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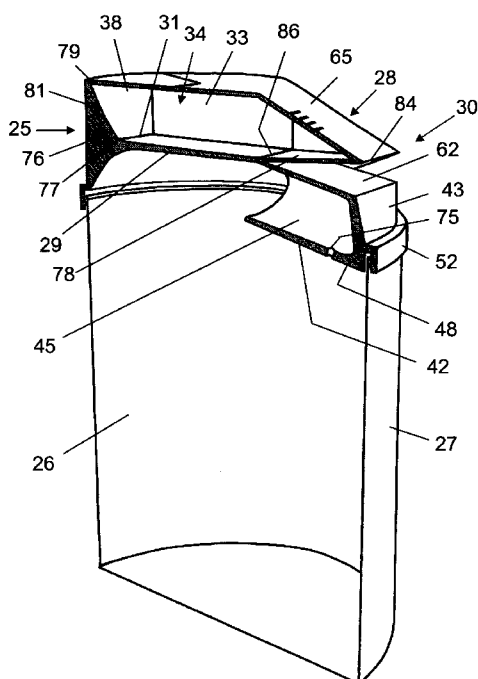


Fig. 7

(57) Abstract: An apparatus and method for dispensing a predetermined dose of powder comprises a container containing powder and a rigid hollow casing formed with a powder receiving cavity so that powder is transferable from a container interior to the cavity upon a first reorientation of the container. A displaceable surface mounted to walls of the apparatus serves to level the powder received in the cavity to define a predetermined dose. A force transmitter transmits an applied force to the leveling surface in order to initiate a leveling operation, allowing the predetermined dose to be transferred from the cavity to an interim holding chamber located between the cavity and a spout element, following the leveling operation and upon a second reorientation of the container. The powder is dispensed when the spout element is set to an opened position. The leveling surface returns to its relaxed state when the force is released.

APPARATUS AND METHOD FOR DISPENSING A PREDETERMINED DOSE OF POWDER

Field of the Invention

The present invention relates to the field of dispensers. More particularly, the invention relates to an apparatus and method for dispensing a predetermined dose of powder.

Background of the Invention

Many containers for powdered and granular materials (hereinafter "powder") are provided with a scoop for dispensing the powder and a lid for sealing the container. A user wishing to dispense a predetermined dose of powder must grope for the scoop within the powder while often soiling his or her hands and a tabletop. The powder is exposed to germs located in the hands of the user.

US 5,706,974 discloses a lid for a container containing powder includes a lip on an interior or bottom surface for selectively attaching a scoop by an interference fit. When the scoop is to be used, it can be easily removed from the lid without the need for rooting and searching within the container for the scoop.

This dispensing method is disadvantageous in that it is unsanitary as the powder becomes exposed to germs located in the surrounding air. Also, the powder will absorb moisture from the surrounding air. Additionally, two hands are needed for a dispensing operation, one to hold the container and one to remove the dose of powder from the container with use of the scoop. At times a mother is holding a crying infant and a one-handed dispensing operation would be beneficial.

US 5,850,944 discloses a measuring dispensing cap for a container comprising a peripheral sidewall and a pivotable flip top supported on the peripheral

- 2 -

sidewall for rocking movement about a hinge axis. A measuring chamber is formed in an area enclosed by the peripheral sidewall underlying the dispensing panel portion, and is defined by a portion of the peripheral sidewall, the dispensing panel portion, and by an angled weir panel extending from the peripheral sidewall downwardly and inwardly, terminating at a weir edge in substantial vertical alignment with the hinge axis, thereby creating a weir opening by which powder is transferred into the measuring chamber upon tilting the container. The flip top is formed with a depending flange which engages the weir panel edge when the flip top is opened to thereby close the weir opening.

Although a measuring chamber is formed, the cap is unable to accurately and reliably discharge a predetermined dose since, in one embodiment, some powder is liable to spill if the container is not properly positioned, and in another embodiment, the dispensing panel is opened at the same time that the weir opening is closed when the flip flop is pushed downwardly. Thus when a large dose of powder is desired to be dispensed, e.g. a dose greater than 8 cm³ suitable for infant food, some of the powder will invariably be spilled during the sudden opening of the dispensing panel. An additional disadvantage is that both the weir opening and the dispensing panel are liable to be open at the same time if an incorrect magnitude of force is applied to the flip flop.

It is an object of the present invention to provide an apparatus and method for accurately and reliably dispensing a predetermined dose of powder.

It is an additional object of the present invention to provide an apparatus and method for ensuring that powder will not be dispensed at the same time that a predetermined dose of powder is being transferred to a measuring chamber.

- 3 -

It is an additional object of the present invention to provide an apparatus and method for dispensing a predetermined dose of powder without having the remaining powder to be exposed to germs associated with the hands of the user or with the surrounding air.

It is yet an additional object of the present invention to provide apparatus for performing a one-handed powder dispensing operation.

Other objects and advantages of the invention will become apparent as the description proceeds.

Summary of the Invention

The present invention provides an apparatus for dispensing a predetermined dose of powder, comprising a container containing powder; a rigid hollow casing formed with a powder receiving cavity, powder being transferable from an interior of said container to said cavity upon a first reorientation of said container; a spout element through which powder is dispensable; a displaceable surface mounted to one or more walls of said apparatus, for leveling the powder received in said cavity to define a predetermined dose of powder; and a force transmitter, for transmitting an applied force to said leveling surface and for initiating thereby a leveling operation, said predetermined dose of powder being transferable from said cavity to an interim holding chamber located between said cavity and said spout element, when said spout element is in a closed position, following said leveling operation and upon a second reorientation of said container.

The apparatus is described with respect to a normal disposition wherein the casing is located above the container interior. All terms indicating relative vertical direction, such as "upper", "lower", "underside", "upwardly",

- 4 -

“downwardly”, and “below”, are described with respect to this normal disposition. It will be appreciated, however, that the apparatus is also usable, depending on the embodiment and the step of the dispensing operation, when positioned in any other desired disposition.

As referred to herein, the “longitudinal” direction is between the powder receiving cavity and the discharge opening associated with the spout element, along which the leveling surface generally extends. An element that is “proximally” located is located in the direction of the spout element, and one that is “distally” located is located in the direction of the cavity. The “transversal” direction is substantially perpendicular to the longitudinal direction, corresponding generally to the width of the leveling surface.

The leveling surface in a relaxed state isolates the cavity and the container interior from the holding chamber. Following displacement of the stressed leveling surface by means of the force transmitter, however, the holding chamber is caused to be in communication with the cavity.

The casing preferably comprises a guide wall with which a rounded lip of the cavity is substantially flush, a distal edge of the leveling surface being slidable along said guide wall during the leveling operation.

In one aspect, the distal edge of the leveling surface in a relaxed state is substantially in contact with an upper edge of the cavity

In one aspect, the leveling surface in a relaxed state is suitably configured, when the container is tilted or inverted, to direct the powder from the container interior to the cavity.

- 5 -

In one aspect, the guide wall is curved along the path of travel of the leveling surface, ensuring that the leveling surface slides along the guide wall during its entire path of travel and thereby defining an accurate predetermined dose of powder.

In one aspect, a lower edge of the cavity is proximally spaced from an upper edge thereof.

In one aspect, the guide wall is concave, in order to direct powder to the cavity.

In one aspect, the leveling surface in a stressed state is adapted to direct powder discharged from the cavity to the spout element.

In one aspect, more than one predetermined dose of powder is retainable in the holding chamber.

In one aspect, one or more reinforcement elements are attached to an underside of the leveling surface, for providing the leveling surface with elasticity to ensure that it will return to its relaxed state after being stressed.

In one aspect, the force transmitter comprises a flexible, thin-walled convex element, and an elongated connecting element extending downwardly from said convex element to a distal end of the leveling surface.

In one aspect, the force applied to the leveling surface by means of the force transmitter is controllable whereby the distal edge of the leveling surface is slidable along the guide wall in one stroke to a casing bottom surface to allow a complete dose of powder to be discharged from the cavity or is slidable partially along the guide wall to allow a partial dose of powder to be discharged from the cavity.

- 6 -

In one aspect, the casing is formed with two vertically spaced cavities whereby a partial dose of powder is transferable to the holding chamber when the distal edge of the leveling surface is displaced along the guide wall to a height which is below an upper cavity.

In one aspect, the leveling surface, with the exception of the distal edge thereof, is peripherally attached to at least one wall of the apparatus.

In one aspect, the at least one wall to which the leveling surface is peripherally attached is an outer wall.

In one aspect, the leveling surface is also peripherally attached to a fixture about which the spout element is pivotally openable and closable.

In one aspect, the leveling surface is peripherally attached to two separated longitudinally extending side walls each of which being inwardly spaced from an outer wall by means of a corresponding transversal protrusion and defining the holding chamber.

In one aspect, the side walls are concave in order to direct the predetermined dose of powder from the holding chamber to the spout element.

In one aspect, the side walls are integrally formed with the guide wall.

In one aspect, the transversal protrusions connected to a corresponding side wall are removably attachable to an outer wall.

In one aspect, the casing is formed with one or more pressure equalizing apertures to prevent the formation of air bubbles within the cavity.

- 7 -

In one aspect, the casing is replaceable to define a different dose of powder that is receivable in the cavity.

In one aspect, the casing is releasably engageable with two separated longitudinally extending side walls each of which being inwardly spaced from an outer wall by means of a corresponding transversal protrusion and defining the holding chamber.

In one aspect, a plurality of pins longitudinally protruding from the guide wall at a location between the cavity and a corresponding transversal edge of the guide wall are receivable within corresponding apertures bored in a side wall abutment surface and wherein an engagement element protruding outwardly from a casing outer wall and extending circumferentially from a first transversal edge to a second transversal edge of the guide wall is insertable in a corresponding groove of the apparatus.

In one aspect, the casing comprises a compartment, which may be in communication with the holding chamber, for receiving the flexible convex element when depressed, said compartment being defined by an arcuate surrounding wall of varying height which extends vertically from an upper peripheral portion of the casing.

In one aspect, the convex element protrudes from an intermediate supporting surface and a U-shaped peripheral wall surrounds the convex element and extends between an upper surface and said intermediate surface, said peripheral wall being of a sufficient height to ensure that the convex element will not be inadvertently depressed.

- 8 -

In one aspect, the apparatus is stackable such that all overlying containers are in mutual alignment.

In one aspect, a plurality of grip elements are applied to an outer wall for increased grippability.

In one aspect, the apparatus comprises a circular outer wall, upper surface connected to said outer wall, and leveling surface, all of which being flexible. A pair of force transmitters transversally protrudes from said outer wall at substantially diametrically opposite portions thereof. The rigid casing has inclined side edges which are spaced from said outer wall to allow for plastic deformation of the outer wall. Said outer wall changes its inclination upon application of a force to said pair of transmitters simultaneously until contacting said inclined side edges of the casing, said applied force being transmitted to the leveling surface such that it is controllably and reversibly flexed, whereby the distal edge of the leveling surface slides along the guide wall to expose at least a portion of the cavity to the holding chamber.

In one aspect, the leveling surface is pivotable about a proximal edge thereof.

In one aspect, the holding chamber is defined by a rigid powder deliverable channel which comprises the leveling surface, channel sidewalls, and a terminal wall at its proximal end to which the spout element is pivotally connected.

In one aspect, a longitudinal axis of the cavity substantially coincides with the projection of a longitudinal axis of the channel.

In one aspect, the channel comprises rigid border elements arranged such that the entire channel is pivotable in unison upon application of the force to the force transmitter.

- 9 -

In one aspect, the force transmitter is triangularly shaped and comprises first and second pivotally connected elements, said first element being pivotally connected to a border element of the channel and said second element being pivotally connected to the casing, said force transmitter being compressible upon application of a pivoting inducing force thereto.

In one aspect, the first element is provided with indicia to indicate the location at which a force is to be applied.

In one aspect, a cap is provided with the casing, spout element, force transmitter, and optionally with the channel, said cap being configured with a lip along its periphery by which said cap is removably securable to the powder container

In one aspect, the cap further comprises a rigid outer wall and one or more flexible portions connecting the first element of the force transmitter and the outer wall, to assist in returning the leveling surface to its normal disposition upon cessation of the applied force.

In one aspect, a rigid upper surface of the channel is pivotally connected to a stationary upper surface of the cap and to the first element of the force transmitter.

In one aspect, the outer wall of the cap has a thick-walled, triangularly shaped portion the height of which is gradually reduced radially inwardly to define an apex, said apex being a weakened portion that interfaces with a proximal edge of the leveling surface and about which the leveling surface is pivotable. The channel terminal wall is supported by, and is at the same angular disposition as, an upper angled edge of the triangularly shaped portion.

- 10 -

In one aspect, the channel is also pivotable by means of a weakened portion associated with channel sidewalls.

In one aspect, an upper edge of the sidewalls is pivotally connected to a weakened portion formed in the triangular portion at a junction with the cap upper surface. Each sidewall comprises a rigid section and a flexible section, said rigid section being pivotable at a weakened portion formed at a junction with said flexible section and with an edge of the cap upper surface while said flexible section changes its longitudinal dimensions.

In one aspect, the cavity casing or holding chamber is made of a transparent or translucent material to assist a user in properly orientating the container and to increase user confidence that the predetermined dose of powder is being dispensed.

In one aspect, the cap further comprises a flexible inner wall extending from the leveling surface to the outer wall, for directing powder to the cavity and for assisting in returning the channel to its normal disposition upon cessation of the applied force.

In one aspect, the casing, spout element, force transmitter, and optionally the channel are configured as components of the container.

In one aspect, the spout element is pivotable from a closed position to an opened position. The spout element may provide an air tight seal when set to a closed position.

The present invention is also directed to a method for dispensing a predetermined dose of powder, comprising the steps of:

- 11 -

- a) providing a cap with a hollow casing formed with a cavity for receiving a predetermined dose of powder; a guide wall with which a rounded lip of said cavity is substantially flush; a displaceable surface mounted to one or more walls of said cap, for leveling the powder received in said cavity to define said predetermined dose of powder; a spout element through which powder is dispensable; an interim holding chamber located between said cavity and said spout element; and a force transmitter for transmitting an applied force to said leveling surface;
- b) securing said cap to a powder container;
- c) tilting said container to a first direction so that powder will be received in said cavity while the passage of powder to said holding chamber is prevented;
- d) applying a force to said force transmitter, whereby said leveling surface slides along said guide wall while powder in excess of said predetermined dose is driven into the interior of said container and said holding chamber is caused to be in communication with said cavity;
- e) tilting said container to a second direction so that said predetermined dose of powder is transferred to said holding chamber;
- f) dispensing powder from said holding chamber via said spout element; and
- g) releasing said force, causing said leveling surface to return to its relaxed state.

In one aspect, the force is applied by depressing a flexible convex element, causing the force to be transmitted to the leveling surface.

In one aspect, the applied force is controllable whereby a distal edge of the leveling surface is slidable along the guide wall in one stroke to a casing bottom surface to allow a complete dose of powder to be discharged from the cavity or is slidable partially along the guide wall to allow a partial dose of powder to be discharged from the cavity.

- 12 -

In one aspect, the holding chamber is a channel which comprises the leveling surface and the force is applied by depressing the force transmitter which comprises first and second pivotally connected elements, said first element being pivotally connected to a border element of said channel and said second element being pivotally connected to the casing, whereby application of the force causes said chamber to pivot so that a distal edge of the leveling surface will slide along the guide wall.

In one aspect, the force is applied by depressing a pair of force transmitters transversally protruding from a round and flexible outer wall of the cap at substantially diametrically opposite portions thereof, causing said outer wall to change its inclination until contacting side edges of the casing and the leveling surface to be controllably and reversibly flexed, whereby the distal edge of the leveling surface slides along the guide wall to expose at least a portion, or the entire opening, of the cavity to the holding chamber.

In one aspect, more than one dose of powder is transferred to the holding chamber before being dispensed from the spout element.

In one aspect, a first cap is replaced by a second cap having a casing formed with a cavity for receiving a different predetermined dose of powder, and repeating steps c-f.

In one aspect, a first casing is replaced by a second casing formed with a cavity for receiving a different predetermined dose of powder, and repeating steps b-f.

The apparatus and method of the present invention provides the following advantages:

1. Powder is dispensed significantly quicker than conventional dispensing methods, by which the powder container cover is removed, a serving

- 13 -

spoon is found after generally being buried within the powder, the powder is collected within the serving spoon, excess powder is removed from the serving spoon, and the powder is dispensed.

