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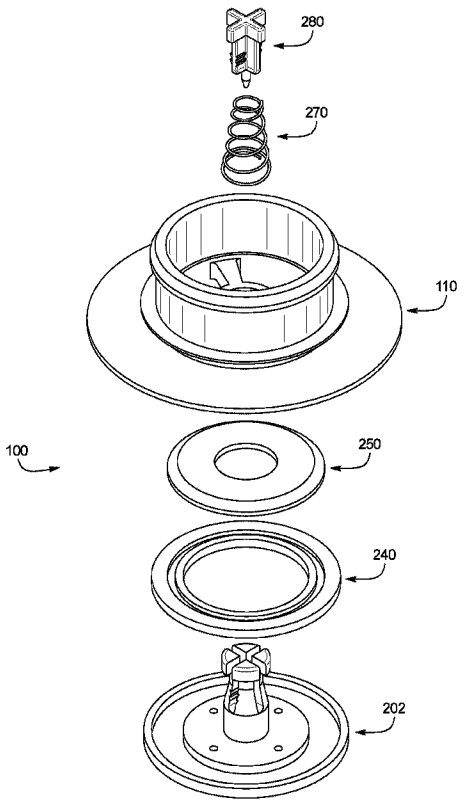

(57) Abrégé/Abstract:
Various embodiments provide a valve for an inflatable object, the valve including a housing defining a gas passageway and configured to be attached to an inflatable object and a sealing assembly connected to and moveable relative to the housing, the sealing assembly including a locking pin securely lockable into the shaft of the stem.

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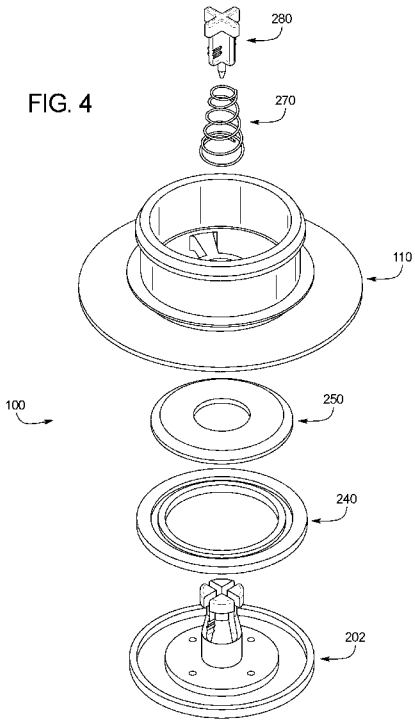
FIG. 4



(57) Abstract: Various embodiments provide a valve for an inflatable object, the valve including a housing defining a gas passageway and configured to be attached to an inflatable object and a sealing assembly connected to and moveable relative to the housing, the sealing assembly including a locking pin securely lockable into the shaft of the stem.

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INFLATION VALVE

BACKGROUND

[0001] Various pneumatic valves are known and used in or for a variety of products. Such valves are often employed in inflatable objects such as inflatable dunnage bags.

[0002] Inflatable dunnage bags are commonly used to stabilize cargo during transportation of cargo containers (such as railroad cars and semi-trailers), thereby improving safety and reducing the likelihood of damage to the cargo. Dunnage bags are commonly inflated and deflated before and after use through valves configured for this purpose. Dunnage bags are typically positioned in voids or spaces between the cargo and/or between the cargo and the walls of the cargo container and inflated to a desired internal pressure, such as a designated operating pressure.

[0003] More specifically, the user typically positions the dunnage bag in the appropriate void or space and then inflates the dunnage bag to the desired internal pressure using pressurized gas such as air from a pressurized gas supply. Typically, to inflate a dunnage bag, the user connects the pressurized gas supply to the valve, which is attached to the inflatable/deflatable body of the dunnage bag and which provides an opening in the dunnage bag. If the dunnage bag needs to be repositioned during inflation, the user opens the valve associated with the dunnage bag to enable the gas from within the dunnage bag to escape, partially deflating the dunnage bag. The user then closes or enables the valve to close and the dunnage bag can be repositioned and inflated to the desired internal pressure, such as the designated operating pressure. When the dunnage bag needs to be removed from its position between the cargo or between the cargo and the walls of the cargo container to

enable the cargo to be unloaded from the cargo container, the user opens the valve to enable the gas in the dunnage bag to escape and thus deflate the dunnage bag.

[0004] There is a continuing need to make such valves simpler, easier to manufacture and assemble, made from or with less components, less expensive, more durable (e.g., reusable for longer durations), and that provide relatively greater gas flow rates into and out of the inflatable object.

[0005] Accordingly, there is a need for a new and improved valve that solves these requirements, and for new and improved inflatable objects such as dunnage bags having such new and improved valves.

SUMMARY

[0006] Various embodiments of the present disclosure provide a reusable valve that is simpler, easier to manufacture and assemble, made from or with less components, less expensive, more durable (e.g., reusable for longer durations), and that provides relatively high gas flow rates through the valve into and out of an inflatable object (such as a dunnage bag) to which it is attached. More specifically, various embodiments of the present disclosure provide a valve that can be used in connection with any suitable inflatable object such as, but not limited to: a dunnage bag, a bag other than a dunnage bag, an air mattress, an inflatable boat or floatable object such as a raft, and a tire.

[0007] In various embodiments, the valve generally includes: (a) a housing defining a gas passageway and configured to be attached to an inflatable object; and (b) a sealing assembly connected to and moveable relative to the housing, and configured to be in: (i) any one of a plurality of resting closed positions to prevent a gas such as air from passing through the

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housing; and (ii) any one of a plurality of different open positions that enable gas such as air to pass through the housing.

[0008] In various embodiments, a cap assembly may be connected to the housing to cover one end of the housing to protect the gas passageway of the housing from contaminants.

[0009] In various embodiments, the housing includes a cylindrical wall having opposing outer and inner surfaces, wherein the inner surface partially defines a gas passageway. The housing further includes, among other elements described below, a stem supporter integrally connected to and extending inwardly transversely from the inner surface of the cylindrical wall. The stem supporter is configured to support the sealing assembly, enable the sealing assembly to move relative to the housing, enable the sealing assembly to be positioned in the open and closed positions, and define relatively large gas passageways through the housing.

[0010] In various embodiments, the sealing assembly includes a stem, a somewhat flexible compressible sealing ring attachable to the stem, a sealing plate attachable to the stem, a spring positionable on the stem, and a locking pin positionable in and lockable into the stem.

[0010A] In a broad aspect, the present invention pertains to a valve for an inflatable object. The valve comprises a housing defining a gas passageway therethrough, and a sealing assembly mounted to and moveable relative to the housing between a closed position that prevents gas from passing through the housing via the gas passageway and an open position that enables gas to pass through the housing via the gas passageway. The sealing assembly comprises a stem and a sealing ring mounted to the stem, the stem comprising a shaft that defines multiple locking-rib-receiving openings. There is a spring that biases

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the sealing assembly to the closed position, and a locking member lockingly engaged to the stem to retain the spring and the sealing assembly on the housing. The locking member comprises multiple locking ribs, the locking-rib-receiving openings of the shaft being sized and shaped to receive the locking ribs. The sealing ring of the sealing assembly sealingly engages the housing when the sealing assembly is in the closed position, and is spaced-apart from the housing when the sealing assembly is in the open position.

[0010B] In a further aspect, the present invention provides an inflatable object comprising an inflatable/deflatable body, and a valve attached to the body and in fluid communication with an interior of the body. The valve comprises a housing defining a gas passageway therethrough, a sealing assembly mounted to and moveable relative to the housing between a closed position that prevents gas from passing through the housing via the gas passageway and an open position that enables gas to pass through the housing via the gas passageway. The sealing assembly comprises a stem and a sealing ring mounted to the stem wherein the stem comprises a shaft that defines multiple locking-rib-receiving openings. There is a spring that biases the sealing assembly to the closed position, and a locking member lockingly engaged to the stem to retain the spring and the sealing assembly on the housing. The locking-rib-receiving openings of the shaft are sized and shaped to receive the locking ribs. The sealing ring of the sealing assembly sealingly engages the housing when the sealing assembly is in the closed position and is spaced-apart from the housing when the sealing assembly is in the open position.

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[0011] Additional features and advantages of the present disclosure are described in, and will be apparent from, the following Detailed Description and the Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Figure 1 is a top perspective view of one example embodiment of a valve of the present disclosure.

[0013] Figure 2 is a bottom perspective view of the valve of Figure 1, showing the valve in a closed position.

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[0014] Figure 3A is a cross-sectional view of the valve of Figure 1, taken substantially along line 3-3 of Figure 1, and showing the valve in a closed position.

[0015] Figure 3B is a cross-sectional view of the valve of Figure 1, similar to Figure 3A, and showing the valve in an open position.

[0016] Figure 4 is an exploded perspective view of the valve of Figure 1.

[0017] Figure 5 is a top perspective view of the housing of the valve of Figure 1.

[0018] Figure 6 is a top view of the housing of the valve of Figure 1.

[0019] Figure 7 is a side view of the housing of the valve of Figure 1.

[0020] Figure 8 is a cross-sectional view of the housing of the valve of Figure 1, taken substantially along line 8-8 of Figure 6.

[0021] Figure 9 is a top perspective view of the stem of the sealing assembly of the valve of Figure 1.

[0022] Figure 10 is a top view of the stem of the sealing assembly of the valve of Figure 1.

[0023] Figure 11 is a bottom view of the stem of the sealing assembly of the valve of Figure 1.

[0024] Figure 12 is a side view of the stem of the sealing assembly of the valve of Figure 1.

[0025] Figure 13 is a side partial cross sectional view of the stem of the sealing assembly of the valve of Figure 1, taken substantially along line 13-13 of Figure 10.

[0026] Figure 14 is a top perspective view of the sealing ring of the sealing assembly of the valve of Figure 1.

[0027] Figure 15 is a side view of the sealing ring of the sealing assembly of the valve of Figure 1.

[0028] Figure 16 is a cross-sectional view of the sealing ring of the sealing assembly of the valve of Figure 1, taken substantially along line 16-16 of Figure 15.

[0029] Figure 17 is a top perspective view of the sealing plate of the sealing assembly of the valve of Figure 1.

[0030] Figure 18 is a side view of the sealing plate of the sealing assembly of the valve of Figure 1.

[0031] Figure 19 is a cross-sectional view of the sealing plate of the sealing assembly of the valve of Figure 1, taken substantially along line 19-19 of Figure 18.

[0032] Figure 20A is a perspective view of the locking pin of the sealing assembly of the valve of Figure 1 (shown from a first side).

[0033] Figure 20B is a perspective view of the locking pin of the sealing assembly of the valve of Figure 1 (shown from a second opposite side).

[0034] Figure 21 is a bottom view of the locking pin of the sealing assembly of the valve of Figure 1.

[0035] Figure 22A is a side view of the locking pin of the sealing assembly of the valve of Figure 1 (shown from a first side).

[0036] Figure 22B is a side view of the locking pin of the sealing assembly of the valve of Figure 1 (shown from an opposite side).

[0037] Figure 23 is a cross-sectional view of the locking pin of the sealing assembly of the valve of Figure 1, taken substantially along line 23-23 of Figure 21.

DETAILED DESCRIPTION

[0038] Various embodiments of the present disclosure provide a valve, and particularly a valve for an inflatable object. It should be appreciated that the

valve of the present disclosure can be used in connection with any suitable inflatable object such as, but not limited to: a dunnage bag, a bag other than a dunnage bag, and air mattress, a raft or other inflatable boat or floatable object, and a tire.

[0039] Referring now to the drawings, Figures 1 to 23 illustrate one example embodiment of the valve of the present disclosure, which is generally indicated by numeral 100. In this illustrated example embodiment, the valve 100 generally includes: (a) a housing 110 defining a gas passageway 190, and configured to be attached to an inflatable object (not shown) such as a dunnage bag (not shown); and (b) a sealing assembly 200 connected to and moveable relative to the housing 110, and configured to be in: (i) any one of a plurality of different closed resting positions (such as shown in Figures 2 and 3A) to prevent a gas such as air from passing through the housing 110, and (ii) any one of a plurality of different open positions (such as shown in Figure 3B) to enable gas such as air to pass through the housing 110.

[0040] In this illustrated example embodiment, the housing 110 (as shown in Figures 1 to 8) is formed from a one piece molded plastic body. In this illustrated example embodiment, the housing 110 generally includes: (a) a cylindrical wall 112; (b) a cylindrical locking lip 120; (c) a cylindrical or partially cylindrical annular ring 126; (d) a cylindrical or partially cylindrical attachment flange 130; (e) a cylindrical sealing seat 150; and (f) a stem supporter 160.

[0041] More specifically, the cylindrical wall 112 of the housing 110 has opposing outer and inner surfaces 114 and 116. The inner surface 114 partially defines the gas passageway 190 of the housing 110.

[0042] The locking lip 120 of the housing 110 is cylindrical and is integrally connected to and extends outwardly or transversely from the outer surface 114 of the cylindrical wall 112 of the housing 110. The locking lip 120 is configured to be engaged by a suitable cap (not shown). In certain alternative

embodiments that are not shown, the locking lip does not extend all the way around the cylindrical wall 112. In certain alternative embodiments that are not shown, the locking lip is provided in two or more sections extending outwardly transversely from the cylindrical wall 112. In certain alternative embodiments that are not shown, the housing does not include any locking lip.

[0043] The annular ring 126 of the housing 110 is cylindrical and is integrally connected to and extends outwardly transversely from the outer surface 114 of the cylindrical wall 112 of the housing 110. The annular ring 126 is configured to assist in securing the valve 100 to a wall (not shown) of an inflatable object (not shown) such as a dunnage bag (not shown). In certain alternative embodiments that are not shown, the annular ring does not extend all the way around the cylindrical wall 112. In certain alternative embodiments that are not shown, the annular ring is provided in two or more sections extending outwardly transversely from the cylindrical wall 112.

[0044] The attachment flange 130 of the housing 110 is cylindrical and is integrally connected to and extends outwardly or transversely from the outer surface 114 of the cylindrical wall 112. The attachment flange 130 has opposing first and second surfaces 132 and 134. The attachment flange 130 of the housing 110 is configured to be positioned such that surface 132 of the attachment flange 130 engages an inner surface (not shown) of a wall (not shown) of an inflatable object (not shown) when the valve 100 is attached to that inflatable object. Thus, the portions of the housing 110 extending from surface 134 of the flange 130 are configured to be positioned inside the inflatable object, and the portions of the housing 110 extending from surface 132 of the flange 130 are configured to be positioned outside of the inflatable object. The attachment flange 130 is thus configured to co-act with the annular ring 126 to assist in securing the valve 100 to a wall (not shown) of an inflatable object (not shown) such as a dunnage bag (not shown). In certain alternative

embodiments that are not shown, the flange does not extend around the entire housing. In certain alternative embodiments that are not shown, the flange is provided in two or more sections.

[0045] Although not shown, the housing can alternatively include a standoff configured to prevent another wall (not shown) of an inflatable object (not shown) from sealing itself to the portion of the valve 100 that is inside of that inflatable object when the valve 100 is attached to that inflatable object, thereby facilitating easier deflation of that inflatable object.

[0046] The sealing seat 150 of the housing 110 is generally cylindrical and is integrally connected to and extends downwardly from the second surface 134 of the flange 150. The sealing seat 150 is configured to be engaged by, mate with, and to provide a seat that is engaged by the sealing assembly 200 (as further discussed below) to close or seal the valve 100 or the passageway 190 defined by the housing 110 of the valve 100.

[0047] The sealing seat 150 is configured to be engaged by the sealing surface of a somewhat flexible compressible sealing ring 240 (described below) as generally shown in Figures 2 and 3A to create the seal between the sealing assembly 200 and the housing 110 when the sealing assembly 200 is in any one of the closed resting positions as shown in Figures 2 and 3A and as further discussed below.

[0048] The stem supporter 160 of the housing 110 is integrally connected to and extends inwardly transversely from the inner surface 116 of the cylindrical wall 112 of the housing 110. As best shown in Figure 6, the stem supporter 160 includes an outer ring 162, a plurality of and particularly three spaced apart connecting arms 164, 166, and 168, and an inner ring 170. The outer ring 162 of the stem supporter 160 is integrally connected to and extends inwardly transversely from the inner surface 116 of the cylindrical wall 112. The spaced apart connecting arms 164, 166, and 168 are integrally connected to

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and extend inwardly transversely from the outer ring 162. The inner ring 170 is integrally connected to each of and extends inwardly transversely from each of the three spaced apart connecting arms 164, 166, and 168. The inner ring 170 defines a central stem receiving opening 176 configured such that the shaft 220 of the stem 202 (described below) is axially moveable through the stem supporter 160 as further discussed below.

