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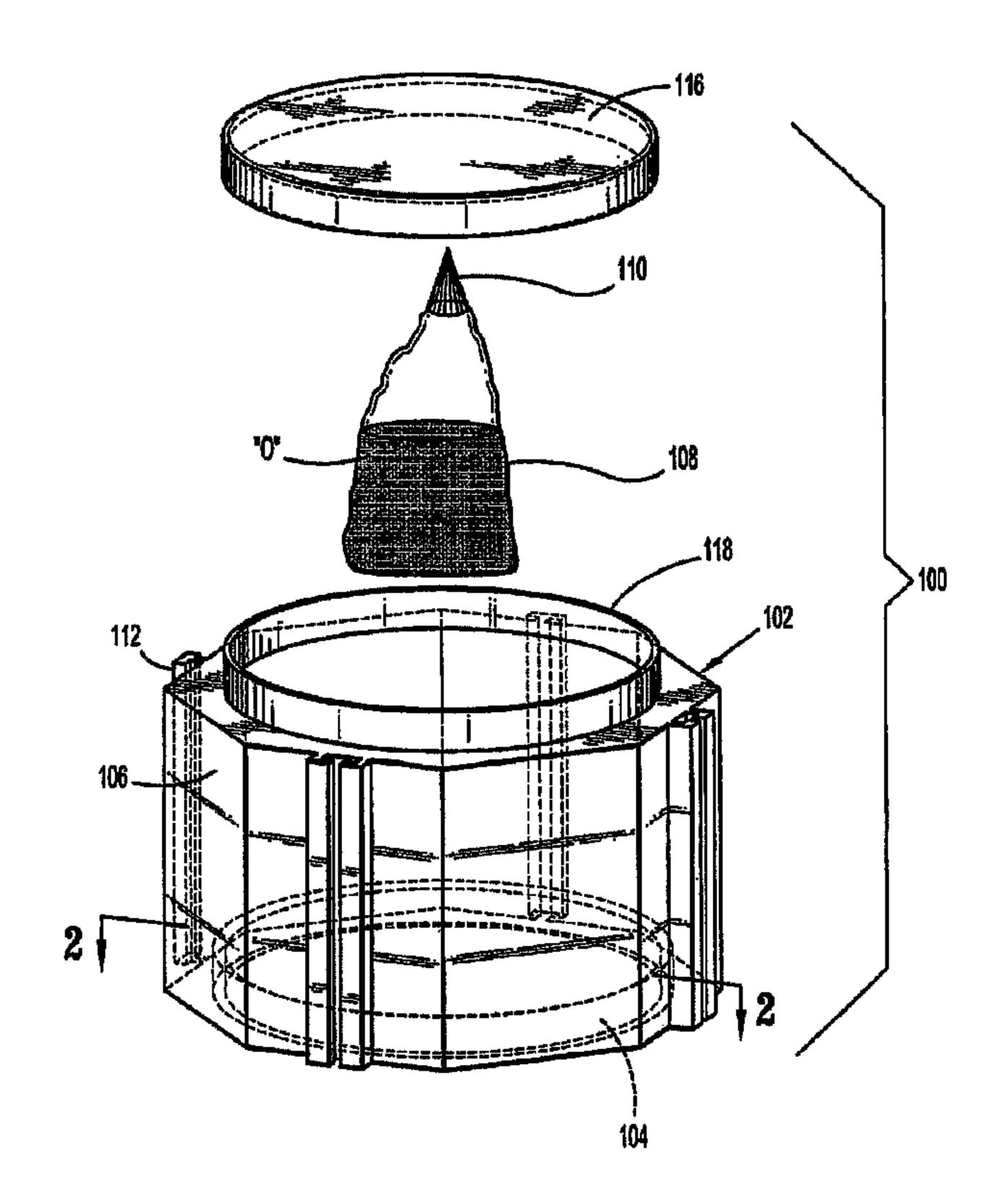
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(54) Title: LIQUID RECLAMATION APPARATUS



#### (57) Abrégé/Abstract:

À liquid reclamation apparatus for use in changing automobile oil includes a container, a portable receptacle within the container and dimensioned to hold a volume of oil sufficient to perform an oil change and a cover releasably secured to the container.

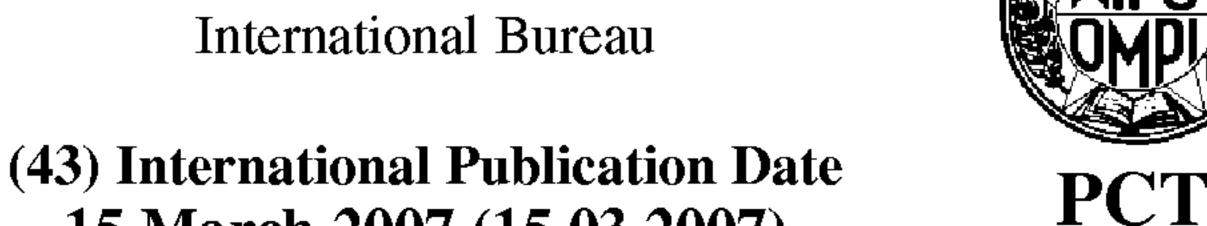




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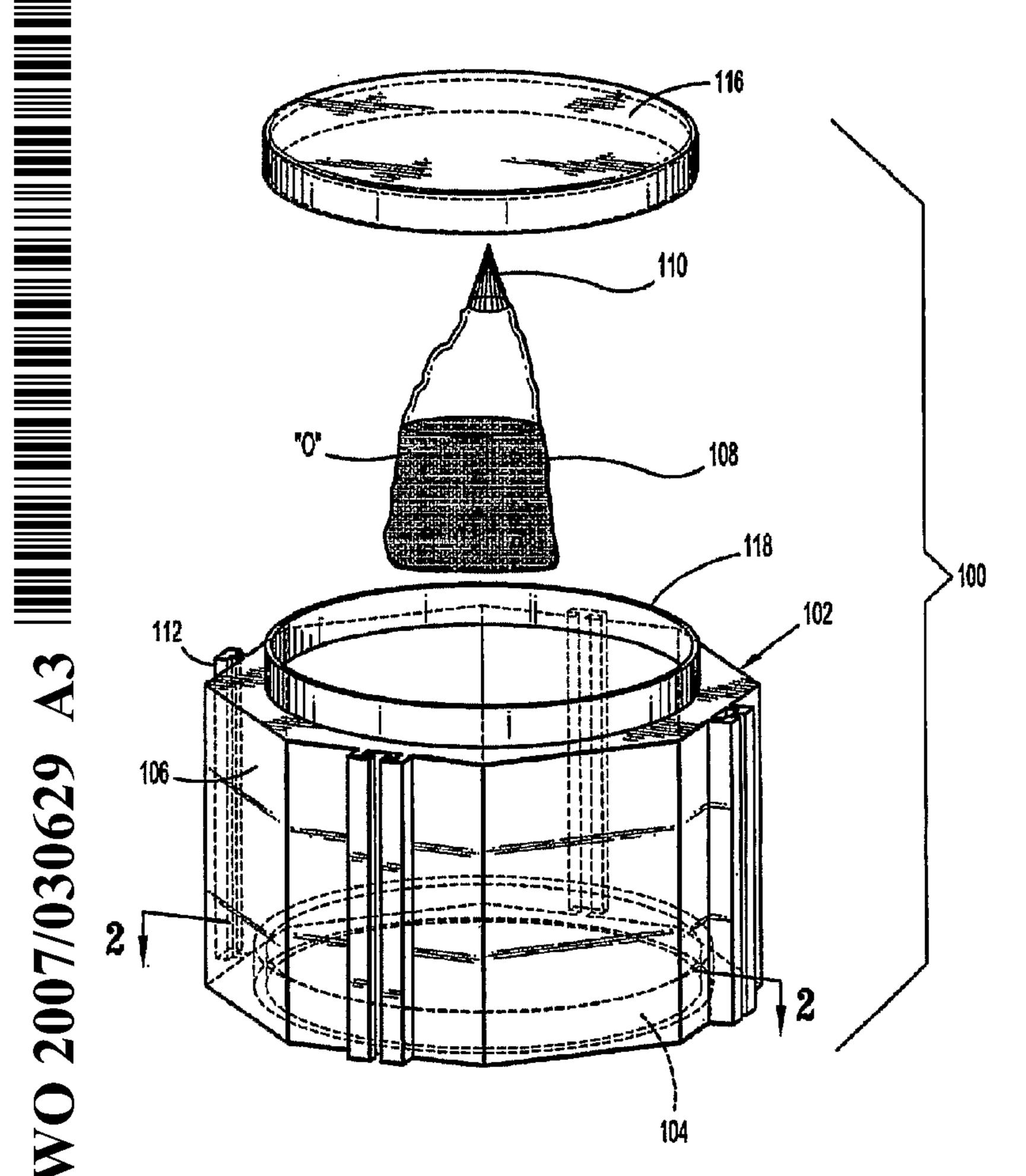
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(54) Title: LIQUID RECLAMATION APPARATUS



(57) Abstract: A liquid reclamation apparatus for use in changing automobile oil includes a container, a portable receptacle within the container and dimensioned to hold a volume of oil sufficient to perform an oil change and a cover releasably secured to the container.

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### LIQUID RECLAMATION APPARATUS

#### CROSS-REFERENCE TO RELATED APPLICATION(S)

This application is a continuation-in-part of U.S. Application Serial No. 11/222,420, filed September 8, 2005; the entire contents of which is hereby incorporated herein by reference.

#### **BACKGROUND**

#### 1. Technical Field

The present disclosure relates to an apparatus for the reclamation of liquids and, more particularly, relates to a system and apparatus for the collection and transportation of liquids such as engine oil and other similar fluids.

#### 2. Background of the Related Art

In order to ensure the long life of an automobile, it is of critical importance that the engine oil be changed regularly. Typically, the automobile manufacturer recommends changing the oil every 3,000 to 5,000 miles. Many owners utilize various service centers and pay mechanics to change the oil for them. However, in an effort to conserve time and money many automobile owners change their own oil.

There are significant drawbacks, however, to changing your own oil. Most importantly, there is no convenient way of disposing the waste oil. Moreover, once the waste oil has been contained, it must be transported to a recycling center in order to comply with environmental laws. For the average automobile owner, this is no easy task. Dealing with engine oil can be very messy. Most automobile owners do not have the proper containers for

the storage and subsequent transport of the waste oil. Thus, there remains a need for a more environmentally and user friendly automobile oil waste receptacle.

#### **SUMMARY**

Accordingly, the present disclosure is directed to improvement in current oil changing practices. In one preferred embodiment, an oil reclamation system is provided. The oil reclamation system includes at least one reclamation apparatus. The reclamation apparatus includes a container, a portable receptacle configured to fit within the container and dimensioned to hold a volume of oil sufficient to perform an oil change on a vehicle and having a dispenser attached thereto, and a cover releasably secured to the container. The portable receptacle preferably includes a flexible bag.

