



- (51) International Patent Classification:  
**B65D 83/20** (2006.01)
- (21) International Application Number:  
PCT/US2015/024581
- (22) International Filing Date:  
6 April 2015 (06.04.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (71) Applicant: **S.C. JOHNSON & SON, INC.** [US/US]; 1525  
Howe Street, Racine, WI 53403 (US).
- (72) Inventors: **RICHARD, Jesse**; 1323 Robin Lane, Racine,  
WI 53402 (US). **GORDON, William, F.**; 414-6th Street,  
Petaluma, CA 94952 (US). **BOREL, Bernard**; 31 Avenue  
de la République, F-54790 Mancielles (FR). **GAILLARD,  
Eric**; 9 Rue des rosiers, F-55310 Dieue sur Meuse (FR).
- (74) Agent: **FLECK, Michael, H.**; Quarles & Brady LLP, 300  
North LaSalle Street, Suite 4000, Chicago, IL 60654 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,  
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,  
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,  
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,  
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,  
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,  
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,  
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,  
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,  
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,  
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,  
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,  
GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: DISPENSING SYSTEMS

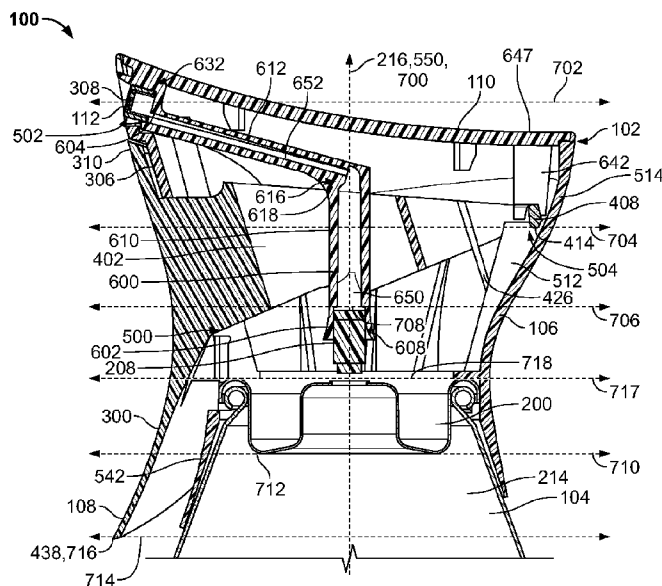


FIG. 12

(57) Abstract: An overcap (102) includes a housing (106) for coupling to a container (104). The housing (106) has a first sidewall (306) including an aperture (500). The overcap (102) also includes a trigger (108) having a grip portion (300) disposed outside of the housing (106) and an arm (400, 402) extending through the aperture (500) of the first sidewall (306) and pivotally coupled to a fulcrum (504) spaced apart from the first sidewall (306). The overcap (102) further includes a cap (110) coupled to the housing (106) and a manifold (600) suspended from the cap (110).

**Published:**

— *with international search report (Art. 21(3))*

## DISPENSING SYSTEMS

### REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0001] Not applicable.

### SEQUENCE LISTING

[0002] Not applicable.

### BACKGROUND OF THE DISCLOSURE

#### 1. Field of the Disclosure

[0003] The present disclosure relates to an apparatus for dispensing a fluid product, and in particular, to a manually actuable dispensing system.

#### 2. Description of the Background of the Disclosure

[0004] Traditional dispensing systems employ an overcap coupled to an aerosol container. Typically, a lower end or skirt of the overcap is thick and forms a step or ridge relative to the container when the overcap is coupled to the container. Consumers often find the step or ridge uncomfortable when gripping the dispensing system. In addition, traditional overcaps may not be suitable for consumers with hands of above-average size or below-average size.

[0005] Such dispensing systems also typically include an actuator such as a trigger or a button. When activated by a user, the actuator causes a manifold to actuate a valve stem of a container. The manifold typically includes a spray insert having a discharge outlet in fluid communication with the valve stem. Traditionally, the entire manifold moves relative to the overcap during actuation of the actuator. As a result, the dispensing system may inaccurately spray a fluid product or require undesirable movement on the part of the user's hand.

## SUMMARY

[0006] According to a first aspect, a dispensing system includes a housing for coupling to a container. The housing has a first sidewall including an aperture. The overcap also includes a trigger having a grip portion disposed outside of the housing and an arm extending through the aperture of the first sidewall and pivotably coupled to a fulcrum spaced apart from the first sidewall. The overcap further includes a cap coupled to the housing and a manifold suspended from the cap.

[0007] According to another aspect, a dispensing system includes a housing for coupling to a container. The housing has a first sidewall including an aperture. The overcap also includes a trigger pivotably coupled to the housing and a cap coupled to the housing. A manifold is unitary with the cap.

[0008] According to a different aspect, a dispensing system has a longitudinal axis and a housing including a first sidewall having an aperture. The dispensing system also includes a trigger having a grip portion disposed outside of the housing and an arm. The arm extends through the aperture of the first sidewall and is pivotably coupled to a second sidewall of the housing opposite the first sidewall. The dispensing system further includes a cap coupled to the housing and a manifold integrally formed with the cap. The manifold has an end portion to receive a valve stem of a container. A discharge aperture is in fluid communication with the manifold. A first plane perpendicular to the longitudinal axis passes through the discharge aperture, a second plane perpendicular to the longitudinal axis passes through an axis of rotation of the trigger, and a third plane perpendicular to the longitudinal axis passes through the end portion of the manifold. The second plane is disposed between the first plane and the third plane.

[0009] According to yet another aspect, a dispensing system includes a container having a mounting cup and a central, longitudinal axis. A first outermost point of the container is a first distance from the central, longitudinal axis along a first line perpendicular to the central, longitudinal axis. An overcap is coupled to the container. The overcap includes a pivotable trigger. A second outermost point of the trigger is a second distance from the central, longitudinal axis along a second line perpendicular to the central, longitudinal axis. The second distance is less than the first distance, and a grip portion of the trigger extends below the mounting cup of the container in a direction along the central, longitudinal axis.

[0010] According to still another aspect, a dispensing system includes a container including a mounting cup. The container has a first footprint. An overcap is coupled to the container. The overcap has a second footprint and includes a pivotable trigger having a portion extending below the mounting cup of the container when the dispensing system is in an upright position. The second footprint of the overcap is disposed entirely within the first footprint.

[0011] According to another aspect, a dispensing system includes a container having a cylindrical portion including a radius and a central, longitudinal axis perpendicular to the radius. A housing is coupled to the container. The dispensing system also includes a trigger pivotably coupled to the housing. A grip portion of the trigger is disposed outside of the housing and no portion of the grip portion is disposed farther from the longitudinal axis in a direction perpendicular to the longitudinal axis than a distance equal to the radius of the cylindrical portion.

[0012] According to another aspect, an overcap includes a housing having a first sidewall and a second sidewall opposite the first sidewall. A trigger is pivotably coupled to the housing and has a grip portion disposed outside of the housing adjacent the first sidewall. The grip portion has a length of about 40 millimeters to about 60 millimeters. The grip portion is concave and has a first radius of curvature, and the second sidewall is concave and has a second radius of curvature less than the first radius of curvature. The overcap has a waist of about 30 millimeters to about 50 millimeters.

[0013] According to a different aspect, a dispensing system includes a housing and a discharge outlet. A trigger has a grip portion pivotably coupled to the housing to rotate from a first position to a second position. The grip portion has an upper surface and an interior surface disposed below the discharge outlet when the dispensing system is in an upright position. The upper surface of the grip portion is to move outward when the grip portion rotates from the first position to the second position to enable at least one of the upper surface or the interior surface to direct a fluid product discharged via the discharge outlet into an interior of the housing.

[0014] According to yet another aspect, a dispensing system includes a container and a housing to be coupled to the container. The housing includes a flexible skirt having an interior face extending toward an exterior face such that a thickness of the end of the skirt is between about 0.3 millimeters and about 1.0 millimeters. The skirt in a first state uncoupled to the container defines an aperture with a first size, and the skirt in a second state coupled to the container

defines the aperture with a second size greater than the first size and forms a circumferential fluid seal between the skirt and the container.

[0015] According to a different aspect, a dispensing system includes a container and a housing to be coupled to the container. The housing includes a flexible skirt having an interior face extending toward an exterior face such that a ratio of a first thickness of an area of the skirt spaced apart from an end of the skirt to a second thickness of the end of the skirt is greater than about 1.5:1. The skirt in a first state uncoupled to the container defines an aperture with a first size, and the skirt in a second state coupled to the container defines the aperture with a second size greater than the first size and forms a circumferential fluid seal between the skirt and the container.

[0016] According to different aspect, a dispensing system includes a housing for coupling to a container. The housing has a first sidewall including an aperture. The system also includes a trigger having a grip portion disposed outside of the housing and an arm extending through the aperture of the first sidewall and pivotably coupled to a second sidewall of the housing opposite the first sidewall. The system further includes a cap coupled to the housing and a manifold suspended from the cap. The trigger is operatively coupled to the manifold such that when a first portion of the trigger moves along a first arcuate path, a second portion of the manifold moves along a second arcuate path opposing the first arcuate path.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a front, top isometric view of a dispensing system;

[0018] FIG. 2 is a front, top isometric view of a container of the dispensing system of FIG. 1;

[0019] FIG. 3 is a front, top isometric view of an overcap of the dispensing system of FIG. 1;

[0020] FIG. 4 is a bottom view of a trigger of the overcap of FIG. 3;

[0021] FIG. 5 is a rear, bottom isometric view of the trigger of FIG. 4;

[0022] FIG. 6 is a front, top isometric view of a housing of the overcap of FIG. 3;

[0023] FIG. 7 is rear, top isometric view of the housing of FIG. 6;

[0024] FIG. 8 is an enlarged, partial cross-sectional view taken along line 8-8 of FIG. 1 showing the housing of FIGS. 6 and 7 coupled to the container of FIG. 2;

[0025] FIG. 9 is a cross-sectional view taken along line 9-9 of FIG. 1 showing the overcap of FIG. 3 coupled to the container of FIG. 2, which is shown schematically for purposes of clarity;

[0026] FIG. 10 is a front, isometric view of a manifold and a cap of the overcap of FIG. 3;

[0027] FIG. 11 is an enlarged side view of a valve stem of the container of FIG. 2 in fluid communication with the manifold of FIG. 10;

[0028] FIG. 12 is a cross-sectional view taken along line 12-12 of FIG. 1 showing the trigger of FIGS. 4 and 5 in a first or unactuated position;

[0029] FIG. 13 is a cross-sectional view similar to the one shown in FIG. 12 with the trigger of FIGS. 4 and 5 depicted in a second or actuated position;

[0030] FIG. 14 is a cross-sectional view similar to the one shown in FIG. 12 further depicting arcuate paths of the trigger and the manifold of FIGS. 12 and 13;

[0031] FIG. 15 is a cross-sectional view similar to the one shown in FIG. 1 further showing an arcuate path of the trigger of FIGS. 12-14;

[0032] FIG. 16 is an enlarged cross-sectional view of a portion of FIG. 12 depicting a rail of the overcap of FIG. 3;

[0033] FIG. 17 is a cross-sectional view of the manifold of FIG. 12 shown schematically in a first state depicted in conjunction with a schematic representation of the manifold in a second state;

[0034] FIG. 18 is a top, schematic view illustrating a first footprint of the container and a second footprint of the overcap of the dispensing system of FIGS. 1-17;

[0035] FIG. 19 is a cross-sectional view similar to the one shown in FIG. 12 further provided with representative dimensions that may be used to implement the dispensing system of FIGS. 1-18;

[0036] FIG. 20 is an enlarged, side view of the trigger of FIGS. 4 and 5 and the manifold of FIG. 10 illustrating a first path of trigger contact points and a second path of manifold contact points;

[0037] FIG. 21 is a graph of example forces applied to the trigger of FIGS. 4 and 5 relative to example magnitudes of displacement of the trigger;

[0038] FIG. 22 is an enlarged, cross-sectional view along line 22-22 of FIG. 1 depicting an alternative coupling between the overcap and the container;

[0039] FIG. 23 is a cross-sectional view along line 23-23 of FIG. 1 depicting the dispensing system of FIGS. 1-20; and

[0040] FIG. 24 is a perspective view of a tamper resistant device which may be employed to implement the dispensing system of FIGS. 1-23.

### DETAILED DESCRIPTION

[0041] FIG. 1 illustrates an example dispensing system 100 disclosed herein. The dispensing system 100 of FIG. 1 includes an overcap 102 and an aerosol container 104. The overcap 102 includes a housing 106, a trigger 108, a cap or lid 110, and a spray insert 112. The container 104 holds and/or stores a fluid product such as, a fragrance, insecticide, a deodorizer, a fungicide, a bacteriocide, a sanitizer, a pet barrier, or other active volatile or other compound disposed within a carrier liquid (for example, an oil-based and/or water-based carrier), a deodorizing liquid, or the like. For example, the liquid may comprise PLEDGE®, a surface cleaning active, RAID®, a pest control active, OUST®, an air and carpet sanitizer, or GLADE®, a deodorant, all sold by S. C. Johnson and Son, Inc., of Racine, Wisconsin, for household, commercial, and institutional use. The liquid may also comprise other actives, such as sanitizers, air and/or fabric fresheners, cleaners, odor eliminators, mold or mildew inhibitors, insect repellents, and the like, or others that have aromatherapeutic properties. The liquid alternatively comprises any fluid known to those skilled in the art that can be dispensed from the container 104. The container 104 may employ a propellant such as, for example, compressed gas, liquefied petroleum gas (LPG), and/or one or more additional and/or alternative propellants to facilitate dispensing of the fluid product from the container 104.

[0042] FIG. 2 is an isometric view of the container 104 of FIG. 1. The container 104 includes a mounting cup 200 disposed on a first end 202 of the container 104. The mounting cup 200 of FIG. 2 includes an annular ridge. In other embodiments, the mounting cup 200 may be other shapes and/or have different configurations. A pedestal 204 is disposed on the first end 202 of the container 104 interiorly of the mounting cup 200. The pedestal 204 of FIG. 2 is a cylindrical protrusion. In the illustrated embodiment, the mounting cup 200 and the pedestal 204 are integrally formed and/or unitary. In other embodiments, the pedestal 204 may have other shapes and/or configurations. The pedestal 204 includes an aperture 206 through which a vertical valve stem 208 extends out of the pedestal 204. The vertical valve stem 208 is operatively coupled to a valve assembly (not shown) disposed in the container 104. When the valve stem 208 is



depressed, the valve assembly opens to permit the fluid product to be discharged from the container 104 via the valve stem 208. In other embodiments, a tilt valve stem may be similarly employed to discharge fluid upon actuation. In the illustrated embodiment, the container 104 includes a second or bottom end 210 that is shaped and dimensioned to enable the second end 210 to support the container 104 on a surface in an upright position as shown in FIG. 2. The container 210 also includes a cylindrical portion 212 and a neck 214. The container 104 of FIG. 2 has a central, longitudinal axis 216.

[0043] FIG. 3 is an isometric view of the overcap 102 of FIG. 1. The trigger 108 of FIG. 3 includes a saddle shaped or hyperbolic paraboloid shaped grip portion 300. Thus, the grip portion 300 is curved about a first axis of curvature 302 and a second axis of curvature 304 substantially perpendicular to the first axis of curvature 302. In other embodiments, the grip portion 300 has other shapes. The grip portion 300 is disposed outside of the housing 106 and, thus, the grip portion 300 is accessible to the user such that the user can squeeze the grip portion 300 toward the housing 106 via one or more fingers. In the illustrated embodiment, the grip portion 300 is outside of the housing adjacent a first sidewall 306 of the housing 106. The grip portion 300 of the trigger 108 is also disposed below the spray insert 112 when the dispensing system 100 and, thus, the overcap 102 are in a partially upright or upright position. Thus, a discharge outlet 308 of the spray insert 112 is disposed above the grip portion 300 of the trigger 108 when the dispensing system 100 is in the partially upright position or the upright position. Thus, when a user grips the overcap 102 and/or the container 104 when the dispensing system 100 is in the upright position or the partially upright position, the discharge outlet 308 of the spray insert 112 is disposed above one or more fingers of the user used to actuate the trigger 108 via the grip portion 300. However, as described in greater detail below in conjunction with FIG. 16, in some embodiments an upper or first end 310 of the trigger 108 moves away from the housing 106 during actuation of the trigger 108 to a position between the discharge outlet 308 and the user's fingers such that the trigger 108 prevents drippings of the fluid product, if any, from contacting the user's hand.

[0044] FIG. 4 is a bottom view of the trigger 108 of FIGS. 1 and 3. In the illustrated embodiment, the trigger 108 includes a first arm 400 and a second arm 402. In other embodiments, the trigger 108 includes other numbers of arms (e.g., 1, 3, 4, 5, 6, . . . , etc.). Proximal ends 404, 406 of the first arm 400 and the second arm 402, respectively, are coupled to

the grip portion 300. In the illustrated embodiment, the first arm 400 and the second arm 402 are coupled to the grip portion 300 via integrally forming the first arm 400, the second arm 402, and the grip portion 300. For example, the first arm 400, the second arm 402, and the grip portion 300 may be a single piece of plastic. In other embodiments, the first arm 400 and/or the second arm 402 may be coupled to the grip portion 300 via one or more mechanical fasteners (e.g., nails, screws, clips, clamps, tape, welds, threads, etc.) and/or chemical fasteners (e.g., glue, epoxy, etc.). The first arm 400 and the second arm 402 extend from the grip portion 300. In the illustrated embodiment, the first arm 400 is substantially parallel to the second arm 402. In some embodiments, the first arm 400 and the second arm 402 are substantially perpendicular to the grip portion 300. In other embodiments, the first arm 400 and the second arm 402 are oriented at other angles relative to the grip portion 300.

[0045] The trigger 108 includes a pivot 408. In the illustrated embodiment, the pivot 408 is a crossbeam extending from a first distal end 410 of the first arm 400 to a second distal end 412 of the second arm 402. The pivot 408 defines an axis of rotation 414 of the trigger 108. The trigger 108 also includes a first brace 416 and a second brace 418. Each of the first brace 416 and the second brace 418 extend from the first arm 400 to the second arm 402 to provide rigidity to the trigger 108. A third brace 420 extends from the second brace 418 to the grip portion 300 to provide rigidity to the trigger 108. In the illustrated embodiment, the first arm 400, the second arm 402, the pivot 408, the first brace 416, the second brace 418, the third brace 420, and the grip portion 300 are unitary and/or integrally formed. In other embodiments, the pivot 408, the first brace 416, the second brace 418, and/or the third brace 420 are coupled to the first arm 400, the second arm 402, and/or the grip portion 300 via one or more mechanical and/or chemical fasteners. In the illustrated embodiment, the first brace 416, the second brace 418, the first arm 400 and the second arm 402 define a space or aperture 422. As described in greater detail below, a manifold 600 (see FIG. 10) extends through the aperture 422. The trigger 108 is sufficiently rigid such that that trigger 108 substantially does not deflect or bend during actuation of the trigger 108.

[0046] FIG. 5 is a bottom, rear isometric view of the trigger 108 of FIG. 4. The trigger 108 includes a first spring 424 and a second spring 426. In the illustrated embodiment, the first spring 424 is a bar coupled to the first arm 400 between the pivot 408 and the first brace 416. The first spring 424 extends downward and rearward from the first arm 400 in the orientation of

FIG. 5. The second spring 426 is a bar coupled to the second arm 402 between the pivot 408 and the first brace 416. The second spring 426 extends downward and rearward from the second arm 402 in the orientation of FIG. 5. As described in greater detail below, when the trigger 108 rotates to actuate the valve stem 208 of the container 104, the first spring 424 compresses and/or bends between the first arm 400 and the housing 106 and the second spring 426 compresses and/or bends between the second arm 402 and the housing 106.

[0047] The trigger 108 includes a first contact surface 430 and a second contact surface 432. The first contact surface 430 and the second contact surface 432 are defined by undersides 434, 436 of the first arm 400 and the second arm 402, respectively. In the illustrated embodiment, the first contact surface 430 and the second contact surface 432 are curved such that the first contact surface 430 and the second contact surface 432 are cams. As described in greater detail below, the first contact surface 430 and the second contact surface 432 engage (e.g., contact) the manifold 600 (see FIG. 10) to move the manifold 600 toward the container 104, which actuates the valve stem 208 of the container 104. Turning again to FIG. 5, a second or lower end 438 of the grip portion 300 moves toward the first sidewall 306 and the container 104 (see FIG. 2) to move the first contact surface 430 and the second contact surface 432 into engagement with the manifold 600. In the illustrated embodiment, a thickness of the grip portion 300 decreases or changes from the first end 310 to the second end 438 of the grip portion 300. For example, a first thickness of the grip portion 300 at the first end 310 may be about 1.6 millimeters; a second thickness of the grip portion 300 at the second end 438 may be about 0.7 millimeters. Thus, the second thickness may be less than the first thickness. In other embodiments, the grip portion 300 has other thicknesses.

