US009358710B2

(12) **United States Patent**
Witz et al.

(10) **Patent No.: US 9,358,710 B2**
(45) **Date of Patent: Jun. 7, 2016**

(54) **PREFORM AND A MOLD STACK FOR PRODUCING THE PREFORM**

(75) Inventors: **Jean-Christophe Witz**, Yutz (FR); **Ralf Walter Fisch**, Saarburg (DE)

(73) Assignee: **HUSKY INJECTION MOLDING SYSTEMS LTD.**, Bolton, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/885,516**

(22) PCT Filed: **Nov. 3, 2011**

(86) PCT No.: **PCT/CA2011/050687**
§ 371 (c)(1),
(2), (4) Date: **May 15, 2013**

(87) PCT Pub. No.: **WO2012/075578**
PCT Pub. Date: **Jun. 14, 2012**

(65) **Prior Publication Data**

US 2013/0244050 A1 Sep. 19, 2013

Related U.S. Application Data

(60) Provisional application No. 61/421,254, filed on Dec. 9, 2010.

(51) **Int. Cl.**
B29B 7/00 (2006.01)
B29C 45/16 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B29C 45/1684*** (2013.01); ***B29B 11/08*** (2013.01); ***B29B 11/14*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC B29B 2911/1402; B29B 2911/14026; B29B 2911/14033; B29B 2911/1404; B29B 2911/14106; B29B 2911/14133; B29B 2911/14326; B29B 2911/14333; B29B 2911/1434; B29B 2911/1436; B29B 2911/144406; B29B 2911/14446; B29B 2911/14466; B29B 2911/14486; B29B 2911/14493; B29B 2911/145; B29B 2911/1464; B29B 2911/14593; B29B 2911/14826; B29B 11/14; B29B 11/08; B29C 45/0055; B29C 45/1625; B29C 45/1646; B29C 45/1684; B29C 45/261; B29C 49/12; B29C 2049/2008; B29C 2049/2013
USPC D9/740–746, 738, 751, 752, 520, 522, D9/562, 568, 569, 570, 904; D15/135, 136
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,979,491 A 9/1976 Zavasnik
D260,240 S * 8/1981 Carluccio D9/520
(Continued)

FOREIGN PATENT DOCUMENTS

CN 1054565 A 9/1991
CN 101678593 A 3/2010
(Continued)

OTHER PUBLICATIONS

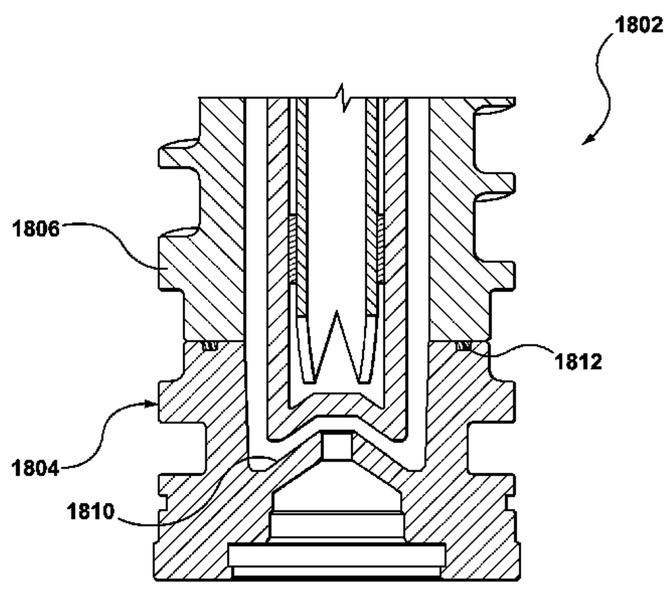
PCT International Search Report, Daigle, Julien, Jan. 19, 2012, 3 pages.
(Continued)

Primary Examiner — Humera Sheikh
Assistant Examiner — Seth Dumbris

(57) **ABSTRACT**

Disclosed is a preform (**300**) suitable for subsequent blow-molding into a final-shaped container. The preform comprises a neck portion (**302**); a gate portion (**306**); and a body portion (**304**) extending between said neck portion and said gate portion; the gate portion including an upwardly-bound region (**324**) defined between the inner and outer walls thereof, substantially whole of the upwardly-bound region extending in a direction towards the neck portion (**302**).

3 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

B29C 45/00	(2006.01)
B29C 45/26	(2006.01)
B29C 45/27	(2006.01)
B29B 11/08	(2006.01)
B29B 11/14	(2006.01)
B29C 49/42	(2006.01)
B29C 49/06	(2006.01)
B29C 49/12	(2006.01)
B29C 49/64	(2006.01)

(52) **U.S. Cl.**

CPC ***B29C45/0055*** (2013.01); ***B29C 45/261*** (2013.01); ***B29C 45/2711*** (2013.01); ***B29C 49/4252*** (2013.01); *B29B 2911/1402* (2013.01); *B29B 2911/1404* (2013.01); *B29B 2911/14026* (2013.01); *B29B 2911/14033* (2013.01); *B29B 2911/14106* (2013.01); *B29B 2911/14133* (2013.01); *B29B 2911/14326* (2013.01); *B29B 2911/14333* (2013.01); *B29B 2911/14446* (2013.01); *B29B 2911/14466* (2013.01); *B29B 2911/14486* (2013.01); *B29B 2911/14493* (2013.01); *B29C 49/06* (2013.01); *B29C 49/12* (2013.01); *B29C 49/6427* (2013.01); *B29C 2791/006* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,512,735	A	*	4/1985	Nilsson et al.	425/526
4,745,013	A	*	5/1988	Kudert et al.	428/36.7
4,867,929	A	*	9/1989	Albrecht et al.	264/521
4,915,992	A	*	4/1990	Takakusaki et al.	428/36.92
4,927,680	A	*	5/1990	Collette et al.	428/36.92
5,038,947	A	*	8/1991	Strassheimer	215/373
5,158,817	A	*	10/1992	Krishnakumar	428/36.92
5,508,076	A	*	4/1996	Bright	B29C 45/006 215/12.2
5,599,496	A	*	2/1997	Krishnakumar et al.	264/532
5,648,133	A	*	7/1997	Suzuki et al.	428/36.92
5,714,111	A	*	2/1998	Beck et al.	264/532
D403,959	S	*	1/1999	Flancman	D9/434
5,888,598	A		3/1999	Brewster et al.	
6,079,579	A	*	6/2000	De Cuyper	215/41
D454,497	S	*	3/2002	Darr et al.	D9/520
7,416,089	B2	*	8/2008	Kraft et al.	215/373
2006/0147664	A1	*	7/2006	Richards et al.	428/35.7
2008/0179271	A1		7/2008	Bangi	
2009/0155501	A1	*	6/2009	Witz et al.	428/34.1
2010/0260886	A1	*	10/2010	Witz et al.	425/521
2012/0061885	A1	*	3/2012	Maki et al.	264/531

FOREIGN PATENT DOCUMENTS

EP	0379264	A2	7/1990	
EP	0413924	A1	2/1991	
EP	2316626	*	5/2011	B29B 11/14
GB	1406700	A	9/1975	
GB	1441657	A	7/1976	
JP	S52116462	U	9/1977	
JP	54146869	*	11/1979	
JP	S5577535	A	6/1980	

OTHER PUBLICATIONS

Database WPI, Week 198001, Thomson Scientific, London, GB, Nov. 16, 1979.

European Search Report, Tomas Ingelgard, Sep. 9, 2014.

* cited by examiner

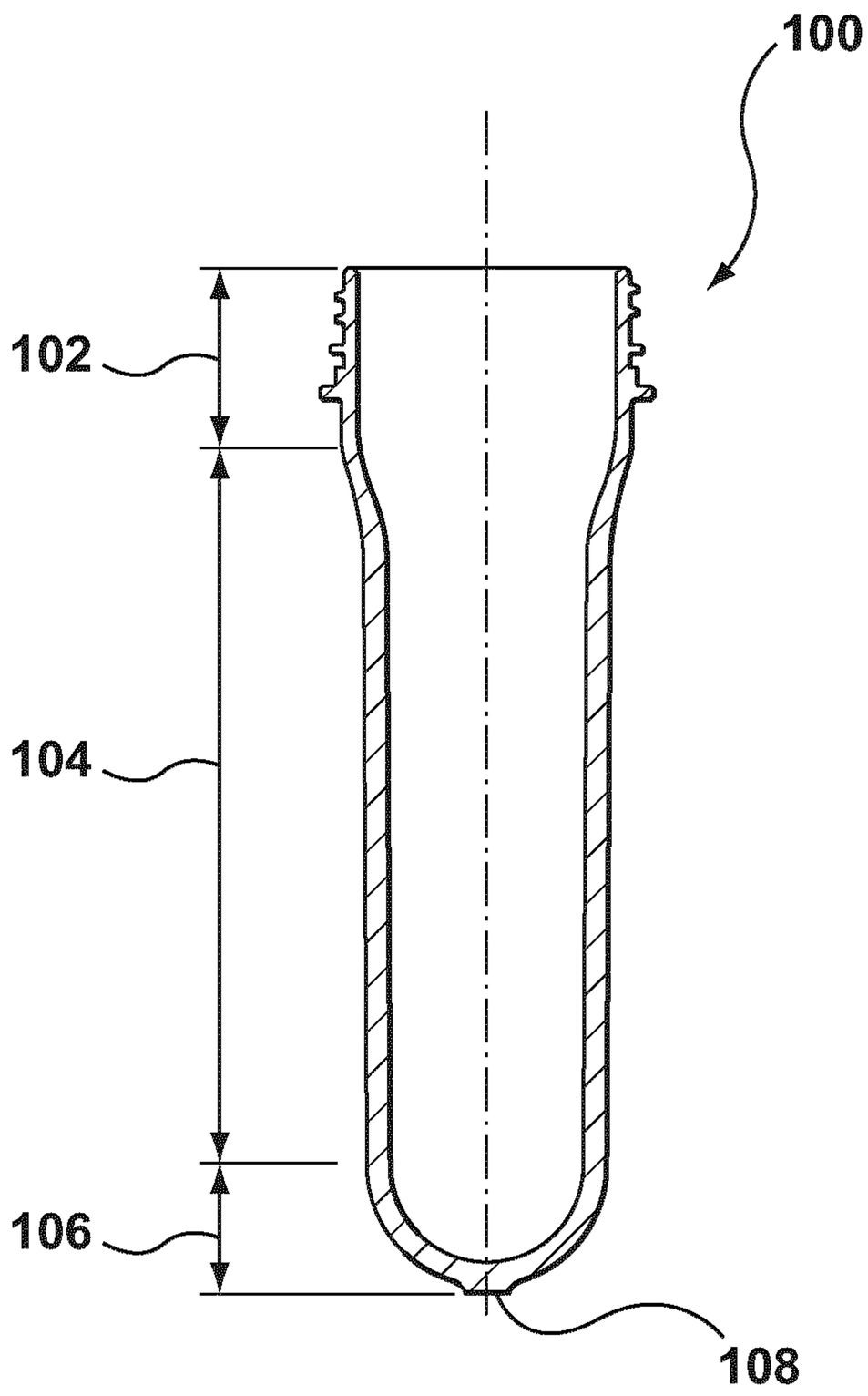


FIG. 1 (PRIOR ART)