Preferably, the oil reclamation system includes first and second reclamation apparatii connected to each other in side by side relation for transport and/or storage. The first reclamation apparatus includes at least one attachment rail adjacent an outer wall portion of said container and the second reclamation apparatus includes at least one attachment groove adjacent an outer wall portion of the container for receiving the at least one attachment rail to connect the containers of the first and second oil reclamation apparatii. The first reclamation apparatus may further include at least one attachment groove adjacent an outer wall portion of the container and the second reclamation apparatus includes at least one attachment rail adjacent an outer wall portion of the container.

The first and second reclamation apparatii may also be arranged and stored in vertical stacked relation. For example, the container of the first reclamation apparatii includes

a recessed portion adapted to accommodate at least the cover of the second reclamation apparatii when in the vertical stacked relation of the first and second reclamation apparatii.

In another embodiment, an oil reclamation system includes a container being expandable from a contracted transport condition to an expanded in use condition. The container defines an internal chamber when in the expanded condition for accommodating a volume of oil. At least one handle is mounted to the container and is adapted to facilitate maneuvering of the container from the contracted position to the expanded position. A cover is releasably mounted to the container to enclose the internal chamber. The handle may be contained within the outer boundary of the container. A valve may be in fluid communication with the internal chamber of the container. The valve permits release of gaseous media from the internal chamber. The container may define a hinge in an outer wall portion thereof, whereby wall portions adjacent the hinge are adapted to pivot upon movement of the container to the expanded condition thereof.

In another preferred embodiment, a liquid reclamation apparatus includes a container, a portable receptacle receivable within the container and dimensioned to accommodate a volume of oil sufficient to perform an oil change on a vehicle and a cover releasably mounted to the container. The cover is attached to the portable receptacle whereby removal of the cover from the container causes corresponding removal of the portable receptacle. The cover is releasably mounted to the container via a threaded connection and may define a dispenser port. The portable receptacle may include an impermeable bag.

Accordingly, the present disclosure is directed to improvement in current oil changing practices. In one preferred embodiment, an oil reclamation system is provided. The oil reclamation system includes at least one reclamation apparatus. The reclamation apparatus includes a container, a portable receptacle configured to fit within the container and dimensioned to hold a volume of oil sufficient to perform an oil change on a vehicle and having a dispenser attached thereto, and a cover releasably secured to the container. The portable receptacle preferably includes a flexible bag.

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The first and second reclamation apparatii may also be arranged and stored in vertical stacked relation. For example, the container of the first reclamation apparatii includes a recessed portion adapted to accommodate at least the cover of the second reclamation apparatii when in the vertical stacked relation of the first and second reclamation apparatii.

The oil reclamation system may further include an expandable bladder associated with the cover. The cover is adapted to expand from an initial condition to an expanded condition to secure the cover to the container in substantial fluid tight relation therewith. A pump may be positioned adjacent the cover. The pump is adapted to deliver fluids to the expandable bladder to cause expansion to the expanded condition thereof. The pump may be a manually operated pump. A relief valve may be in fluid communication with the expandable bladder to relief pressure in the bladder.

In another embodiment, an oil reclamation system includes a container being expandable from a contracted transport condition to an expanded in use condition. The container defines an internal chamber when in the expanded condition for accommodating a volume of oil. At least one handle is mounted to the container and is adapted to facilitate maneuvering of the container from the contracted position to the expanded position. A cover is releasably mounted to the container to enclose the internal chamber. The handle may be contained within the outer boundary of the container. A valve may be in fluid communication with the internal chamber of the container. The valve permits release of gaseous media from the internal chamber. The container may define a hinge in an outer wall portion thereof, whereby wall portions adjacent the hinge are adapted to pivot upon movement of the container to the expanded condition thereof.

In another preferred embodiment, a liquid reclamation apparatus includes a container, a portable receptacle receivable within the container and dimensioned to accommodate a volume of oil sufficient to perform an oil change on a vehicle and a cover releasably mounted to the container. The cover is attached to the portable receptacle whereby removal of the cover from the container causes corresponding removal of the portable

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receptacle. The cover is releasably mounted to the container via a threaded connection and may define a dispenser port. The portable receptacle may include an impermeable bag.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present disclosure are described hereinbelow with references to the drawings, wherein:

- FIG. 1 is a perspective view of the oil reclamation apparatus of the present disclosure;
- FIG. 2 is a cross-sectional view of the oil reclamation apparatus taken along the lines 2-2 of FIG. 1;
- FIG. 3 is an enlarged perspective view of the container of the oil reclamation apparatus;
- FIG. 4 is a view illustrating side by side assembly of a plurality of oil reclamation apparatii;
- FIG. 5 is a perspective view illustrating a stacked relation of two oil reclamation apparatii;
- FIG. 6 is a perspective view of an alternate embodiment of the oil reclamation apparatus of the present disclosure in a contracted transit condition;
- FIG. 7 is a cross-sectional view of the oil reclamation apparatus of FIG. 6 in the contracted condition;
- FIG. 8 is a perspective view of the oil reclamation apparatus of FIG. 6 in an expanded in use position;
- FIG. 9 is a perspective view of an alternate embodiment of the liquid reclamation apparatus of the present disclosure;

FIG. 10 is a side cross-sectional view of the liquid reclamation apparatus of FIG. 9;

- FIG. 11 is a side cross-sectional view of the portable receptacle of the liquid reclamation apparatus of FIG. 9;
- FIG. 12 is a perspective view of another embodiment of the liquid reclamation apparatus illustrating a cover with a bladder seal;
- FIG. 13 is a side cross-sectional view illustrating the bladder seal of the cover in an unexpanded condition;
- FIG. 14 is a side cross-sectional view similar to the view of FIG. 13 illustrating the bladder seal of the cover in an expanded condition secured to the container in fluid tight relation therewith; and
- FIG. 15 is side plan view of an alternate receptacle for use with the liquid reclamation apparatus.

## DETAIL DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The liquid reclamation system and apparatus of the present disclosure provides the vehicle owner with a viable option when changing the oil in his/her car. Within the empty container of the apparatus, there may be a receptacle of new oil. This receptacle is removed from the container and the used oil may be drained into the container. Once the used oil is drained from the automobile and into the container, the new oil within the receptacle is emptied into the car. Then, the empty receptacle may be placed inside of the container with the used oil and the apparatus is sealed. The container may be configured to include a recessed bottom allowing for one container to be stacked on top of another. Furthermore, the containers may contain connective slots along the side, so that one container may be secured to an

adjacent container. This horizontal and vertical connectivity facilitates storage and transport of a large number of apparatii 100, e.g., on a grate.

Referring now to the drawings, in which like reference numerals identify identical or substantially similar parts throughout the several views, FIGS. 1-3 illustrate the oil reclamation apparatus 100 of the present disclosure. Oil reclamation apparatus 100 includes container 102 dimensioned to receive and transport a liquid, e.g., oil. Container 102 has recessed bottom 104 which permits stacking of a plurality of apparatii 100 as will be discussed. Container 102 may define any shape in cross-section including circular, elliptical or polygonal. In one preferred embodiment, container 102 defines an octagonal shape having a plurality of interconnecting sides 106a-h. Other dimensions are also envisioned. Container 102 may be constructed of a variety of different materials including but not limited to polymeric and metallic materials.

Each container 102 may house portable receptacle 108 which is configured to fit within container 102 and is dimensioned to hold a liquid. Receptacle 108 includes a dispenser 110 to ease fluid transfer. Receptacle 108 may be any device capable of storing and dispensing fluid. In one embodiment, receptacle 108 is a polymeric bag filled with fluid oil "o" (see FIG. 1). Preferably, receptacle 108 is capable of accommodating a volume of liquid, e.g., five or six quarts, sufficient to perform an oil change on a vehicle. Other containers, cans, boxes, etc. are also envisioned. Dispenser 110 may be a spout or the like adapted for dispensing of oil. Dispenser 110 could be funnel or cone-shaped defining an internal lumen to permit the oil to be dispensed. Dispenser 110 may incorporate a one way valve. Other spouts, caps, nozzles etc. are also envisioned.

Container 102 may further include attachment rails 112 on at least two sides of the container 102 and attachment grooves 114 on another two sides. Attachment rails 112 of one container 102 are dimensioned to be received within attachment grooves 114 of an adjacent container 102 to facilitate storage and/or transport of a number of apparatii 100 in side by side relation. FIG. 4 illustrates several apparatii 100 stored in side by side relation with attachment rails 112 of one apparatii 100 being received within attachment grooves 114 of a second adjacent apparatii 100. Attachment rails 112 and grooves 114 may have a variety of configurations. In one preferred embodiment, the cross-sectional dimension of attachments rail 112 is generally t-shaped for reception within a correspondingly dimensioned t-shaped groove 114. Other shapes are also envisioned.

Container 102 may further include cover 116. Cover 116 may be detachably secured about rim 118 of container 102 by any means including threaded means, bayonet coupling, interference fit, etc. Cover 116 and rim 118 are dimensioned to be accommodated within recessed portion 104 of an adjacent stacked container 102 so as to interlock via a friction or interference fit with the recessed bottom 104 of container 102 thereby facilitating stacking of a large number of apparatii 100. FIG. 5 illustrates a stacked relation of two apparatii 100.

The side by side connectability of adjacent apparatii 100 as provided by attachment rails and grooves 112, 114 and the stacking capability as provided by the reception of cover 116 and rim 118 within recess 104 substantially improves storage and transport of a large number of apparatii 100. Moreover, the side by side and vertical connecting features permits for a large number of apparatii to be stored and/or transported on, e.g., a grid. The

grid may be lifted in unison by a forklift or other machine and loaded onto a transport vehicle as a single unit.

The operation of the liquid reclamation apparatus 100 of the present disclosure will now be discussed in the context of automobile engine oil replacement. Cover 116 is removed from container 102 and portable receptacle 108 is removed. Container 102 is placed underneath the automobile and the waste oil is drained into container 102. Portable receptacle 108 containing a fresh supply of oil is dispensed through dispenser 110 into the automobile, replacing the oil which was just drained. Portable receptacle 108, once emptied, may then be placed inside of container 102 with the waste oil. Cover 116 may then be secured to container 102 locking the waste oil and used portable receptacle 108 therein. Once secured, container 102 may be transported to a recycling facility for proper disposal.

Referring now to FIGS. 6-8, another embodiment of the present disclosure will be discussed. Liquid reclamation apparatus 200 includes container 202. Container 202 is preferably fabricated from a flexible membrane such as polypropylene, polyethylene, etc., which permits the container 202 to expand from the collapsed transit condition shown in FIGS. 6-7 to the expanded in use condition shown in FIG. 8. In one preferred embodiment, container 202 defines medial hinge line 204 about which the membrane portions 205 adjacent and intersecting the hinge line 204 pivot to assume the expanded condition of FIG. 8. Preferably, the thickness of membrane portions 205 of container 202 increases or is greatest adjacent hinge line 204 to ensure that the container 202 remains in the expanded in use condition once it is deployed. It is also envisioned that the membrane may incorporate reinforcing structure such as strips of rigid polymeric material adjacent hinge line 204 to increase stability upon

expansion of container 202. One skilled in the art may readily determine the dimensioning and material selection required to accomplish this objective.

