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(54) Title: MULTI-SEAL PAINT CUP ASSEMBLY

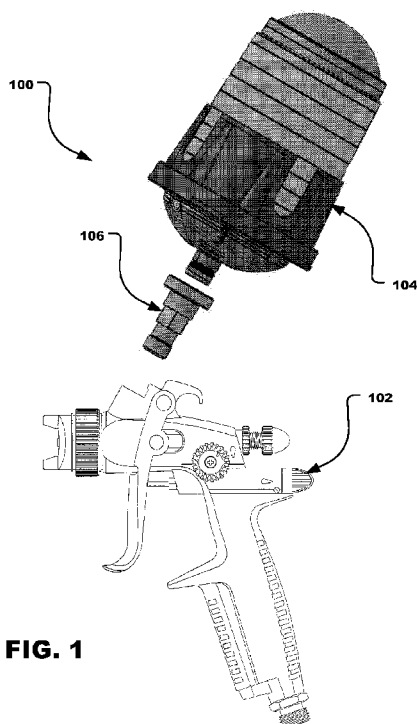


FIG. 1

(57) Abstract: A paint cup assembly for a paint sprayer can include a cap formed with an external rim and a plurality of threads adjacent to the external rim and a paint reservoir configured to engage the cap. The paint reservoir can include a distal end formed with a hub having threads configured to engage the threads on the cap. Moreover, a seal can be disposed between the external rim of the cap and the distal end of the paint reservoir. The seal can be compressed between the external rim of the cap and the distal end of the paint reservoir as the paint reservoir is threaded around the cap. Further, the seal can prevent air infiltration into the paint reservoir as paint is withdrawn from the paint reservoir by a spray gun.



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MULTI-SEAL PAINT CUP ASSEMBLY

TECHNICAL FIELD

5 The present disclosure is directed to a paint cup assembly and to a paint cup assembly having multiple seals.

BACKGROUND ART

10 Spray guns can be used for rapidly coating surfaces with liquids, such as paint. Paint can be contained in a container that attaches to the spray gun. The outlet of the container can be a releasably connectable coupling that connects to the spray gun. Paint can flow from the container into the spray gun and then, fed to a spray nozzle. The spray nozzle can combine the paint with air, atomize the liquid, and form a spray. At the end of the spraying operation, the container and the mating connection to the spray gun should be thoroughly cleaned so that the paint from one operation does not contaminate the paint to be sprayed in the next spraying operation. Additionally, the coupling between container and spray gun should be free of any dried liquid that might interfere with the connection between container and spray gun. A container with a lid and a disposable cup or liner can be used to eliminate or reduce the labor required to clean the container and the coupling to the spray gun.

20 BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are illustrated by way of example and are not limited in the accompanying figures.

FIG. 1 includes a plan view of a paint sprayer assembly in accordance with a particular embodiment.

25 FIG. 2 includes a plan view of a paint cup assembly engaged with an adapter in accordance with a particular embodiment.

FIG. 3 includes an exploded plan view of a paint cup assembly and an adapter in accordance with a particular embodiment.

FIG. 3a includes a detailed cross-sectional view of a paint liner.

FIG. 4 includes a detailed plan view of a first embodiment of a paint cup assembly outlet tube in accordance with a particular embodiment.

FIG. 5 includes a detailed plan view of a second embodiment of a paint cup assembly outlet tube in accordance with a particular embodiment.

5 FIG. 6 includes a detailed plan view of a third embodiment of a paint cup assembly outlet tube in accordance with a particular embodiment.

FIG. 7 includes a plan view of a valve retainer in accordance with a particular embodiment.

10 FIG. 8 includes a cross-sectional view of a valve plunger in accordance with a particular embodiment.

FIG. 9 includes a cross-sectional view of a valve actuator in accordance with a particular embodiment.

FIG. 10 includes a cross-sectional view of a first embodiment of an adapter in accordance with a particular embodiment.

15 FIG. 11 includes a cross-sectional view of a second embodiment of an adapter in accordance with a particular embodiment.

FIG. 12 includes a cross-sectional view of a third embodiment of an adapter in accordance with a particular embodiment.

20 FIG. 13 includes a cross-sectional view of the paint cup assembly taken along line 13-13 in FIG. 2 in accordance with a particular embodiment.

FIG. 14 includes a detailed plan view of a third embodiment of a paint cup assembly valve assembly in accordance with a particular embodiment.

FIG. 15 includes a top plan view of a seal in accordance with a particular embodiment.

25 FIG. 16 includes a side plan view of a seal in accordance with a particular embodiment.

FIG. 17 includes a cross-sectional view of another embodiment of a paint cup assembly in accordance with a particular embodiment.

FIG. 18 includes a detailed cross-sectional view of the paint cup assembly in accordance with a particular embodiment taken at circle 18 in FIG. 17.

5 FIG. 19 includes a perspective view of a paint cup assembly filling station in accordance with a particular embodiment.

FIG. 20 includes a top plan view of a paint cup assembly filling station in accordance with a particular embodiment.

10 FIG. 21 includes a side plan view of a paint cup assembly filling station in accordance with a particular embodiment.

FIG. 22 includes a first cross-sectional view of a paint cup assembly filling station in accordance with a particular embodiment taken along line 22-22 in FIG. 20.

FIG. 23 includes a second cross-sectional view of a paint cup assembly filling station in accordance with a particular embodiment taken along line 23-23 in FIG. 20.

15 FIG. 24 includes a first perspective view of a paint cup assembly support stand in accordance with a particular embodiment.

FIG. 25 includes a second perspective view of a paint cup assembly support stand in accordance with a particular embodiment.

20 Skilled artisans appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures can be exaggerated relative to other elements to help to improve understanding of embodiments of the invention. The use of the same reference symbols in different drawings indicates similar or identical items.

25 DETAILED DESCRIPTION

The following description in combination with the figures is provided to assist in understanding the teachings disclosed herein. The following discussion will focus on specific implementations and embodiments of the teachings. This focus is provided to assist in

describing the teachings and should not be interpreted as a limitation on the scope or applicability of the teachings.

As used herein, the terms “comprises,” “comprising,” “includes,” “including,” “has,” “having,” or any other variation thereof, are intended to cover a non-exclusive inclusion.

5 For example, a process, method, article, or apparatus that comprises a list of features is not necessarily limited only to those features but can include other features not expressly listed or other features that are inherent to such process, method, article, or apparatus. Further, unless expressly stated to the contrary, “or” refers to an inclusive-or and not to an exclusive-or. For example, a condition A or B is satisfied by any one of the following: A is true (or present)
10 and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

The use of “a” or “an” is employed to describe elements and components described herein. This is done merely for convenience and to give a general sense of the scope of the embodiments of the disclosure. This description should be read to include one or at least one
15 and the singular also includes the plural, or vice versa, unless it is clear that it is meant otherwise.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. The materials, methods, and examples are illustrative only and not intended to be
20 limiting.

Referring initially to FIG. 1, a paint sprayer assembly is illustrated and is generally designated 100. As illustrated, the paint sprayer assembly 100 includes a paint spray gun 102 and a paint cup assembly 104 that can be removably engaged with the paint spray gun 102 via an adapter 106. In a particular aspect, the adapter 106 can be threadably engaged with the
25 paint spray gun 102 and the paint cup assembly 104 can be inserted into the adapter 104. Further, during operation of the paint spray gun 102, the paint cup assembly 104 can be in fluid communication with the paint spray gun 102. Specifically, the paint cup assembly 104 can deliver paint to the paint spray gun 102 and the paint spray gun 102 can be used to transmit the fluid, e.g., paint, to a substrate, e.g., a car body.

30 FIG. 2 through FIG. 9 illustrate details concerning the paint cup assembly 104 that is depicted in FIG. 1 in conjunction with the paint spray gun 102. Specifically, FIG. 2 and FIG.

3 include details concerning the paint cup assembly 104 in its entirety and FIG. 4 through FIG. 9 illustrate details concerning various component parts of the paint cup assembly 104.

As indicated in FIG. 2 and FIG. 3, the paint cup assembly 104 can include a paint reservoir, e.g., a paint liner 202. The paint cup assembly 104 can also include an extended
5 ring 204 that can at least partially surround the paint liner 202. In a particular aspect, the extended ring 204 can include an axial extension, e.g., a skirt, that can extend toward a closed proximal end of the paint liner such that the ring can be configured to allow a user to grasp the paint cup assembly without collapsing the paint liner during attachment with a paint
10 sprayer. As illustrated, the paint cup assembly 104 can include a cap 206 that can be threadably engaged with the extended ring 204. As described in detail below, the cap 206 can engage the adapter 106 in order for the paint cup assembly 104 to be attached to a spray gun (not illustrated). A seal 207 can be installed between the cap 206 and the extended ring 204. In particular, the seal 207 can circumscribe a portion of the cap 206. As described
15 further herein, the seal 207 can form a tertiary sealing structure for preventing paint from leaking from the paint cup assembly 104 during use or during storage.

FIG. 3 indicates that the paint liner 202 can include a hollow body 302 that defines a proximal end 304 and a distal end 306. The hollow body 302 can be generally frustoconical. The proximal end 304 of the hollow body 302 can be closed. Further, the proximal end 304 of the hollow body 302 can be rounded. The distal end 306 of the hollow body 302 can be
20 open and can facilitate filling the paint liner 202 with paint, as described in detail below. The hollow body 302 can also include a rim 308 that circumscribes the distal end 306 of the hollow body 302. When the extended ring 204 is engaged with the cap 206, the rim 308 of the paint liner 202 can be captured, or otherwise trapped, between the extended ring 204 and the cap 206.

25 In a particular aspect, the paint liner 202, including the hollow body 302, can be transparent. In another aspect, the paint liner 202, including the hollow body 302, can be translucent. In still another aspect, the paint liner 202, including the hollow body 302, can be opaque. In still another aspect, portions of the paint liner 202 can be opaque and other portions can be transparent, translucent, or a combination thereof. For example, the paint
30 liner 202 can be substantially opaque with one or more transparent strips to facilitate measuring while filling the paint liner 202 with paint.

In a particular aspect, the paint liner 202 can be disposable. Further, in a particular aspect, the paint liner 202 can be collapsible. Specifically, the paint liner 202 can be collapsible as paint is withdrawn from within the paint liner 202. Also, in a particular aspect, the paint liner 202 can be constructed from low density polyethylene (LDPE).

5 As illustrated in FIG. 3, the paint liner 202 can include a plurality of indicia 310 spaced along the length of the hollow body 302 of the paint liner 202. Each of the indicia can be spaced along the length of the hollow body 302. Each of the indicia 310 can represent an incremental change in an internal volume of the paint liner. In a particular aspect, the plurality of indicia 310 can be lines that are printed, or otherwise disposed, on an exterior
10 surface of the body 302. In another aspect, the plurality of indicia 310 can be printed, or otherwise disposed, on an interior surface of the body 302. In still another aspect, the plurality of indicia 310 can be printed, or otherwise disposed, on an interior surface of the body 302 and on an exterior surface of the body 302. The indicia 310 can partially circumscribe the body 302. Alternatively, the indicia 310 can fully circumscribe the body
15 302.

It can be appreciated that the volume between adjacent indicia can be the same. Further, it can be appreciated that due to the tapered shape of the body 302 the spacing of the indicia along the body can vary.

In a particular aspect, each of the plurality of indicia 310 can be a raised rib extending
20 from the body. Each of the ribs can extend internally into the body. Conversely, each of the ribs can extend externally, or outwardly, from the body.

In another aspect, each of the indicia 310 can serve as a crush zone to facilitate collapsing of the paint liner 202 as paint is expressed from the paint liner 202 during a spraying operation. As illustrated in FIG. 3a, the body 302 of the paint liner 202 can have a
25 body wall thickness, t_{BW} , and each of the indicia 310 can have an indicia wall thickness, t_{IW} , and the indicia wall thickness can be less than the body wall thickness.

In a particular aspect, the indicia wall thickness can be less than or equal to ninety percent (90%) of the body wall thickness. In another aspect, the indicia wall thickness can be less than or equal to eighty-five percent (85%) of the body wall thickness. In yet another
30 aspect, the indicia wall thickness can be less than or equal to eighty percent (80%) of the

body wall thickness. In still another aspect, the indicia wall thickness can be less than or equal to seventy-five percent (75%) of the body wall thickness. In another aspect, the indicia wall thickness can be less than or equal to seventy percent (70%) of the body wall thickness. In still yet another aspect, the indicia wall thickness can be less than or equal to sixty-five percent (65%) of the body wall thickness. In yet another aspect, the indicia wall thickness can be less than or equal to sixty percent (60%) of the body wall thickness.

In another aspect, the indicia wall thickness can be less than or equal to fifty-five percent (55%) of the body wall thickness. In still another aspect, the indicia wall thickness can be less than or equal to fifty percent (50%) of the body wall thickness. In another aspect, the indicia wall thickness can be less than or equal to forty-five percent (45%) of the body wall thickness. In another aspect, the indicia wall thickness can be less than or equal to forty percent (40%) of the body wall thickness. In yet another aspect, the indicia wall thickness can be less than or equal to thirty-five percent (35%) of the body wall thickness. Further, in another aspect, the indicia wall thickness can be less than or equal to thirty percent (30%) of the body wall thickness. In still another aspect, the indicia wall thickness can be less than or equal to twenty-five percent (25%) of the body wall thickness. In another aspect, the indicia wall thickness may not be less than twenty percent (20%) of the body wall thickness. Further, the indicia wall thickness can be within a range between and including any of the percentage of body wall thickness values described herein.

Returning to FIG. 3, the extended ring 204 can include a hub 312 having a proximal end 314 and a distal end 316. As illustrated, a skirt 318 can extend longitudinally from the proximal end 314 of the hub 312. The skirt 318 can be formed with a plurality of slots 320. The slots 320 can allow a user to see the indicia 310 on the paint liner 202 while filling the paint liner 202 with paint.

FIG. 3 indicates that the distal end 316 of the hub 312 can be formed with a plurality of teeth 322 that extend radially outward from the hub 312. Accordingly, when viewed from the distal end 316, the hub 312 of the extended ring 204 can have a gear, or cog, shape. This gear, or cog, shape can be configured to key the paint cup assembly 104 to a filling station, described in detail below, during filling. Specifically, the gear shape can be configured to fit into a correspondingly shaped hole formed in a filling station in order to prevent the paint cup assembly 104 from rotating within the hole as the extended ring 204 is engaged with the cap 206.

The hub 312 can include an interior surface (not illustrated) that can be formed with a plurality of internal threads. As such, the hub 312, and the extended ring 204, can be configured to threadably engage the cap 206. When assembled, as illustrated in FIG. 2, the skirt 318 of the extended ring 204 can at least partially surround the paint liner 202. Further, the skirt 318 can extend at least partially along the length of the paint liner 202. In a particular aspect, the skirt 318 can be substantially rigid and the skirt 318 can be configured to be grasped without collapsing the paint liner 202. Particularly, the extended ring 204 can be constructed from twenty percent (20%) talc filled polypropylene.

As further illustrated in FIG. 3, the cap 206 of the paint cup assembly 104 can include generally hemispherical hollow body 329 having a proximal end 330 and a distal end 332. The proximal end 330 of the cap 206 can be formed with a plurality of external threads 334 that are configured to engage the internal threads (not illustrated) formed in the hub 312 of the extended ring 204. The cap 206 can also include a primary sealing structure 336 and a secondary sealing structure 338. The cap 206 can also include an external rim 339 having an external diameter. The primary sealing structure 336 can be located at a distance from the external rim 339 and the secondary sealing structure 338 can be located between the primary sealing structure 336 and the external rim 339. Further, the seal 207 can be disposed around the hollow body 329 near the external threads 334 and abutting the external rim 339.

During use, the extended ring 204 can be threaded onto the cap 206 and the rim 308 of the paint liner 202 can be sandwiched between the extended ring 204 and the cap 206. A primary seal can be established between the rim 308 of the paint liner 202 and the primary sealing structure 336 on the cap 206. The primary seal can substantially prevent fluid from leaking through the interface established by the paint liner 202 and the cap 206. A secondary seal can be established between secondary sealing structure 338 on the cap 206 and the hub 312 of the extended ring 204. The secondary seal can substantially prevent fluid from leaking through the interface established by the cap 206 and the extended ring 204. The seal 207 can be compressed between distal end 316 of the hub 312 of the extended ring 204 and the external rim 339 of the cap 206, as the extended ring 204 is threaded on the cap 206, to form a tertiary seal between the distal end 316 of the hub 312 and the external rim 339 of the cap 206.

Accordingly, when the paint cup assembly 104 is filled with fluid and assembled as illustrated in FIG. 1, the paint cup assembly 104 can be shaken to stir, or otherwise mix, the fluid within the paint cup assembly 104.

As illustrated in FIG. 3, the cap 206 can include an outlet tube 340 that can extend
5 from the distal end 332 of the cap 206. Specifically, the outlet tube 340 can extend from the center of the distal end 332 of the cap 206. The outlet tube 340 can be configured to be removably engaged with the adapter 106. For example, as depicted in FIG.3, the outlet tube 340 can be formed with external threads 342.

Alternatively, as illustrated in FIG. 4, the outlet tube 340 can be formed within one or
10 more locking pins 400 that can extend radially outward from the outlet tube 340. The locking pins 400 can be configured to engage one or more grooves, or slots, formed within the adapter 106. Examples of grooves or slots formed within the adapter 106 are described below in conjunction with FIG. 10 and FIG. 11.