[0048] FIG. 6 is a top, isometric view of the housing 106 of FIGS. 1 and 3. In the illustrated embodiment, the first sidewall 306 of housing 106 defines a first aperture 500 and a second aperture 502. The first aperture 500 is rectangular. In other embodiments, the first aperture 500 is other shapes. In the illustrated embodiment, the housing 106 includes a fulcrum 504. The fulcrum 504 of FIG. 6 is defined by a first notch 506 and a second notch 508 of a first rib 510 and a second rib 512, respectively. The ribs 510, 512 are disposed on a second sidewall 514 of the housing 106 opposite the first sidewall 306. In other embodiments, the fulcrum 504 is defined by one or more additional and/or alternative hinging, rotatable or pivotable structures, e.g., a living hinge, could be used in lieu of, or in addition to, the fulcrum 504. As described in

greater detail below with reference to FIG. 12, the first arm 400 and the second arm 402 extend through the first aperture 500 such that the pivot 408 rests on and/or is supported by the fulcrum 504.

[0049] The second aperture 502 of the housing 106 of FIG. 6 is circular. In other embodiments, the second aperture 502 is other shapes. The second aperture 502 receives the spray insert 112 and/or a second end portion 604 of the manifold 600 (see FIG. 10). However, as described in greater detail below with reference to FIG. 12, the housing 106 does not directly support the spray insert 112 or the manifold 600. The housing 106 includes a third aperture 516 defined by a top or first end 518 of the housing 106. A flange or rim 520 is disposed in an interior 522 of the housing 106 adjacent the first end 518. The rim 520 supports the cap 110 (see FIGS. 1 and 3). The housing 106 also includes a fourth aperture 524 defined by a bottom or second end 526 of the housing 106 opposite the first end 518.

[0050] FIG. 7 is a top, rear view of the housing 106 of FIG. 6. In the illustrated embodiment, the housing 106 includes a third rib 528 and a fourth rib 530 disposed on the first sidewall 306. The third rib 528 and the fourth rib 530 extend from a second flange 532 toward the first end 518 of the housing 106 to provide rigidity to the housing 106. In some embodiments, the first rib 528 and the second rib 530 support the cap 110. The second flange 532 is spaced apart from the first end 518 and the second end 526 of the housing 106. In the illustrated embodiment, a plurality of braces 534 provides rigidity to the second flange 532. As described in greater detail below with reference to FIG. 8, the second flange 532 may rest on and/or contact the mounting cup 200 of the container 104. In the illustrated embodiment, a cantilevered tongue 536 having a top surface 538 extends from the second sidewall 514 toward the first sidewall 306. In some embodiments, the tongue 536 facilitates molding of the housing 106.

[0051] With reference to FIG. 8, the housing 106 receives a portion of the container 104 via the fourth aperture 524 (see FIGS. 6 and 7). In the illustrated embodiment, the mounting cup 200 is snap fit between the second flange 532 and a plurality of protrusions 540 disposed about the interior 522 of the housing 106 adjacent a skirt 542 of the housing 106. Thus, the second flange 532 and the protrusions 540 contact the mounting cup 200 of the container 104 to secure the overcap 102 to the container 104. In other embodiments, the housing 106 couples to the container 104 in other ways such as, for example, via one or more mechanical and/or chemical

fasteners. In the illustrated embodiment, each of the protrusions 540 has a trapezoidal cross-sectional shape. In other embodiments, one or more of the protrusions 540 has a different shape.

**[0052]** FIG. 9 is a cross-sectional view of the overcap 102 and the container 104. In the illustrated embodiment, the skirt 542 decreases in thickness from an area 544 adjacent the mounting cup 200 toward the second end 526. For example, in the illustrated embodiment, the area 544 has a thickness of about 1.2 millimeters, and the second end 526 has a thickness of about 0.6 millimeters. However, the foregoing dimensions are merely examples and, thus, other dimensions may be employed without departing from the scope of this disclosure. For example, in some embodiments, the area 544 has a thickness of about 1.1 to about 1.6 millimeters and the second end 526 has a thickness of about 0.3 to about 1.0 millimeters. In some embodiments, the second end 526 has a thickness of about 0.3 to about 0.6 millimeters. In some embodiments, the ratio of the thickness of the area 544 to the thickness of the second end 526 is greater than 1:1, or greater than 1.5:1, or greater than 2:1, or greater than 3:1, or greater than 4:1, or greater than 5:1. In some embodiments, the thickness of the area 544 and/or the second end 526 may be variable about a circumference thereof and, in such a scenario, the aforementioned thicknesses are illustrative of the narrowest or thinnest portions of the area 544 and the second end 526.

**[0053]** In the embodiment of FIG. 9, the skirt 542 has a cross-sectional shape bounded by an exterior face 546 of the skirt 542, an interior face 548 of the skirt 542, and the second end 526 of the housing 106. The exterior face 546 of the skirt 542 curves or bows outward from the area 544 and, thus, away from a longitudinal axis 550 of the dispensing system 100. The interior face 548 extends from the area 544 away from the longitudinal axis 550 and is angled, sloped, and/or bowed toward the exterior face 546. As a result, the interior face 548 and the exterior face 546 converge and, thus, the thickness of the skirt 542 decreases from the area 544 adjacent the mounting cup 200 toward the second end 526 of the housing 106. In the illustrated embodiment, the interior face 548 substantially follows or matches a contour of a portion of the neck 214 of the container 104. In some embodiments, the skirt 542 elastically deforms when the overcap 102 is coupled to the container 104 to enable a shape and a size of the skirt 542 to substantially conform to a shape and a size of the neck 214 of the container 104. For example, the skirt 542 in an uncoupled or first state may have a first shape (e.g., circular, oval, etc.) and define the fourth aperture 524 with a first size (e.g., a first diameter) when the overcap 102 is not coupled to the container 104. When the overcap 102 is coupled to the container 104, the skirt 542 may

elastically deform to a coupled or second state in which the skirt 542 has a second shape different than the first shape and/or defines the fourth aperture 524 with a second size larger than the first size to substantially conform to the shape and the size of the neck 214 of the container 104. For example, the skirt 542 may bend outwardly and/or expand to substantially conform to the shape and the size of the neck 214 of the container 104. In some embodiments, the elastic deformation of the skirt 542 enables the skirt 542 to form an interference fit or a press fit between the container 104 and the skirt 542. In some embodiments, the elastic deformation of the skirt 542 enables the skirt 542 to form a circumferential fluid seal between the skirt 542 and the container 104. In addition, the minimal thickness of the second end 526 of the skirt 542 provides a substantially smooth transition between the container 104 and the overcap 102 that is more comfortable to a user gripping the dispensing system 100 than traditional dispensing systems employing an overcap. In some embodiments, the elastic deformation of the skirt 542 enables the overcap 102 to form an interference fit and/or a fluid seal on containers having different shapes or sizes than the container 104 of FIG. 9 and provides a substantially smooth transition between the respective containers and the skirt 542.

**[0054]** FIG. 10 is a front, isometric view of the cap 110 and the manifold 600. In the illustrated embodiment, the manifold 600 includes a first end portion 602 and a second end portion 604. The second end portion 604 of FIG. 10 has an orifice 606 to receive the spray insert 112. The first end portion 602 fluidly couples to the valve stem 208 (see FIG. 2) of the container 104. In the illustrated embodiment, the first end portion 602 includes a flared portion 608. The manifold 600 includes a first duct 610 and a second duct 612. The first duct 610 of FIG. 10 is generally transverse to the second duct 612. For example, the first duct 610 and the second duct 612 may be oriented such that the first duct 610 extends at an angle 614 of about 105 degrees relative to the second duct 612. In some embodiments, the angle 614 is about 90 to about 130 degrees. In other embodiments, the angle 614 is other numbers of degrees. The first duct 610 is coupled to the second duct 612 via a first joint 616. In the illustrated embodiment, the first joint 616 includes a brace 618. The brace 618 of FIG. 10 is an arched plate having a vertex 620 substantially coincident with a junction 622 of the first duct 610 and the second duct 612. In other embodiments, the brace 618 has other shapes and/or configurations. For example, the brace 618 may be a curved beam, a triangular plate, a rectangular beam, and/or other shapes and/or configurations. In some embodiments, the joint 614 does not include the brace 618.

[0055] In the illustrated embodiment, a first protrusion 624 and a second protrusion 626 extend from the first duct 610 of the manifold 600. In the illustrated embodiment, the first protrusion 624 and the second protrusion 626 are disposed on opposite sides 628, 630 of the first duct 610 adjacent the first end portion 602. As described in greater detail below with reference to FIG. 11, the first contact surface 430 of the trigger 108 engages the first protrusion 624, and the second contact surface 432 of the trigger 108 engages the second protrusion 626 to drive the first end portion 602 of the manifold 600 toward the container 104 to depress and actuate the valve stem 208.

[0056] In the illustrated embodiment, the manifold 600 is suspended from the cap 110. For example, the second end portion 604 of the manifold 600 is coupled to the cap 110 via a second joint 632. In the illustrated embodiment, the second joint 632 includes a link 634 and a plate 636. In the illustrated embodiment, the cap 110, the link 634, the plate 636, and the manifold 600 are integrally formed and/or unitary. In other embodiments, the cap 110, the link 634, the plate 636 and/or the manifold 600 are coupled in other ways. In the illustrated embodiment, the link 634 is an elongated bar disposed between the second end portion 604 and an interior face 638 of the cap 110 and extends in substantially the same direction as the second duct 612. The plate 636 of FIG. 10 is transverse to the second duct 612, and the second duct 612 extends through the plate 636.

[0057] The example cap 110 of FIG. 10 includes a first support 640 and a second support 642 suspended from the interior surface 638. In some embodiments, the first support 640 and the second support 642 are disposed adjacent and/or in contact with the first rib 510 and the second rib 512 (see FIG. 6) of the housing 106. The first support 640 includes a third notch 644, and the second support 642 includes a fourth notch 646. In some embodiments, the third notch 644 and the fourth notch 646 cooperate with the first notch 506 and the second notch 508 (see FIG. 6) of the first rib 510 and the second rib 512, respectively. For example, the pivot 408 (see FIGS. 4 and 5) of the trigger 108 may be disposed in the notches 506, 508, 644, 646 and captured between the ribs 510, 512 and the supports 640, 642, as shown in FIG. 12. The cap 110 includes an exterior or top surface 647.

[0058] FIG. 11 is a side view of the trigger 108 in an unactuated or first position in which the first contact surface 430 of the trigger 108 is spaced apart from the first protrusion 624 of the manifold 600. In the illustrated embodiment, the valve stem 208 is received in the first end

portion 602 of the manifold 600 to fluidly couple the valve stem 208 and, thus, the container 104 to the manifold 600. In the illustrated embodiment, the first contact surface 430 is convex. The first protrusion 624 includes an engaging surface 648 facing toward the first contact surface 430. In the illustrated embodiment, the engaging surface 648 is an angled or ramp surface oriented such that the first end portion 602 of the manifold 600 moves toward the container 104 (i.e., downward in the orientation of FIG. 11) when the first contact surface 430 engages the engaging surface 648. The second protrusion 626 of the manifold 600 is a mirror image of the first protrusion 624. Therefore, the foregoing description of the first protrusion 624 is applicable to the second protrusion 626. To avoid redundancy, the second protrusion 626 is not separately described.

**[0059]** FIG. 12 is a cross-sectional view of the example dispensing system 100 of FIGS. 1-11 illustrating the trigger 108 operatively coupled to the container 104. In the embodiment of FIG. 12, the trigger 108 is in the unactuated or first position. The grip portion 300 of the trigger 108 is disposed outside of the housing 106 of the overcap 102. The first arm 400 and the second arm 402 extend through the first aperture 500 of the first sidewall 306, and the pivot 408 is pivotably coupled to the second sidewall 514 via the fulcrum 504. In the illustrated embodiment, the pivot 408 is disposed and/or captured between the first rib 510 and the first support 640, and the pivot 408 is disposed and/or captured between the second rib 512 and the second support 642.

**[0060]** The cap 110 is coupled to the housing 106, and the manifold 600 is suspended within the housing 106 from the cap 110. In the illustrated embodiment, the manifold 600 is oriented relative to the housing to align the second end portion 604 of the manifold 600 and, thus, the discharge outlet 308 of the spray insert 112 with the second aperture 502 of the first sidewall 306 of the housing 106. However, in the illustrated embodiment, the housing 106 does not directly support the second end portion 604 of the manifold 600. For example, the second end portion 604 may be disposed within the second aperture 502 and spaced apart from the first sidewall 306. In other embodiments, the housing 106 supports the second end portion 604 of the manifold 600 and/or limits movement of the second end portion 604 of the manifold 600 during actuation of the trigger 108.

**[0061]** The first end portion 602 of the manifold 600 is disposed over the valve stem 208, and the valve stem 208 is received in a first fluid passageway 650 of the first duct 610. In some embodiments, when the trigger 108 is in the first position as shown in FIG. 12, the first end



portion 602 of the manifold 600 does not sealingly engage the valve stem 208. For example, the first end portion 602 may be spaced apart from the valve stem 208 or in contact with the valve stem 208 without sufficient pressure to sealingly engage the valve stem 208. In other embodiments, the valve stem 208 is in sealing engagement with the manifold 600 in the first position. The first fluid passageway 650 is in fluid communication with a second fluid passageway 652 of the second duct 612 of the manifold 600, and the second fluid passageway 652 is in fluid communication with the discharge outlet 308 of the spray insert 112.

[0062] In the illustrated embodiment, the central, longitudinal axis 216 of the container 104, a central, longitudinal axis 700 of the valve stem 208, and the central, longitudinal axis 550 of the dispensing system 100 are substantially collinear. A first plane 702 perpendicular to the longitudinal axis 550 of the dispensing system 100 passes through the discharge outlet 308 of the spray insert 112. A second plane 704 perpendicular to the longitudinal axis 550 passes through the axis of rotation 414 of the trigger 108. A third plane 706 perpendicular to the longitudinal axis 550 of the dispensing system 100 passes through the first end portion 602 of the manifold 600. In the illustrated embodiment, the third plane 706 passes through the first end portion 602 of the manifold 600 and an uppermost point or tip 708 of the valve stem 208. As used in this disclosure, an uppermost point or tip of a valve stem is a point of the valve stem extending outside of a container and disposed farthest away from the container in a direction along a longitudinal axis of the valve stem. A fourth plane 710 perpendicular to the longitudinal axis 550 of the dispensing system 100 passes through a lowermost point 712 of the mounting cup 200. As used in this disclosure, a lowermost point of a mounting cup is a point of the mounting cup disposed within a container and farthest away from an end of the container on which the mounting cup is supported in a direction along a longitudinal axis of the container. A fifth plane 714 perpendicular to the longitudinal axis 550 of the dispensing system 100 passes through a lowermost point 716 of the grip portion 300 of the trigger 108. As used in this disclosure, a lowermost point of a grip portion of a trigger is a point of the grip portion of the trigger that is closest to a bottom end or base (e.g., the second end 210) of a container in a direction along a longitudinal axis of the container. A sixth plane 717 perpendicular to the longitudinal axis 550 of the dispensing system 100 passes through an uppermost point 718 of the container 104. An uppermost point of the container is a point of the container that is farthest away from a bottom end or base of the container in a direction along a longitudinal axis of the container. In the

illustrated embodiment, the uppermost point 718 of the container 104 is disposed on the mounting cup 200.

[0063] In the illustrated embodiment, the second plane 704 is disposed between the first plane 702 and the third plane 706. Thus, when the dispensing system 100 is in an upright position as shown in FIG. 12, the discharge outlet 112 is disposed above the axis of rotation 414 of the trigger 108, and the axis of rotation 414 of the trigger 108 is disposed above the tip 708 of the valve stem 208. Further, the axis of rotation 414 of the trigger 108 is disposed on an opposite side of the longitudinal axis 550 of the dispensing system 100 as the discharge outlet 308. In addition, the grip portion 300 of the trigger 108 is disposed on the same side of the longitudinal axis 550 of the dispensing system 100 as the discharge outlet 308.

[0064] In the illustrated embodiment, the fifth plane 714 is disposed below the fourth plane 710. Thus, the lowermost point 716 of the grip portion 300 of the trigger 108 is disposed below the lowermost point 712 of the mounting cup 200. As described in greater detail below with reference to FIG. 18, an entire footprint of the overcap 102 is disposed within a footprint of the container 104 even though the grip portion 300 of the trigger 108 extends below the mounting cup 200.

[0065] FIG. 13 is a cross-sectional view of the overcap 102 of FIG. 12 illustrating the trigger 108 in a second or actuated position. In the illustrated embodiment, when a user squeezes the trigger 108, the trigger 108 pivots about the axis of rotation 414 from the first position to the second position, and the lower end 438 of the grip portion 300 of the trigger 108 moves toward the container 104 to actuate the valve stem 208. In some embodiments, the trigger 108 rotates between about 2 degrees and about 10 degrees to rotate from the first position to the second position. Thus, the trigger may have a total range of movement of about 2 degrees to about 10 degrees of rotation. In some embodiments, the trigger 108 rotates between about 5 degrees and about 7 degrees to rotate from the first position to the second position. Thus, in such embodiments, the trigger has a total range of movement of about 5 degrees to about 7 degrees of rotation. For example, in the illustrated embodiment, the trigger 108 rotates about six degrees to rotate from the first position to the second position. In some embodiments, the grip portion 300 of the trigger 108 contacts the skirt 524 and/or the container 104 when the trigger 108 is in the second position.

**[0066]** When the trigger 108 moves from the first position to the second position (see, e.g., FIG. 13), the first contact surface 430 and the second contact surface 432 of the trigger 108 engage the first protrusion 624 and the second protrusion 626 of the manifold 600, respectively, and drive the first end portion 602 of the manifold toward the container 104. In some embodiments, the first end portion 602 sealingly engages the valve stem 208 as the first end portion 602 moves toward the container 104. As the trigger 108 moves further toward the second position, the first end portion 602 of the manifold 600 depresses the valve stem 208, and the first spring 424 and the second spring 426 compress between the trigger 108 and the housing 106. As a result, a fluid product is dispensed from the container 104 into the first flow passageway 650 via the valve stem 208. The fluid product then flows through the second fluid passageway 652, into the spray insert 112, and out of the discharge outlet 308. When the user releases the trigger 108, the first spring 424 and the second spring 426 urge the trigger 108 to return to the first position shown in FIG. 12.

**[0067]** In the illustrated embodiment, the manifold 600 is flexible or pliable to enable a shape and/or a size of the manifold 600 to change when the trigger 108 drives the first end portion 602 of the manifold 600 toward the container 104. For example, the manifold 600 may elastically deform to bend or flex at the first joint 616, the second joint 632, at one or more areas along the first duct 610, and/or at one or more areas along the second duct 612 to enable the first end portion 602 of the manifold 600 to sealingly engage the valve stem 208 and depress the valve stem 208 while the second end portion 604 is maintained in alignment with the second aperture 502 of the housing 106. Example elastic deformation of the manifold 600 is further described below with reference to FIG. 17.

**[0068]** FIG. 14 is a cross-sectional view of the overcap 102 of FIG. 12 illustrating the trigger 108 in the first position. In the illustrated embodiment, the lower end 438 and/or the lowermost point 716 of the grip portion 300 of the trigger 108 moves in a first arcuate path 719, and the first end portion 602 of the manifold 600 moves in a second arcuate path 720 when the trigger 108 pivots from the first position (see FIG. 12) to the second position (see FIG. 13). In some embodiments, the first arcuate path 719 and/or the second arcuate path 720 are arcs of a circle. In other embodiments, the first arcuate path 719 and/or the second arcuate path 720 are not arcs of a circle. For example, the first arcuate path 719 and/or the second arcuate path 720 may be parabolic and/or one or more additional and/or alternative shapes. In some embodiments, the

first arcuate path 719 has an arc length of about 4 millimeters to about 14 millimeters. In some embodiments, the first arcuate path 719 has an arc length of about 7 millimeters to about 9 millimeters. In the illustrated embodiment, the first arcuate path 719 has an arc length of about 8 millimeters. In other embodiments, the first arcuate path 719 has an arc of other distances.