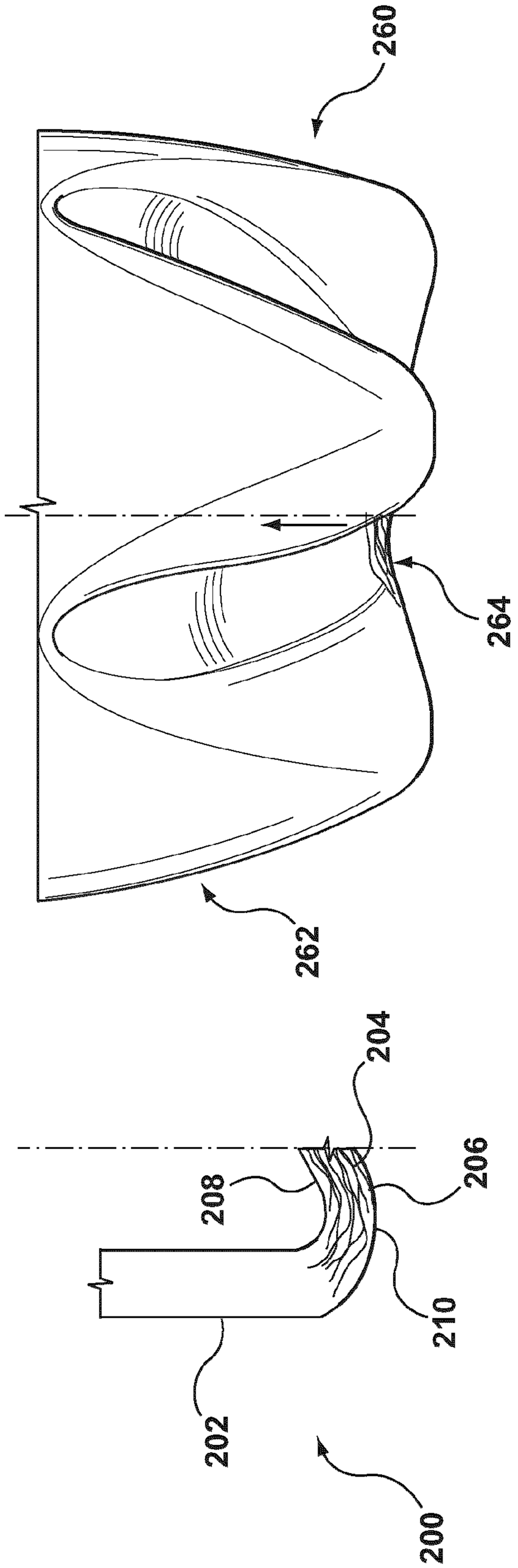


FIG. 2

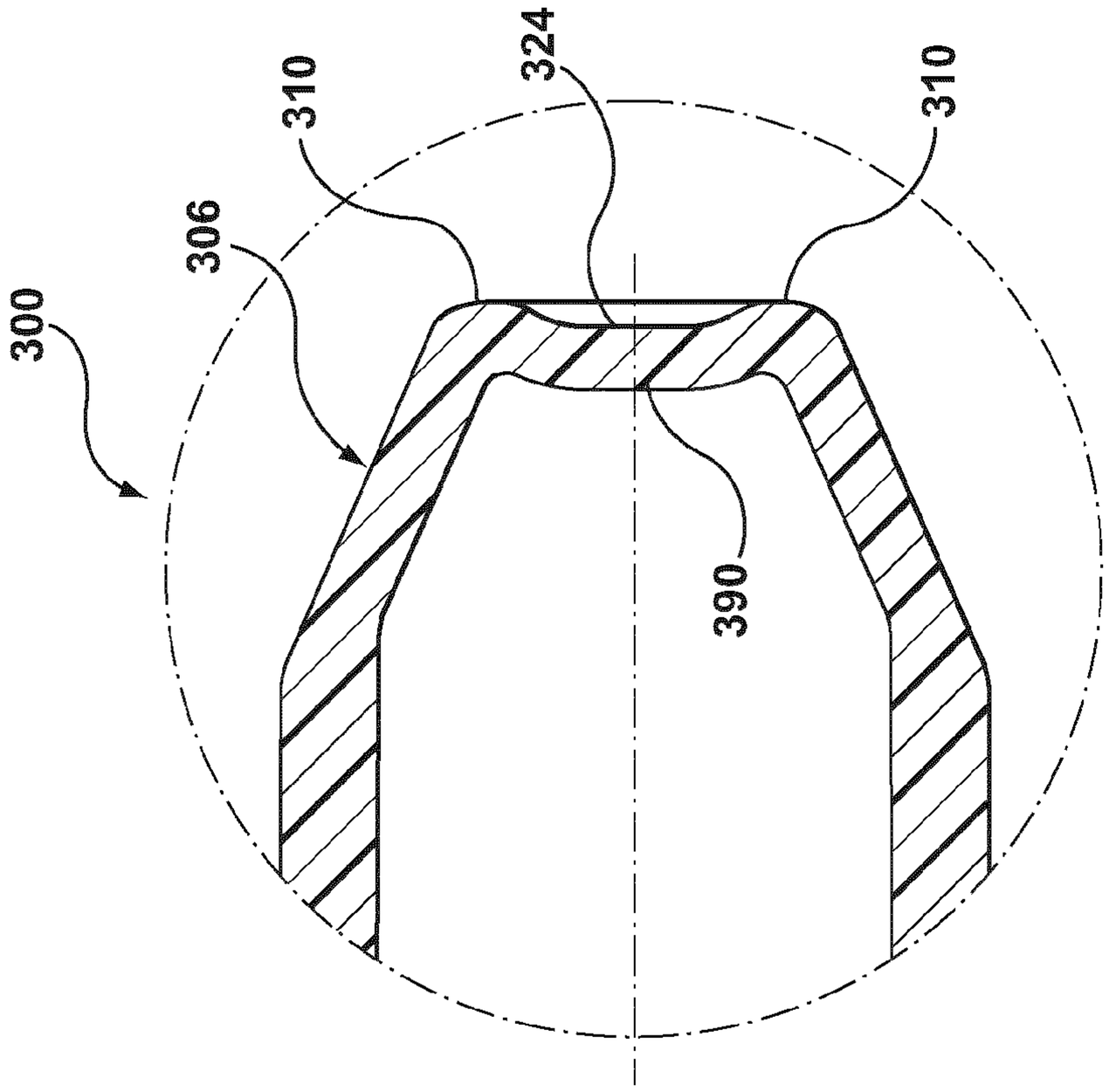


FIG. 4

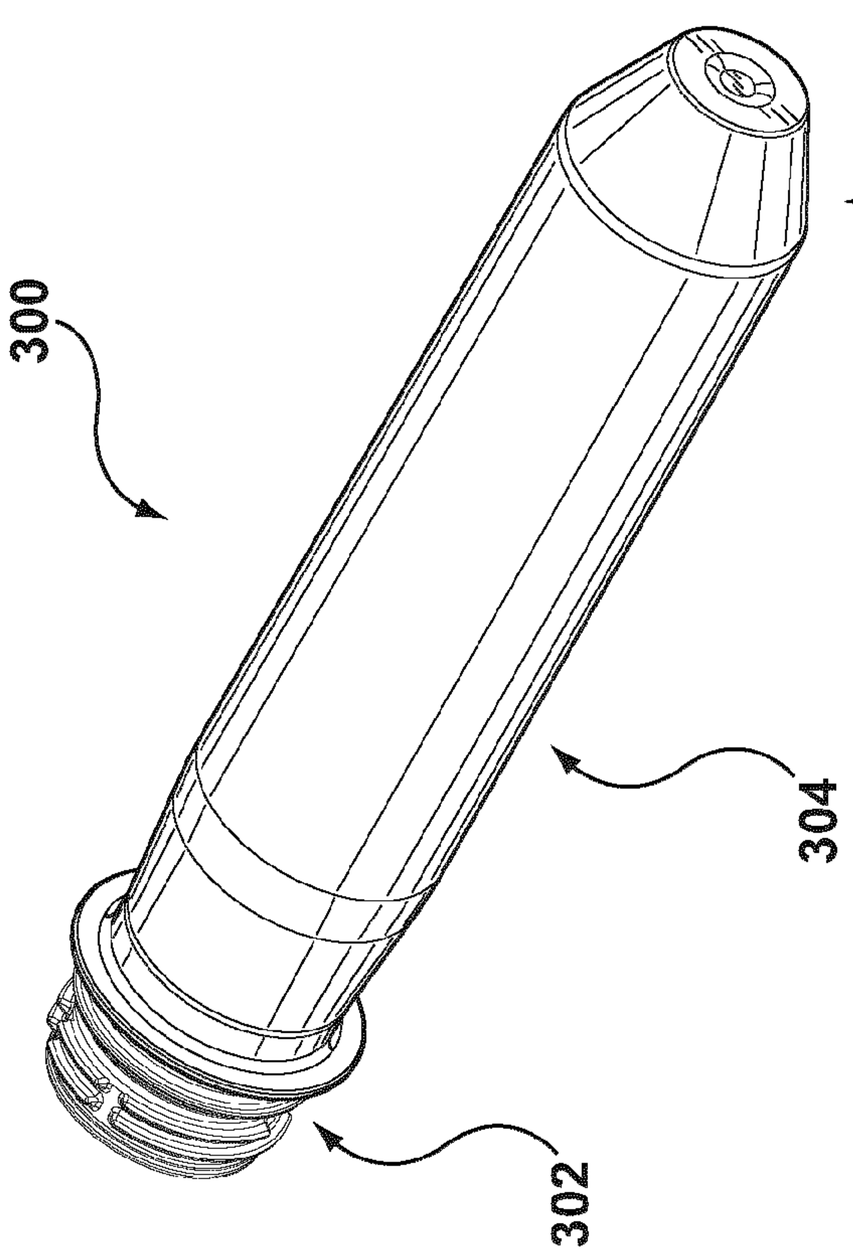


FIG. 3

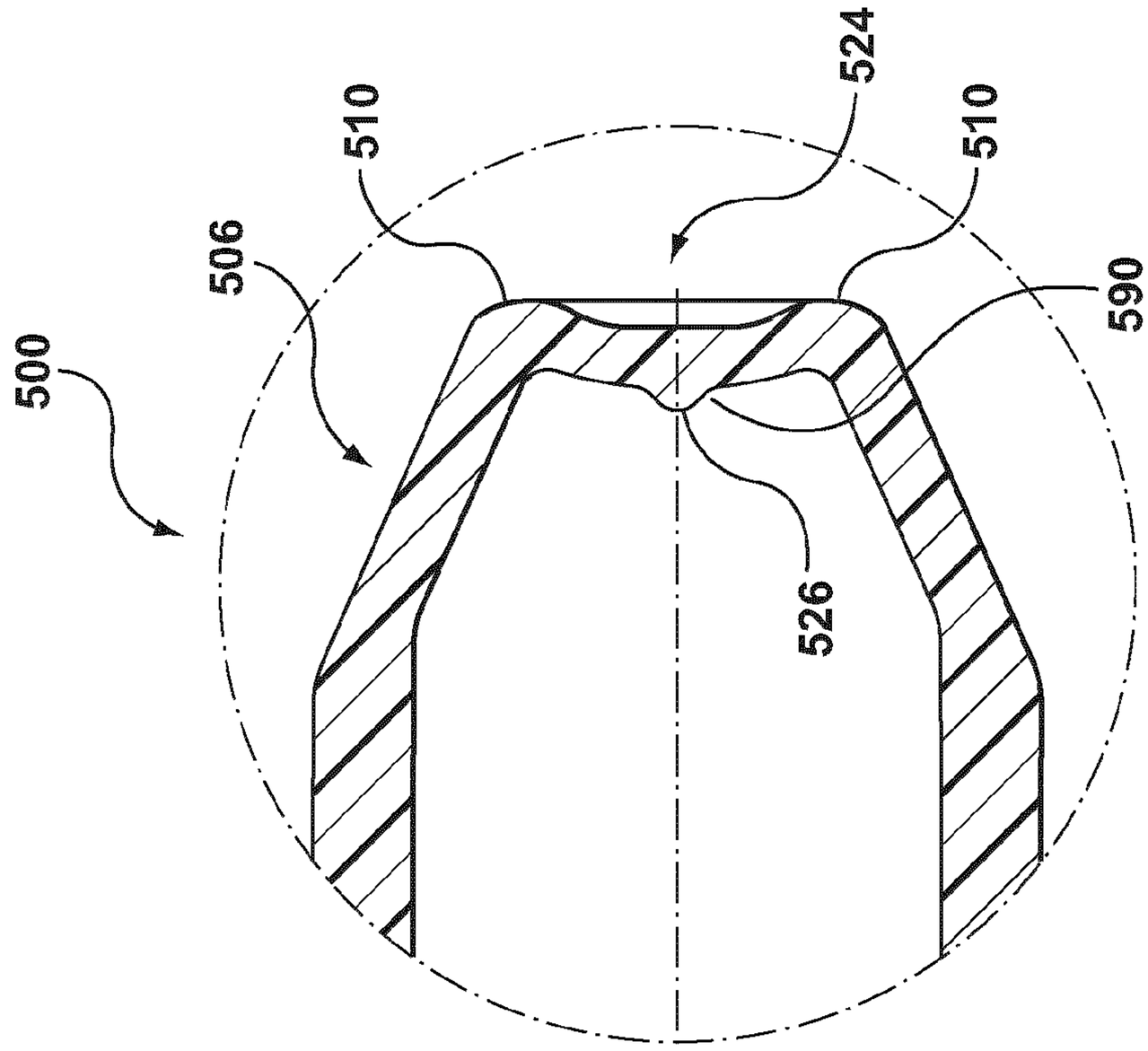


FIG. 6

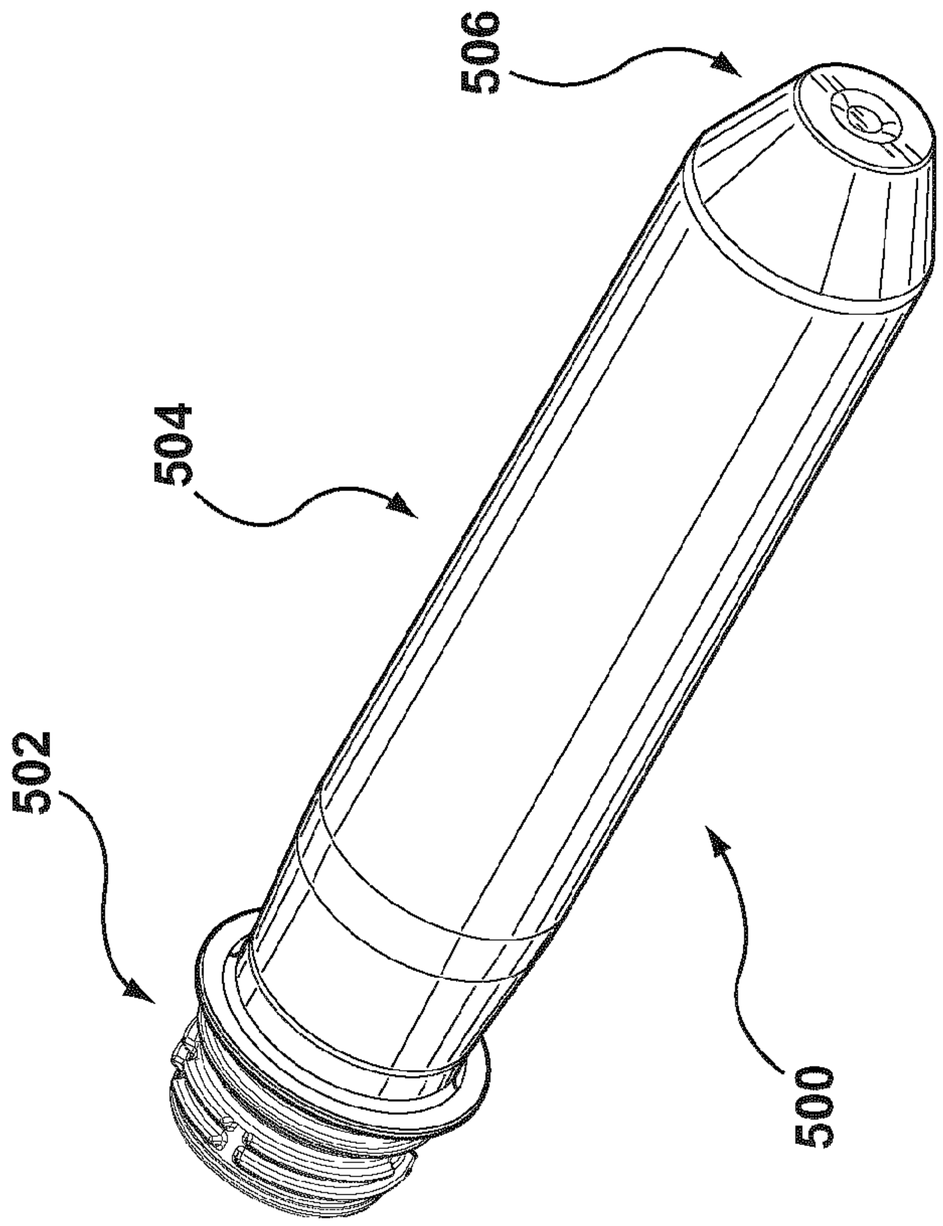


FIG. 5

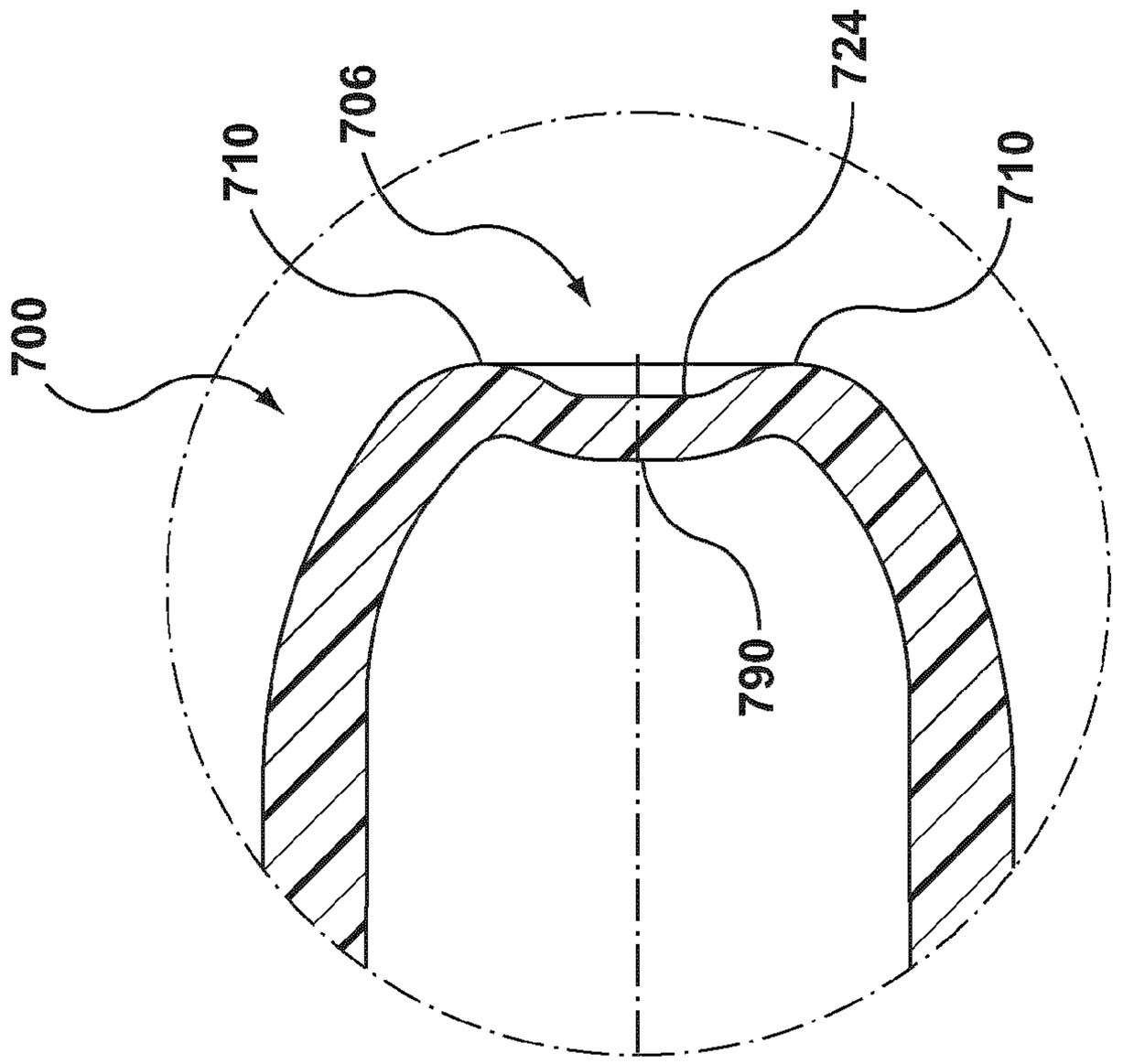


FIG. 8

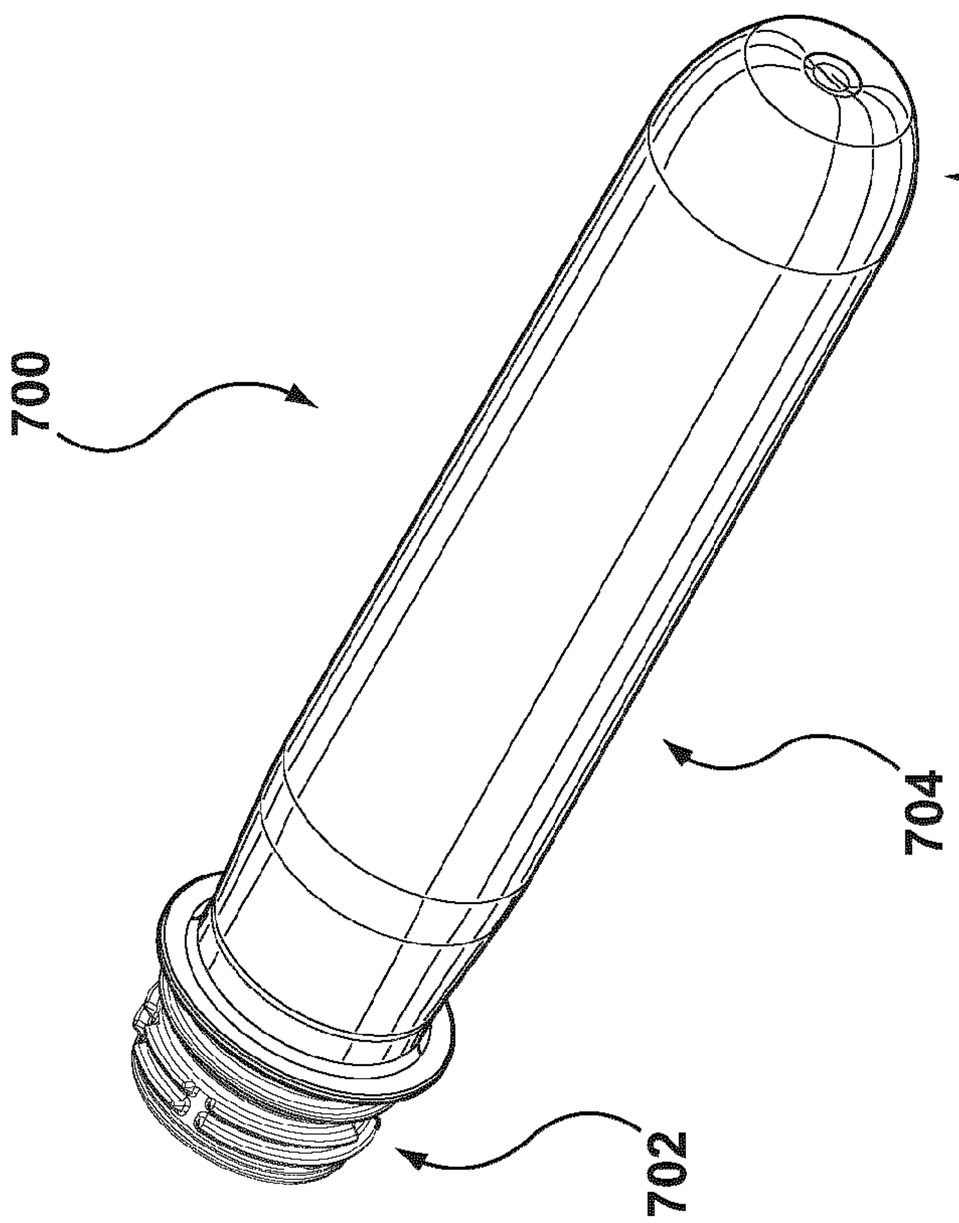


FIG. 7

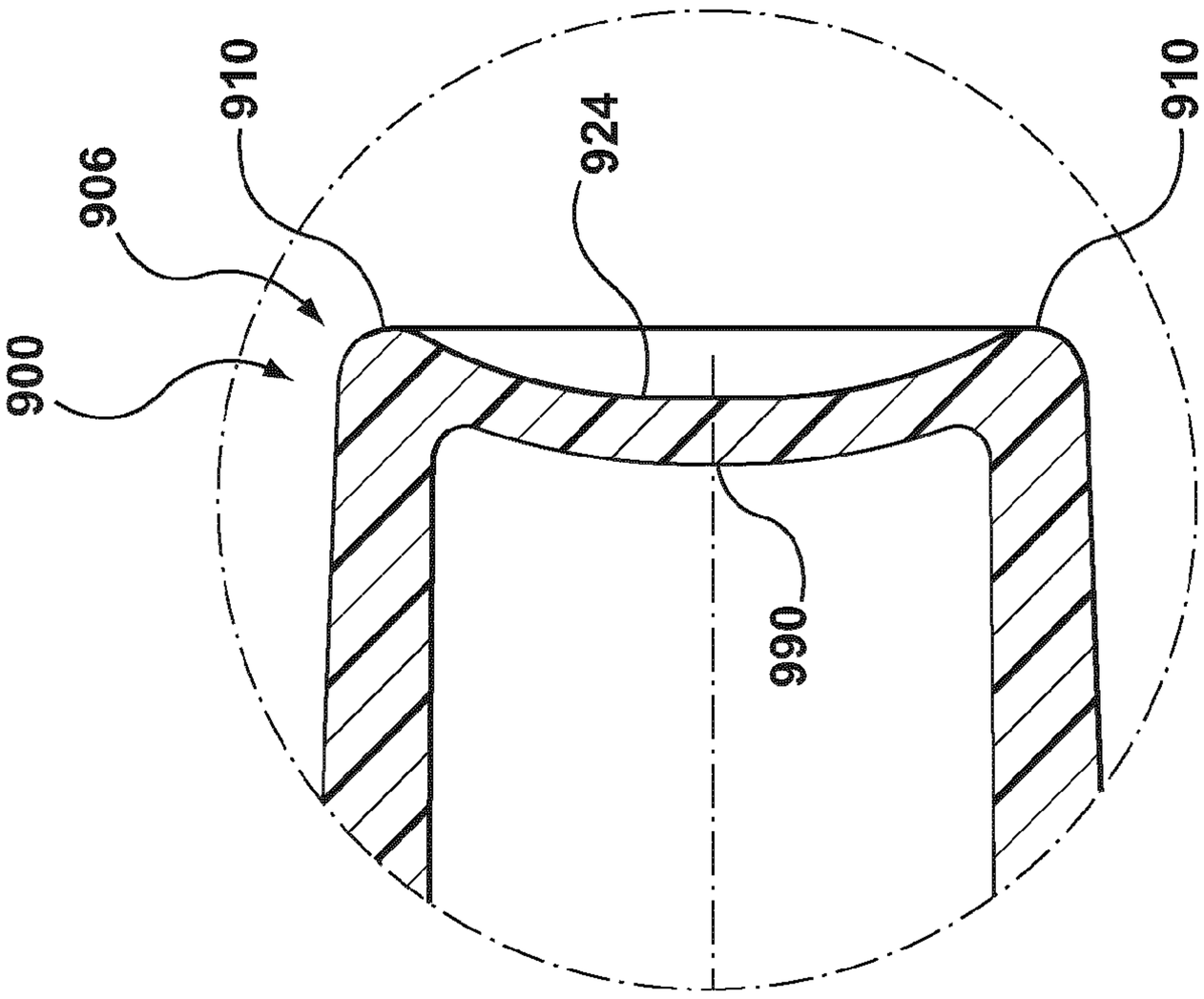


FIG. 10

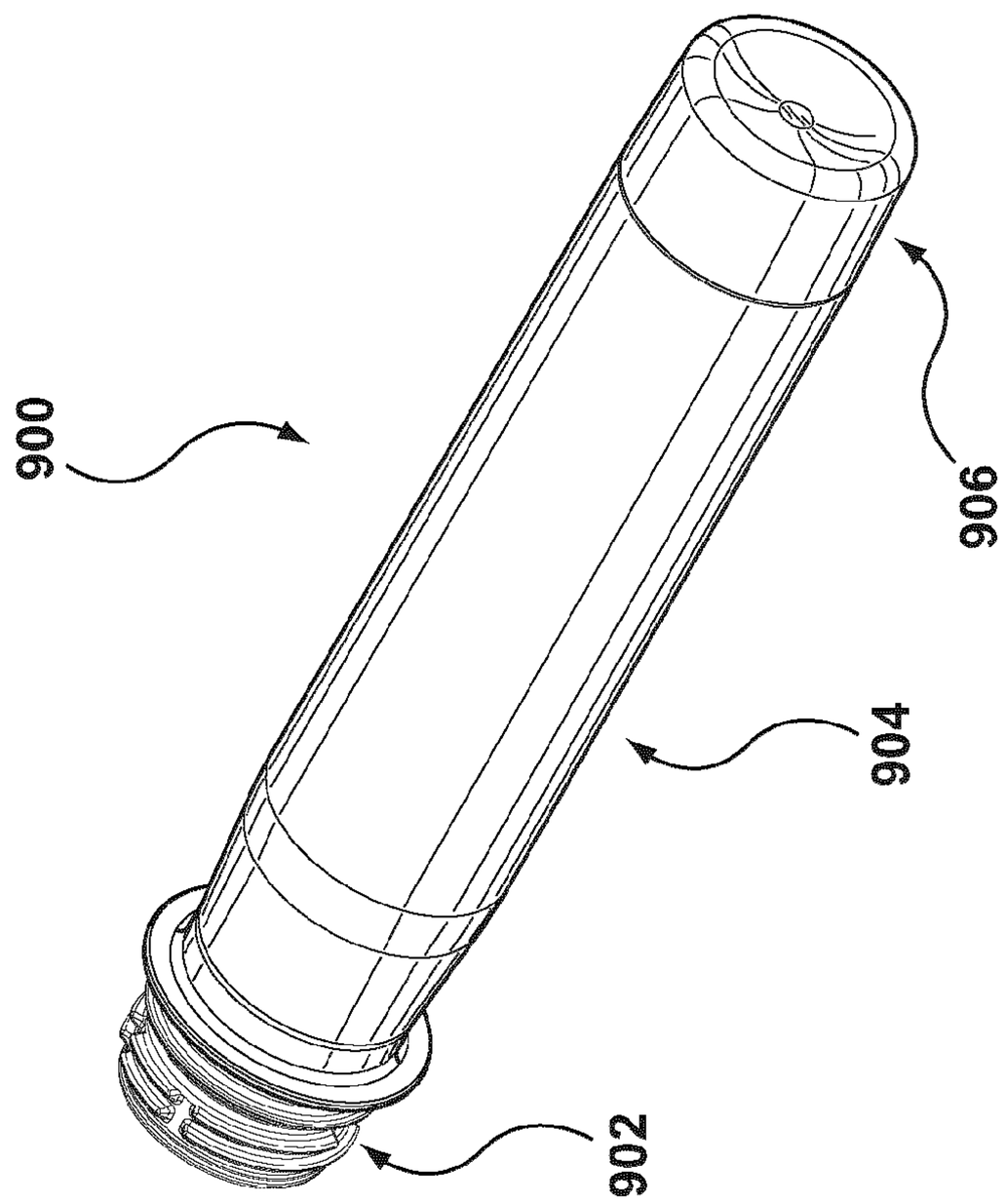


FIG. 9

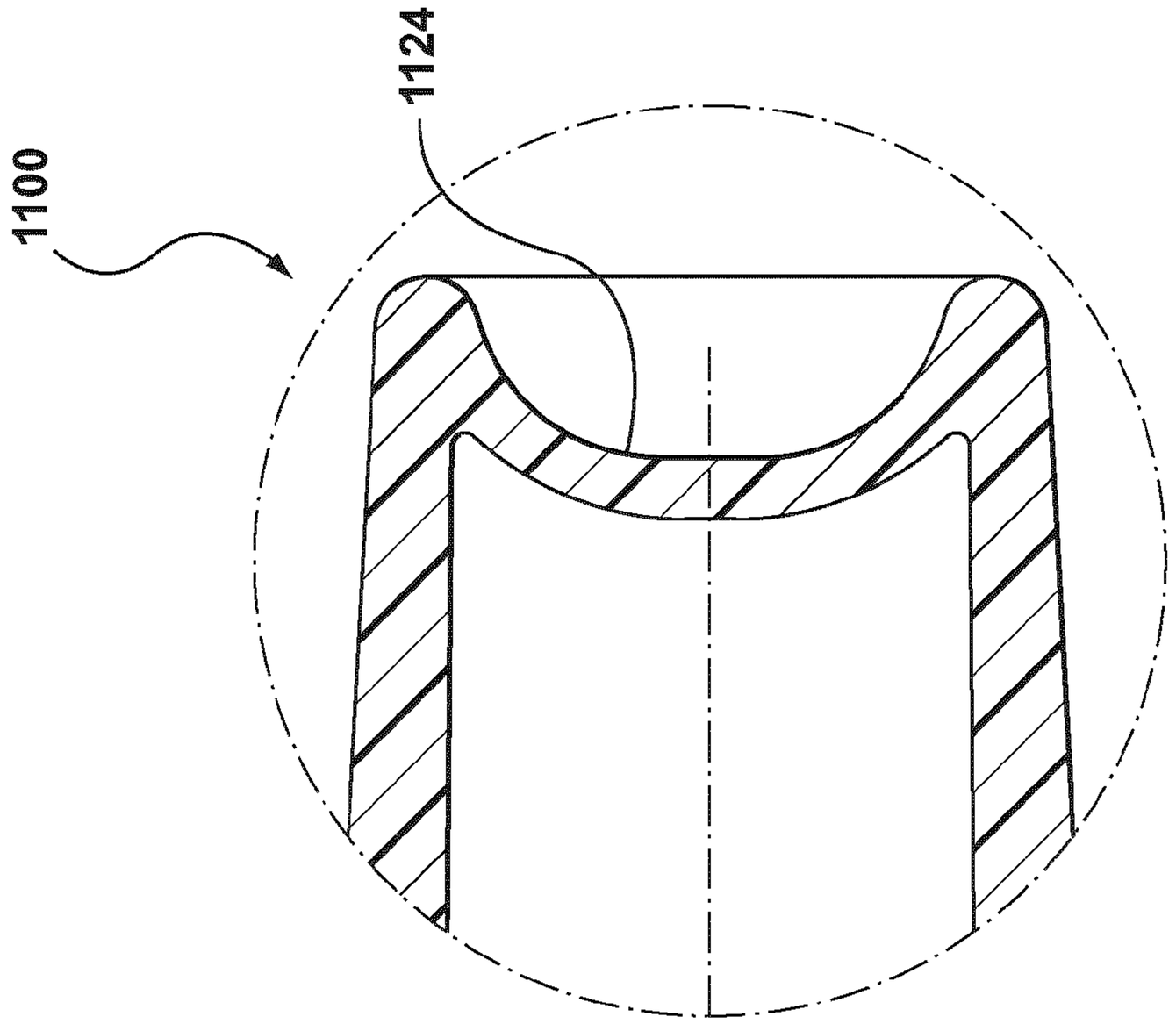


FIG. 12

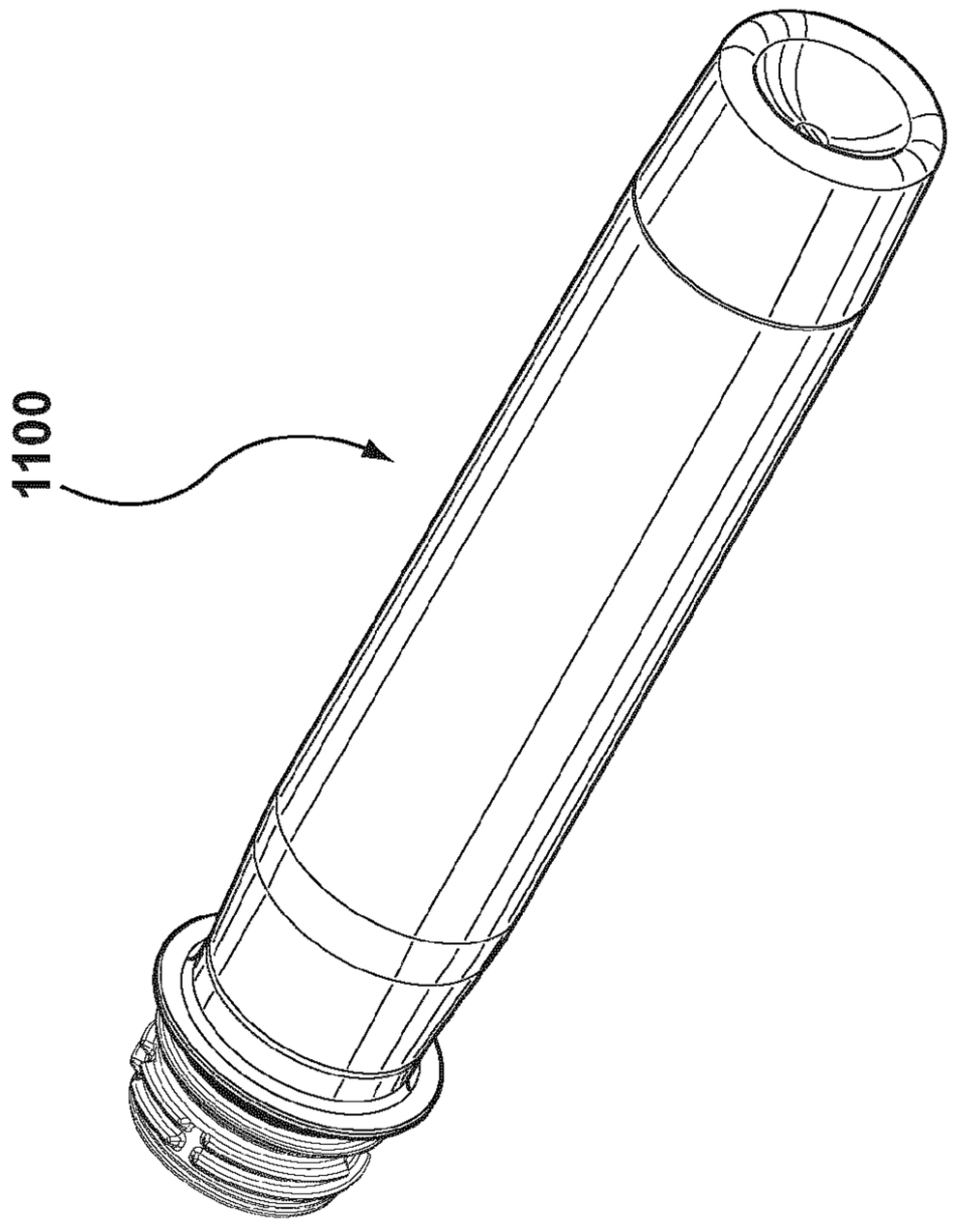


FIG. 11

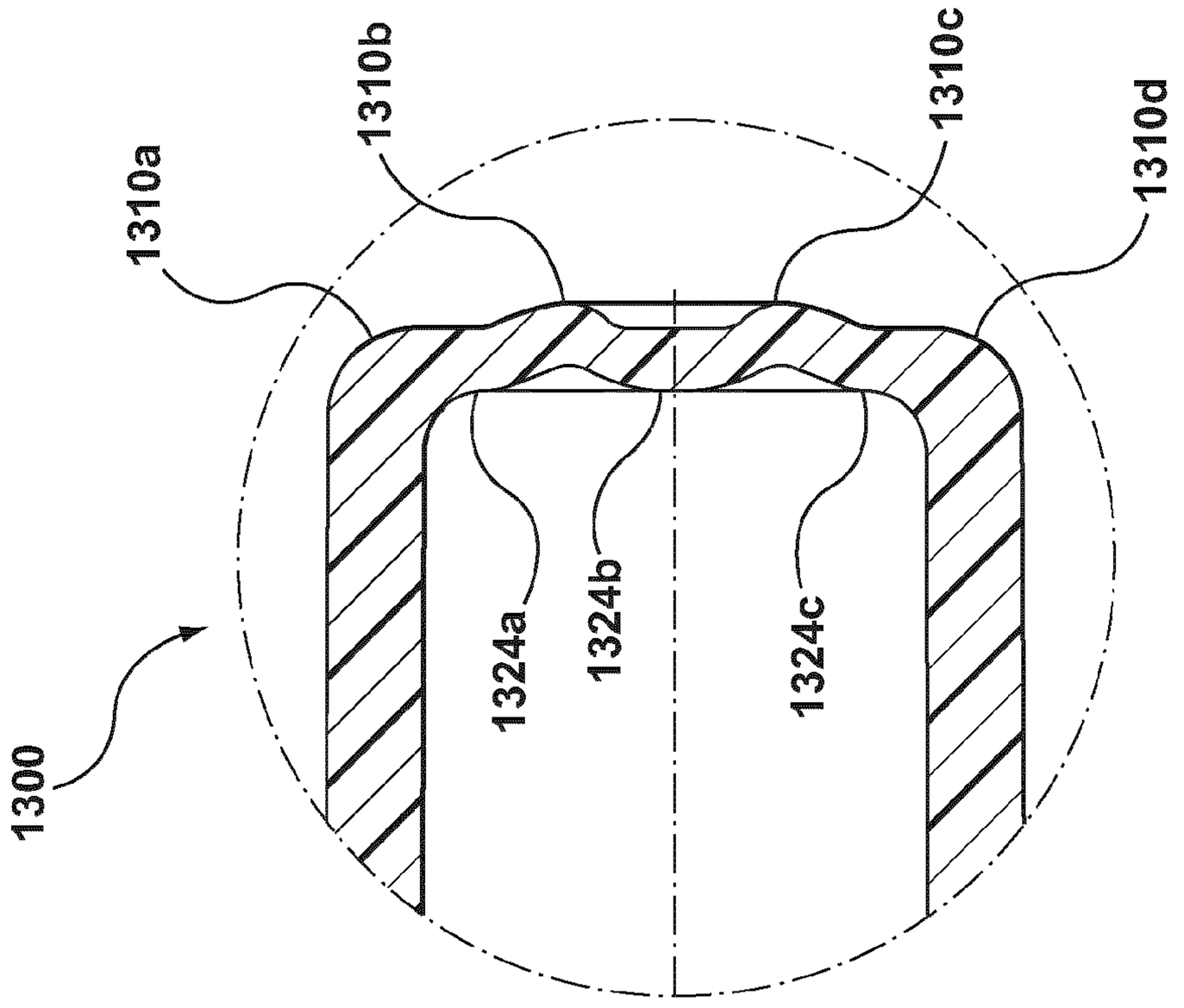

1310a
1310b
1310c
1310d
1300
1324a
1324b
1324c

FIG. 14

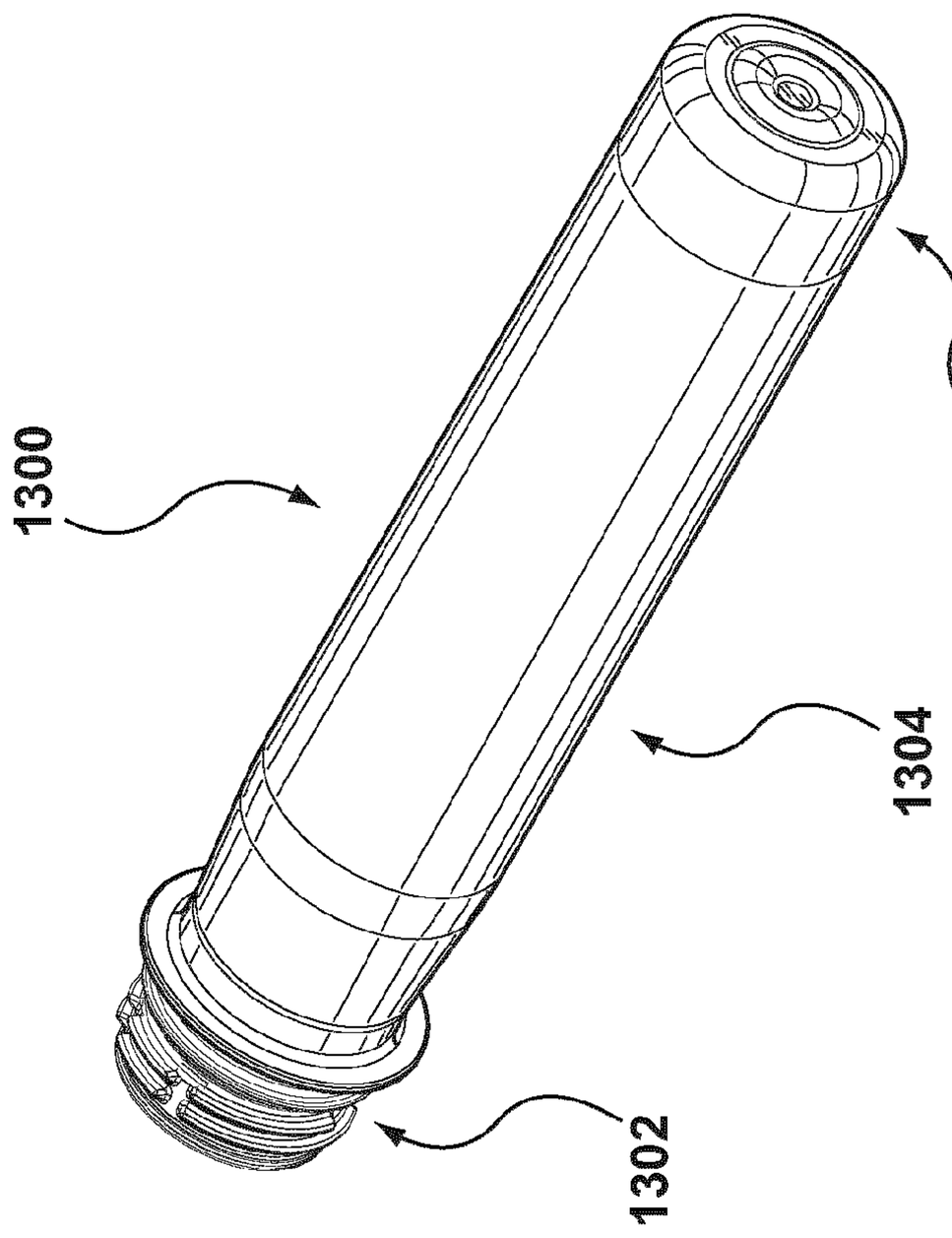

1300
1306
1304
1302

FIG. 13

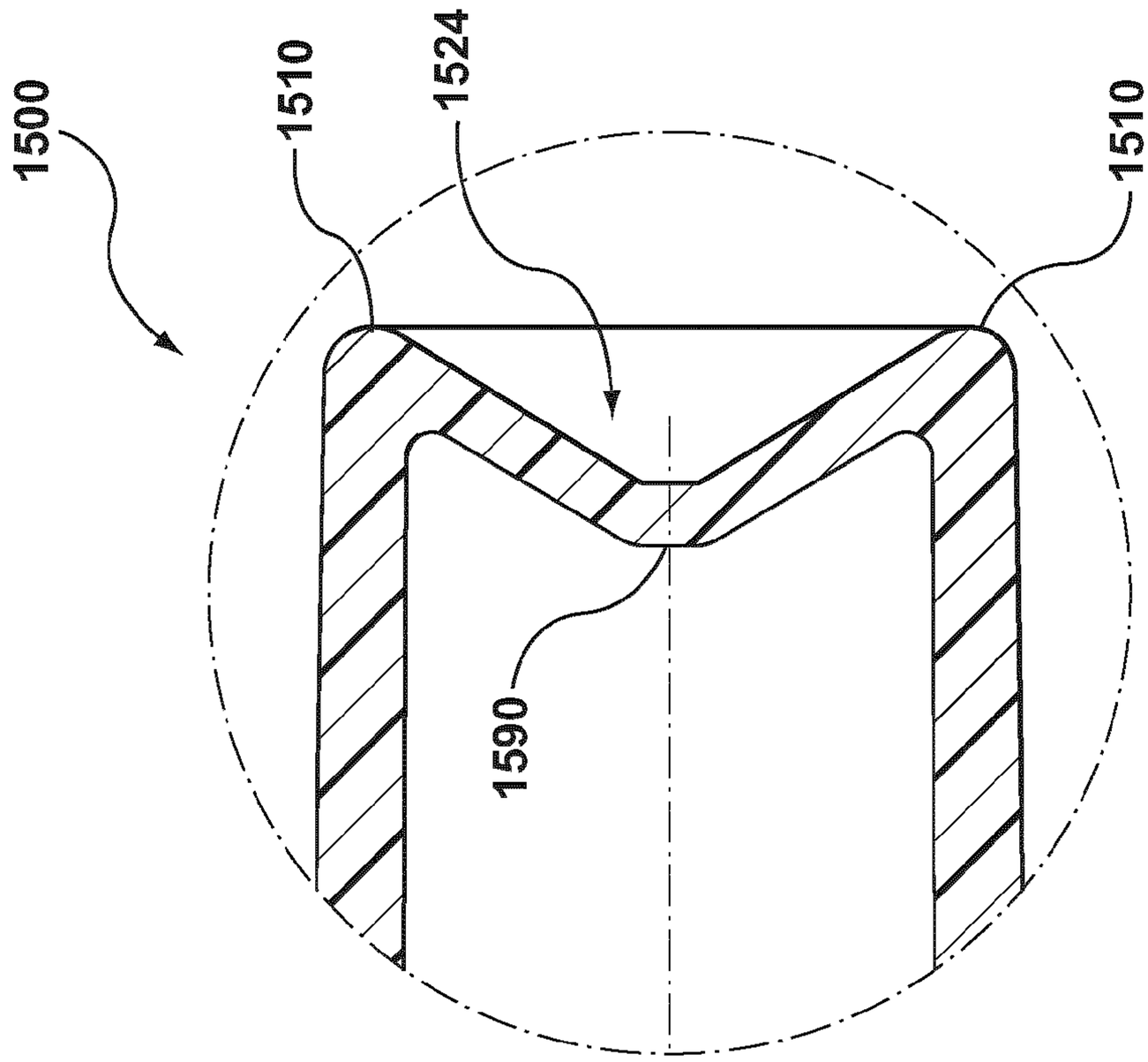


FIG. 16

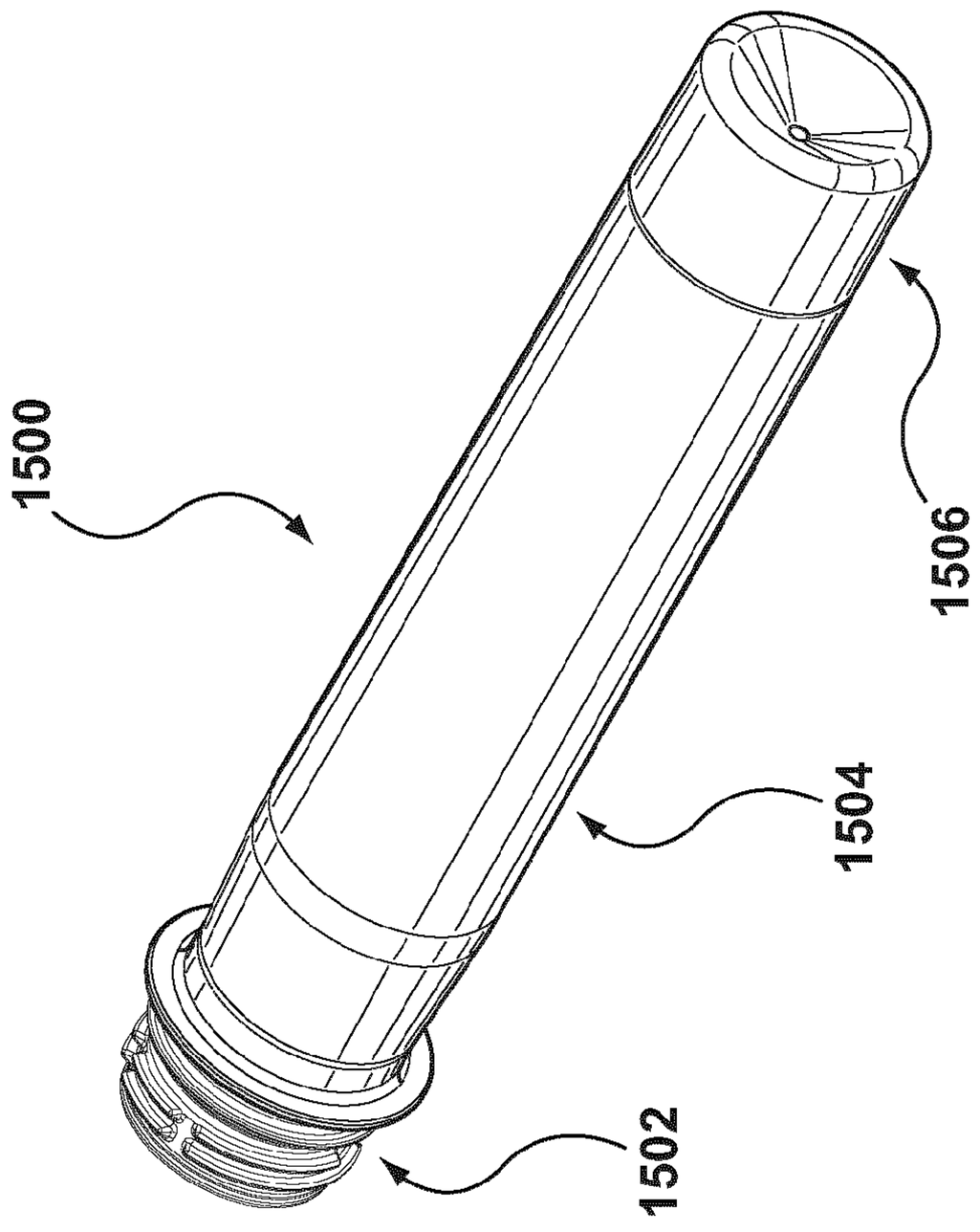


FIG. 15

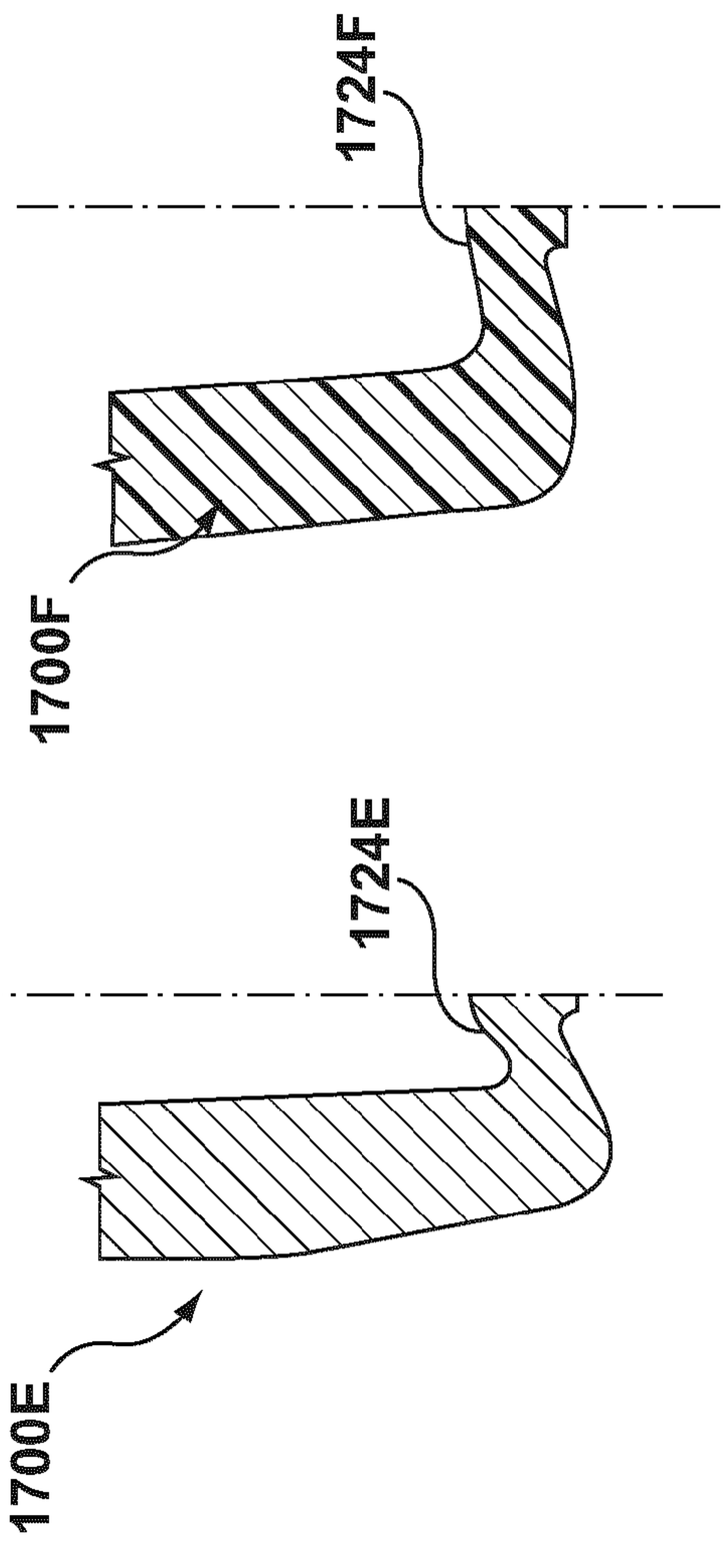


FIG. 17C

FIG. 17B

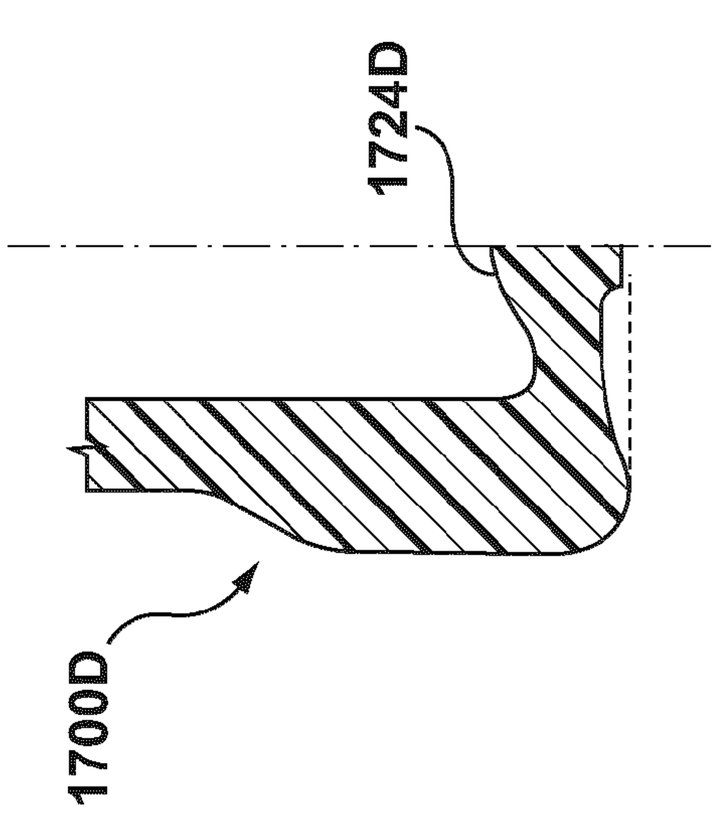


FIG. 17A

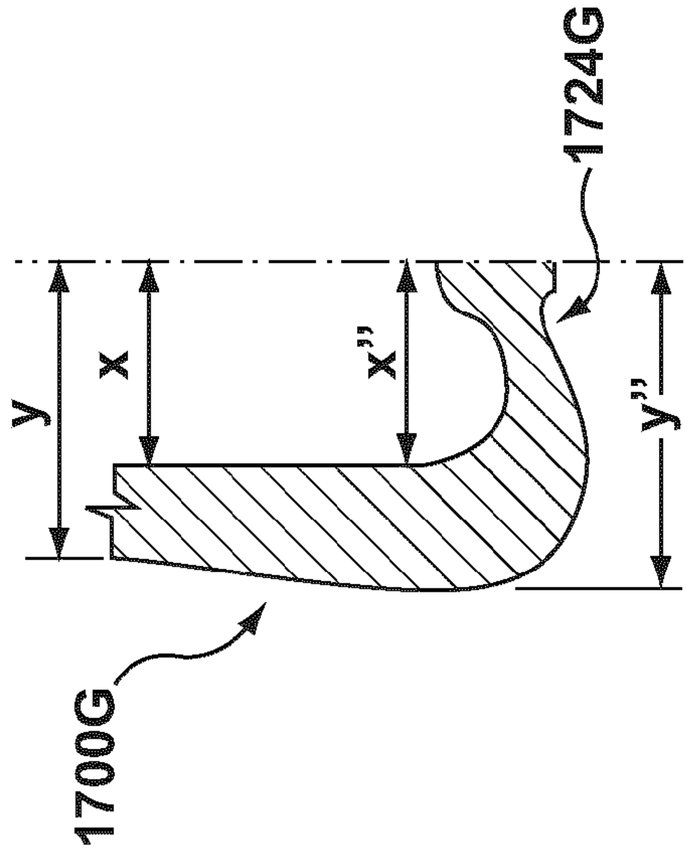


FIG. 17D

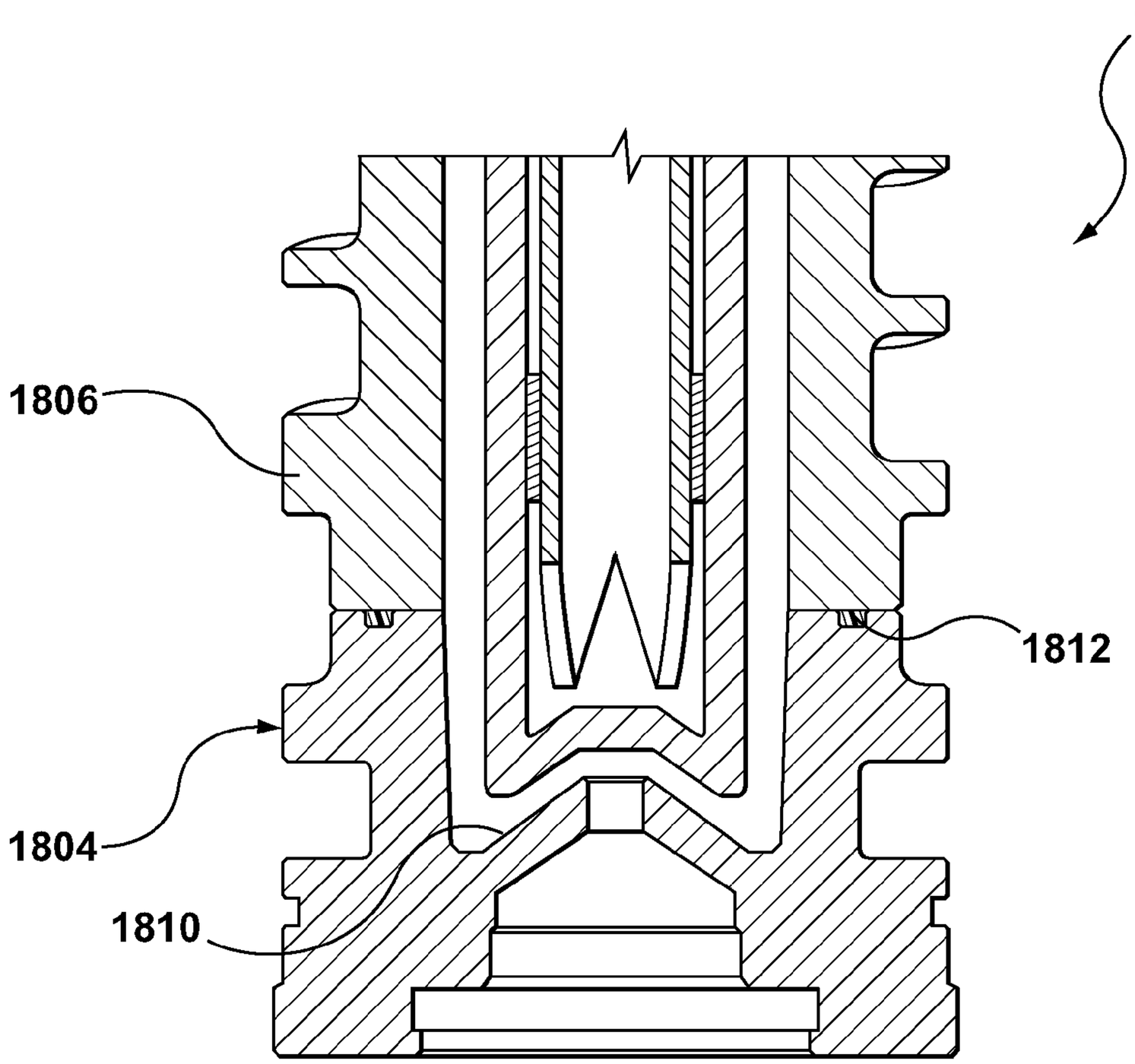


FIG. 18

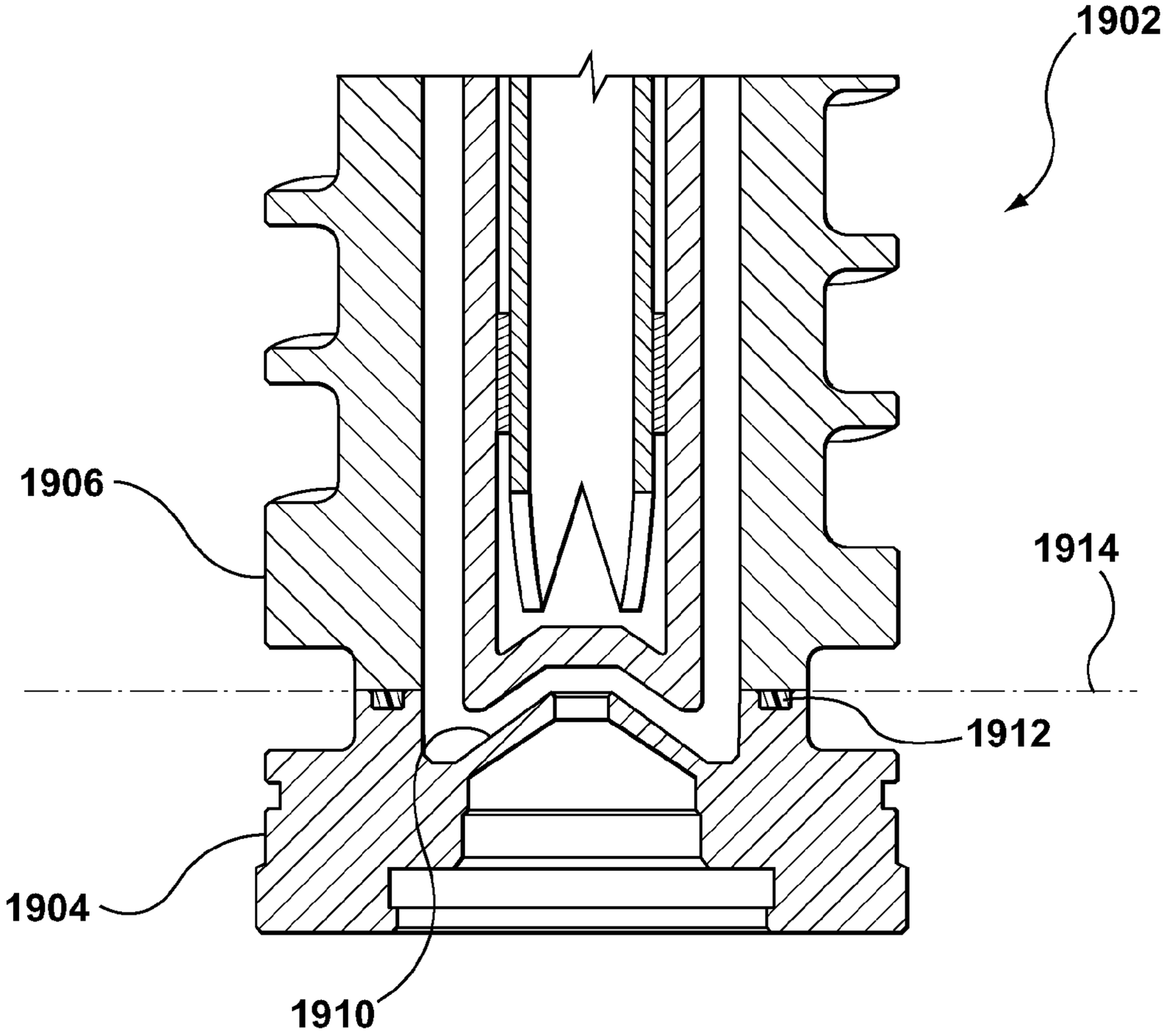


FIG. 19

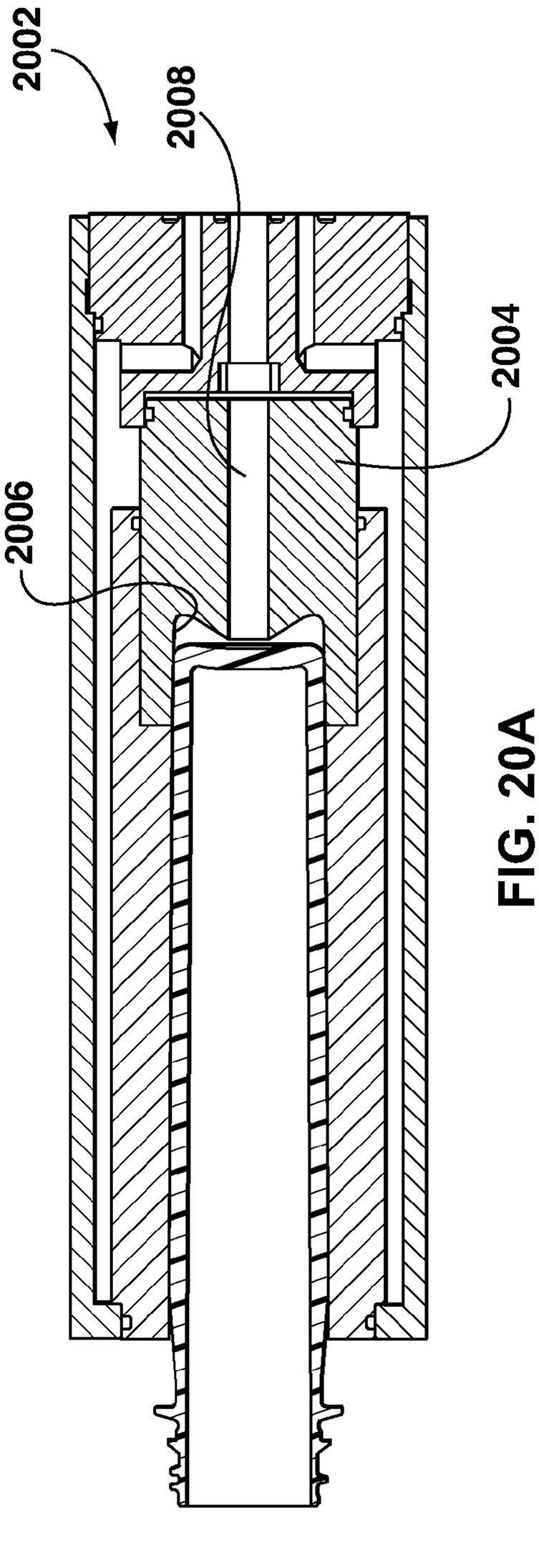


FIG. 20A

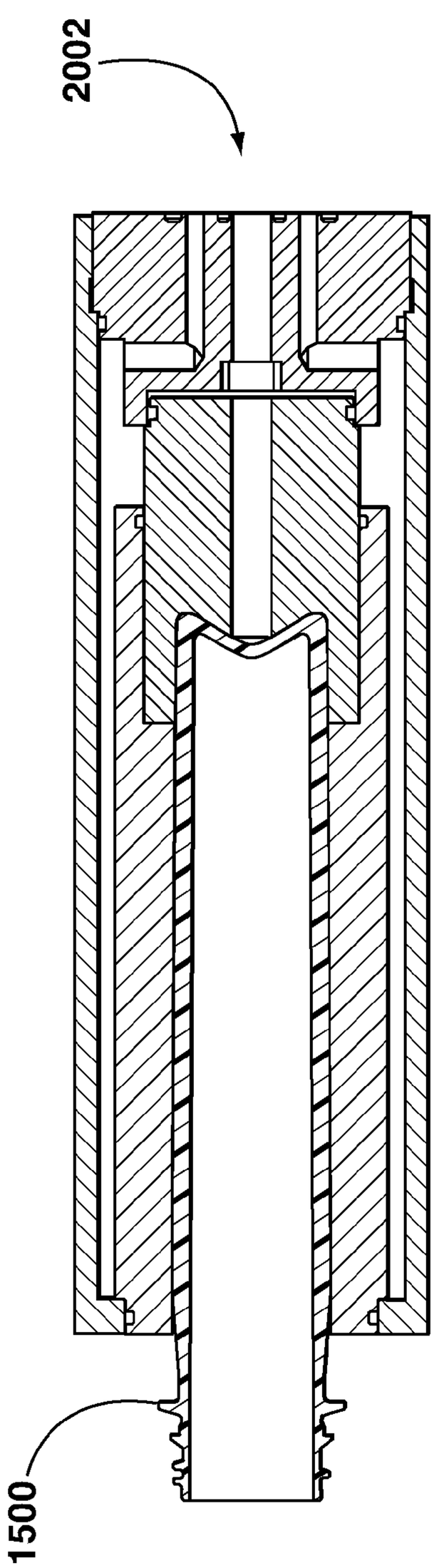


FIG. 20B

PREFORM AND A MOLD STACK FOR PRODUCING THE PREFORM

FIELD OF THE INVENTION

The present invention generally relates to, but is not limited to, a molding systems and processes, and more specifically the present invention relates to, but is not limited to, a preform and a mold stack for producing the preform

BACKGROUND OF THE INVENTION

Molding is a process by virtue of which a molded article can be formed from molding material by using a molding system. Various molded articles can be formed by using the molding process, such as an injection molding process. One example of a molded article that can be formed, for example, from polyethylene terephthalate (PET) material is a preform that is capable of being subsequently blown into a beverage container, such as, a bottle and the like.

As an illustration, injection molding of PET material involves heating the PET material to a homogeneous molten state and injecting, under pressure, the so-melted PET material into a molding cavity defined, at least in part, by a female cavity piece and a male core piece mounted respectively on a cavity plate and a core plate of a mold. The cavity plate and the core plate are urged together and are held together by clamp force, the clamp force being sufficient to keep the cavity and the core pieces together against the pressure of the injected PET material. The molding cavity has a shape that substantially corresponds to a final cold-state shape of the molded article to be molded. The so-injected PET material is then cooled to a