In another aspect, the outlet tube 340 can be formed with one or more grooves
15 configured to engage one or more locking pins within the adapter. FIG. 5 illustrates one such groove, generally designated 500. As such, the groove 500 can include a generally helical portion 502 that extends to a relatively straight portion 504. The relatively straight portion 504 can be substantially parallel to the end face of the outlet tube 340. To install the paint cup assembly 104 (FIG. 3) within the adapter 106 (FIG. 3), the outlet tube 340 can be
20 inserted into the adapter 106 (FIG. 3) such that the groove 500, or grooves, fit over corresponding locking pins. Thereafter, the paint cup assembly 104 (FIG. 3) can be rotated in order to move the groove 500, or grooves, over the locking pins until the paint cup assembly 104 (FIG. 3) is essentially locked in placed within the adapter 106 (FIG. 3).

It can be appreciated that a spring in a valve assembly, described below, can provide a
25 biasing force to facilitate locking the paint cup assembly 104 (FIG. 3) within the adapter 106 (FIG. 3). Further, it can be appreciated that the relatively straight portion 504 can be slightly angled with respect to the end face of the outlet tube 340 in order to provide a ramped structure to further facilitate locking the paint cup assembly 104 (FIG. 3) within the adapter 106 (FIG. 3). For example, the relatively straight portion 504 can be angled in a range of one
30 degree to twenty degrees (1° - 20°) relative to a line parallel to the end face of the outlet tube 340. Additionally, the relatively straight portion 504 can terminate in a notch 506, or divot.

A locking pin can move into the notch 506 and can further secure attachment of the paint cup assembly 104 (FIG. 3) to the adapter (FIG. 3).

FIG. 6 illustrates another groove, generally designated 600. As illustrated, the groove 600 can include a vertical portion 602 that can be substantially perpendicular to the end face of the outlet tube 304. The vertical portion 602 leads to a first angled portion 604 that can be angled away from the end face of the outlet tube 304, e.g., in a range of one degree to twenty degrees (1° - 20°). The first portion 604 can be angled with respect to a line parallel to the end face of the outlet tube 304. A second angled portion 606 extends from the first angled portion 604 in the opposite direction as the first angled portion 604, i.e., toward the end face of the outlet tube 304. The second angled portion 606 can be angled in a range of one degree to twenty degrees (1° - 20°). The second angled portion 606 can be angled with respect to a line parallel to the end face of the outlet tube 304.

In a particular aspect, the cap 206 can be constructed from polypropylene (PP).

Returning to FIG. 3, the paint cup assembly 104 can also include a valve assembly 350. The valve assembly 350 can be installed within the cap 206. Specifically, the valve assembly 350 can be installed within the cap 206 between the outlet tube 340 and a valve retainer 352. The valve assembly 350 can include a plunger 354 and a spring 356. In another aspect, the valve assembly 350 can include a ball (not illustrated) in lieu of a plunger.

In a particular aspect, the plunger 354 can be constructed from a thermoplastic elastomer (TPE). Further, the spring 365 can be a conical compression spring made from stainless steel.

As illustrated in FIG. 7, the valve retainer 352 include a generally disk shaped frame 700. The frame 700 of the valve retainer 352 can be formed with a central opening 702 through which a portion of the plunger 354 can extend through after installation and during operation of the valve assembly 350, as described below. FIG. 7 depicts that the frame 700 of valve retainer 352 can include one or more windows 704, or openings, formed therein. A filter material 706, e.g., a mesh type material, can be disposed within each window 704. In a particular aspect, the frame 700 can include an upper portion and a lower portion and the filter material 706 can be sandwiched there between. In another aspect, the frame 700 can be

a single piece and formed with the windows 704 and the filter material 706 can be welded to an upper surface or lower surface of the frame 700.

In a particular aspect, the frame 700 of the valve retainer 352 can be constructed from polypropylene. Further, the filter material 706 can be a mesh type material suitable for filtering a fluid such as paint.

As illustrated in FIG. 8, the plunger 354 can include a shaft 800 that can include a proximal end 802 and a distal end 804. A head 806 can extend from the distal end 804 of the shaft 800. The head 806 of the plunger 354 can include a proximal end 808 and a distal end 810. A sealing collar 812 can extend radially from the proximal end 808 of the head 806. The sealing collar 812 can be formed with a sealing face 814. The sealing face 814 of the sealing collar 812 can be configured to engage a valve seat, described below, formed in the outlet tube 340 (FIG. 3) of the cap 206 (FIG. 3). When the sealing face 814 engages the valve seat, flow through the outlet tube 340 (FIG. 3) can be substantially blocked and the paint cup assembly 104 (FIG. 3) can be sealed.

FIG. 8 depicts that the head 806 of the plunger 354 can be formed with one or more flutes 816. The flutes 816 can facilitate fluid flow through the paint cup assembly 104 (FIG. 3) when the sealing face 814 is disengaged from the valve seat.

Returning to FIG. 3, the paint cup assembly 104 can further include the adapter 106. A valve actuator 850 can be installed within the adapter 106. FIG. 9 illustrates further details concerning the valve actuator 850 and FIG. 10 illustrates further details regarding the adapter 106.

As illustrated in FIG. 9, the valve actuator 850 can include a generally cylindrical, base 900. A generally cylindrical, hollow post 902 can extend from the base 900. As illustrated, the base 900 can be formed with a central bore 904. Further, the post 902 can be formed with one or more slots 906, or openings. The slots 906 are configured to allow fluid, e.g., paint, to flow through the post 902 and the base 900 when the valve assembly 350 (FIG. 3) is in the open configuration. In a particular embodiment, the post 902 can be configured to engage the plunger 354 (FIG. 3, FIG. 8) and move the plunger 354 linearly in order to disengage the sealing face 814 (FIG. 8) of the plunger 354 (FIG. 8) from the valve seat, described in detail below in conjunction with FIG. 13.

In a particular aspect, the valve actuator 850 can be constructed from nylon.

FIG. 10 depicts details concerning the construction of the adapter 106. As illustrated, the adapter 106 can include an adapter body 1000 that can define a proximal end 1002 and a distal end 1004. Further, the adapter 106 can include an internal bore 1006 along the length of the adapter body 1000. The internal bore 1006 can include a first bore portion 1008 that can extend from the proximal end 1002 of the adapter body 1000 toward the distal end 1004 of the adapter body 1002. Further, the internal bore 1006 can include a second bore portion 1010 that can extend from the first bore portion 1008 toward the distal end 1004 of the adapter body 1002. A third bore portion 1012 can extend from the second bore portion 1010 and terminate at the distal end 1004 of the adapter body 1002.

In a particular aspect, the base 900 (FIG. 9) of the valve actuator 354 (FIG. 3) can be sized and shaped to fit into the second bore portion 1010 of the internal bore 1006 formed in the adapter body 1000. Moreover, the base 900 (FIG. 9) of the valve actuator 354 (FIG. 3) can be press fitted into the second bore portion 1010.

As illustrated in FIG. 10, the first bore portion 1008 can be formed with one or more grooves 1016 that can be configured to engage one or more locking pins 400 (FIG. 4) that extend radially outward from the outlet tube 340 (FIG. 4) of the cap 206 (FIG. 3). The groove 1016 can include a generally helical portion 1018 that can extend to a relatively straight portion 1020. The relatively straight portion 1020 can be substantially parallel to the end face of the adapter 106. To install the paint cup assembly 104 (FIG. 3) within the adapter 106 (FIG. 3), the outlet tube 340 (FIG. 3) can be inserted into the adapter 106 (FIG. 3) such that the locking pins 400 (FIG. 4) fit into corresponding grooves 1016. Thereafter, the paint cup assembly 104 (FIG. 3) can be rotated in order to move the locking pins 400 (FIG. 4) within the grooves 1016 until the paint cup assembly 104 (FIG. 3) is essentially locked in place within the adapter 106 (FIG. 3).

It can be appreciated that the relatively straight portion 1020 can be slightly angled toward to the end face of the adapter 106 in order to provide a ramped structure to further facilitate locking the paint cup assembly 104 (FIG. 3) within the adapter 106 (FIG. 3). For example, the relatively straight portion 1020 can be angled in a range of one degree to twenty degrees (1° - 20°) relative to a line parallel to the end face of the adapter 106. Additionally, the relatively straight portion 1020 can terminate in a notch 1022, or divot. A locking pin can

move into the notch 1022 and can further secure attachment of the paint cup assembly 104 (FIG. 3) to the adapter 106 (FIG. 3).

FIG. 11 illustrates another groove, generally designated 1100, that can be formed in the adapter 106. As illustrated, the groove 1100 can include a vertical portion 1102 that can be substantially perpendicular to the end face of the adapter 106. The vertical portion 1102 leads to a first angled portion 1104 that can be angled away from the end face of the adapter 106, e.g., in a range of one degree to twenty degrees (1° - 20°). The first portion 1104 can be angled with respect to a line parallel to the end face of the adapter 106. A second angled portion 1106 can extend from the first angled portion 1104 in the opposite direction as the first angled portion 1104, i.e., toward the end face of the adapter 106. The second angled portion 1106 can be angled in a range of one degree to twenty degrees (1° - 20°). The second angled portion 1106 can be angled with respect to a line parallel to the end face of the adapter 106.

As illustrated in FIG. 12, in an alternative embodiment, the adapter 106 can be formed within one or more locking pins 1200 that can extend radially inward from the adapter body 1000. For example, the locking pins 1200 can extend radially inward from the wall of the first bore portion 1008 of the internal bore 1006 formed in the adapter body 1000. In a particular aspect, the locking pins 1200 can be configured to engage one or more grooves, or slots, formed within the outlet tube 340 of the cap 206.

In a particular aspect, the adapter 106 can be constructed from a metal, such as aluminum.

Referring now to FIG. 13, a detailed view of the paint cup assembly 104 is illustrated. FIG. 13 depicts the outlet tube 340 of the cap 206 inserted into the first bore portion 1008 of the internal bore 1006 formed in the adapter 106. As the outlet tube 340 is inserted into the adapter 106, the valve actuator 850 within the adapter 106 can engage the plunger 354 of the valve assembly 350. Specifically, the post 902 of the valve actuator 850 can contact and engage the head 806 of the plunger 354.

The post 902 of the valve actuator 850 can cause the plunger 354 to move linearly into the cap 206 and through the valve retainer 352, e.g., through the central opening 702 of the valve retainer 352. As the plunger 354 moves as described, the spring 356 can be

compressed between the valve retainer 352 and the head 806 of the plunger 354. Further, as the plunger 354 moves into the cap 206, the sealing face 814 formed on the sealing collar 812 of the head 806 can be unseated, or otherwise disengaged, from a valve seat 1300 formed within the cap 206 at the base of the outlet tube 340.

5 As the sealing face 814 of the head 806 is unseated from the valve seat 1300 of the outlet tube 340, fluid, e.g., paint, can flow from the paint liner 202 through the cap 206 and out of the outlet tube 340. The fluid can then flow through the valve actuator 850 and through the adapter 106 into a paint sprayer. As the fluid flows through the cap 206, the filter material 706 (FIG. 7) disposed within the valve retainer 352 can filter the fluid, e.g., to
10 remove any dirt, dust, or other particles.

 Accordingly, as illustrated in FIG. 13, the valve assembly 350 can be configured to be operable from a closed configuration in which fluid flow through the outlet tube 340 can be prevented to an open configuration in which fluid flow through the outlet tube 340 can be permitted upon engagement with a paint sprayer. In particular, the open configuration can be
15 achieved automatically during engagement of the paint cup assembly 104 with the adapter 106 or paint sprayer (not illustrated). Further, it can be appreciated that the engagement can be achieved by reducing a distance between the paint cup assembly and the adapter 106 or paint sprayer (not illustrated). Further, in a particular embodiment, engagement can include an interference fit. In another aspect, engagement can include a threaded engagement.

20 Referring to FIG. 14, a third embodiment of a valve assembly is illustrated and is designated 1400. As illustrated, the valve assembly 1400 can include a membrane 1402 disposed within an outlet tube 1404 of a cap (not illustrated). In particular aspect, the membrane 1402 can be self-sealing when a trocar is removed therefrom.

 The valve assembly 1400 can further include a trocar 1406 or a similarly configured
25 needle or piercing hollow shaft. The trocar 1406 can be disposed within an internal bore 1408 of an adapter 1410. The trocar 1406 can be supported by one or more support structures 1412 that extend radially from a base of the trocar 1406 to the wall of the internal bore 1408.

 As a paint cup assembly (not illustrated) is engaged with the adapter 1410, the outlet tube 1404 of the cap (not illustrated) can be inserted into the internal bore 1408 of the adapter
30 1410. Further, as the outlet tube 1404 is pushed into the adapter, the trocar 1406 can pierce

the membrane 1402 in order to permit fluid flow out of the paint cup assembly (not illustrated) and through the adapter 1410 into a paint sprayer (not illustrated).

When the paint cup assembly (not illustrated) is disengaged from the adapter 1410, the trocar 1406 can be retracted, or otherwise removed, from the membrane 1402. Once the trocar 1406 is removed from the membrane 1402, the membrane 1402 can seal the hole formed at the location within the membrane 1402 in which the trocar 1406 pierced the membrane 1402. As such, if the paint cup assembly (not illustrated) remains at least partially filled with fluid, leakage of the fluid can be substantially minimized.

FIG. 15 and FIG. 16 depict details concerning the seal 207. As illustrated, the seal 207 can include a generally annular body 1500 that defines a central opening 1502. The seal 207 can include an internal diameter 1504 and an external diameter 1506. Further, the seal 207 can include a width 1508 that can be the difference between the external diameter 1506 and the internal diameter 1504. The seal 207 can also include a thickness 1510 measured from an upper surface of the seal 207 to a bottom surface of the seal 207.

In a particular aspect, the seal 207 can include a polymer. The polymer can include a thermoset polymer. Moreover, the thermoset polymer can include polyethylene, polyethylene foam, or a combination thereof. The polyethylene foam can include a closed cell polyethylene foam. In another aspect, the seal 207 can include a hydrophobic polymer.

In a particular aspect, the seal width 1508 can be at least about 4 mm. For example, the seal width 1508 can be at least about 5 mm, at least about 6 mm, at least about 7 mm, or at least about 8mm. The seal width 1508 can also be limited. For example, the seal width 1508 may be no greater than about 12.5 mm, such as no greater than about 12.0 mm, no greater than about 11.0 mm, or no greater than about 10.0 mm. The seal width 1508 can be in a range between and including any of the minimum or maximum widths described above.

In another aspect, the seal width 1508 can be at least 4% of the outer diameter of the external rim 339 of the cap 206. For example, the seal width 1508 can be at least 4.5% of the outer diameter, at least 5.0% of the outer diameter, at least 5.5% of the outer diameter, at least 6.0% of the outer diameter, or at least 6.5% of the outer diameter of the external rim 339 of the cap 206. The seal width 1508 may be limited and may not be greater than 10% of the outer diameter of the external rim 339 of the cap 206. Further, the seal width 1508 may not

be greater than 9% of the outer diameter or 8% of the outer diameter. The seal width 1508 can be in a range between and including any of the minimum or maximum percentage values described above.

In another particular aspect, the seal thickness 1510 can be at least about 0.5 mm.

5 Further, the seal thickness 1510 can be at least about 0.75 mm, at least about 1.0 mm, at least about 1.25 mm, at least about 1.5 mm, at least about 1.75 mm, or at least about 2.0 mm.

However, the seal thickness 1510 can be limited and may be no greater than about 3.5 mm, such as no greater than about 3.25 mm, no greater than about 3.0 mm, no greater than about 2.75 mm, no greater than about 2.5 mm, or no greater than about 2.25 mm. The seal

10 thickness 1510 can be in a range between and including any of the minimum or maximum thicknesses described above.

In another aspect, the external rim 339 of the cap 206 can includes a rim thickness and the seal thickness 1510 can be at least about 50% of the rim thickness. For example, the seal thickness 1510 can be at least about 50% of the rim thickness, at least about 55% of the rim thickness, at least about 60% of the rim thickness, at least about 65% of the rim thickness, at least about 70% of the rim thickness, at least about 75% of the rim thickness, or at least about 80% of the rim thickness. In another aspect, the seal thickness 1510 can be limited. As such, the seal thickness 1510 may be not greater than about 200% of the rim thickness, such as not greater than about 175% of the rim thickness not greater than about 150% of the rim thickness, not greater than about 125% of the rim thickness, or not greater than about 100% of the rim thickness. The seal thickness 1510 can be in a range between and including any of the minimum or maximum thicknesses described above.

In yet another aspect, the outer diameter 1506 of the seal 207 can be at least about 75% of the outer diameter of the external rim 339 of the cap 209. For example, the outer diameter 1506 can be at least about 80% of the outer diameter of the external rim, at least about 85% of the outer diameter of the external rim, at least about 90% of the outer diameter of the external rim, or at least about 95% of the outer diameter of the external rim. However, the outer diameter 1506 of the seal 207 may be no greater than about 120% of the outer diameter of the external rim, such as no greater than about 115% of the outer diameter of the external rim, no greater than about 110% of the outer diameter of the external rim, no greater than about 105% of the outer diameter of the external rim, or no greater than about 100% of the outer diameter of the external rim. The outer diameter 1506 of the seal 207 can be in a

range between and including any of the minimum or maximum outer diameters described above.

In another aspect, the inner diameter 1504 of the seal 207 can be approximately equal to, or slightly less, than the outer diameter of the distal end 334 of the cap 206. The seal 207 can be a single monolithic seal. In another aspect, the seal 207 can be a composite seal. For example, the seal 207 can be a multi-layered seal. Each layer of the seal 207 can comprise the same material or a different material. The seal 207 can be fixedly connected to the external rim 339 of the cap 206. For example, the seal 207 can be connected to the external rim 339 of the cap 206 by an adhesive. In another aspect, the seal 207 can be removably engaged with the cap.