Container 202 further includes upper and lower housing components 208, 210 disposed within an internal chamber of container 202. Upper and lower housing components 208, 210 may be fabricated from a polymeric material or the like and are preferably embedded, integrally formed or attached to container 202 by conventional means. Upper housing component 208 incorporates cap or cover 212 which is releasably mounted to the housing component 208. In one preferred embodiment, cap 212 and upper housing component 208 incorporate cooperating threads 214, 216 to establish the releasable attachment of the cap 212 to the housing component 208. Other connection arrangements are also envisioned including bayonet coupling, interference fit, etc. Cap 212 incorporates handle 218 which facilitates expansion of container 202 to the expanded condition by providing a means upon which the operator may grasp and expand the container 202. Handle 218 is preferably recessed within cap 212 so as to not extend beyond the outer boundary of container 202. It is envisioned that lower housing component 210 may incorporate a handle. Cap 212 further incorporates check valve 220 in fluid communication with the internal chamber of container 202. Check valve 220 permits the inflow of air into the container 202 so as to maintain the expanded condition of the container 202 while preventing the exit of air from the container 202. Check valve 220 may also be adapted to prevent the flow of oil from container 202 subsequent to performing the oil change.

Preferably, container 202 is shipped in the compressed condition of FIGS. 6-7 prior to use. As appreciated, multiple apparatii 200 may be packaged in its compressed condition into a single package, e.g., in stacked relation. Container 202 may or may not be

provided with oil receptacle having a supply of oil sufficient to perform an oil change. In use by an operator, container 202 is expanded from the transit condition of FIGS. 6-7 to the expanded condition of FIG. 8. Cap 212 is removed and the used oil is drained from the vehicle into container 202. Upon completion, cap 212 is placed back onto container 202 and secured thereon through the threaded means.

Referring now to FIGS. 9-11, another embodiment of the present disclosure will now be discussed. Liquid reclamation apparatus 300 includes container 302 and dispenser cover 304 releasably mounted to the container. Portable flexible receptacle 306 is attached to dispenser cover 304 and is disposed within container 302. Receptacle 306 is dimensioned to hold oil. Dispenser cover 304 defines spout 308 to permit dispensing of the oil contained within receptacle 306. Dispenser cover 304 may be detachably mounted to container 302 via a threaded connection 310. Apparatus 300 further includes cap 312 which is releasably mounted to spout 308 of dispenser cover 304 by conventional means.

In use, apparatus 300 may be purchased full of oil or it may be empty. If full, dispenser cover 304 is unscrewed and the dispenser cover with attached portable receptacle 306 are removed from container 302. The waste oil or fluid may then be drained into container 302. Cap 310 is removed from spout 308 and the oil from the portable receptacle 306 is subsequently emptied into the engine. Once receptacle 306 is emptied, dispenser cover 304 with mounted cap 310 is secured to container 302. Apparatus 300 may then be sent to the proper recycling plant if required.

Referring now to FIGS. 12-14, another embodiment of the present disclosure is illustrated. Liquid reclamation apparatus 400 includes container 402 and cover 404 adapted to

be releasably mounted to the container 402. Container 402 is substantially similar to the containers described in the prior embodiments, and reference is made thereto for the specifics of the container 402. Cover 404 includes internal cap 406 and outer circumferential flange 408 disposed radially outwardly from the internal flange 406. Outer flange 408 defines a stepped region consisting of first transverse wall 410 relative to axis "k" and second transverse wall 412 interconnected to the first transverse wall 410 through longitudinal wall 414.

As best depicted in FIGS. 13-14, cover 404 also includes pump 416 (not shown in FIG. 12), fluid conduit 418 in fluid communication with the pump 416, and expandable bladder 420 (not visible in FIG. 12). Pump 416 may be any suitable manual pump adapted for compression to deliver fluids, e.g., air, into expandable bladder 420 via fluid conduit 418. Fluid conduit 418 is shown schematically; however, it is appreciated that fluid conduit 418 may be a tube extending through internal cap 406 or through the wall of the internal cap 406.

Expandable bladder 420 may be any suitable balloon member or the like fabricated from an elastomeric or polymeric material. Preferably, expandable bladder 420 is expandable from the initial position depicted in FI G. 13 to the expanded condition of FIG. 14. Expandable bladder 420 may be secured to the inner surface of first transverse wall 410 with the use of cements or adhesives or the like. Other means for attaching expandable bladder 420 to internal cap 406 are also envisioned.

Cover 404 may further include a check valve 424 in fluid communication with pump 416, fluid conduit 418 or expandable bladder 420. Check valve 424 preferably serves as a relief valve adapted to ensure that the pressure in expandable member 422 does not exceed a

predetermined value. Check valve 424 may also function as a stop or overflow valve where the fluid may be bled. Any suitable valve may be utilized.

The operation of liquid reclamation apparatus 400 will now be discussed. The oil is dispensed in container 402. Cover 404 is positioned over annular port wall 424 of container 404 as shown in FIG. 13. Thereafter, manual pump 416 is actuated by the operator to deliver fluids into expandable bladder 420 to cause the expandable bladder 420 to assume the expanded condition of FIG. 14. As illustrated, expandable bladder 420 will expand such that a portion of the expandable bladder 420 engages the interior of transverse wall 426 of container 402. In this position, expandable bladder 420 secures cover 404 to container 402. In addition, expandable bladder 420 engages the interior surfaces of annular port wall 424 and transverse wall 426 of container 402 in substantial sealed relation therewith. Thus, expandable bladder 420 in the expanded condition of FIG. 14 secures cover 404 to container 402, and also seals the interior of the cover 404 relative to the container 402 to prevent any release of oil from the container 402.

FIG. 15 illustrates an alternate embodiment of a receptacle for use with the oil reclamation apparatus 100. For example, receptacle 500 may be substituted for receptacle 108 of the embodiment of FIG. 1. Receptacle 500 includes receptacle member 502, handle 504 at one end of the receptacle member 502 and dispenser 506 at the other end of the receptacle member 502. Receptacle member 502 is preferably flexible and defines a general cylindrical configuration when expanded or filled with oil. Receptacle member 502 is also relatively collapsible when devoid of oil. Handle 504 provides a means for the user to readily grasp receptacle 500 to assist in dispensing the oil. Handle 504 is preferably secured to receptacle member by conventional means. In one preferred embodiment, handle 504 is pivotally

mounted to receptacle member 502 via pivot pins 508. Handle 504, thus, may pivot downwardly as shown by directional arrows toward receptacle member 502 to reduce the overall length and profile of receptacle 502, thereby, facilitating storage within container 102 of the apparatus 500. Handle 504 may also be monolithically formed with receptacle member 502 and be an extension of the receptacle member 502. In this regard, handle 504 may pivot along a driving hinge 510 (see FIG. 15) between the two components. Dispenser 506 defines neck 512 and cap 514 which seals the dispenser 506. Cap 514 may be secured to neck 512 via conventional means including screw threads, bayonet coupling, snap fit, frictional fit, etc. In one embodiment, cap 514 may be secured via a cement or adhesive and removed from neck 512 via a tearing action. Alternatively, cap 514 may be connected to neck 512 along tear line 516 and removed therefrom along the tear line. It is also envisioned that dispenser 506 and receptacle member 502 may be monolithically formed of a suitable polymeric material and further envisioned that receptacle may be entirely formed as a monolithically single unit.

It will be understood that various modifications and changes in form and detail may be made to the embodiments of the present disclosure without departing from the spirit and scope of the invention. Therefore, the above description should not be construed as limiting the invention but merely as exemplifications of preferred embodiments thereof. Those skilled in the art will envision other modifications within the scope and spirit of the present invention as defined by the claims appended hereto. Having thus described the invention with the details and particularity required by the patent laws, what is claimed and desired protected is set forth in the appended claims.

#### WHAT IS CLAIMED IS:

1. An oil reclamation system, which comprises:

at least one reclamation apparatus, said reclamation apparatus including a container, a portable receptacle configured to fit within said container and dimensioned to hold a volume of oil sufficient to perform an oil change on a vehicle, and having a dispenser attached thereto, and a cover releasably secured to said container.

- 2. The oil reclamation system according to claim 1 wherein said portable receptacle includes a flexible bag.
- 3. The oil reclamation system according to claim 1 including threaded means for releasably securing said cover to said container.
- 4. The oil reclamation system according to claim 1 including first and second reclamation apparatii connected to each other in side by side relation.
- 5. The oil reclamation system according to claim 4 wherein said first reclamation apparatus includes at least one attachment rail adjacent an outer wall portion of said container and said second reclamation apparatus includes at least one attachment groove adjacent an outer wall portion of said container for receiving said at least one attachment rail to connect said containers of said first and second oil reclamation apparatii.
- 6. The oil reclamation system according to claim 5 wherein said first reclamation apparatus further includes at least one attachment groove adjacent an outer wall

portion of said container and said second reclamation apparatus includes at least one attachment rail adjacent an outer wall portion of said container.

- 7. The oil reclamation system according to claim 1 including first and second reclamation apparatii arranged in vertical stacked relation.
- 8. The oil reclamation system according to claim 7 wherein said container of said first reclamation apparatii includes a recessed portion adapted to accommodate at least said cover of said second reclamation apparatii when in said vertical stacked relation of said first and second reclamation apparatii.
- 9. The oil reclamation system according to claim 1 wherein said portable receptacle includes a volume of oil sufficient to perform an oil change on a vehicle.
- 10. The oil reclamation system according to claim 1 including an expandable bladder associated with said cover and adapted to expand from an initial condition to an expanded condition to secure said cover to said container in substantial fluid tight relation therewith.
- 11. The oil reclamation system according to claim 10 including comprising a pump positioned adjacent said cover, said pump adapted to deliver fluids to the expandable bladder to cause expansion to the expanded condition thereof.
- 12. The oil reclamation system according to claim 11 wherein said pump is a manually operated pump.

- 13. The oil reclamation system according to claim 11 including a relief valve in fluid communication with said expandable bladder.
  - 14. An oil reclamation apparatus, which comprises:

a container being expandable from a contracted transport condition to an expanded in use condition, said container defining an internal chamber when in said expanded condition for accommodating a volume of oil;

at least one handle mounted to said container and adapted to facilitate
maneuvering of said container from said contracted position to said expanded position; and
a cover releasably mounted to said container to enclose said internal chamber.

