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(54) **Storage container**

(57) A storage container for hazardous material, such as transuranic waste, has a stainless steel can body covered by a stainless steel lid. The can body has a locking collar welded thereto and a locking ring fastened to the lid removably mounted within the locking collar. Locking tabs on the locking ring are received beneath locking shoulders on locking collar upon rotating the locking to hold the lid closed. A U-shaped handle is pivoted on the locking ring for rotating the locking ring to lock the lid to the locking collar and thus to the can body, the U-shaped handle being further used to lift the storage container. A spring biased locking pin with a thumb operated tab is coaxial with one pintle of the U-shaped handle, the tab being squeezed toward the handle by the operators thumb to unlock the pin against the bias of a coil spring so as to allow the locking ring to rotate to an unlocked position when it is desired to remove the lid from the can body.

The storage container is equipped with draining means and venting means.

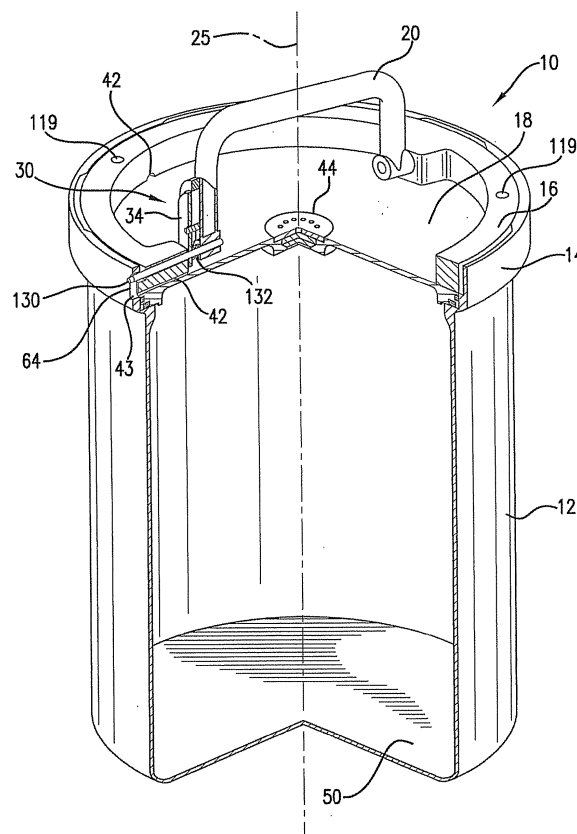


FIG.2

Description

Field of the Invention:

[0001] The present invention relates to storage containers. More particularly, the present invention relates to storage containers especially useful for storing radioactive materials, such as but not limited to, plutonium in the form of oxides and salts, as well as in other forms.

Background of the Invention:

[0002] Plutonium is a man made radioactive element, which is used as an explosive ingredient in nuclear weapons as well as a fuel for nuclear reactors. It has the important nuclear property of being readily fusionable with neutrons and is available in relatively large quantities. Caution must be exercised in handling plutonium to avoid unintentional formation of a critical mass. Plutonium in liquid solutions is more apt to be critical than solid plutonium so it also very important to avoid unintentional creation of a liquid solution. Since plutonium is considered to be highly carcinogenic, it is important that plutonium in any form be contained so as not to escape into the surrounding environment where it can be inhaled or otherwise ingested by humans or other living beings. Frequently, plutonium oxides and salts are in the form of powders which require very special handling to ensure that particles do not become suspended in the air and liquid does not come into contact with the powders. Optionally, such containers are vented through high efficiency particle filters.

Summary of the Invention:

[0003] A storage container for hazardous material, such as radioactive material, comprises a can body having a cylindrical side wall with a closed bottom wall, defining a space for containing the hazardous material. A rim is disposed at an open top of the can body, the rim having an annular land and a locking collar is welded to the rim adjacent the annular land. The locking collar has grooves with arcuate shoulders, the grooves having spaces therebetween and the arcuate shoulders defining arcuate locking grooves therebeneath and having spaced locking apertures therein. A lid is configured for receipt within the locking collar, inboard of the arcuate locking grooves. The lid has a sealing arrangement for sealing the lid with respect to the space defined by the can body. A locking ring is mounted on the lid in fixed relation to the lid, the locking ring having spaced locking tabs for positioning in the locking grooves beneath the arcuate locking shoulders. A handle is attached to the locking ring for rotating the locking ring to position the locking tabs in the locking grooves beneath the locking shoulders. To lock the lid on the can body, a latch biased to the closed position is associated with the handle.

[0004] In another aspect of the storage container, the

latch is a spring biased pin engaging a locking hole in the locking collar to prevent the locking ring from rotating with respect to the locking collar.

[0005] In still a further aspect of the storage container, there are a plurality of locking holes in the collar, any one of which is engaged by the spring biased pin.

Brief Description of the Drawings:

[0006] Various other features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which the reference characters designate the same or similar parts throughout the several views, and wherein:

Fig 1A is a perspective view of a storage container configured in accordance with the present invention; Fig. 1B is a perspective view of the storage container of Fig. 1A with pewter shielding which attaches with clips adjacent to the top of the container;

Fig. 2 is a perspective view, partially in elevation, showing a handle positioned for rotating a locking ring to lock a lid in place on the storage container and for gripping to lift the storage container;

Fig. 3A-3C are perspective views of the storage container of Figs. 1A, 1B and 2 illustrating how the container is closed, locked and opened;

Fig. 4 is a perspective view of a can body used to configure the storage container;

Fig. 5 is a perspective view of a locking collar which is fixed to the can body;

Fig. 6 is a perspective view of a lid which closes the top opening of the container body;

Fig. 7 is a perspective view of a locking ring which is connected to the lid;

Fig. 8 is an exploded perspective of a handle which is pivoted to the locking ring of Fig. 7, and

Fig. 9 is a perspective view of a vent assembly which includes a filter element.