temperature sufficient to enable ejection of the so-formed molded article from the mold. When cooled, the molded article shrinks inside of the molding cavity and, as such, when the cavity and core plates are urged apart, the molded article tends to remain associated with the core piece. Thereafter, the molded article can be ejected off of the core piece by use of one or more ejection structure. Ejection structures are known to assist in removing the molded articles from the core halves. Examples of the ejection structures include stripper plates, stripper rings and neck rings, ejector pins, etc.

With reference to FIG. **1**, a preform **100** is depicted, the preform **100** being an example of a typical prior art preform. The preform **100** consists of a neck portion **102**, a gate portion **106** and a body portion **104** extending between the neck portion **102** and the gate portion **106**. The gate portion **106** is associated with a substantially spherical shape that terminates in a vestige portion **108**.

U.S. Pat. No. 5,599,496 discloses a method of making a refillable polyester container having a low orientation base with improved resistance to caustic wash cracking. The method includes providing a preform with an upper base-forming thickened portion which resists axial elongation (thereby increasing the orientation of the body) and a lower base-forming tapered portion which decreases in thickness so as to gradually reduce the wall thickness of a central dome in the container base. The bottom of the preform base includes a central thickened region which is maintained in a recess during blowing to insure centering and prevent the formation of stress concentrations.

US patent application 2008/0179271 discloses a container base that is capable of withstanding an internal pressure and further capable of causing an even deflection, such as that created by introducing liquefied gas during a hot filling process. The base includes a heel with a standing ring disposed at a lower portion thereon. A generally concave push up portion

extends radially inward from the standing ring portion. At least two reinforcing rings are disposed on the push up portion, wherein the reinforcing rings diminish uneven deflection to prevent the container from tipping while resting on a flat surface.

SUMMARY OF THE INVENTION

According to a first broad aspect of the present invention, there is provided a preform suitable for subsequent blow-molding into a final-shaped container. The preform comprises a neck portion; a gate portion; and a body portion extending between said neck portion and said gate portion; the gate portion including an upwardly-bound region defined between the inner and outer walls thereof, substantially whole of the upwardly-bound region extending in a direction towards the neck portion.