[0069] In the illustrated embodiment, each of the first arcuate path 719 and the second arcuate path 720 have horizontal vector components along an X-Axis and vertical vector components along a Y-Axis. In the embodiment of FIG. 14, the Y-Axis is parallel to the longitudinal axis 550 of the dispensing system 100, and the X-Axis is perpendicular to the Y-Axis and the axis of rotation 414 of the trigger 108. As used in this disclosure, vertical vector components having an upward direction are referred to as positive vertical vector components; vertical vector components having a downward direction are referred to as negative vertical vector components; horizontal vector components having a rightward direction are referred to as positive horizontal vector components; and horizontal vector components having a leftward direction are referred to as negative horizontal vector components.

[0070] In the illustrated embodiment, the first arcuate path 719 opposes the second arcuate path 720. For example, in the illustrated embodiment, although both the first arcuate path 719 and the second arcuate path 720 have negative vertical vector components, the first arcuate path 719 has a positive horizontal vector component and the second arcuate path 720 has a negative horizontal vector component. Thus, the first arcuate path 719 and the second arcuate path 720 have opposing or opposite horizontal vector components. As a result, in the embodiment of FIG. 14, the lower end 438 of the trigger 108 moves along the first arcuate path 719 in a first direction substantially opposite to a second direction in which the first end portion 602 of the manifold 600 moves along the second arcuate path 720. In the illustrated embodiment, the first direction is substantially counterclockwise in the orientation of FIG. 14, and the second direction is substantially clockwise in the orientation of FIG. 14. As a result, the first end 310 of the grip portion 300 of the trigger 108 moves outward or away from the first sidewall 306 of the housing 106 and the lower end 438 of the grip portion 300 moves toward the container 104 when the trigger 108 rotates from the first position to the second position.

[0071] In some embodiments, an arc length of the second arcuate path 720 is about 2 millimeters to about 6 millimeters. In some embodiments, the arc length of the second arcuate path 720 is about 3 millimeters to about 4 millimeters. Thus, the arc length of the second arcuate path 720

may be less than the arc length of the first arcuate path 719. In some embodiments, the negative vertical vector component of the second arcuate path 720 has a magnitude of about 2 millimeters to about 4 millimeters. In the illustrated embodiment, the arc length of the second arcuate path 720 is about 3 millimeters. Thus, the first end portion 602 may have a total travel distance or range of movement in a direction toward the container 104 of about 3 millimeters. In other embodiments, the negative vertical vector component of the second arcuate path 720 is other distances. In some embodiments, the magnitude of the vertical vector component of the second arcuate path 720 is about 1.5 times to about 6 times greater than the magnitude of the horizontal vector component of the second arcuate path

[0072] Dispensing systems fashioned in the manner as taught herein provide significant advantages over traditional sprayers. The present embodiments provide better alignment and movement between the valve stem 208 and the manifold 600. Because the manifold 600 is fixed to the cap 110 as a single component, a pivot point is created for the manifold 600 to move about. Similarly, the trigger 108 has a pivot point around which it moves as well, wherein the arcuate paths of the trigger 108 and the manifold 600 are opposite one another as noted above. When the structural features of the manifold 600 and trigger 108 connect during an actuation step, the opposing arcuate paths 719, 720 keep the forces on the manifold 600 near vertical. As also noted above, the vertical travel distance is relatively short, which ensures that the travel distance of the structural features along their opposing arcuate paths is relatively flat. Therefore, the force acting on the structural features over the travel range does not substantially change, which allows for a more rigid dispensing system that can translate rotational movement of a user's hand into vertical motion of the valve stem 208 while limiting translation of structural features of the trigger 108 and manifold 600. The trigger 108 may also have less play or lost motion than traditional sprayers with triggers.

[0073] FIG. 15 is a cross-sectional view of the dispensing system 100, which illustrates that an uppermost point 722 of the grip portion 300 of the trigger 108 moves along a third arcuate path 724 when the trigger 108 moves from the first position to the second position. As used in this disclosure, an uppermost point of a grip portion of a trigger is a point of the grip portion farthest away from a lowermost point (e.g., the lowermost point 716) of the grip portion in a direction along a longitudinal axis of a dispensing system on which the trigger is employed (e.g., longitudinal axis 550). In the illustrated embodiment, the third arcuate path 724 of the

uppermost point 722 of the grip portion 300 has a magnitude of about 5 millimeters. Thus, the magnitude of the third arcuate path 724 of the uppermost point 722 of the grip portion 300 is less than the magnitude of the first arcuate path 719 of the lowermost point 716 of the grip portion 300 of the trigger 108.

[0074] In the illustrated embodiment, the third arcuate path 722 has a negative vertical vector component and a negative horizontal vector component. In some embodiments, the negative vertical vector component has a magnitude of about 4.7 millimeters. In some embodiments, a magnitude of the negative horizontal vector component of the third arcuate path 724 is 0.7 millimeters. Thus, the uppermost point 722 of the grip portion 300 moves outward and away from the longitudinal axis 550 of the dispensing system 100. In other embodiments, the magnitudes of the vertical vector component and/or the horizontal vector component of the third arcuate path 724 are other distances. As described in greater detail below with reference to FIG. 16, the outward movement of the uppermost point 722 of the grip portion 300 enables the grip portion 300 to shield a hand of a user gripping the overcap 102 from fluid product, if any, dripping from the discharge outlet 308.

[0075] With reference still to FIG. 15, the grip portion 300 of the trigger 108 is sized, shaped, and/or dimensioned such that the first arcuate path 719 and the third arcuate path 724 lie on the same circle 726. Thus, the uppermost point 722 of the grip portion 300 and the lowermost point 716 of the grip portion 300 follow substantially the same trajectory when the trigger 108 moves from the first position to the second position. In other embodiments, the uppermost point 722 of the grip portion 300 and the lowermost point 716 do not follow the same trajectory.

[0076] With continued reference to FIG. 15, when the trigger 108 is in the first position, a first distance D1 along the Y-axis from the axis of rotation 414 of the trigger 108 to the uppermost point 718 of the container 104 is about 19 millimeters to about 21 millimeters. In some embodiments, the first distance D1 is about 10 millimeters to about 35 millimeters. A second distance D2 along the Y-axis from the axis of rotation 414 of the trigger 108 and the lowermost point 716 of the grip portion 300 of the trigger is about 39 millimeters to about 41 millimeters. In some embodiments, the second distance D2 is about 30 millimeters to about 50 millimeters. However, the above-noted dimensions are merely examples and, thus, other dimensions may be used without departing from the scope of this disclosure.

[0077] FIG. 16 is a cross-sectional view of the overcap 102 illustrating the trigger 108 in the actuated or second position. In the illustrated embodiment, the first sidewall 306 of the housing 106 includes a rail 800. In the illustrated embodiment, the rail 800 is an inwardly stepped and/or sloped surface 802 extending from the second aperture 502 to the first aperture 500 of the first sidewall 306. In the illustrated embodiment, during and/or after a fluid product is dispensed from the discharge outlet 308, residual amounts of the fluid product may collect on or near the discharge outlet 308 and drip and/or flow downward in the orientation of FIG. 16. In some embodiments, surface tension of the fluid product urges the fluid product to cohere to and/or remain in contact with the rail 800 as the fluid product flows downward. As a result, the rail 800 directs the fluid product into the housing 106 via the first aperture 500. Thus, the example rail 800 of FIG. 16 may prevent or limit residual drippings of the fluid product from contacting the hand of the user gripping the dispensing system 100.

[0078] In some embodiments, some of the residual fluid does not cohere to the rail 800 and falls or drips from the discharge outlet 308. In the illustrated embodiment, because the uppermost point 722 of the grip portion 300 of the trigger 108 moves outward (e.g., to the left in the orientation of FIG. 16) when the trigger 108 moves from the first position to the second position, an upper surface 804 and/or an interior surface 806 of the grip portion 300 catches the fluid product (i.e., the falling or dripping fluid product lands on the upper surface 804 and/or the interior surface 806) and directs the fluid product into the housing 106. In the embodiment of FIG. 16, the uppermost point 722 of the grip portion 300 is disposed farther outward from the longitudinal axis 550 of the dispensing system 100 than the discharge outlet 308 when the grip portion 300 is in the second position. In the illustrated embodiment, the upper surface 804 and the interior surface 806 are slanted, sloped and/or angled toward the interior 522 of the housing 106 to direct the fluid product into the housing 106.

[0079] FIG. 17 is a cross-sectional, schematic view of the manifold 600 of FIG. 6 when the manifold 600 is in a first or unactuated state 900 and a second or actuated second state 902. In the illustrated embodiment, the manifold 600 is in the first state 900 when the trigger 108 is in the first position. In the illustrated embodiment, when the manifold 600 is in the first state, the first duct 610 and the second duct 612 are substantially straight. In other embodiments, the first duct 610 and/or the second duct 612 are in other configurations (e.g., curved) when the trigger 108 is in the first position.

**[0080]** The manifold 600 is in the second state when the trigger 108 is in the second position. In the illustrated embodiment, when the trigger 108 engages the manifold 600 via the protrusions 624, 626 (see FIG. 10) extending from the first duct 610, the trigger 108 applies force to the manifold 600 that elastically deforms the manifold 600. For example, in the illustrated embodiment, the manifold 600 flexes or bends relative to the cap 110 at the second joint 632, at a first flexure area 904 of the second duct 612, at a second flexure area 906 of the second duct 612, at the first joint 616, and at a third flexure area 908 of the first duct 610. As a result, the first end portion 602 of the manifold 600 moves along the second arcuate path 720. In the illustrated embodiment, the first end portion 602 of the manifold 600 moves toward the container 104 (i.e., downward in the orientation of FIG. 17) and toward the grip portion 300 of the trigger 108 (i.e., leftward in the orientation of FIG. 17) when the manifold 600 elastically deforms from the first state 900 to the second state 902.

**[0081]** In the illustrated embodiment, the housing 106 substantially prevents elastic deformation of the cap 110 when the trigger 108 moves from the first position to the second position. For example, the first flange 520 (see FIGS. 6 and 7), the third rib 528 (see FIG. 7), and the fourth rib 530 (see FIG. 7) support the cap 110 adjacent the second end portion 604 of the manifold 600 to provide rigidity to the cap 110 and substantially prevent the cap 110 from elastically deforming (e.g., bending) when the trigger 108 moves from the first position to the second position.

**[0082]** In the illustrated embodiment, the second joint 632 elastically deforms such that an elbow or junction 910 between the second end portion 604 and the second duct 612 straightens (i.e., a radius of curvature of the elbow 910 increases). The first flexure area 904 extends from the second joint 632 toward the first joint 616 of the manifold 600. The second duct 612 over the first flexure area 904 is curved about a first center of curvature C1 and has a first radius of curvature R1. In some embodiments, the first flexure area 904 extends along about half of a length of the second duct 612.

**[0083]** The second flexure area 906 extends from the first flexure area 904 to the first joint 616 of the manifold 600. The second duct 612 over the second flexure area 906 is curved about a second center of curvature C2 and has a second radius of curvature R2. In the illustrated embodiment, the first center of curvature C1 and the second center of curvature C2 are on opposite sides of the second duct 612. As a result, the first flexure area 904 is concave and the



second flexure area 906 is convex. Thus, the second duct 612 in the second state 902 has a point of inflection 912. In some embodiments, the first radius of curvature R1 is equal to the second radius of curvature R2. In other embodiments, the first radius of curvature R1 is different than the second radius of curvature R2. In some embodiments, the second flexure area 906 extends along about half of the length of the second duct 612. In other embodiments, the first flexure area 904 and/or the second flexure area 906 extend over other amounts of the length of the second duct 612.

**[0084]** The first joint 616 elastically deforms such that the first joint 616 straightens and, thus, the angle 614 between the first duct 610 and the second duct 612 increases. In some embodiments, the brace 618 substantially prevents the first joint 616 from deforming and, thus, in some embodiments, the angle 614 in the second state 902 is substantially the same as the angle 614 in the first state 902.

**[0085]** The third flexure area 908 extends from the first joint 616 to the first end portion 602 of the manifold 600. In the illustrated embodiment, the first duct 610 over the third flexure area 908 is curved about a third center of curvature C3 and has a third radius of curvature R3. In the illustrated embodiment, the third center of curvature C3 is on the same side of the manifold 600 as the second center of curvature C2. The third radius of curvature R3 of FIG. 17 is greater than the first radius of curvature R1 and/or the second radius of curvature R2. In other embodiments, the third radius of curvature R3 is equal to or less than the first radius of curvature R1 and/or the second radius of curvature R2. In other embodiments, the manifold 600 elastically deforms in other ways. For example, the manifold 600 may have one or more additional, fewer, and/or alternative flexure areas, points of inflection, etc.

**[0086]** FIG. 18 is a top, schematic view of the dispensing system 100 illustrating an example first footprint 1000 of the container 104 and an example second footprint 1002 of the overcap 102. The first footprint 1000 is a schematic illustration of outermost points of the container 104, including a first outermost point 1004 of the cylindrical portion 212. The second footprint 1002 is a schematic illustration of outermost points of the overcap 102, including a second outermost point 1006 of the trigger 108. As shown in FIG. 18, the second footprint 1002 of the overcap 102 is entirely within the first footprint 1000 of the container 104. Thus, the first footprint 1000 of the container 104 circumscribes the second footprint 1002 of the overcap 102. In the illustrated embodiment, the cylindrical portion 212 of the container 104 has a circular, cross-

sectional shape. Thus, in the embodiment of FIG. 18, the first footprint 1000 is circular. In other embodiments, the container 104 and/or the first footprint 1000 may be other shapes.

[0087] In the illustrated embodiment, the longitudinal axis 216 of the container 104 passes through a center of curvature 1008 of the cylindrical portion 212 of the container 102. In the embodiment of FIG. 18, the center of curvature 1008 is coincident with a centroid of the container 104. Thus, the longitudinal axis 216 of the container 104 is a central, longitudinal axis of the container. As used in this disclosure, a central, longitudinal axis is a longitudinal axis passing through a center of a cross-sectional shape and/or a centroid of a structure.

[0088] In the illustrated embodiment, the first outmost point 1004 of the container 104 is a first distance D1 from the longitudinal axis 216 measured along a first line or radius 1010 perpendicular to the longitudinal axis 216. The second outmost point 1006 of the trigger 108 is a second distance D2 from the longitudinal axis 216 measured along a second line or radius 1012 perpendicular to the longitudinal axis. In the illustrated embodiment, the second line 1012 is coplanar with the first line 1010. In the illustrated embodiment, the first distance D1 is greater than the second distance D2; thus, the second distance D2 is less than the first distance D1. Thus, no portion of the overcap 102, including the grip portion 300, is disposed farther from the longitudinal axis 216 in a direction perpendicular to the longitudinal axis 216 than a distance equal to the first radius 1010 of the cylindrical portion 214. As a result, if the dispensing system 100 is supported on a surface by a side of the container 104 (instead of by the bottom end 210 (see FIG. 2) of the container 104), during, for example, packing, shipping, transport, and/or storage, no portion of the trigger 108 contacts the surface, which reduces a likelihood of accidental actuation of the trigger 108. Further, such an arrangement also has the added benefit of providing for a more secure vertical orientation when the container 104 is provided adjacent other vertically oriented containers in a packing, shipping, transport, and/or storage situation where jostling of the containers may occur.

[0089] In some embodiments, the second outermost point 1006 of the trigger 108 is disposed on the lower end 438 of the grip portion 300 of the trigger 108. In other embodiments, the second outermost point 1006 is disposed on a different portion of the grip portion 300 and/or other component of the overcap 102. As used in this disclosure, an outermost point of a container is a point of the container that is disposed farthest away from a central, longitudinal axis of the container in a direction along a line or radius extending from and perpendicular to the

longitudinal axis. As used in this disclosure, an outermost point of an overcap is a point of the overcap that is disposed farthest away from a central longitudinal axis of a container measured in a direction along a line or radius extending from and perpendicular to the longitudinal axis when the overcap is coupled to the container.

[0090] As may be seen in, for example, FIG. 18 of the present disclosure, the footprint of the dispensing system 100 provides for a container 104 with a larger diameter than portions of the overcap 102. Interestingly, this footprint was possible without a reduction in the volume of the container even though a larger trigger 108 is provided than conventionally found in similar sprayer systems. In fact, traditional containers utilize smaller triggers and, when a larger trigger is used, oftentimes the trigger extends out beyond the footprint of the container and/or the volume of the container must be reduced to accommodate an oversized overcap with a larger trigger. Neither of these drawbacks is present in the disclosed embodiments.

[0091] By way of a non-limiting example, standard containers include a height dimension between uppermost and lowermost ends of between about 245 to about 250 millimeters. Further, such containers preferably have a diameter of between about 52 to about 66 millimeters and, more preferably, between about 58 to about 59 millimeters. Still further, such containers typically have a volume of at least 8 ounces. Utilization of a longer trigger in traditional sprayers typically required such triggers to extend past a footprint or outermost diameter of the container to maintain the above-noted container dimensions. However, the present disclosure provides a unique solution to this problem by providing a trigger within the footprint of the container as disclosed herein. In one preferred embodiment, the lowermost end of the trigger (for example, lower end 438 of trigger 108) extends below an uppermost portion of the container (for example, the mounting cup 200 of the container 104).

[0092] FIG. 19 is a cross-sectional view of the dispensing system 100 of FIGS. 1-18 showing dimensions that may be employed to implement the dispensing system 100. In the illustrated embodiment, the grip portion 300 of the trigger 108 is concave and has a smallest radius of curvature  $R_{S1}$  of about 44.5 millimeters in a plane on which the longitudinal axis 550 lies and is perpendicular to the axis of rotation 414 of the trigger 108.

[0093] The second sidewall 514 of the housing 106, which is on an opposite side of the longitudinal axis 550 as the grip portion 300 of the trigger 108, is concave and has a smallest radius of curvature  $R_{S2}$  of about 23.5 millimeters along the plane. Thus, the smallest radius of

curvature  $R_{S2}$  of the second sidewall 514 is about half of the smallest radius of curvature  $R_{S1}$  of the grip portion 300 of the trigger 108. A center of curvature 1100 of the grip portion 300 is offset from a center of curvature 1102 of the second sidewall 514. For example, in the illustrated embodiment, the center of curvature 1100 of the grip portion 300 is offset by about 8 millimeters from the center of curvature 1102 of the second sidewall 514 in a direction along the longitudinal axis 550. The center of curvature 1100 of the grip portion 300 of FIG. 19 is farther from the uppermost point 718 of the container 104 than the center of curvature 1102 of the second sidewall 514 in the direction along the longitudinal axis 550.

[0094] In the illustrated embodiment, the center of curvature 1100 of the grip portion 300 is spaced apart from the center of curvature 1102 of the second sidewall 514 in a direction perpendicular to the longitudinal axis 550 by about 106.8 millimeters. For example, the center of curvature 1100 of the grip portion 300 is about 66.3 millimeters from the longitudinal axis 550 in the direction perpendicular to the longitudinal axis 550. Thus, the center of curvature 1102 of the second sidewall 514 is about 40.5 millimeters from the longitudinal axis 550 in the direction perpendicular to the longitudinal axis 550. In other embodiments, the center of curvature 1100 of the grip portion 300 is offset and/or spaced apart from the center of curvature 1102 of the second sidewall 514 by other distances and/or in other ways.

[0095] In the illustrated embodiment, the grip portion 300 of the trigger 108 has a length in a direction along the longitudinal axis 550 of about 48 millimeters to about 51 millimeters. In some embodiments, the grip portion 300 has a length in the direction along the longitudinal axis 550 of about 40 millimeters to about 60 millimeters. In the illustrated embodiment, the uppermost point 722 of the grip portion 300 of the trigger 108 is a distance of about 29.5 millimeters from the uppermost point 718 of the container 104 in the direction along the longitudinal axis 550. The lowermost point 716 of the grip portion 300 of the trigger 108 is disposed below the uppermost point 718 of the container 104 by a distance of about 20 millimeters in a direction along the longitudinal axis 550. Thus, about two fifths of the grip portion 300 of the trigger 108 is disposed below the uppermost point 718 of the container 104 in the direction along the longitudinal axis 550. The axis of rotation 414 of the trigger 108 is disposed above the uppermost point 718 of the container 104 by a distance of about 20 millimeters in a direction along the longitudinal axis 550. Thus, the lowermost point 716 of the

grip portion 300 of the trigger 108 is disposed below the axis of rotation 414 in the direction along the longitudinal axis 550 by a distance of about 40 millimeters.