Detailed Description of the Drawings:

[0007] Referring now to Figs. 1, 1A and 2, storage containers 10 and 10A, respectively, are used for storing hazardous radioactive materials, such as but not limited to, plutonium in the form of oxides and salts, as well as other hazardous materials. The container 10 includes a can body 12, a locking collar 14, a locking ring 16, a lid 18 and a pivoted handle 20. The pivoted handle 20 is pivoted from the Fig. 1A and 1B position for storage to the Fig. 2 position for locking and unlocking the lid 18 in place on the can body 12 and for lifting the storage container 10. The can body 12 is preferably light weight steel having a thickness of about 0.029 inches so that assay equipment, which is calibrated for this thickness, is calibrated for the stainless steel wall of the can body. In Fig. 1B the storage container 10 is enclosed in a pewter

shielding overpack 21. Typically the storage containers 10 are in five or ten gallon sizes.

[0008] Referring now to Figs. 3A-3C, closing, locking and opening the storage container 10 with the lid 18 is illustrated by the arrows 21A and 21B. As will be explained hereinafter, the handle 20, locking ring 16 and lid 18 form a closure assembly 22 that closes a top opening 24 of the can body 12. As seen in Fig. 3A, the top opening 24 in the can body 12 is closed by lowering the closure assembly 22 along the axis 25 of the can body in the direction of arrow 21A to close the top opening 24. As is seen in Fig. 3B, the lid assembly 22 is within the locking collar 14. Upon then rotating the closure assembly 22 clockwise in the direction of arrow 21A, locking tabs on the lid assembly 22 seat beneath shoulders on the locking collar 14 as the locking assembly 22 rotates from the position of Fig. 3B to the position of Fig. 3C. A spring projected latch 30 then projects into one of several holes in the locking collar 14 to lock the lid assembly 22 to the locking collar 14 and thus to the can 12. The storage container 10 formed by the locked can 12 and the locking assembly 22 is thus ready to be safely carried by the handle 20. The lock 30 has a spring projected pin which indicates when locking has occurred. When it is desired to store or stack the storage containers 10, the handle 20 is pivoted down to the position of Figs. 1A and 1B.

[0009] To open a storage container 10, the steps are reversed. Starting with Fig. 3C, the spring biased lock 30 is opened by pressing a thumb plate 34 in the direction of arrow 21B. Then as shown in Fig. 3B the handle 20 is rotated in the counter clockwise direction 21B to unlock the lid 18 from the locking collar 14 of the can body 12. As seen in Fig. 3A, the lid assembly 22 is removed by lifting the assembly 22 with the handle 20 up in the direction of arrow 21B.

[0010] From Figs. 3A-3C it is seen that ease of use of the storage container is facilitated by having a lid closure assembly 22 which is simple to use and has a pin which snaps into a closed and locked position so as to give the operator a clear visual indication that there is a positive seal.

[0011] Referring now more specifically to Fig. 1B, in one embodiment of the invention, pewter shielding 21 fits over the can body 12 of the storage container 10 and is held in place by clips 38 that have a detent end 39 that seat within a groove 40 defining a ridge 41. The ridge 41 is disposed between the can body 12 and the locking ring 14 which is welded to the can body 12.

[0012] As is evident from the views of Figs. 2 and 3A-3C, the locking ring 16 has drain slots 42 that allow liquid to drain from the lid 18. The lid 18 also includes a filtered vent 44 that allows vapor and gas to escape from the storage container 10.

[0013] Figs. 4-9 reference component parts of the storage container 10 discussed in Figs. 1-3C. Beginning with Fig. 4, the can body 12 has a closed bottom 50 and a cylindrical sidewall 52 that defines the top opening 24 at a rim 56. The can body 12 is deep drawn of stainless

steel that is chosen for its corrosion resistance strength and weight. Preferably, the can is drawn from 22-gauge stainless steel and has a thickness of about 0.03 inch (preferably 0.029 inch), which is identical to the original nuclear material cans (NMC's) so that dosimetry equipment does not require recalibration. By having familiar sizing, the deep drawn can bodies 12 are identical to the original NMC's wherein each size container has been designed to fit into the next larger size to assure proper nesting. Each storage container 10 is laser etched with indicia at 58 that includes a serial number and barcode.

[0014] Referring now to Fig. 5 where the locking collar 14 is shown in detail, the locking collar 14 is machined from stainless steel and is laser welded at its lower edge 60 to the rim 56 of the cylindrical wall 52 that defines the can body 12 (Fig. 4). A collar portion 62 extends upwardly from the lower edge 60 and has therein plurality of locking slots 64 which receive a spring biased locking pins from the locking pin arrangement 30 on the handle 20 (see Figs. 1A-3C). The locking slots 64 also provide the aligned slots 43 for liquid drainage seen in Figs. 2 and 3A-3C. The locking slots 64 are in alignment with locking shoulders 66 that are spaced from one another by reception grooves 68 for receiving locking tabs which extend from the locking ring 16 (see 100, Fig. 7). O-ring surfaces 70 and 72 provide precision machined surfaces that abut axially facing and radially facing seals on the lid 18 to create a containment boundary for the contents of the storage container 10. The locking collar 14 is designed for allowing two passes of laser welding to attach the locking collar to the can body 12. Laser welding introduces less heat into these components and thus minimizes warping. Utilizing two welds strengthens the attachment and ensures containment of the hazardous substance in the can body 12.

[0015] Referring now to Fig. 6, the lid 18 for enclosing the storage container 10 has a circular periphery 80 having a peripheral converging groove 82 therein which receives a primary seal gland 84. Adjacent to the periphery 80, is an axially facing converging groove 86 that receives a face seal gland 88. The primary seal gland 80 seals radially with the axially extending, O-ring surface 72 on and the axially facing, face seal gland 88 seals radially with the radially extending, O-ring surface 70 on the ring 14 of Fig. 5. An annular seal protector 89 is positioned inboard of the face seal gland 88 to protect the face seal gland when the lid 14 is set down on another surface during maintenance or loading so that the lid 18 will rest on the seal protector 89 rather than on the face seal gland.

[0016] Preferably, the primary seal gland 80 is made of VITON™ which has high radiation resistance while providing excellent sealing properties. The face seal gland 88 is made of low durometer silicon that has high chemical resistance properties. By positioning both seals (which are configured as O-rings) in the converging grooves 82 and 86 maintenance is simplified. Four shoulder screw holes 92 (two are shown), which are aligned with the seal protector 89, attach the lid 18 to the locking

ring 16 of Fig. 7. A stepped filter cavity 94 is preferably centrally positioned and receives a filter element such as filter element 44 of Fig. 9.