- 15. The oil reclamation apparatus according to claim 14 wherein said handle is contained within said outer boundary of said container.
- 16. The oil reclamation apparatus according to claim 14 including a valve in fluid communication with said internal chamber of said container, said valve permitting release of gaseous media from said internal chamber.
- 17. The oil reclamation apparatus according to claim 14 wherein said container defines a hinge in an outer wall portion thereof, whereby wall portions adjacent said hinge are adapted to pivot upon movement of said container to said expanded condition thereof.
  - 18. A liquid reclamation apparatus which comprises: a container;

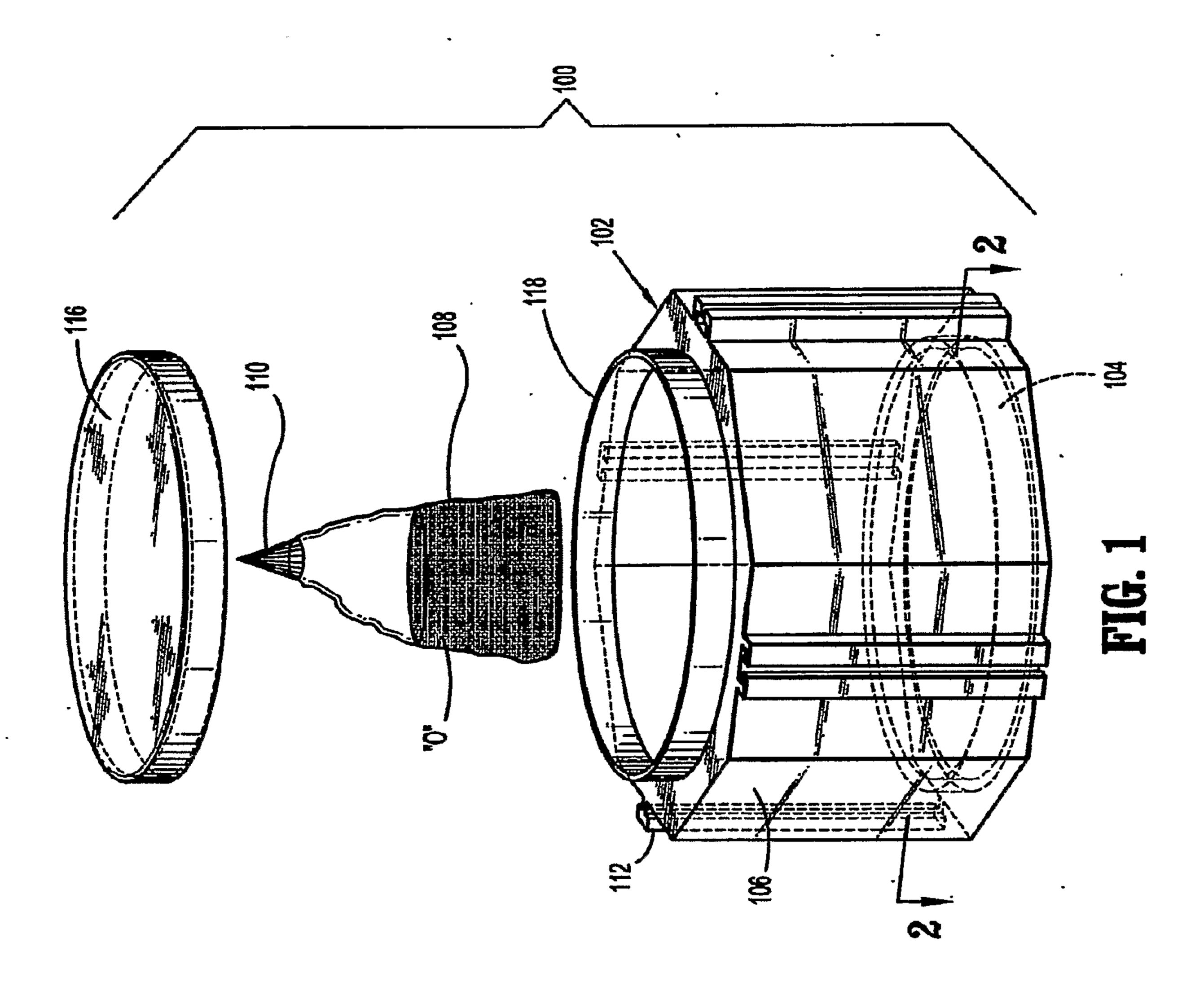
a portable receptacle receivable within said container and dimensioned to accommodate a volume of oil sufficient to perform an oil change on a vehicle; and

a cover releasably mounted to said container, said cover being attached to said portable receptacle whereby removal of said cover from said container causes corresponding removal of said portable receptacle.

- 19. The liquid reclamation apparatus according to claim 18 wherein said cover is releasably mounted to said container via a threaded connection.
- 20. The oil reclamation apparatus according to claim 18 wherein said cover includes a dispenser port.

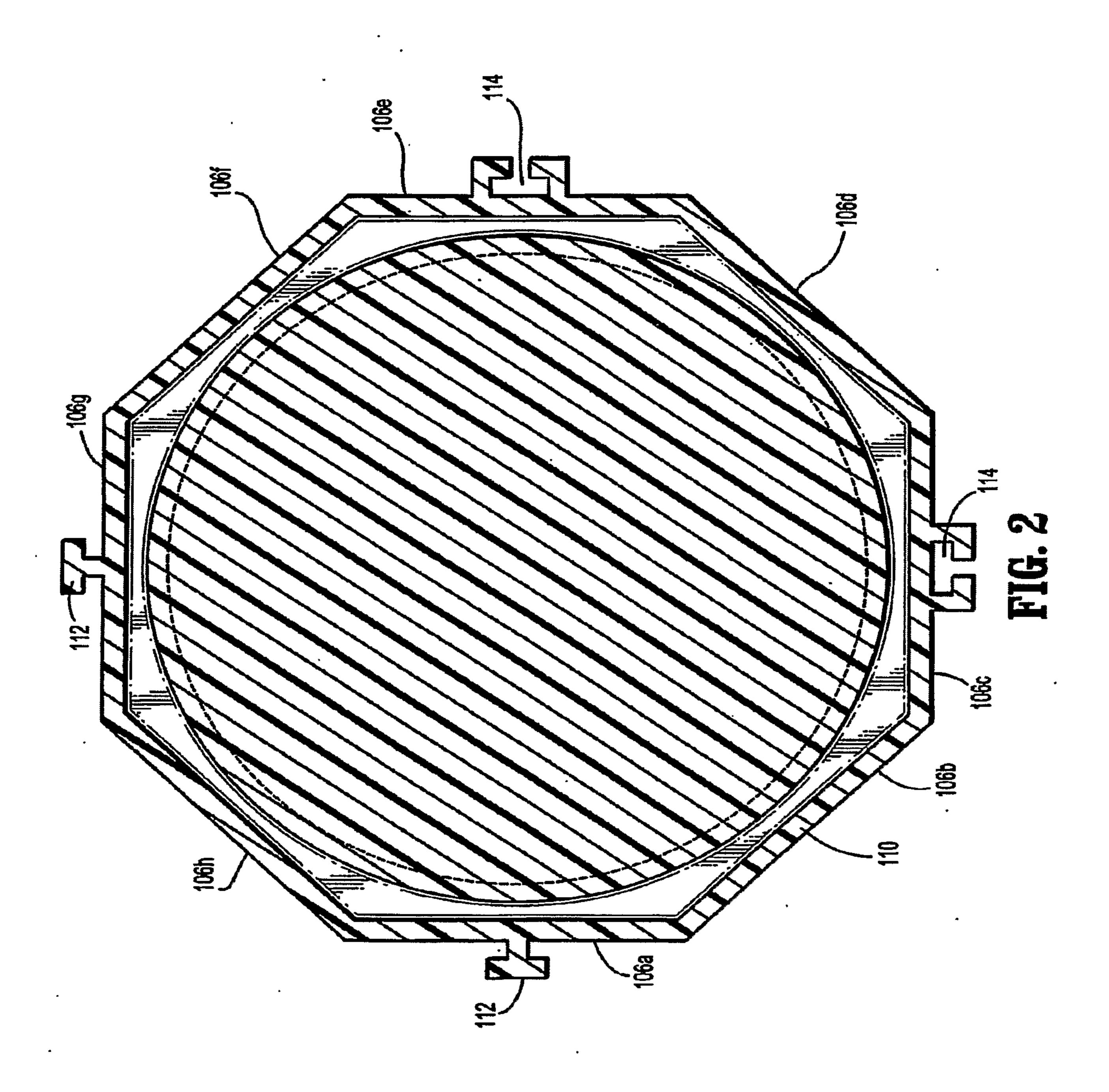
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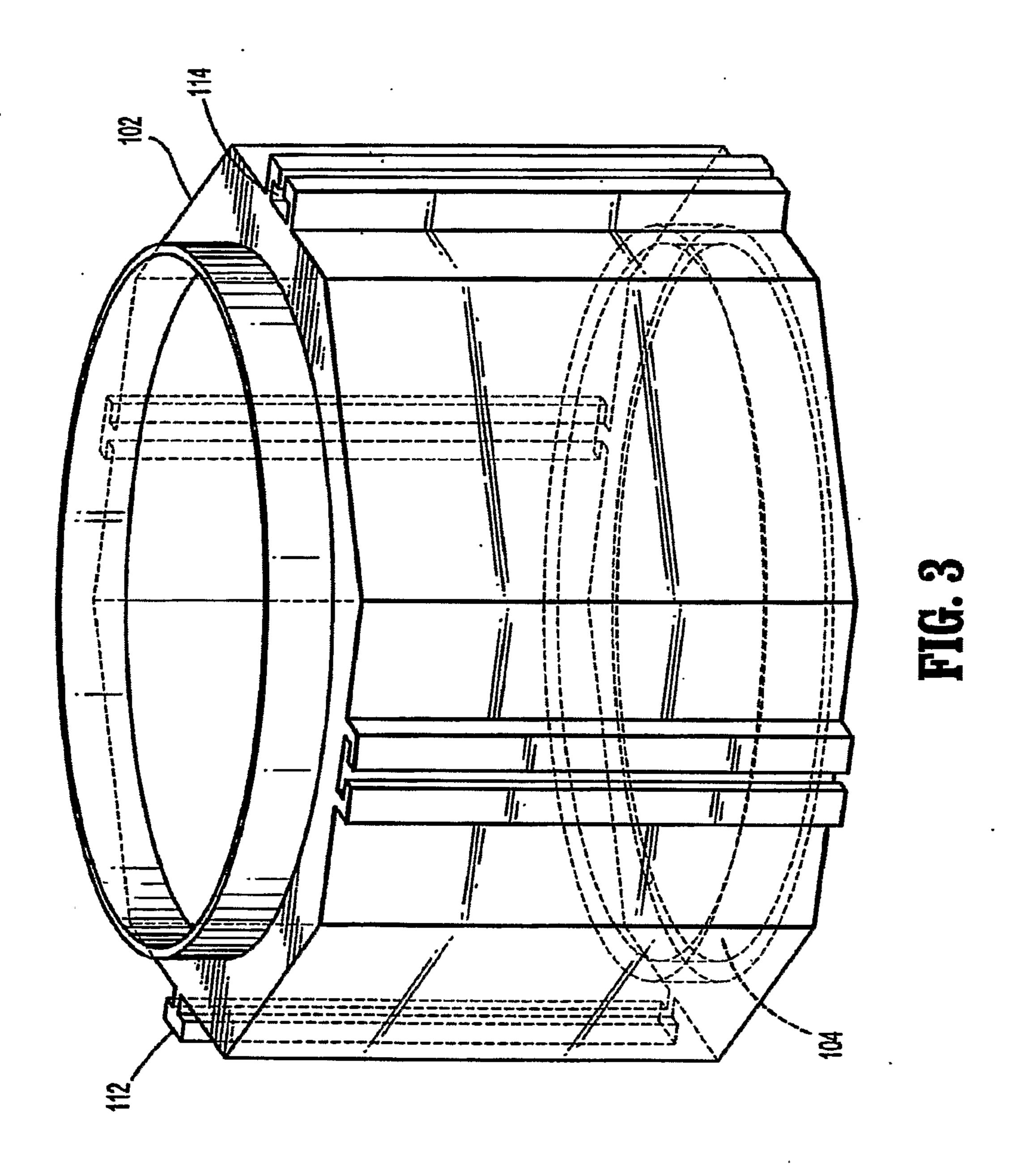
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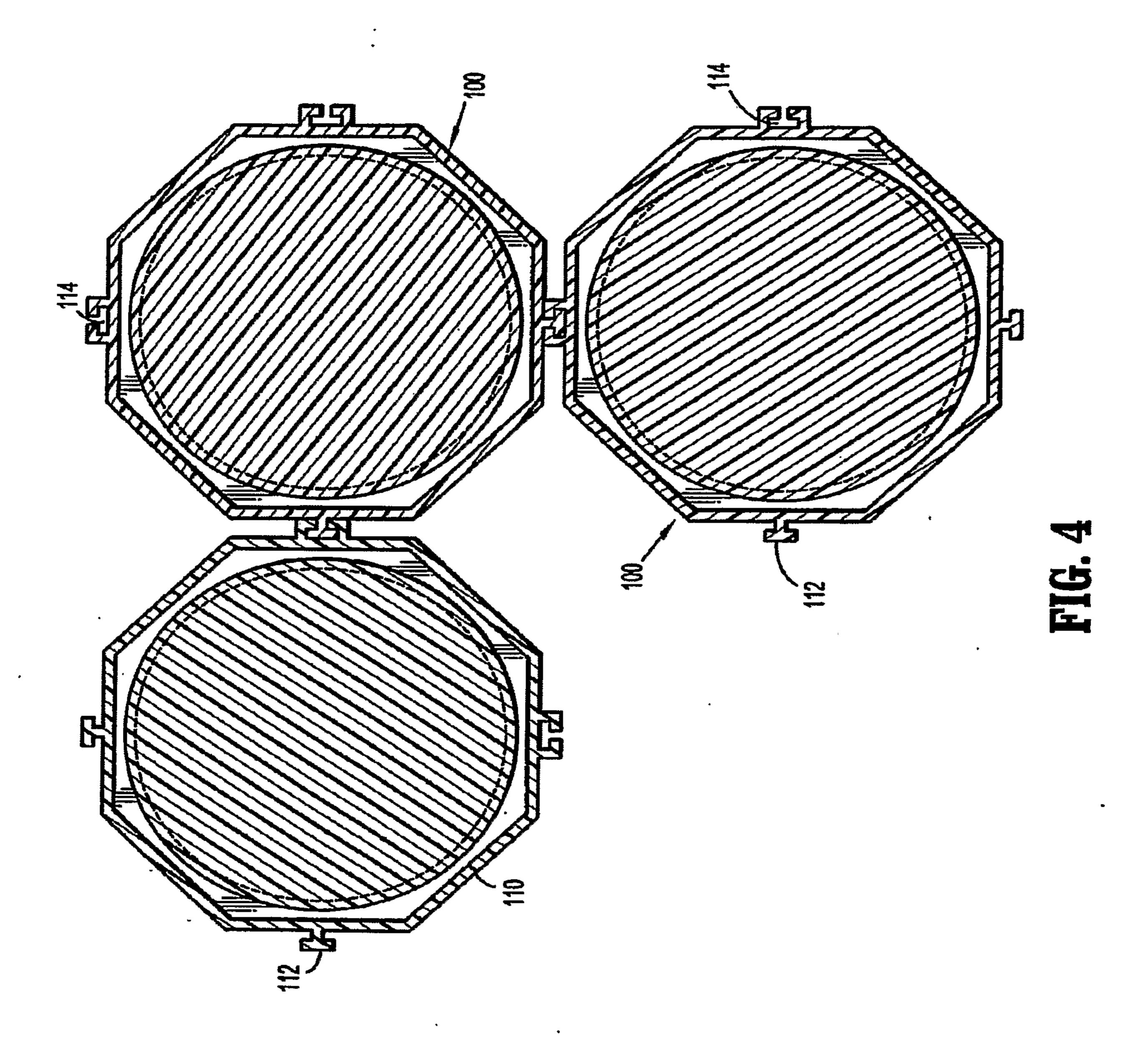