Referring now to FIG. 17, another embodiment of a paint cup assembly is illustrated and is designated 1700. As depicted, the paint cup assembly can include a cap 206 and a paint reservoir 1704 removably engaged therewith. In a particular aspect, the cap 206 can be identical to the cap 206 illustrated and described above in conjunction with FIG. 2, FIG. 3, and FIG. 13.

The paint reservoir 1704 can include a generally flat, generally round, substantially rigid bottom 1710 (the paint cup assembly 1700 is illustrated in an upside down orientation in FIG. 17 to depict the manner in which the paint cup assembly 1700 would typically be used.)

As indicated in FIG. 17, a substantially rigid sidewall 1712 can extend from the rigid bottom 1710 to form an internal volume 1714 configured to receive paint. The sidewall 1712 can include a distal end 1716 formed with a hub 1718. The hub 1718 can be formed with threads (not illustrated) that are configured to threadably engage the external threads 334 formed on the cap 206, 1702. In fact, the configuration of the hub 1718 on the paint reservoir 1704 can be substantially identical to the hub 312 formed on the external ring 204. As such, the paint reservoir 1704 can be interchangeable with the external ring 204/paint liner 202 on the paint cap 206, 1702 and a user would be able to choose whether to utilize a relatively rigid paint reservoir 1704 or a collapsible paint liner 202/external ring 204 assembly depending on the user's particular preferences and or the particular paint spraying operation to be performed by the user.

In a manner similar to the hub 312 formed on the external ring 204, but more clearly illustrated than in FIG. 13, the hub 1718 of the paint reservoir 1704 can include a primary seal engagement surface 1720 at the base of the hub 1718 and a secondary seal engagement surface 1722 formed on the inner wall of the hub 1718 adjacent to the primary seal engagement surface 1720. As illustrated, the secondary seal engagement surface 1722 can be substantially perpendicular to the primary seal engagement surface 1720. When the paint reservoir 1704 is engaged with the cap 206, as depicted in FIG. 17, the primary sealing structure 336 can engage the primary seal engagement surface 1720 to establish a primary seal and the secondary sealing structure 338 can engage the secondary seal engagement surface 1722 to form a secondary seal.

Further, a paint containment pocket 1724 can be established, or otherwise formed, between the primary seal, the secondary seal, the primary seal surface 1720, and the secondary seal surface 1722. The paint containment pocket 1724 can capture and substantially contain any paint that breaches the primary seal formed between the primary sealing structure 336 and the primary seal engagement surface 1720. The seal 207, illustrated in FIG. 3, FIG. 15, and FIG. 16, can be installed between a distal end 1730 of the hub 1718 (aka, a cap engagement structure) and the external rim 339 of the cap 206. The seal 207 can establish a tertiary seal that can further contain any paint that leaks from the paint containment pocket 1724. In order to leak from the paint cup assembly, paint has to breach three different seals. Accordingly, the likelihood of paint leaking from the paint cup assembly can be substantially reduced.

FIG. 17 and FIG. 18 further illustrate that the bottom 1710 of the paint reservoir 1704 can be formed with an air inlet port 1740. In a particular aspect, the air inlet port 1740 can be formed in a center of the bottom 1710 of the paint reservoir 1704.

A valve assembly 1750 can be installed, or otherwise disposed, on the bottom 1710 of the paint reservoir 1704 adjacent to the air inlet port 1740 so that the valve assembly 1750 can be in fluid communication with the air inlet port 1740. The valve assembly 1750 can include a pressure actuated valve assembly. Further, the valve assembly 1750 can include a flexible bleeder 1752 and a bleeder retainer 1754. The flexible bleeder 1752 can be made from a flexible thermoplastic elastomer (TPE) and the bleeder retainer 1754 can be made from polypropylene (PP).

The flexible bleeder 1752 can be generally frustoconical and can include a flat base 1756. An angled wall 1758 can extend from the base 1756 and can include a distal end 1760. The distal end 1760 of the angled wall 1758 can be formed with a rim 1762. As illustrated in FIG. 17 and FIG. 18, the flat base 1756 of the flexible bleeder 1752 can abut and block the air inlet port 1740 formed in the paint reservoir 1704 when the bleeder 1752 is in the closed configuration illustrated in FIG. 17 and FIG. 18.

In a particular aspect, the angled wall 1758 of the bleeder 1752 can deform as the air pressure is reduced within the paint reservoir 1704. As the angled wall 1758 deforms the base 1756 of the flexible bleeder 1752 can moved away from the air inlet port 1740.

Accordingly, the flexible bleeder 1752 can move between a closed configuration in which the bleeder 1752 blocks the air inlet port 1740 and an open configuration in which the bleeder 1752 unblocks the air inlet port 1740. The bleeder 1752 is pressure actuated and can move to the open configuration as the air pressure inside the paint reservoir 1704 is reduced. For example, the air pressure can be reduced within the paint reservoir 1704 as paint is withdrawn from the paint reservoir 1704 during use of a spray gun attached thereto.

As indicated in FIG. 17, the bleeder retainer 1754 can be engaged with an interior surface of the bottom 1710 of the paint cup reservoir 1704. The bleeder retainer 1754 can surround the flexible bleeder 1752. The bleeder retainer 1754 can include a central hub 1770 that can include an interior 1772 in which the bleeder 1752 can be installed or otherwise disposed. The central hub 1770 can also include at least one opening 1774 formed therein to let air pass through the central hub 1770 when the valve assembly 1750 is opened.

The bleeder retainer 1754 can also include a generally annular rim 1776 that can extend outwardly from the central hub 1770. The rim 1776 of the bleeder retainer 1754 can surround the air inlet port 1740 and abut the interior surface of the bottom 1710 of the paint reservoir 1704. The rim 1776 of the bleeder retainer 1754 can be formed with at least one engagement bore 1778 through the rim 1776. The paint reservoir 1704 can include at least one engagement post 1780 that can extend perpendicularly from the interior surface of the bottom 1710 of the paint reservoir 1704. The engagement bore 1778 of the rim 1776 can fit over the engagement post 1780 and maintain the bleeder retainer 1754 in engagement with the bottom 1710 of the paint reservoir 1704. In particular, the engagement bore engages the engagement post in an interference fit.

In a particular embodiment, the valve assembly 1750 can be operable to move between a closed configuration, in which air flow through the air inlet port 1740 can be prevented, and an open configuration, in which air flow through the air inlet port 1740 can be permitted, upon actuation of a spray gun coupled to the paint cup assembly 1700. The valve assembly 1750 can be pressure actuated and a change in pressure within the paint cup assembly 1700 can cause the valve assembly 1750 to move to the open configuration. The open configuration can be achieved automatically upon actuation of the spray gun.

In a particular aspect, the valve assembly 1750 can move to the open configuration at least partially based on pressurized air flowing through the spray gun. The pressurized air can include an air pressure of at least about 10psi. Moreover, the air pressure can be at least about 15 psi, at least about 20 psi, at least about 25 psi, or at least about 30 psi. The air pressure can be less than about 50 psi, less than about 45 psi, or less than about 35 psi. Further, the air pressure can be within a range between and including any of the minimum and maximum pressure values describe above.

In another aspect, the valve assembly 1750 can substantially prevent paint from leaking out of the air inlet port 1740 when the valve assembly 1750 is in the closed configuration and the paint cup assembly 1700 is standing substantially upright on the bottom 1710 of the paint reservoir 1704 (rotated 180° from the orientation illustrated in FIG. 17).

FIG. 19 through FIG. 23 illustrate a paint cup filling station, generally designated 1900. As shown, the paint cup filling station 1900 can include a first paint cup tray 1902 and a second paint cup tray 1904 separated by a housing 1906. Depending on the orientation of the paint cup filling station 1900, the first paint cup tray 1902 can be considered an upper paint cup tray; the second paint cup tray 1904 can be considered a lower paint cup tray; and vice-versa.

The housing 1906 can have a first side wall 1910, a second side wall 1912, a third side wall 1914, and a fourth side wall 1916. Further, the housing 1906 can be constructed from a corrugated material and the housing 1906 can be foldable, or otherwise collapsible. When erected, the side walls 1910, 1912, 1914, 1916 can be connected to adjacent sidewalls 1910, 1912, 1914, 1916, the paint cup trays 1902, 1904, or a combination thereof via one or more fasteners 1920, e.g., removable push pin fasteners, thumb screws, etc.

As shown in FIG. 19, the first paint cup tray 1902 can be formed with one or more paint cup assembly holes 1930. Further, the second paint cup tray 1904 can also be formed with one or more paint cup assembly holes 1932. Each paint cup assembly hole 1930, 1932 can be configured to receive a correspondingly sized and shaped paint cup assembly 1940.

5 Further, each paint cup assembly hole 1930, 1932 can be connected to one or more adjoining paint assembly holes 1930, 1932 via one or more fluid channels 1950. Accordingly, if a particular paint cup assembly 1940 is being filled and begins to overflow the fluid, e.g., paint, can flow from the particular paint cup assembly 1940 that is being overfilled and into one or more adjacent paint cup assemblies.

10 FIG. 21 indicates that at least one of the sidewalls 1910, 1912, 1914, 1916 can be formed with one or more elongated windows 1960. Each elongated window 1960 can be aligned with a respective paint cup assembly hole 1930, 1932. Specifically, a center axis of the window 1960 can be aligned with a center of a paint cup assembly hole 1930, 1932. Each elongated window 1960 can be configured to allow a user to view at least a portion of the
15 paint cup assembly 1940 when the paint cup assembly 1940 is installed in the paint cup filling station 1900. For example, the elongated window 1960 can be configured to allow a user to view a paint liner of the paint cup assembly 1940. Accordingly, the user can easily determine the level of paint in the paint cup assembly 1940 while the paint cup assembly 1940 is being filled with paint.

20 In a particular aspect, at least a portion of a slot formed in an extended ring of the paint cup assembly 1940, e.g., the slot 320 illustrated in FIG. 2 and FIG. 3, can be substantially aligned with the elongated window 1960 when the paint cup assembly 1940 is installed in the paint cup filling station 1900.

25 As further illustrated in FIG. 21, the paint cup filling station 1900 can include a group of indicia 1962 adjacent to each elongated window 1960. The indicia 1962 can be used to indicate a volume amount of paint, or fluid, within the paint cup assembly 1940. The indicia 1962 on the paint cup filling station 1900 can be keyed to indicia on the paint liner of the paint cup assembly 1940.

30 In a particular aspect, the elongated window 1960 can have a window height, H_w , measured from a top of the window 1960 to a bottom of the window 1960 along the center axis of the window 1960. A paint liner, e.g., the paint liner 212 depicted in FIG. 2 and FIG.

3, can have paint liner height, H_{PL} , measured from the top of a paint liner 212 to a bottom of the paint liner 212 along a center axis of the paint liner 212. Further, in a particular aspect, H_W can be at least 95% H_{PL} . For example, H_W can be at least 100% H_{PL} , such as at least 105% H_{PL} , or at least 110% H_{PL} . In another aspect, H_W can be less than or equal to 150% H_{PL} , such as less than or equal to 125% H_{PL} , or less than or equal to 115% H_{PL} . Moreover, H_W can be within a range between and including any of the percentage of H_{PL} values described herein.

In another aspect, the elongated window 1960 can have a window width, W_W , measured from a left side of the window 1960 to a right side of the window 1960. The slot in the extended ring of the paint cup assembly 1940 can include a slot width, W_S , measured from a left side of the slot to a right side of the slot. In this aspect, W_W can be at least 95% W_S . For example, W_W can be at least 100% W_S , such as at least 105% W_S , or at least 110% W_S . In another aspect, W_W can be less than or equal to 150% W_S , such as less than or equal to 125% W_S , or less than or equal to 115% W_S . Moreover, W_W can be within a range between and including any of the percentage of W_S values described herein.

In another aspect, the paint liner of the paint cup assembly 1940 can have an outer diameter, OD , measured at the outer perimeter of the rim of the paint liner. In this aspect, W_W can be at least 5% OD . For example, W_W can be at least 6% OD , such as at least 7% OD , at least 8% OD , at least 9% OD , or at least 10% OD . In another aspect, W_W can be less than or equal to 25% OD , such as less than or equal to 20% OD , or less than or equal to 15% OD . Moreover, W_W can be within a range between and including any of the percentage of OD values described herein.

In a particular aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a three ounce (3 oz.) capacity. In another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a five ounce (5 oz.) capacity.

In still another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having an eight ounce (8 oz.) capacity. In yet another aspect,

one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a twenty-five ounce (25 oz.) capacity. In another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a thirty-two ounce (32 oz.) capacity.

In another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a ninety milliliter (90 ml) capacity. In yet still another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a one hundred fifty milliliter (150 ml) capacity.

In yet another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a two hundred fifty milliliter (250 ml) capacity. In another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a seven hundred fifty milliliter (750 ml) capacity. In yet another aspect, one or more of the paint cup assembly holes 1930, 1932 formed in the first paint cup tray 1902 and the second paint cup tray 1904 can be configured to receive a paint cup assembly having a nine hundred fifty milliliter (950 ml) capacity. The capacity of the paint cup assembly can be within a range between and including any of the capacity values described above.

It can be appreciated that the first paint cup tray 1902 can include an array of similarly sized paint cup assembly holes 1930 and the second paint cup tray 1902 can include an array of similarly sized paint cup assembly holes 1932. The paint cup assembly holes 1930 in the first paint cup tray 1902 can be different in size from the paint cup assembly holes 1932 in the second paint cup tray 1904. As such, the paint cup assembly filling station 1900 can be oriented as shown to receive paint cup assemblies having a particular size or the paint cup assembly filling station 1900 can be inverted to receive paint cup assemblies having a different size, e.g., capacity.

Also, it can be appreciated that the first paint cup tray 1902, the second paint cup tray 1904, or a combination thereof can include paint cup assembly holes 1932 of varying sizes.

In a particular aspect, the paint cup trays 1902, 1904 are constructed from acrylonitrile butadiene styrene (ABS) plastic. Moreover, the housing 1906 can be
5 constructed from high density polyethylene (HDPE).

Referring now to FIG. 24 and FIG. 25, a paint cup assembly support stand is illustrated and is generally designated 2400. As shown, the paint cup assembly support stand 2400 can include a base 2402. Further, one or more support arms 2404 can extend from the base 2402. In a particular aspect, the support arms 2404 can extend in a direction that is
10 substantially perpendicular to the base 2402. Further, at least one paint cup assembly support ring 2406 can extend from each support arm 2404. Specifically, each paint cup assembly support ring 2406 can be parallel to the base 2402.

As shown in FIG. 24 and FIG. 25, a support frame 2408 can extend from each support arm 2404 to the paint cup assembly support ring 2406 and the base of the paint cup assembly
15 support stand 2400. The support frames 2408 can provide additional structural support for the weight of a paint cup assembly (not shown) inserted into the paint cup assembly support rings 2406.

In a particular aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a three ounce (3 oz.) capacity. In another aspect, each
20 paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a five ounce (5 oz.) capacity.

In still another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having an eight ounce (8 oz.) capacity. In yet another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly
25 having a twenty-five ounce (25 oz.) capacity. In another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a thirty-two ounce (32 oz.) capacity.

In another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a ninety milliliter (90 ml) capacity. In yet still another

aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a one hundred fifty milliliter (150 ml) capacity.

In yet another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a two hundred fifty milliliter (250 ml) capacity. In
5 another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a seven hundred fifty milliliter (750 ml) capacity. In yet another aspect, each paint cup assembly support ring 2406 can be configured to receive a paint cup assembly having a nine hundred fifty milliliter (950 ml) capacity.

FIG. 24 and FIG. 25 indicate that in an exemplary embodiment, the paint cup
10 assembly support stand 2400 can include three support arms 2404 extending from the base 2402 and each support arm 2404 can include a single paint cup assembly support ring 2406. It can be appreciated that the paint cup assembly support stand 2400 can include any number of support arms 2404 and any number of paint cup assembly support rings 2406. For example, in another aspect, the paint cup assembly support stand 2400 can include a single
15 support arm 2404 having multiple paint cup assembly support rings 2406 extending therefrom, e.g., radially. Further, each paint cup assembly support ring 2406 can be similarly sized to receive paint cup assemblies having similar capacities, as described herein. Alternatively, the paint cup assembly support stand 2400 can include multiple paint cup assembly support rings 2406 having various sizes and the paint cup assembly support stand
20 2400 can receive and support paint cup assemblies having varying capacities.

With the configuration described herein, the multi-seal paint cup assembly provides a paint cup assembly that is substantially leak-proof regardless of the orientation of the paint cup assembly. In order for paint to leak from the multi-seal paint cup assembly, the paint has to breach a primary seal, a secondary seal, and a tertiary seal. The primary seal and the
25 secondary seal are semi-rigid, while the tertiary seal is an elastomeric seal. The seal arrangement is configured to work with a rigid paint reservoir and a paint reservoir utilizing collapsible paint liners.

Note that not all of the activities described above in the general description or the examples are required, that a portion of a specific activity may not be required, and that one
30 or more further activities can be performed in addition to those described. Still further, the order in which activities are listed is not necessarily the order in which they are performed.

Certain features that are, for clarity, described herein in the context of separate embodiments, can also be provided in combination in a single embodiment. Conversely, various features that are, for brevity, described in the context of a single embodiment, can also be provided separately or in any subcombination. Further, reference to values stated in
5 ranges includes each and every value within that range.

Benefits, other advantages, and solutions to problems have been described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems, and any feature(s) that can cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature of any or all the
10 claims.