[0017] Referring now to Fig. 7, the locking ring 16 has four locking tabs 100 separated by spaces 102 on the outer periphery of the locking ring 16. Oppositely disposed lugs 108 and 110 are positioned on the inner periphery 112 of the locking ring and have holes 114 and 116 therein for receiving a handle pin and locking pin which extend from the handle 20 of Fig. 8. The hole 114 extends completely through the lug 108 so that the locking pin may project behind the locking ring 16 to the locking collar 14 of Fig. 5 and enter one of the locking slots 64 beneath the locking shoulders 66 of the locking collar 14. A stop 117 prevents over rotation of the locking ring 16. Shoulder screws are received at 119 to attach the locking ring 16 to the lid 18 so that the lid rotates with the locking ring 16 and so that the lid is liftable by lifting the locking ring with U-shaped handle 20. Water shedding drain slots 42 extend completely through the locking ring 16 to allow water accumulating on the lid 18 to drain therefrom and out of the aligned slots 43 in the locking collar 14 that also serve as the locking slots 64.

[0018] Referring now to Fig. 8, the handle 20 is used to open and close the storage container 10, as well as to provide a positive locking device with a spring projected locking pin 130 that is a portion of the locking pin arrangement 30 and has the tab 34 fixed thereto. The locking pin 130 is spring projected by a coil spring 132. The tab 34 allows one to retract the locking pin 130 against the bias of the spring by pressing the tab 34 with their thumb. The locking pin 130 is also a pivot which cooperates with a handle pin 134 to allow the U-shaped portion 136 of the handle 20 to pivot when the locking pin 130 and handle pin 134 are positioned in the bores 114 and 116 of the lugs 108 and 110 of the locking ring 16, (see Fig. 7). As is seen in Figs. 1A and 1B, the handle 20 is configured to fold in either direction to lie within the locking ring 16 for storage and to extend upwardly from the lid 22 for carrying the storage container 10. The handle 20 is also used for opening and closing the storage container 10 and for positively locking the storage container with the spring biased locking pin 130. The thumb tab 34 is pulled back by thumb engagement to retract the operating pin 130 so that the operating pin can disengage from the locking slot 64 (Fig. 5) in which it is received.

[0019] The locking pin 130 and handle pin 134 are configured to provide smooth rotation of the handle 20 while simultaneously providing enough friction to keep the handle 20 from being loose. The locking pin 130 and handle pin 134 have diameters which provide a safety factor of at least three against shear stresses created during lifting. The handle 20 is formed of stainless steel tube and has as few machined parts as necessary. Because the handle has symmetry, identical operation of both left and right hand operators is provided.

[0020] Referring now to Fig. 9 the filtered vent 44 seats in the hole 45 in the can lid 22 (Fig. 6). The filtered vent

44 is comprised of a filter media 150 having an inner side 152 and an outer side 154. The filter media 150 provides venting of the storage container 10 while maintaining a minimum of 200ml/min of air at no more than one inch water column and captures 99.97% of 0.45 micron mass mean diameter DOP aerosol at the rated flow. The filter media 150 also provides reliable operation at a required temperature of 500°C.

[0021] A protective screen 156 covers the inner side 152 of the filter media 150 and a water resistant media 158 which is configured to resist water entry of up to 12 inches of water column abuts the outer surface 154 of the filter media. A filter cover 160 having vent holes 162 therein provides a protective layer that keeps the filter media 150 from being damaged fits into the opening 45 in the lid 22. The filter cover 160 is preferably made of stainless steel and the ports 162 provide openings for helium leak testing.

[0022] From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.

[0023] A storage container for hazardous material, such as transuranic waste, has a stainless steel can body covered by a stainless steel lid. The can body has a locking collar welded thereto and a locking ring fastened to the lid removably mounted within the locking collar. Locking tabs on the locking ring are received beneath locking shoulders on locking collar upon rotating the locking to hold the lid closed. A U-shaped handle is pivoted on the locking ring for rotating the locking ring to lock the lid to the locking collar and thus to the can body, the U-shaped handle being further used to lift the storage container. A spring biased locking pin with a thumb operated tab is coaxial with one pintle of the U-shaped handle, the tab being squeezed toward the handle by the operators thumb to unlock the pin against the bias of a coil spring so as to allow the locking ring to rotate to an unlocked position when it is desired to remove the lid from the can body.

Claims

1. A storage container for hazardous material comprising:

a can body having a cylindrical side wall with a closed bottom wall and an open top, the can body defining a space for containing the hazardous material;
a rim is disposed at the open top of the can body, the rim having an annular land;
a locking collar welded to the rim adjacent to the annular land; the locking collar having grooves with spaced shoulders thereon, the arcuate