2. A predetermined dose of powder is accurately and reliably dispensed as the leveling surface removes excess powder that may have accumulated in the cavity, and the entire dose is transferred to the holding chamber and to the spout element.
3. Powder is not exposed to germs located in the surrounding air or in the hands of the user, and will not absorb moisture from the surrounding air.
4. Powder may be dispensed by using only one hand. This feature is particularly beneficial when a mother is holding a crying infant and has to quickly prepare food from the powder.
5. Manufacturing costs are minimal as all components of the apparatus are produced by single or double injection molding, are disposable, or are made from a washable material.

Brief Description of the Drawings

In the drawings:

- Figs. 1-4 schematically illustrate four stages, respectively, of a method for dispensing a predetermined dose of powder, according to one embodiment of the invention;
- Fig. 5 is a perspective view from above of a cap for dispensing a predetermined dose of powder, according to one embodiment of the present invention;
- Fig. 6 is a perspective view from above of the cap of Fig. 5 shown in a compressed condition;
- Fig. 7 is a perspective, vertical cross sectional view of the cap of Fig. 5 and container taken at the longitudinal axis of the powder deliverable channel when

- 14 -

a spout element is in a closed condition, showing the leveling surface at a normal disposition above the powder receiving cavity;

-Figs. 8 and 9 are two different perspective views, respectively, of a vertical cross section of the cap of Fig. 5 and container taken at an intermediate portion of the leveling surface and facing the powder receiving cavity, showing the leveling surface at a normal disposition above the powder receiving cavity;

-Fig. 10 is a perspective view of the cap of Fig. 5 from within its interior, showing the leveling surface at a normal disposition above the powder receiving cavity;

-Fig. 11 is a perspective view of a vertical cross section of the cap of Fig. 5 and container taken at an intermediate portion of the leveling surface and facing the channel terminal wall;

-Fig. 12 is a perspective, vertical cross sectional view of the cap of Fig. 5 and container taken at the longitudinal axis of the powder deliverable channel when a spout element is in an opened condition, showing the leveling surface at a pivoted disposition below the powder receiving cavity;

-Figs. 13-15 are schematic, vertical cross sectional views of the cap of Fig. 5 taken at the longitudinal axis of the powder deliverable channel, showing three stages, respectively, of a leveling operation;

-Fig. 16 is a perspective, vertical cross sectional view of the cap of Fig. 5 taken at the longitudinal axis of the powder deliverable channel when the leveling surface is at a pivoted disposition below the powder receiving cavity, showing a channel sidewall made of a rigid section and of a flexible section;

-Fig. 17 is a schematic illustration of apparatus for dispensing a predetermined dose of powder, according to another embodiment of the invention;

-Fig. 18 is a perspective, vertical and longitudinal cross sectional view of a cap for dispensing a predetermined dose of powder, according to another embodiment of the invention;

-Fig. 19 is a side view of two powder containers in stacked relationship, to each of which is secured the cap of Fig. 18;

- 15 -

- Fig. 20 is a perspective, vertical and longitudinal cross sectional view from the bottom of the cap of Fig. 18, showing the distal edge of the leveling surface in contact with the casing bottom surface;
- Fig. 21 is a vertical and longitudinal cross sectional view of the cap of Fig. 18, showing the leveling surface displaced only partially along the guide wall in response to the application of a reduced force to the force transmitter;
- Fig. 22 is a perspective, vertical and longitudinal cross sectional view from the top of the cap of Fig. 18, showing a curved wall for directing powder from the holding chamber to a discharge opening;
- Fig. 23 is a vertical and longitudinal cross sectional view of a container in an upright position and the cap of Fig. 18 secured thereto, showing the leveling surface in a relaxed state;
- Fig. 24 is a vertical and longitudinal cross sectional view of a container in an inverted position and the cap of Fig. 18 secured thereto, showing that the leveling surface in a relaxed state serves to isolate the container interior from the holding chamber;
- Fig. 25 is a perspective, vertical and longitudinal cross sectional view from the side of the cap of Fig. 18, showing a cavity casing provided with pressure equalizing grooves;
- Fig. 26 is a perspective, vertical and transversal cross sectional view from the bottom and side of the cap of Fig. 18 taken at an intermediate portion of the leveling surface and facing the powder receiving cavity, showing the leveling surface in a relaxed state;
- Fig. 27 is a perspective, vertical and transversal cross sectional view from the side of the cap of Fig. 18 taken at an intermediate portion of a leveling surface provided with reinforcement elements and facing the powder receiving cavity, showing the leveling surface in a stressed state;
- Fig. 28 is a perspective view from the bottom of the cap of Fig. 27;

- 16 -

- Fig. 29 is a perspective view from the top of a cap for dispensing a predetermined dose of powder, according to another embodiment of the invention;
- Fig. 30 is a perspective view from the discharge end of a cap for dispensing a predetermined dose of powder, according to another embodiment of the invention;
- Fig. 31 is a perspective view from the bottom of an assembled cap for dispensing a predetermined dose of powder, according to another embodiment of the invention;
- Fig. 32 is a perspective view from the bottom of the cap of Fig. 31, shown when a replaceable cavity casing is removed;
- Fig. 33 is a perspective view from the top and side of a replaceable cavity casing;
- Fig. 34 is a perspective view from the bottom and front of the casing of Fig. 33;
- Fig. 35 is a perspective view from the bottom of the cap of Fig. 31, showing an abutment surface to which the casing of Fig. 33 is releasably securable;
- Fig. 36 is a perspective, vertical cross sectional view from the side of the casing of Fig. 33, showing an engagement element thereof releasably secured to a groove formed in the cap lip;
- Fig. 37 is a perspective, vertical cross sectional view from the side of a casing formed with two vertically spaced cavities;
- Fig. 38 is a perspective view from the bottom of the cap of Fig. 29, showing a differently configured leveling surface;
- Fig. 39 is a perspective view from the top of a cap for dispensing a predetermined dose of powder, according to another embodiment of the invention;
- Fig. 40 is a perspective view from the bottom of the cap of Fig. 39;
- Fig. 41 is a perspective view from a distal end of a flexible leveling unit used in the cap of Fig. 39;

- 17 -

- Fig. 42 is a perspective view from the front of a cavity casing used in the cap of Fig. 39;
- Fig. 43 is a vertical and transversal cross sectional view of the cap of Fig. 39, showing the casing of Fig. 42 mounted thereto;
- Fig. 44 is a vertical and transversal cross sectional view of the cap of Fig. 39, showing the flexible leveling unit of Fig. 41 and the casing of Fig. 42 mounted thereto when in a relaxed state; and
- Fig. 45 is a vertical and transversal cross sectional view of the cap of Fig. 39, shown in a stressed state.

Detailed Description of Preferred Embodiments

The present invention is a novel cap for accurately and reliably dispensing a predetermined dose of powder. The cap seals the upper one or more edges of a powder container and comprises an integral powder receiving portion. The predetermined dose is dispensed after performing two tilting operations, as will be described hereinafter, without the remaining powder being exposed to the surrounding air or to the hands of the user. If a different dose of the powder is desired to be dispensed thereafter, the cap is simply replaced by a second cap having a different sized powder receiving portion. The apparatus is suitable for the dispensing of any desired type of powder, such as baby food, coffee and spices.

Figs. 1-4 schematically illustrate the method for dispensing a predetermined dose of powder, according to one embodiment of the invention.

Fig. 1 schematically illustrates the container, which is generally indicated by numeral 10, in an upright position. Removable cap 2 has a spout 3 through which powder 7 is dischargeable from the container. Container 10 also comprises integral powder receiving portion 5, a pivotable divider 9 for separating container interior 4 from channel 14 through which the powder is

- 18 -

deliverable to spout 3, and force transmitter 8 by which a pivoting inducing force is transmitted to divider 9.

When container 10 is tilted in direction A, powder 7 is gravitationally delivered through interior 4 to powder receiving portion 5 and introduced therein, as shown in Fig. 2, while passage of powder 7 to channel 14 is prevented by means of divider 9.

After a force F is applied to transmitter 8, divider 9 is shown in Fig. 3 to be pivoted about weakened portion 12. The distal edge of divider 9, i.e. spaced from weakened portion 12, slides along the lip of powder receiving portion 5 during the pivoting motion of divider 9, ensuring that the predetermined dose of powder remains in portion 5 while excess powder is driven by divider 9 to interior 4. Since divider 9 also serves to level the powder within portion 5, it will also be called the "leveling surface". When divider 9 is in a pivoted position, powder receiving portion 5 is in communication with channel 14.

When container 10 is tilted in direction B being in an opposite rotational direction to direction A shown in Fig. 1, but not necessarily of the same angular displacement, and a force F continues to be applied to transmitter 8, powder 7A is delivered gravitationally from powder receiving portion 5 via channel 14 to spout 3, as shown in Fig. 4, until being discharged from the container. As divider 9 in the pivoted position extends to powder receiving portion 5, powder 7 remaining in interior 4 is isolated from the surrounding air and remains in a sanitary condition. Container 10 is then set in an upright position following the dispensing operation until a second dispensing operation is performed.

Fig. 5 illustrates a perspective view from above of an exemplary cap 25, according to one embodiment of the present invention. All components of cap 25 are made of plastic material, some components being made of rigid plastic

- 19 -

(hereinafter “rigid”) and some being made of flexible plastic (hereinafter “flexible”). Although only the two terms “rigid” and “flexible” will be used, it will be appreciated that the components may have different degrees of rigidity or flexibility, primarily based on the thickness and shape of the component. All of the components may be produced according to any method well known to those skilled in the art. For example, all of the components may be produced by injection molding in a single mold for reduced production costs. A rigid component may be connected to an adjacent component by a short, narrow and flexible element, allowing the rigid component to be snapped into the adjacent component by folding the flexible connecting element.

Cap 25 is securable to the top of a powder container by means of lip 52, which is shown to be circular but can be configured in any other way to accommodate a given shape of the powder container. Protruding upwardly from, and in abutting relation with, annular rim 53 defining the outer edge of cap 25 is the outer rigid wall 54, which circumferentially extends a portion along lip 52 and may terminate with a diagonal edge 55. A plate 56 occupying a fraction of the area inscribed by lip 52 is provided inwardly therefrom. Lip 52 generally extends downwardly from plate 56.

Rigid and hollow casing 62 formed with a powder receiving cavity extends upwardly from plate 56. Casing 62 may be configured in any desired fashion, and may be rectilinear as shown. Longitudinal axis 63 of the powder receiving cavity, which divides the latter into two equal portions, substantially coincides with the projection of the longitudinal axis of the powder deliverable channel.

Connected to each circumferential edge 55 of outer wall 54 is a corresponding rounded flexible portion 61, and interposed between the two rounded portions 61 is the force transmitter upper wall 65, which is normally spaced above casing 62. Edge 64 of each rounded portion 61 extending from upper wall 65 to rim 53

- 20 -

is unattached. Applied to upper wall 65 are indicia 66, e.g. four stripes as shown, to indicate the location at which a force is to be applied to the force transmitter.

Cap 25 may be provided with a rigid, planar upper surface 69 substantially parallel to plate 56, to facilitate the stacking of a plurality of caps. Upper surface 69 abuts outer wall 54 and its edge 71 may extend between the two outer wall circumferential edges 55. An opening 47 through which powder is dispensable via the powder deliverable channel is formed in upper surface 69, and may be covered by pivotable spout element 49. A rigid connecting element 74, which is the upper surface of the powder deliverable channel, extends from force transmitter upper wall 65 to weakened edge 71 of the cap upper surface, and is further connected to each rounded portion 61.

Fig. 6 illustrates cap 25 in a compressed condition while a force F is applied to the force transmitter. Force transmitter upper wall 65 is shown to be substantially in contact with casing 62, causing connecting element 74 and the powder deliverable channel as represented by sidewall 32 thereof to change their angular disposition with respect to weakened edge 71 and the two rounded portions 61 to swell above upper wall 65.

Fig. 7 is a perspective, vertical cross sectional view of apparatus 30, including cap 25 and container 26, taken at the longitudinal axis of the powder deliverable channel. A powder receiving cavity 45 is shown to be formed in casing 62. Casing 62 is formed with a thickened portion 48 at the interface between the casing bottom surface 42 and the casing outer wall 43. An interspace within which container outer wall 27 is insertable and securable is defined between thickened portion 48 and lip 52.

- 21 -

Force transmitter 28 is shown to be triangular, having upper wall 65 and lower wall 78 pivotally connected at weakened portion 84, which faces away from powder dispensable channel 34 and is normally located above, and spaced from, casing 62. Force transmitter lower wall 78 may be pivotally connected to the casing upper surface at junction 86 in order to seal the powder received in cavity 45. Powder deliverable channel 34 has a bottom leveling surface 29 that longitudinally extends from force transmitter 28 to channel terminal wall 38.

It will be appreciated that the force transmitter can be configured in other ways as well, such as by means of a flexible tubular element or a spring actuated element, insofar as it transfers a pivoting inducing force to the powder deliverable channel and sufficiently seals powder that has been received in cavity 45.

Additional structural elements of cap 25 may be viewed by referring to Figs. 8 and 9, which illustrate two different perspective views, respectively, of a vertical cross section of the apparatus taken at an intermediate portion of leveling surface 29 and facing powder receiving cavity 45. Lip 46 of cavity 45, which may be oval as shown or may be of any rounded shape to prevent accumulation of powder at discontinuous surfaces, longitudinally terminates at guide wall 35 projecting above plate 56 from lower edge 37 to upper edge 39. Guide wall 35 is generally concave, extending between two portions of rim 53, and may be of variable height as shown with a maximum height slightly above cavity 45 and gradually decreasing to rim 53, or alternatively, may be of a uniform height. Guide wall 35 serves two purposes- to guide the powder into cavity 45 by virtue of its concave structure after container 26 has been tilted, and also, to provide a surface along which the distal edge of leveling surface 29 slides while leveling the powder that has accumulated within cavity 45. As seen more clearly in Figs. 13-15, guide wall 35 is sloped or is downwardly curved such that lower edge 37 is longitudinally spaced from upper edge 39 in the

- 22 -

direction of channel terminal wall 38 (Fig. 7), to ensure that the leveling surface distal edge will be in abutting relation with the entire periphery of cavity lip 46 while leveling surface 29 is being pivoted and that a predetermined dose of powder will be accurately and reliably retained within cavity 45.

An inner flexible wall, as represented by segments 58 and 59, extends within the cap interior from leveling surface 29 to lip 52, or alternatively to a desired portion of outer wall 54 or any other wall provided with the cap. The inner wall functions as a divider, serving to prevent the passage of powder, when the container is tilted, to zones 67 and 68 of the cap interior which are located between powder deliverable channel 34 and outer wall 54. As the inner wall, which may cover leveling surface 29, is preferably concave as shown, the powder deflected by segments 58 and 59 will be further guided into cavity 45. The flexibility of the inner wall also serves to return channel 34 to the illustrated normal disposition above cavity 45.

The flexible inner wall 72 surrounding leveling surface 29A and occupying the interior of cap 25 between guide wall 35 and lip 52 is shown in Fig. 10 from within the interior of the cap while being disposed above cavity 45. Opposed connecting portions 82 and 83 extend upwardly from inner wall 72 to the two sides, respectively, of leveling surface 29A. Connecting portions 82 and 83 may be arcuate as shown, angled, or alternatively, may be mutually parallel. Likewise leveling surface 29A may assume any desired configuration, such as a non-uniform width, as shown. In plate 56 occupying the interior of cap 25 between guide wall 35 and a diametrically opposite portion of lip 52 are bored one or more apertures 75 passing through casing bottom surface 42 (Fig. 7). Apertures 75, which equalize the pressure within the container interior and powder receiving cavity 45, serves to prevent the formation of air bubbles within cavity 45 which would limit the amount of powder that could be transferred to cavity 45 and would detract from the accuracy of the apparatus.

- 23 -

Powder deliverable channel 34, as shown in Fig. 11, comprises rigid bordering elements, including leveling surface 29, sidewalls 32 and 33 extending upwardly from leveling surface 29, and at its upper surface, element 74 (Fig. 6) substantially parallel to leveling surface 29. Channel 34, at its proximal end, leads to terminal wall 38, to which spout element 49 is pivotally connected by means of weakened upper edge 44 of terminal wall 38 (Fig. 6).

With reference also to Figs. 7 and 12, leveling surface 29 is pivotable at its proximal edge 31. Outer wall 54 is provided with a thick-walled portion 76 having a triangular section in the vicinity of spout element 49. The height of portion 76 is gradually reduced radially inwardly from outer wall 54, so that a weakened portion interfacing with proximal edge 31 is formed at apex 77. Channel terminal wall 38 is supported by, and is at the same angular disposition as, the upper angled edge 81 of portion 76.