[0049] It should be appreciated that the spaced apart connecting arms 164, 166, and 168 and the inner ring 170 define three spaced apart relatively large gas passage openings 190a, 190b, and 190c that also partially define the passageway 190 of the housing 110. These spaced apart relatively large gas passage openings 190a, 190b, and 190c enable a significant amount of gas to pass though the housing 110 and thus the valve 100 when the sealing assembly 200 is in any one of the open positions during inflation or deflation (through the valve 100) of the inflatable object to which the valve 100 is attached. The stem supporter 160 is thus configured to: (a) support the sealing assembly 200; (b) enable the sealing assembly 200 to move relative to the housing 110; (c) enable the sealing assembly 200 to be positioned in any one of the closed resting positions and any one of the open positions; and (d) enable gas to pass through the housing 110.

[0050] In this illustrated embodiment, the housing 110 is one piece and molded from a plastic such as polyethylene. It should be appreciated that the housing can be made from other suitable materials, made in other suitable manners, and made from two or more connectable pieces in accordance with the present disclosure. It should be appreciated that the one or more of the components of the housing can be alternatively configured in accordance with the present disclosure. For example, the number or positions of the spaced apart connecting arms and the openings that they partially define may vary in accordance with the present disclosure.

[0051] In this illustrated example embodiment, the sealing assembly 200 (as shown in Figures 1, 2, 3A, 3B, 4, and 9 to 23) is formed from five connectable or connected components and specifically includes: (a) a stem 202; (b) a flexible compressible sealing ring 240 positioned in and connectable or attachable to the stem 202; (c) a sealing plate 250 positionable on and connectable or attachable to the stem 202 to maintain the flexible compressible sealing ring 240 on or connected to the stem 202; (d) a spring 270; and (e) a locking pin 280 positionable in and lockably connectable into the stem 202 to maintain the entire sealing assembly 200 connected to the housing 110 and to facilitate operation of the sealing assembly 200 and the entire valve 100 as further discussed below.

[0052] More specifically, in this illustrated example embodiment, the stem 202 (as shown in Figures 1, 2, 3A, 3B, 4, 9, 10, 11, 12, and 13) is formed from a one piece molded plastic body. The stem 202 generally includes: (a) a base 204; and (b) a shaft 220 including a lower portion 221 and a locking pin receiver 222.

[0053] The base 204 of the stem 202 is generally cylindrical and has a first or bottom side 205 and an opposite second or top side 206. The base 204 includes an upwardly extending cylindrical first or outer ring or rim 207 and an upwardly extending cylindrical second or inner ring 208. The base 204 defines a cylindrical sealing ring receiving channel 209 (between the cylindrical first or outer ring or rim 207 and the cylindrical second or inner ring 208) that is configured to receive the compressible sealing ring 240. The base 204 is thus configured to receive and hold the compressible sealing ring 240. The cylindrical second or inner ring 208 defines a plurality of and in this illustrated example embodiment four spaced apart locking leg receivers 210a, 210b, 210c, and 210d that are respectively configured to receive the locking legs 258a, 258b, 258c, and 258d of the sealing plate 250 to enable the sealing plate 250 to

be locked into the base 204 and thus maintain the compressible sealing ring 240 connected or attached to the base 204 as further discussed below. The base 204 defines a plurality of recesses 211 that are provided for molding purposes and to reduce the amount of material needed to form the base 204 and thus the stem 202.

[0054] The shaft 220 of the stem 202 is somewhat cylindrical, somewhat elongated, and is integrally connected to and extends centrally from the second or top side 206 of the base 204 and particularly from the cylindrical ring 208 of the base 204.

[0055] The shaft 220 is configured to move axially back and forth through the central stem receiving opening 176 defined by the inner ring 170 of the housing 110 to enable the sealing assembly 200 to axially move to: (i) any one of the resting closed positions to prevent gas from passing through the housing 110, and (ii) any on of the plurality of different open positions to enable gas to pass through the housing 110. The shaft 220 is configured to rotate in the central stem receiving opening 176 of the inner ring 170 of the stem supporter 160 of the housing 110 to enable the sealing assembly 200 to move: (a) from any one of the plurality of different open positions to any of the other plurality of different open positions; or (b) from any one of the plurality of different closed positions to any of the other plurality of different closed positions.

[0056] The shaft 220 includes a cylindrical lower portion 221 integrally connected at a bottom end to the base 204 and at a top end to the locking pin receiver 222. The cylindrical lower portion 221 at least partially defines a locking pin nose receiving area 221a configured to receive the nose 288 of the locking pin 280. The locking pin receiver 222 of the stem 202 is configured to receive and be securely lockingly engaged by the locking pin 280 to maintain the spring 270 in place and to maintain the stem 202 connected to the housing 110 as generally shown in Figures 1, 3A, and 3B. The locking pin receiver 222 of the

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stem 202 generally extends along the longitudinal axis of the shaft 220. The locking pin receiver 222 includes four upwardly extending evenly spaced apart somewhat or partially symmetrical locking arms 224, 228, 232, and 236 that are each configured to receive and be securely lockingly engaged by the locking pin 280 (as best shown in Figures 9, 10, 12, and 13).

[0057] Locking arm 224 includes: (a) a first arm member 224a integrally connected to the cylindrical lower portion 221 of the shaft 220; (b) a second arm member 224b integrally connected to the first arm member 224a; and (c) a third arm member or hand 224c integrally connected to the second arm member 224b. The first arm member 224a defines a plurality of locking notches 224e and 224f configured to receive the respective locking lips or ribs of the locking pin 280 as further described below. The third arm member or hand 224c extends outwardly transversely to provide a first spring engagement surface or contact area.

[0058] Similarly, locking arm 228 includes: (a) a first arm member 228a integrally connected to the cylindrical lower portion 221 of the shaft 220; (b) a second arm member 228b integrally connected to the first arm member 228a; and (c) a third arm member or hand 228c integrally connected to the second arm member 228b. The first arm member 228a defines a plurality of locking notches 228e and 228f configured to receive the respective locking lips or ribs of the locking pin 280 as further described below. The third arm member or hand 228c extends outwardly or transversely to provide a second spring engagement surface or contact area.

[0059] Similarly, locking arm 232 includes: (a) a first arm member 232a integrally connected to the cylindrical lower portion 221 of the shaft 220; (b) a second arm member 232b integrally connected to the first arm member 232a; and (c) a third arm member or hand 232c connected to the second arm member 232b. The first arm member 232a defines a plurality of locking notches 232e

and 232f configured to receive the respective locking lips or ribs of the locking pin 280 as further described below. The third arm member or hand 232c extends outwardly or transversely to provide a third spring engagement surface or contact area.

[0060] Similarly, locking arm 236 includes: (a) a first arm member 236a integrally connected to the cylindrical lower portion 221 of the shaft 220; (b) a second arm member 236b integrally connected to the first arm member 236a; and (c) a third arm member or hand 236c connected to the second arm member 236b. The first arm member 236a defines a plurality of locking notches 236e and 236f configured to receive the respective locking lips or ribs of the locking pin 280 as further described below. The third arm member or hand 236c extends outwardly or transversely to provide a fourth spring engagement surface or contact area.

[0061] In this illustrated embodiment, the stem 202 is one piece and molded from a plastic such as polyethylene. It should be appreciated that the stem can be made from other suitable materials, made in other suitable manners, and made from two or more connectable pieces in accordance with the present disclosure. It should be appreciated that the one or more of the components of the stem can be alternatively configured in accordance with the present disclosure.

[0062] In this illustrated example embodiment, the somewhat flexible compressible sealing ring 240 (as shown in Figures 3A, 3B, 4, 14, 15, and 16) is generally cylindrical and has a first or bottom side 240a and an opposite second or top side 240b. The sealing ring 240 includes an upwardly extending cylindrical first or outer ring 242 and an upwardly extending cylindrical second or inner ring 244. The sealing ring 240 defines a cylindrical sealing plate receiving channel 246 (between the cylindrical first or outer ring 242 and the cylindrical second or inner ring 244) that is configured to receive part of outer or

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first ring 251 of the sealing plate 250. The sealing ring 240 also defines a cylindrical central opening 248 that enables the sealing ring 240 to be positioned over the shaft 220. The sealing ring 240 is configured to be positioned in the cylindrical scaling ring receiving channel 209 of or defined by the base 204 of the stem 202 and held in place by the sealing plate 250.

[0063] In one embodiment, sealing ring 240 is made from or includes a rubber or an elastomeric, such as a vulcanized elastomeric or a thermoplastic vulcanizate. Another example suitable material for sealing ring may be SANTOPRENE® (SANTOPRENE is a registered trademark of Monsanto Company Corporation), which is manufactured by ExxonMobil Chemical. It should be appreciated that other materials can be employed for the sealing ring.

[0064] In this illustrated example embodiment, the sealing plate 250 (as shown in Figures 3A, 3B, 4, 17, 18, and 19) is generally cylindrical and has a first or bottom side 250a and an opposite second or top side 250b. The sealing plate 250 generally includes an outer or first ring 251 and an inner or second ring 253. The outer or first ring 251 is generally cylindrical and is configured to fit into the cylindrical sealing plate receiving channel 246 of the sealing ring 240 as best shown in Figures 3A and 3B. The inner or second ring 253 is integrally connected to and extends inwardly from the outer or first ring 251. The inner or second ring 253 defines a central stem receiving opening 254 configured such that the shaft 220 of the stem 202 axially extends through the sealing plate 240. The sealing plate 250 includes spaced apart downwardly extending locking legs 258a, 258b, 258c, and 258d to enable the sealing plate 250 to be locked into the base 204 of the stem 202 and thus maintain the compressible sealing ring 240 to the base 204 of the stem 202. The locking legs 258a, 258b, 258c, and 258d are configured to be inserted into the locking leg receivers 210a, 210b, 210c, and 210d defined by the base 204 as partially shown in Figures 3A and 3B. In this illustrated embodiment, a friction fit is

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provided between the locking legs 258a, 258b, 258c, and 258d and the walls of the base 204 that define the locking leg receivers 210a, 210b, 210c and 210d.

[0065] In this illustrated embodiment, the sealing plate 250 is one piece and molded from a plastic such as polyethylene. It should be appreciated that the sealing plate can be made from other suitable materials, made in other suitable manners, and made from two or more connectable pieces in accordance with the present disclosure. It should be appreciated that the one or more of the components of the sealing plate can be alternatively configured in accordance with the present disclosure

[0066] It should be appreciated from the above and as shown in Figures 1, 2, 3A, 3B, and 4, that to assemble the sealing assembly 200 before attaching the sealing assembly 200 to the housing 110, the flexible compressible sealing ring 240 is positioned in the base 204 of the stem 202 and the sealing plate 250 is used to secure the sealing ring 240 to the base 204 of the stem 202.

[0067] In this illustrated example embodiment, the spring 270 (as shown in Figures 1, 3A, 3B, and 4) biases the stem 202 toward the closed position (as specifically shown in Figures 2 and 3A) relative to housing 101 when the sealing assembly 200 is attached to the housing 110. In this illustrated embodiment, the spring 270 is made of steel such as a stainless steel or other corrosion resistant steel. It should be appreciated that the spring can be made from other suitable materials in accordance with the present disclosure.

[0068] In this illustrated example embodiment, the locking pin 280 (as shown in Figures 1, 3A, 3B, 4, 20A, 20B, 21, 22A, 22B, and 23) is securely lockably connectable into the stem 202 and particularly received in and securely locked into the locking pin receiver 234 of the stem 202 to retain the spring 270 and the stem 202 connected to the housing 110, and to enable a user or a

device to move the stem 202 from one of the normally closed positions to one of the plurality of open positions. It should be appreciated that in this illustrated embodiment, the locking pin 280 is configured to not be readily or easily removable from the stem 202. In certain embodiments, a suitable adhesive or glue is employed to further securely attach the locking pin 280 to the stem 202.

[0069] In this illustrated example embodiment, the locking pin 280 (as shown in Figures 1, 3A, 3B, 4, 20A, 20B, 21, 22A, 22B, and 23) includes: (a) a generally cross(+) shaped head 282 including four integrally connected head sections 282a, 282b, 282c, and 282d; (b) a generally cross(+) shaped neck 284 including four integrally connected neck sections 284a, 284b, 284c, and 284d; (c) a plurality of locking ribs or lips 286a, 286b, 286c, 286d, 286e, 286f, 286g, and 286h; and (d) a nose 288.

[0070] More specifically, in this illustrated example embodiment, (a) the head section 282a is integrally connected to the neck section 284a; (b) the head section 282b is integrally connected to the neck section 284b; (c) the head section 282c is integrally connected to the neck section 284c; and (d) the head section 282d is integrally connected to the neck section 284d.

[0071] In this illustrated example embodiment, (a) the locking ribs or lips 286a and 286b are integrally connected to and transversely extend from one side of the neck section 284d; and (b) the locking ribs or lips 286c and 286d are integrally connected to and transversely extend from the opposite side of the neck section 284d. In this illustrated example embodiment, (a) the locking ribs or lips 286e and 286f are integrally connected to and transversely extend from one side of the neck section 284b; and (b) the locking ribs or lips 286g and 286h are integrally connected to and transversely extend from the opposite side of the neck section 284b.

[0072] In this illustrated example embodiment, the nose 288 extends longitudinally from the neck 284.

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[0073] In this illustrated embodiment, the locking pin 280 is one piece and molded from a plastic such as polyethylene. It should be appreciated that the locking pin can be made from other suitable materials, made in other suitable manners, and made from two or more connectable pieces in accordance with the present disclosure. It should be appreciated that the one or more of the components of the locking pin can be alternatively configured in accordance with the present disclosure.

[0074] In this illustrated example embodiment, the locking pin 280 can be inserted into and locked into the stem 202 in two different orientations.

[0075] In one such orientation, (a) the head section 282a is positioned between arm member or hand 224c and arm member or hand 228c; (b) the head section 282b is positioned between arm member or hand 228c and arm member or hand 232c; (c) the head section 282c is positioned between arm member or hand 232c and arm member or hand 236c; and (d) the head section 282d is positioned between arm member or hand 236c and arm member or hand 224c.

[0076] In this orientation, (e) the neck section 284a is positioned between first arm member 224b and the first arm member 228b; (f) the neck section 284b is positioned between first arm member 228b and the first arm member 232b; (g) the neck section 284c is positioned between first arm member 232b and first arm member 236b; and (h) the neck section 284d is positioned between first arm member 236b and first arm member 224b.

[0077] In this orientation, (i) the neck section 284a is also positioned between second arm member 224a and the second arm member 228a; (j) the neck section 284b is also positioned between second arm member 228a and the second arm member 232a; (k) the neck section 284c is also positioned between second arm member 232a and second arm member 236a; and (l) the

neck section 284d is also positioned between second arm member 236a and second arm member 224a.

[0078] In this orientation, (m) the locking rib or lip 286a is positioned in the locking notch 224e; (n) the locking rib or lip 286b is positioned in locking notch 224f; (o) the locking rib or lip 286c is positioned in the locking notch 236e; and (p) the locking rib or lip 286d is positioned in locking notch 236f.

[0079] In this orientation, (q) the locking rib or lip 286e is positioned in the locking notch 228e; (r) the locking rib or lip 286f is positioned in locking notch 228f; (s) the locking rib or lip 286g is positioned in the locking notch 232e; and (t) the locking rib or lip 286h is positioned in locking notch 232f.

[0080] In this orientation, the nose 288 is positioned in the locking pin nose receiving area 221a defined by the stem 202.

[0081] In this orientation, the multiple respective engagements between upper surfaces of the locking ribs or lips 286a, 286b, 286c, 286d, 286e, 286f, 286g, and 286h and the lower surfaces of upper portion 222 of the shaft 220 of the stem 202 that partially define the notches 224e, 224f, 228e, 228f, 232e, 232f, 236e, and 236f co-act to provide a secure engagement between the locking pin 280 and the shaft 220 of the stem 202 when the locking pin 280 is inserted into the shaft 220 of the stem 202. This prevents the locking pin 280 from coming out of the shaft 220.

[0082] In this illustrated example embodiment, the locking pin 280 can be rotated 180 degrees to provide the other orientation in which the locking pin 280 can be inserted into the shaft 220 of the stem 202.

[0083] In this illustrated embodiment, the locking ribs or lips 286a, 286b, 286c, 286d, 286e, 286f, 286g, and 286h are positioned on two of the opposing neck sections 284b and 284d. It should be appreciated that in alternative embodiments of the present disclosure, the locking ribs or lips (and

associated notches) can be alternatively positioned such as on each of the neck sections.

[0084] It should also be appreciated that in alternative embodiments of the present disclosure, the quantity of the locking ribs or lips (and associated notches) can vary.

[0085] It should further be appreciated that in alternative embodiments of the present disclosure, the shape or configuration of the locking ribs or lips (and associated notches) can vary.

[0086] It should also be appreciated that in this illustrated embodiment, the sealing assembly 200 is formed from five individually formed components. It should be appreciated that the sealing assembly can be made in other suitable manners and made from more or less than five pieces in accordance with the present disclosure. It should be appreciated that one or more of the components of the sealing assembly can be alternatively configured in accordance with the present disclosure.

