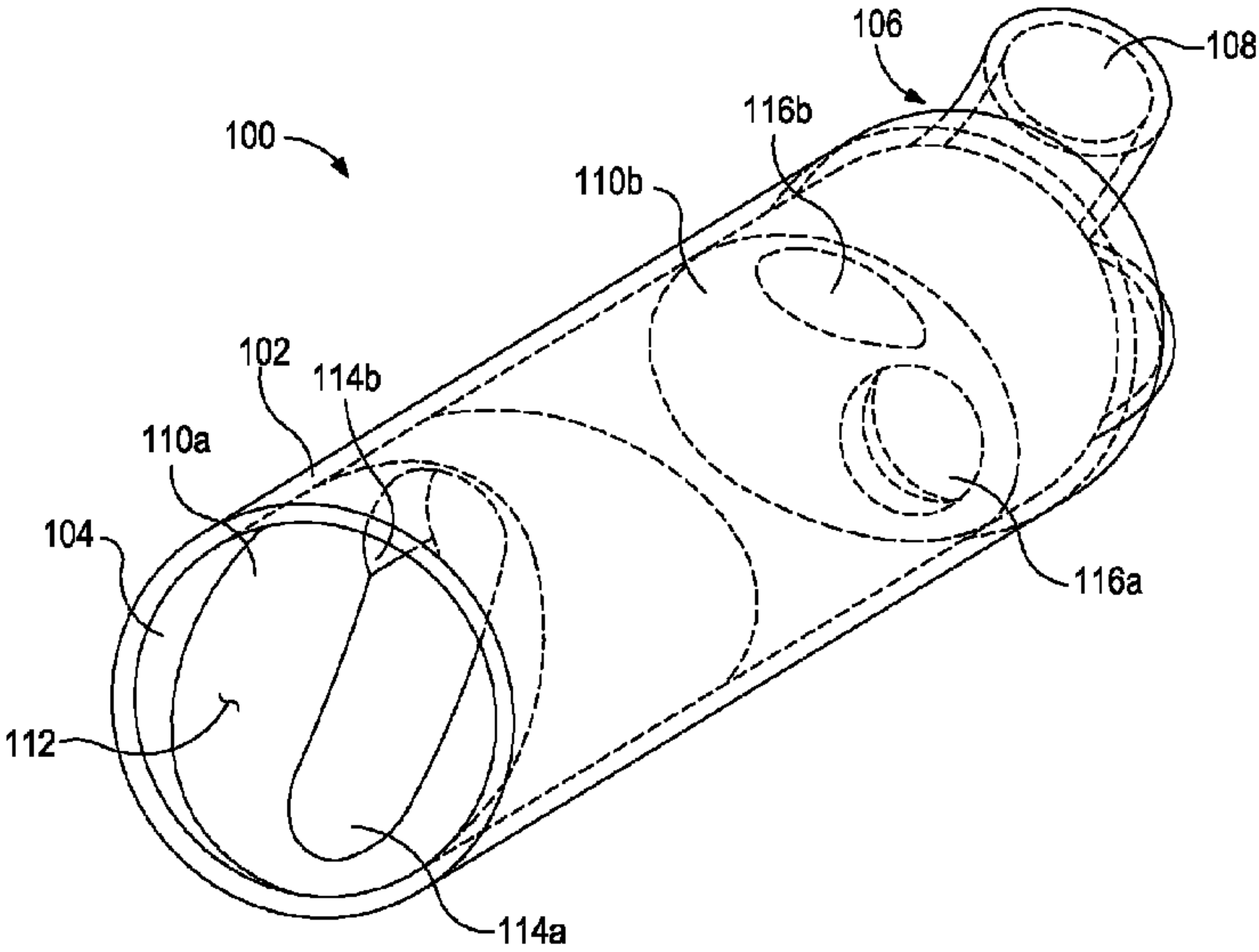


FIG. 11C



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