The specification and illustrations of the embodiments described herein are intended to provide a general understanding of the structure of the various embodiments. The specification and illustrations are not intended to serve as an exhaustive and comprehensive description of all of the elements and features of apparatus and systems that use the structures
15 or methods described herein. Separate embodiments can also be provided in combination in a single embodiment, and conversely, various features that are, for brevity, described in the context of a single embodiment, can also be provided separately or in any subcombination. Further, reference to values stated in ranges includes each and every value within that range. Many other embodiments can be apparent to skilled artisans only after reading this
20 specification. Other embodiments can be used and derived from the disclosure, such that a structural substitution, logical substitution, or another change can be made without departing from the scope of the disclosure. Accordingly, the disclosure is to be regarded as illustrative rather than restrictive.

WHAT IS CLAIMED IS:

1. A paint cup assembly for a paint sprayer, comprising:
a cap formed with external rim and a plurality of threads adjacent to the external rim;
a paint reservoir configured to engage the cap, wherein the paint reservoir comprises a distal end formed with a hub having threads configured to engage the threads on the cap; and
a seal disposed between the external rim of the cap and the distal end of the paint reservoir, wherein the seal is compressed between the external rim of the cap and the distal end of the paint reservoir as the paint reservoir is threaded around the cap wherein the seal prevents air infiltration into the paint reservoir as paint is withdrawn from the paint reservoir by a spray gun.
2. The paint cup assembly of claim 1, wherein the seal circumscribes a portion of the cap.
3. The paint cup assembly of claim 1, wherein the cap comprises a generally hollow body and the seal circumscribes a portion of the hollow body.
4. The paint cup assembly of claim 1, wherein the seal comprises a polymer.
5. The paint cup assembly of claim 4, wherein the polymer comprises a thermoset polymer.
6. The paint cup assembly of claim 5, wherein the thermoset polymer comprises polyethylene.
7. The paint cup assembly of claim 6, wherein the thermoset polymer comprises polyethylene foam.

8. The paint cup assembly of claim 6, wherein the polyethylene foam comprises a closed cell polyethylene foam.
9. The paint cup assembly of claim 4, wherein the seal comprises a hydrophobic polymer.
10. The paint cup assembly of claim 1, wherein the seal comprises a seal width of at least about 4 mm, such as at least about 5 mm, at least about 6 mm, at least about 7 mm, or at least about 8mm.
11. The paint cup assembly of claim 10, wherein the seal width is no greater than about 12.5 mm, such as no greater than about 12.0 mm, no greater than about 11.0 mm, or no greater than about 10.0 mm.
12. The paint cup assembly of claim 1, wherein the external rim of the cap comprises an outer diameter and the seal comprises a seal width that is at least 4% of the outer diameter, such as at least 4.5% of the outer diameter, at least 5.0% of the outer diameter, at least 5.5% of the outer diameter, at least 6.0% of the outer diameter, or at least 6.5% of the outer diameter.
13. The paint cup assembly of claim 1, wherein the seal comprises a seal thickness of at least about 0.5 mm, such as least about 0.75 mm, at least about 1.0 mm, at least about 1.25 mm, at least about 1.5 mm, at least about 1.75 mm, or at least about 2.0 mm.
14. The paint cup assembly of claim 16, wherein the seal thickness is no greater than about 3.5 mm, such no greater than about 3.25 mm, no greater than about 3.0 mm, no greater than about 2.75 mm, no greater than about 2.5 mm, or no greater than about 2.25 mm.
15. The paint cup assembly of claim 1, wherein the external rim of the cap includes a rim thickness and the seal comprises a seal thickness that is at least about 50% of the rim

thickness, such as at least about 55% of the rim thickness, at least about 60% of the rim thickness, at least about 65% of the rim thickness, at least about 70% of the rim thickness, at least about 75% of the rim thickness, or at least about 80% of the rim thickness.

16. The paint cup assembly of claim 15, wherein the seal thickness is not greater than about 200% of the rim thickness, such as not greater than about 175% of the rim thickness not greater than about 150% of the rim thickness, not greater than about 125% of the rim thickness, or not greater than about 100% of the rim thickness.

17. The paint cup assembly of claim 1, wherein the external rim comprises an outer diameter and the seal comprises an outer diameter that is at least about 75% of the outer diameter of the external rim, such as at least about 80% of the outer diameter of the external rim, at least about 85% of the outer diameter of the external rim, at least about 90% of the outer diameter of the external rim, or at least about 95% of the outer diameter of the external rim.

18. The paint cup assembly of claim 17, wherein the outer diameter of the seal is no greater than about 120% of the outer diameter of the external rim, no greater than about 115% of the outer diameter of the external rim, no greater than about 110% of the outer diameter of the external rim, no greater than about 105% of the outer diameter of the external rim, or no greater than about 100% of the outer diameter of the external rim.

19. The paint cup assembly of claim 1, wherein the seal comprises a single monolithic seal.

20. The paint cup assembly of claim 1, wherein the seal comprises a composite seal.

21. The paint cup assembly of claim 20, wherein the seal is a multi-layer seal.

22. The paint cup assembly of claim 21, wherein each layer of the seal comprises the same material.

23. The paint cup assembly of claim 21, wherein each layer of the seal comprises a different material.

24. The paint cup assembly of claim 1, wherein the seal is fixedly connected to the external rim of the cap.

25. The paint cup assembly of claim 24, wherein the seal is connected to the external rim of the cap by an adhesive.

26. The paint cup assembly of claim 1, wherein the seal is removably engaged with the cap.

27. A paint cup assembly for a paint spray, the paint cup assembly comprising:

a cap comprising an external rim extending radially outward from the cap, a primary seal extending outward from the cap at a distance from the external rim, and a secondary seal extending outward from the cap between the external rim and the primary seal; and

a paint reservoir comprising a cap engagement structure configured to engage the cap, wherein the cap engagement structure includes a hub formed with a primary seal engagement surface and a secondary seal engagement surface adjacent to the primary seal engagement surface;

wherein when the paint reservoir is engaged with the cap, the primary seal engages the primary seal engagement surface and the secondary seal engages the secondary seal engagement surface to form a paint containment pocket.

28. The paint cup assembly of claim 27, wherein the paint containment pocket is formed between the primary seal, the secondary seal, the primary seal surface, and the secondary seal surface.
29. The paint cup assembly of claim 28, wherein the paint containment pocket is configured to capture and contain any paint that breaches the seal formed between the primary seal and the primary seal engagement surface.
30. The paint cup assembly of claim 29, further comprising a tertiary seal disposed between the external rim of the cap and a distal end of the cap engagement structure.
31. The paint cup assembly of claim 30, wherein the tertiary seal is configured to contain any paint that leaks from the paint containment pocket.
32. A paint cup assembly for a paint spray, the paint cup assembly comprising:
a paint reservoir,
a cap configured to engage the paint reservoir, wherein the cap comprises a primary seal, a secondary seal, and a tertiary seal and wherein when the cap is engaged with the paint reservoir the cap is configured to prevent any fluid from leaking from the paint reservoir in any orientation.
33. The paint cup assembly of claim 32, wherein the cap comprises an external rim extending radially outward from the cap and the primary seal extends outwardly from the cap at an angle with respect a central axis of the cap and at a distance from the external rim.
34. The paint cup assembly of claim 33, wherein the secondary seal extends outward from the cap between the external rim and the primary seal.

35. The paint cup assembly of claim 34, wherein the paint reservoir comprises a cap engagement structure configured to engage the cap, wherein the cap engagement structure includes a hub formed with a primary seal engagement surface and a secondary seal engagement surface adjacent to the primary seal engagement surface.

36. The paint cup assembly of claim 35, wherein when the paint reservoir is engaged with the cap, the primary seal engages the primary seal engagement surface and the secondary seal engages the secondary seal engagement surface to form a paint containment pocket.

37. The paint cup assembly of claim 36, wherein the paint containment pocket is formed between the primary seal, the secondary seal, the primary seal surface, and the secondary seal surface.

38. The paint cup assembly of claim 37, wherein the paint containment pocket is configured to contain any paint that breaches the seal formed between the primary seal and the primary seal surface.

39. The paint cup assembly of claim 38, wherein the tertiary seal is configured to prevent paint from leaking from the paint containment pocket.

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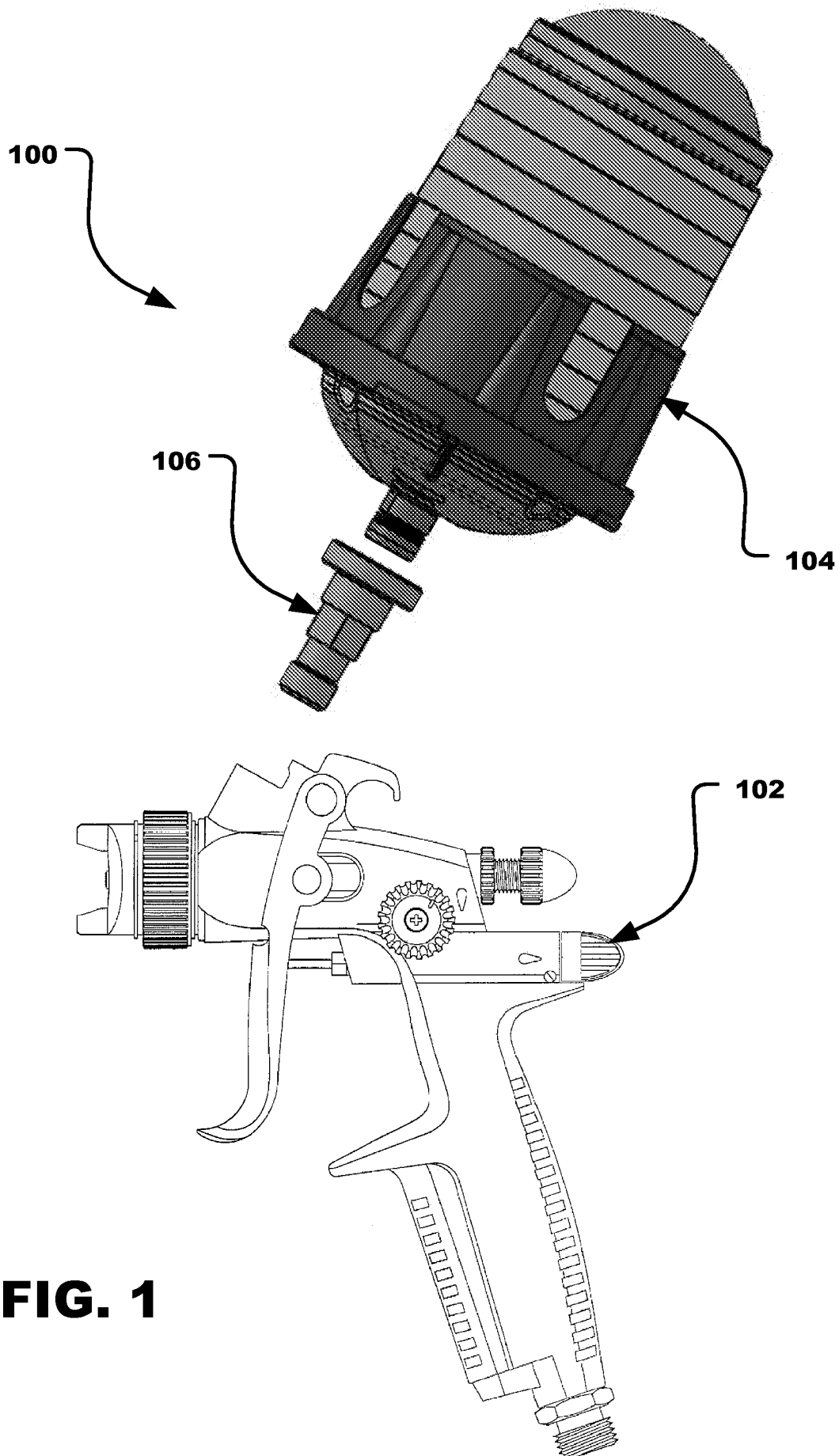


FIG. 1

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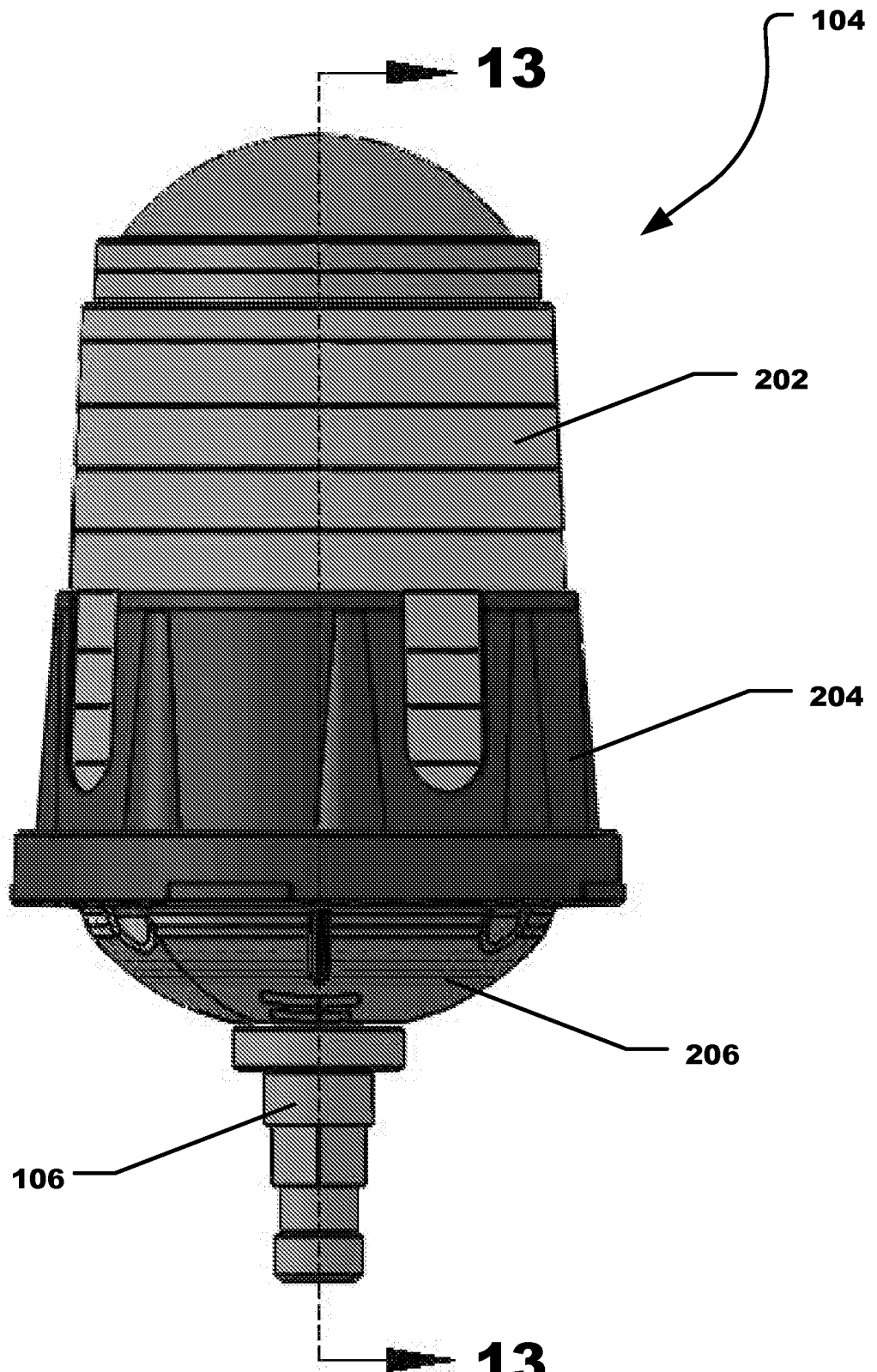


FIG. 2

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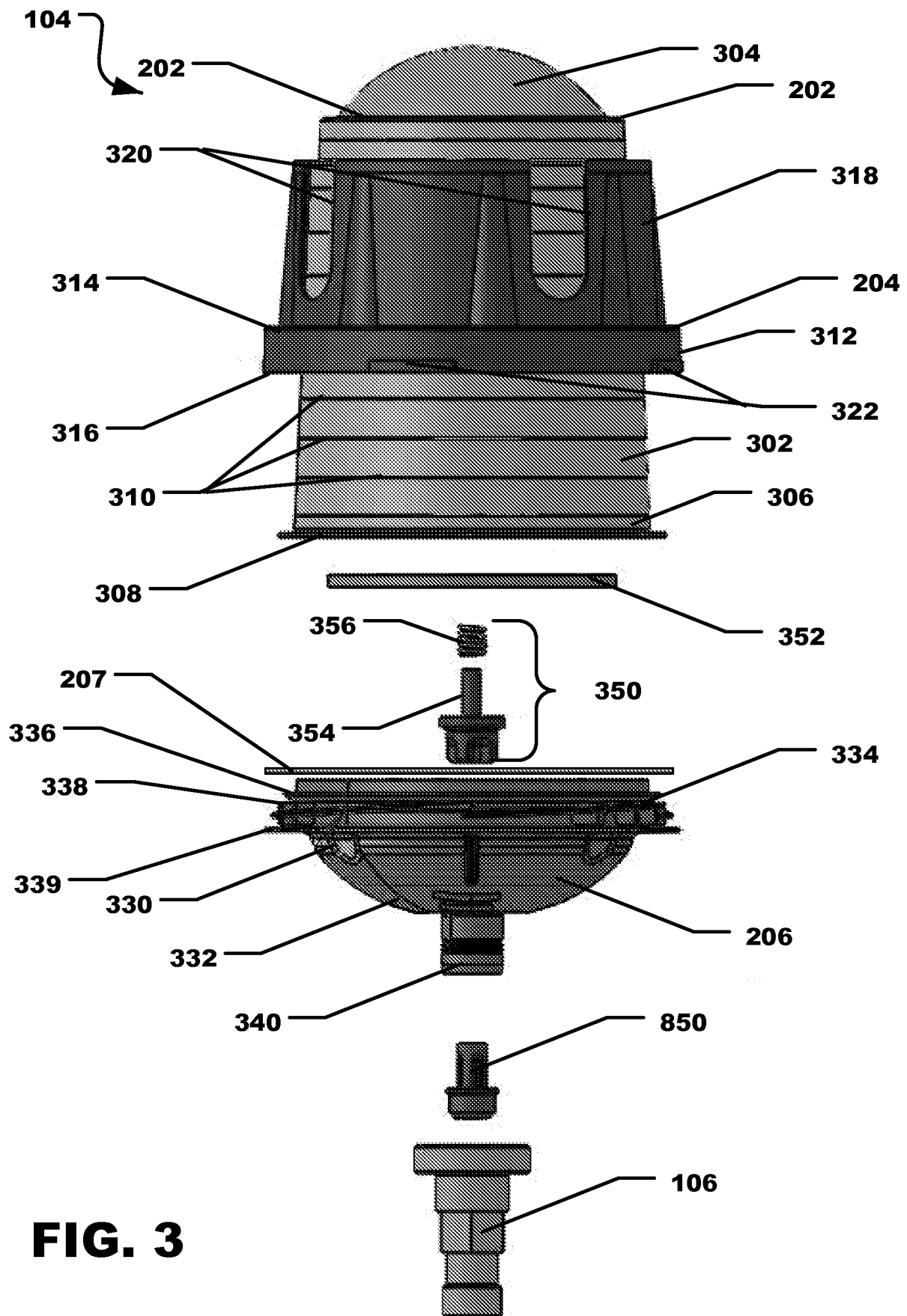