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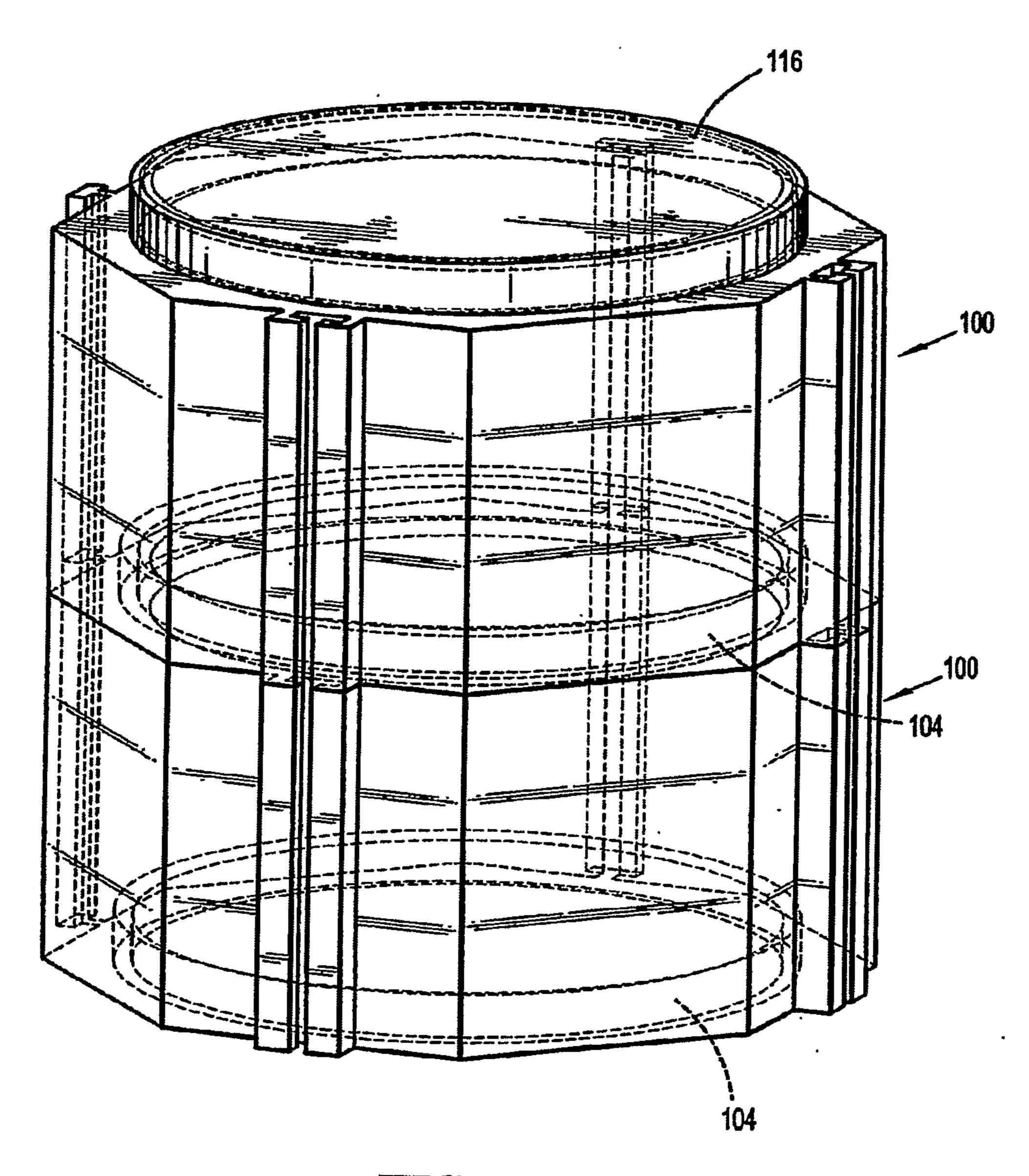