Another portion of channel 34 is also pivotable. Upper edge 36 of sidewalls 32 and 33 may be pivotally connected to a weakened portion formed in apex 79 of triangular portion 76, at the junction with cap upper surface 69, as shown in Figs. 6 and 7.

As adjacent rigid bordering elements of channel 34 are connected to each other and the entire channel is pivotable, powder deliverable channel 34 will change its angular disposition upon application of a pivoting inducing force to force transmitter 28, which is pivotally connected to element 74 of the channel (Fig. 6).

Alternatively, as shown in Fig. 16, each of sidewalls 32 and 33 comprise two sections: a rigid section J and a flexible section K. Rigid section J is pivotable about a weakened portion formed at junction 87, and leveling surface 29 is

- 24 -

pivotable about its proximal edge 31 extending along apex 77 of triangular outer wall portion 76.

Rigid section J and flexible section K are separated by interface 85, which extends from junction 87 to an intermediate portion 89 of leveling surface 29. Edge 71 of cap upper surface 69 extends from rounded portion 61 to junction 87. Upon application of a pivoting inducing force to force transmitter 28, the angular disposition of the rigid elements of the powder dispensing channel, namely sidewall sections J, leveling surface 29, and upper surface 74, will change in unison. Thus flexible section K, which is connected to leveling surface 29, cap upper surface 69, and channel terminal wall 38, is forced to change its longitudinal dimensions upon application of the pivoting inducing force.

Figs. 13-15 illustrate a leveling operation performed by leveling surface 29. Fig. 13 illustrates the normal configuration of cap 25 such that cap upper surface 69 and channel upper surface 74 are substantially coplanar, force transmitter lower wall 78 is upwardly spaced from casing upper wall 57, and distal edge 23 of leveling surface 29 is substantially in contact with upper edge 39 of guide wall 35. After a force has been applied to force transmitter upper wall 65, the force is transmitted to channel upper surface 74, causing the latter to be pivotally displaced and to be substantially coplanar with rigid force transmitter upper wall 65, as shown in Fig. 14. Simultaneously with the pivotal displacement of surface 74, rigid leveling surface 29 connected to upper surface 74 by the channel sidewalls is also pivotally displaced at its proximal edge 31 with respect to triangular outer wall portion 76. Consequently, distal edge 23 of the leveling surface slides downwardly along guide wall 35, driving the excess powder that has accumulated within cavity 45 to the container interior. Fig. 15 illustrates force transmitter 28 in a fully compressed condition while leveling surface distal edge 23 is in abutting relation with guide wall lower edge 37.

- 25 -

When the force transmitter is fully compressed, cavity 45 is completely unobstructed as shown in Fig. 12. Accordingly, channel 34 is in communication with cavity 45, allowing the predetermined dose of powder to be transferred from cavity 45 to channel 34 and then dispensed when spout element 49 is opened and container 26 is suitably tilted.

In another embodiment of the invention schematically illustrated in Fig. 17, the powder deliverable channel and the casing of the powder receivable cavity are configured as part of the powder container.

A container 110 has a releasable lid 112 through which powder is introducible into interior 114, which is defined by bottom surface 115, a first side surface 121 which is stationary, and a second side surface 123 which is displaceable. Casing 116 of the powder receivable cavity 118 is attached to one end of bottom surface 115 and in close proximity to displaceable leveling surface 123 such that cavity lip 119 faces interior 114. Leveling surface 123 is a portion of the powder deliverable channel 134, and force transmitter 128 is connected to both channel 134 and casing 116.

Powder contained within interior 114 is delivered to cavity 118 when container 110 is tilted in direction C, a change in orientation of approximately 90 degrees, depending on the amount of powder that is contained therewithin. The powder is directed to surface 123 and is then gravitationally delivered to cavity 118. Channel 134 is accordingly displaced in direction D towards interior 114 after a force is applied to force transmitter 128, whereby surface 123 slides along the guide wall that surrounds cavity lip 119 and performs a leveling operation. Cavity 118 is therefore caused to be in communication with channel 134, and surface 123 isolates the predetermined dose of powder received in cavity 118 from container interior 114. When the level of powder within interior 114 is above cavity 118, container 110 need not be tilted prior to the leveling

- 26 -

operation. Container 110 is then inverted again while the displacement inducing force continues to be applied, to allow the powder to be dispensed through opening 139, which may be a spout element.

Fig. 18 illustrates a perspective view of a partially removed cap 135A, according to another embodiment of the present invention. Cap 135A comprises a force transmitter in the form of a flexible, thin-walled convex element 142, e.g. a rubber dome, and an elongated connecting element 147 extending downwardly from the center of dome 142 to the distal end of leveling surface 159. Leveling surface 159 is connected to a rigid fixture 151, to which a spout element 149 is pivotally connected at its proximal end. A bottom vertically disposed leg 155 of fixture 151 may extend upwardly from a plate which occupies a fraction of the area inscribed by lip 152 and which extends inwardly therefrom.

Dome 142 protrudes from an intermediate, horizontally disposed supporting surface 153, which is spaced between a cap upper surface 138 and casing upper wall 157. A U-shaped peripheral wall 156 surrounds dome 142 and extends between upper surface 138 and intermediate surface 153. Peripheral wall 156 is of a sufficient height to ensure that dome 142 will not protrude from upper surface 138 and will therefore not be inadvertently depressed. When dome 142 is depressed, a leveling inducing force is transmitted to leveling surface 159, causing the distal edge of the latter to slide along the casing guide wall surrounding cavity 145 and to drive powder in excess of a predetermined dose into the interior of the container.

The rear wall 165 of casing 158 is integral with cap outer wall 161. An upper thickened portion 166 interfaces upper wall 157 and rear wall 165 of casing 158 with intermediate support surface 153 of cap 135A, and a lower thickened portion 168 interfaces with rear wall 165 and lower wall 171 of casing 158 and with lip 152 of cap 135A.

- 27 -

By virtue of this configuration of the force transmitter wherein upper surface 138 and outer circular wall 161 of cap 135A are rigid, with only leveling surface 159 and dome 142 being flexible, an interim holding chamber to which powder is transferable from cavity 45 defined by upper surface 138, spout element 149 in a closed position, leveling surface 159 and outer wall 161 may be of an increased volume. Thus more than one dose of powder may be retained in the holding chamber, and then all of the retained powder will be discharged from cap 135A at one time when spout element 149 is then pivoted to an opened position and the container is suitably tilted. Grip elements 163, e.g. vertically disposed, may be applied to outer wall 161 for increased grippability.

As shown in Fig. 22, outer wall 161 of cap 135A. or alternatively, one or more curved internal walls, may direct the predetermined dose of powder transferred to holding chamber 181 from cavity 145 into the discharge opening 185 defined by fixture 151 when the spout element is in an opened condition.

Since outer wall 161 of cap 135A is circular, a tubular powder container 164 secured to a first cap 135A may be stacked on top of a second cap 135A, as shown in Fig. 19, thereby facilitating compact storage. The outer edge of upper surface 138 is formed with an oblique surface 167, e.g. a chamfered or beveled surface, extending to an upper edge of grip elements 163. A bottom rim 169 of an overlying powder container 164 is engageable with oblique surface 167 of an underlying cap 135A, and may be separated from the underlying cap by applying an upwardly directed force thereto by the fingers or by a suitable implement placed between bottom rim 169 and intermediate supporting surface 153 of the underlying cap.

As a result of the flexibility of dome 142, the manual force applied to dome 142 may be controlled so that leveling surface 159 will be angularly displaced in one

- 28 -

stroke to casing bottom surface 143, in which are formed apertures 75 for equalizing the pressure within the container interior and the powder receiving cavity, so that an entire dose will be discharged from cavity 145 as shown in Fig. 20, or alternatively, a reduced force may be applied to dome 142 so that leveling surface 159 will be angularly displaced only partially, e.g. halfway, along guide wall 146, as shown in Fig. 21, so that only a partial dose of powder will be discharged from the cavity.

A partial dose of powder can also be discharged by means of a casing 282 shown in Fig. 37, which is formed with two vertically spaced cavities 284 and 285.

As shown in longitudinal cross sectional views of Figs. 18 and 23-25, leveling surface 159 in a relaxed state, i.e. when not angularly displaced, extends upwardly from fixture 151 to a height slightly above cavity 145. Since cavity 145 is rounded, e.g. oval, and leveling surface 159 in a relaxed state is located above the varying cavity lip 148 while contacting the guide wall 146 and may therefore be slightly concave when viewed from below, the projection from the side of the distal end of leveling surface 159 is shown to contact in Figs. 21, 23 and 24 substantially the entire projected cavity lip 148.

Fig. 23 illustrates container 164 in an upright position and Fig. 24 illustrates container 164 in an inverted position, after being tilted to initiate a dispensing operation. The inclined configuration of leveling surface 159 in a relaxed state serves as a divider to prevent passage of powder to holding chamber 181 when container 164 is tilted or inverted while powder is being transferred to cavity 145 from container 164.

In this embodiment, the entire periphery of flexible leveling surface 159 is attached to the cap, with the exception of the distal edge of the leveling surface, which is unattached so as to be slidable along the guide wall. The proximal edge

- 29 -

of leveling surface 159 is attached to fixture 151. Each transversal edge of leveling surface 159 is attached at a longitudinally extending attachment region 183 to a corresponding transversal protrusion 191, which transversally protrudes inwardly from outer wall 161 for a limited length. An attachment region 183 may be seen more clearly in Fig. 26.

When dome 142 is depressed, connecting element 147 transmits the leveling inducing force to leveling surface 159, which is thereby caused to be plastically deformed in such a way that its central region located between the two attachment regions 183 is urged to be downwardly displaced in a controlled manner and its distal edge slides along guide wall 146. At the completion of the leveling operation, distal edge 160 of leveling surface 159 contacts casing bottom surface 143, as shown in Fig. 20, and the leveling surface may become slightly convex when viewed from below, as shown in Fig. 27.

With reference to Fig. 25, cap 135A may comprise a casing 162 for a powder receiving cavity which is formed with pressure equalizing grooves. Casing upper wall 177 is integral with, or connected to, intermediate supporting surface 153 of the cap. Casing rear wall 175 is spaced from outer wall 161 of the cap to define an interspace 176 therebetween. Substantially parallel grooves 178 and 179 formed in casing rear wall 175 are in communication with both interspace 176 and powder receiving cavity 170.

As shown in Figs. 26-28, holding chamber 204 may be defined by separated side walls 206 and 207 between which dome 142 and peripheral wall 156 are interposed. Side walls 206 and 207 longitudinally extend from spout element 205 to, and may be integral with, guide wall 209 of cap 135A. Alternatively, side walls 206 and 207, as well as each transversal protrusion 191 and the leveling surface 212 which are connected to the side walls, may be removable from cap 135A. Protrusions 191 are removably attachable to cap 135A by means of a

- 30 -

corresponding extension 211 that is insertable in a groove formed in lip 152. Side walls 206 and 207 may be arcuate, e.g. concave, in order to direct the predetermined dose of powder transferred to holding chamber 204 from cavity 145 to spout element 205 when the latter is in an opened condition. Side walls 206 and 207 may also extend downwardly from upper surface 138 to a rounded portion 198 of a corresponding transversal protrusion 191, which protrudes inwardly from lip 152.

Fig. 26 illustrates the peripherally attached leveling surface 212 in a relaxed state such that it is slightly concave when viewed from below and located above, or in contact with, cavity lip 148. In Figs. 27 and 28, leveling surface 212 is in a stressed state, after dome 142 has been depressed to a fullest extent, such that the leveling surface is slightly convex when viewed from below and located completely below cavity 145.

As the leveling surface is attached to side walls 206 and 207, it assumes the same projected shape as holding chamber 204, for example, as shown in Fig. 28, wherein its distal edge 213 is significantly wider than its proximal edge 214, e.g. twice as wide, and its side edges are curved. Alternatively, as shown in Fig. 38, a triangular leveling surface 215 may be employed such that its widest dimension is the distal edge 217 thereof. A powder receiving cavity 219 may have any desired shape that can be suitably leveled by the corresponding leveling surface, for example one that has a major axis and a minor axis but is not elliptical, i.e. the sum of the distances of different points on cavity lip 248 from two fixed points changes.

Leveling surface 212 shown in Figs. 27 and 28 is provided with a plurality of elongated and spaced reinforcement elements 216 attached to its underside. Reinforcement elements 216, which may longitudinally extend substantially the entire length of leveling surface 212, or extend only a limited length thereof,

- 31 -

provide the leveling surface with the required amount of elasticity that will ensure that it will return to its relaxed state after being stressed. It will be appreciated that the leveling surface of any other embodiment described herein may be provided with a plurality of reinforcement elements.

Fig. 29 illustrates a cap 135B which is configured similarly to cap 135A shown in Fig. 18, with the exception of an arcuate outer wall 193 and two spaced oblique outer walls 195 and 196 extending from arcuate outer wall 193 and leading to spout element 186, all of which project upwardly from plate 197.

Fig. 30 illustrates a cap 135C that has an outer circular wall 199 which encircles the entire cap and abuts from the side the fixture of spout element 187. The discharge opening associated with spout element 187 is sufficiently large to allow more than one dose of powder to be dispensed from the holding chamber at once. Upper planar surface 201 of cap 135C extends radially inwardly from the entire periphery of outer wall 199, and dome 142 protrudes upwardly from a central region of upper surface 201.

Fig. 31 illustrates a cap 135D which comprises a replaceable cavity casing 262, to allow the predetermined dose receivable in the cavity to be adjusted. Fig. 32 illustrates the void area 264 within cap 135D when the casing is removed. Cap 135D may be configured identically to cap 135C of Fig. 30, or of any other embodiment, with the exception of the provision of replaceable cavity casing 262.

Figs. 33 and 34 illustrate replaceable cavity casing 262. Cavity casing 262 comprises guide wall 222 with which cavity lip 148 is flush, and rounded casing outer wall 243 within which cavity 145 is formed. The two transversal, substantially straight edges 226 and 227 of guide wall 222 protrude transversally from casing outer wall 243. Underlying casing outer wall 243 and

- 32 -

located above casing bottom surface 233 is rounded and planar engagement element 232. Engagement element 232 protrudes outwardly from casing outer wall 243, and extends circumferentially from edge 226 to edge 227 of guide wall 222.

Two pins 229 longitudinally protrude from guide wall 222. Each of the pins 229 is located between cavity 145 and a corresponding transversal edge of guide wall 222, and is substantially coplanar with engagement element 232.

With reference also to Figs. 32, 35 and 36, each transversal protrusion 191 of cap 135D and rounded portion 236 thereof terminate with a corresponding planar abutment surface 239, from which upwardly extends a sidewall 241. An aperture 244 is bored in each abutment surface 239, for receiving a corresponding pin 229 by which casing 262 is releasably secured to the two abutment surfaces and properly positioned within cap 135D. To further assist in suitably securing casing 262, engagement element 232 is insertable within a groove 274 formed in the cap lip 272.

As shown in Figs. 33 and 36, casing 262 may also comprise a dome receiving compartment 276 when the dome is depressed, to increase the compactness of the cap and to prevent passage of powder outside of the holding chamber when the container is inverted. In order to provide the dome receiving compartment 276, a central portion 247 of guide wall 222 is removed, from upper edge 251 thereof to a peripheral portion 253 of the casing surrounding an uppermost region 255 of cavity 145. Dome receiving compartment 276 is defined by an arcuate surrounding wall 259 of varying height, which is substantially perpendicular to guide wall 222 and extends vertically from upper peripheral portion 253 of casing 262. Surrounding wall 259, which peripherally extends between the two transversal edges of removed portion 247 and is in

- 33 -

communication with the holding chamber, has a shape of the dome when depressed and therefore receives the dome during a leveling operation.

Fig. 37 illustrates a replaceable cavity casing 282 that is formed with two cavities 284 and 285. Upper cavity 284 is separated from lower cavity 285 by partition 287 extending from rear wall 289 of casing 282. Engagement element 232 extending rearwardly from rear wall 289 is insertable within a groove formed in the cap lip 272. Thus when dome 142 is depressed halfway, leveling surface 159 will slide along guide wall 283 and will be displaced to partition 287, enabling powder to be transferred from upper cavity 284 to the holding chamber. Likewise if dome 142 is completely depressed, powder can be transferred from both cavities 284 and 285.

Fig. 39 illustrates another embodiment of the invention wherein cap 335 shown in a relaxed state comprises a pair of spaced force transmitters 342 and 344. In this embodiment, both planar upper surface 338 and circular outer wall 361 of cap 335, as well as the leveling surface, are made of a flexible material; however, the material from which upper surface 338 and outer wall 361 are made is substantially more rigid than the material from which the leveling surface is made. It will be appreciated that the upper surface and outer wall may have any other desired shape. Force transmitters 342 and 344 are shown to have a rectangular cross section and to transversally protrude from outer wall 361 at substantially diametrically opposite portions thereof. Differently configured force transmitters are also in the scope of the invention.