[0096] Still referring to FIG. 19, a lowermost point on the second end 526 of the skirt 542 is a distance of about 18.5 millimeters below the uppermost point 718 of the container 104 in a direction along the longitudinal axis 550. The lowermost point on the second end 526 of the skirt 542 is a distance of about 59 millimeters from an uppermost point 1104 of the overcap 102 in the direction along the longitudinal axis 550. In the illustrated embodiment, the uppermost point 1004 of the overcap 102 is disposed on the upper surface 647 of the cap 110. A lowermost point 1106 of the upper surface 647 of the cap 110 is a distance of about 30.5 millimeters from the uppermost point 718 of the container 104 in a direction along the longitudinal axis 550. In the illustrated embodiment, the discharge outlet 308 is a distance of about 27.5 millimeters from the longitudinal axis 550 in a direction perpendicular to the longitudinal axis 550. The above-noted dimensions are merely examples and, thus, other dimensions may be employed without departing from the scope of this disclosure.

[0097] In the illustrated embodiment, when the trigger 108 is in the first or unactuated position, a waist 1108 of the overcap 102 is about 40 millimeters to about 42 millimeters. In some embodiments, the waist 1108 is about 30 millimeters to about 50 millimeters. As used in this disclosure, a waist of an overcap is a smallest distance from a point on an exterior surface of a grip portion (e.g., the grip portion 300) of a trigger having a smallest radius of curvature to a point on an exterior surface of a sidewall opposite the grip portion (e.g., the second sidewall 514) having a smallest radius of curvature. In the illustrated embodiment, the skirt 542 has a minimum thickness of about 0.6 millimeters. However, the above-noted dimensions are merely examples and, thus, other embodiments may employ other dimensions in accordance with the teachings of this disclosure. The above-noted shape, dimensions and/or proportions enable a user to easily grip the dispensing system 100 and actuate the trigger 108. Further, the curvatures of the grip portion 300 of the trigger 108 and the housing 106 direct a hand of the user to grip the dispensing system 100 at or near the waist 1108 of the overcap 102, which positions fingers of the user onto or near the lower end 438 of the grip portion 300 trigger 108. In some embodiments, the dispensing system 100 is sized such that users having average sized hands, below average sized hands, and above average sized hands can grip the dispensing system 100

with one hand at substantially the same position (i.e., at or near the waist 1108) and actuate the trigger 108.

[0098] FIG. 20 is an enlarged, side view of the trigger 108 and the manifold 600 illustrating a first path 1200 of trigger contact points 1202 and a second path 1204 of manifold contact points 1206. As used in this disclosure, a trigger contact point is a point on a trigger that contacts a manifold during actuation of the trigger; a manifold contact point is a point on the manifold that is contacted by the trigger during actuation of the trigger. The trigger contact points 1202 are on the first contact surface 430 of the trigger 108. The manifold contact points 1206 are on the engaging surface 648 of the first protrusion 624. The second protrusion 626 of the manifold 600 is a mirror image of the first protrusion 624, and the second contact surface 432 is a mirror image of the first contact surface 430. Therefore, the foregoing and following description of the first protrusion 624 and the first contact surface 430 is applicable to the second protrusion 626 and the second contact surface 432. To avoid redundancy, the manifold contact points on the second protrusion 626 and the trigger contact points on the second contact surface 432 are not separately described.

[0099] When the trigger 108 moves from the first position to the second position, the first arm 400 rotates toward the container 104. As a result, the first contact surface 430 moves toward the container 104 and the second sidewall 514 (i.e., downward and rightward in the orientation of FIG. 17). When the first contact surface 430 contacts the engaging surface 648 of the first protrusion 624, the first end portion 602 of the manifold 600 moves toward the container 104 and toward the grip portion 300 of the trigger 108 (i.e., downward and leftward in the orientation of FIG. 17). As a result, the first contact surface 430 slides along the engaging surface 648 and, thus, the trigger contact points 1202 and the manifold contact points 1206 change during actuation of the trigger 108. The first path 1200 of the trigger contact points 1202 substantially corresponds to movement of the engaging surface 648 of the first protrusion 624 as the trigger 108 actuates from the first position to the second position. The second path 1204 of the manifold contact points 1206 substantially corresponds to movement of the first contact surface 430 as the trigger 108 moves from the first position to the second position. Table 1 below illustrates example vector components of the trigger contact points 1202 and the manifold contact points 1206 as the trigger 108 moves from the first position to the second position.

Force (N)	Trigger Displacement Magnitude	Trigger Contact Points				Manifold Contact Points			
		Magnitude	Z	Y	X	Magnitude	Z	Y	X
1	1.21	0.438	-0.001	-0.399	-0.179	0.159	0.002	-0.157	0.026
5	2.78	0.934	-0.006	-0.862	-0.360	0.822	0.009	-0.811	0.136
10	4.75	1.549	-0.012	-1.442	-0.565	1.647	0.019	-1.624	0.273
15	6.74	2.167	-0.018	-2.030	-0.757	2.474	0.029	-2.440	0.410
18	7.93	2.538	-0.022	-2.383	-0.872	2.970	0.035	-2.929	0.493

Table 1

**[00100]** FIG. 21 is a graph 1300 of example forces applied to the trigger 108 relative to example magnitudes of displacement of the trigger 108 during actuation of the trigger 108. In the illustrated embodiment, the forces are determined when the overcap 102 is not coupled to the container 104 and, thus, the forces do not include forces to depress the valve stem 208. In the illustrated embodiment, the force to move the trigger 108 from the first position to the second position increases to a maximum force of about 18 Newton. A maximum magnitude of displacement of the trigger 108 is about 7.93 millimeters. In the illustrated embodiment, a relationship between the forces applied to the trigger 108 and the magnitudes of displacement of the trigger 108 is substantially linear when the trigger 108 is displaced from magnitudes of about 1.21 millimeters to about 7.93 millimeters. In other embodiments, the forces, the magnitudes of displacement, and/or the relationship between the forces and the magnitudes of displacement are different than illustrated in FIG. 21.

**[00101]** FIG. 22 is an enlarged cross-sectional, side view of the container 104 and the housing 106 of the overcap 102 along line 22-22 of FIG. 1, illustrating an alternative protrusion 1400 securing the overcap 102 to the container 104. For example, the protrusion 1400 of FIG. 22 may cooperate with the second flange 532 to snap-fit the housing 106 onto the container 104. In the illustrated embodiment, the protrusion 1400 has a triangular-shaped cross-sectional shape. In other embodiments, the protrusion 1400 has other cross-sectional shapes. The protrusion 1400 extends from the housing 106 and is spaced apart from the second flange 532. In the

illustrated embodiment, the protrusion 1400 contacts a curled portion 1402 of the container 104 on which the mounting cup 200 is disposed to secure the overcap 102 to the container 104. In some embodiments, the protrusion 1400 does not contact the mounting cup 200. In other embodiments, the protrusion 1400 contacts the curled portion 1402 and the mounting cup 200.

**[00102]** FIG. 23 is a cross-sectional view of the dispensing system 100 of FIGS. 1-21 showing dimensions that may be employed to implement the dispensing system 100. In the illustrated embodiment, the dispensing system 100 has a height H1 of about 244.5 millimeters to about 248.5 millimeters. The height H1 of the dispensing system 100 is measured from the uppermost point 1104 of the overcap 102 to a lowermost point 1500 of the container 104 in a direction along the longitudinal axis 550 of the dispensing system 100. The container 104 has a height H2 of about 205 millimeters to about 208 millimeters. The height H2 of the container 104 is measured from the uppermost point 718 of the container 104 to the lowermost point 1500 of the container 104 along the longitudinal axis 550 of the dispensing system 100. Thus, the overcap 102 extends above the uppermost point 718 of the container 104 by a height H3 of about 40 millimeters in a direction along the longitudinal axis 550. As a result, the overcap 102 accounts for about one sixth to about one seventh of the height H1 of the dispensing system 100. Thus, the overcap 102 of the dispensing system 100 disclosed herein is smaller and/or more compact than overcaps of traditional dispensing systems. As a result, a container (e.g., the container 104) having a greater height and, thus, a larger volume may be employed by the dispensing system 100 relative to traditional dispensing systems with the same height H1 and the same footprint (e.g., the footprint 1000 of FIG. 18) as the dispensing system 100.

**[00103]** FIG. 24 is a perspective view of the dispensing system 100 including a tamper resistant device 1600 having frangible or breakable beam 1601 spanning the first aperture 500 of the housing 106 of the overcap 102. In the illustrated embodiment, the trigger 108 is not shown. The beam 1601 of FIG. 24 is shown in a first or unbroken state. The beam 1601 is in the first state when the trigger 108 has not been actuated for a first time. When the beam 1601 is in the first state, a first end 1602 and a second end 1604 of the beam are coupled to (e.g., integrally formed with) the housing 106.

**[00104]** The beam 1601 of FIG. 24 is substantially horizontal or perpendicular to the longitudinal axis 550 of the dispensing system 100. In other embodiments, the beam 1601 is oriented in other ways. A first leg 1606 and a second leg 1608 support the beam 1601. In the



illustrated embodiment, the first leg 1606 and the second leg 1608 extend from the second flange 532. In some embodiments, the beam 1601, the first leg, 1606, the second leg 1608, and the housing 106 are integrally formed. In other embodiments, the beam 1601 is coupled to the housing 106 in other ways.

**[00105]** When the trigger 108 is in the unactuated state, the beam 1601 is disposed below the first arm 400, the second arm 402, and the third brace 420 (FIGS. 4 and 5) of the trigger 108. When the trigger 108 is actuated for the first time, the trigger 108 rotates toward the container 104, and the first arm 400, the second arm 402, and/or the third brace 420 contact the beam 1601. As a result, the trigger 108 applies force to the beam 1601 sufficient to sever or separate the first end 1602 and the second end 1604 of the beam 1601 from the housing 106. When the beam 1601 severs or separates from the housing 106, the beam 1601 is in a second or broken state. As a user further squeezes the trigger 108, the tamper resistant device 1600 bends or sways toward the longitudinal axis 550 to enable the trigger 108 to move to the actuated position. For example, the force applied to the beam 1600 may bend the legs 1606, 1608 toward the longitudinal axis 550. In some embodiments, substantially no portions of the beam 1601 separate or break off from the beam 1601 and/or the legs 1606, 1608. When the trigger 108 is actuated for a second time, the trigger 108 contacts the beam 1601 and applies force to the beam 1601. As a result, the tamper resistant device 1600 bends or sways toward the longitudinal axis 550 to enable the trigger 108 to move to the actuated position. In some embodiments, when the tamper resistant device 1600 bends or sways, the beam 1601 and/or the legs 1606, 1608 apply a spring force to the trigger 108, which biases or urges the trigger 108 toward the unactuated position.

#### INDUSTRIAL APPLICABILITY

**[00106]** The examples disclosed herein can be used to dispense or discharge fluid products from a container.

**[00107]** Numerous modifications to the examples disclosed herein will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this disclosure is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the claimed invention and to teach the best mode of carrying out same. The

exclusive rights to all modifications which come within the scope of the claims are reserved. All patents and publications are incorporated by reference.

What is claimed is:

1. A dispensing system, comprising:
  - a housing for coupling to a container, the housing having a first sidewall including an aperture;
  - a trigger having a grip portion disposed outside of the housing and an arm extending through the aperture of the first sidewall and pivotably coupled to a fulcrum spaced apart from the first sidewall;
  - a cap coupled to the housing; and
  - a manifold suspended from the cap.
2. The dispensing system of claim 1, wherein the manifold includes a first joint and a second joint.
3. The dispensing system of claim 2, wherein the first joint comprises a link disposed between the manifold and the cap.
4. The dispensing system of claims 2 or 3, wherein the second joint comprises a brace coupled to a first duct of the manifold and a second duct of the manifold.
5. The dispensing system according to any of the preceding claims, wherein the manifold is unitary with the cap.
6. The dispensing system according to any of the preceding claims, wherein the manifold includes a protrusion and the trigger includes a cam to engage the protrusion.
7. The dispensing system according to any of the preceding claims, wherein the trigger comprises a second arm spaced apart from the arm to define a space, the manifold extending through the space.

8. The dispensing system according to any of the preceding claims, further comprising a spring coupled to the arm, the spring to compress between the arm and the housing.
9. The dispensing system according to any of the preceding claims, wherein the manifold includes a duct having a first flexure area and a second flexure area.
10. The dispensing system according to any of the preceding claims, wherein the arm is pivotably coupled to a rib disposed on a second sidewall of the housing opposite the first sidewall.
11. The dispensing system according to any of the preceding claims, wherein the dispensing system has a longitudinal axis, and further comprising:
  - a discharge aperture in fluid communication with the manifold, wherein the manifold has an end portion to receive a valve stem of a container, and wherein a first plane perpendicular to the longitudinal axis passes through the discharge aperture, a second plane perpendicular to the longitudinal axis passes through an axis of rotation of the trigger, and a third plane perpendicular to the longitudinal axis passes through the end portion of the manifold, wherein the second plane is disposed between the first plane and the third plane.
12. The dispensing system of claim 11, further comprising a container including a mounting cup, wherein a fourth plane perpendicular to the longitudinal axis extends through a lowermost point of the mounting cup, and wherein a lowermost point of the grip portion of the trigger is disposed below the lowermost point of the mounting cup when the trigger is operatively coupled to the container.
13. The dispensing system according to any of the preceding claims, wherein a lowermost point of the grip portion is to move along a first arcuate path, and a portion of the manifold is to move along a second arcuate path opposing the first arcuate path when the trigger moves from an unactuated position to an actuated position.

14. The dispensing system of claim 13, wherein the portion of the manifold is to move toward the first sidewall when the portion moves along the second arcuate path.
15. The dispensing system according to any of the preceding claims, wherein a lower end of the grip portion of the trigger is to move toward the first sidewall to engage the manifold.

16. A dispensing system, comprising:

a container having a mounting cup and a central, longitudinal axis, a first outermost point of the container being a first distance from the central, longitudinal axis along a first line perpendicular to the central, longitudinal axis; and

an overcap coupled to the container, the overcap including a pivotable trigger, wherein a second outermost point of the trigger is a second distance from the central, longitudinal axis along a second line perpendicular to the central, longitudinal axis, the second distance less than the first distance, and wherein a grip portion of the trigger extends below the mounting cup of the container in a direction along the central, longitudinal axis.

17. The dispensing system of claim 16, wherein a portion of the trigger is curved about a first axis of curvature.

18. The dispensing system of claim 17, wherein the portion of the trigger is curved about a second axis of curvature perpendicular to the first axis of curvature.

19. The dispensing system according to any of claims 16 to 18, wherein the trigger has a length in a direction along the central, longitudinal axis of between about 40 millimeters and about 60 millimeters.

20. The dispensing system according to any of claims 16 to 19, wherein a lowermost point of the grip portion of the trigger is to move along an arcuate path having an arc length of between about 4 millimeters and less than about 14 millimeters.

21. The dispensing system according to any of claims 16 to 20, wherein the container has a first footprint and the overcap has a second footprint, and wherein the second footprint of the overcap is disposed entirely within the first footprint.

22. The dispensing system according to any of claims 16 to 21, wherein the overcap includes a housing, a cap coupled to the housing, and a manifold integrally formed with the cap.

23. The dispensing system of claim 22, wherein a lowermost point of the grip portion is to move along a first arcuate path, and an end portion of the manifold is to move along a second arcuate path opposing the first arcuate path when the trigger moves from an unactuated position to an actuated position.

24. The dispensing system according to any of claims 16 to 23, wherein a total range of movement of the trigger is between about 2 degrees and less than about 10 degrees of rotation of the trigger.

25. The dispensing system according to any of claims 16 to 24, wherein the trigger has a first portion adjacent a discharge outlet and a second portion adjacent the container, the first portion having a first thickness and the second portion having a second thickness less than the first thickness.

26. The dispensing system according to any of claims 16 to 25, wherein an upper end of the grip portion is to move away from the central longitudinal axis when the trigger moves toward an actuated position.

27. The dispensing system according to any of claims 16 to 26, wherein the trigger has an uppermost point adjacent a discharge outlet and a lowermost point adjacent the container, and wherein the trigger is dimensioned such that the uppermost point and the lowermost point follow the same trajectory when the trigger pivots about an axis of rotation.

28. The dispensing system according to any of claims 16 to 27, wherein the overcap includes a first sidewall and a second sidewall opposite the first sidewall, and wherein the trigger includes an arm extending through an aperture of the first sidewall and pivotably coupled to the second sidewall.

29. The dispensing system according to claim 28, wherein the grip portion is concave and the second sidewall is concave.

30. The dispensing system according to any of claims 16 to 29, wherein the overcap includes an elastically deformed skirt substantially conforming to a shape of the container.



31. A dispensing system, comprising:

a housing;

a discharge outlet; and

a trigger having a grip portion pivotably coupled to the housing to rotate from a first position to a second position, the grip portion having an upper surface and an interior surface disposed below the discharge outlet when the dispensing system is in an upright position,

wherein the upper surface of the grip portion is to move outward when the grip portion rotates from the first position to the second position to enable at least one of the upper surface or the interior surface to direct a fluid product discharged via the discharge outlet into an interior of the housing.

32. The dispensing system of claim 31, wherein the upper surface is sloped toward the interior of the housing when the grip portion is in the second position.

33. The dispensing system of claims 31 or 32, wherein the housing includes a first aperture disposed below the discharge outlet when the dispensing system is in the upright position, the trigger including an arm extending from the grip portion and through the first aperture.

34. The dispensing system of claim 33, wherein at least one of the upper surface or the interior surface is to direct the fluid product into the interior of the housing via the first aperture.

35. The dispensing system according to any of claims 31 to 34, wherein the housing includes a surface disposed between the discharge outlet and the grip portion of the trigger, wherein the surface is to direct the fluid product toward the interior of the housing.

36. The dispensing system of claim 35, wherein the surface is sloped.

37. The dispensing system of claim 35, wherein the surface is stepped.

38. The dispensing system of claim 35, wherein the housing defines a second aperture to receive at least one of an end portion of the manifold or a spray insert defining the discharge outlet, and wherein the surface extends from the first aperture to the second aperture.
39. The dispensing system according to any of claims 31 to 38, wherein an uppermost point of the grip portion and a lowermost point of the grip portion follow substantially the same trajectory when the grip portion moves from the first position to the second position.
40. The dispensing system according to any of claims 31 to 39, wherein the dispensing system has a longitudinal axis, and the grip portion is disposed on an opposite side of the longitudinal axis as an axis of rotation of the trigger.
41. The dispensing system according to any of claims 31 to 40, wherein the grip portion is curved about a first axis and a second axis perpendicular to the first axis.
42. The dispensing system according to any of claims 31 to 41 further comprising an aerosol container, and wherein the housing is coupled to the aerosol container.
43. The dispensing system of claim 42, wherein a lowermost point of the grip portion is disposed below a lowermost point of a mounting cup of the aerosol container when the dispensing system is in an upright position.
44. The dispensing system according to any of claims 31 to 43, wherein an uppermost point of the grip portion moves along an arcuate path having a negative vertical vector component when the grip portion moves from the first position to the second position.
45. The dispensing system according to any of claims 31 to 44, wherein a portion of the upper surface of the grip portion is to be disposed farther outward from a longitudinal axis of the dispensing system than the discharge outlet when the grip portion is in the second position.
46. A dispensing system, comprising:

a container; and

a housing to be coupled to the container, wherein the housing includes a flexible skirt having an interior face extending toward an exterior face such that a ratio of a first thickness of an area of the skirt spaced apart from an end of the skirt to a second thickness of the end of the skirt is greater than about 1.5:1,

wherein the skirt in a first state uncoupled to the container defines an aperture with a first size, and

wherein the skirt in a second state coupled to the container defines the aperture with a second size greater than the first size and forms a circumferential fluid seal between the skirt and the container.

47. The dispensing system of claim 46, wherein the skirt is flared in the first state.

48. The dispensing system of claim 46 or 47, wherein the second thickness of the end of the skirt is about 0.3 millimeters to about 1.0 millimeters.

49. The dispensing system according to any of claims 46 to 48, wherein the first thickness of the area is about 1.1 millimeters to about 1.6 millimeters.

50. The dispensing system according to any of claims 46 to 49, wherein the first thickness of the area is a thickness of a narrowest portion of the area about a circumference of the area.

51. The dispensing system according to any of claims 46 to 50, wherein the second thickness of the end is a thickness of a narrowest portion of the end about a circumference of the area.

52. The dispensing system according to any of claims 46 to 51, wherein the exterior face bows outwardly.

53. The dispensing system according to any of claims 46 to 52, wherein the interior face bows outwardly.

54. The dispensing system according to any of claims 46 to 53, wherein the housing includes a flange and a protrusion securing the housing to the container.
55. The dispensing system according to claim 54, wherein the protrusion contacts a mounting cup of the container.
56. The dispensing system according to claim 54, wherein the protrusion contacts a curled portion of the container.
57. The dispensing system according to claim 54, wherein the protrusion is snap-fit onto the container.
58. The dispensing system according to any of claims 46 to 57, wherein a portion of the interior face substantially conforms to a shape and a size of a neck of the container.
59. The dispensing system according to any of claims 46 to 58, wherein the ratio of the first thickness of the area of the skirt to the second thickness of the end of the skirt is greater than about 3:1.
60. The dispensing system according to any of claims 46 to 59, wherein the ratio of the first thickness of the area of the skirt to the second thickness of the end of the skirt is greater than about 5:1.