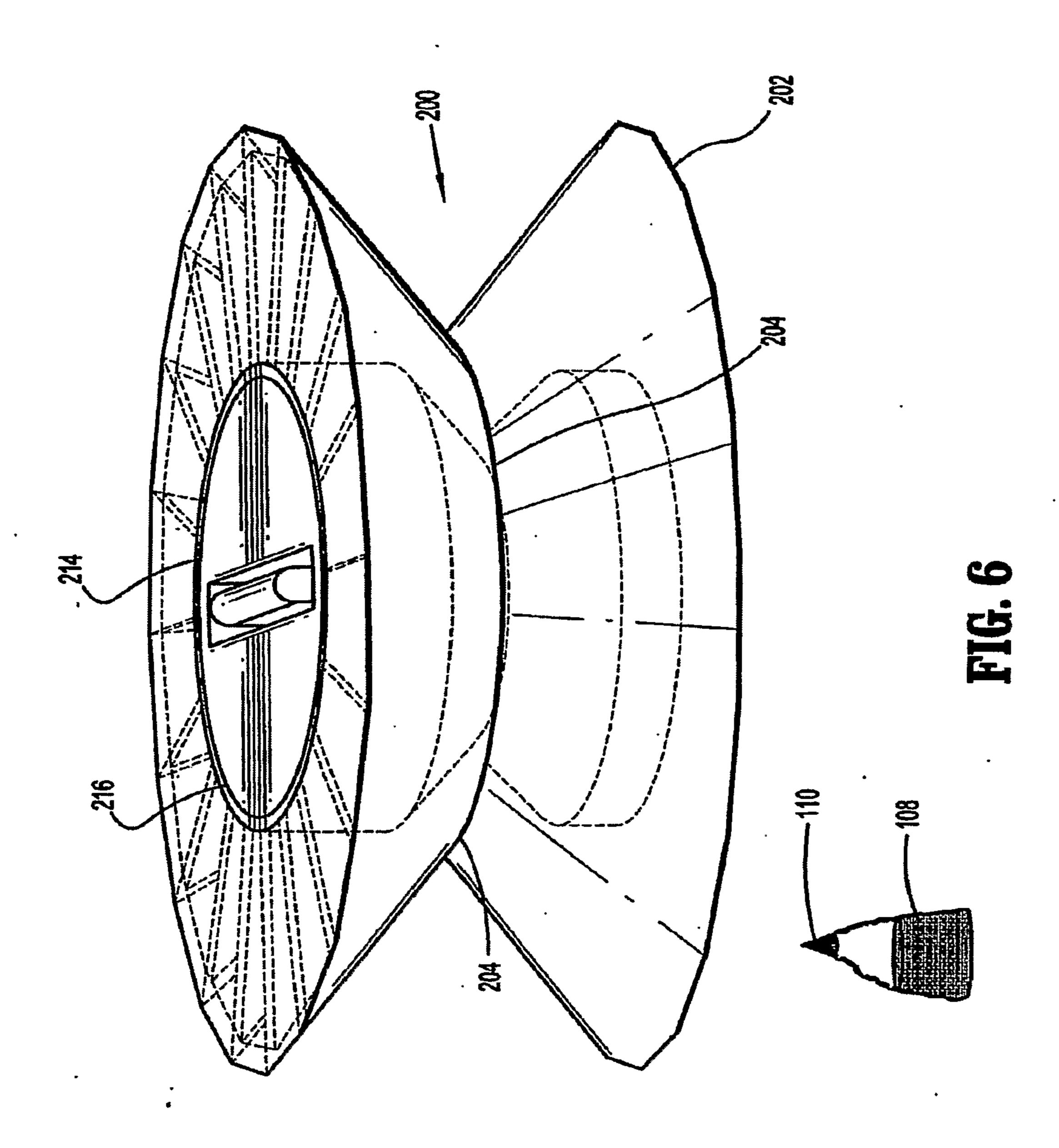
FIG. 5

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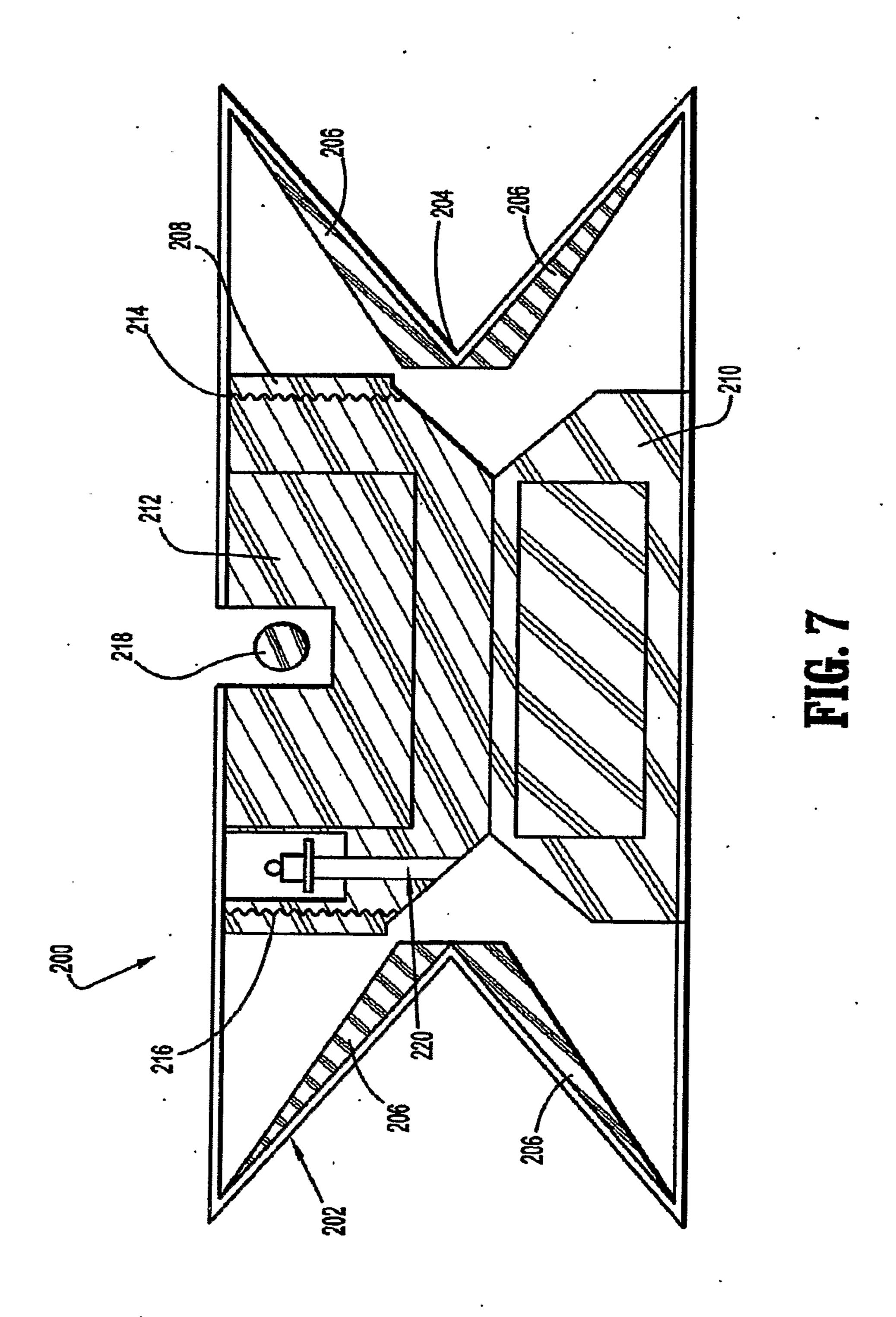
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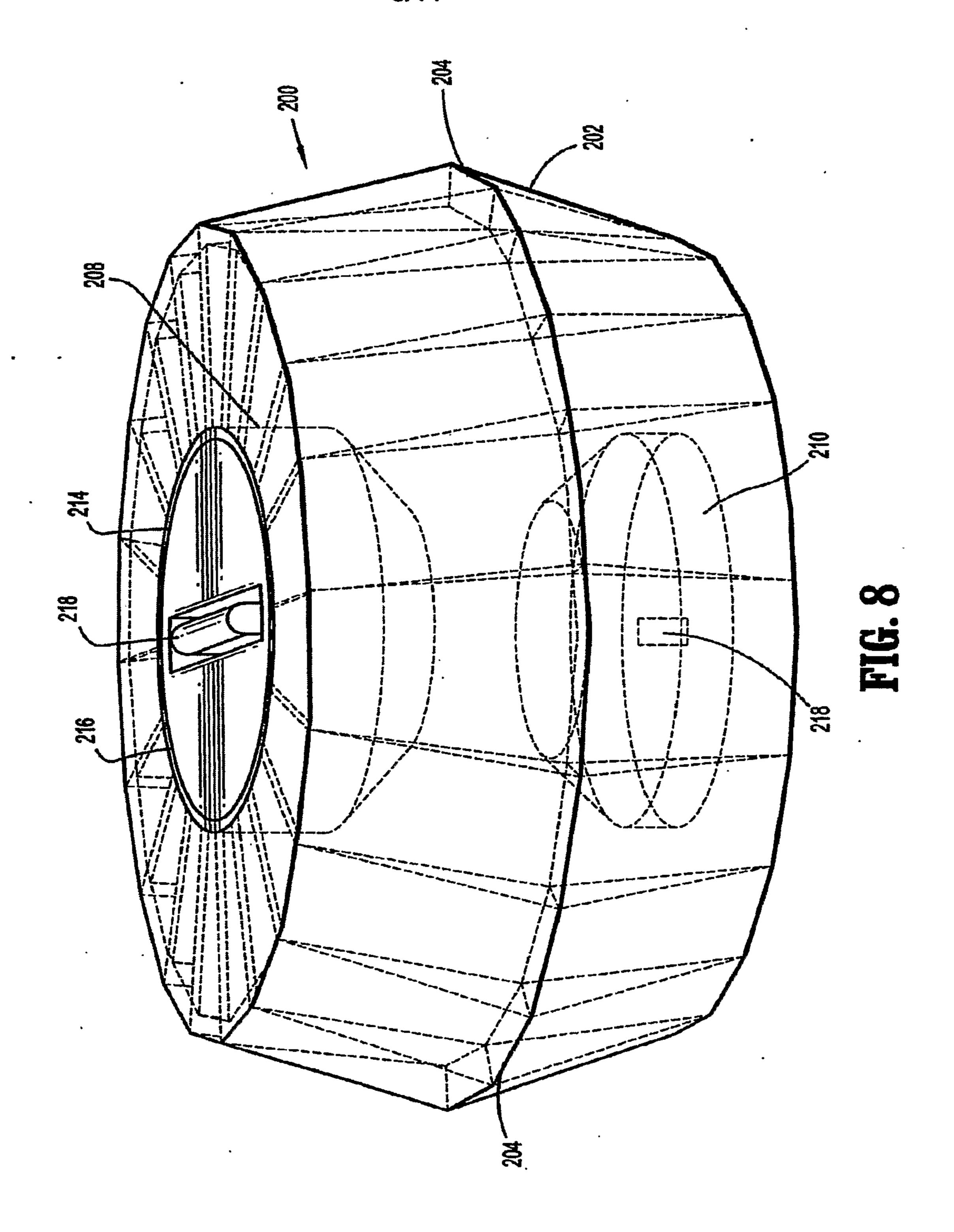
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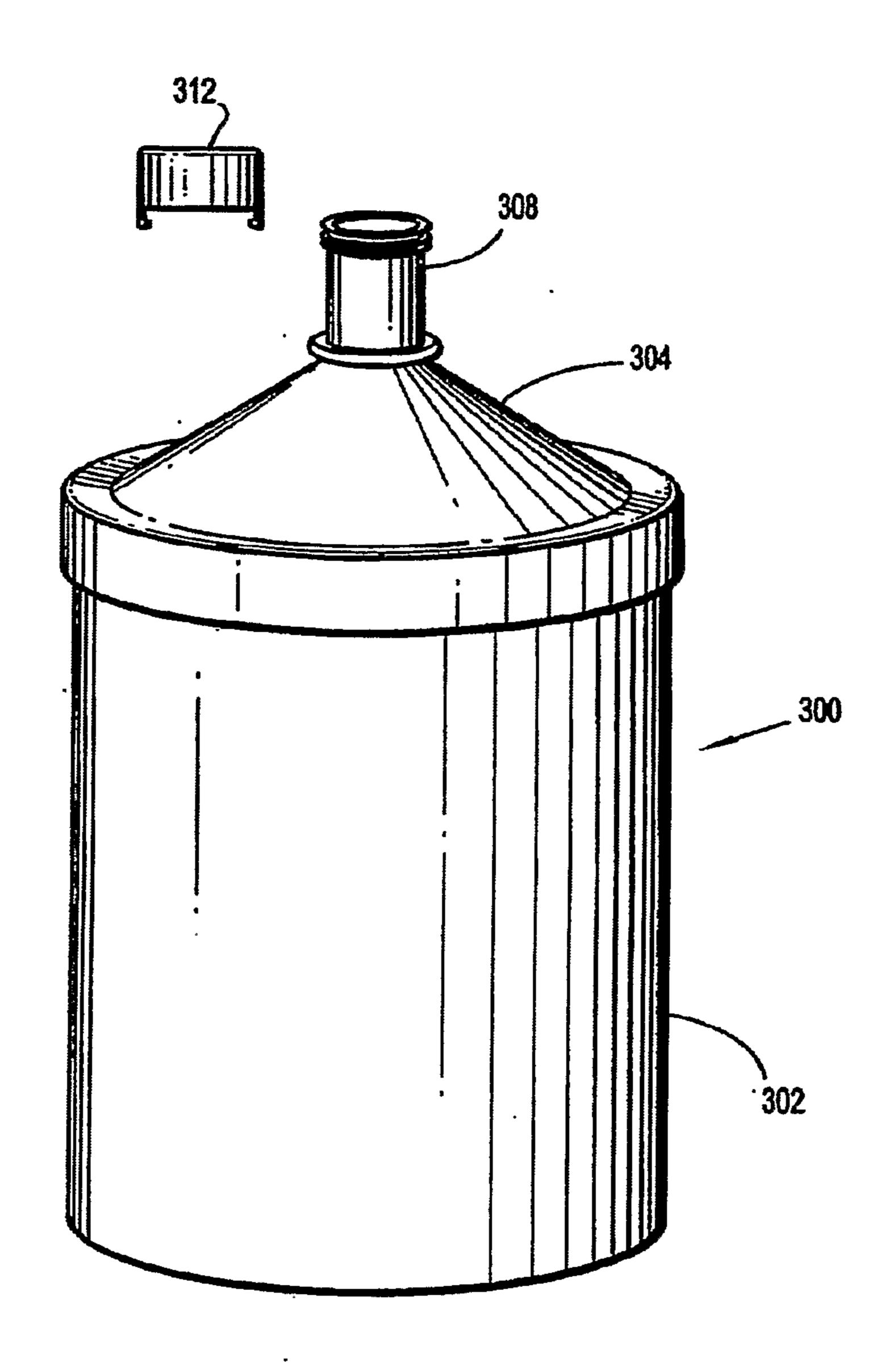