FIG. 3

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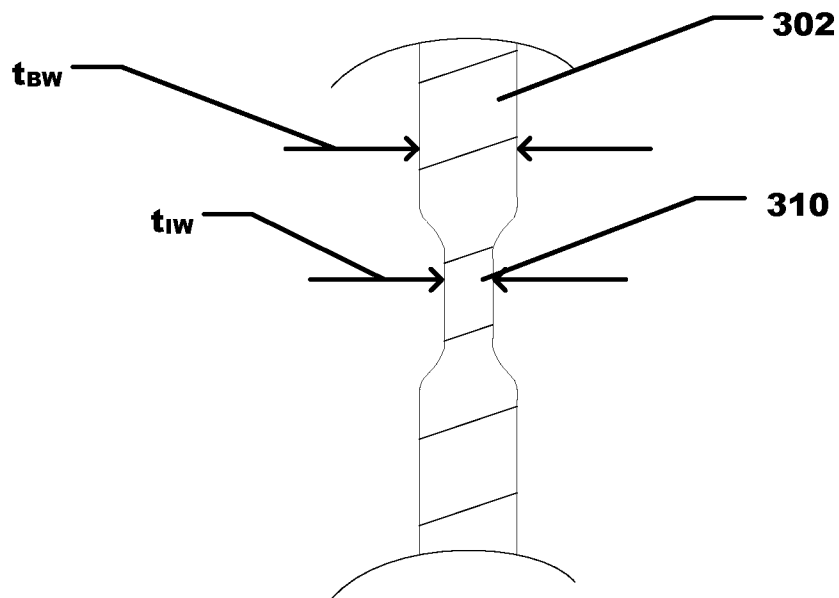


FIG. 3a

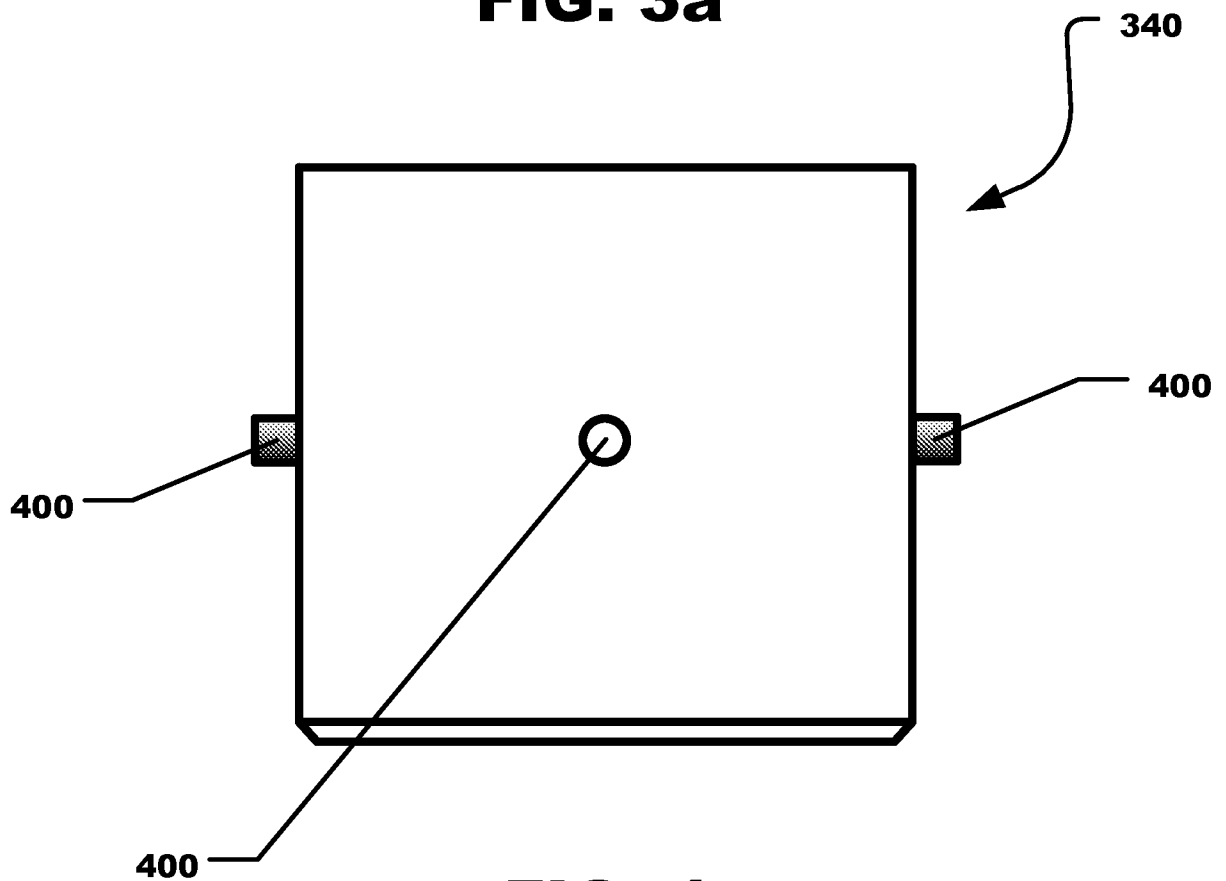
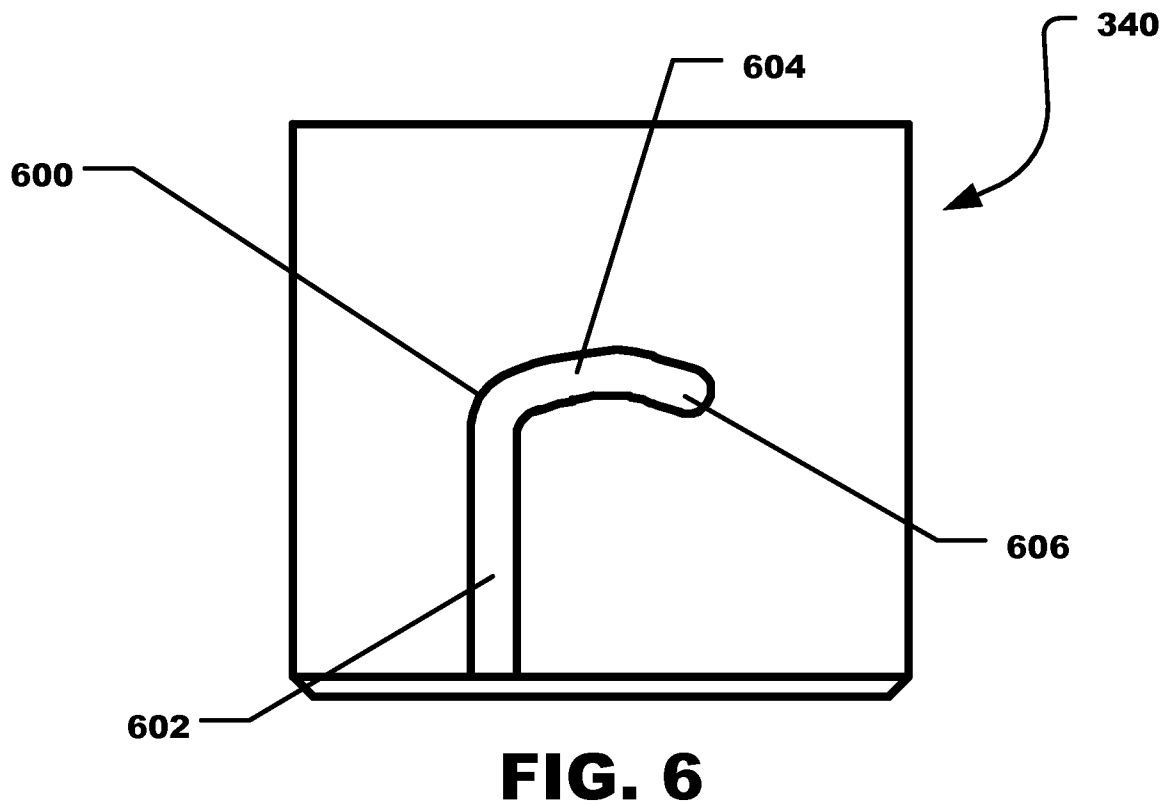
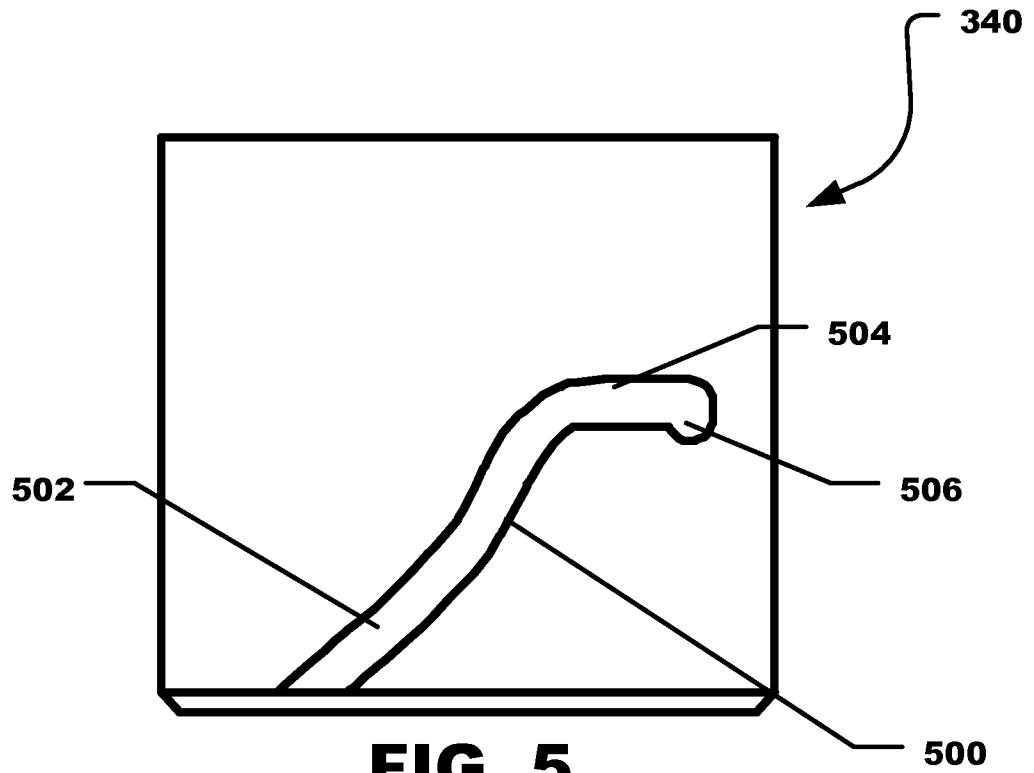


FIG. 4

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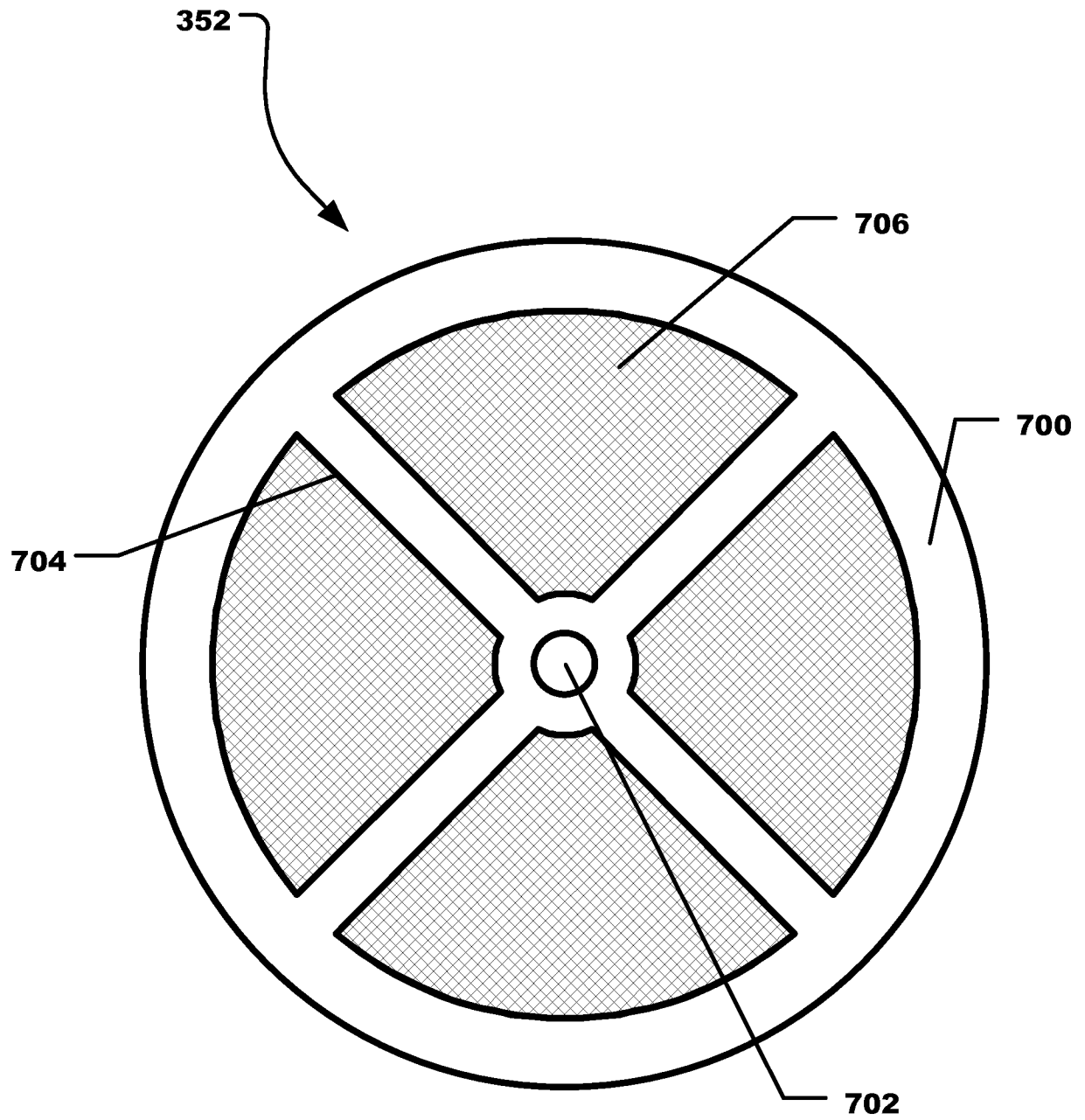