According to a second broad aspect of the present invention, there is provided a mold stack for manufacturing a preform preform suitable for subsequent blow-molding into a final-shaped container, the preform including a neck portion; a gate portion; and a body portion extending between said neck portion and said gate portion; the gate portion including an upwardly-bound region defined between the inner and outer walls thereof, substantially whole of the upwardly-bound region extending in a direction towards the neck portion. The mold stack comprises a gate insert that includes a molding face a portion of which is configured to define the gate portion that includes the upwardly-bound region, which upwardly-bound region.

These and other aspects and features will now become apparent to those skilled in the art upon review of the following description of specific non-limiting embodiments in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

A better understanding of the non-limiting embodiments of the present invention (including alternatives and/or variations thereof) may be obtained with reference to the detailed description of the non-limiting embodiments along with the following drawings, in which:

FIG. **1** depicts a cross section view of a preform **100** implemented in accordance with known techniques.

FIG. **2**, is a schematic representation of a portion of a preform implemented according to a non-limiting embodiment of the present invention and a portion of a container that is subsequently blow-molded from the preform.

FIG. **3** depicts a perspective view of a preform and

FIG. **4** depicts a portion of the preform of FIG. **3**, the preform being implemented in accordance with another non-limiting embodiment of the present invention.

FIG. **5** depicts a perspective view of a preform and

FIG. **6** depicts a portion of the preform of FIG. **5**, the preform being implemented in accordance with another non-limiting embodiment of the present invention.

FIG. **7** depicts a perspective view of a preform and

FIG. **8** depicts a portion of the preform of FIG. **7**, the preform being implemented in accordance with yet another non-limiting embodiment of the present invention.

FIG. **9** depicts a perspective view of a preform and

FIG. **10** depicts a portion of the preform of FIG. **9**, the preform being implemented in accordance with a further non-limiting embodiment of the present invention.

FIG. **11** depicts a perspective view of a preform and

FIG. **12** depicts a portion of the preform of FIG. **11**, the preform being implemented in accordance with another non-limiting embodiment of the present invention.