[0087] As mentioned above and as generally shown in Figures 1, 2, 3A, and 3B, the sealing assembly 200 is moveable relative to the housing 110, and configured to be in: (i) any one of a plurality of closed resting positions to prevent a gas such as air to pass through the housing 110, and (ii) any one of a plurality of different open positions to enable gas such as air to pass through the housing 110. Figure 3A shows one of the closed resting positions. Figure 3B shows one of the open positions.

[0088] Although not illustrated, the valve of the present disclosure may include a cap or a combined attachment ring and cap assembly. The combined attachment ring and cap assembly is configured to assist in attaching the valve to an inflatable object such as a dunnage bag, and is configured to prevent contaminants from entering the housing and the inflatable object through the valve.

[0089] It should be appreciated that the embodiment of the valve illustrated in the accompanying figures employs one example configuration of components and one example size and shape of each of the components. It should be appreciated that other embodiments of the valve may employ different configurations of the components and/or components of different sizes or shapes.

[0090] In various embodiments, the present disclosure also provides an inflatable object including an inflatable/deflatable body including one or more walls; and inflation/deflation valve mounted to the body, wherein the valve is the valve described herein in accordance with the present disclosure.

[0091] It should thus be appreciated from the above that the present disclosure provides a valve configured to be attached to an inflatable object, said valve comprising: a housing defining a gas passageway; and a sealing assembly connected to and moveable relative to the housing to: (a) a resting closed position that prevents gas from passing through the housing, and (b) an open position that enables gas to pass through the housing, the sealing assembly including: (i) a stem, (i) a sealing ring positionable in and connected to the stem, (iii) a sealing plate attached to the stem, (iv) a spring, and (v) a locking pin positioned in and locked into the stem.

[0092] In various such embodiments of the valve, the locking pin includes a plurality of locking ribs or lips, and the stem includes a shaft that defines a plurality of notches configured to receive the locking lips or ribs of the locking pin.

[0093] In various such embodiments of the valve, the shaft has a plurality of spaced apart locking arms that are each configured to receive and be securely lockingly engaged by the locking pin.

[0094] In various such embodiments of the valve, the locking arms define the plurality of locking notches.

[0095] In various such embodiments of the valve, the locking pin includes: (a) a generally cross shaped head including four connected head sections; and (b) a generally cross shaped neck including four connected neck sections.

[0096] In various such embodiments of the valve, the plurality of locking ribs or lips extend from at least two of the neck sections.

[0097] In various such embodiments of the valve, one of the locking ribs or lips is integrally connected to and transversely extends from one side of one of the neck sections and another one of the locking ribs or lips is integrally connected to and transversely extends from an opposite side of said neck section.

[0098] In various such embodiments of the valve, two of the locking ribs or lips are integrally connected to and transversely extend from one side of one of the neck sections and another two of the locking ribs or lips are integrally connected to and transversely extend from an opposite side of said neck section.

[0099] In various such embodiments of the valve, the housing includes: (a) a cylindrical wall; (b) a locking lip connected to and extending outwardly from an outer surface of the cylindrical wall; (c) an annular ring connected to and extending outwardly from the outer surface of the cylindrical wall; (d) an attachment flange connected to and extending outwardly from the outer surface of the cylindrical wall; and (e) a sealing seat connected to and extending from the attachment flange.

[00100] In various such embodiments of the valve, the stem includes: (a) a base, and (b) a shaft connected to extending from the base and including a locking pin receiver opposite the base.

[00101] It should also be appreciated from the above that the present disclosure provides a valve sealing assembly stem for a valve configured to be

attached to an inflatable object, said valve sealing assembly stem connectable to a housing of the valve, said valve sealing assembly stem comprising: a base; and a shaft connected to and extending from the base, the shaft including a locking pin receiver opposite the base, the locking pin receiver having a plurality of spaced apart locking arms that are each configured to receive and be securely lockingly engaged by the locking pin.

[00102] In various such embodiments of the valve sealing assembly stem, the locking arms define a plurality of locking notches configured to receive locking lips or ribs of a locking pin.

[00103] It should also be appreciated from the above that the present disclosure provides an inflatable object comprising: an inflatable/deflatable body including one or more walls; and a valve mounted to the body, the valve including: a housing defining a gas passageway; and a sealing assembly connected to and moveable relative to the housing, and configured to be in: a sealing assembly connected to and moveable relative to the housing to: (a) a resting closed position that prevents gas from passing through the housing; and (b) an open position that enables gas to pass through the housing, the sealing assembly including: (i) a stem, (i) a sealing ring positionable in and connected to the stem, (iii) a sealing plate attached to the stem, (iv) a spring, and (v) a locking pin positioned in and locked into the stem.

[00104] In various such embodiments of the inflatable object, the locking pin includes a plurality of locking ribs or lips, and the stem includes a shaft that defines a plurality of notches configured to receive locking lips or ribs of the locking pin.

[00105] In various such embodiments of the inflatable object, the stem includes a shaft having a plurality of spaced apart locking arms that are each configured to receive and be securely lockingly engaged by the locking pin.

[00106] In various such embodiments of the inflatable object, the locking arms define the plurality of locking notches.

[00107] In various such embodiments of the inflatable object, the locking pin includes: (a) a generally cross shaped head including four connected head sections; and (b) a generally cross shaped neck including four connected neck sections.

[00108] In various such embodiments of the inflatable object, the plurality of locking ribs or lips extend from at least two of the neck sections.

[00109] In various such embodiments of the inflatable object, the locking ribs or lips is integrally connected to and transversely extends from one side of one of the neck sections and another one of the locking ribs or lips is integrally connected to and transversely extends from an opposite side of said neck section.

[00110] In various such embodiments of the inflatable object, two of the locking ribs or lips are integrally connected to and transversely extend from one side of one of the neck sections and another two of the locking ribs or lips are integrally connected to and transversely extend from an opposite side of said neck section.

[00111] In various such embodiments of the inflatable object, the housing includes: (a) a cylindrical wall; (b) a locking lip connected to and extending outwardly from an outer surface of the cylindrical wall; (c) an annular ring connected to and extending outwardly from the outer surface of the cylindrical wall; (d) an attachment flange connected to and extending outwardly from the outer surface of the cylindrical wall; and (e) a sealing seat connected to and extending from the attachment flange.

[00112] In various such embodiments of the inflatable object, the stem includes: (a) a base; and (b) a shaft connected to and extending from the base and including a locking pin receiver opposite the base.

[00113] It should be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present disclosure, and it should be understood that this application is to be limited only by the scope of the appended claims.

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The invention claimed is:

1. A valve for an inflatable object, the valve comprising:

a housing defining a gas passageway therethrough;

a sealing assembly mounted to and moveable relative to the housing between a closed position that prevents gas from passing through the housing via the gas passageway and an open position that enables gas to pass through the housing via the gas passageway, the sealing assembly comprising a stem and a sealing ring mounted to the stem wherein the stem comprises a shaft that defines multiple locking-rib-receiving openings;

a spring that biases the sealing assembly to the closed position; and

a locking member lockingly engaged to the stem to retain the spring and the sealing assembly on the housing, wherein the locking member comprises multiple locking ribs, wherein the locking-rib-receiving openings of the shaft are sized and shaped to receive the locking ribs, wherein the sealing ring of the sealing assembly sealingly engages the housing when the sealing assembly is in the closed position and is spaced-apart from the housing when the sealing assembly is in the open position.

2. The valve of claim 1, wherein the shaft comprises multiple spaced-apart locking arms each configured to receive and lockingly engage the locking member.

3. The valve of claim 2, wherein the locking arms define the locking-rib-receiving openings.

4. The valve of claim 1, wherein the locking member comprises a cross-shaped head comprising multiple connected head sections and a cross-shaped neck comprising multiple connected neck sections.

5. The valve of claim 4, wherein the locking ribs extend from at least two of the neck sections.

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6. The valve of claim 4, wherein one of the locking ribs extends from one side of one of the neck sections and another one of the locking ribs extends from an opposite side of that neck section.

7. The valve of claim 4, wherein two of the locking ribs extend from one side of one of the neck sections and another two of the locking ribs extend from an opposite side of that neck section.

8. The valve of claim 1, wherein the housing comprises an annular wall, a sealing seat at a bottom of the wall, and a stem supporter radially inward of an inner surface of the wall.

9. The valve of claim 8, wherein the stem supporter defines a stem-receiving opening, wherein the shaft of the stem of the sealing assembly extends through the stem-receiving opening.

10. The valve of claim 9, wherein the spring is positioned between the stem supporter and a spring-engagement surface of the shaft of the stem of the sealing assembly.

11. The valve of claim 1, wherein the sealing assembly further comprises a sealing plate attached to the stem and retaining the sealing ring in place on the stem.

12. An inflatable object comprising:

an inflatable/deflatable body; and

a valve attached to the body and in fluid communication with an interior of the body, the valve comprising:

a housing defining a gas passageway therethrough;

a sealing assembly mounted to and moveable relative to the housing between a closed position that prevents gas from passing through the housing via the gas passageway and an open position that enables gas to pass through the housing via the gas

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passageway, the sealing assembly comprising a stem and a sealing ring mounted to the stem wherein the stem comprises a shaft that defines multiple locking-rib-receiving openings;

a spring that biases the sealing assembly to the closed position; and

a locking member lockingly engaged to the stem to retain the spring and the sealing assembly on the housing, wherein the locking member comprises multiple locking ribs, wherein the locking-rib-receiving openings of the shaft are sized and shaped to receive the locking ribs, wherein the sealing ring of the sealing assembly sealingly engages the housing when the sealing assembly is in the closed position and is spaced-apart from the housing when the sealing assembly is in the open position.

13. The inflatable object of claim 12, wherein the housing comprises an annular wall, a sealing seat at a bottom of the wall, and a stem supporter radially inward of an inner surface of the wall.

14. The inflatable object of claim 12, wherein the sealing assembly of the valve further comprises a sealing plate attached to the stem and retaining the sealing ring in place on the stem.