FIG. 7

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FIG. 8

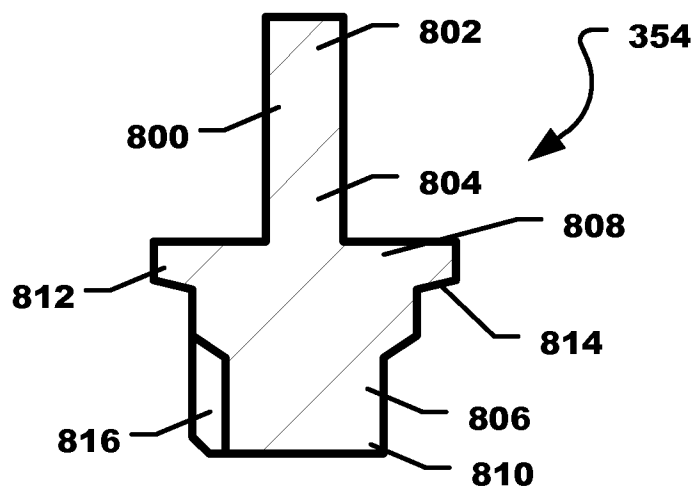


FIG. 9

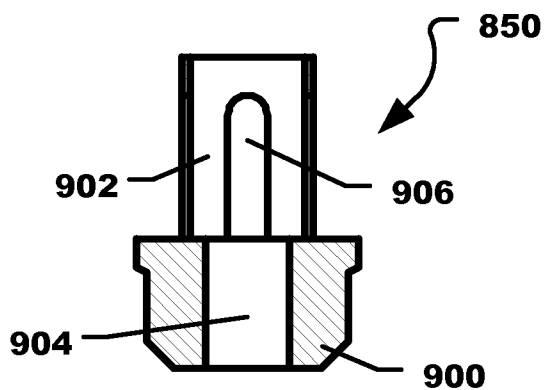
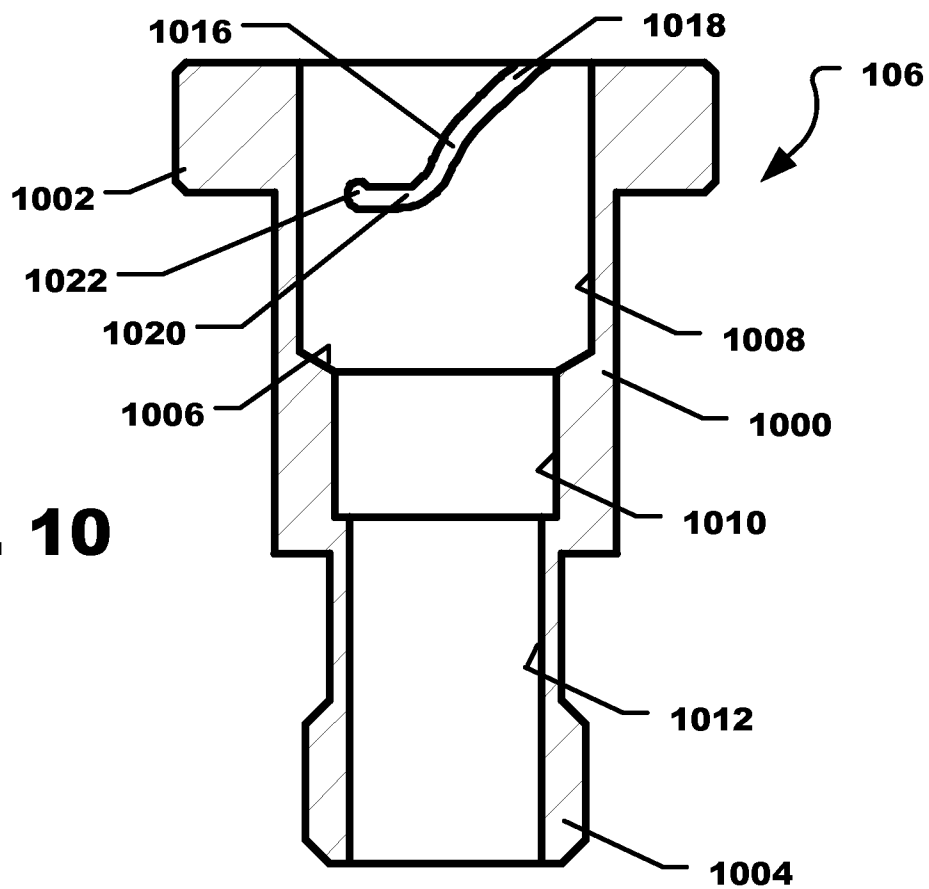


FIG. 10



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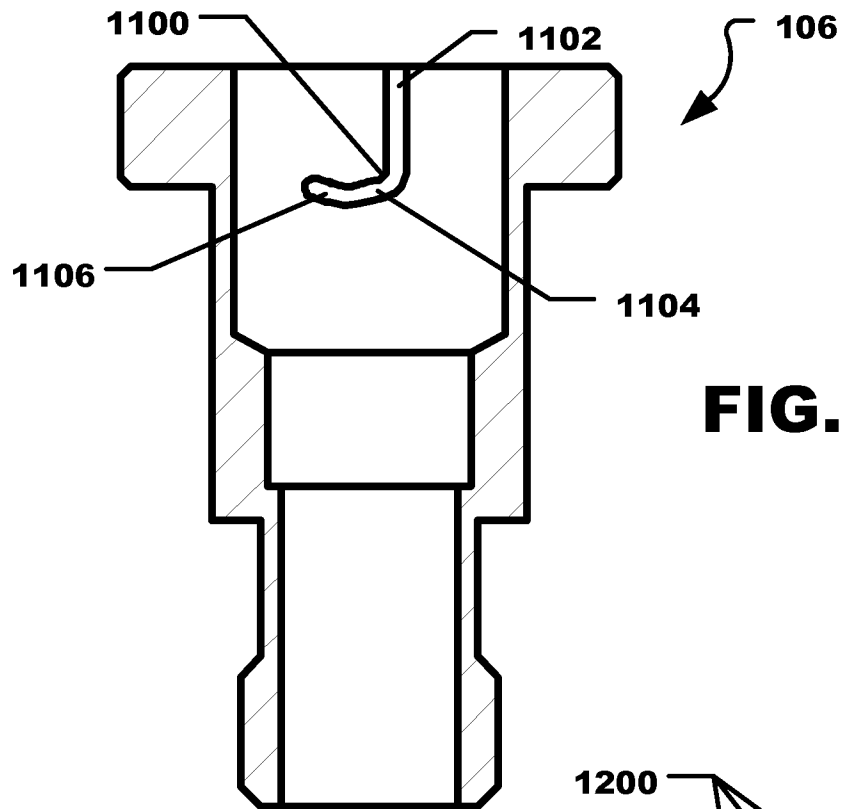


FIG. 11

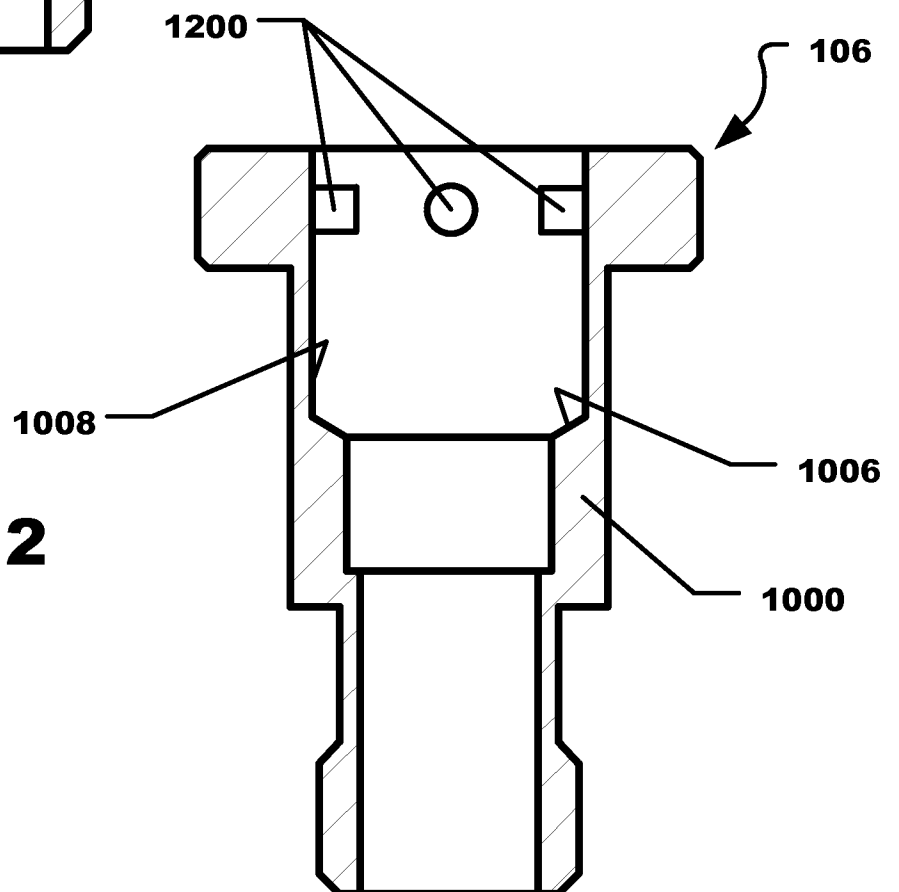
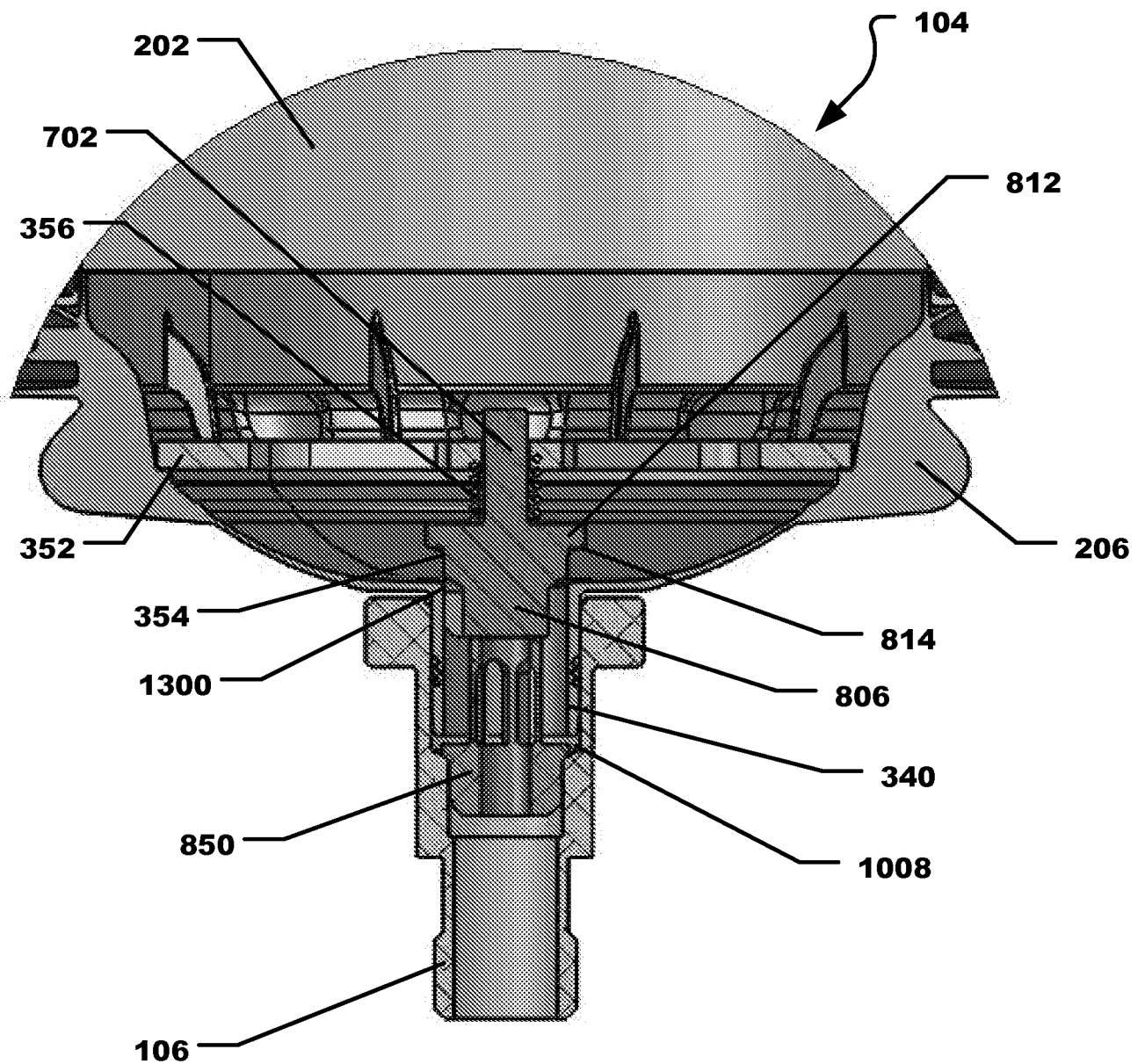
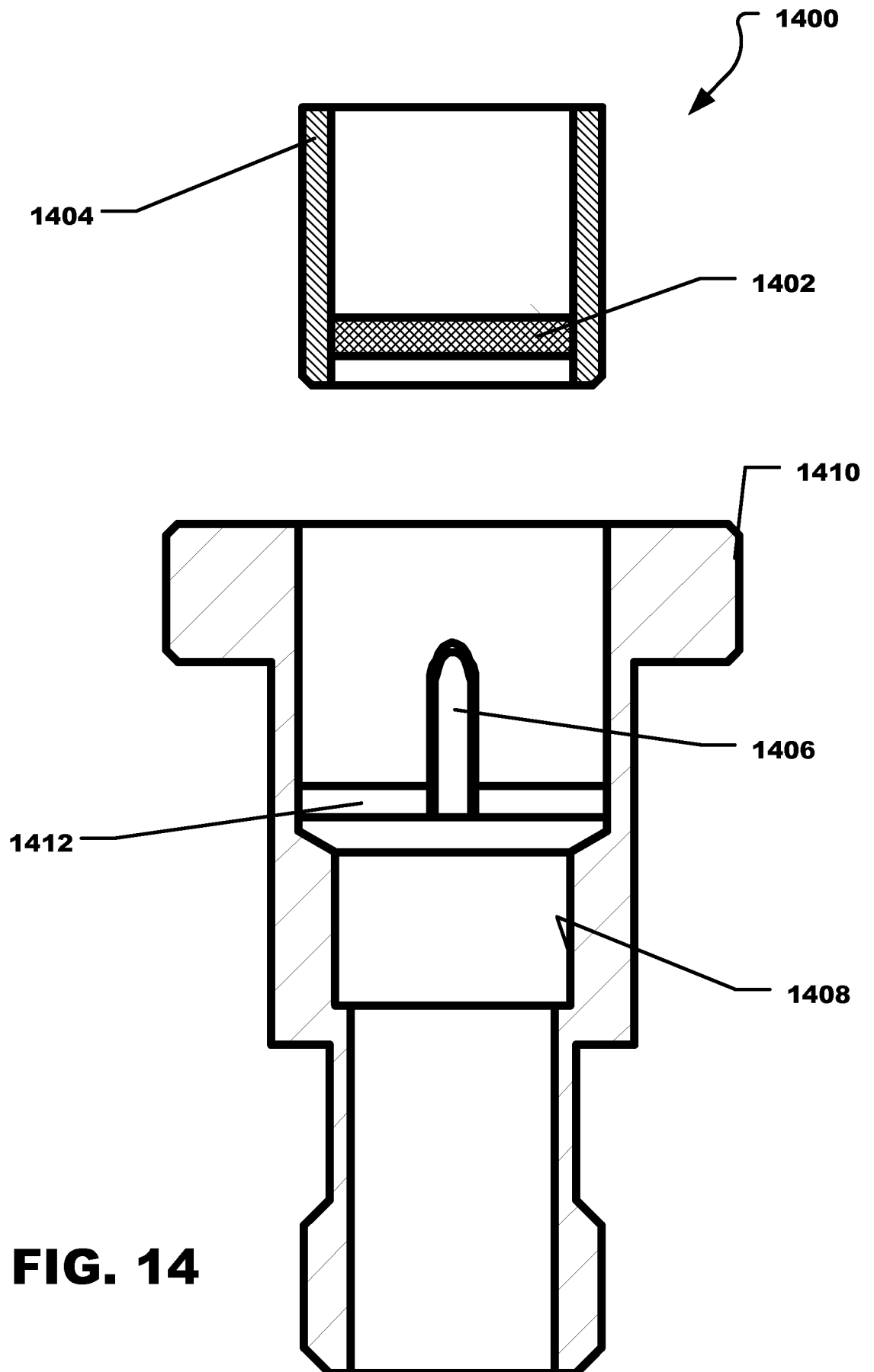