FIG. **13** depicts a perspective view of a preform and

FIG. **14** depicts a portion of the preform of FIG. **13**, the preform being implemented in accordance with another non-limiting embodiment of the present invention.

FIG. **15** depicts a perspective view of a preform and

FIG. **16** depicts a portion of the preform of FIG. **15**, the preform being implemented in accordance with another non-limiting embodiment of the present invention.

FIGS. **17**A-**17**D, which depict a portion of a respective preforms implemented in accordance with yet further embodiments of the present invention.

FIG. **18** depicts a portion of a mold stack for manufacturing the preform **1500** of FIGS. **15**, the mold stack being implemented according to a non-limiting embodiment of the present invention.

FIG. **19** depicts a portion of a mold stack for manufacturing the preform **1500** of FIG. **15**, the mold stack being implemented in accordance with another embodiment of the present invention.

FIGS. **20**A and **20**B depict a cross section of a preform holder that can be used in some embodiments of the present invention to define portions of the preforms according to embodiments of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

Reference is now made to FIG. **2**, which depicts a schematic representation of a portion of a preform **200** implemented according to a non-limiting embodiment of the present invention and a portion of a final-shaped container **260** that is subsequently blow-molded from the preform **200**.

It is noted that even though not depicted in FIG. **2**, the preform **200** consists of a neck portion, a gate portion (a portion of which is depicted at **202**) and a body portion extending between the neck portion and the gate portion, much akin to the preform **100** of FIG. **1**. The neck portion and the body portion of the preform **200** can be implemented in a substantially similar manner to the neck portion **102** and the body portion **104** of the preform **100** of FIG. **1**.

It should be further appreciated that FIG. **2** depicts only one-half of the gate portion **202**, the other half (not depicted) being a mirror image thereof.

The gate portion **202** is implemented in accordance with non-limiting embodiments of the present invention. More specifically the gate portion **202** comprises an upwardly-bound region **204** defined between an outer wall **206** and an inner wall **208** thereof. It is noted that substantially the whole of the upwardly-bound region **204** extends in a direction towards the neck portion (i.e. the top of the preform **200** as viewed in FIG. **2**, of the whole if the preform **200** was shown). In other words, the upwardly-bound region **204** extends upwardly towards the neck portion relative to a lowest-most extremity **210** of the gate portion **202**. Put another way, it can be said that the lowest-most extremity **210** defines the beginning of the upwardly-bound region **204**, at least in the example presented in FIG. **2**.