61. A dispensing system, comprising:  
a housing for coupling to a container, the housing having a first sidewall including an aperture;  
a trigger having a grip portion disposed outside of the housing and an arm extending through the aperture of the first sidewall and pivotably coupled to a second sidewall of the housing opposite the first sidewall;  
a cap coupled to the housing; and  
a manifold suspended from the cap,  
wherein the trigger is operatively coupled to the manifold such that when a first portion of the trigger moves along a first arcuate path, a second portion of the manifold moves along a second arcuate path opposing the first arcuate path.
62. The dispensing system of claim 61, wherein the manifold includes a first flexure area, a second flexure area, and a third flexure area.
63. The dispensing system of claim 62, wherein the manifold includes a first duct and a second duct transverse to the first duct, the second duct including the first flexure area and the second flexure area.
64. The dispensing system of claim 63, wherein the second duct is to be substantially straight when the trigger is in a first position, and wherein the second duct is to have a point of inflection when the first portion of the trigger moves along the first arcuate path to a second position.
65. The dispensing system according to any of claims 61 to 64, wherein the second portion of the manifold is to move toward the first sidewall when the trigger moves toward the first sidewall.
66. The dispensing system according to any of claims 61 to 65, wherein the manifold is unitary with the cap.

67. The dispensing system according to any of claims 61 to 66, wherein the manifold comprises a joint between the cap and an end portion of the manifold.

68. The dispensing system according to any of claims 61 to 67, further comprising a discharge aperture in fluid communication with the manifold, and wherein the dispensing system has a longitudinal axis, and wherein the manifold has an end portion to receive a valve stem of a container; and

wherein a first plane perpendicular to the longitudinal axis passes through the discharge aperture, a second plane perpendicular to the longitudinal axis passes through an axis of rotation of the trigger, and a third plane perpendicular to the longitudinal axis passes through the end portion of the manifold, and wherein the second plane is disposed between the first plane and the third plane.

69. The dispensing system of any of claims 61 to 68 further comprising the container.

70. The dispensing system of claim 69, wherein the container is an aerosol container having a mounting cup, and a lowermost point of the grip portion is disposed below a lowermost point of the mounting cup when the dispensing system is in an upright position.

71. The dispensing system according to any of claims 61 to 70, wherein the manifold includes a protrusion, and the trigger includes a cam to engage the protrusion.

72. The dispensing system of claim 71, wherein the cam is defined by an underside of the arm.

73. The dispensing system of claim 71, wherein the protrusion extends from the manifold adjacent an end portion of the manifold in which a valve stem of a container is to be received.

74. The dispensing system according to any of claims 61 to 73, wherein the second arcuate path has a vertical vector component and a horizontal vector component, and wherein a

magnitude of the vertical vector component is greater than a magnitude of the horizontal vector component.

75. The dispensing system of claim 74 wherein the magnitude of the vertical vector component is about 1.5 times to about 6 times greater than the magnitude of the horizontal vector component.

76. An overcap, comprising:

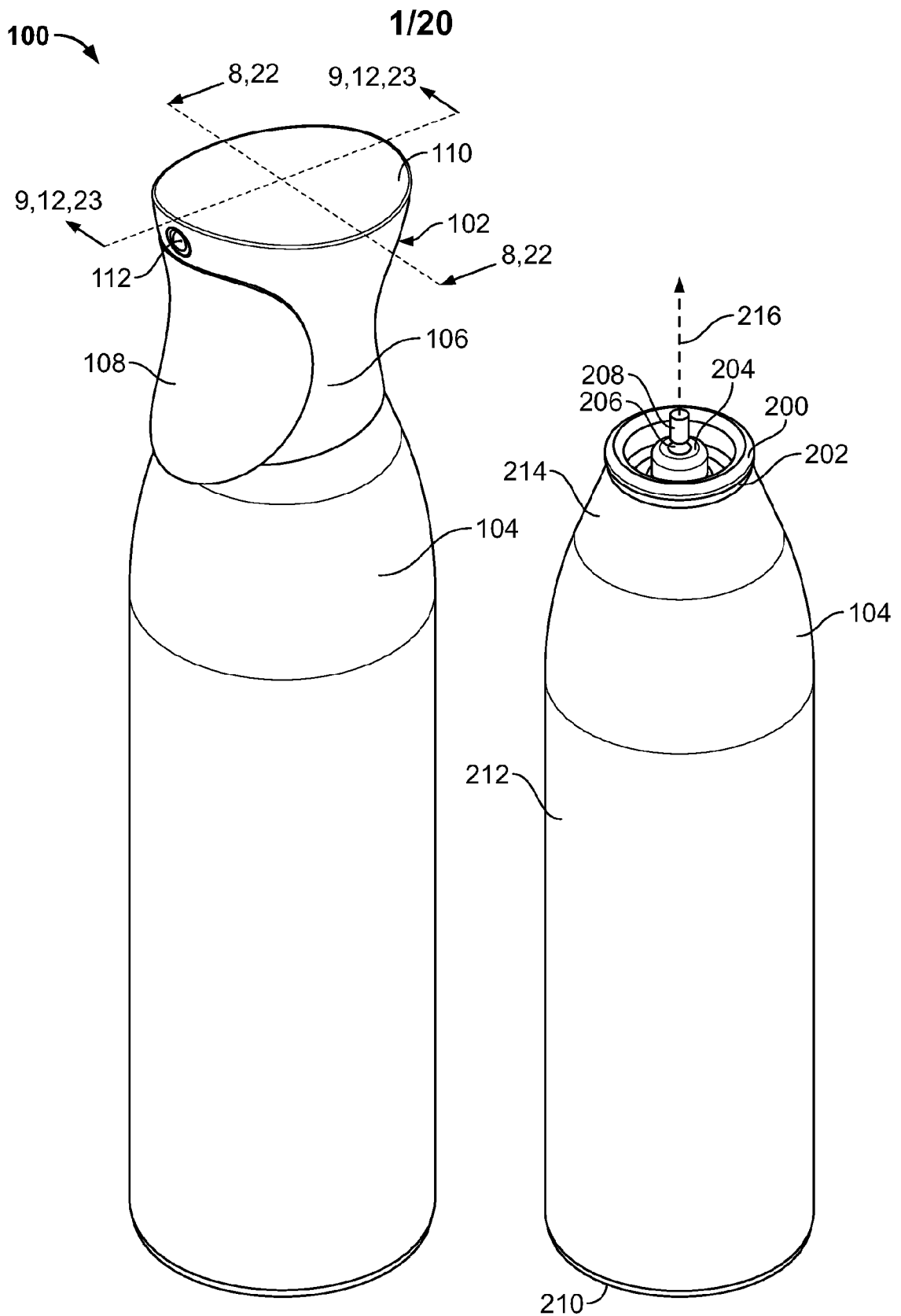
a housing having a first sidewall and a second sidewall opposite the first sidewall;

a trigger pivotably coupled to the housing having a grip portion disposed outside of the housing adjacent the first sidewall, wherein the grip portion has a length of about 40 millimeters to about 60 millimeters, and wherein the grip portion is concave and has a smallest first radius of curvature at a first point on the grip portion, and the second sidewall is concave and has a smallest second radius of curvature less than the first radius of curvature at a second point on the second sidewall; and

a waist of about 30 millimeters to about 50 millimeters.

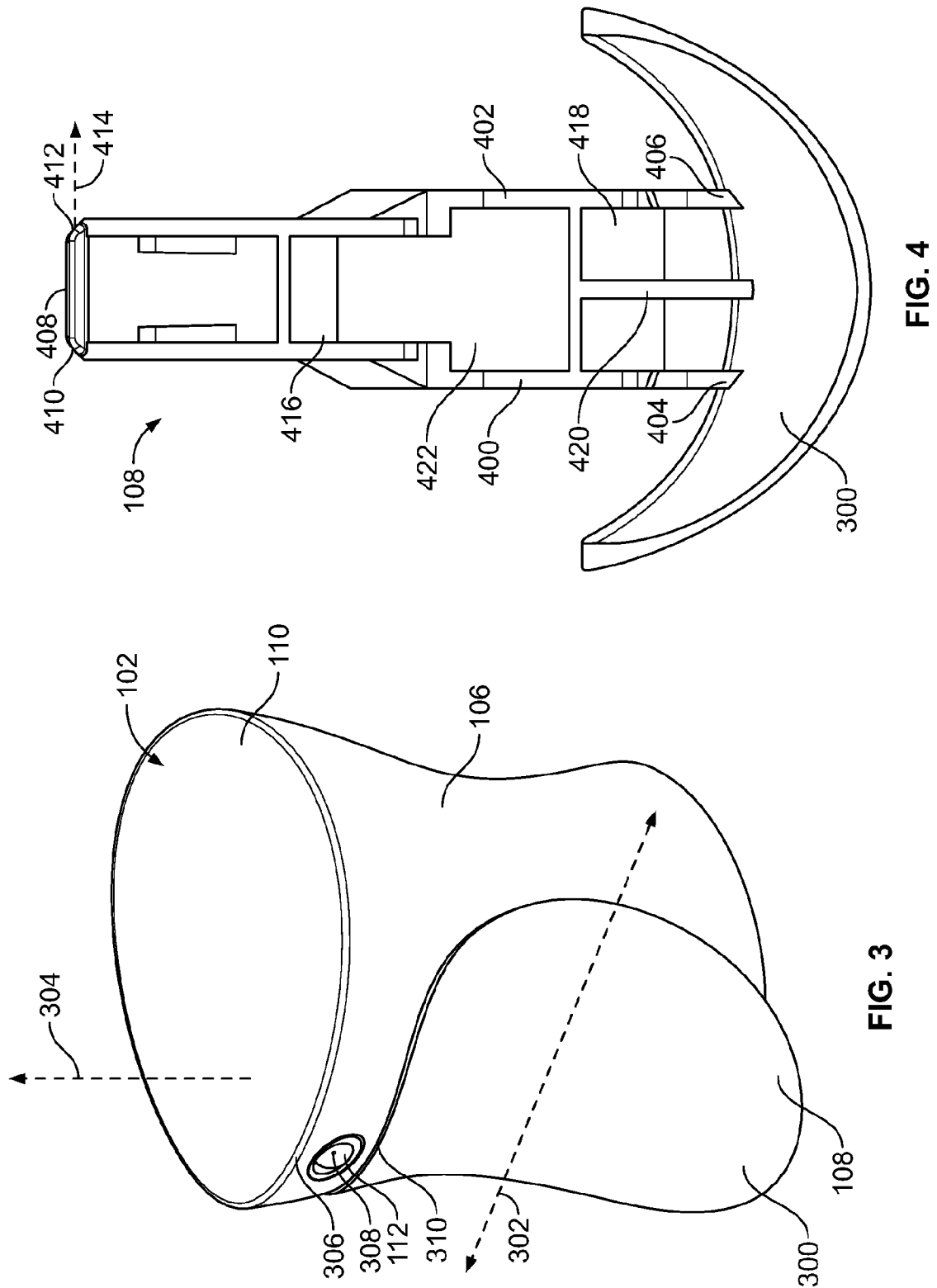
77. The overcap of claim 76, wherein the first point on the grip portion is offset from the second point on the second sidewall in a direction along a longitudinal axis of the overcap.