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FIG. 1

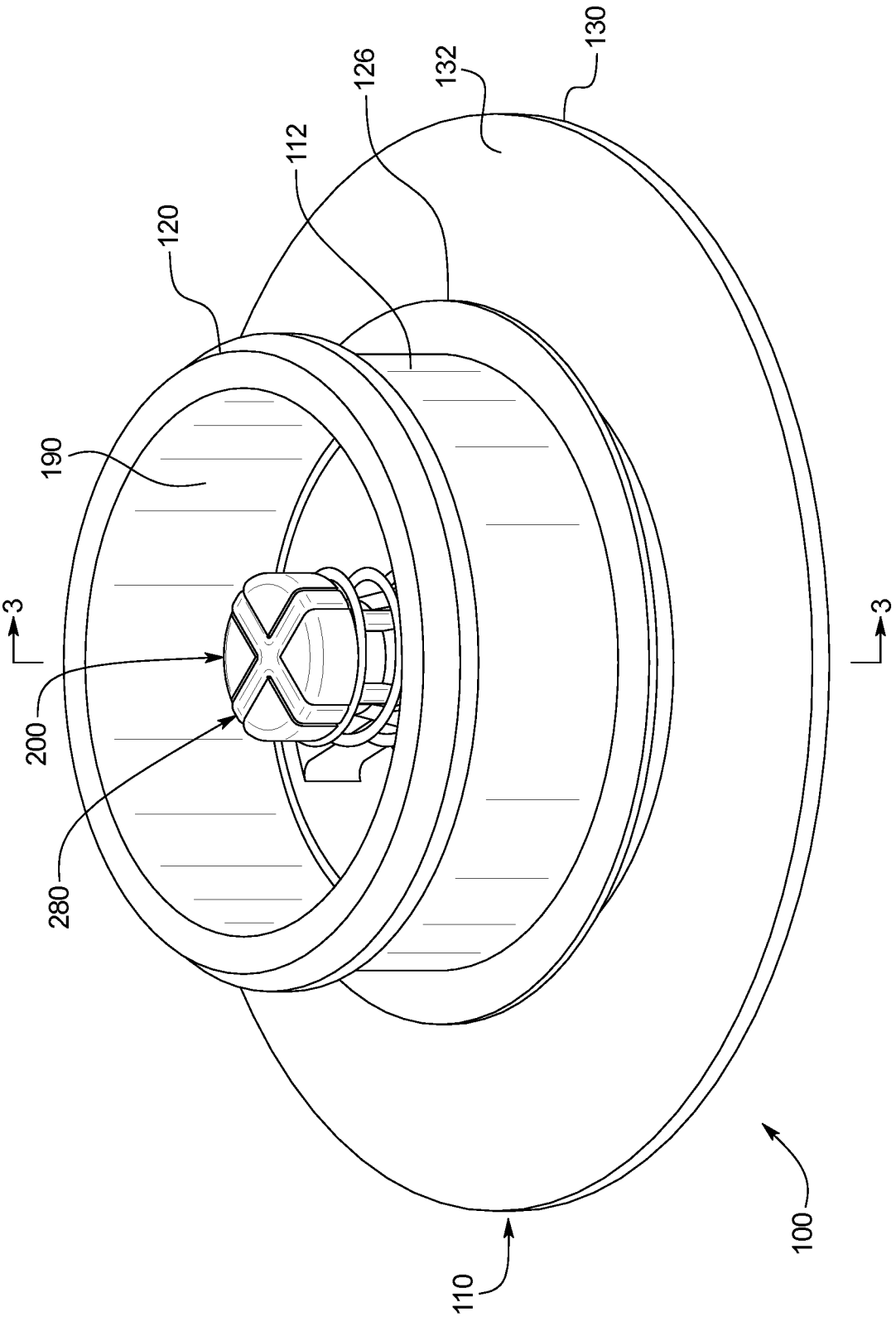

FIG. 2

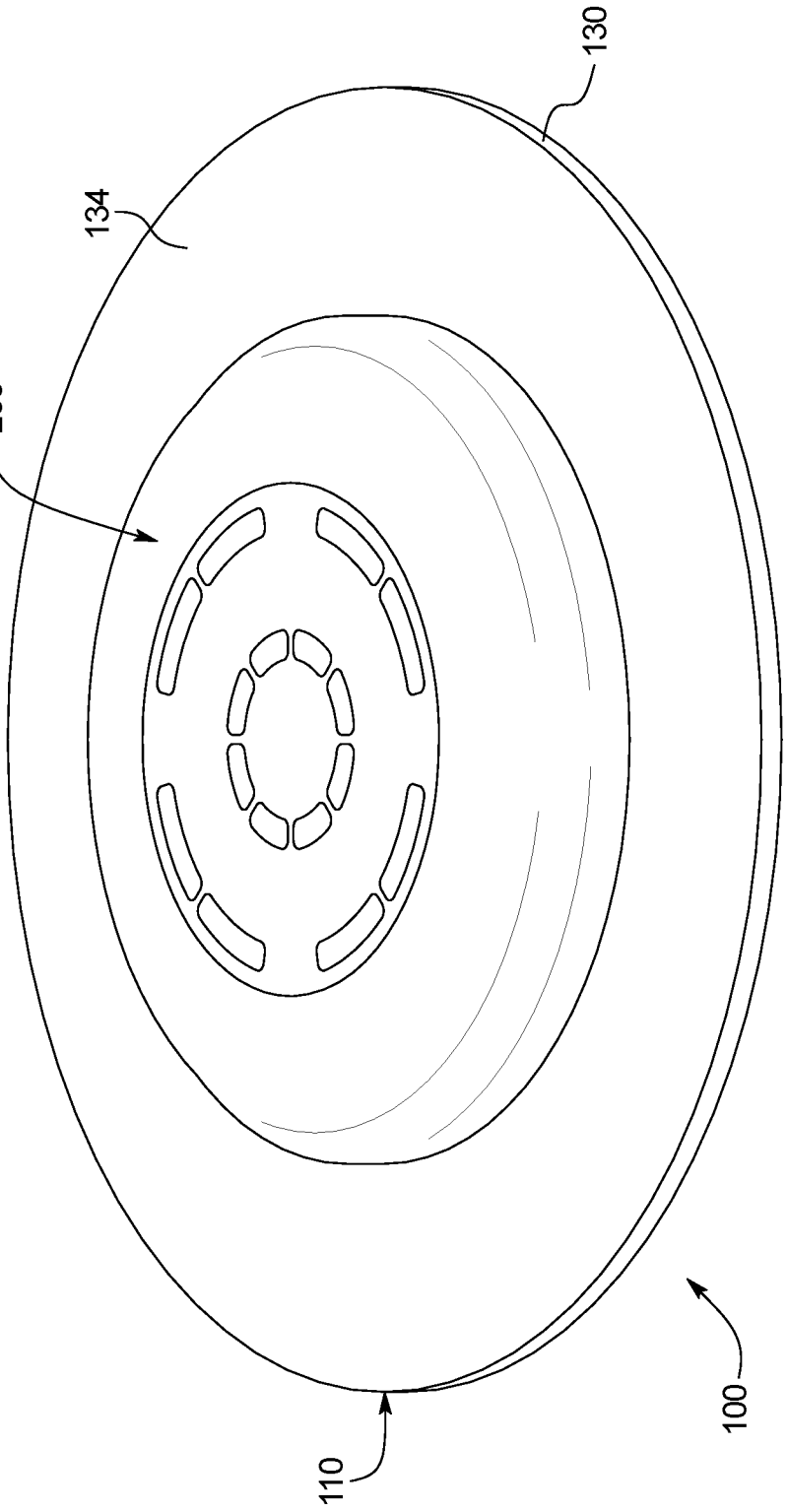

FIG. 3A

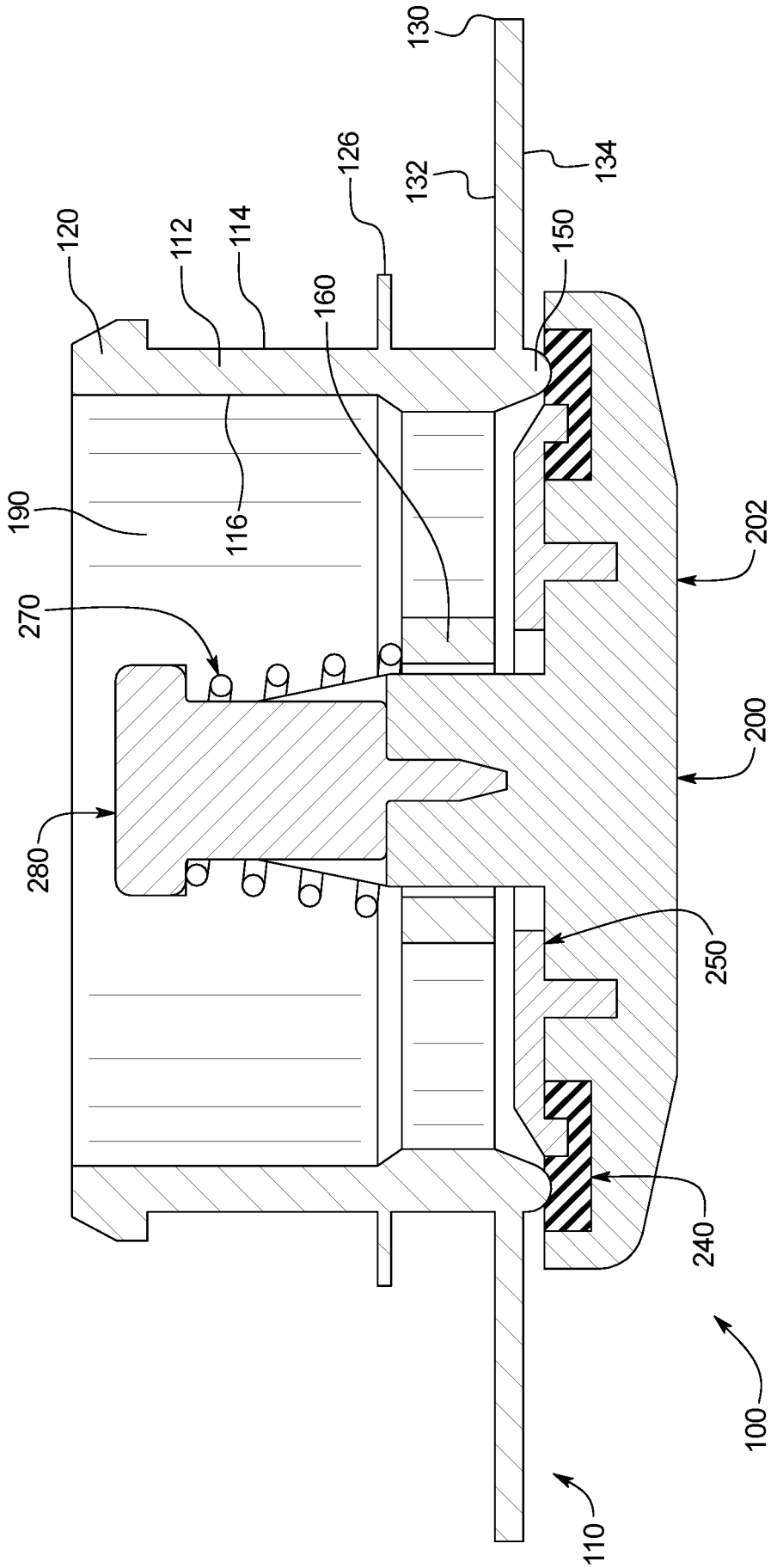
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FIG. 3B

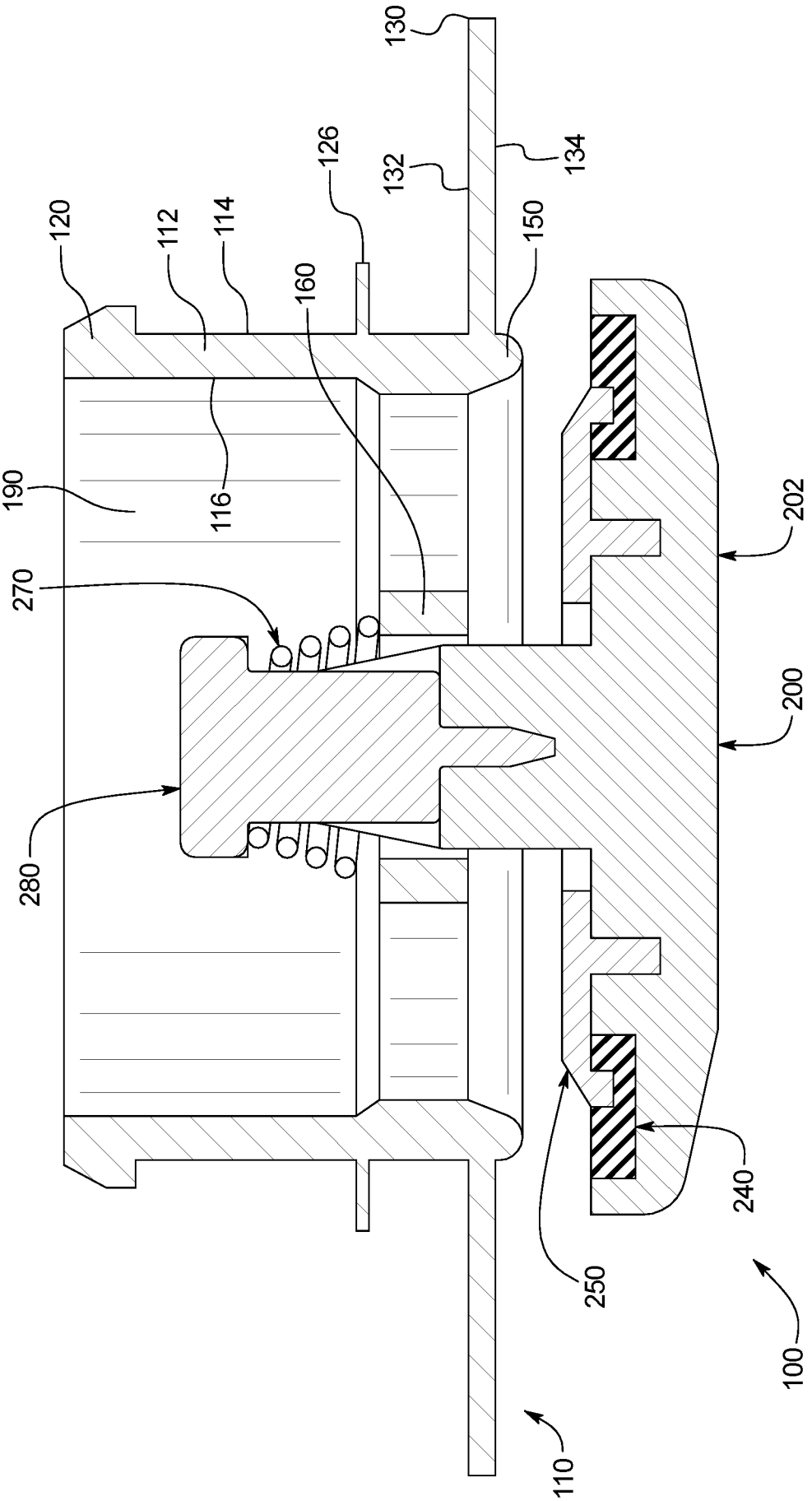
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FIG. 4

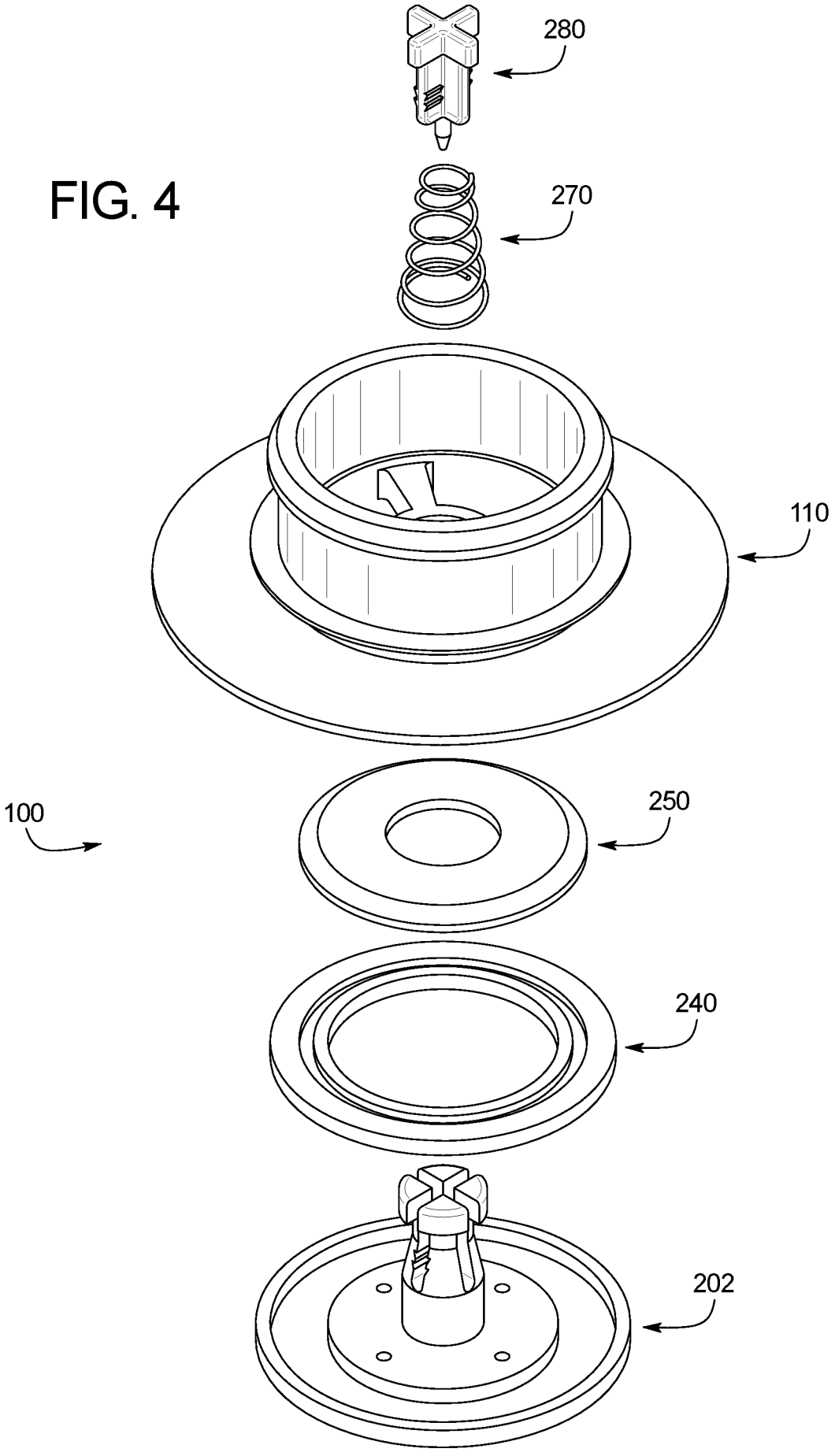


FIG. 5

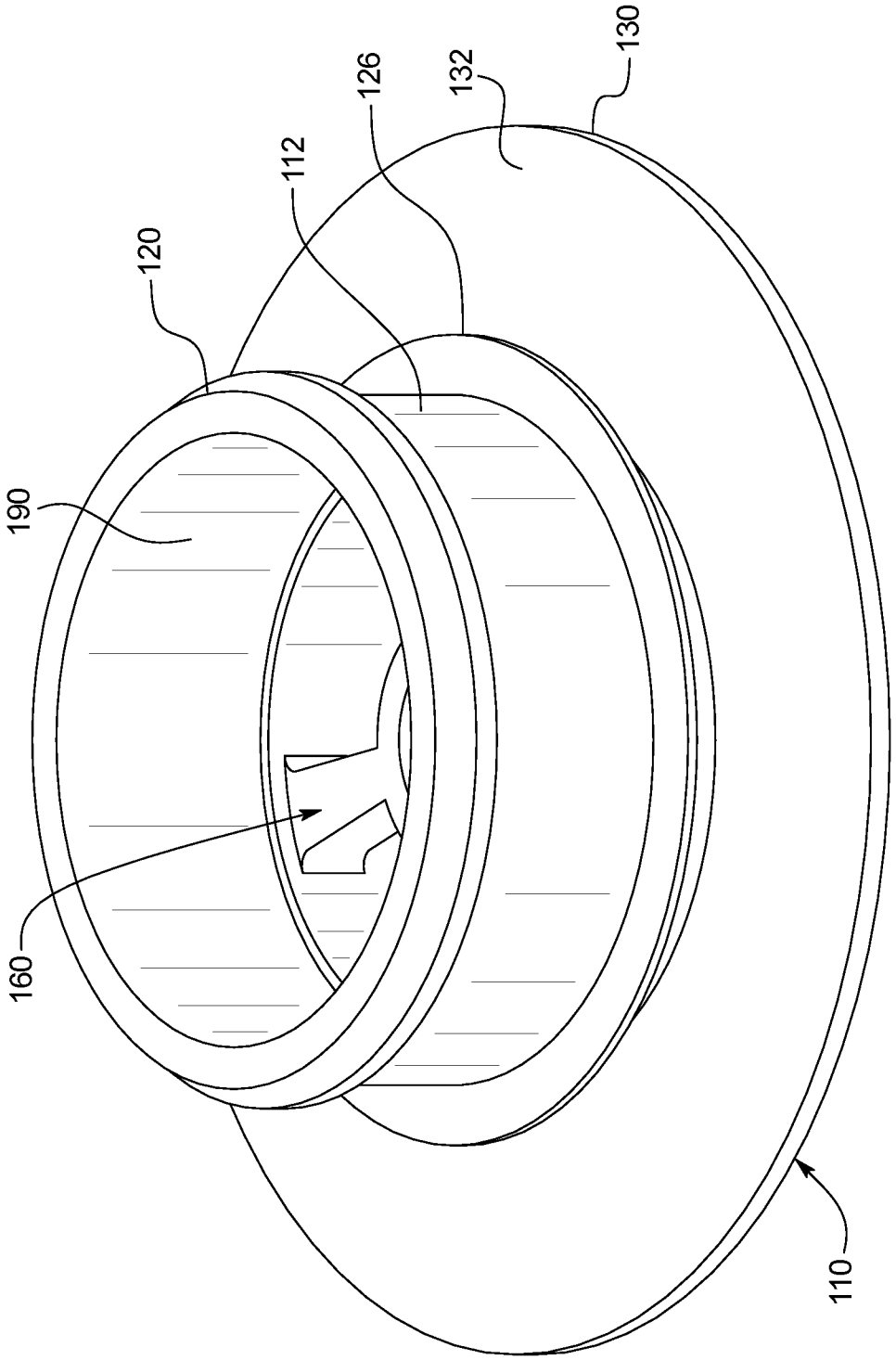
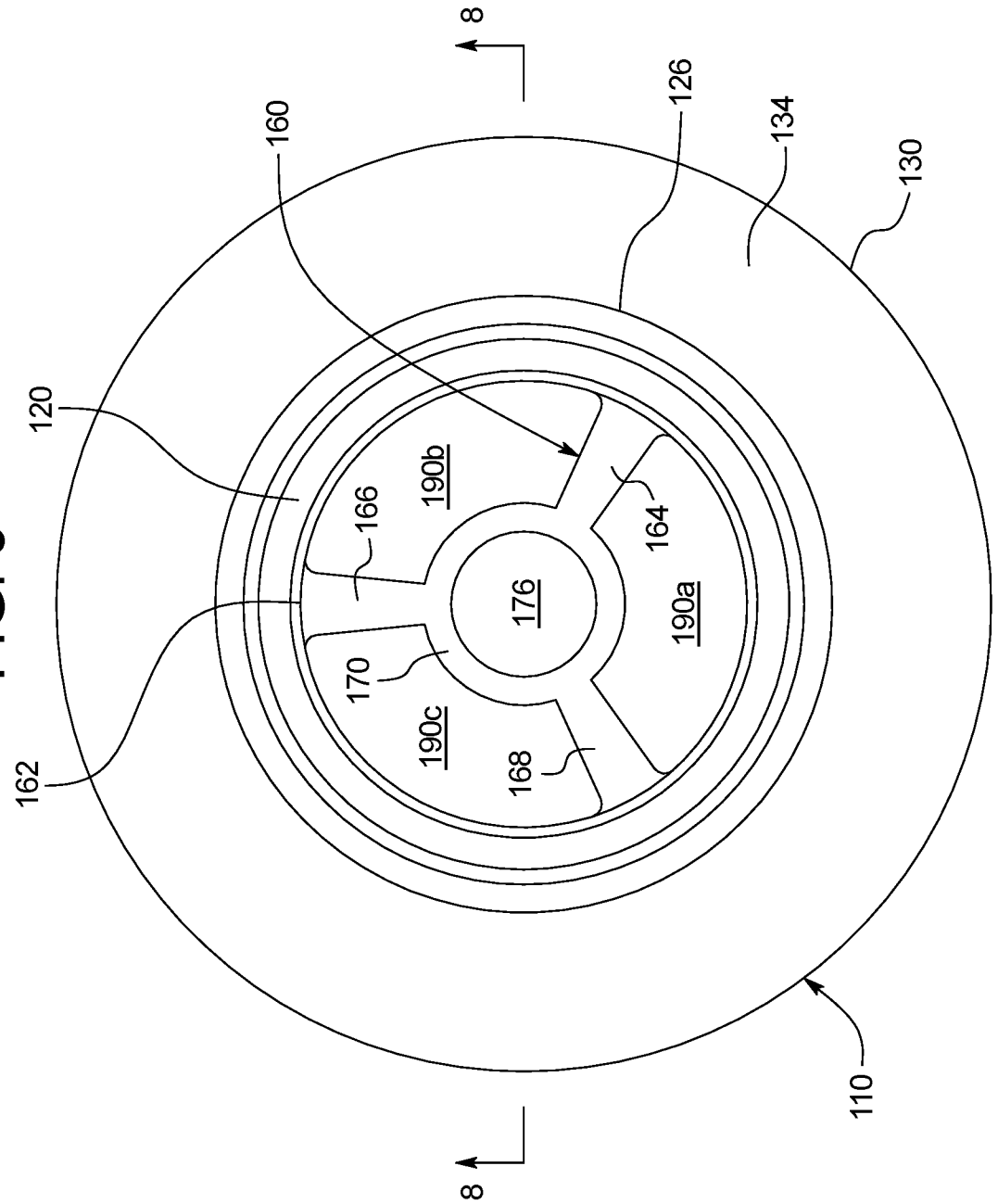