FIG. 12

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**FIG. 13**

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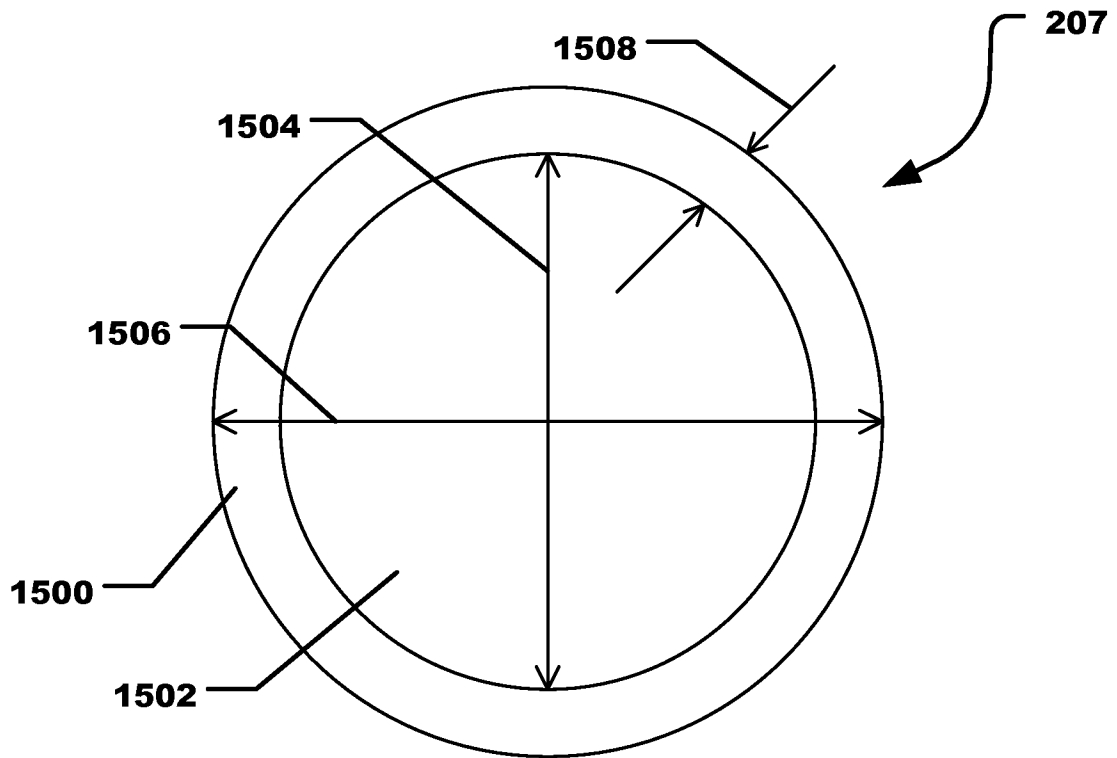
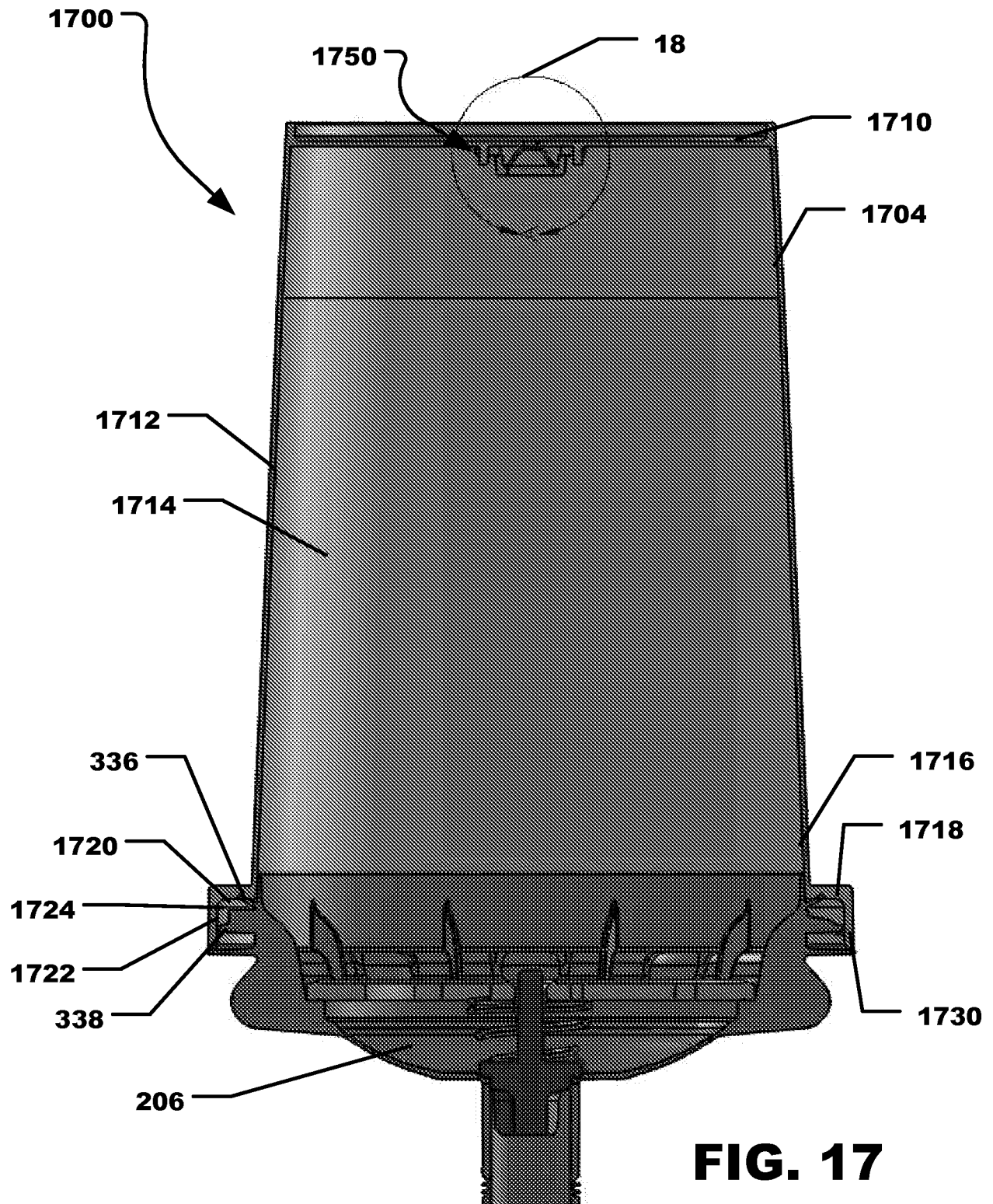


FIG. 15



FIG. 16

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**FIG. 17**

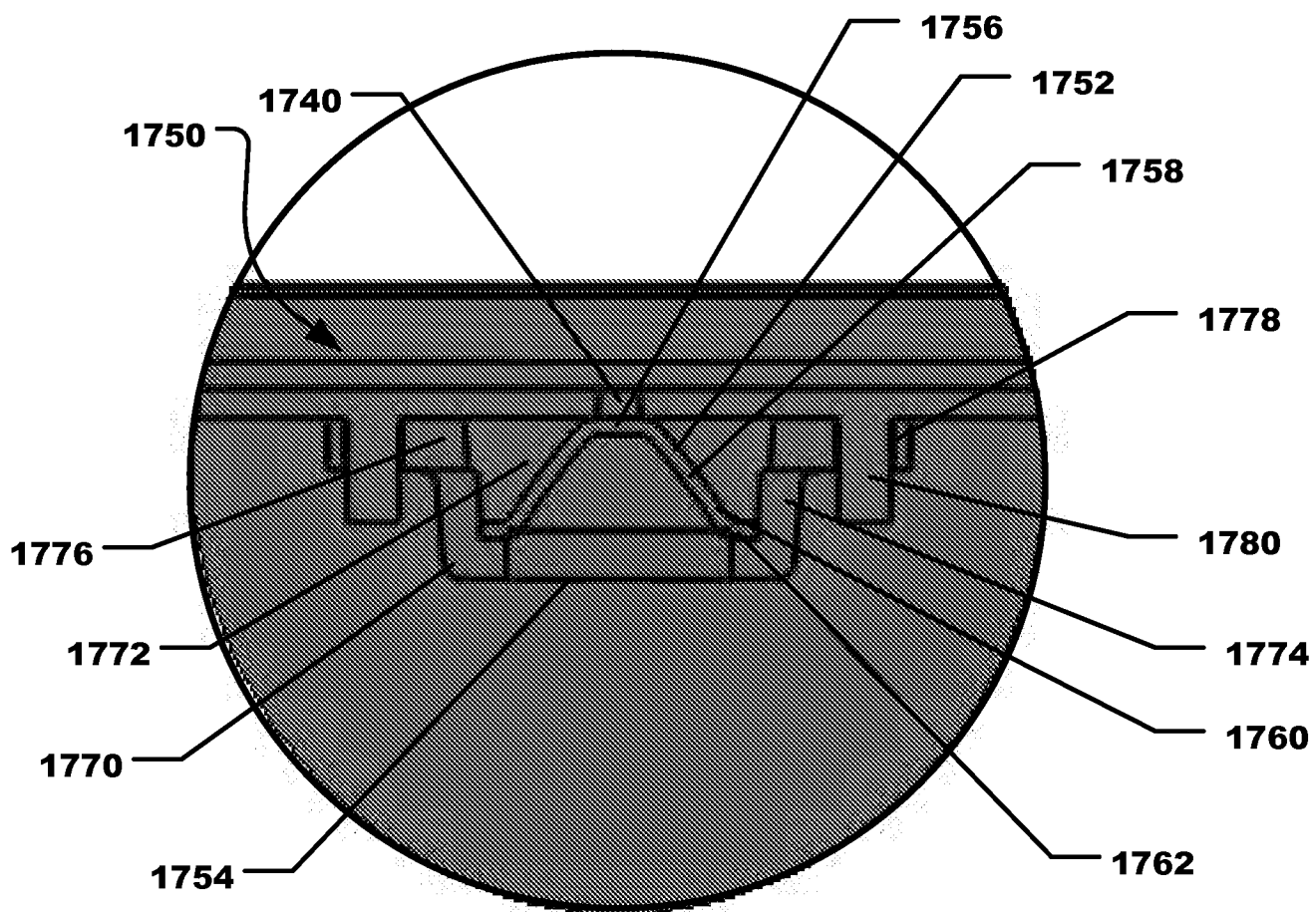
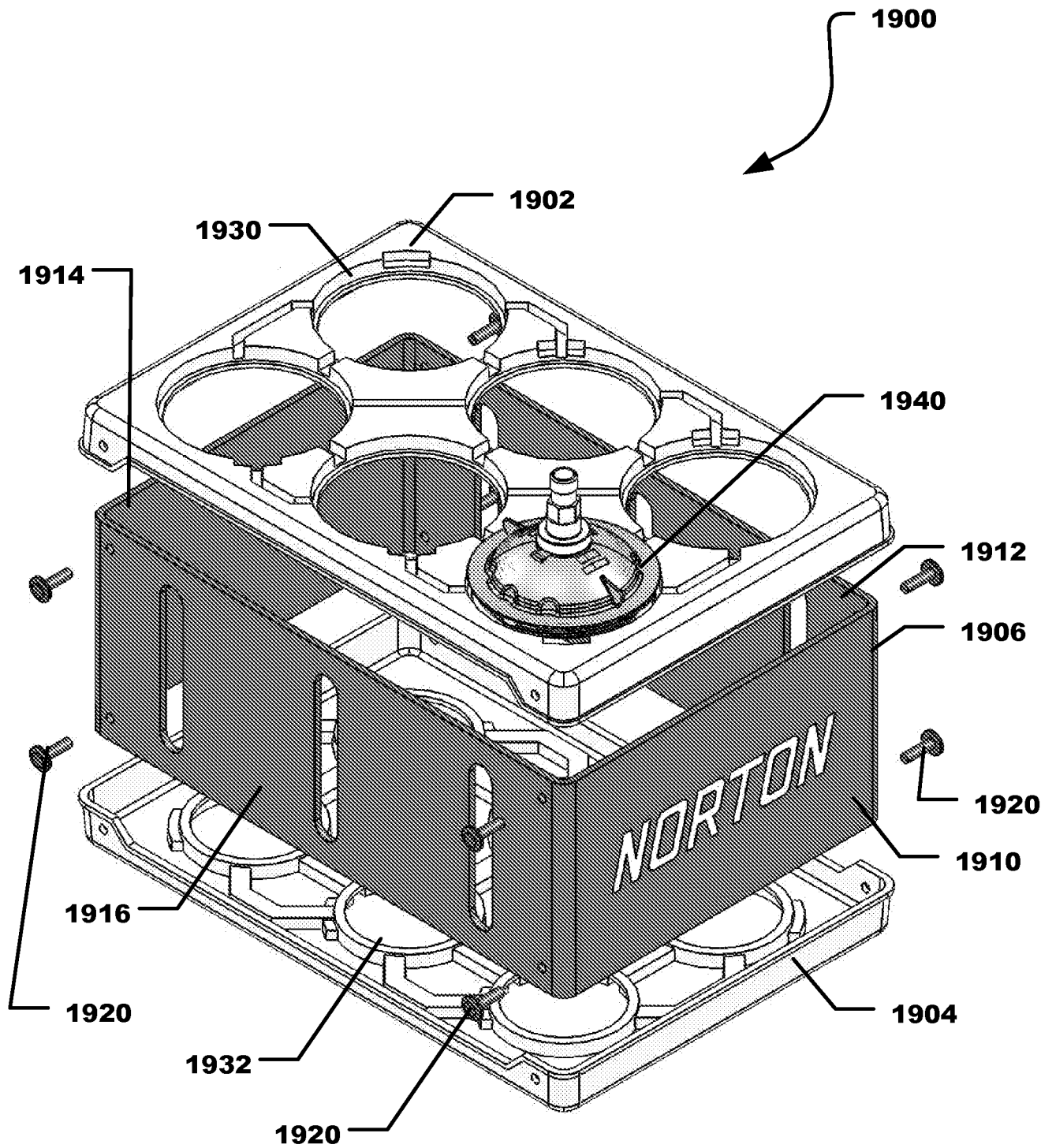


FIG. 18

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**FIG. 19**

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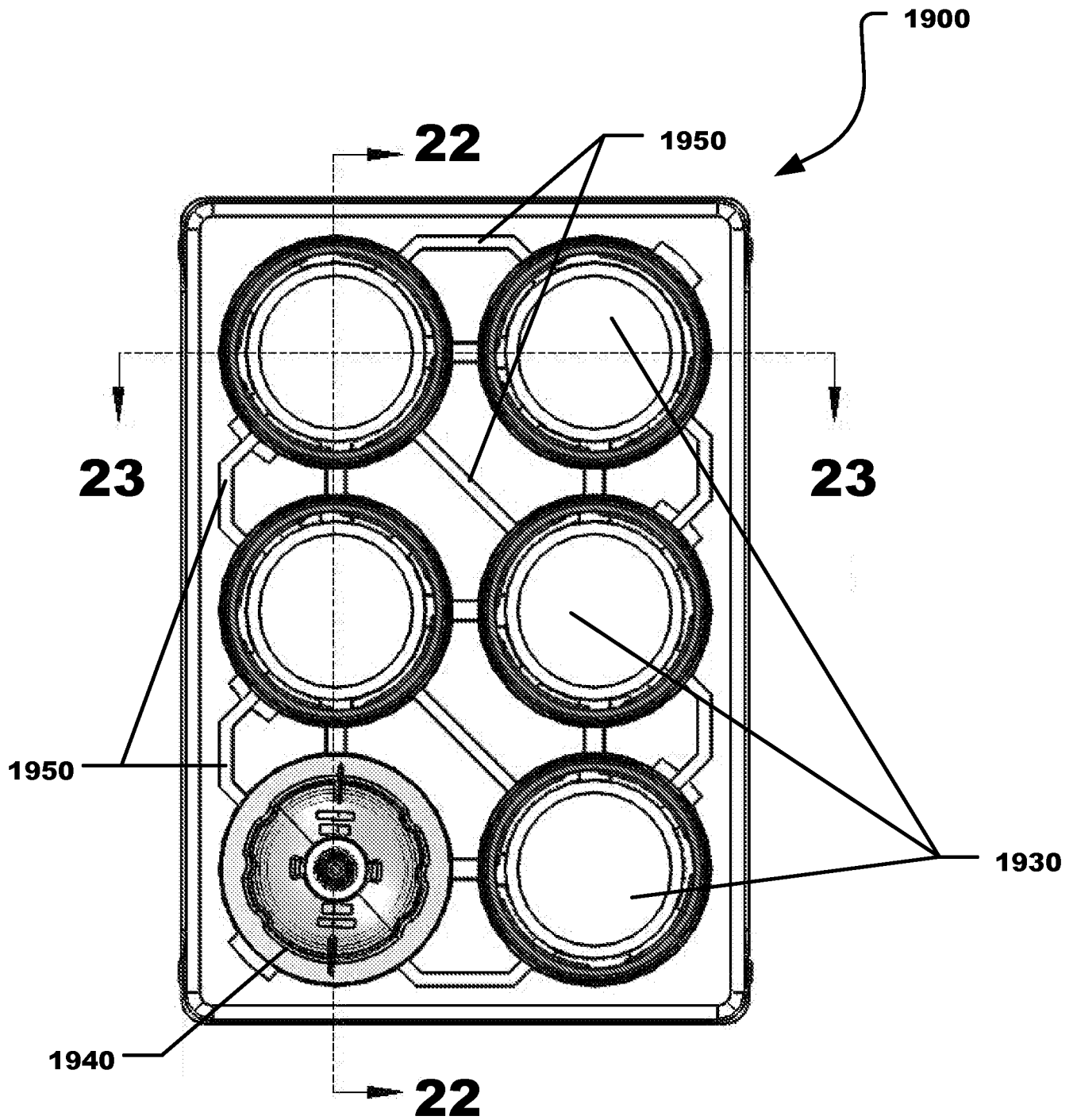