Fig. 40 illustrates the interior of cap 335 when in a relaxed state. Casing 362 formed with cavity 345, bottom surface 343, and guide wall 346 is rigid and mounted within the interior of cap 335. Also mounted within the interior of the cap is flexible leveling unit 372, including leveling surface 359, which occupies the remaining portion of cap 335, from guide wall 346 to discharge opening 385.

- 34 -

Leveling surface 359 is peripherally attached to cap outer wall 361, with the exception of distal edge 313 of the leveling surface. Flexible leveling unit 372 also comprises circumferentially extending, curved side surface 365, which extends downwardly from, and is attached to, leveling surface 359, serving to attach leveling surface 359 to the inner face of cap outer wall 361. Side surface 365 has substantially the same curvature as cap outer wall 361. A corner element 377 of flexible leveling unit 372 is attached to each end of side surface 365 and to guide wall 346, pointing in the direction of cavity 345. The three elements of flexible leveling unit 372, i.e. leveling surface 359, side surface 365, and corner element 377, may be made of the same material and may be attached together and to cap outer wall 361 in the same way, e.g. by welding. In the relaxed state, leveling surface 359, side surface 365, and corner element 377 may be mutually perpendicular, as shown.

Fig. 41 illustrates thin walled and variably shaped flexible leveling unit 372 when removed from the interior of the cap. A thin and narrow projection 381 extends outwardly from the bottom of corner element 377 and extends circumferentially below side surface 365. Oblique side edge 379 of each corner element 377 extends from projection 381 to a concave edge 380 slightly below upper edge 373 of the flexible unit. Upper edge 373 is connected to distal edge 313 of leveling surface 359.

Fig. 42 illustrates casing 362 when removed from the interior of the cap. Planar guide wall 346 has inclined side edges 347 and 348 arranged such that casing upper wall 357 is shorter than casing bottom surface 343. An engagement element 369 projecting outwardly from near the bottom of guide wall 346 extends circumferentially between side edges 347 and 348 without occupying any volume of the holding chamber.

- 35 -

Fig. 43 is a vertical cross sectional view of the cap without showing the flexible unit. Outer circular wall 361 of the cap is thin walled. At this view, cap outer wall 361 appears to contact side edges 347 and 348 of guide wall 346; however in reality, there is an interspace between outer wall 361 and side edges 347 and 348 of the rigid casing 362, to allow for plastic deformation of the outer wall, as will be described hereinafter. Likewise there is an interspace between casing upper wall 357 and cap upper surface 338. Casing engagement element 369 is shown to be in abutment with the underside of cap lip 152.

Fig. 44 is a vertical cross sectional view of an assembled cap 335 in a relaxed state, while illustrating the relative location of both casing 362 and flexible leveling unit 372. Leveling surface 359 is shown to be inclined, its upper face 366 gradually decreasing in height from a height of its distal edge 313 and upper edge 373 of flexible leveling unit 372 connected thereto which is located slightly above an uppermost region of cavity 345 yet below casing upper wall 357, to a proximal edge located discharge opening 385 (Fig. 40).

Flexible unit 372 is coupled to cap outer wall 361 by means of projection 381, for example by welding, injection molding or mechanical engagement, so that projection 381 thereof will be in abutment with the underside of cap lip 152 and its side surface 365 will be in abutment with cap outer wall 361.

Corner element 377 of flexible leveling unit 372 is shown to be positioned in the interspace between cap outer wall 361 and guide wall 346. Since oblique side edge 379 of each corner element 377 extends to distal edge 313 of the leveling surface, corner element 377 therefore serves to both cover the interspace between cap outer wall 361 and guide wall 346 and to transmit a force to distal edge 313 of leveling surface 359.

- 36 -

Fig. 45 is a vertical cross sectional view of an assembled cap 335 in a stressed state. As a result of a force F being applied simultaneously to the two force transmitters 342 and 344, as shown in Fig. 44, cap outer wall 361 becomes plastically deformed, changing its inclination until contacting the inclined edges of guide wall 346, as shown in Fig. 45. In response to the change in inclination of cap outer wall 361, cap upper surface 338 bulges outwardly and oblique side edge 379 of each corner element 377 also changes its disposition. Due to the change in disposition of cap outer wall 361 and corner element side edge 379, a force is transmitted to distal edge 313 and upper face 366 of leveling surface 359, causing the latter to be controllably and reversibly flexed such that distal edge 313 slides downwardly along guide wall 359 until the entire cavity 345 becomes exposed, thereby enabling a predetermined dose of powder to be discharged to the holding chamber.

While some embodiments of the invention have been described by way of illustration, it will be apparent that the invention can be carried out with many modifications, variations and adaptations, and with the use of numerous equivalents or alternative solutions that are within the scope of persons skilled in the art, without departing from the spirit of the invention or exceeding the scope of the claims.

- 37 -

CLAIMS

1. Apparatus for dispensing a predetermined dose of powder, comprising:
 - a) a container containing powder;
 - b) a rigid hollow casing formed with a powder receiving cavity, powder being transferable from an interior of said container to said cavity upon a first reorientation of said container;
 - c) a spout element through which powder is dispensable;
 - d) a displaceable surface mounted to one or more walls of said apparatus, for leveling the powder received in said cavity to define a predetermined dose of powder; and
 - e) a force transmitter, for transmitting an applied force to said leveling surface and for initiating thereby a leveling operation, said predetermined dose of powder being transferable from said cavity to an interim holding chamber located between said cavity and said spout element, when said spout element is in a closed position, following said leveling operation and upon a second reorientation of said container.
2. The apparatus according to claim 1, wherein the casing comprises a guide wall with which a rounded lip of the cavity is substantially flush, a distal edge of the leveling surface being slidable along said guide wall during the leveling operation.
3. The apparatus according to claim 2, wherein the leveling surface in a relaxed state isolates the cavity and the container interior from the holding chamber.
4. The apparatus according to claim 3, wherein the leveling surface in a relaxed state is suitably configured, when the container is tilted or inverted, to

- 38 -

direct the powder from the container interior to the cavity.

5. The apparatus according to claim 2, wherein the distal edge of the leveling surface in a relaxed state is substantially in contact with an upper edge of the cavity

6. The apparatus according to claim 3, wherein the holding chamber is in communication with the cavity when the leveling surface is in a stressed state.

7. The apparatus according to claim 2, wherein the guide wall is curved along the path of travel of the leveling surface, ensuring that the leveling surface slides along the guide wall during its entire path of travel and thereby defining an accurate predetermined dose of powder.

8. The apparatus according to claim 7, wherein a lower edge of the cavity is proximally spaced from an upper edge thereof.

9. The apparatus according to claim 6, wherein the leveling surface in a stressed state is adapted to direct powder discharged from the cavity to the spout element.

10. The apparatus according to claim 1, wherein more than one predetermined dose of powder is retainable in the holding chamber.

11. The apparatus according to claim 1, wherein one or more reinforcement elements are attached to an underside of the leveling surface, for providing the leveling surface with elasticity to ensure that it will return to its relaxed state after being stressed.

12. The apparatus according to claim 2, wherein the force transmitter

- 39 -

comprises a flexible, thin-walled convex element, and an elongated connecting element extending downwardly from said convex element to a distal end of the leveling surface.

13. The apparatus according to claim 12, wherein the force applied to the leveling surface by means of the force transmitter is controllable whereby the distal edge of the leveling surface is slidable along the guide wall in one stroke to a casing bottom surface to allow a complete dose of powder to be discharged from the cavity or is slidable partially along the guide wall to allow a partial dose of powder to be discharged from the cavity.

14. The apparatus according to claim 13, wherein the casing is formed with two vertically spaced cavities whereby a partial dose of powder is transferable to the holding chamber when the distal edge of the leveling surface is displaced along the guide wall to a height which is below an upper cavity.

15. The apparatus according to claim 2, wherein the leveling surface, with the exception of the distal edge thereof, is peripherally attached to at least one wall of the apparatus.

16. The apparatus according to claim 15, wherein the at least one wall to which the leveling surface is peripherally attached is an outer wall.

17. The apparatus according to claim 15, wherein the leveling surface is also peripherally attached to a fixture about which the spout element is pivotally openable and closable.

18. The apparatus according to claim 15, wherein the leveling surface is peripherally attached to two separated longitudinally extending side walls each

- 40 -

of which being inwardly spaced from an outer wall by means of a corresponding transversal protrusion and defining the holding chamber.

19. The apparatus according to claim 18, wherein the side walls are concave in order to direct the predetermined dose of powder from the holding chamber to the spout element.

20. The apparatus according to claim 18, wherein the side walls are integrally formed with the guide wall.

21. The apparatus according to claim 1, wherein the casing is formed with one or more pressure equalizing apertures to prevent the formation of air bubbles within the cavity.

22. The apparatus according to claim 2, wherein the casing is replaceable to define a different dose of powder that is receivable in the cavity.

23. The apparatus according to claim 22, wherein the casing is releasably engageable with two separated longitudinally extending side walls each of which being inwardly spaced from an outer wall by means of a corresponding transversal protrusion and defining the holding chamber.

24. The apparatus according to claim 23, wherein a plurality of pins longitudinally protruding from the guide wall at a location between the cavity and a corresponding transversal edge of the guide wall are receivable within corresponding apertures bored in a side wall abutment surface and wherein an engagement element protruding outwardly from a casing outer wall and extending circumferentially from a first transversal edge to a second transversal edge of the guide wall is insertable in a corresponding groove of the apparatus.

- 41 -

25. The apparatus according to claim 12, wherein the casing comprises a compartment for receiving the flexible convex element when depressed, said compartment being defined by an arcuate surrounding wall of varying height which extends vertically from an upper peripheral portion of the casing.

26. The apparatus according to claim 25, wherein the compartment is in communication with the holding chamber.

27. The apparatus according to claim 12, wherein the convex element protrudes from an intermediate supporting surface and a U-shaped peripheral wall surrounds the convex element and extends between an upper surface and said intermediate surface, said peripheral wall being of a sufficient height to ensure that the convex element will not be inadvertently depressed.

28. The apparatus according to claim 27, which is stackable such that all overlying containers are in mutual alignment.

29. The apparatus according to claim 1, wherein a plurality of grip elements are applied to an outer wall for increased grippability.

30. The apparatus according to claim 15, which comprises a circular outer wall, upper surface connected to said outer wall, and leveling surface, all of which being flexible,

wherein a pair of force transmitters transversally protrude from said outer wall at substantially diametrically opposite portions thereof,

wherein the rigid casing has inclined side edges which are spaced from said outer wall to allow for plastic deformation of the outer wall,

wherein said outer wall changes its inclination upon application of a force to said pair of transmitters simultaneously until contacting said inclined side

- 42 -

edges of the casing, said applied force being transmitted to the leveling surface such that it is controllably and reversibly flexed, whereby the distal edge of the leveling surface slides along the guide wall to expose at least a portion of the cavity to the holding chamber.

31. The apparatus according to claim 2, wherein the leveling surface is pivotable about a proximal edge thereof.

32. The apparatus according to claim 31, wherein the holding chamber is defined by a rigid powder deliverable channel which comprises the leveling surface, channel sidewalls, and a terminal wall at its proximal end to which the spout element is pivotally connected.

33. The apparatus according to claim 32, wherein a longitudinal axis of the cavity substantially coincides with the projection of a longitudinal axis of the channel.

34. The apparatus according to claim 32, wherein the entire channel is pivotable in unison upon application of the force to the force transmitter.

35. The apparatus according to claim 34, wherein the force transmitter is triangularly shaped and comprises first and second pivotally connected elements, said first element being pivotally connected to a border element of the channel and said second element being pivotally connected to the casing, said force transmitter being compressible upon application of a pivoting inducing force thereto.

36. The apparatus according to claim 35, wherein the first element is provided with indicia to indicate the location at which a force is to be applied.

- 43 -

37. The apparatus according to claim 1, wherein a cap is provided with the casing, spout element, and force transmitter, said cap being configured with a lip along its periphery by which said cap is removably securable to the powder container.

38. The apparatus according to claim 35, wherein a cap is provided with the casing, spout element, channel and force transmitter, said cap further comprising a rigid outer wall and one or more flexible portions connecting the first element of the force transmitter and said outer wall, to assist in returning the channel to its normal disposition upon cessation of the applied force.

39. The apparatus according to claim 38, wherein a rigid upper surface of the channel is pivotally connected to a stationary upper surface of the cap and to the first element of the force transmitter.

40. The apparatus according to claim 39, wherein the outer wall of the cap has a thick-walled, triangularly shaped portion the height of which is gradually reduced radially inwardly to define an apex, said apex being a weakened portion that interfaces with a proximal edge of the leveling surface and about which the leveling surface is pivotable.

41. The apparatus according to claim 40, wherein the channel terminal wall is supported by, and is at the same angular disposition as, an upper angled edge of the triangularly shaped portion.

42. The apparatus according to claim 39, wherein the channel is pivotable by means of a weakened portion associated with the channel sidewalls.

43. The apparatus according to claim 42, wherein an upper edge of the sidewalls is pivotally connected to a weakened portion formed in the triangular

- 44 -

portion at a junction with the cap upper surface.

44. The apparatus according to claim 42, wherein each sidewall comprises a rigid section and a flexible section, said rigid section being pivotable at a weakened portion formed at a junction with said flexible section and with an edge of the cap upper surface while said flexible section changes its longitudinal dimensions.

45. The apparatus according to claim 37, wherein all components of the cap are produced by single or double injection molding.

46. The apparatus according to claim 38, wherein all components of the cap are produced by single or double injection molding.

47. The apparatus according to claim 2, wherein the guide wall is concave, in order to direct powder to the cavity.

48. The apparatus according to claim 38, wherein the cap further comprises a flexible inner wall extending from the leveling surface to the outer wall, for directing powder to the cavity and for assisting in returning the channel to its normal disposition upon cessation of the applied force.

49. The apparatus according to claim 32, wherein the channel, casing, spout element, and force transmitter are configured as components of the container.

50. The apparatus according to claim 1, wherein the casing, spout element, and force transmitter are configured as components of the container.

51. The apparatus according to claim 1, wherein the casing or holding chamber is made of a transparent or translucent material.

- 45 -

52. The apparatus according to claim 1, wherein the casing, holding chamber, and leveling surface are made of a washable or disposable material.

53. The apparatus according to claim 1, wherein the spout element is pivotable from a closed position to an opened position.

54. The apparatus according to claim 18, wherein the transversal protrusions connected to a corresponding side wall are removably attachable to an outer wall.

55. A method for dispensing a predetermined dose of powder, comprising the steps of:

- a) providing a cap with-
 - i. a hollow casing formed with a cavity for receiving a predetermined dose of powder;
 - ii. a guide wall with which a rounded lip of said cavity is substantially flush;
 - iii. a displaceable surface mounted to one or more walls of said cap, for leveling the powder received in said cavity to define said predetermined dose of powder;
 - iv. a spout element through which powder is dispensable;
 - v. an interim holding chamber located between said cavity and said spout element; and
 - vi. a force transmitter for transmitting an applied force to said leveling surface;
- b) securing said cap to a powder container;
- c) tilting said container to a first direction so that powder will be received in said cavity while the passage of powder to said holding chamber is prevented;

- 46 -

- d) applying a force to said force transmitter, whereby said leveling surface slides along said guide wall while powder in excess of said predetermined dose is driven into the interior of said container and said holding chamber is caused to be in communication with said cavity;
- e) tilting said container to a second direction so that said predetermined dose of powder is transferred to said holding chamber;
- f) dispensing powder from said holding chamber via said spout element; and
- g) releasing said force, causing said leveling surface to return to its relaxed state.

56. The method according to claim 55, wherein the force is applied by depressing a flexible convex element, causing the force to be transmitted to the leveling surface.

57. The method according to claim 56, wherein the applied force is controllable whereby a distal edge of the leveling surface is slidable along the guide wall in one stroke to a casing bottom surface to allow a complete dose of powder to be discharged from the cavity or is slidable partially along the guide wall to allow a partial dose of powder to be discharged from the cavity.

58. The method according to claim 55, wherein the holding chamber is a channel which comprises the leveling surface and the force is applied by depressing the force transmitter which comprises first and second pivotally connected elements, said first element being pivotally connected to a border element of said channel and said second element being pivotally connected to the casing, whereby application of the force causes said chamber to pivot so that a distal edge of the leveling surface will slide along the guide wall.