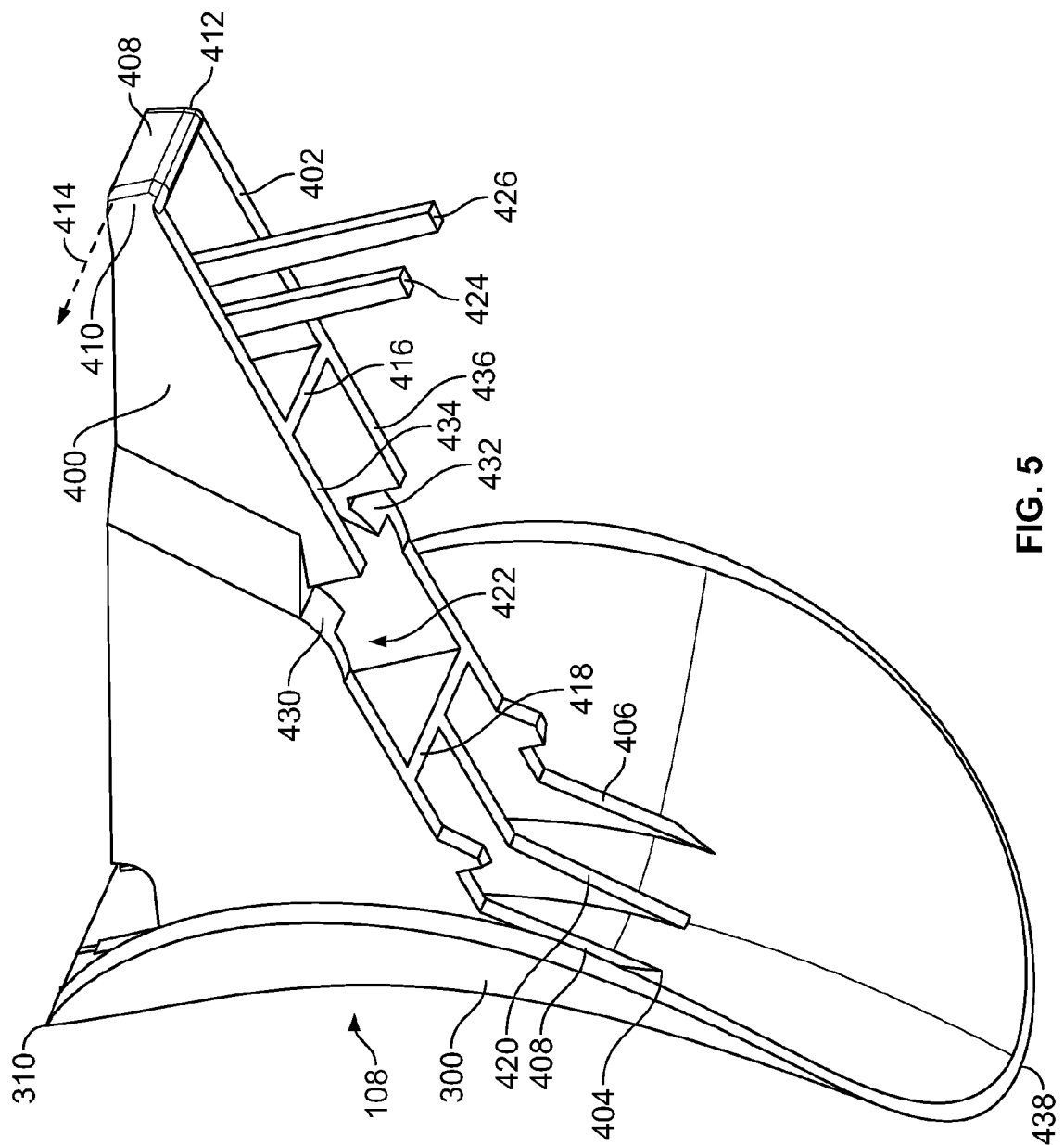


**FIG. 1**

**FIG. 2**



**3/20**



**FIG. 5**

4/20

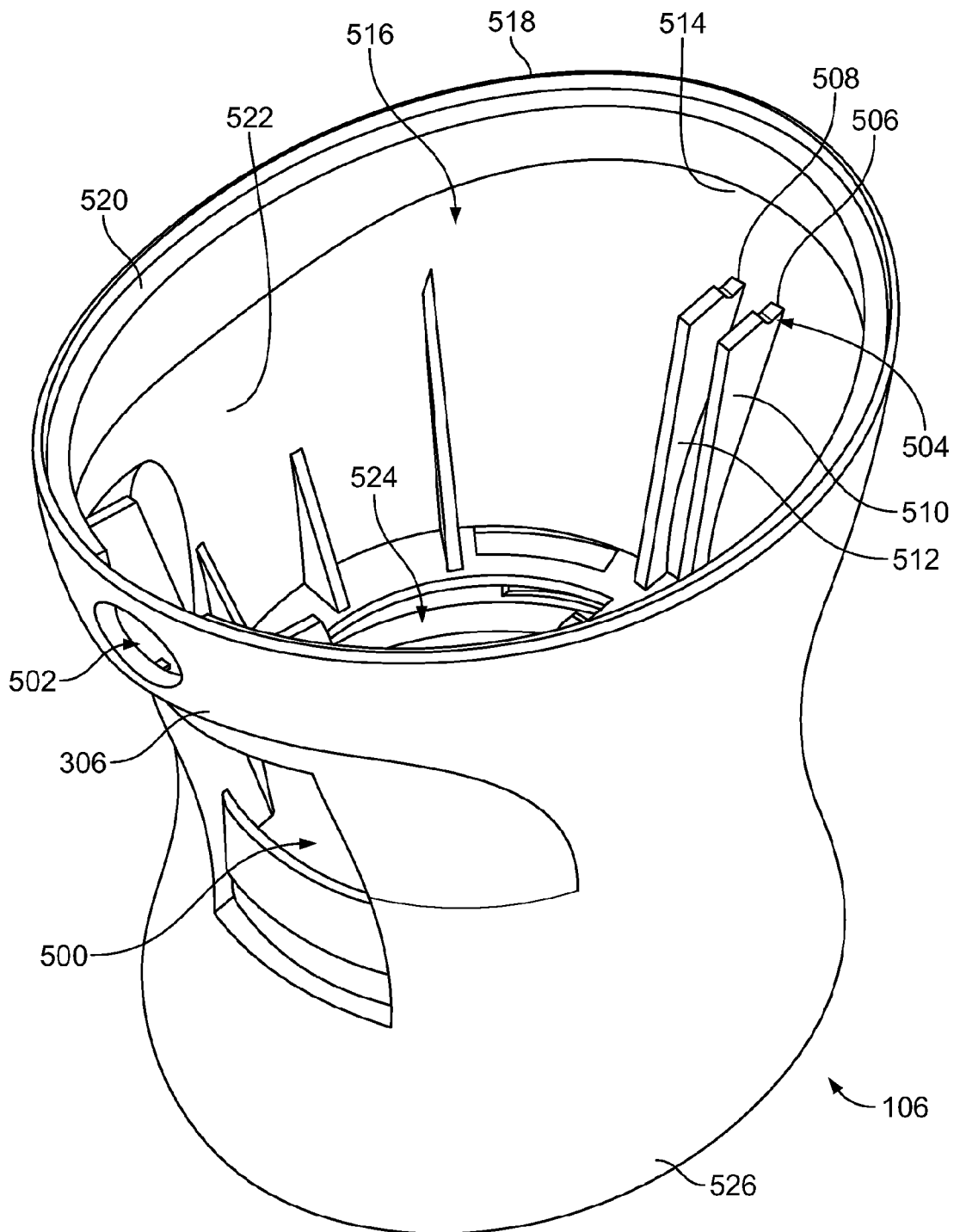
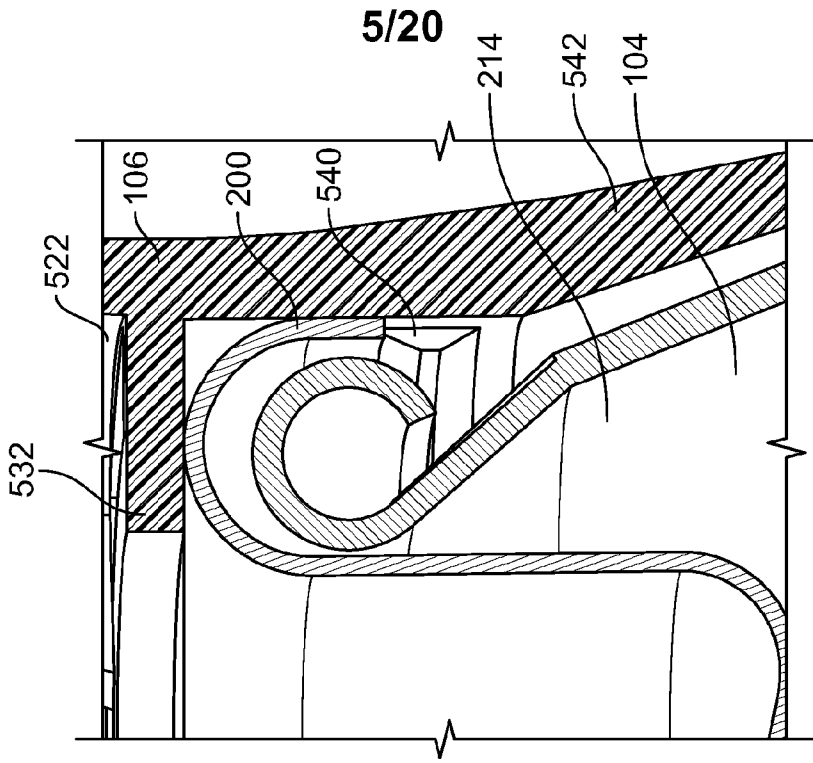
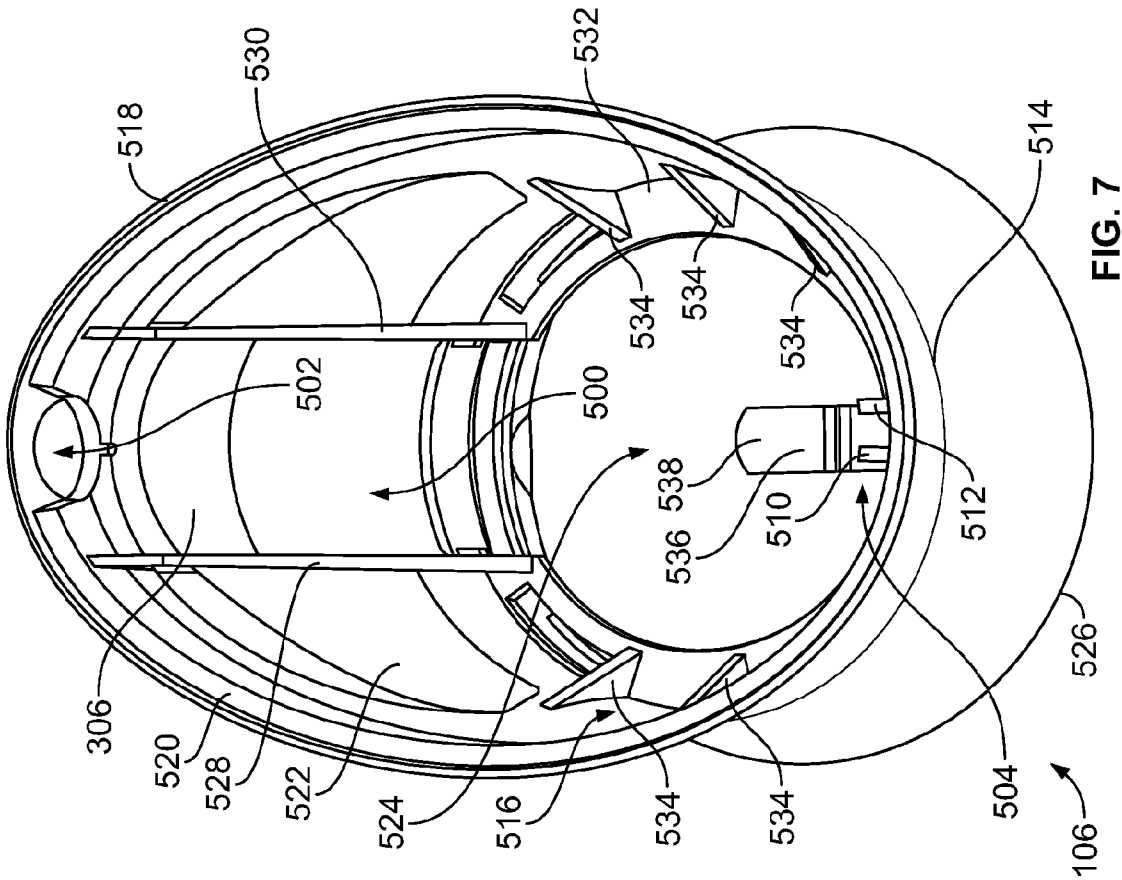
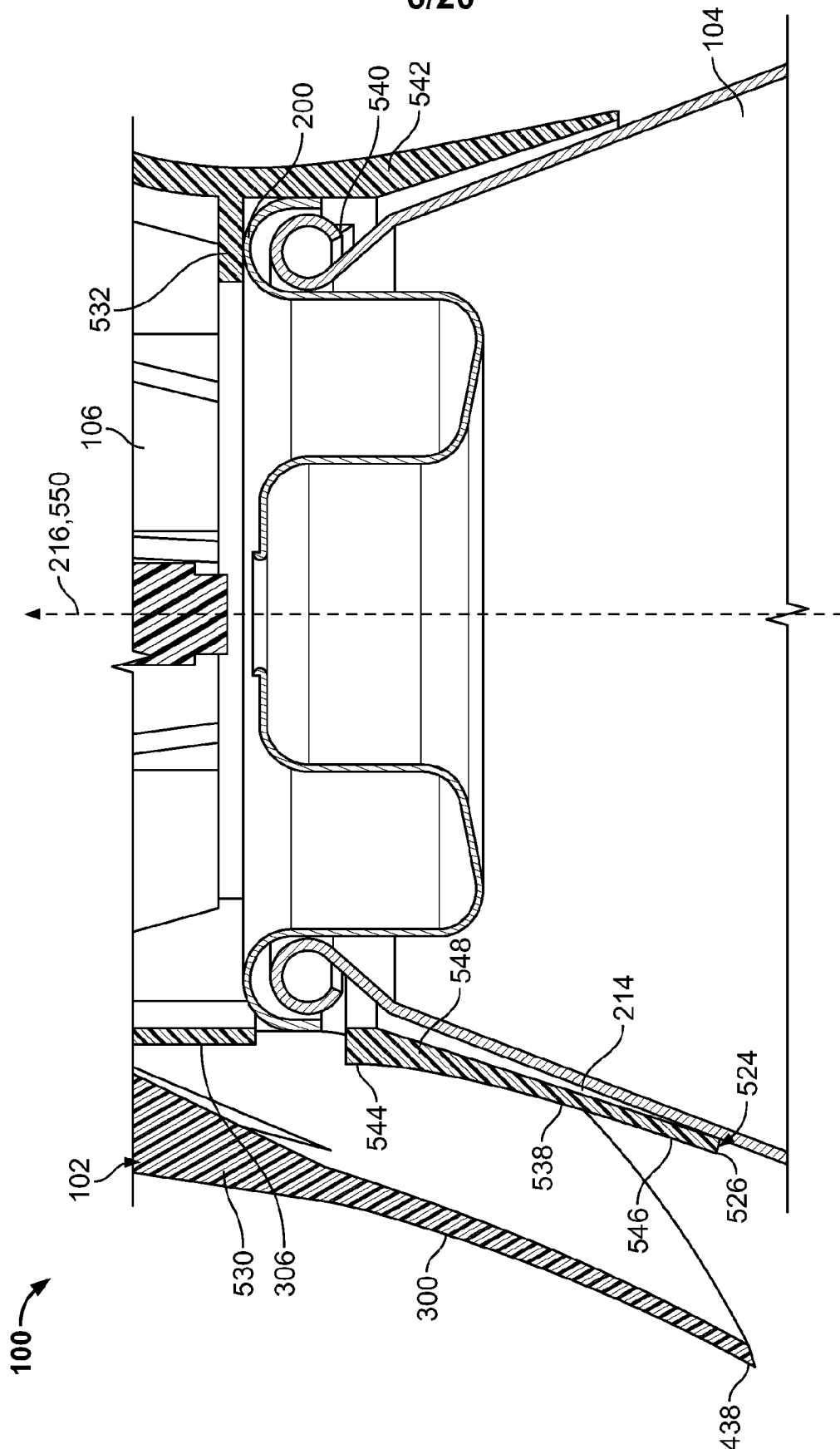


FIG. 6



6/20



**FIG. 9**

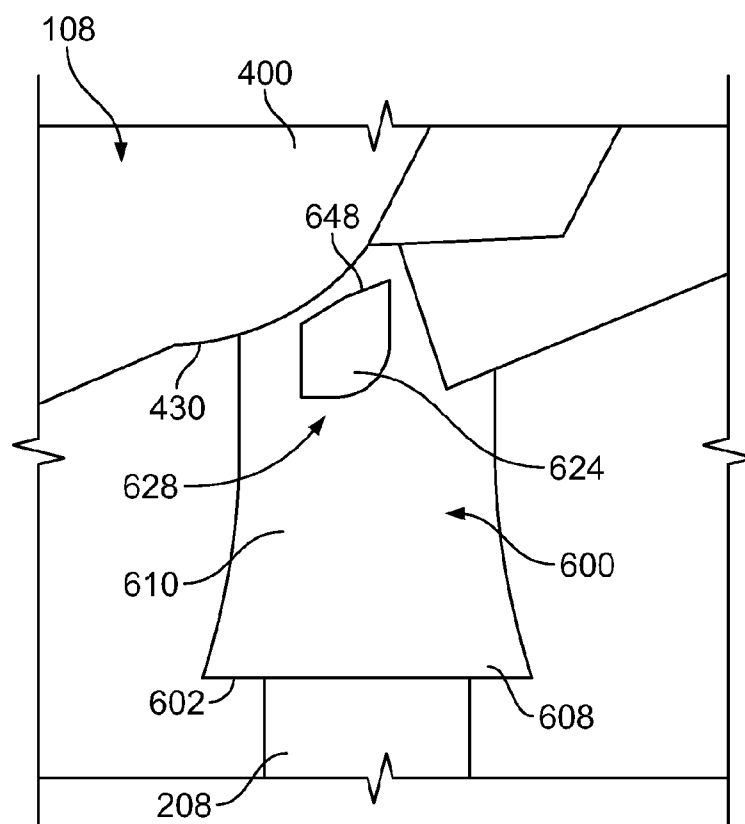
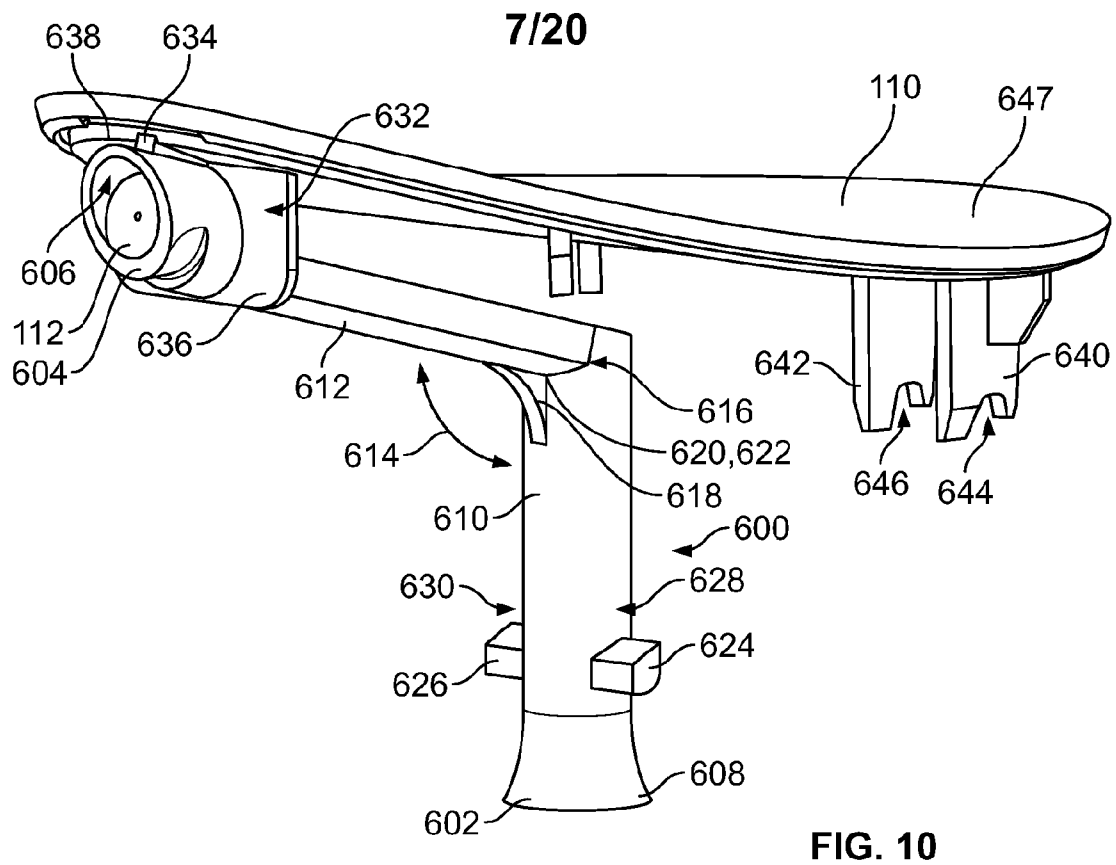
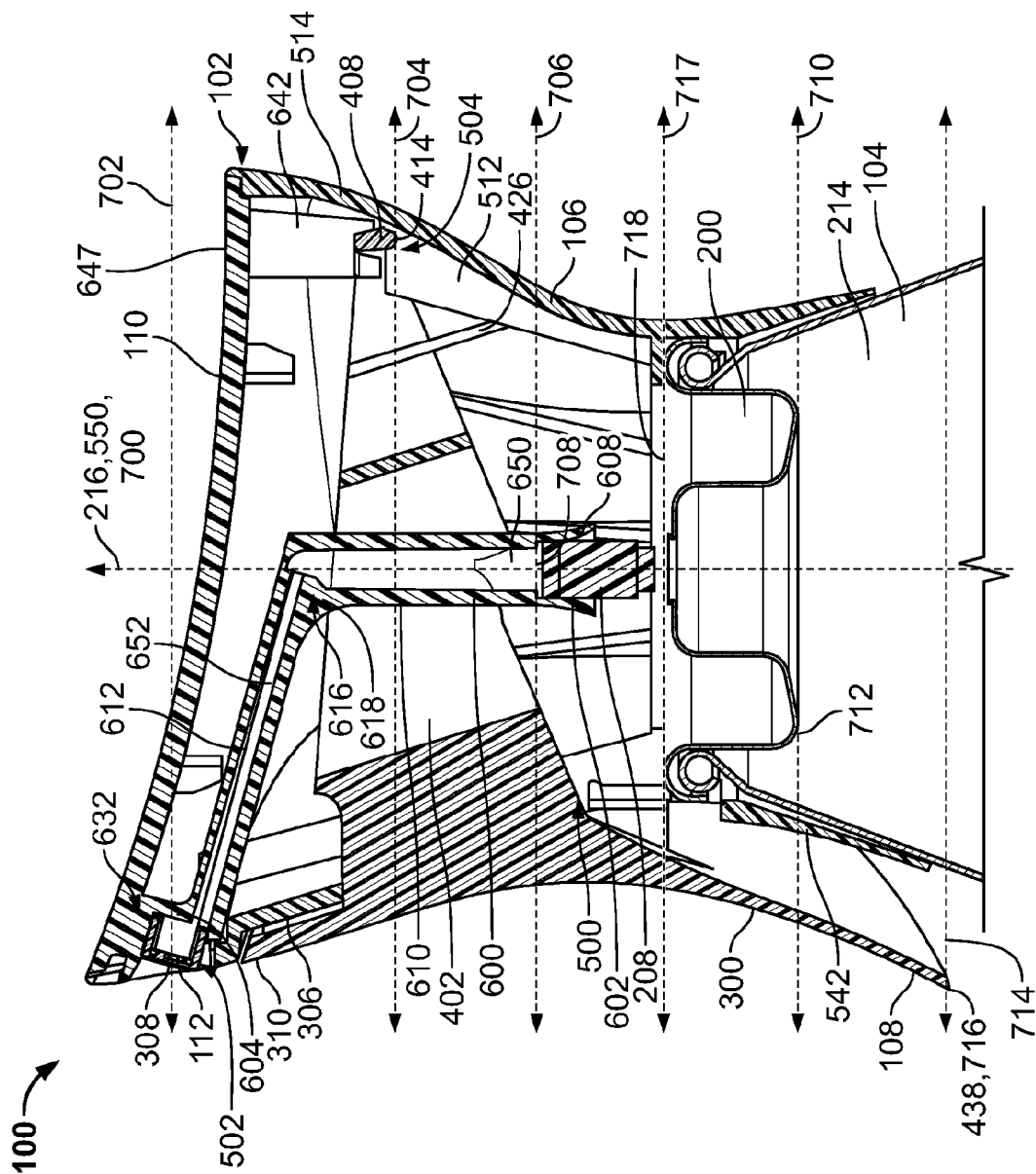