- shoulders defining arcuate locking spaces therebeneath and having at least one locking aperture therein;
- a lid configured for receipt in the locking collar positioned inboard of the arcuate locking grooves; the lid having a sealing arrangement for sealing the lid with respect to the space defined by the can body;
- a locking ring mounted on the lid; the locking ring having spaced locking tabs for initial positioning in the spaces beneath the arcuate locking shoulders, and
- a handle attached to the locking ring for rotating the locking ring to position the locking tabs in the locking groove beneath the locking shoulders, and a latch associated with the handle and being biased to a latching position with at least one locking aperture.
2. The storage container of claim 1 wherein the latch associated with the handle is a locking pin projecting from the handle that allows the handle to pivot from a nested position within a space within the locking ring to a position projecting from the locking ring for gripping by an operator.
 3. The storage container of claim 2 wherein the handle is U-shaped.
 4. The storage container of claim 3 wherein there are a plurality of locking apertures and the locking pin is received in only one of the locking apertures.
 5. The storage container of claim 1 wherein a thumb or finger tab projects from the handle enabling an operator to retract the pin using a thumb or finger.
 6. The storage container of claim 2 wherein a locking aperture is positioned at each locking shoulder.
 7. The storage container of claim 3 wherein a locking aperture is positioned at each locking shoulder.
 8. The storage container of claim 7 wherein there are five locking shoulders.
 9. The storage container of claim 1 including radial drains through the locking ring and the locking collar to drain liquid from the lid and a filtered vent in the lid to allow gas and vapor to exhaust from the can body.
 10. The storage container of claim 1 wherein a groove is provided between the can body and the locking collar and wherein a cylindrical pewter shield is provided around the can body, the pewter shield having clips associated therewith which engage the groove to latch the pewter shield to the storage container.
 11. A storage container for transuranic material comprising:
 - a stainless steel can body having a cylindrical side wall with a closed bottom wall and an open top, the can body defining a space for containing the transuranic material;
 - a stainless steel rim disposed at the open top of the can body, the rim having an annular land;
 - a stainless steel locking collar welding in the rim on the annular land; the locking collar having grooves with spaced shoulders thereon, the arcuate shoulders defining arcuate locking spaces therebeneath and having locking apertures therein, the locking apertures having drainage portions for liquid therein;
 - a stainless steel lid configured for receipt in the locking collar and positioned inboard of the arcuate locking grooves; the lid having a sealing arrangement for sealing the lid with respect to the space defined by the can body and having a gas and vapor vent therethrough;
 - a stainless steel locking ring mounted on the lid; the locking ring having spaced locking tabs for positioning in the spaces beneath the arcuate locking shoulders;
 - a U-shaped handle pivoted on the locking ring for rotating the locking ring to position the locking tabs in the locking groove beneath the locking shoulders and for lifting the storage container, and
 - a spring biased pin coaxial with a pivot for the handle and being biased to a latching position with one of the locking apertures.
 12. The storage container of claim 11 wherein a thumb or finger tab projects from the locking pin adjacent the handle enabling an operator to retract the locking pin against the bias of the spring using a thumb or finger.
 13. The storage container of claim 11 wherein there are five locking shoulders, each of which has a locking aperture with liquid drainage.
 14. The storage container of claim 11 wherein a groove is provided between the can body and the locking collar and wherein a cylindrical pewter shield is provided around the can body, the pewter shield having clips associated therewith which engage the groove to latch the pewter shield to the storage container.