FIG. 6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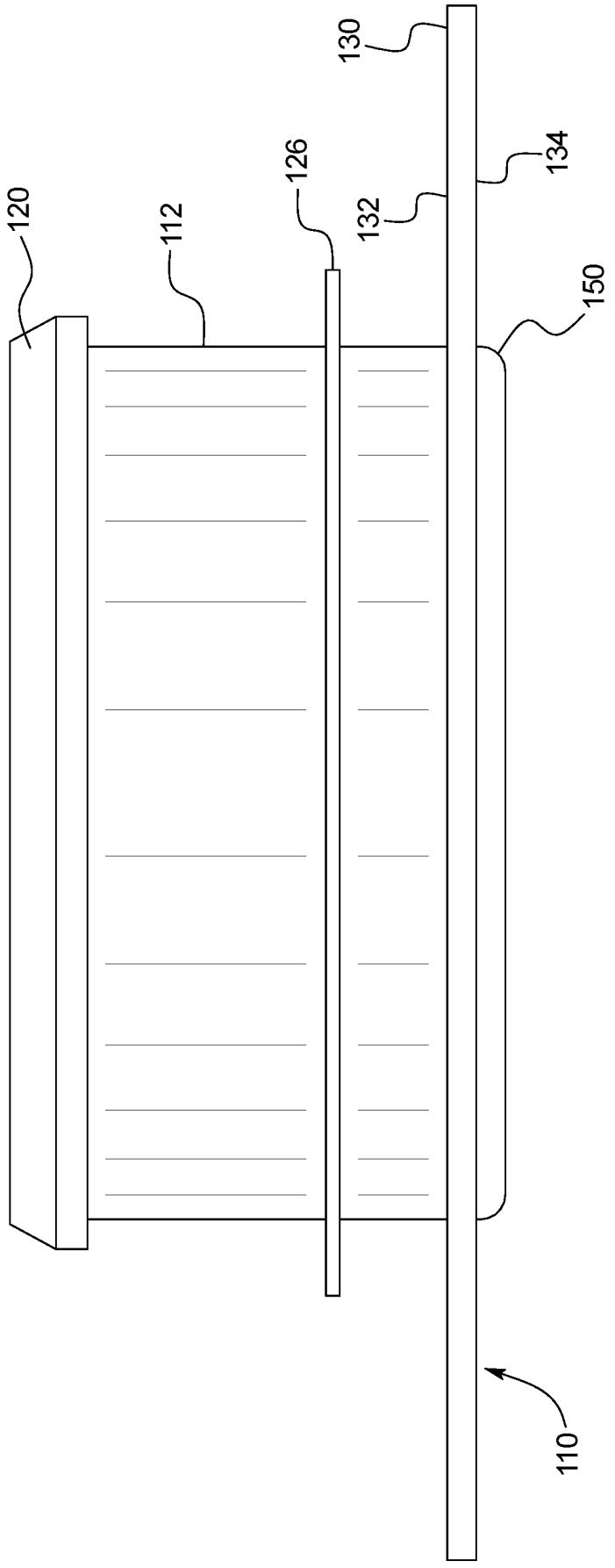
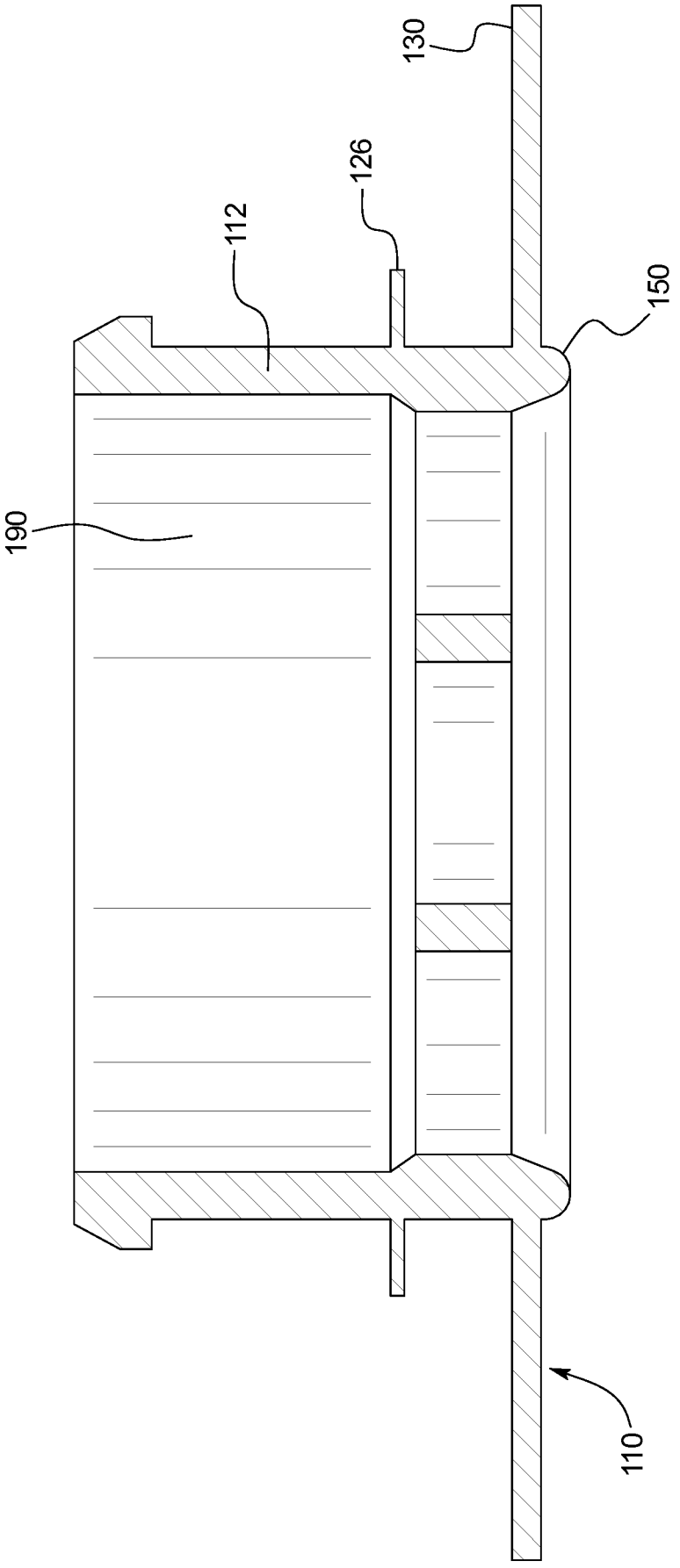
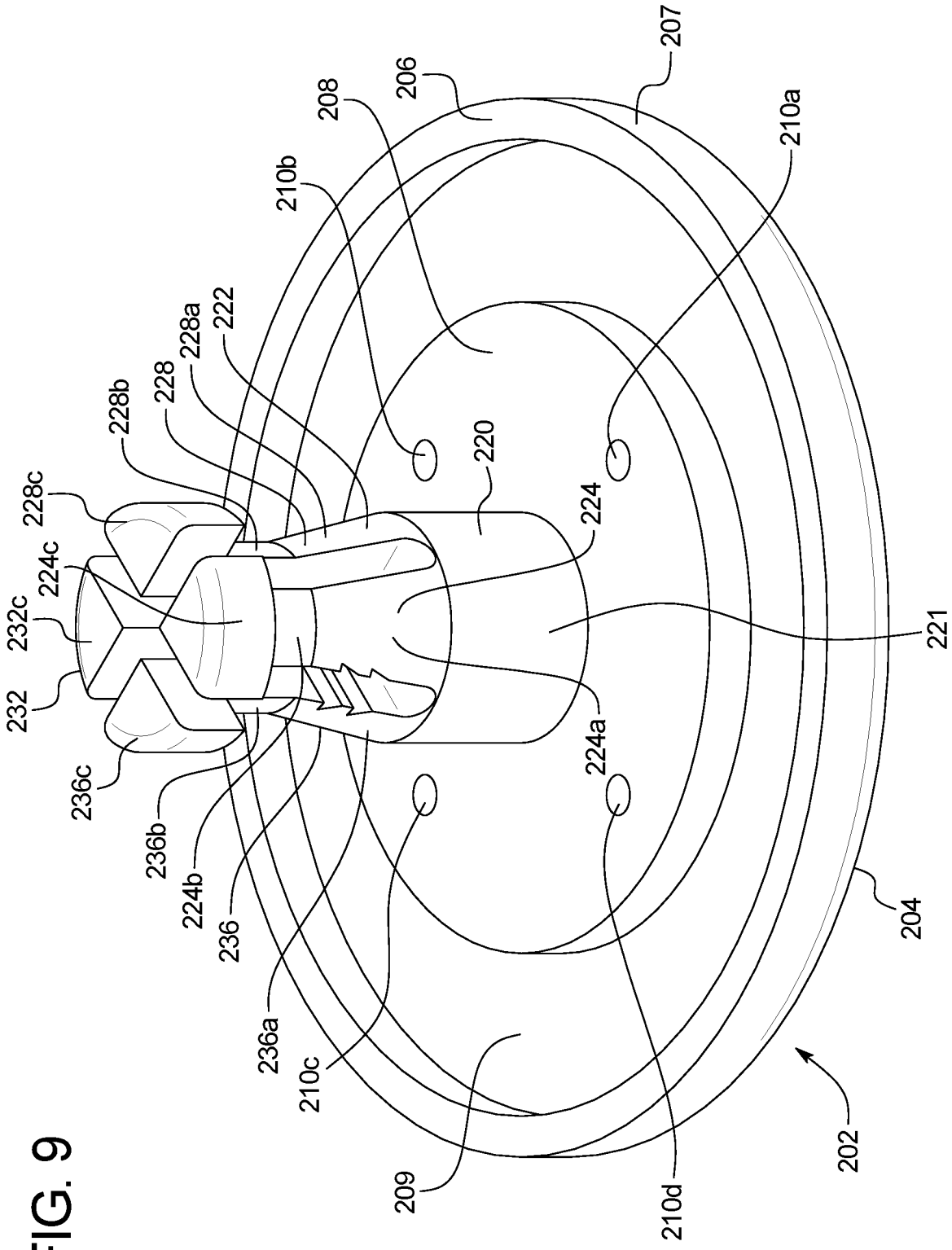


FIG. 7

FIG. 8

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228b
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228c
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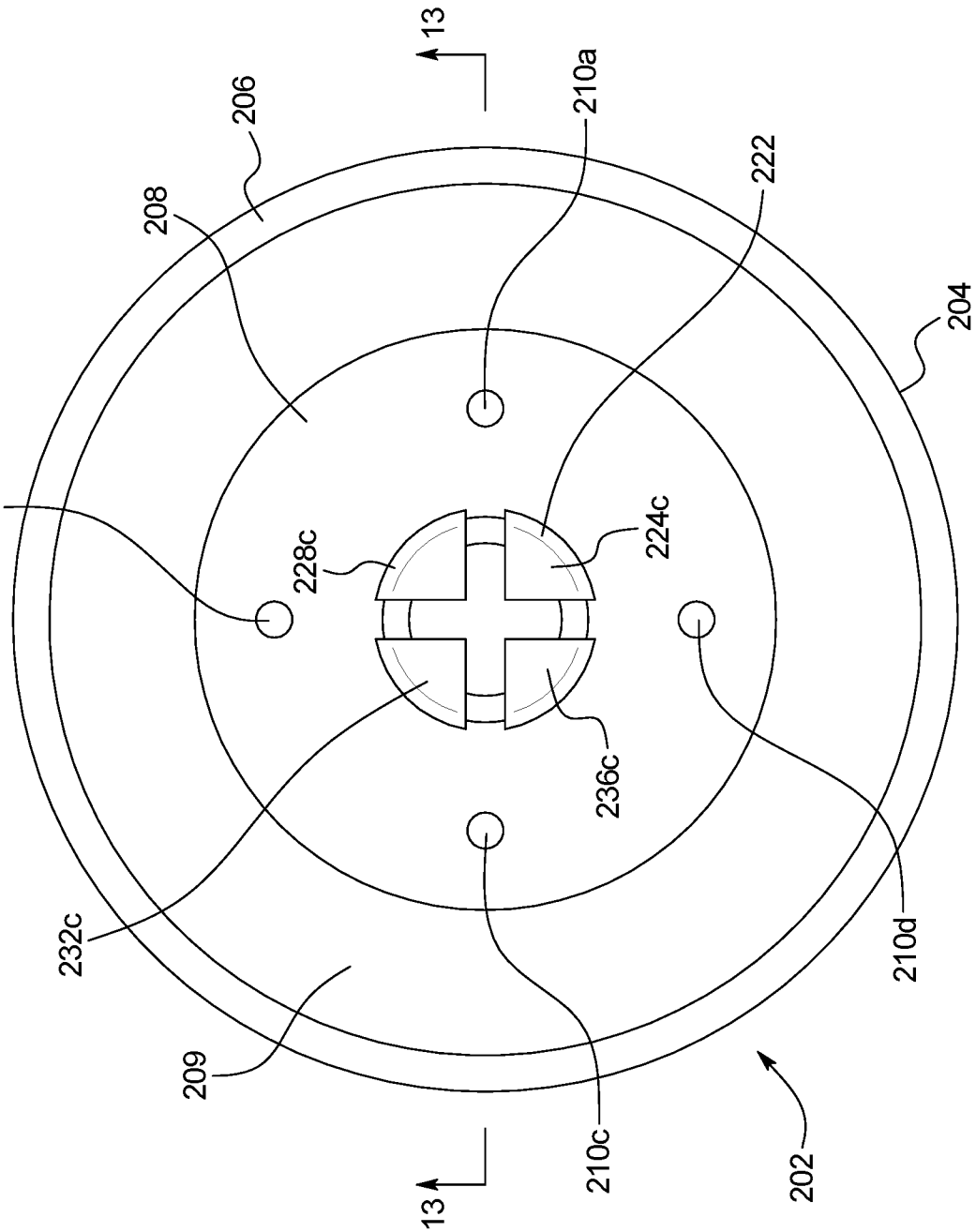
210d
202