FIG. 11

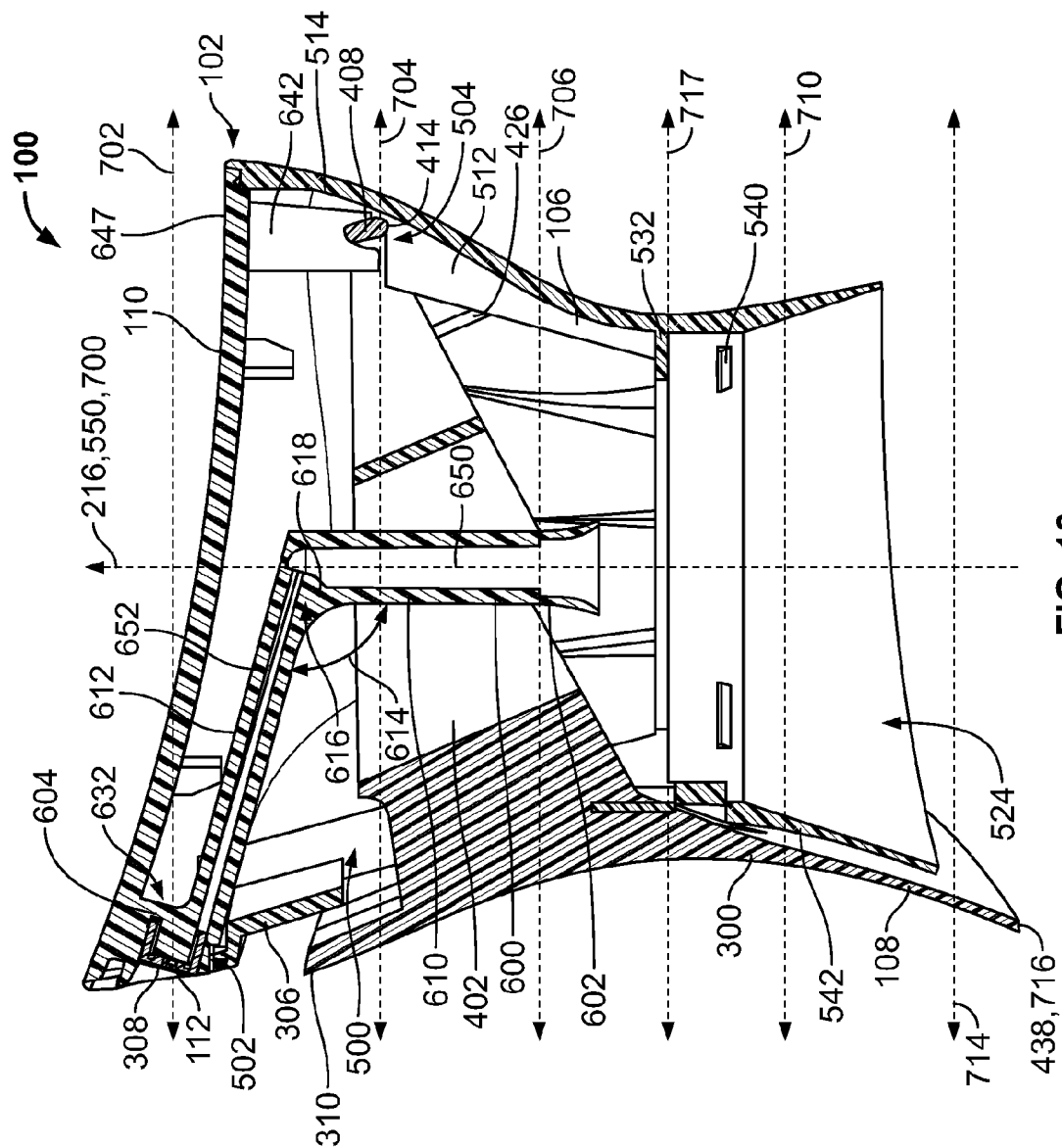
8/20



**FIG. 12**

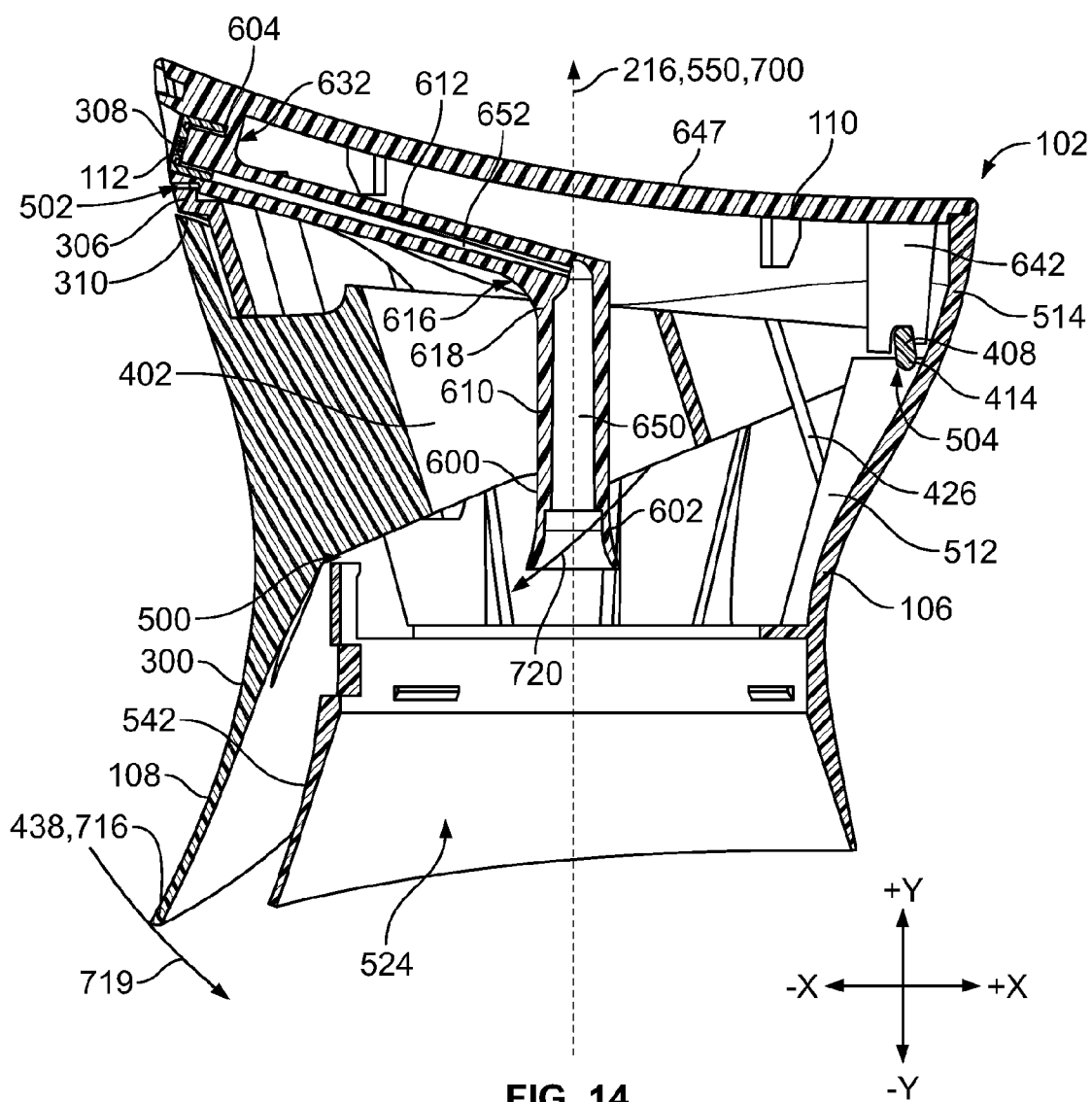


**9/20**

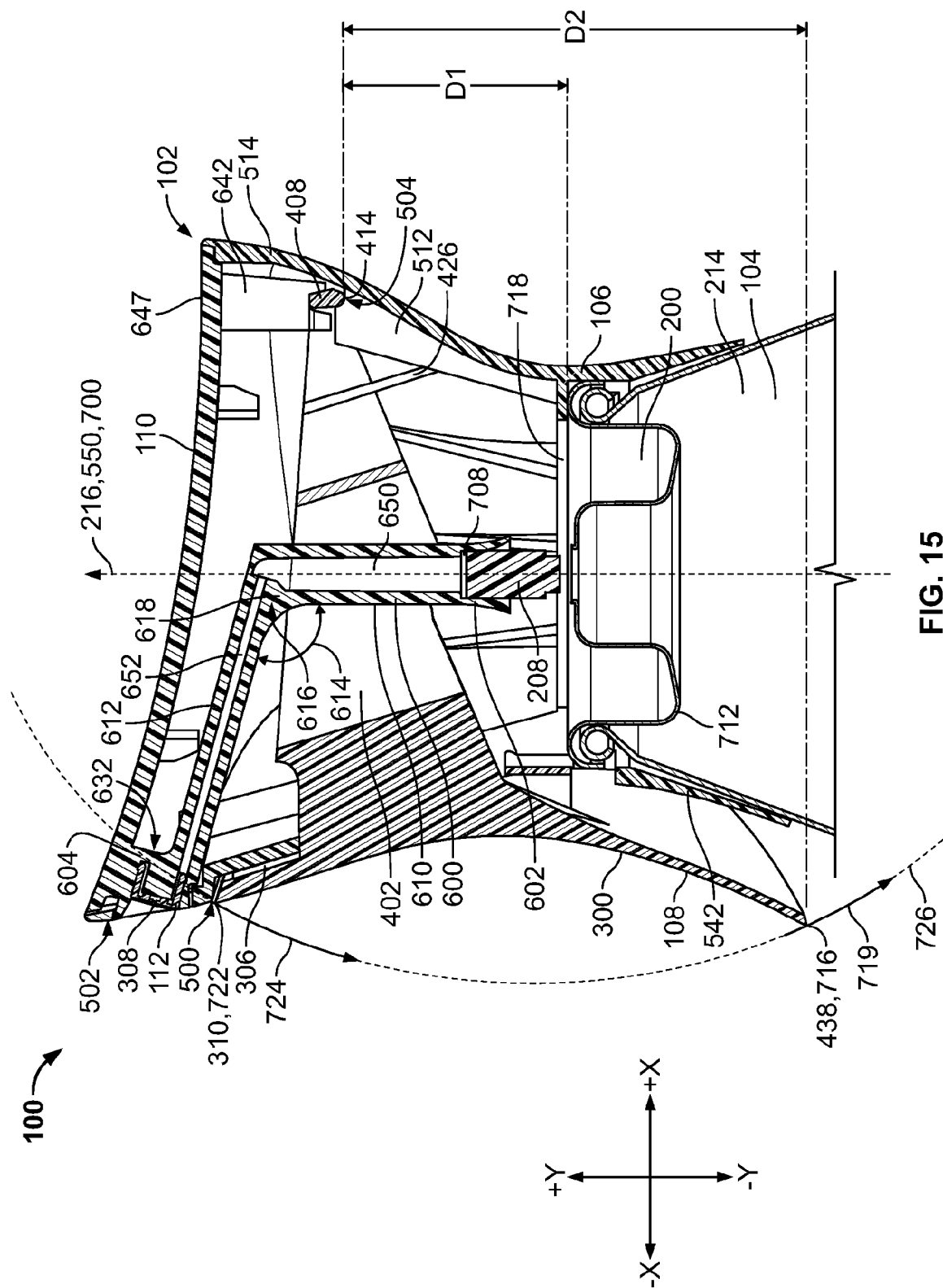


**FIG. 13**

10/20



11/20



**FIG. 15**

SUBSTITUTE SHEET (RULE 26)

12/20

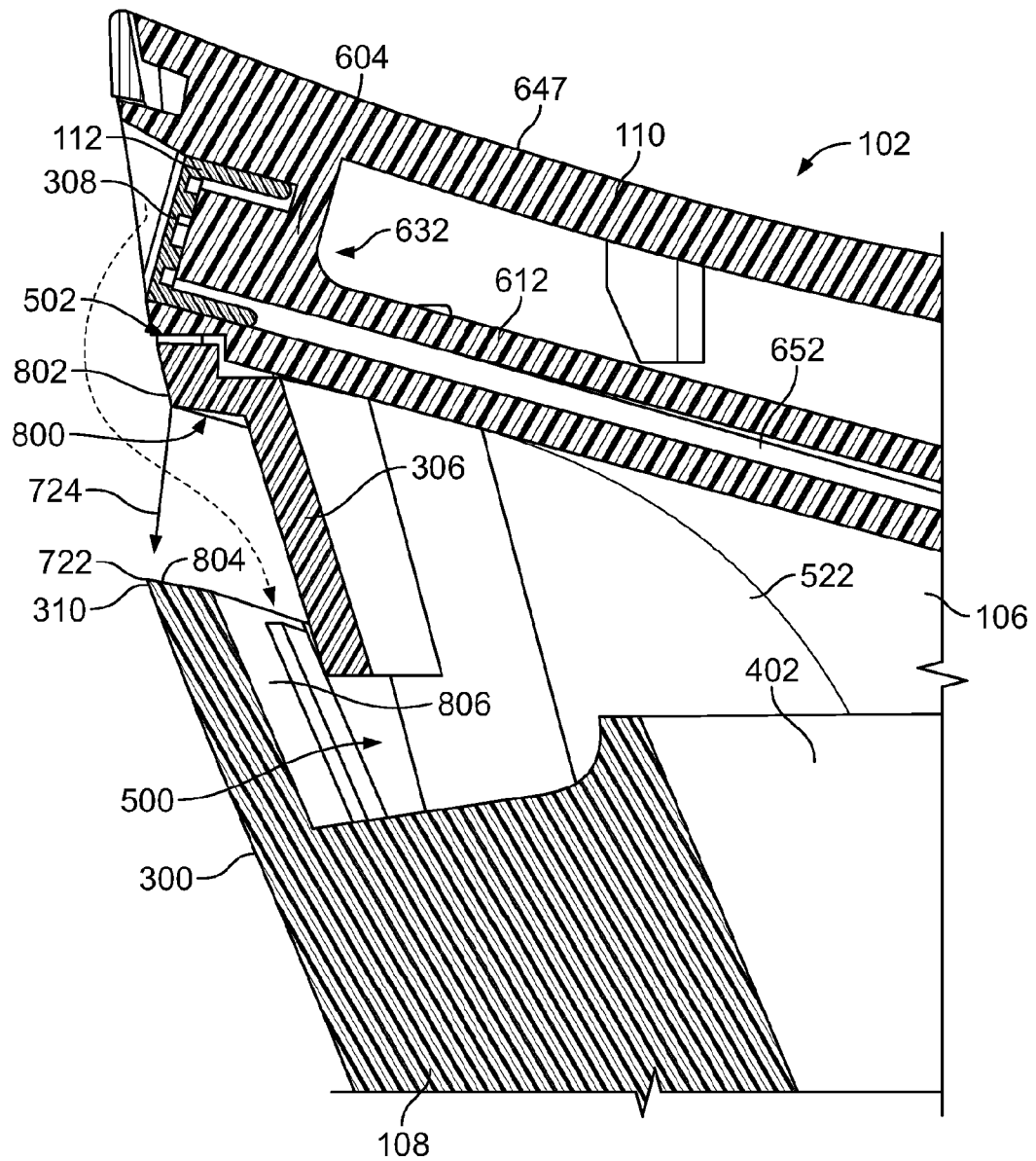
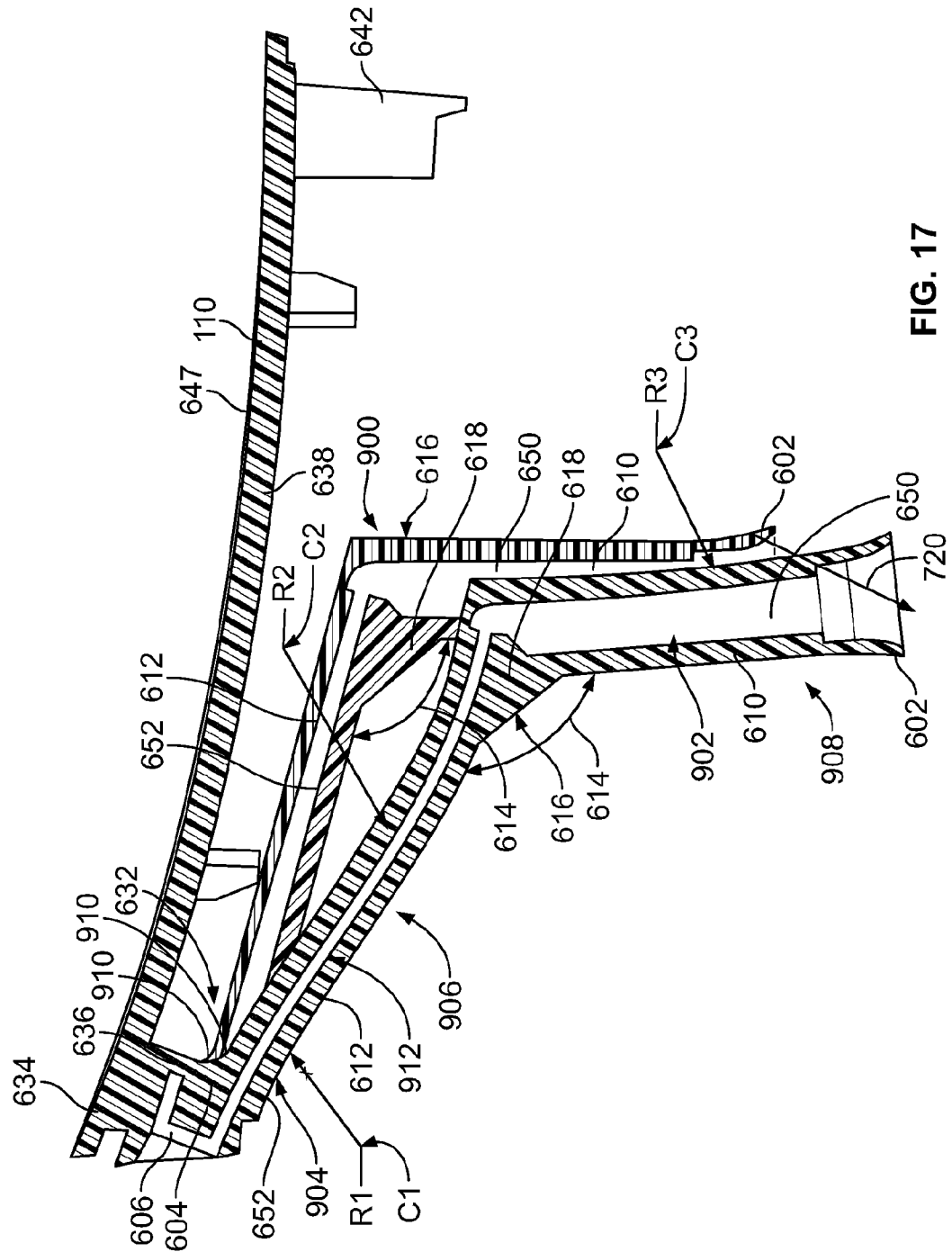


FIG. 16

13/20



**FIG. 17**

14/20

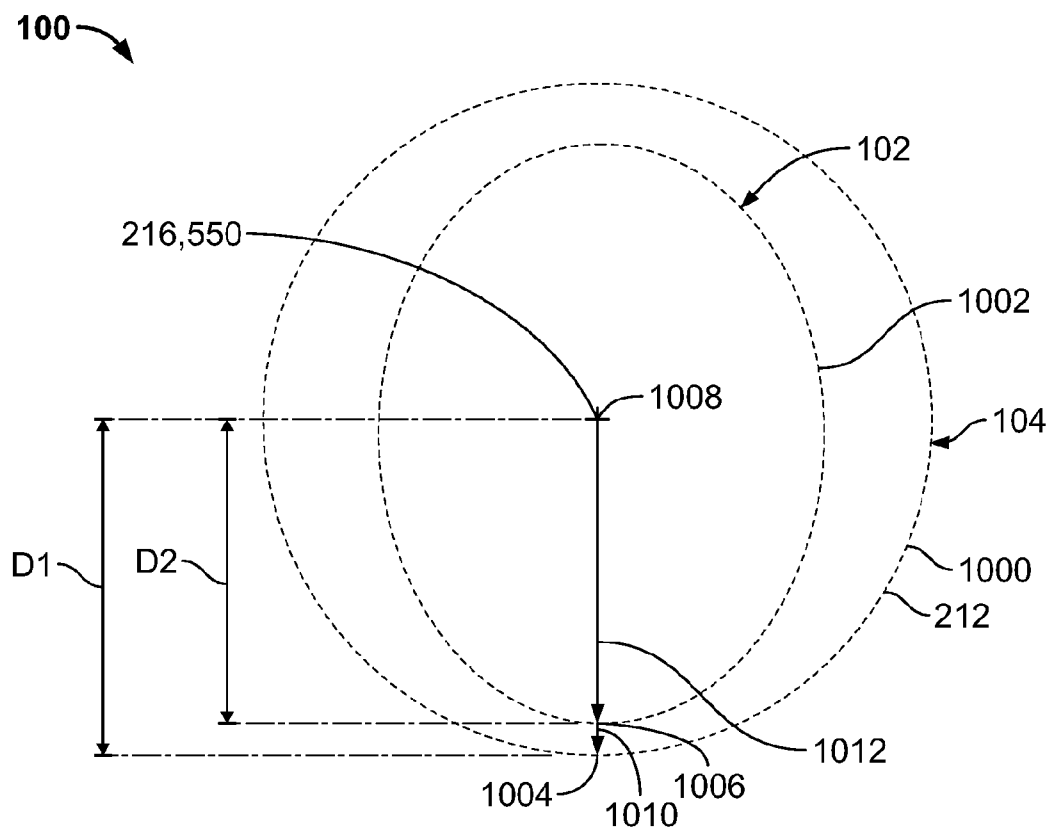
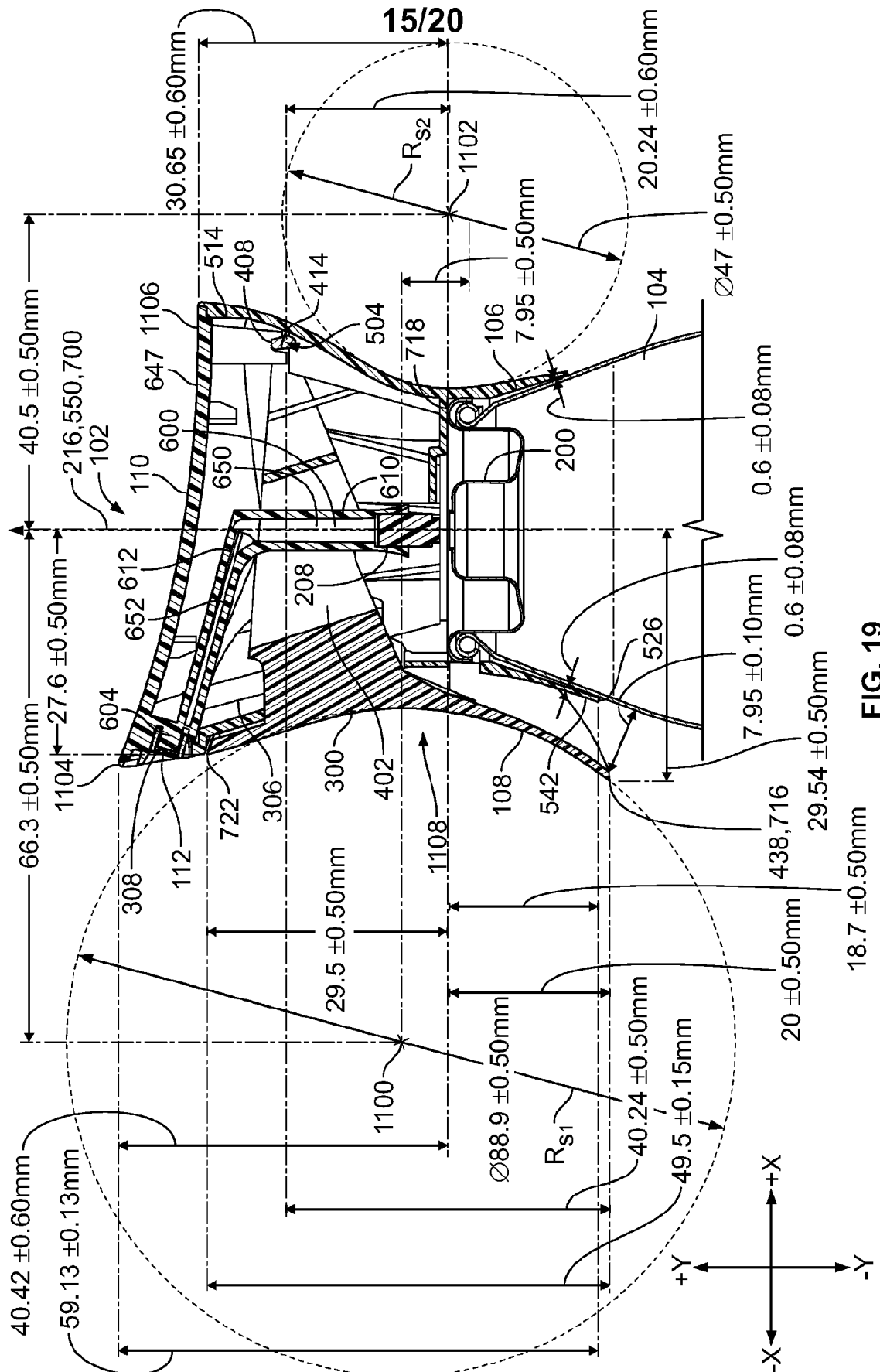