FIG. 9

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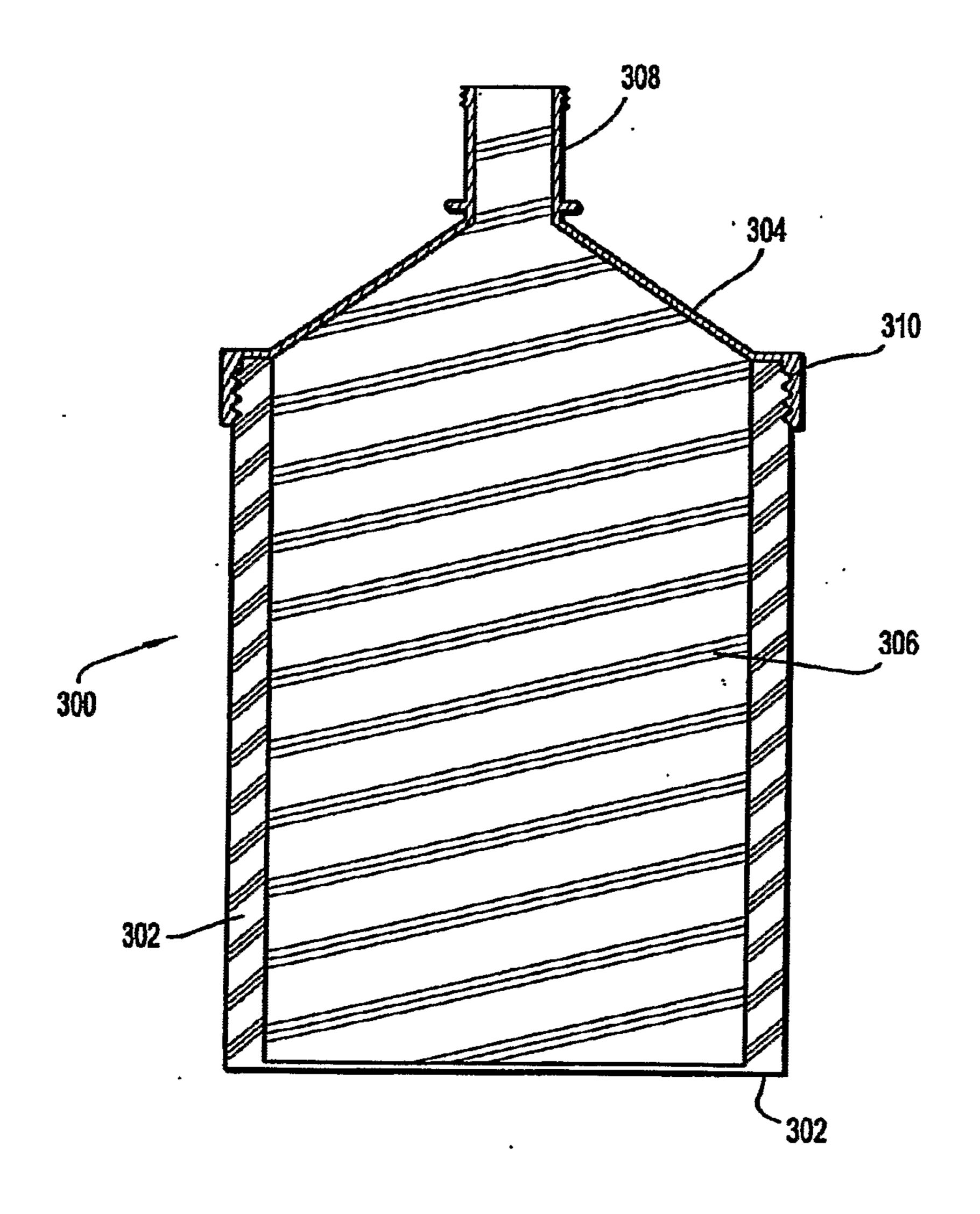


FIG. 10

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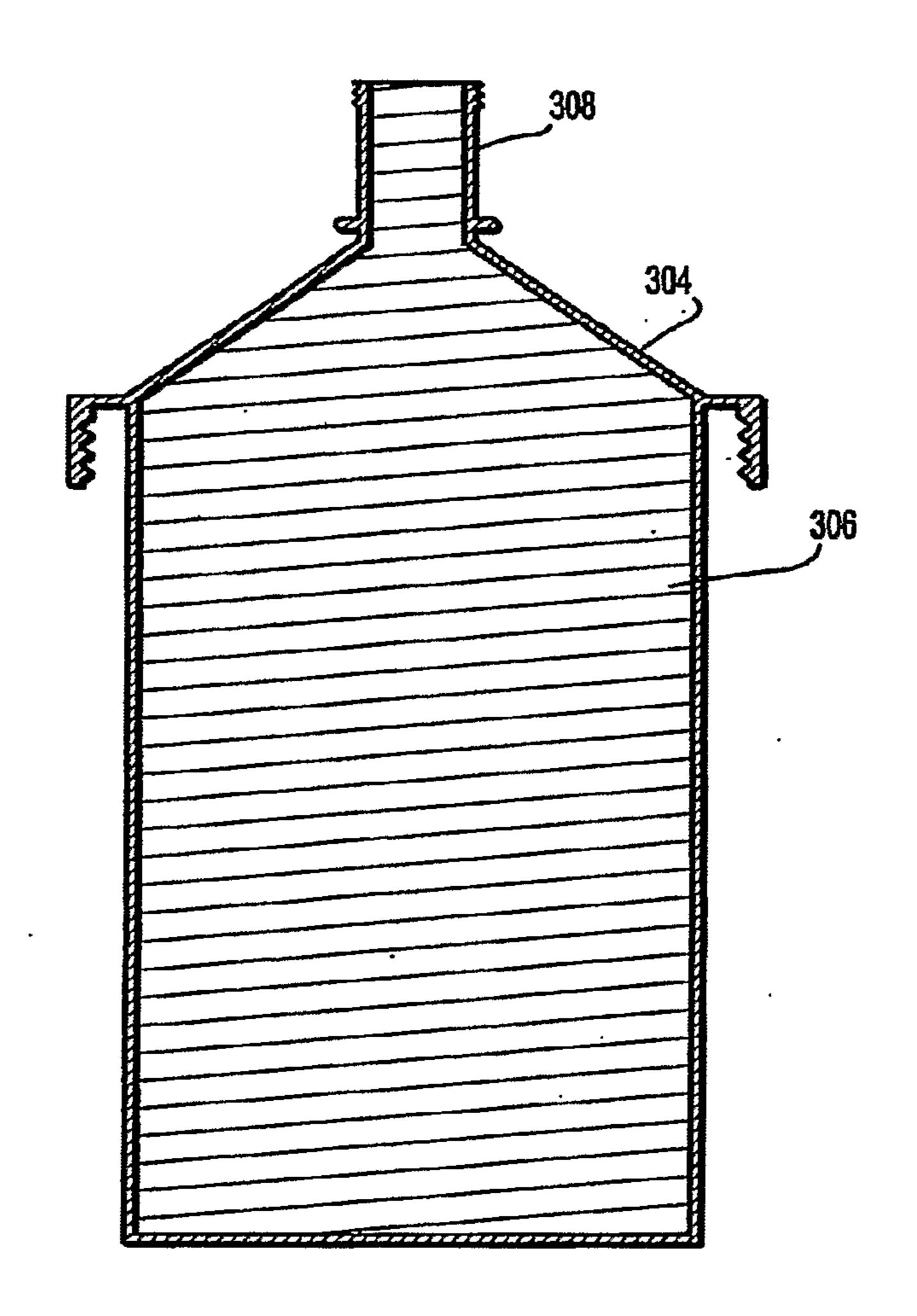