FIG. 9

FIG. 10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13

FIG. 11

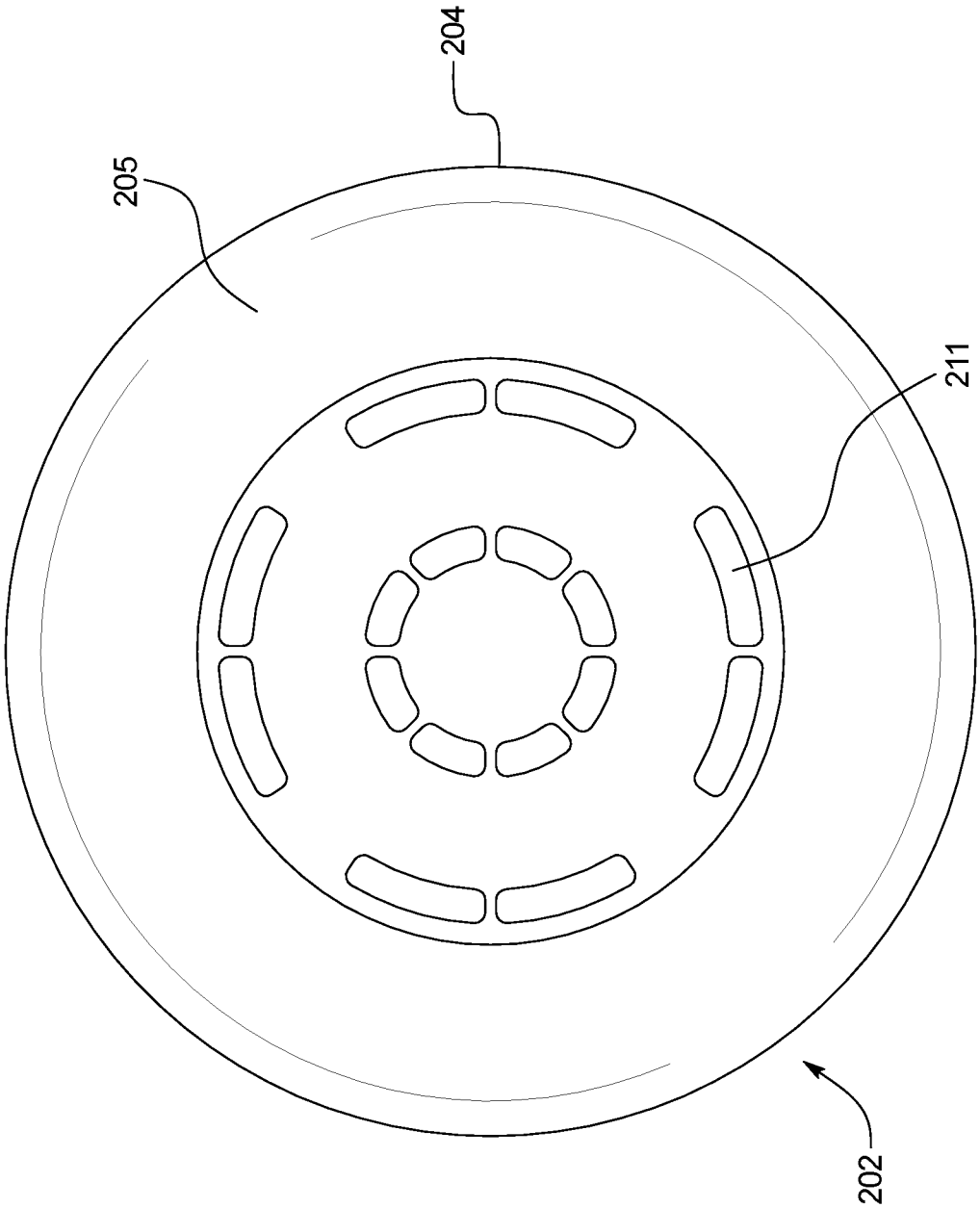

FIG. 12

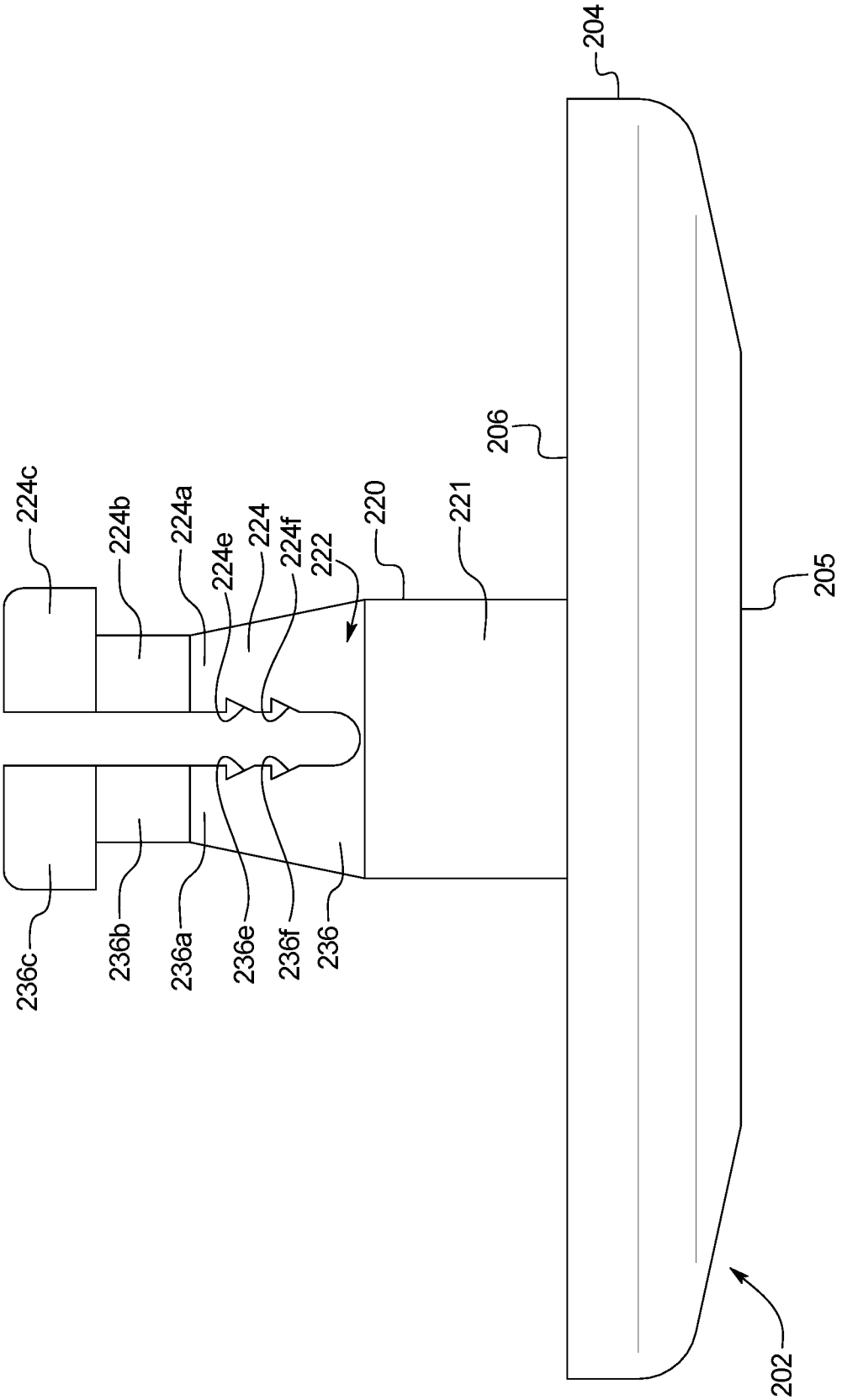
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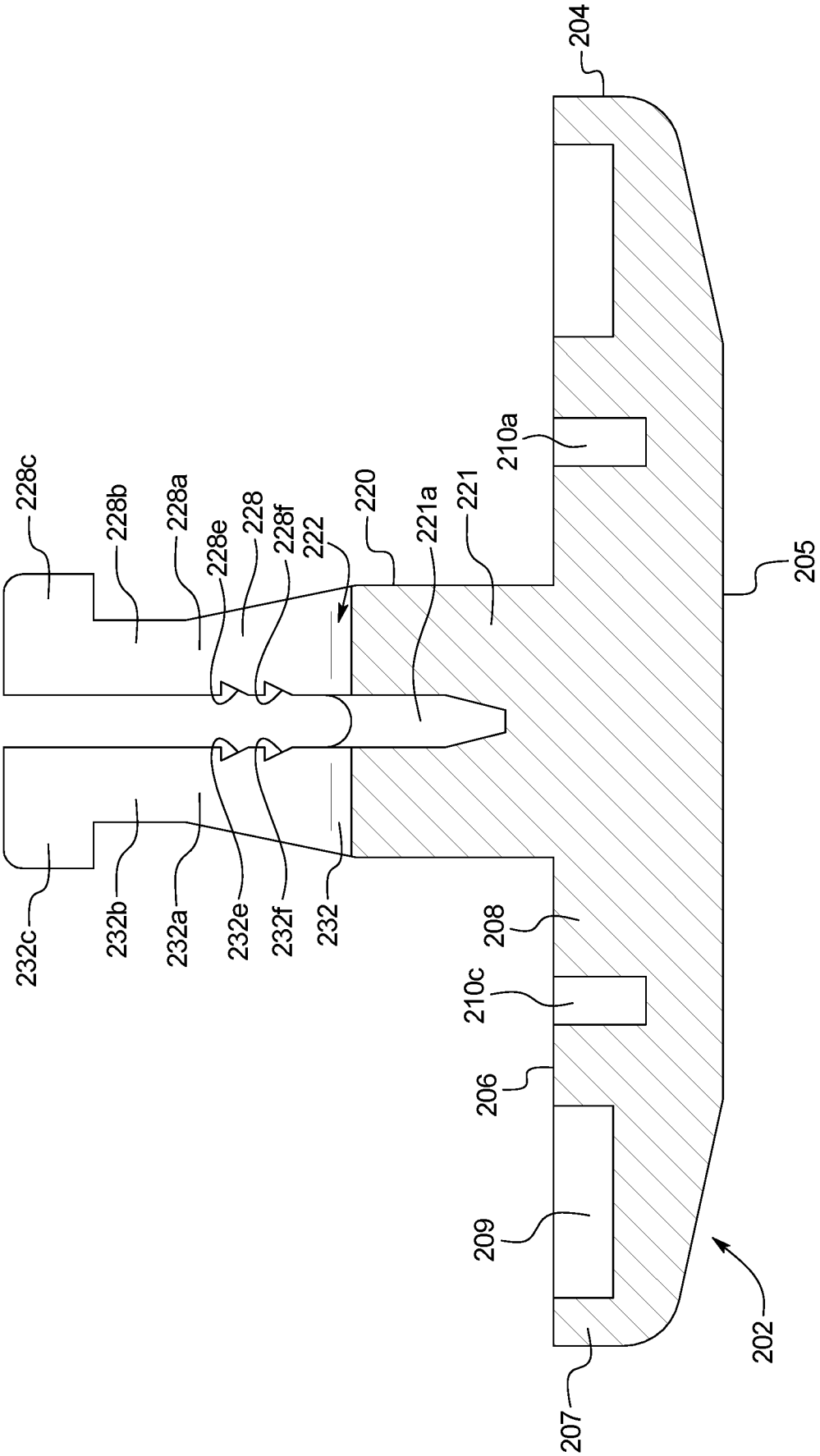
FIG. 13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207
202