FIG. 18



16/20

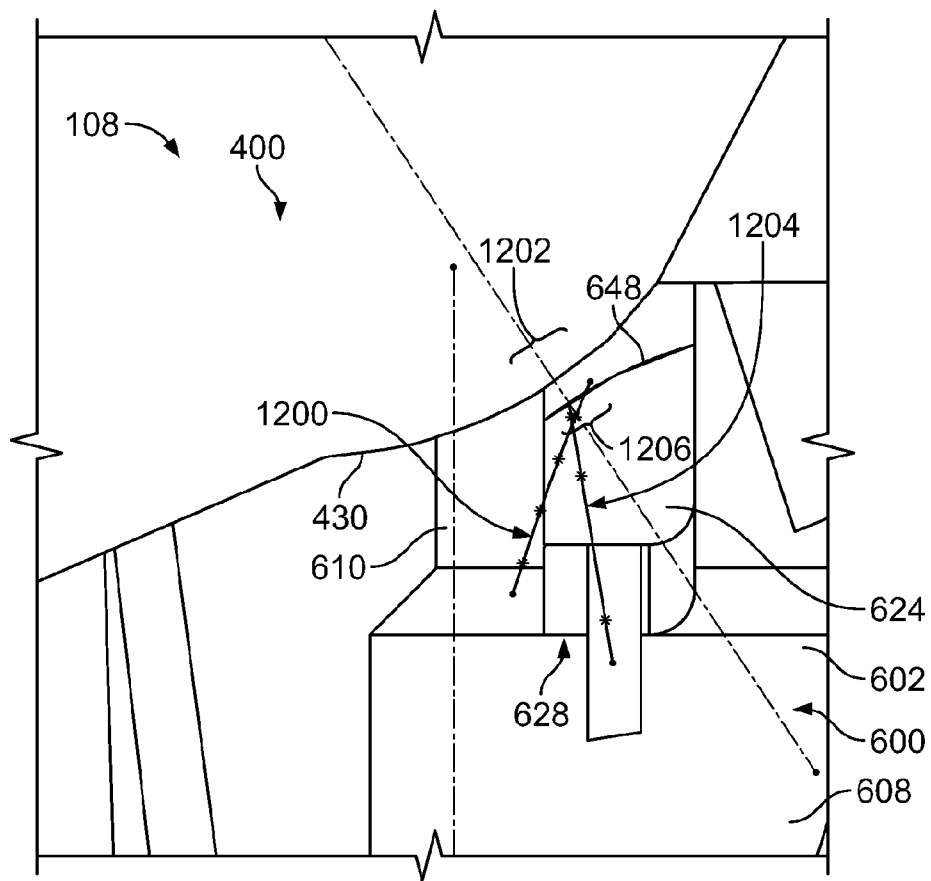


FIG. 20



17/20

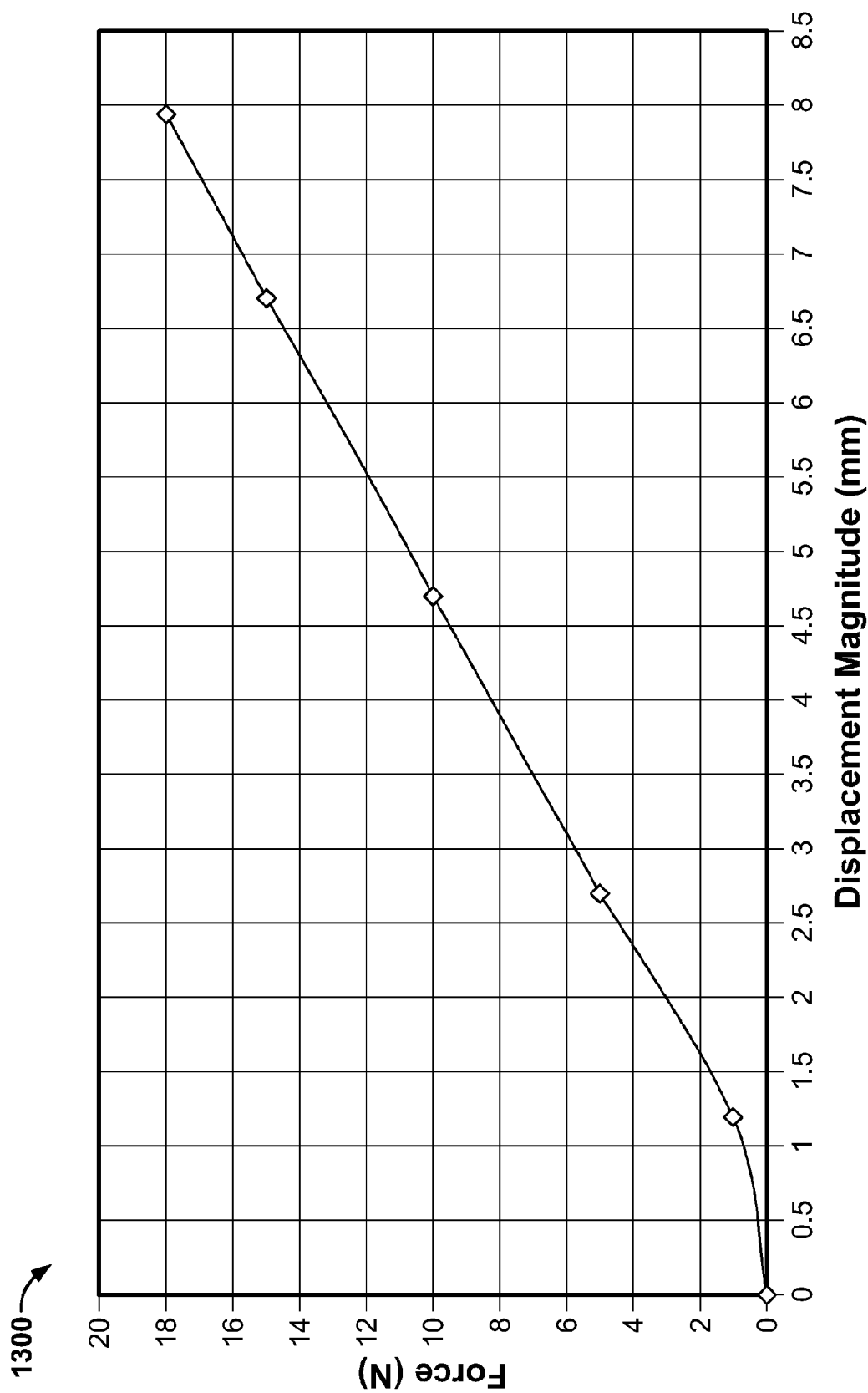


FIG. 21

18/20

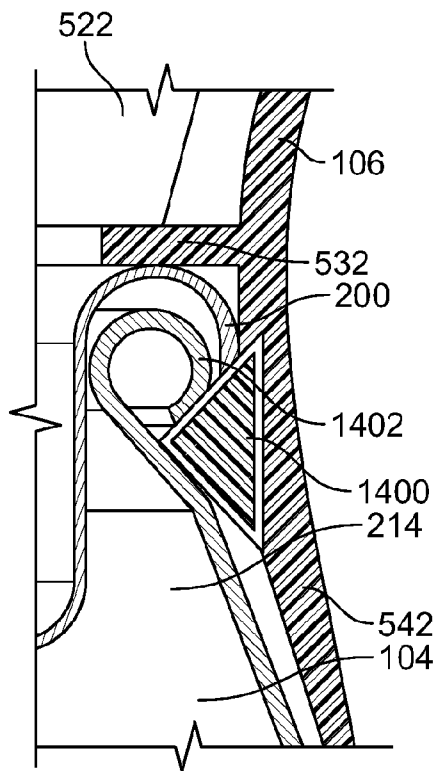
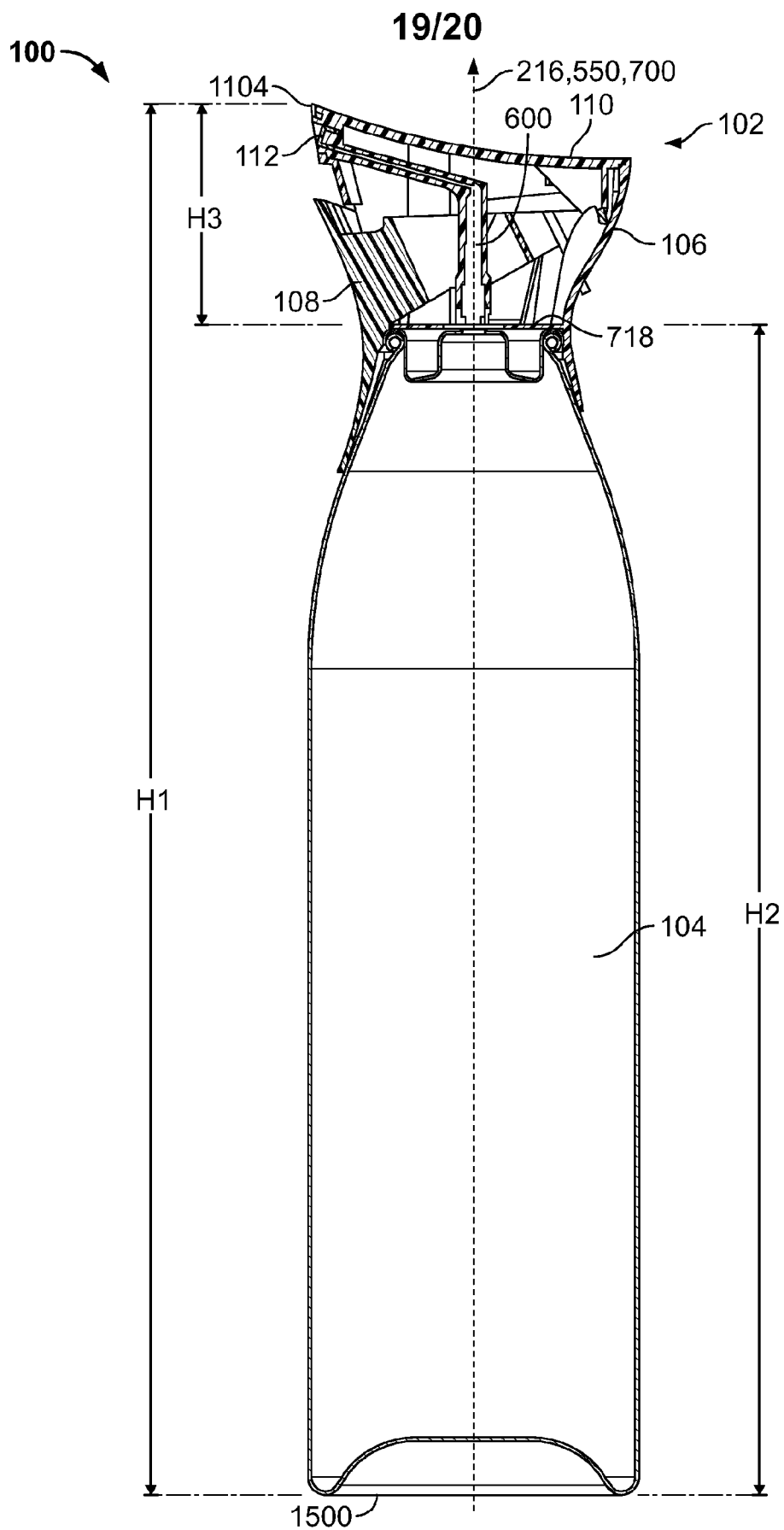


FIG. 22



**FIG. 23**

20/20

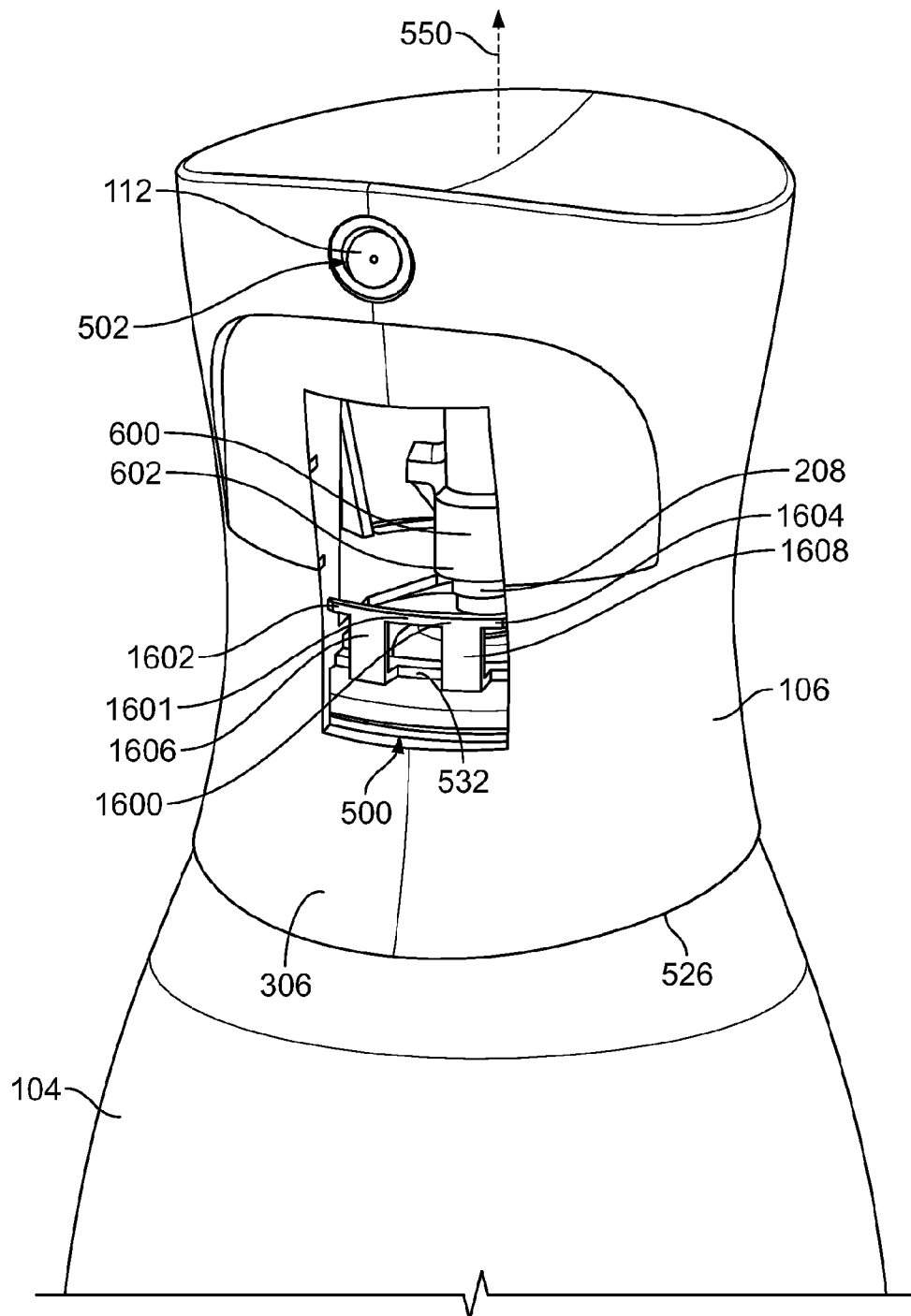


FIG. 24

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2015/024581

A. CLASSIFICATION OF SUBJECT MATTER  
INV. B65D83/20  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/059551 A1 (TOMKINS STEVE JAMES [US] ET AL) 11 March 2010 (2010-03-11) paragraph [0053]; figure 23 paragraph [0035] - paragraph [0052]; figures	1-9, 11, 13, 15
X	----- US 2012/312896 A1 (THURIN MATTHEW N [US] ET AL) 13 December 2012 (2012-12-13) paragraph [0023] - paragraph [0041]; figures	1-7, 10-12, 15
A	----- US 2004/222246 A1 (BATES CHRISTOPHER EUGENE [US] ET AL) 11 November 2004 (2004-11-11) paragraph [0035]; figures ----- -/--	1



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 November 2015

Date of mailing of the international search report

16/02/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer

Endrizzi, Silvio

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2015/024581

### Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-15

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2015/024581

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 2011/108583 A1 (SELL STEVEN A [US] ET AL) 12 May 2011 (2011-05-12) paragraph [0039] - paragraph [0069]; figures</p> <p>-----</p>	1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/024581

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010059551 A1	11-03-2010	US 2010059551 A1	11-03-2010
		US 2011266309 A1	03-11-2011
		US 2011266310 A1	03-11-2011
-----			
US 2012312896 A1	13-12-2012	AR 086887 A1	29-01-2014
		US 2012312896 A1	13-12-2012
		WO 2012170616 A1	13-12-2012
-----			
US 2004222246 A1	11-11-2004	AT 366215 T	15-07-2007
		CA 2523249 A1	18-11-2004
		CN 1784347 A	07-06-2006
		DE 602004007372 T2	28-02-2008
		EP 1620328 A2	01-02-2006
		ES 2288262 T3	01-01-2008
		JP 4431115 B2	10-03-2010
		JP 2006511349 A	06-04-2006
		KR 20050046786 A	18-05-2005
		MX PA05011925 A	17-02-2006
		US 2004222246 A1	11-11-2004
		US 2007062980 A1	22-03-2007
		WO 2004099029 A2	18-11-2004
-----			
US 2011108583 A1	12-05-2011	BR PI0909973 A2	20-10-2015
		CN 102056818 A	11-05-2011
		EP 2285709 A1	23-02-2011
		US 2011108583 A1	12-05-2011
		WO 2009152112 A1	17-12-2009
-----			



**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-15

claims 1-15 are directed to a dispensing system comprising a manifold suspended from a cap. It is considered that the dispensing system having a manifold suspended from a cap comprises a "first special technical feature".

---

2. claims: 16-30

claims 16-30 are directed to a dispensing system comprising a grip portion of the trigger extending below the mounting cup of the container in a direction along the central, longitudinal axis. It is considered that the dispensing system having a grip portion of the trigger extending below the mounting cup of the container in a direction along the central, longitudinal axis comprises a "second special technical feature".

---

3. claims: 31-45

claims 31-45 are directed to a dispensing system comprising a grip portion of the trigger having an upper surface and an interior surface disposed below the discharge outlet when the dispensing system is in an upright position. It is considered that the dispensing system having a grip portion of the trigger with an upper surface and an interior surface disposed below the discharge outlet when the dispensing system is in an upright position comprises a "third special technical feature".

---

4. claims: 46-60

claims 46-60 are directed to a dispensing system comprising a flexible skirt having an interior face extending toward an exterior face such that a ratio of a first thickness of an area of the skirt spaced apart from an end of the skirt to a second thickness of the end of the skirt is greater than about 1.5:1. It is considered that the dispensing system having a flexible skirt with an interior face extending toward an exterior face such that a ratio of a first thickness of an area of the skirt spaced apart from an end of the skirt to a second thickness of the end of the skirt is greater than about 1.5:1 comprises a "fourth special technical feature".

---

5. claims: 61-75

claims 61-75 are directed to a dispensing system comprising

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

a trigger operatively coupled to the manifold such that when a first portion of the trigger moves along a first arcuate path, a second portion of the manifold moves along a second arcuate path opposing the first arcuate path.. It is considered that the dispensing system having a trigger operatively coupled to the manifold such that when a first portion of the trigger moves along a first arcuate path, a second portion of the manifold moves along a second arcuate path opposing the first arcuate path comprises a "fifth special technical feature".

---

**6. claims: 76, 77**

claims 76 and 77 are directed to a dispensing system comprising a trigger pivotably coupled to the housing having a grip portion disposed outside of the housing adjacent the first sidewall, wherein the grip portion has a length of about 40 millimeters to about 60 millimeters, and wherein the grip portion is concave and has a smallest first radius of curvature at a first point on the grip portion, and the second sidewall is concave and has a smallest second radius of curvature less than the first radius of curvature at a second point on the second sidewall; and a waist of about 30 millimeters to about 50 millimeters. It is considered that the dispensing system having such a trigger comprises a "sixth special technical feature".

---