FIG. 20

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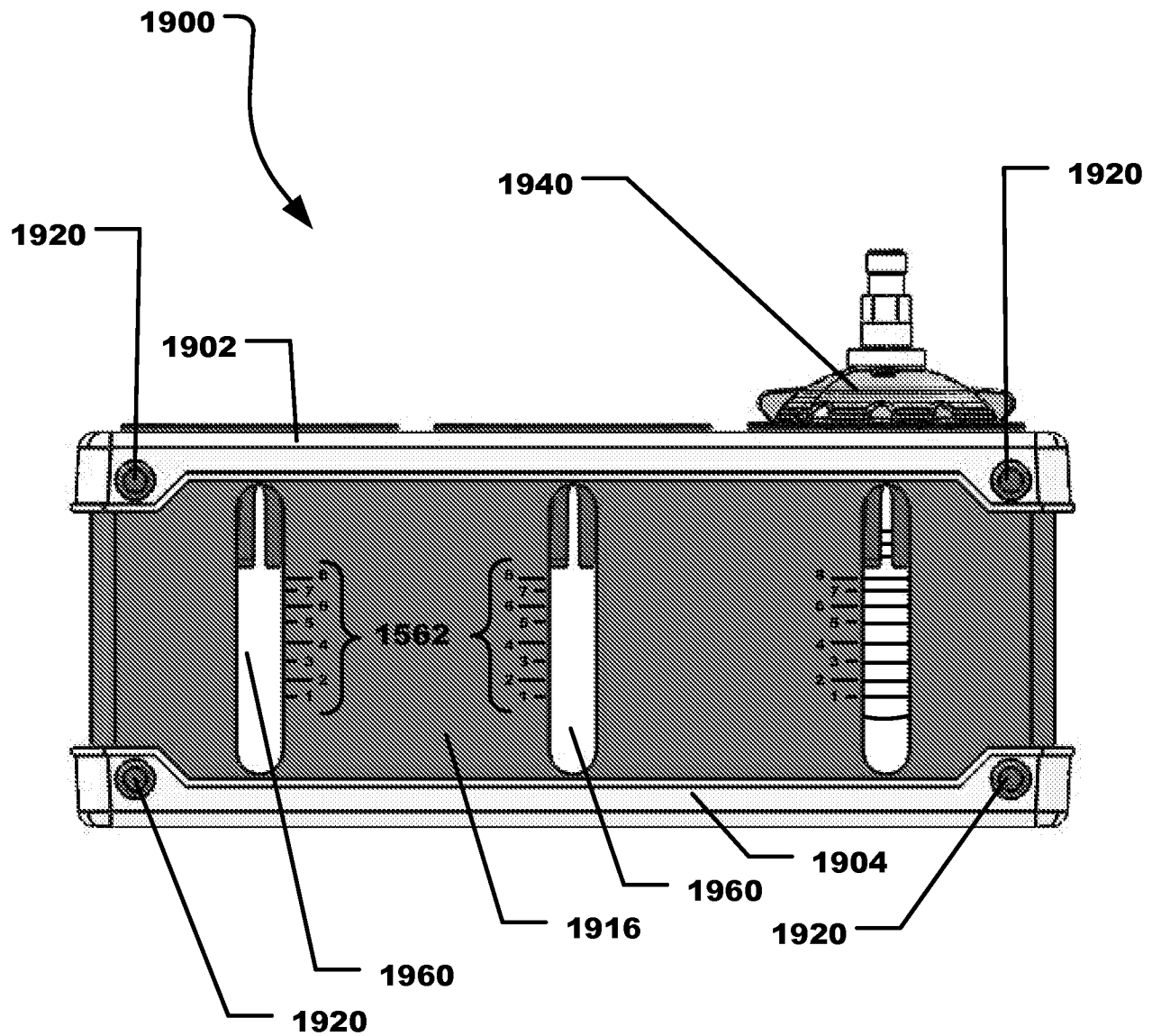


FIG. 21

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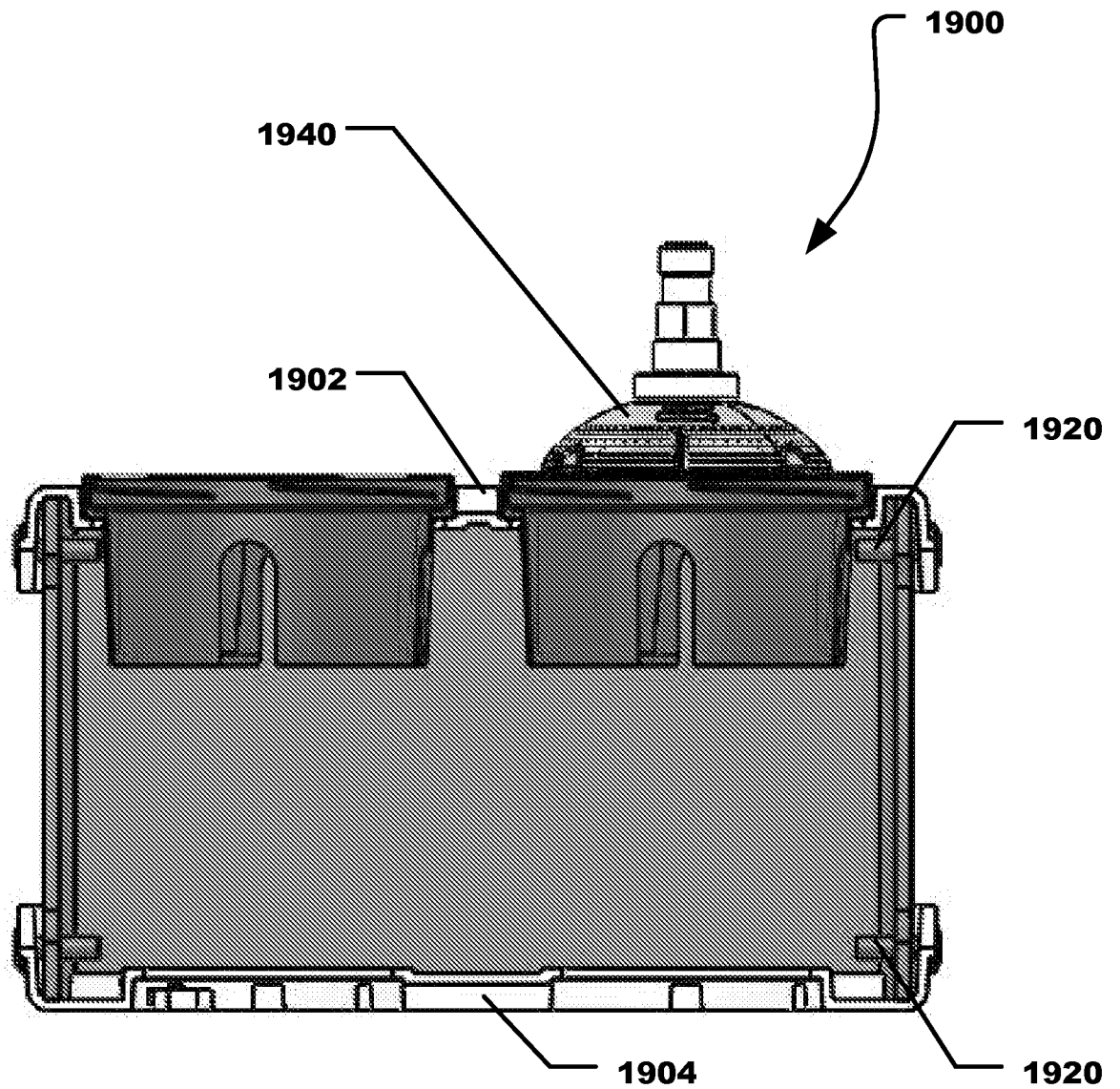


FIG. 23

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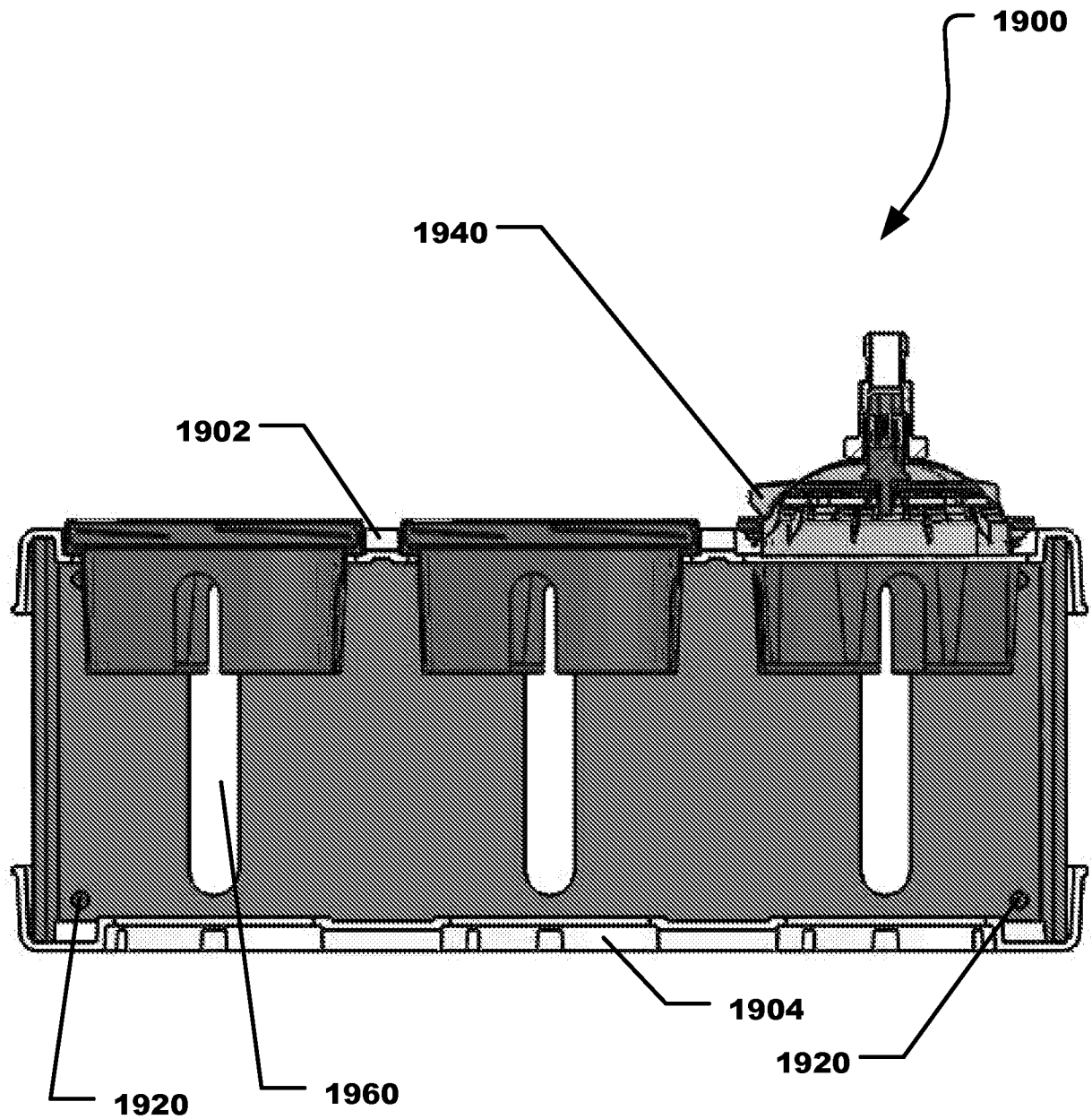


FIG. 22

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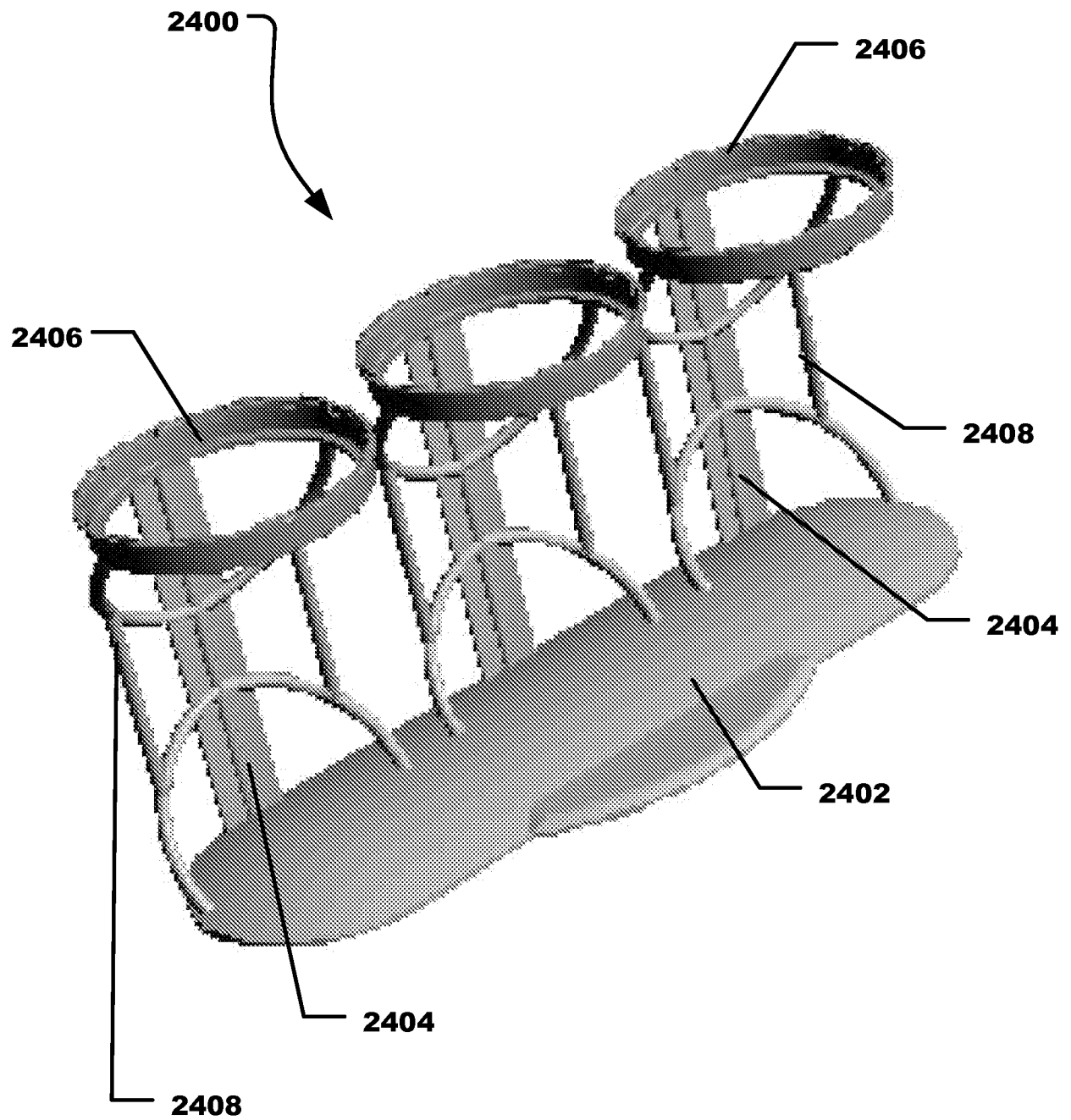


FIG. 24

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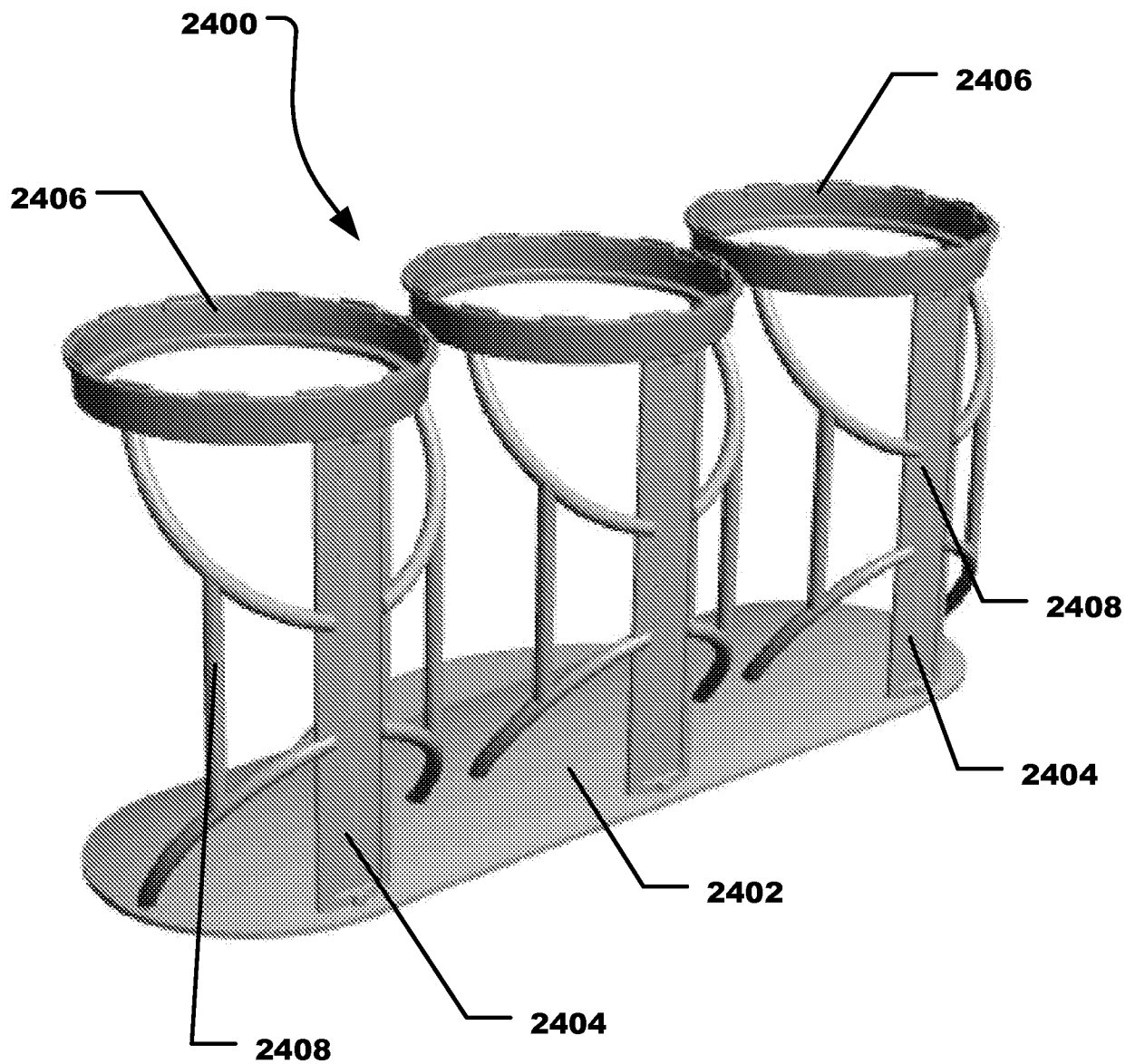


FIG. 25