FIG. 14

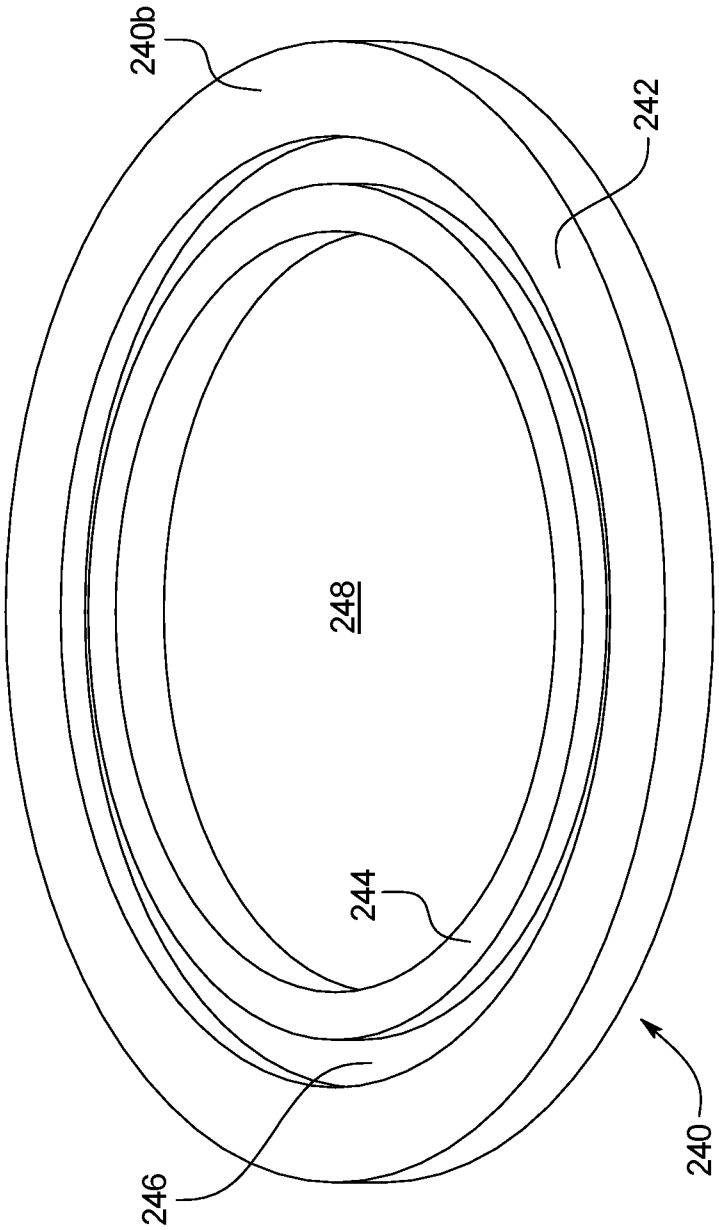

FIG. 15

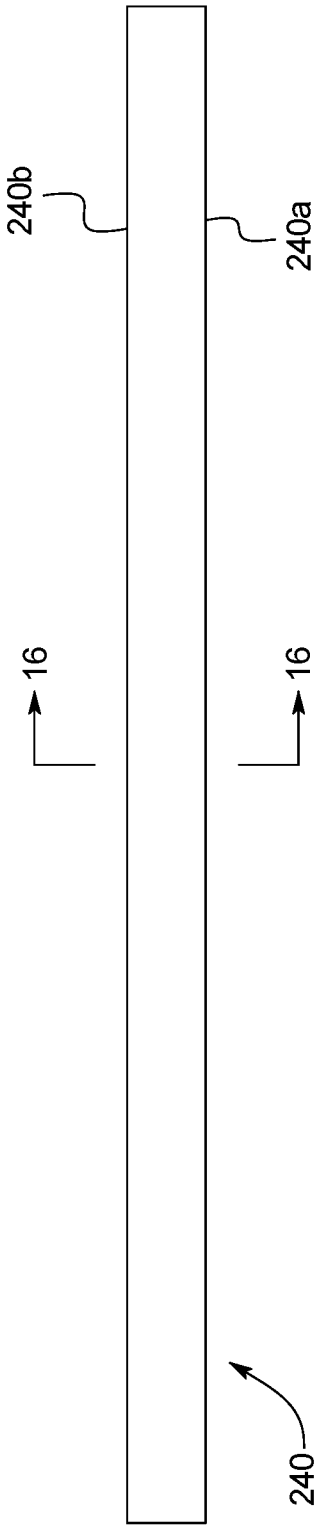

FIG. 16

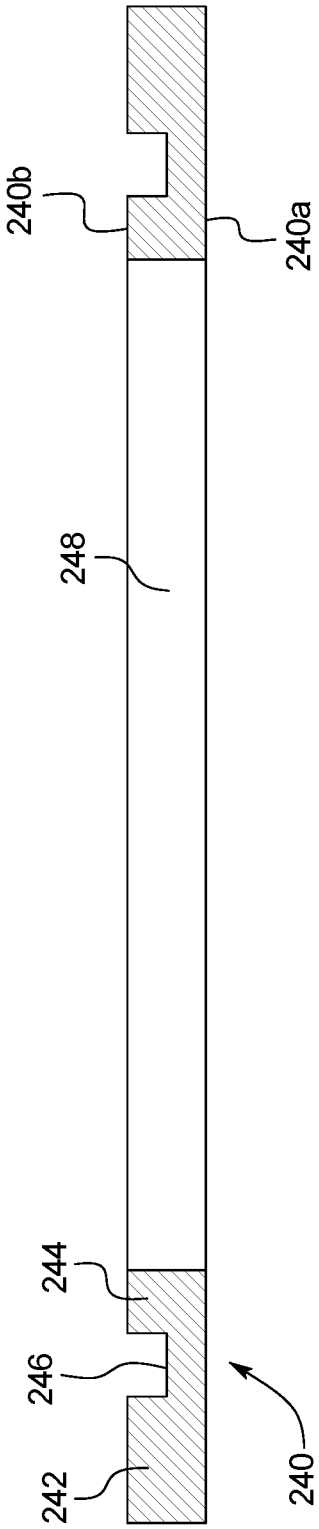

FIG. 17

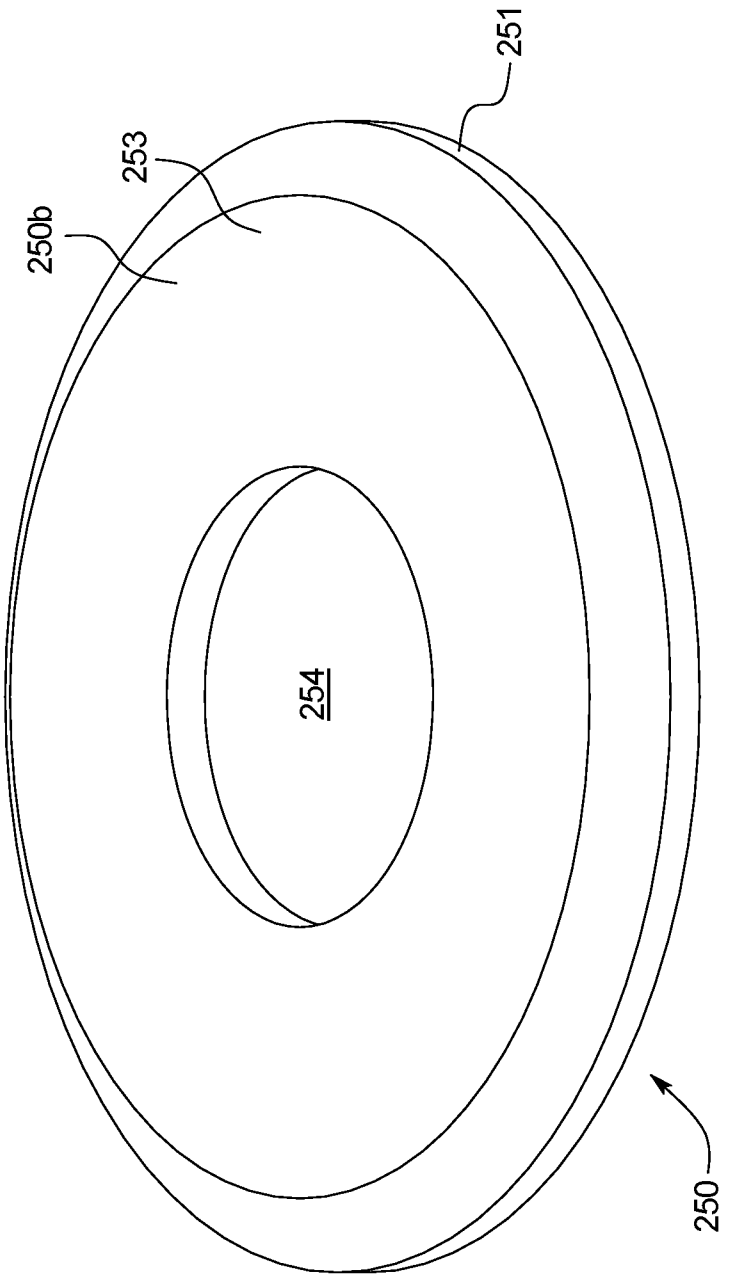

FIG. 18

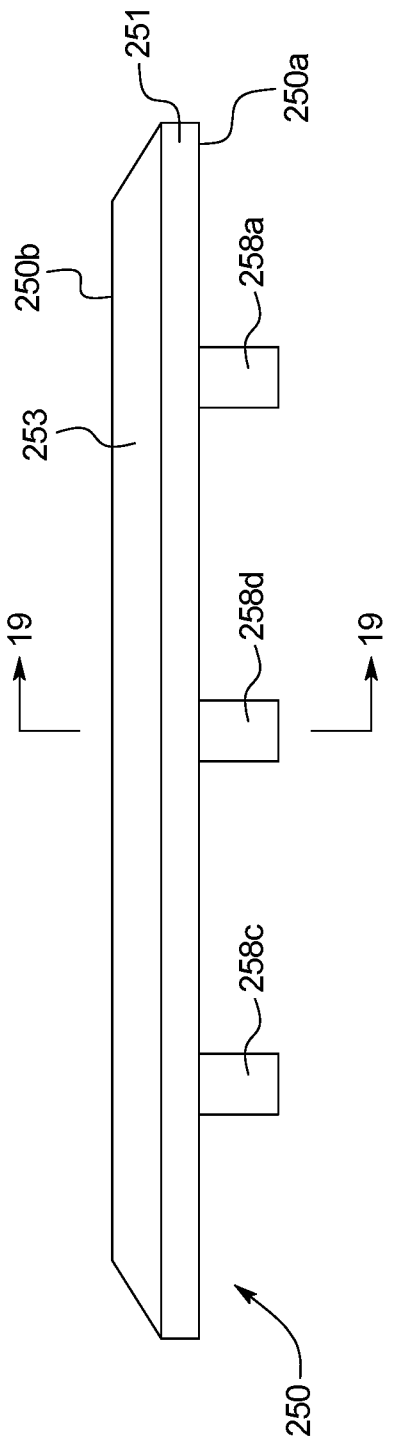
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FIG. 19

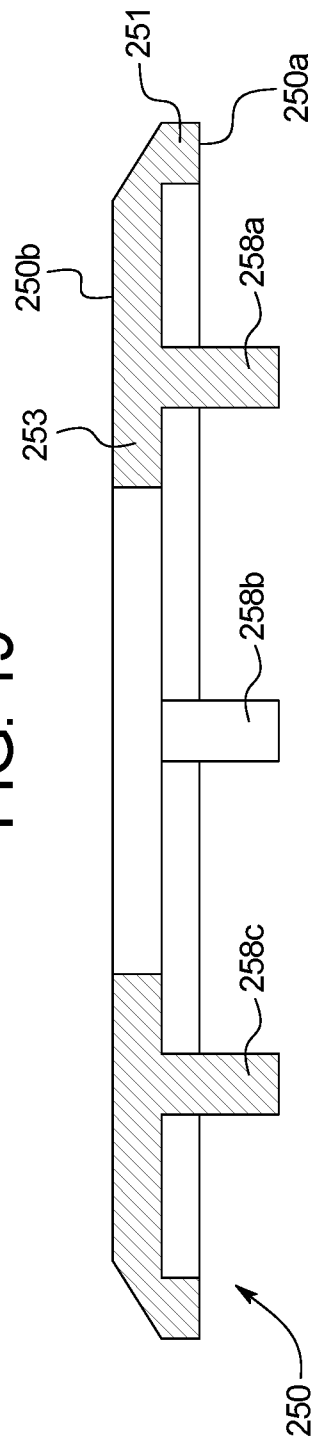
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FIG. 20A