59. The method according to claim 55, wherein the force is applied by

- 47 -

depressing a pair of force transmitters transversally protruding from a round and flexible outer wall of the cap at substantially diametrically opposite portions thereof, causing said outer wall to change its inclination until contacting side edges of the casing and the leveling surface to be controllably and reversibly flexed, whereby the distal edge of the leveling surface slides along the guide wall to expose at least a portion of the cavity to the holding chamber.

60. The method according to claim 55, wherein more than one dose of powder is transferred to the holding chamber before being dispensed from the spout element.

61. The method according to claim 55, wherein a first cap is replaced by a second cap having a casing formed with a cavity for receiving a different predetermined dose of powder, and repeating steps c-f.

62. The method according to claim 55, wherein a first casing is replaced by a second casing formed with a cavity for receiving a different predetermined dose of powder, and repeating steps b-f.

63. The method according to claim 55, wherein the predetermined dose of powder is dispensed in a one-handed operation.

1/29

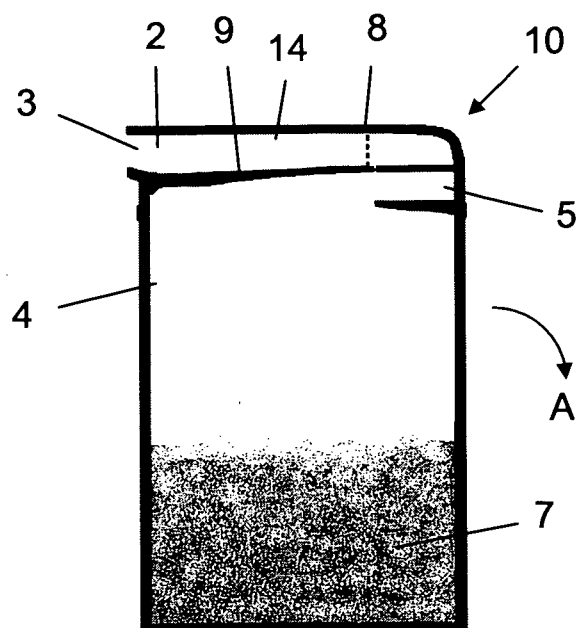