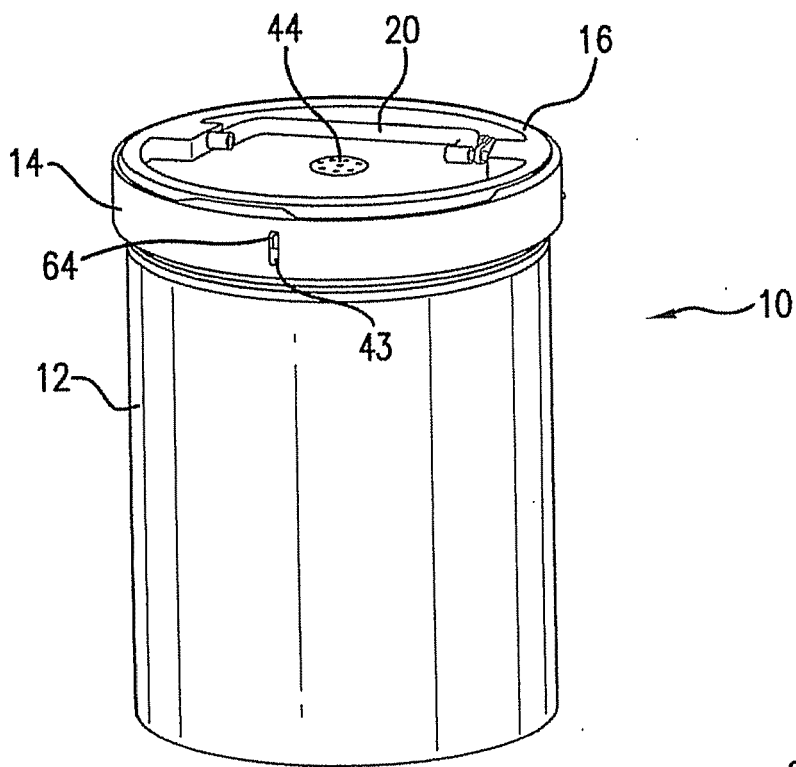


FIG. 1A

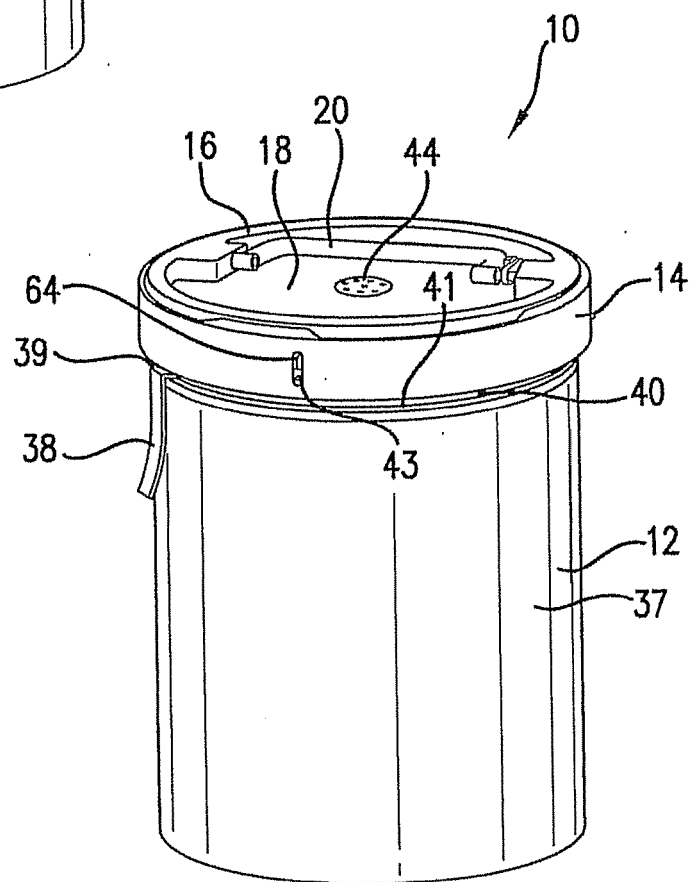