Also shown in FIG. **2** is a portion of the final-shaped container **260**, the final-shaped container **260** having been produced from the preform **200** by known techniques, such as blow-molding techniques, stretch-blow-molding techniques and the like. The final-shaped container **260** comprises a container base **262**. The container base **262** is implemented as "petaloid-base" type having a plurality of legs (not separately numbered). In alternative embodiments, the final-shaped container **260** can be implemented as a "champagne-base" container (not depicted). The container base **262** includes an upwardly-bound container region **264**. The upwardly-bound container region **264** is generally defined from the material that was defining the upwardly-bound region **204** of the preform **200**. According to embodiments of the present invention and based on the so-called "memory effect" phenomenon associated with the molding material used for forming the preform **200** (and, therefore, the final-shaped container **260**), the upwardly-bound container region **264** is urged upwardly (as viewed in FIG. **2**) or, in other words, towards the neck portion (not depicted) of the preform **200**/final-shaped container **260**. As is known to those of skill in the art, the memory effect phenomenon is linked to the injection process and the shape of the preform so being formed. A technical effect of the embodiments of the present invention includes enhanced stability due at least partially to this upward urging of the material within the container base **262**, instead of buckling out (i.e. in the downward direction, as viewed in FIG. **2**) as may be the case with traditional preforms, such as some variations of the preform **100** depicted in FIG. **1**.

What follows is the description of other non-limiting embodiments that can be used to implement the upwardly-bound region **204**. It should be expressly understood that various features described above and below can be mixed in various additional non-limiting embodiments, even if not specifically depicted herein.