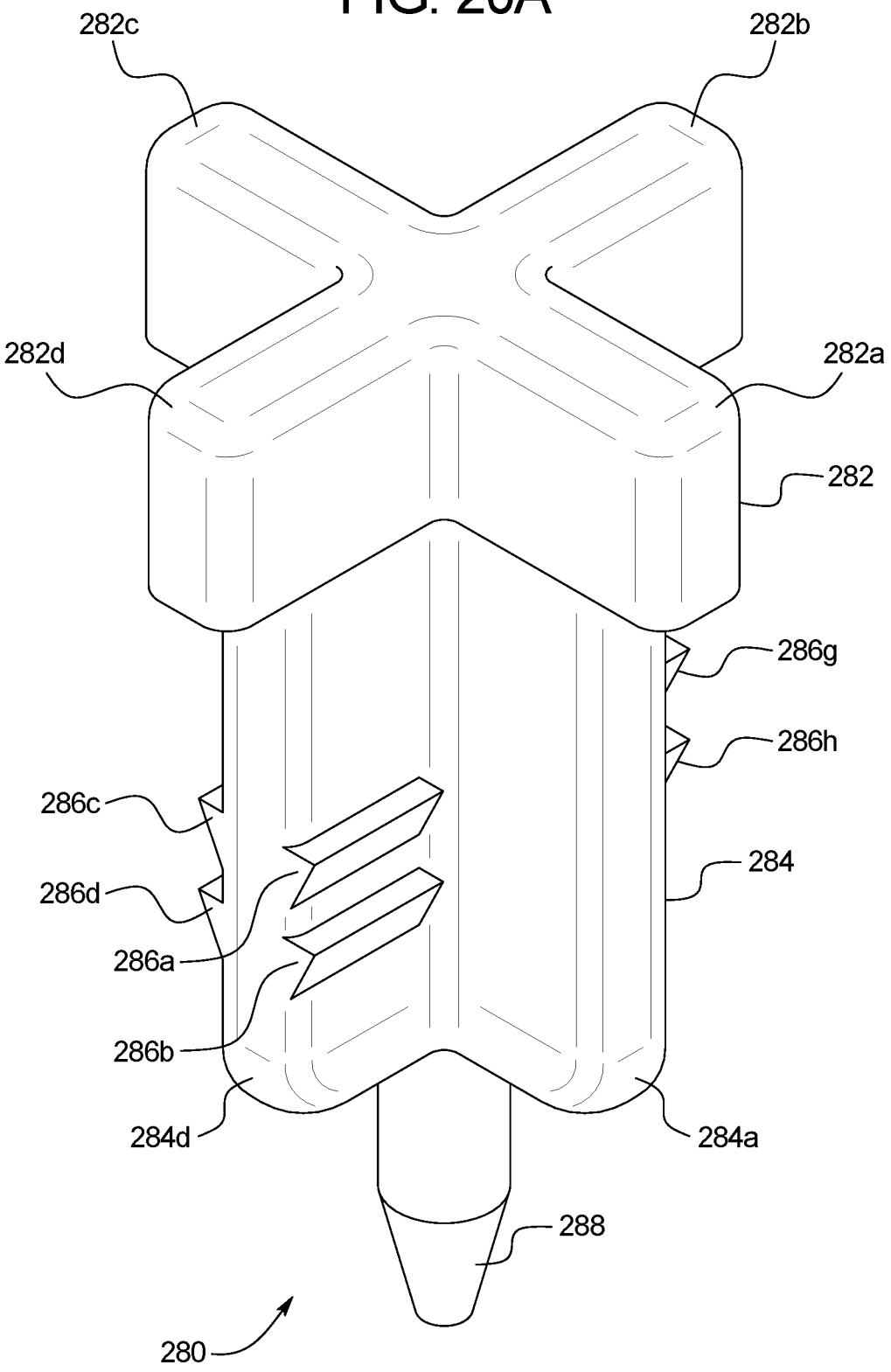

282c
282b
282d
282a
282
286g
286h
286c
286d
284
286a
286b
284d
284a
288
280

FIG. 20B

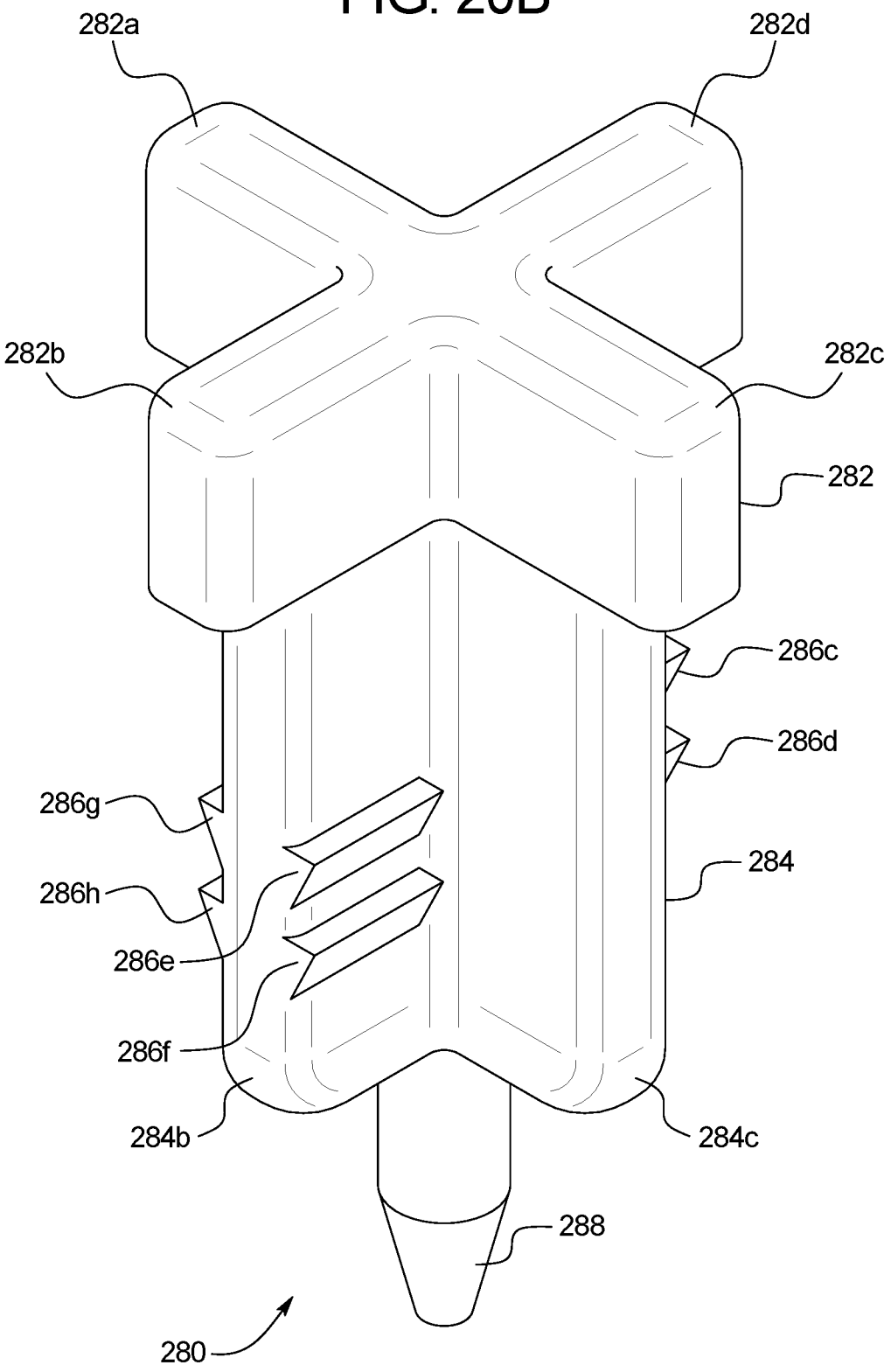

282a
282d
282b
282c
282
286c
286d
286g
284
286h
286e
286f
284b
284c
288
280

FIG. 21

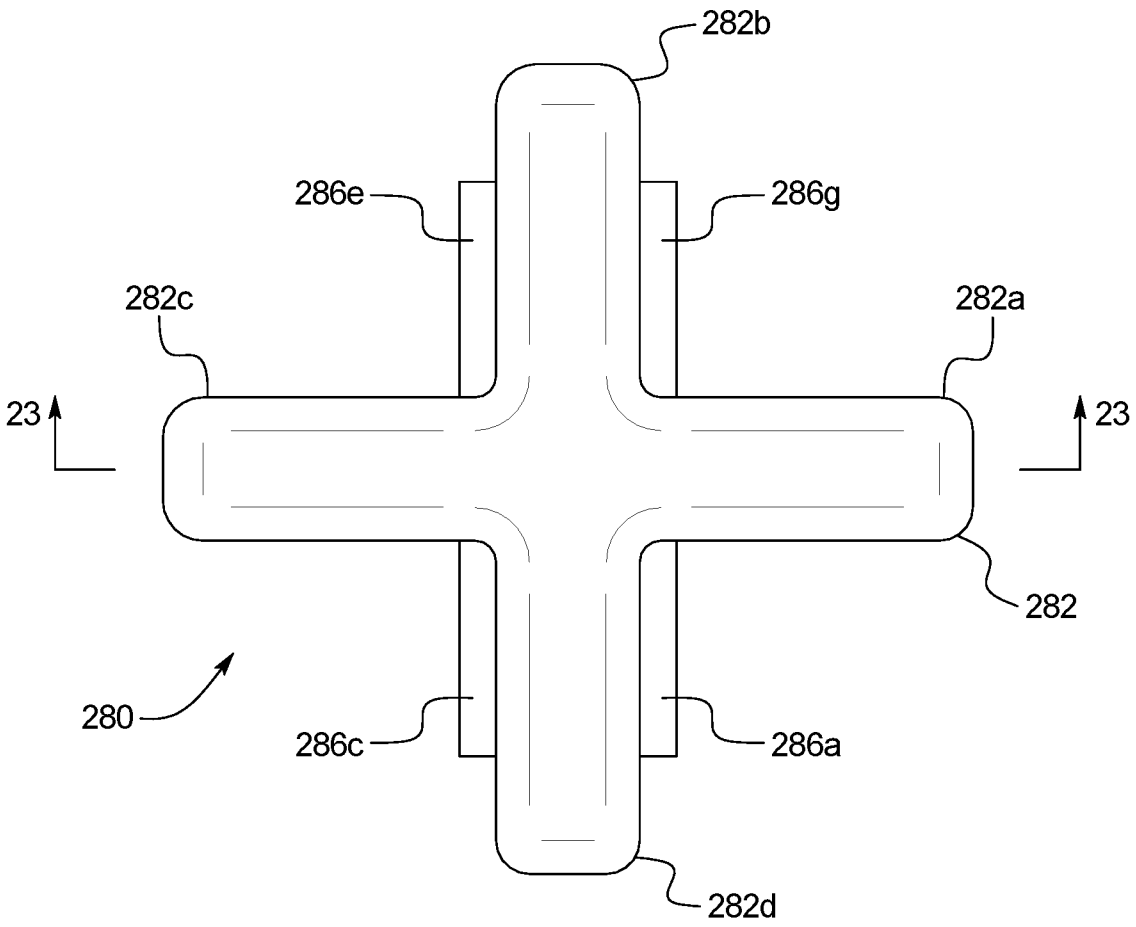


FIG. 22A

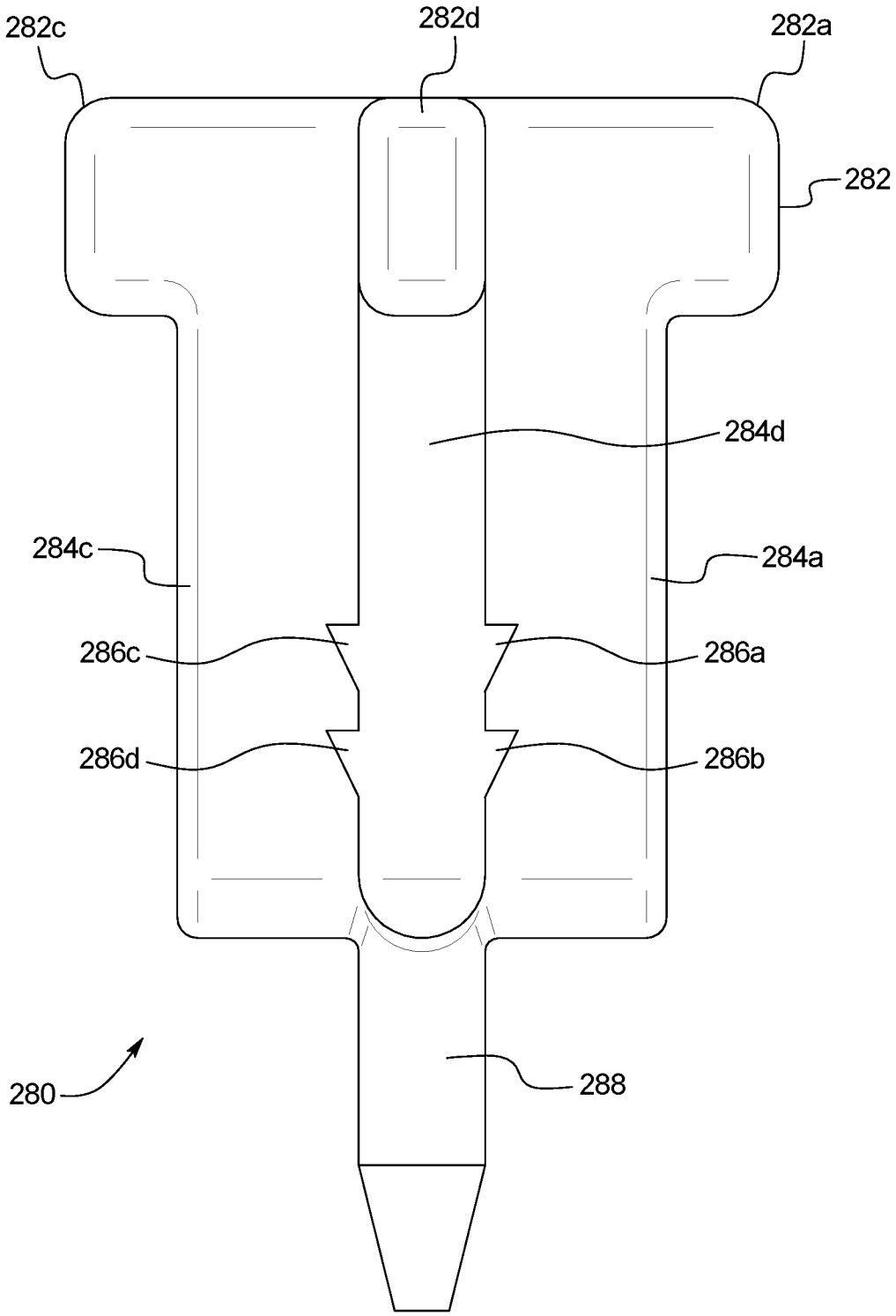


FIG. 22B

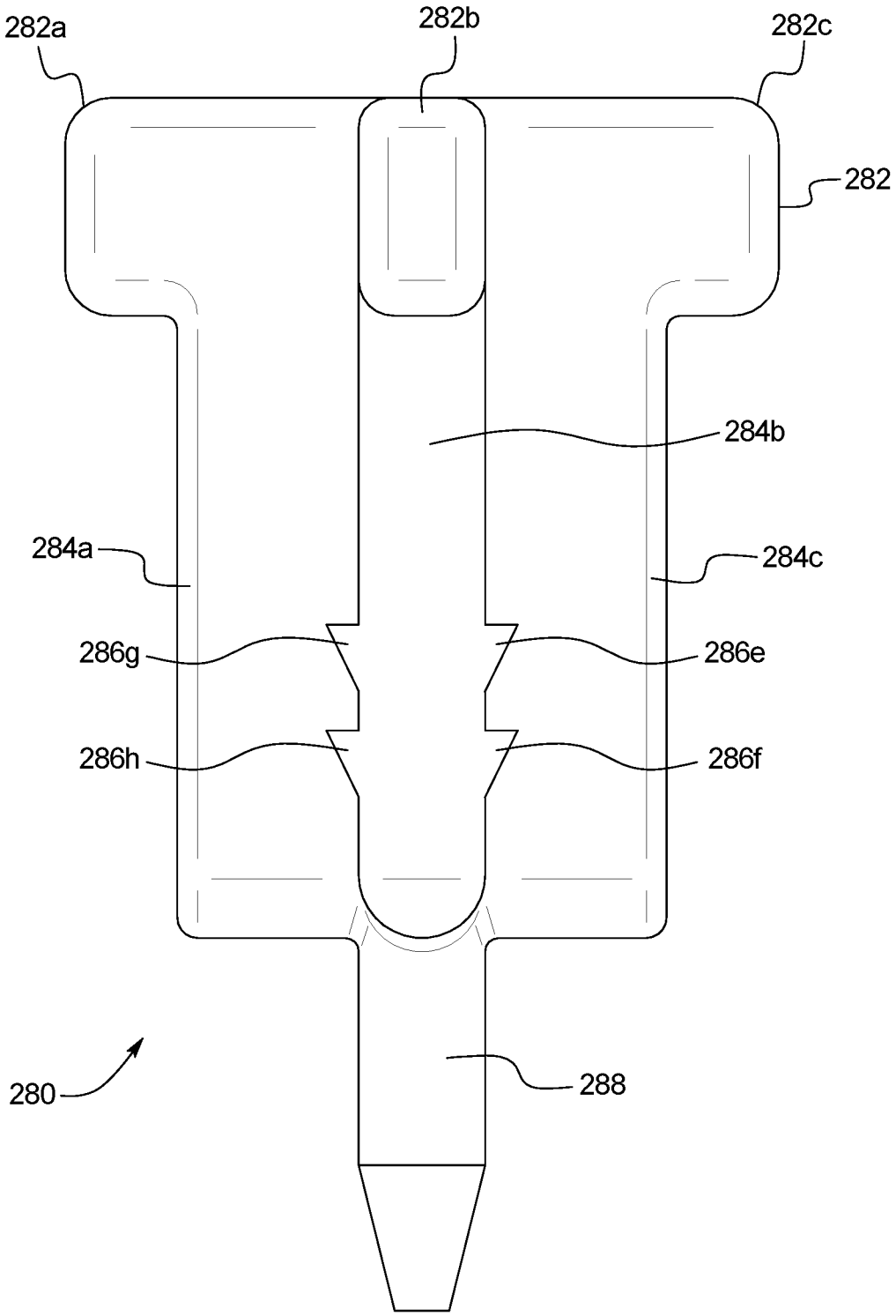
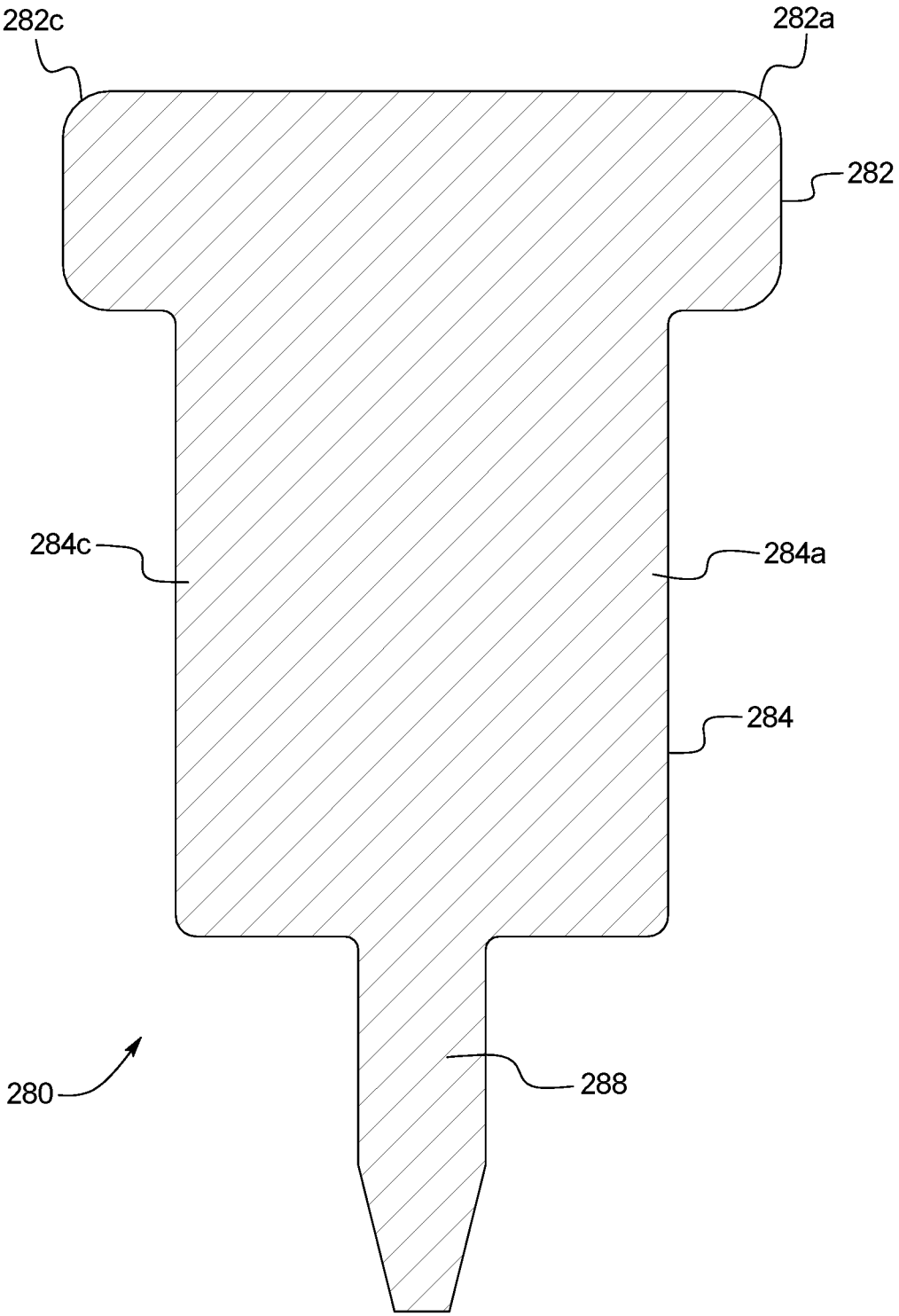
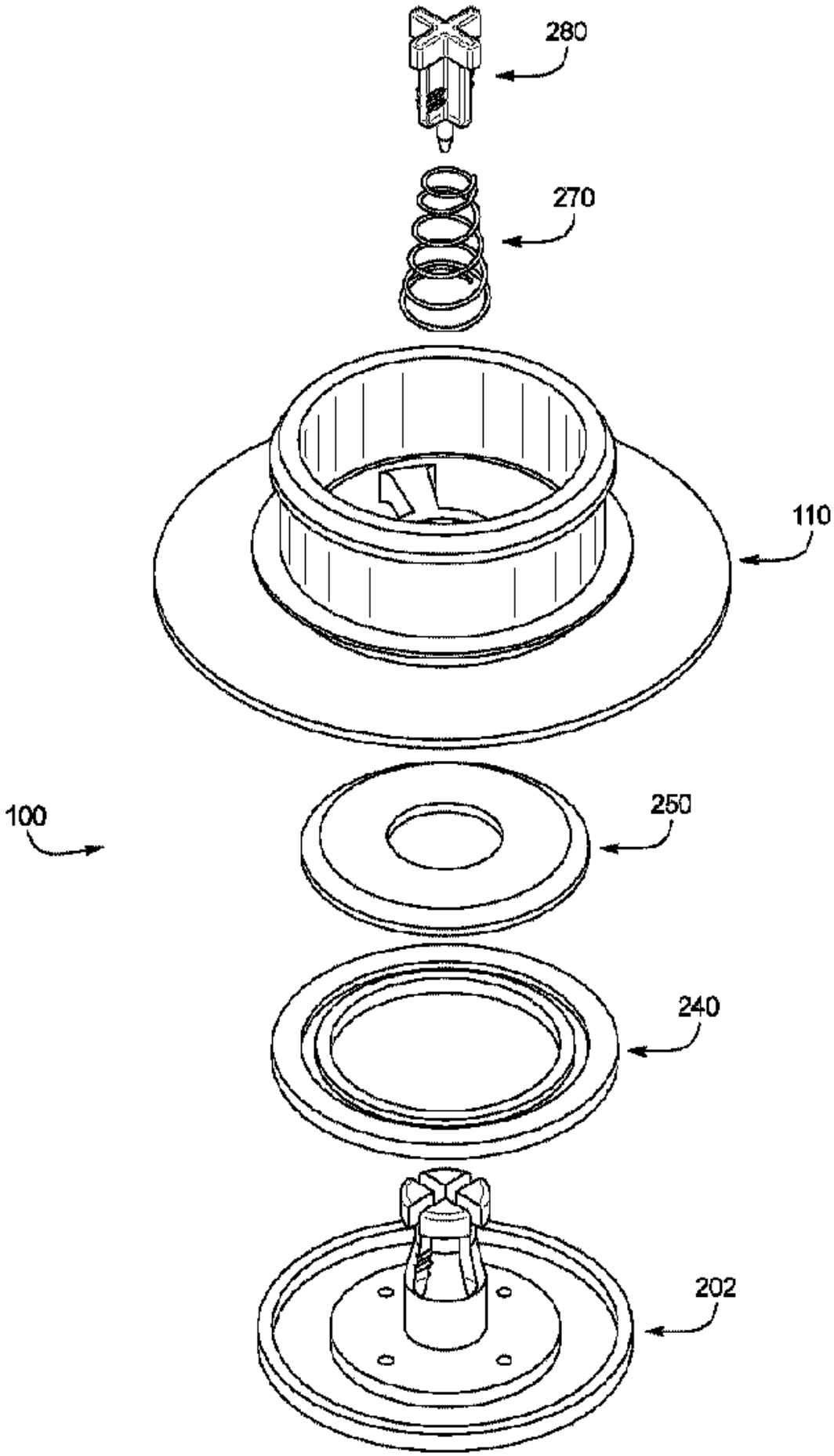


FIG. 23




280
270
110
100
250
240
202