FIG. 1B

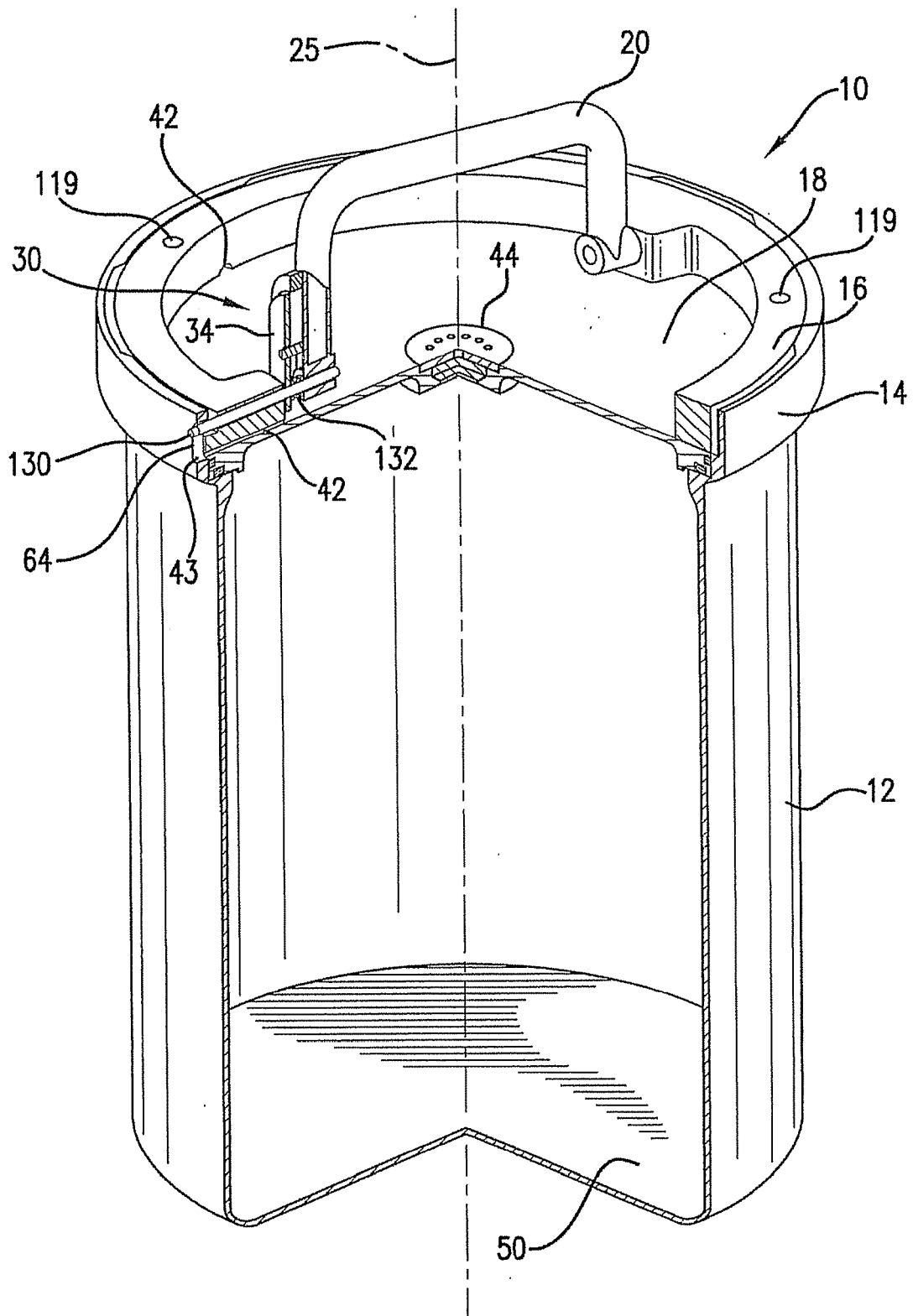
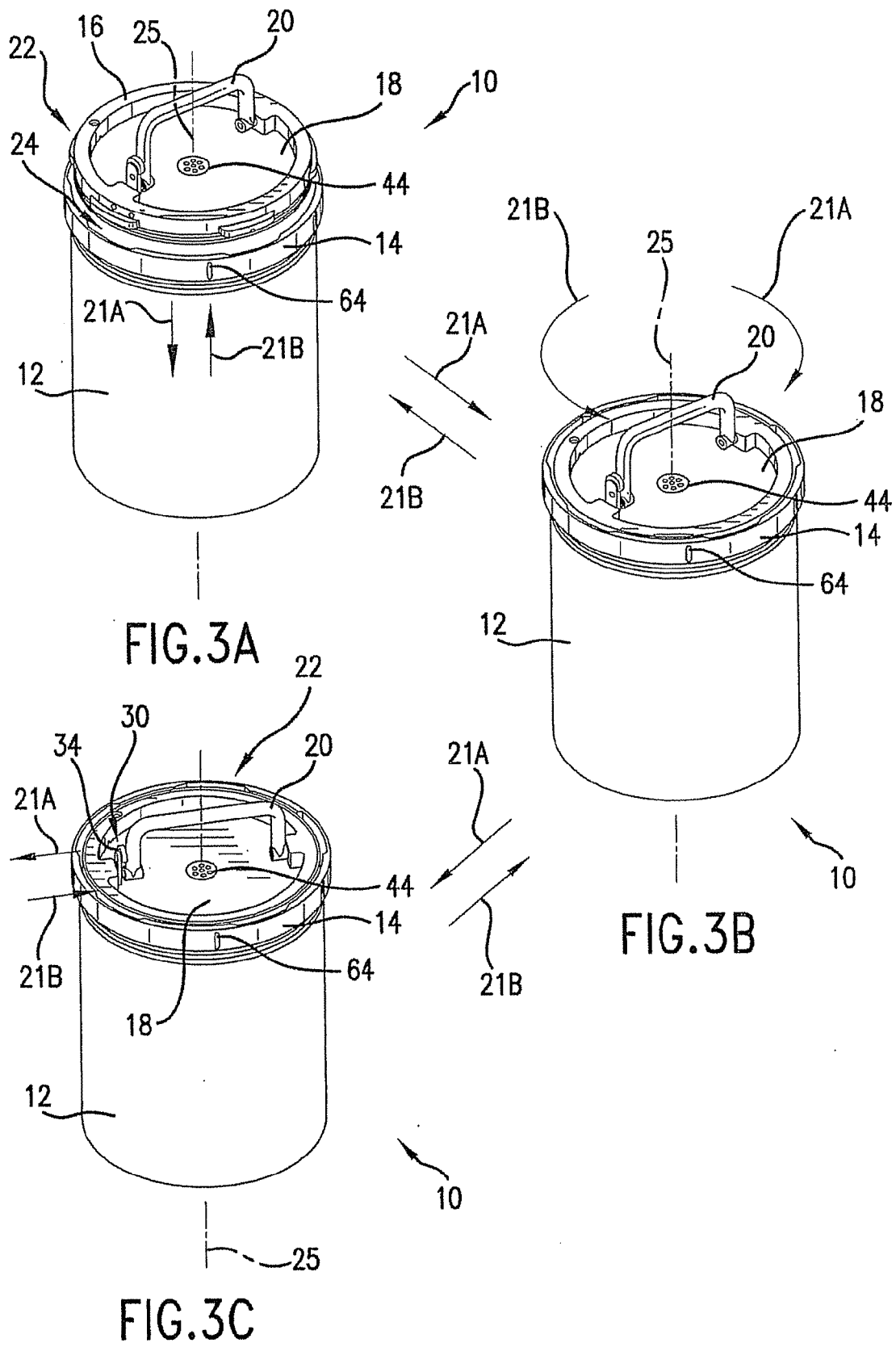