FIG. **3** depicts a perspective view of a preform **300** and FIG. **4** depicts a portion of the preform **300** of FIG. **3**, the preform **300** being implemented in accordance with another non-limiting embodiment of the present invention. The preform **300** consists of a neck portion **302**, a gate portion **306** and a body portion **304** extending between the neck portion **302** and the gate portion **306**. It is noted that the neck portion **302** and the body portion **304** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **302** and the body portion **304** are depicted for illustration purposes only. The gate portion **306** is implemented in accordance with a non-limiting embodiment of the present invention.

The gate portion **306** comprises an upwardly-bound region **324**. The upwardly-bound region **324** extends from a lowest-most extremity **310** towards a region peak portion **390**. The shape of the upwardly-bound region **324**, within this embodiment of the present invention, can be categorized as generally semi-spherical in nature. It is noted that in this embodiment of the present invention, the gate portion **306** is implemented as a conical variation with the inner and outer walls (not separately numbered) of the gate portion **306** extending between the body portion **304** and the lowest-most extremity **310** are generally parallel therebetween.

FIG. **5** depicts a perspective view of a preform **500** and FIG. **6** depicts a portion of the preform **500** of FIG. **5**, the preform **500** being implemented in accordance with another non-limiting embodiment of the present invention. The preform **500** consists of a neck portion **502**, a gate portion **506** and a body portion **504** extending between the neck portion **502** and the gate portion **506**. It is noted that the neck portion **502** and the body portion **504** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **502** and the body portion **504** are depicted for illustration purposes only. The gate portion **506** is implemented in accordance with a non-limiting embodiment of the present invention.

The gate portion **506** comprises an upwardly-bound region **524**. The upwardly-bound region **524** extends from a lowest-most extremity **510** towards a region peak portion **590**. The

shape of the upwardly-bound region **524**, within this embodiment of the present invention, can be categorized as generally semi-spherical in nature. However, in accordance with this embodiment of the present invention, the upwardly-bound region **524** comprises a locating bump **526** defined within on the inner wall of the gate portion **506** and, namely, the locating bump **526** is defined on the region peak portion **590**. An additional technical effect of this embodiment of the present invention can include ability to positively locate a stretch rod (not depicted) used during the stretch blow molding operation to convert the preform **500** into the final-shaped container **260**.