Fig. 1

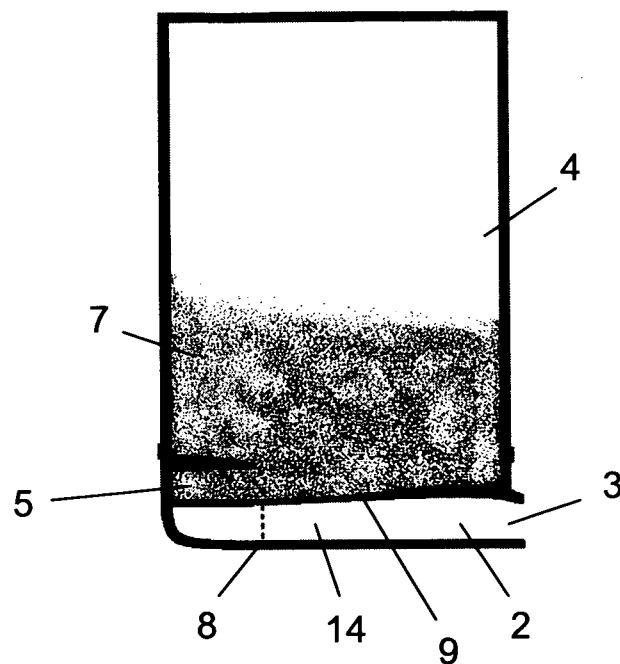


Fig. 2

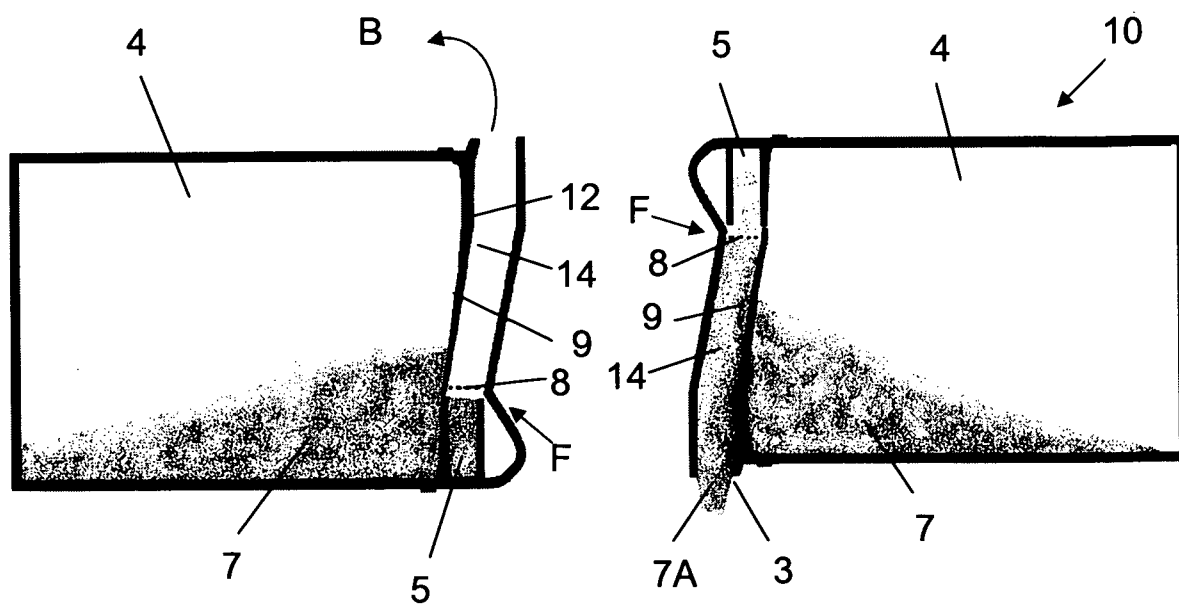


Fig. 3

Fig. 4

2/29

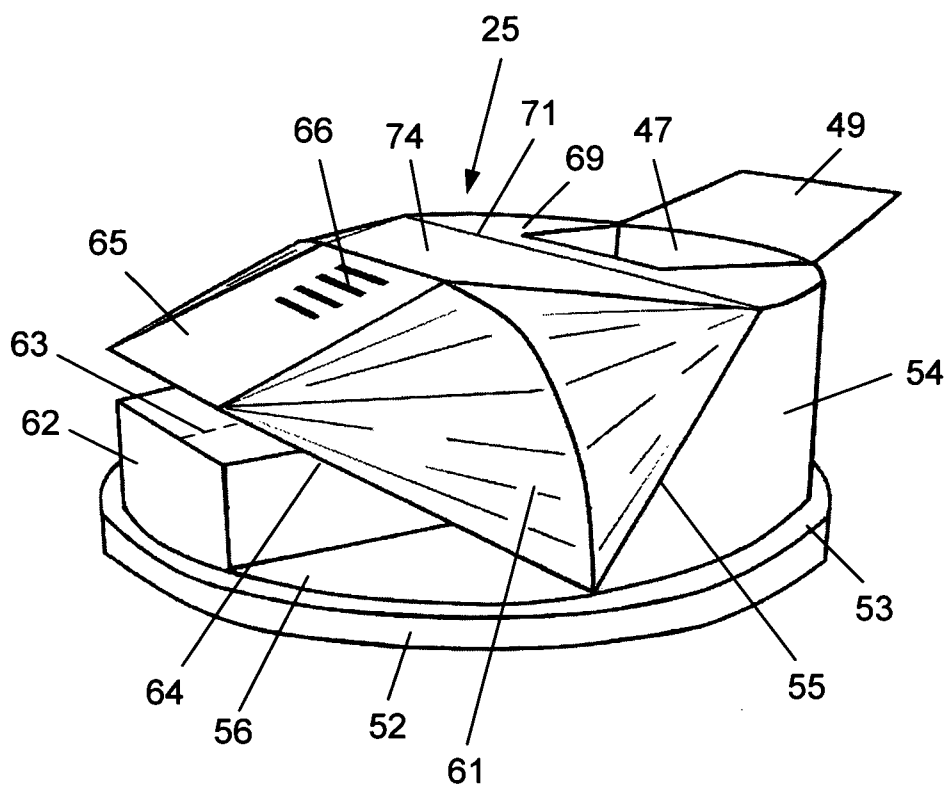


Fig. 5

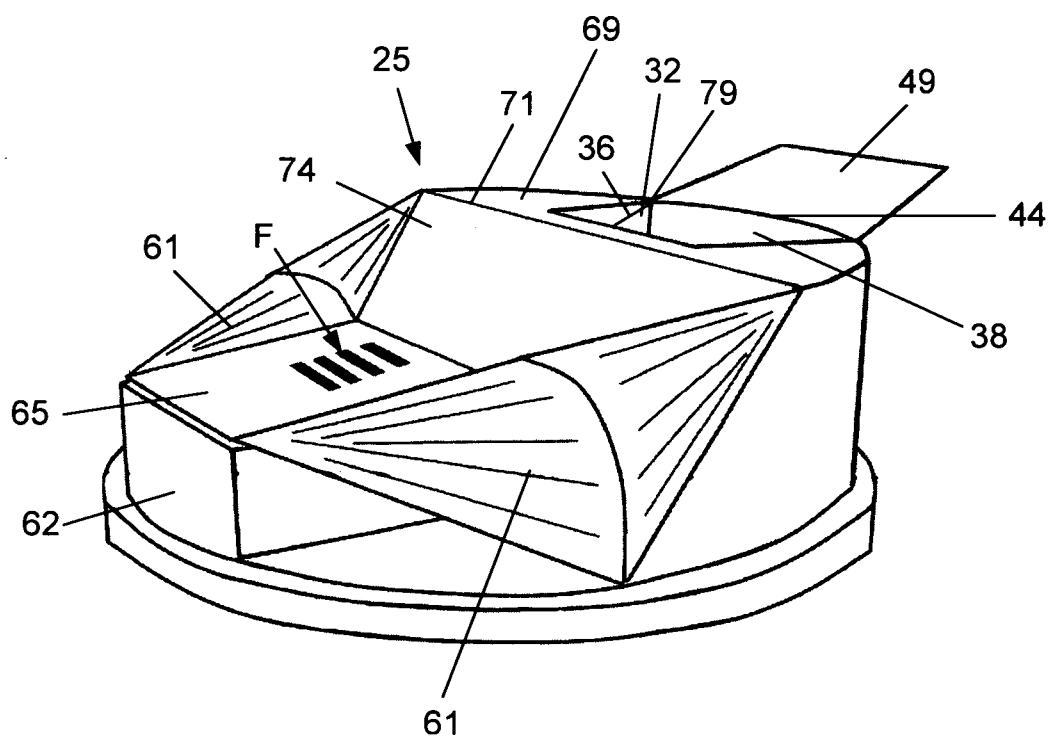


Fig. 6

3/29

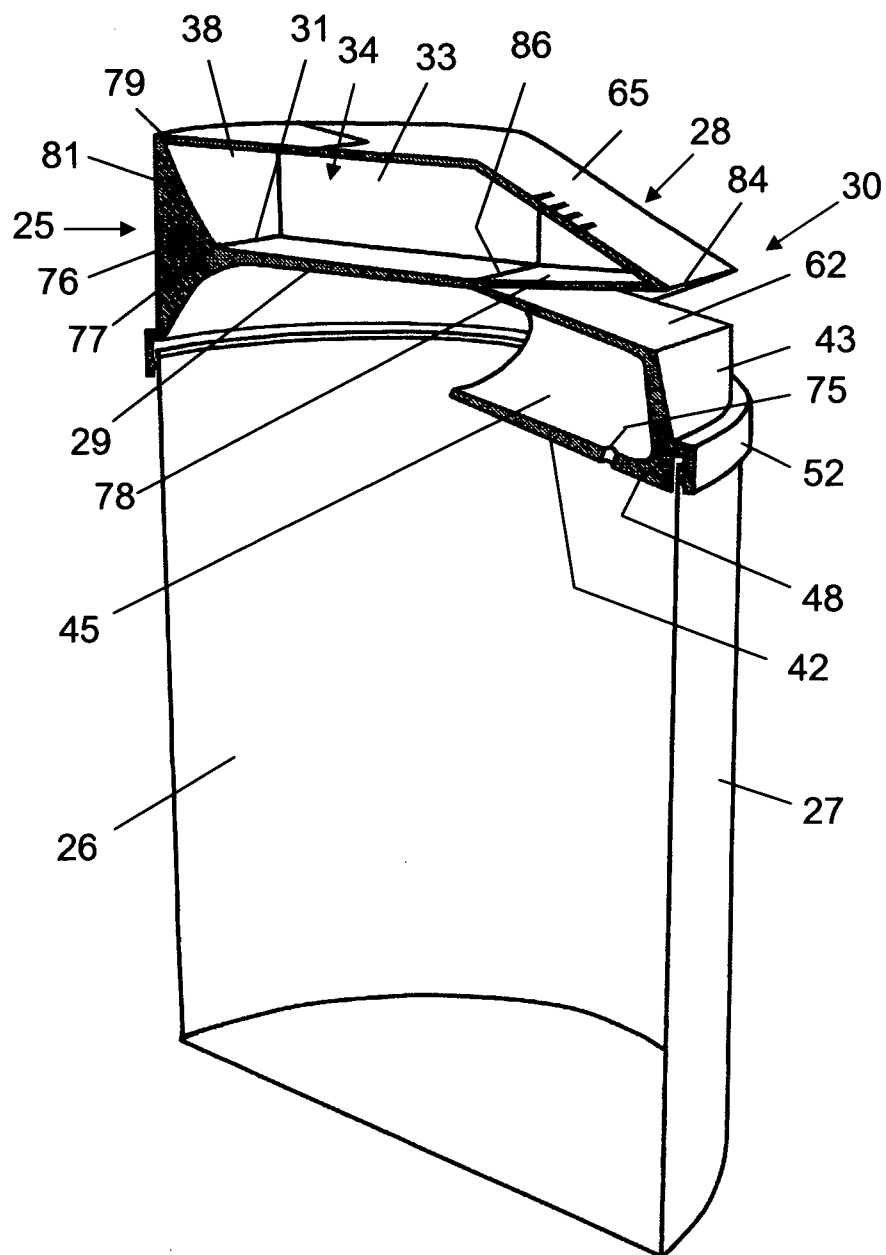


Fig. 7

4/29

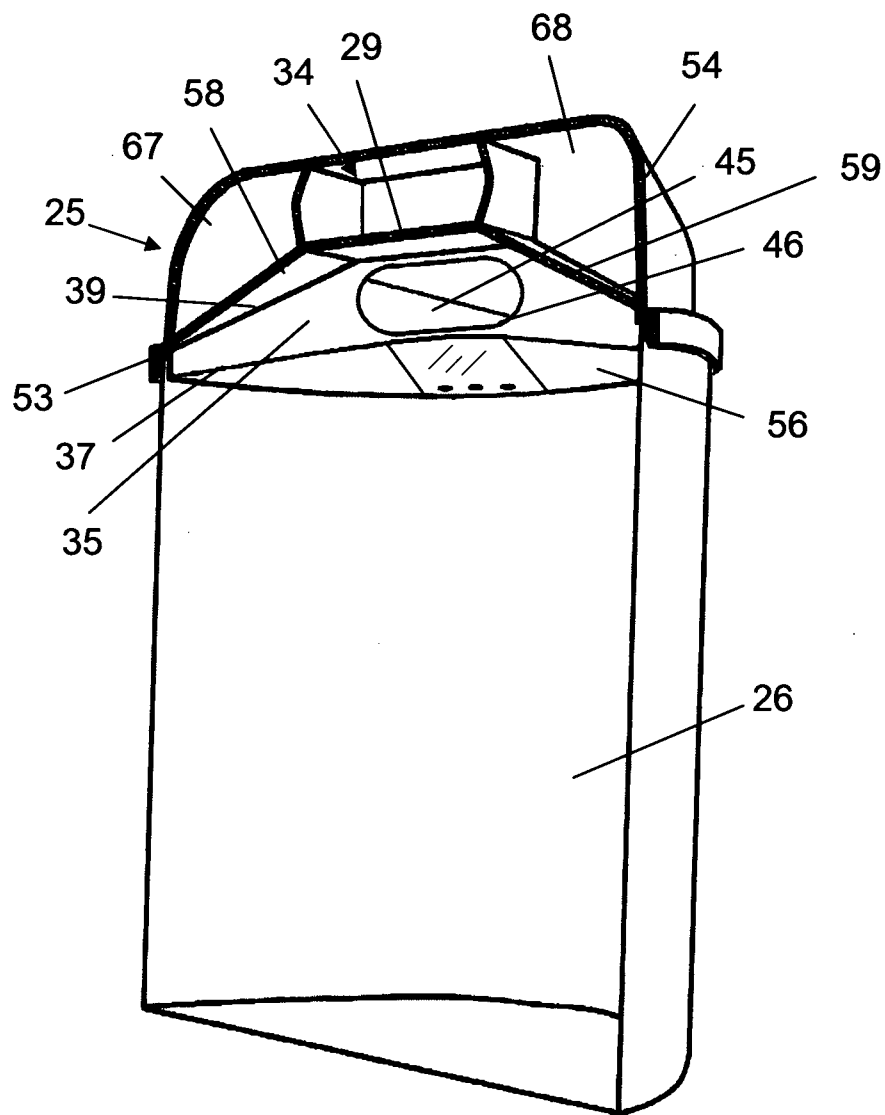


Fig. 8

5/29

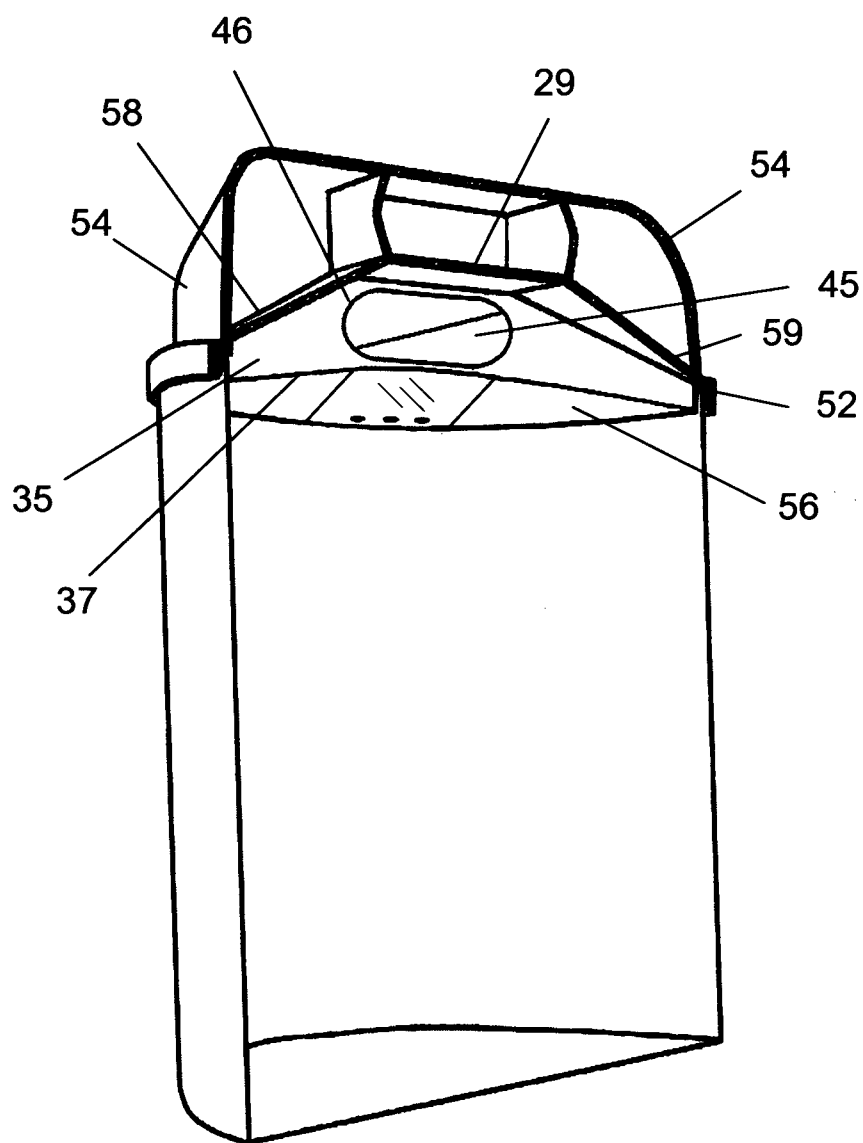


Fig. 9

6/29

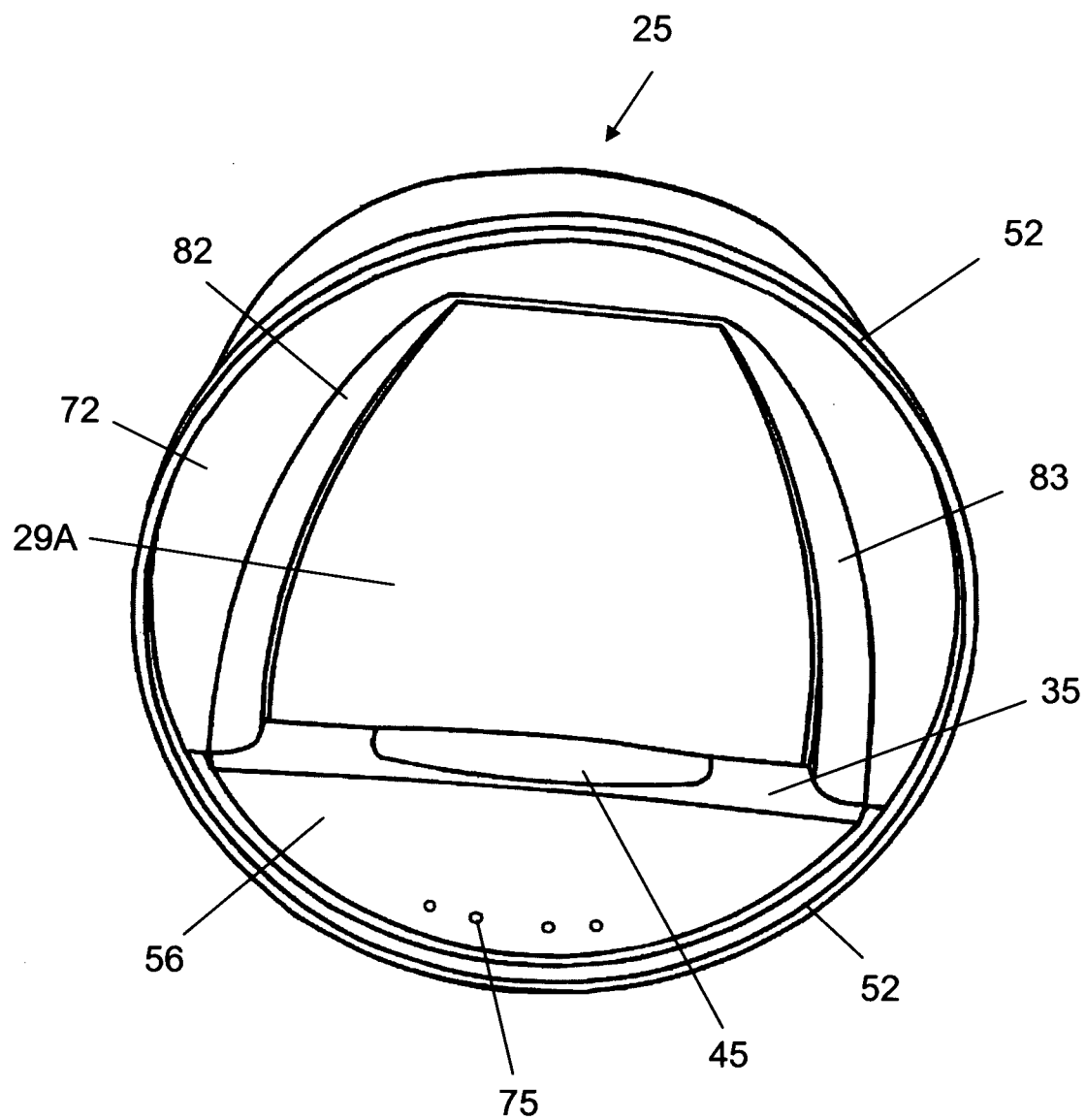


Fig. 10

7/29

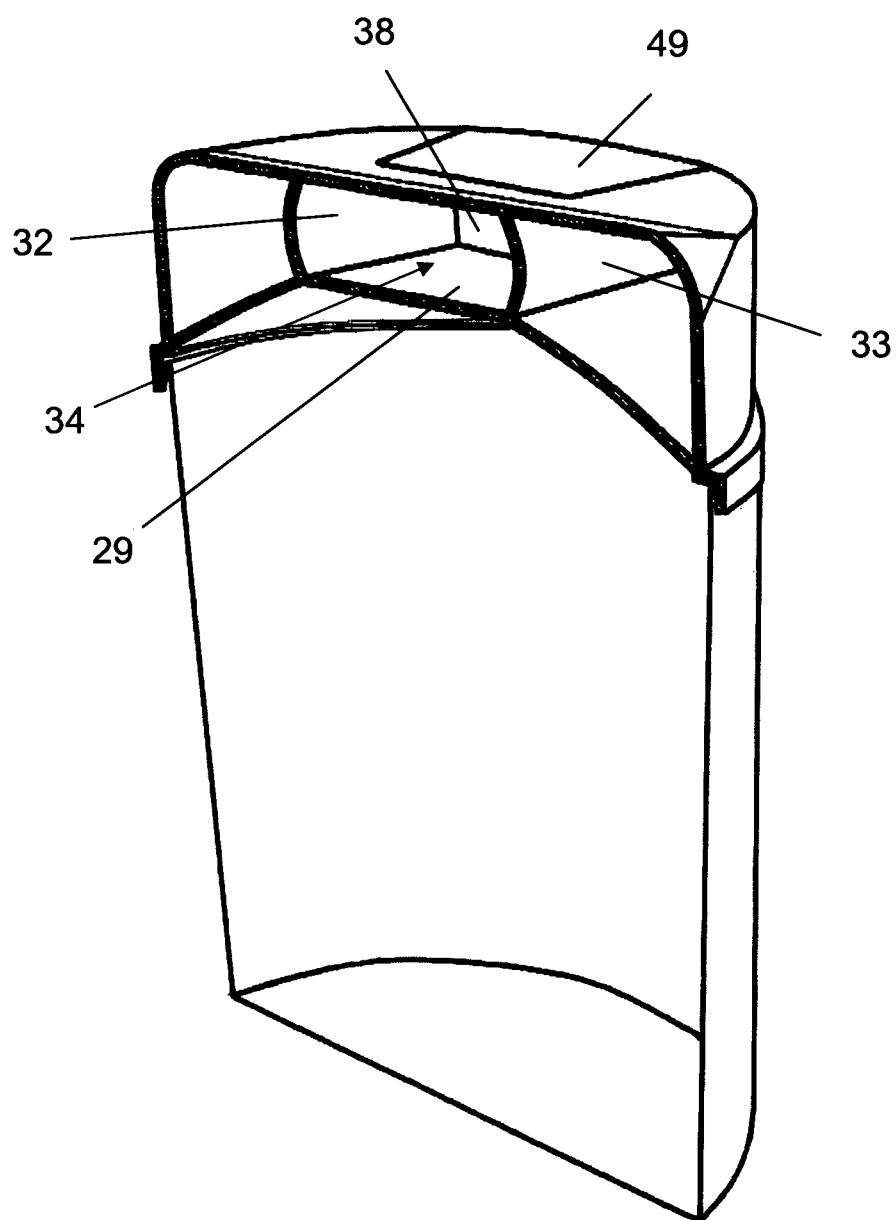


Fig. 11

8/29

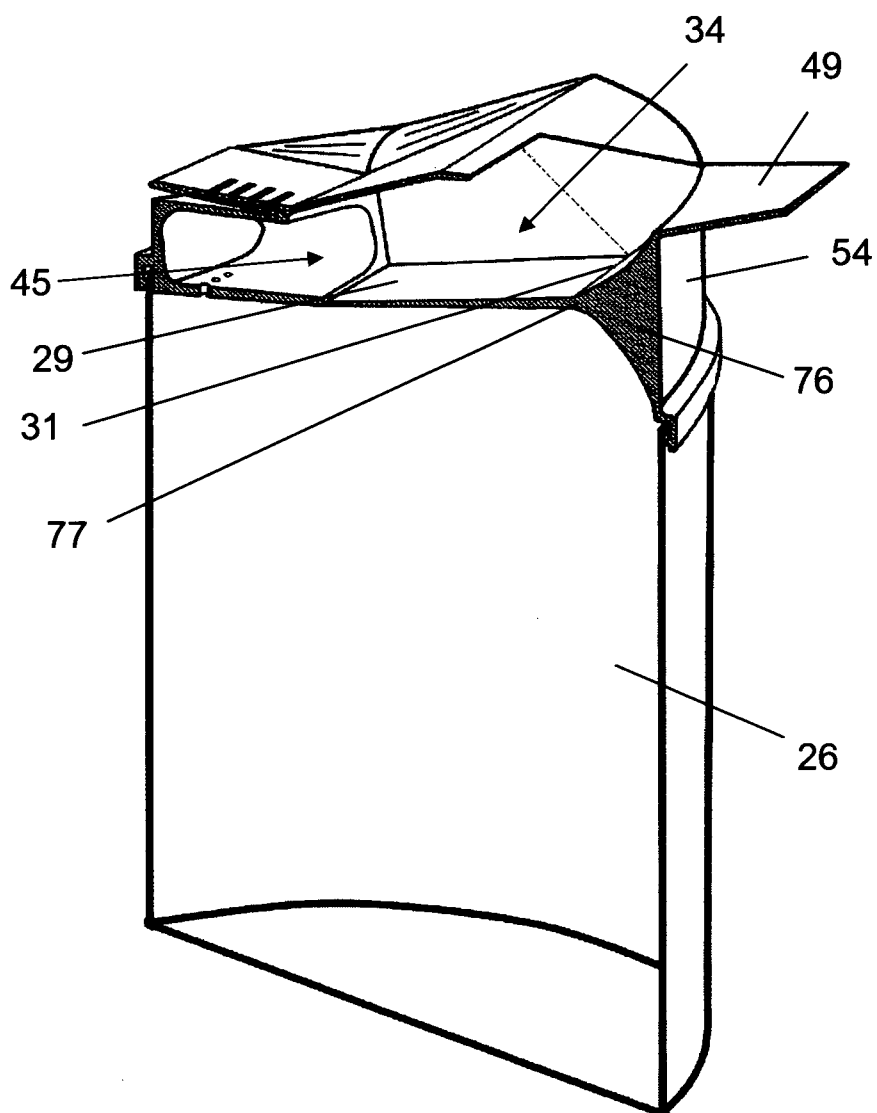


Fig. 12

9/29

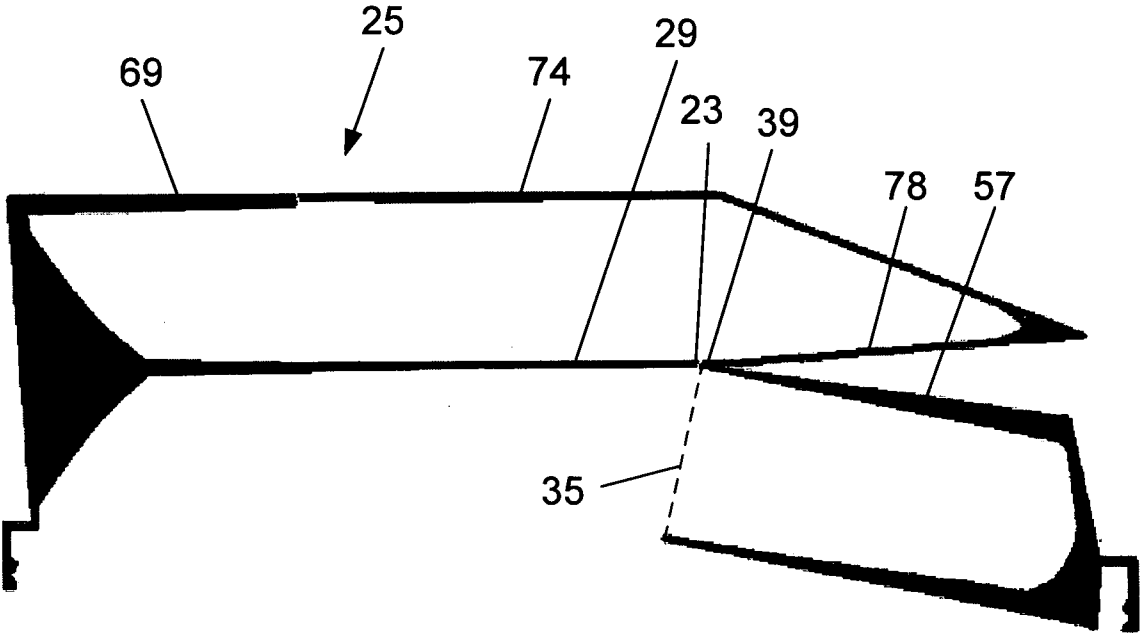