FIG.2



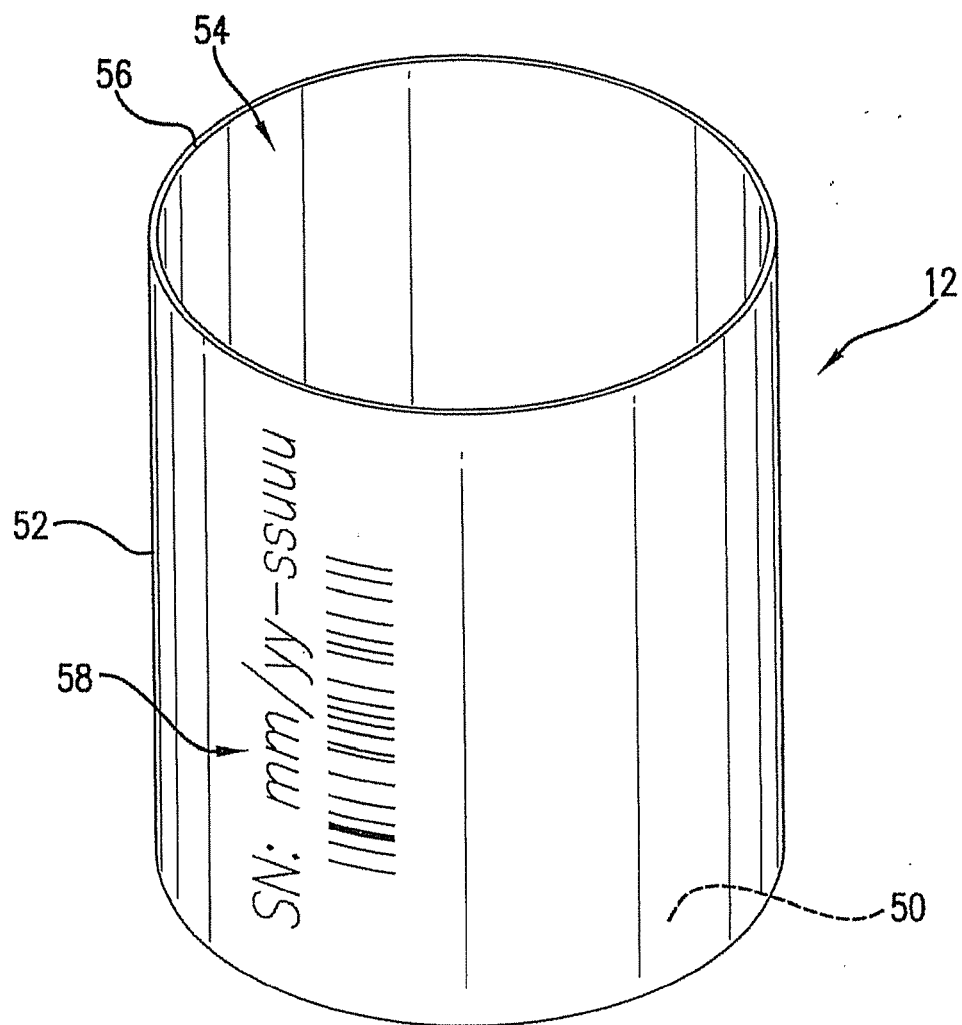


FIG. 4

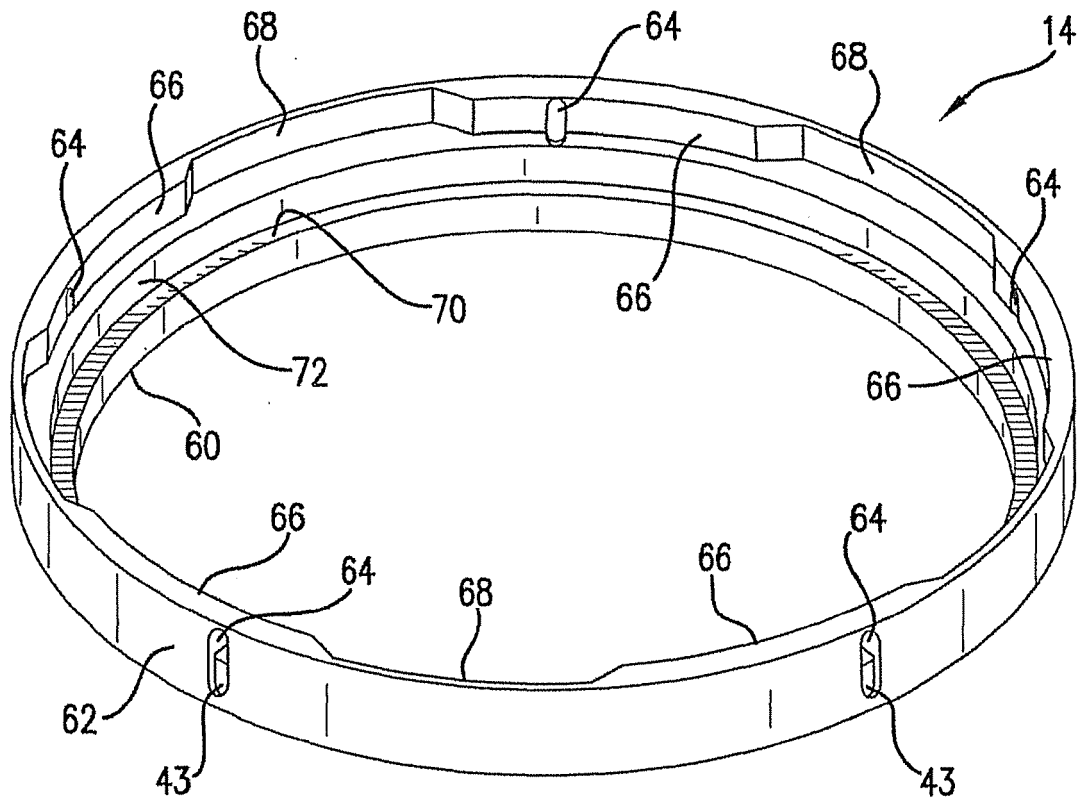


FIG. 5

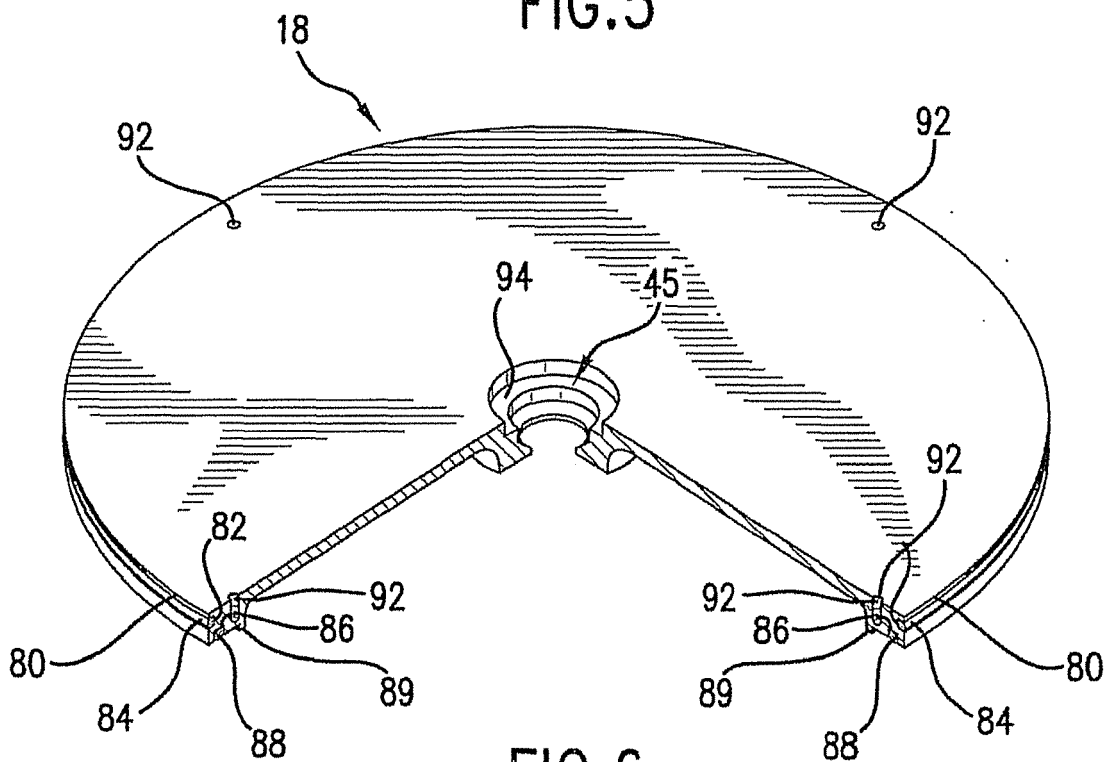


FIG. 6

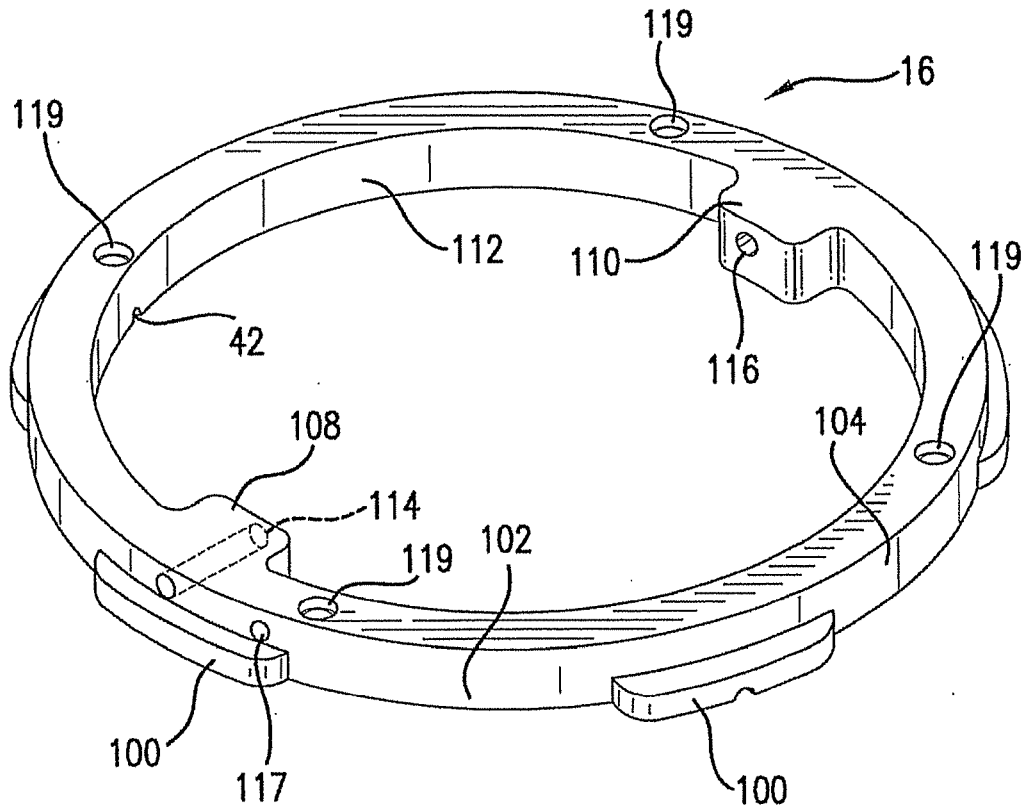


FIG. 7

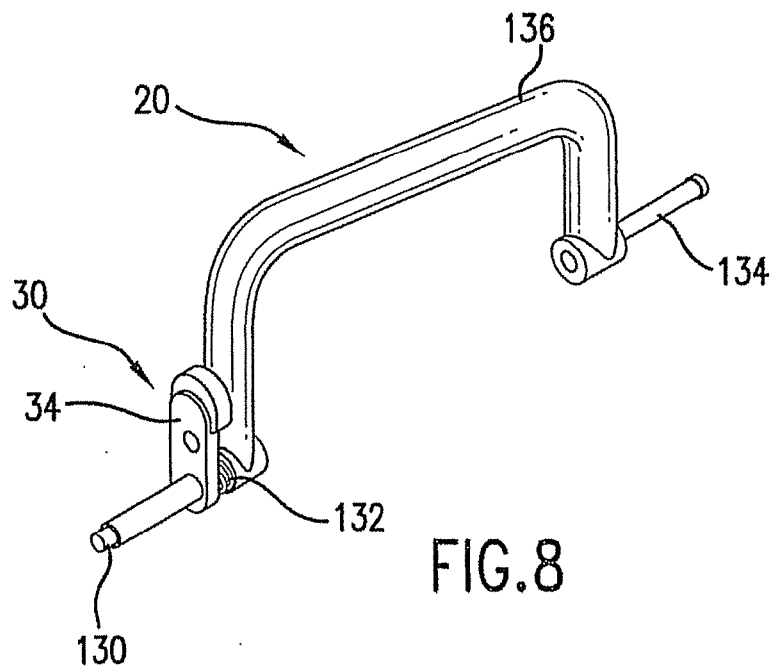


FIG. 8

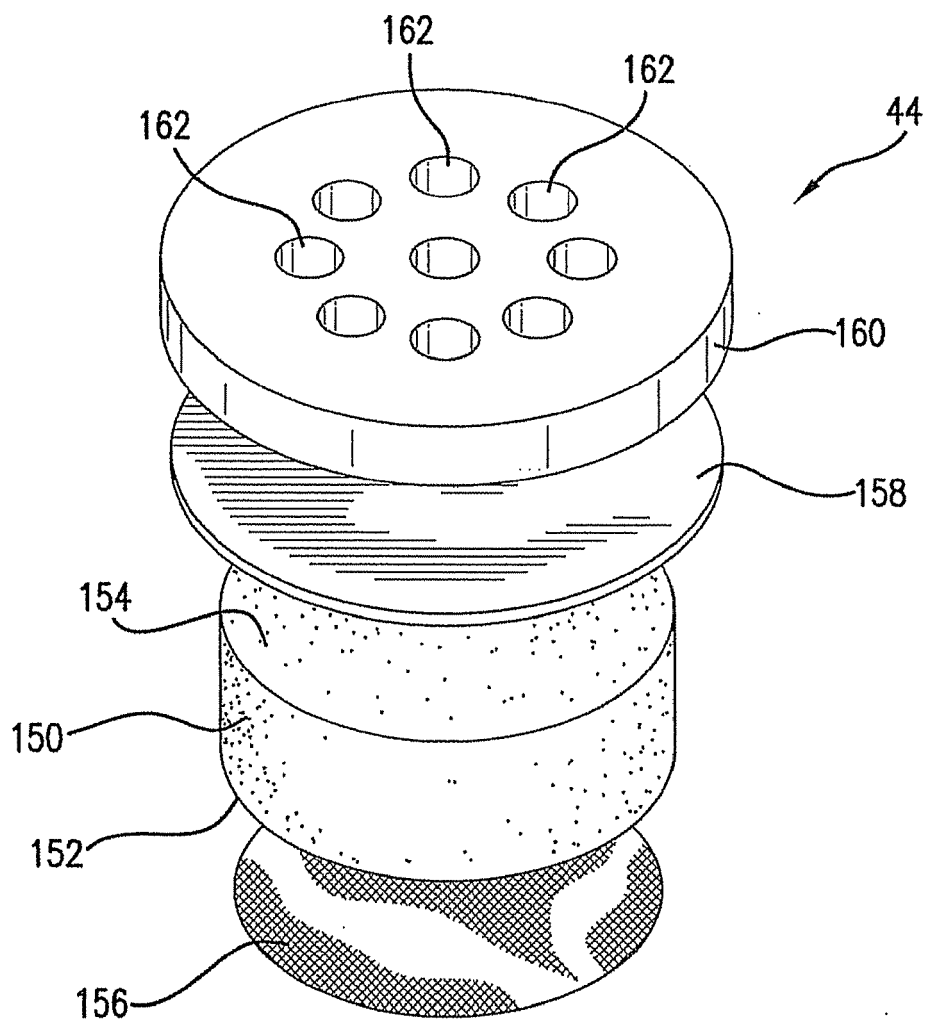


FIG.9



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 2100

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/246375 A1 (WICKLAND TERRY J [US] ET AL) 25 October 2007 (2007-10-25)	1-8,10	INV. G21F5/015 G21F5/12 B65D53/02 B65D55/02 B65D85/82
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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 09 17 2100

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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16-02-2010

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