It is noted that in this embodiment of the present invention, the gate portion **506** is implemented as a conical variation with the inner and outer walls (not separately numbered) of the gate portion **506** extending between the body portion **504** and the lowest-most extremity **510** are generally parallel therebetween.

FIG. **7** depicts a perspective view of a preform **700** and FIG. **8** depicts a portion of the preform **700** of FIG. **7**, the preform **700** being implemented in accordance with yet another non-limiting embodiment of the present invention. The preform **700** consists of a neck portion **702**, a gate portion **706** and a body portion **704** extending between the neck portion **702** and the gate portion **706**. It is noted that the neck portion **702** and the body portion **704** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **702** and the body portion **704** are depicted for illustration purposes only. The gate portion **706** is implemented in accordance with a non-limiting embodiment of the present invention.

The gate portion **706** comprises an upwardly-bound region **724**. The upwardly-bound region **724** extends from a lowest-most extremity **710** towards a region peak portion **790**. The shape of the upwardly-bound region **724**, within this embodiment of the present invention, can be categorized as generally semi-spherical in nature. It is noted that in this embodiment of the present invention, the gate portion **706** is implemented as a generally semi-spherical variation with the inner and outer walls (not separately numbered) of the gate portion **706** defining a respective radii extending between the body portion **704** and the lowest-most extremity **710**.

FIG. **9** depicts a perspective view of a preform **900** and FIG. **10** depicts a portion of the preform **900** of FIG. **9**, the preform **900** being implemented in accordance with yet another non-limiting embodiment of the present invention. The preform **900** consists of a neck portion **902**, a gate portion **906** and a body portion **904** extending between the neck portion **902** and the gate portion **906**. It is noted that the neck portion **902** and the body portion **904** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **902** and the body portion **904** are depicted for illustration purposes only. The gate portion **906** is implemented in accordance with a non-limiting embodiment of the present invention.

The gate portion **906** comprises an upwardly-bound region **924**. The upwardly-bound region **924** extends from a lowerest extremity **910** towards a region peak portion **990**. The shape of the upwardly-bound region **924**, within this embodiment of the present invention, can be categorized as generally semi-spherical in nature. It is noted that in this embodiment of the present invention, the gate portion **906** is implemented without a pronounced transition from the body portion **904**. In other words and as can be appreciated from FIG. **10**, the body portion **904** terminates into the lowerest extremity **910**.

A variation of the embodiment of FIG. **9** and FIG. **10** is further depicted with reference to FIGS. **11** and **12**, in which FIG. **11** depicts a perspective view of a preform **1100** and FIG. **12** depicts a portion of the preform **110** of FIG. **11**, the preform **1100** being implemented in accordance with yet another non-limiting embodiment of the present invention. The preform **1100** is implemented substantially similar to that of preform **900** other then an upwardly-bound region **1124** is associated with a more pronounced radius.

FIG. **13** depicts a perspective view of a preform **1300** and FIG. **14** depicts a portion of the preform **1300** of FIG. **13**, the preform **1300** being implemented in accordance with yet another non-limiting embodiment of the present invention. The preform **1300** consists of a neck portion **1302**, a gate portion **1306** and a body portion **1304** extending between the neck portion **1302** and the gate portion **1306**. It is noted that the neck portion **1302** and the body portion **1304** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **1302** and the body portion **1304** are depicted for illustration purposes only. The gate portion **1306** is implemented in accordance with a non-limiting embodiment of the present invention.

Within this embodiment of the present invention, the gate portion **1306** comprises a plurality of lower-most extremities and a plurality of upwardly-bound regions. More specifically, the gate portion **1306** can comprise a first upwardly-bound region **1324***a*, a second upwardly-bound region **1324***b* and a third upwardly-bound region **1324***c*. The first upwardly-bound region **1324***a* is extending between a first lower-most extremity **1310***a* and a second lower-most extremity **1310***b*. The second upwardly-bound region **1324***b* is extending between the second lower-most extremity **1310***b* and a third lower-most extremity **1310***c*. The third upwardly-bound region **1324***c* is extending between the third lower-most extremity **1310***c* and a fourth lower-most extremity **1310***d*.

FIG. **15** depicts a perspective view of a preform **1500** and FIG. **16** depicts a portion of the preform **1500** of FIG. **15**, the preform **1500** being implemented in accordance with yet another non-limiting embodiment of the present invention. The preform **1500** consists of a neck portion **1502**, a gate portion **1506** and a body portion **1504** extending between the neck portion **1502** and the gate portion **1506**. It is noted that the neck portion **1502** and the body portion **1504** can be implemented according to any known technique(s), standard(s) and design(s)—and as such, the neck portion **1502** and the body portion **1504** are depicted for illustration purposes only. The gate portion **1506** is implemented in accordance with a non-limiting embodiment of the present invention.

The gate portion **1506** comprises an upwardly-bound region **1524**. The upwardly-bound region **1524** extends between a lowerest extremity **1510** and a region peak portion **1590**. The shape of the upwardly-bound region **1524**, within this embodiment of the present invention, can be categorized as generally conical in nature. In other words, it can be said that a cone is defined with a base defined by the lowerest extremity **1510** and the region peak portion **1590**. It is noted that in this embodiment of the present invention, the gate portion **1506** is implemented without a pronounced transition from the body portion **1504**. In other words and as can be appreciated from FIG. **16**, the body portion **1504** terminates into the lowerest extremity **1510**.

It is noted that inventors contemplate numerous additional variations and/or enhancements to the geometry of the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506**. For example, even though the above description contemplates the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506** to be of substantially constant thickness, this needs not be so in

every embodiment of the present invention. As such, in alternative embodiments of the present invention, it is contemplated that the wall thickness of the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506** can be varied. For example, the wall thickness can be varied to create a heat absorption profile, as may be required for a given application. The wall thickness can also be varied for better positioning of the stretch rod used during the stretch blow-molding process. It is also contemplated that a portion of the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506** can include a step, either inwardly or outwardly or both vis-à-vis a center axis of the preform.

Examples of some of such alternative implementations will be described in further detail with reference to FIGS. **17**A-**17**D, which depict a portion of a respective preform **1700**D-**1700**G implemented in accordance with yet further embodiments of the present invention. Each instance of the preform **1700**D-**1700**G comprises a respective upwardly-bound region **1724**D-**1724**G. Preform **1700**D is an example of an implementation whereby the gate portion includes a step on an outside wall, resulting in the gate portion having a thicker wall then the body portion. Preform **1700**E is an example of an implementation whereby the wall thickness of the gate portion gradually reduces towards the bottom of the preform. Preform **1700**F is an example of an implementation whereby the wall thickness of the gate portion gradually increases towards the bottom of the preform. Preform **1700**G is an example of a preform implemented with a modified draft. More specifically, preform **1700**G is associated with a first outer radius y and a first inner radius x. Located closer to the upwardly-bound region **1724**G, the preform **1700**G is associated with a second outer radius y" (which is larger then the first outer radius y) and a second inner radius y" (which is larger then the first inner radius y). Those skilled in the art will appreciate that FIGS. **17**A-**17**D are meant to be illustrations of some of the alternative embodiments rather then an exhaustive list thereof.

It should be expressly understood that various features described above and below can be mixed in various additional non-limiting embodiments, even if not specifically depicted herein. Just as an example, the locating bump **526** described with reference to FIG. **6** can be applied to other embodiments of the present invention. By the same token, the thickness variations and the steps can also me matched and mixed with other embodiments and variations described herein.

The above described embodiments of a gate portion, namely the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506**, can be manufactured using a standard gate insert (not depicted) similar to that used to produce the gate portion **106** depicted in FIG. **1**. Such gate insert can be of a one-piece construction or a two piece construction. An example of the two-piece construction of the gate insert is disclosed in a co-owned U.S. Pat. No. 7,566,216 issued to Kmoch et al on Jul. 28, 2009.

Naturally, the molding surface defining face of the gate insert, whether one piece or two piece, needs to be adapted to define the geometry of the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506** described above. In some embodiments of the present invention, the fate insert and/or the cavity insert may need to be implemented as a split insert (as is known in the art) to manufacture undercut portions of the design, such as for example, the case is in the embodiment of FIG. **17**A.

With reference to FIGS. **18** and **19**, non-limiting embodiments of a molding stack for producing preforms in accordance with various non-limiting embodiments of the present invention shall be described. Specifically, FIG. **18** depicts a portion of a mold stack **1802** for manufacturing the preform **1500** of FIGS. **15** and **16** and FIG. **19** depicts a portion of a mold stack **1902** for manufacturing the preform **1500**.

Mold stack **1802** includes a gate insert **1804** and a cavity insert **1806**, only a portion of which is depicted. The gate insert **1804** includes a molding face **1810**, a portion of which is configured to define the gate portion **1506** that includes the upwardly-bound region **1524**, which upwardly-bound region **1524** extends between the lowerest extremity **1510** and the region peak portion **1590**, as described above. It is worthwhile noting that there is a split line **1812** defined between the gate insert **1804** and the cavity insert **1806**. It is noted that in this embodiment, it can be said that the portion of the gate insert **1804** defining the gate portion **1506** is encapsulated below the split line **1812**, the term below referring to the direction as seen in FIG. **18**.

Mold stack **1902** includes a gate insert **1904** and a cavity insert **1906**, only a portion of which is depicted. The gate insert **1904** includes a molding face **1910**, a portion of which is configured to define the gate portion **1506** that includes the upwardly-bound region **1524**, which upwardly-bound region **1524** extends between the lowerest extremity **1510** and the region peak portion **1590**, as described above. It is worthwhile noting that there is a split line **1912** defined between the gate insert **1804** and the cavity insert **1806**. It is noted that in this embodiment, it can be said that the split line **1912**, if it was continued in a virtual line **1914**, would penetrate the portion of the gate insert **1804** defining the gate portion **1506**.

It is expected that those skilled in the art will be able to adapt teachings of the mold stack **1802**, **1902** presented in regard to preform **1500** to mold stacks for production of other embodiments of the preforms discussed herein.

In alternative non-limiting embodiments of the present invention, the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506** can be molded using the standard gate insert, as for example one used for molding the gate portion **106** of FIG. **1** with a shape as known in the prior and then reshaped into geometries described with reference to gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506**. The reshaping can be done, for example, in an End-of-Arm tool, which is used for post-mold treatment of the preforms. It is anticipated that by de-molding the preform at a slightly elevated temperature vis-à-vis prior art approaches and/or by using pulsed heating and/or cooling in the End-Of-Arm Tool, it should be possible to reshape a standard preform into a preform having the gate portions **202**, **306**, **506**, **706**, **906**, **1106**, **1306**, **1506**.

An example of such an alternative implementation is depicted with reference to FIG. **20**A and FIG. **20**B. FIG. **20**A depicts a cross section of a preform holder **2002** of a post-mold cooling apparatus (not depicted), the preform holder **2002** implemented in accordance with a non-limiting embodiment of the present invention. The preform holder **2002** is depicted at stage where it has received a preform **1500** manufactured in a standard gate insert for producing a flat bottom preforms. FIG. **20**B depicts a cross section of the preform holder **2002** after the preform **1500** has been reshaped into the state depicted in FIG. **15**. The preform holder **2002** comprises a bottom insert **2004** having a contoured face **2006** that has a geometry of the final shape of the preform **1500** depicted in FIG. **15**. The bottom insert **2004** also includes a vacuum channel **2008** connectable, in use, to a source of under-pressure. When the preform **1500** is received in the preform holder **2002**, after it has been molded, and under application of vacuum, the gate portion **1506** is reshaped to have the upwardly-bound region **1524**. It is expected that construction of the preform holder **2002** can be easily adapted for reshaping preforms according to other

embodiments described above. In other words, the preform holder **2002** is configured for reshaping a preform suitable for subsequent blow-molding into a final-shaped container, from preform molded in a standard gate insert mold stack to a preform implemented according to embodiments of the present invention, by providing a bottom insert having a countoured face and a vacuum channel, the countoured face configured to define the gate portion that includes the upwardly-bound region under application of under-pressure through the vacuum channel.

Description of the non-limiting embodiments of the present inventions provides examples of the present invention, and these examples do not limit the scope of the present invention. It is to be expressly understood that the scope of the present invention is limited by the claims. The concepts described above may be adapted for specific conditions and/or functions, and may be further extended to a variety of other applications that are within the scope of the present invention. Having thus described the non-limiting embodiments of the present invention, it will be apparent that modifications and enhancements are possible without departing from the concepts as described. Therefore, what is to be protected by way of letters patent are limited only by the scope of the following claims.

What is claimed is:

1. An injection molded preform suitable for subsequent blow-molding into a final-shaped container, the preform comprising:

a neck portion;

a gate portion having a substantially constant thickness; and

a body portion extending between said neck portion and said gate portion;

wherein the gate portion is implemented as either a conical form or a semi-spherical shape extending between the body portion and a lower-most extremity; and

the gate portion further comprises an upwardly-bound region of a semi-spherical or conical shape extends upwardly from the lower-most extremity towards the neck portion, whole of the upwardly-bound region extending in a direction towards the neck portion;

wherein the upwardly-bound region includes an outer planar surface of a gate vestige at an apex thereof

wherein the upwardly-bound region is blow moldable to form an upwardly-bound container region of the container.

2. The preform of claim **1**, wherein the upwardly-bound region further includes a locating bump defined on an inner surface of the gate portion, the locating bump for positively locating a stretch rod used during the blow-molding process.

3. A process for molding a container, comprising:

injection molding a preform having a neck portion, a gate portion and a body portion extending between said neck portion and said gate portion, wherein the gate portion, having a substantially constant thickness, is implemented as either a conical form or a semi-spherical shape extending between the body portion and a lower-most extremity, wherein the gate portion further comprises an upwardly-bound region of a semi-spherical or conical shape that extends upwardly from the lower-most extremity towards the neck portion, whole of the upwardly-bound region extending in a direction towards the neck portion, wherein the upwardly-bound region includes an outer planar surface of a gate vestige at an apex thereof;

blow-molding the injection molded preform into the final-shaped container, wherein the upwardly-bound region is blow molded to form an upwardly-bound container region of the container.

* * * * *