FIG. 11

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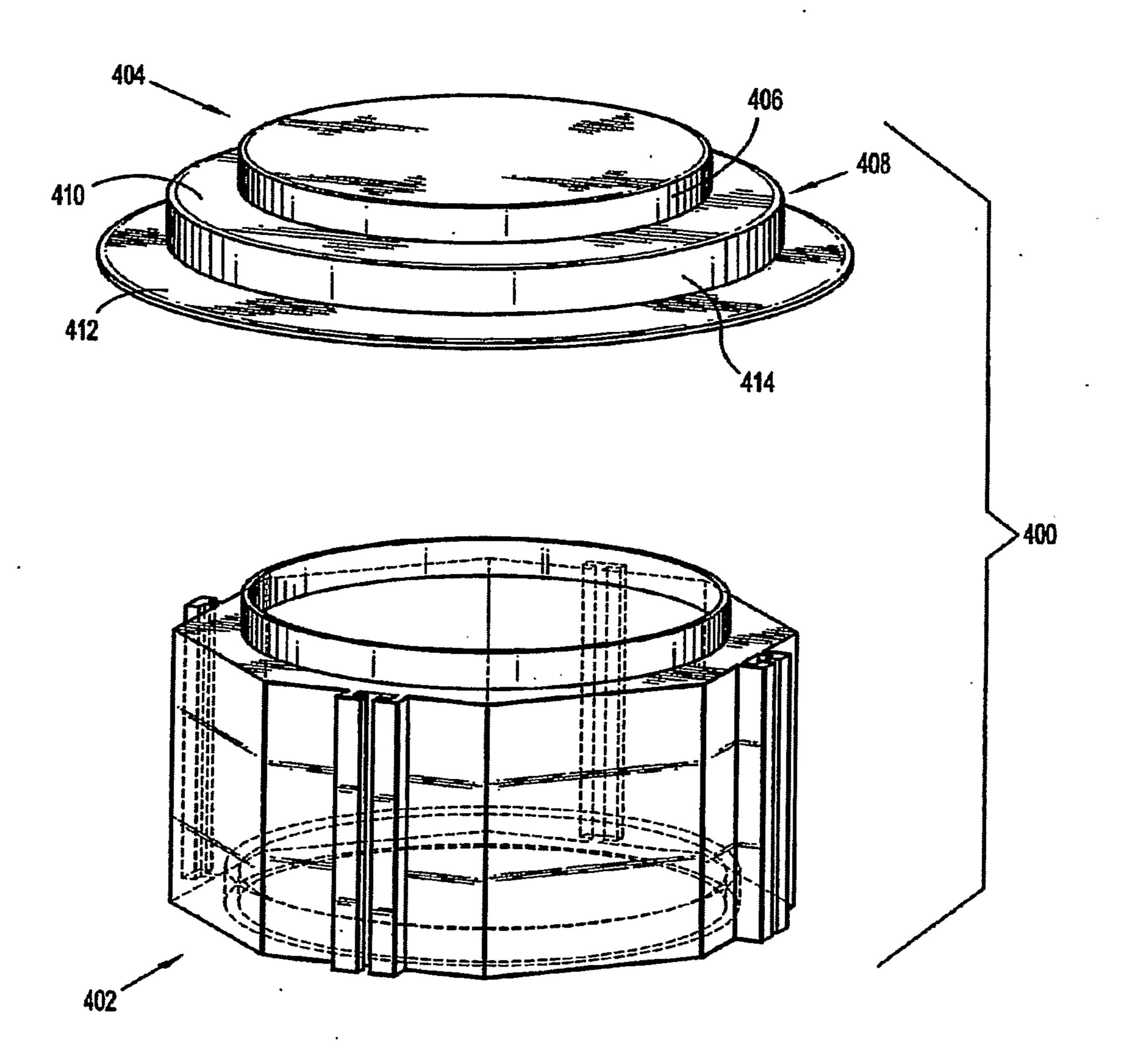
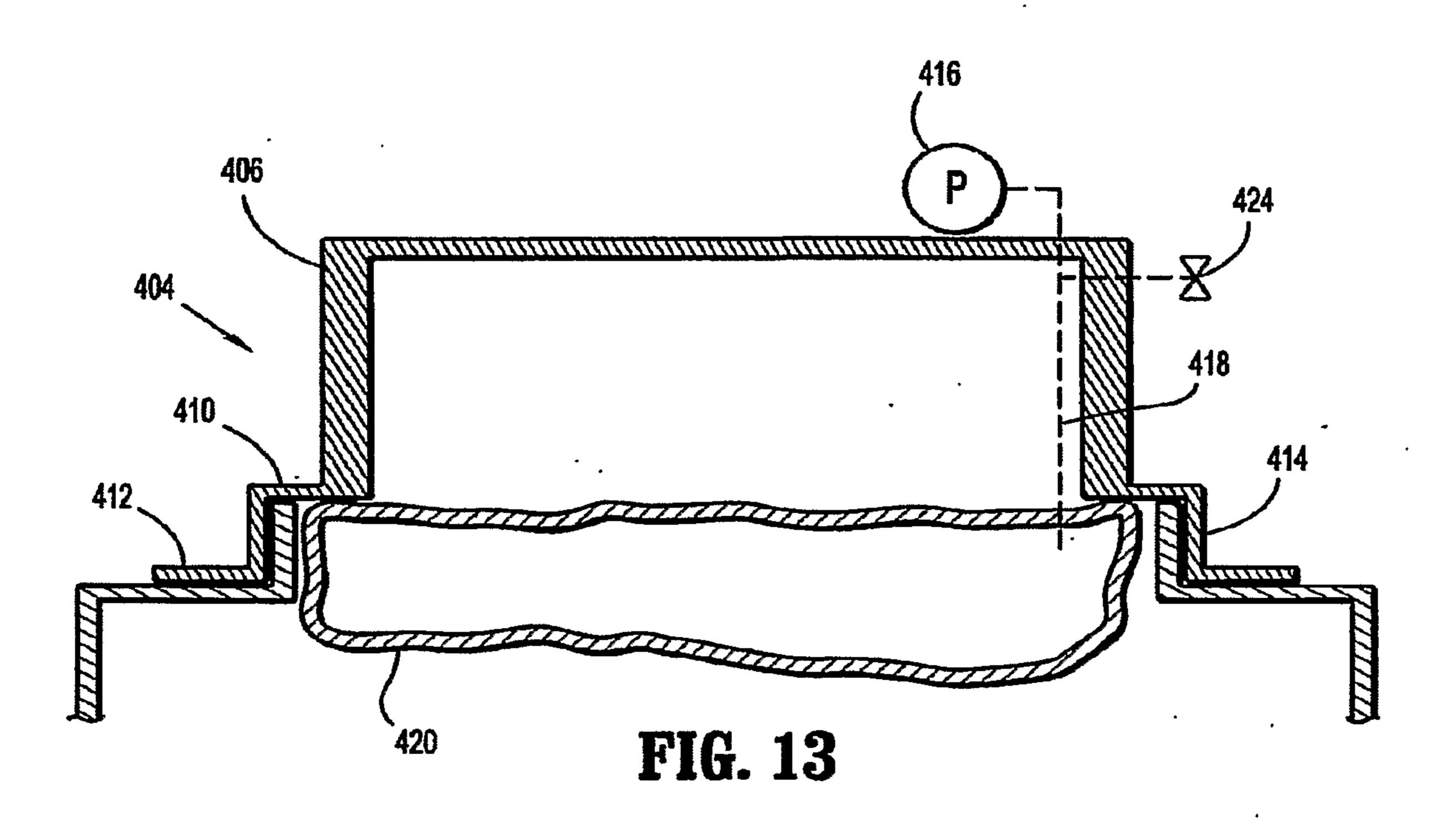
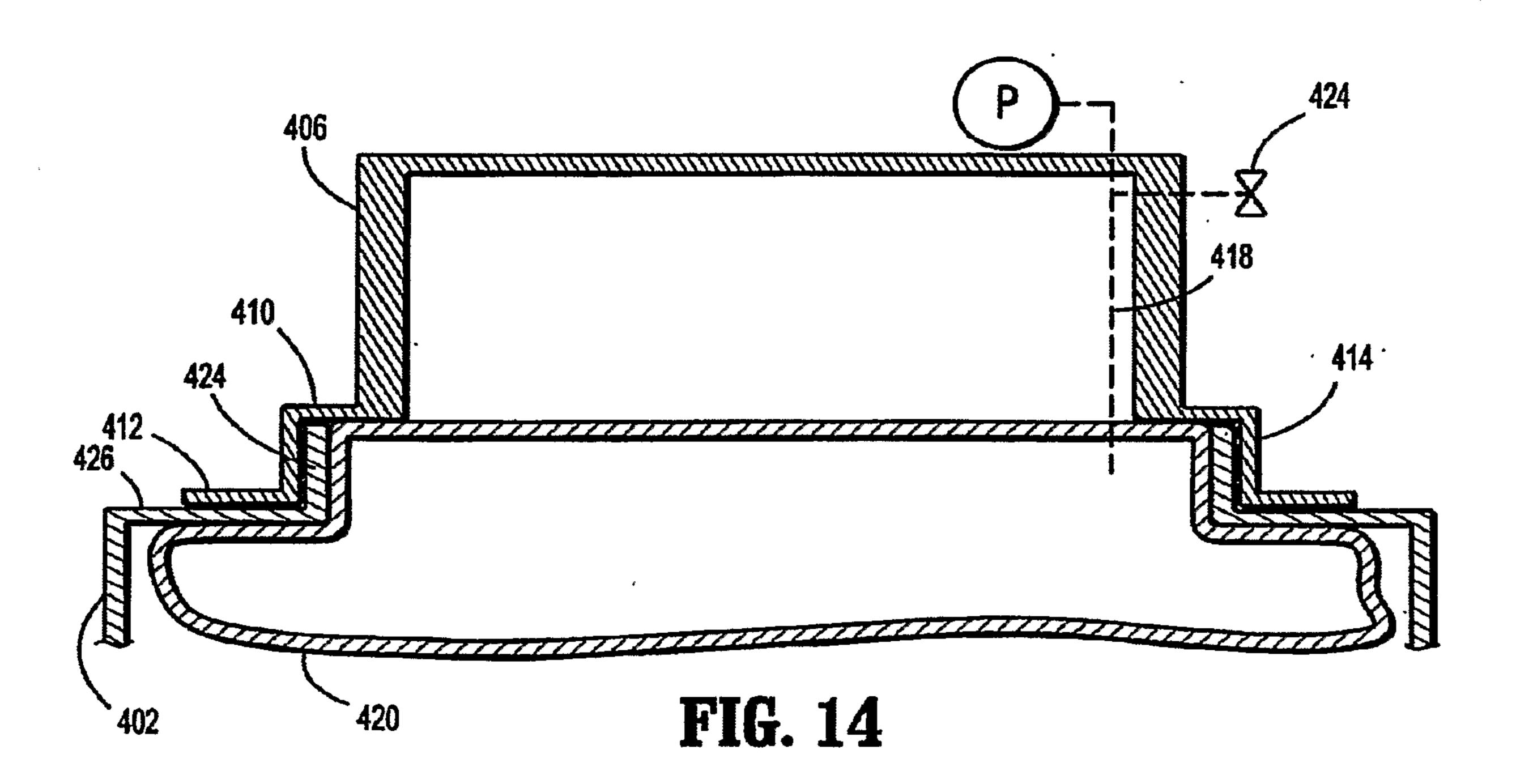


FIG. 12

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