Fig. 13

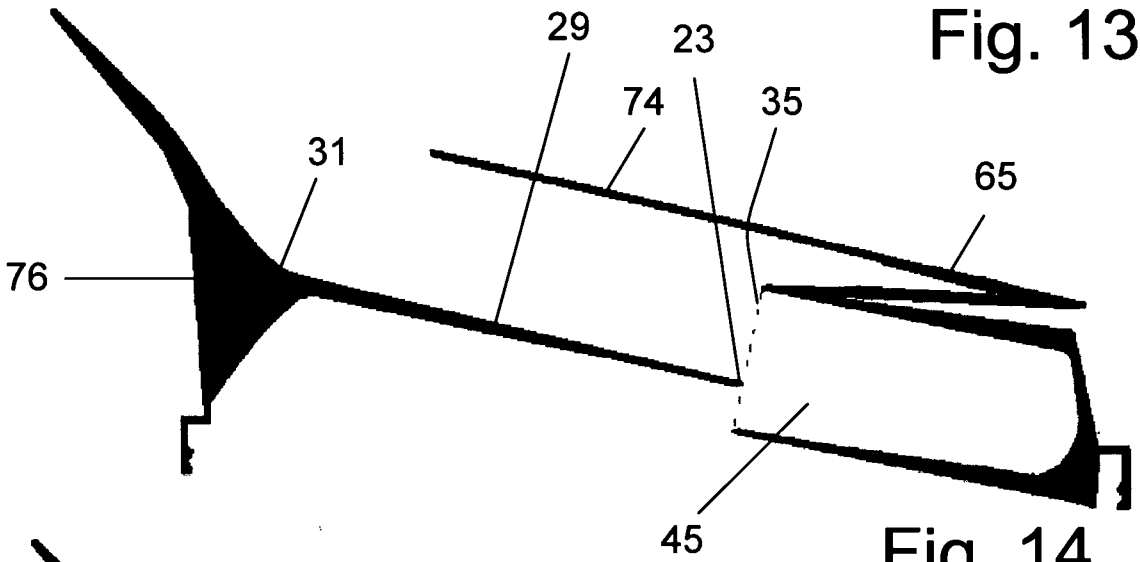


Fig. 14

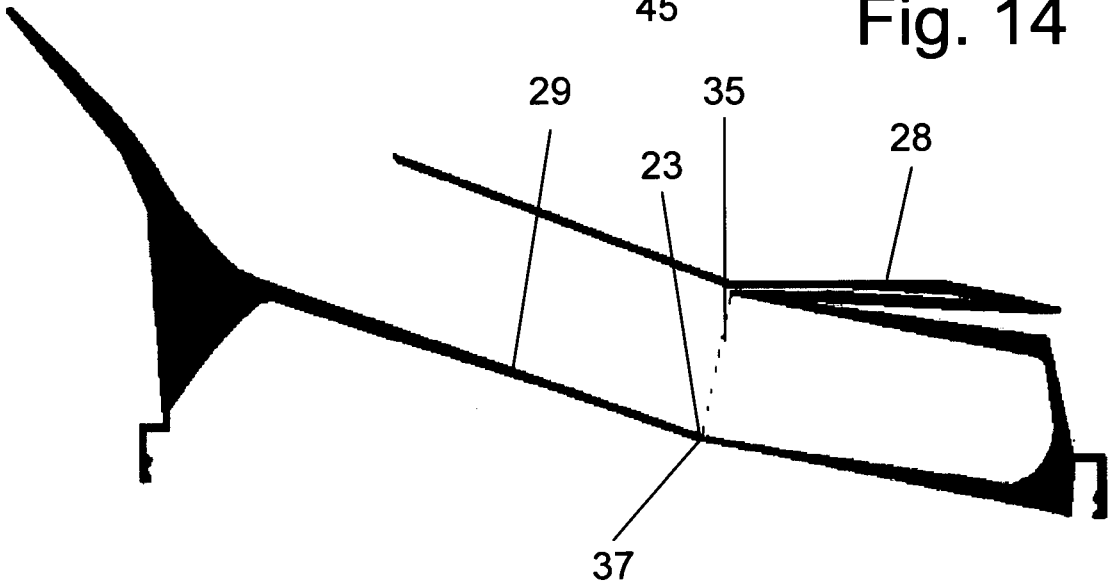


Fig. 15

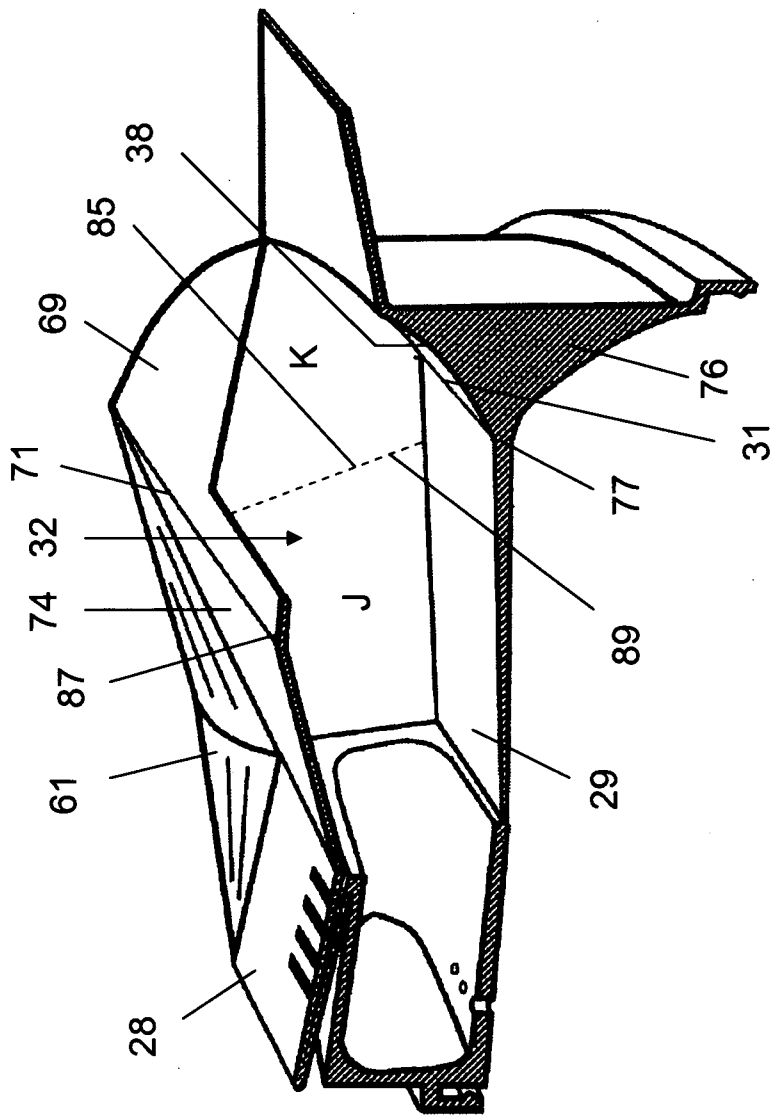


Fig. 16

11/29

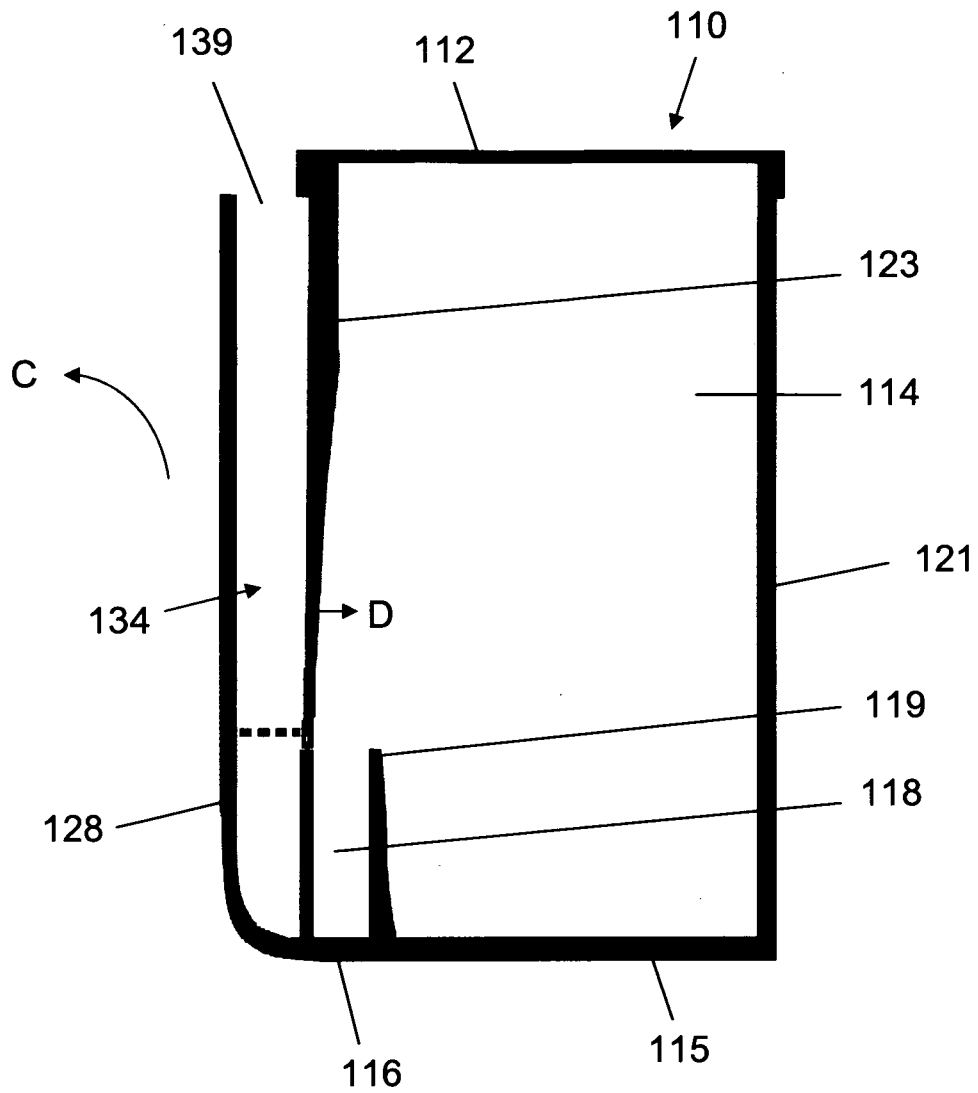


Fig. 17

12/29

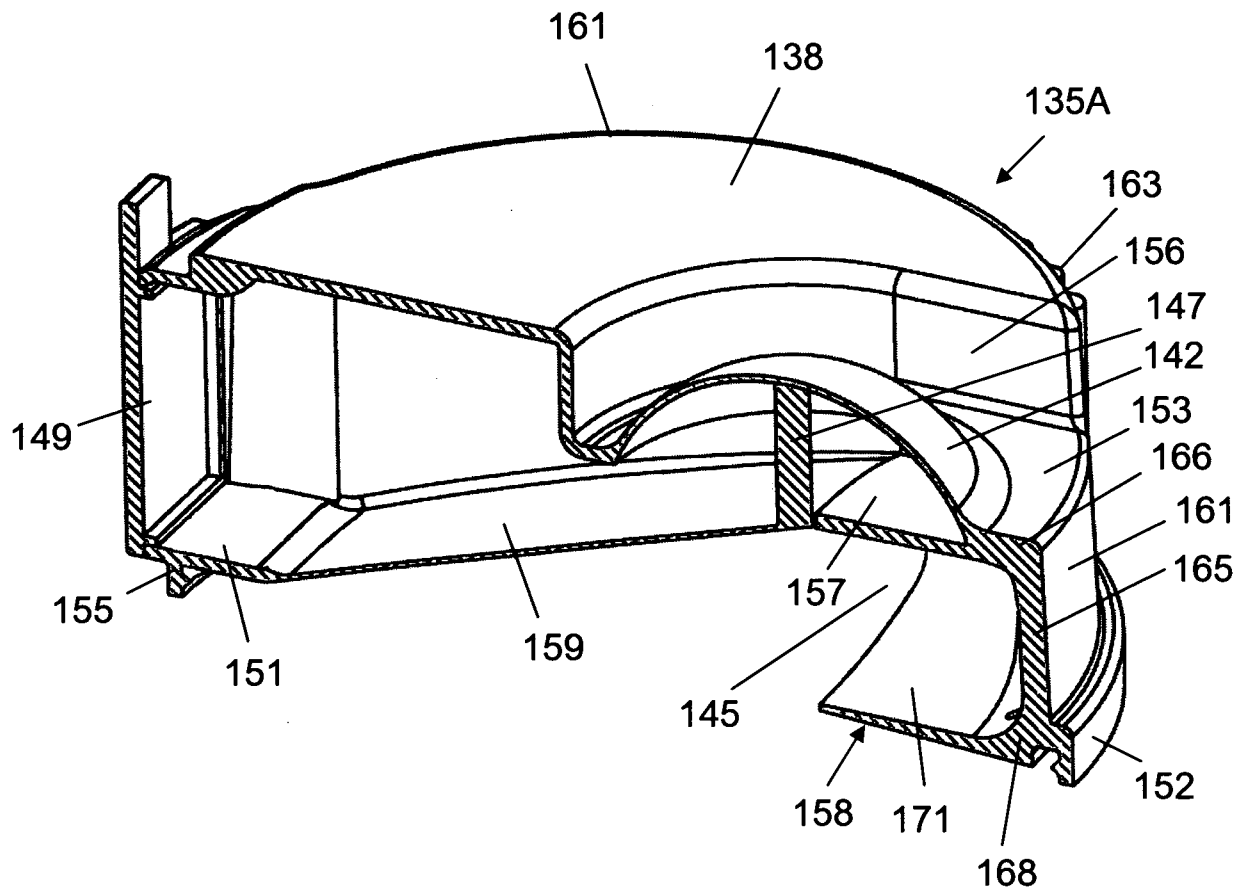


Fig. 18

13/29

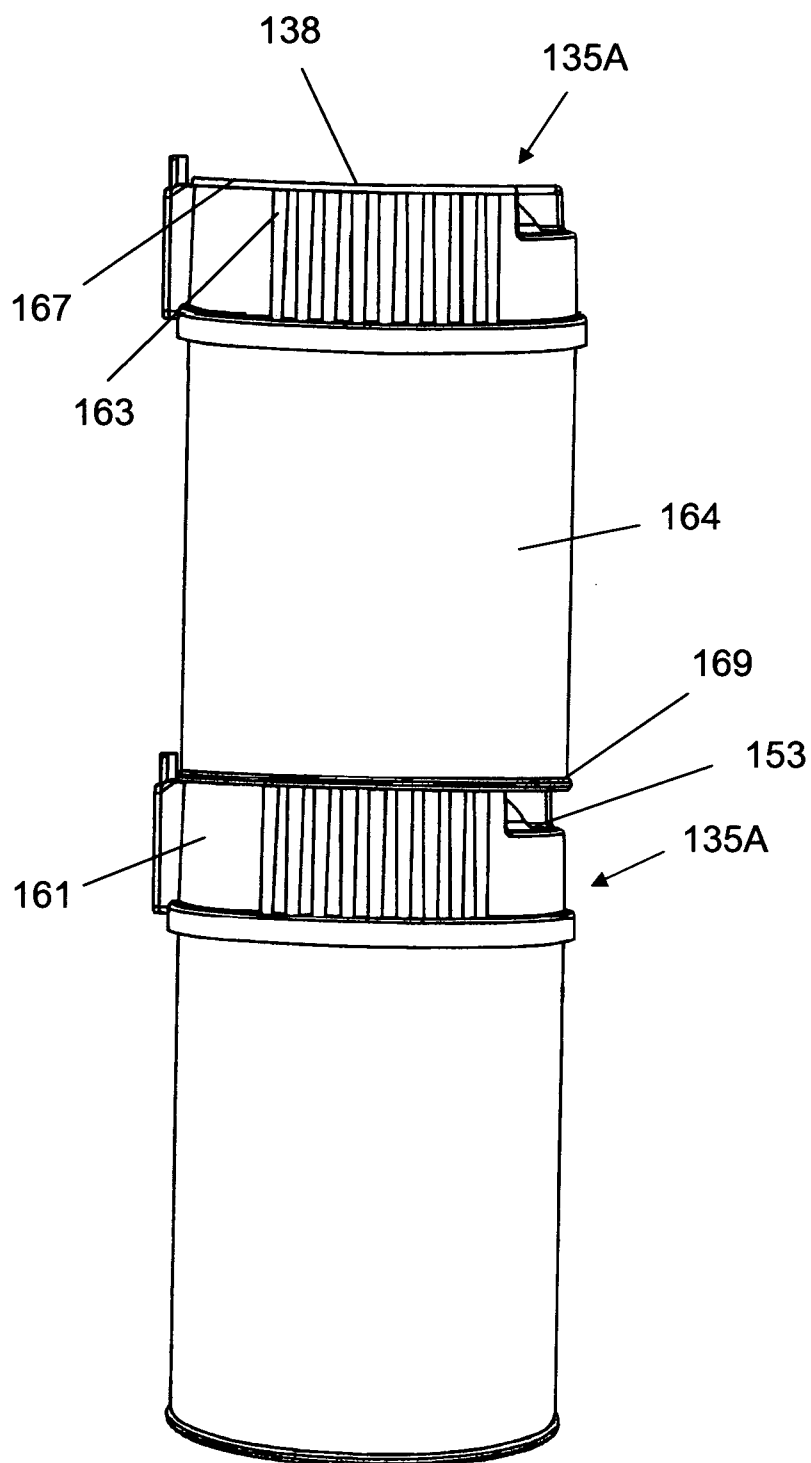


Fig. 19

14/29

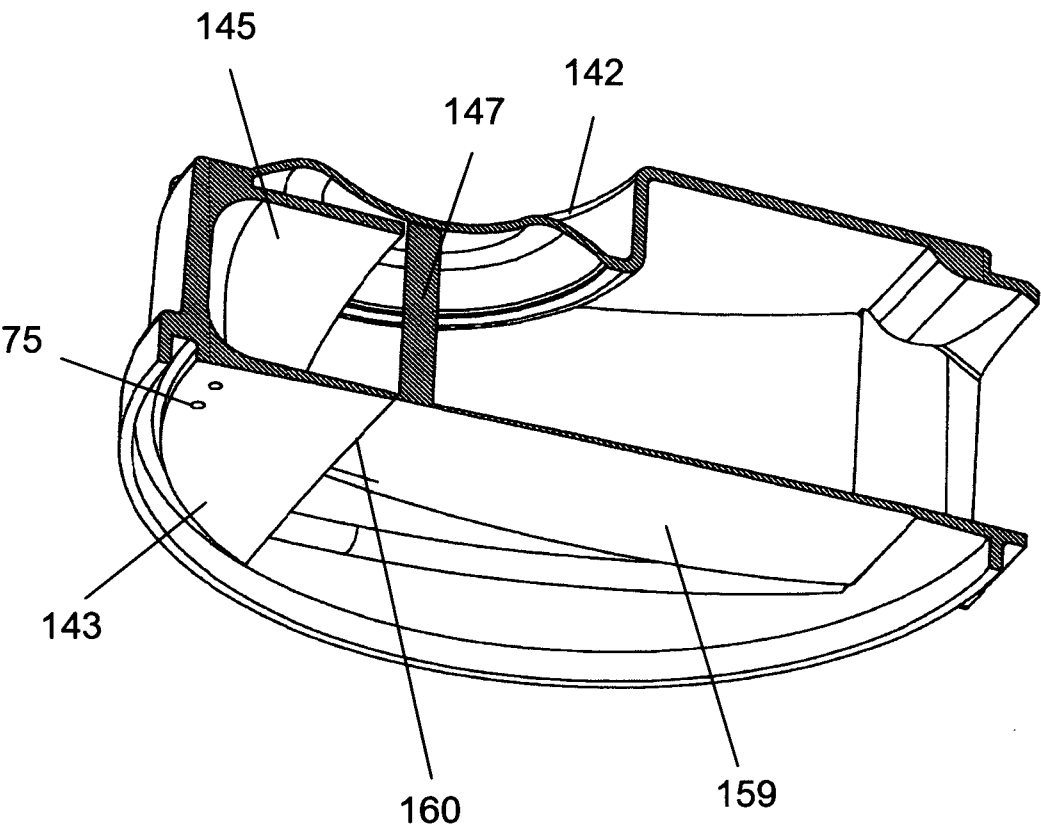


Fig. 20

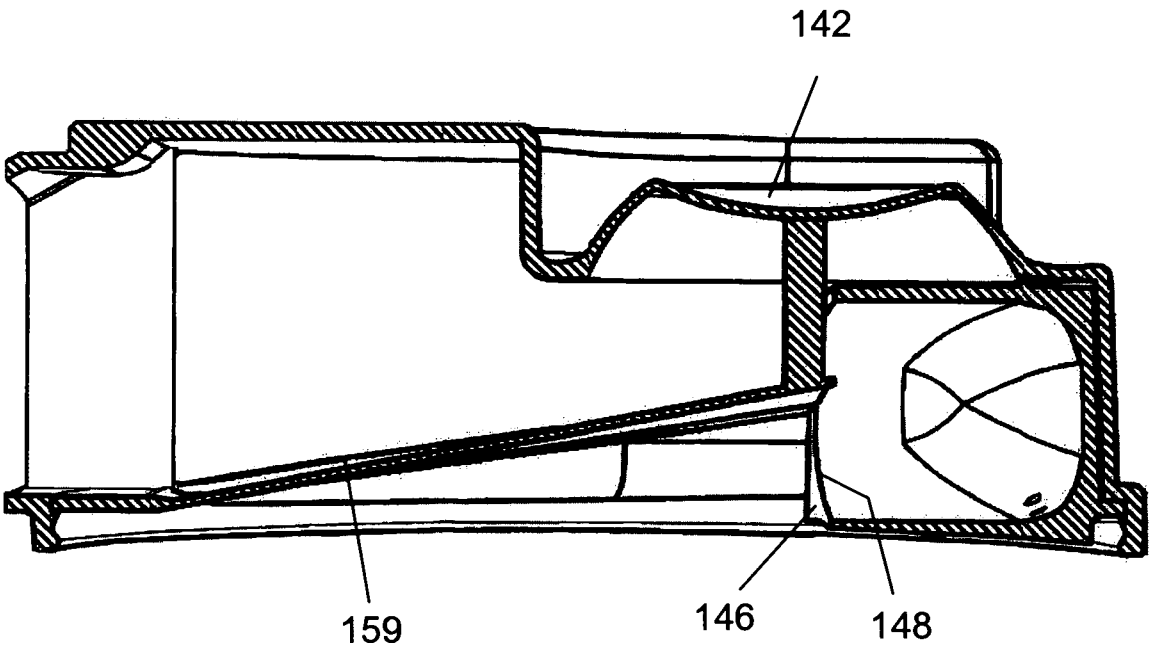


Fig. 21

15/29

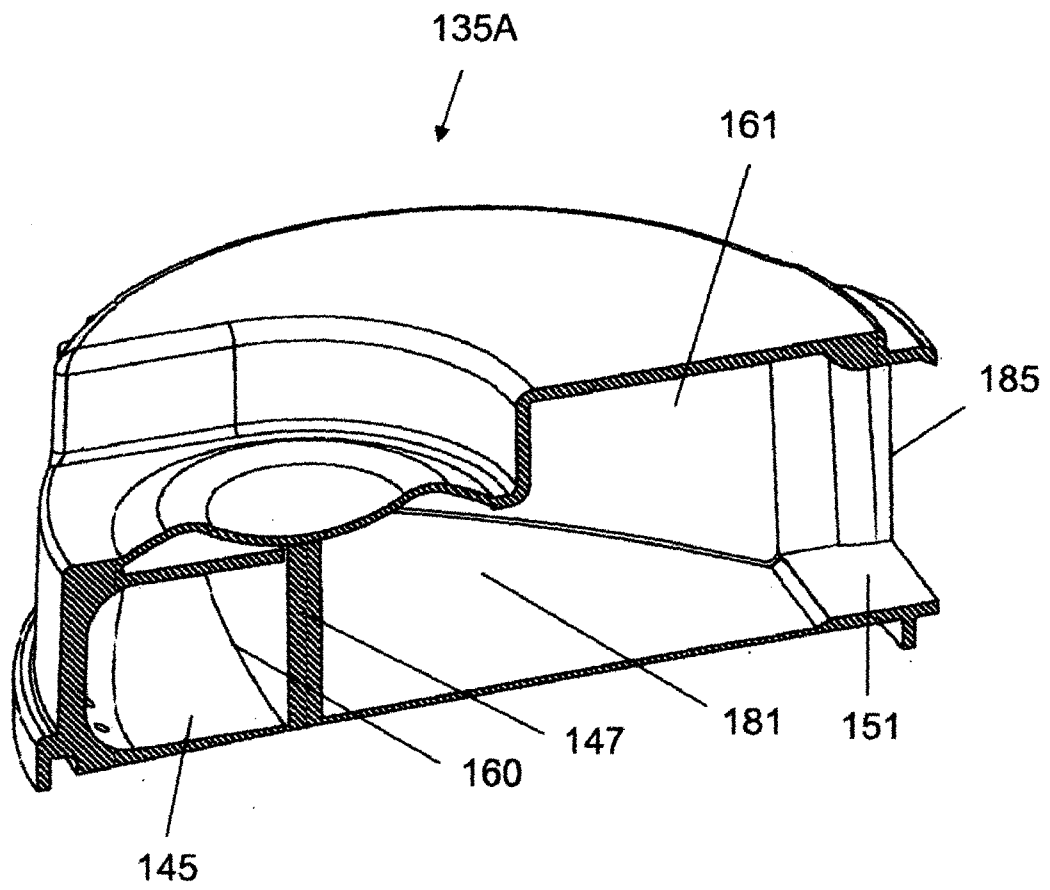


Fig. 22

16/29

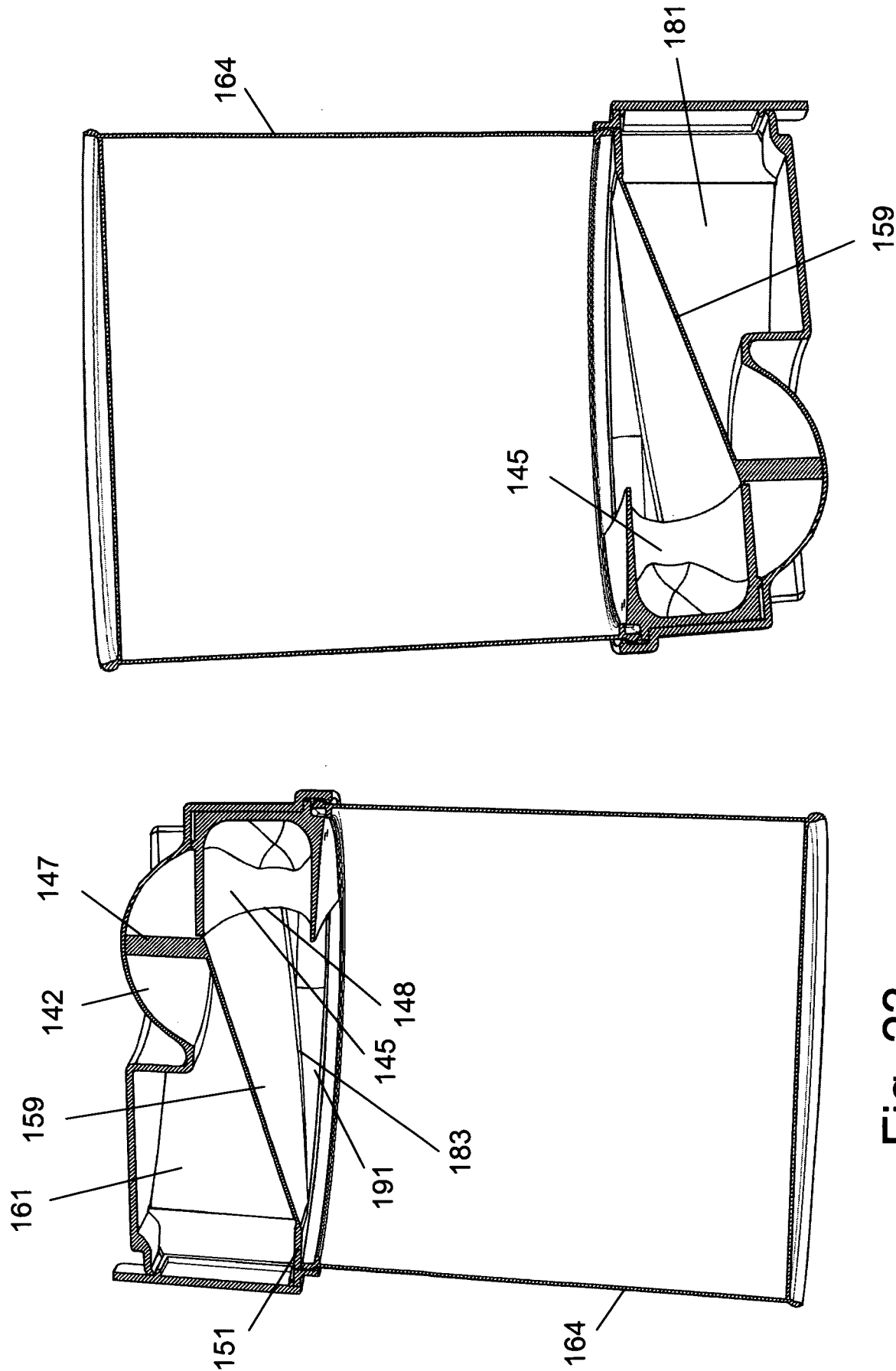


Fig. 24

Fig. 23

17/29

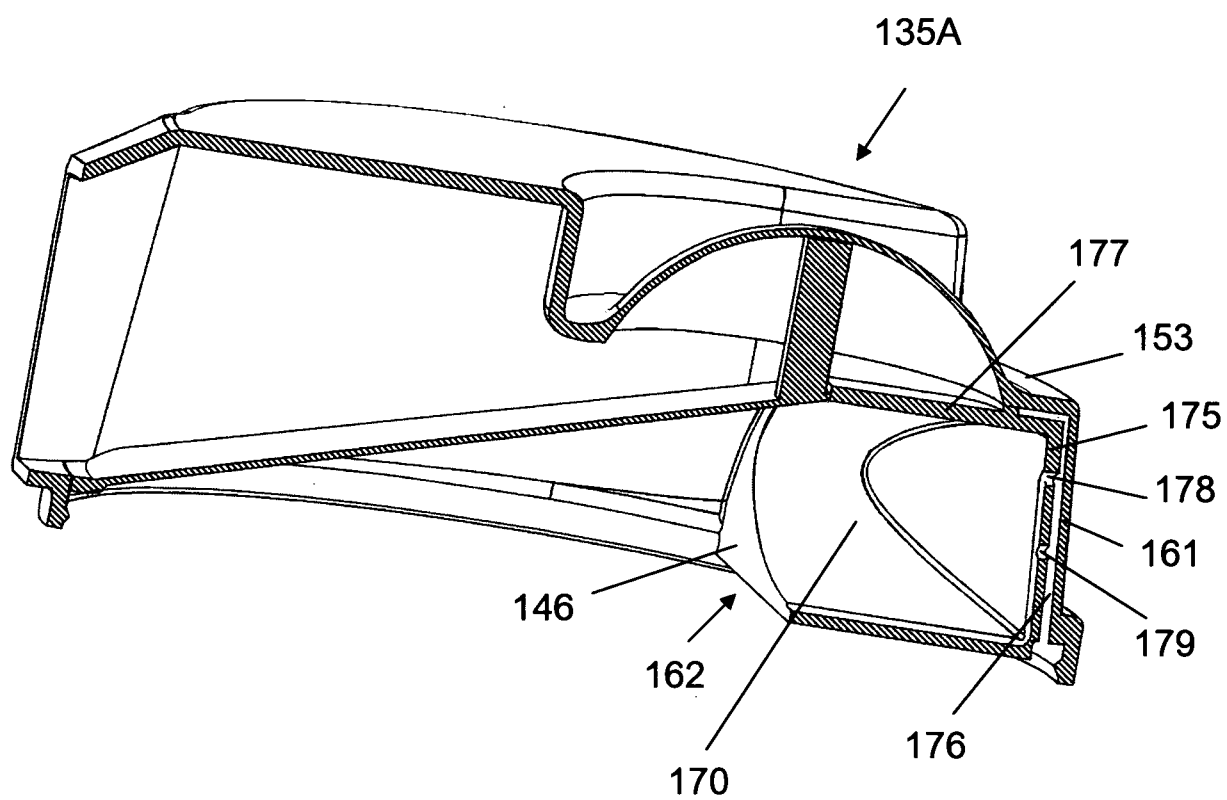
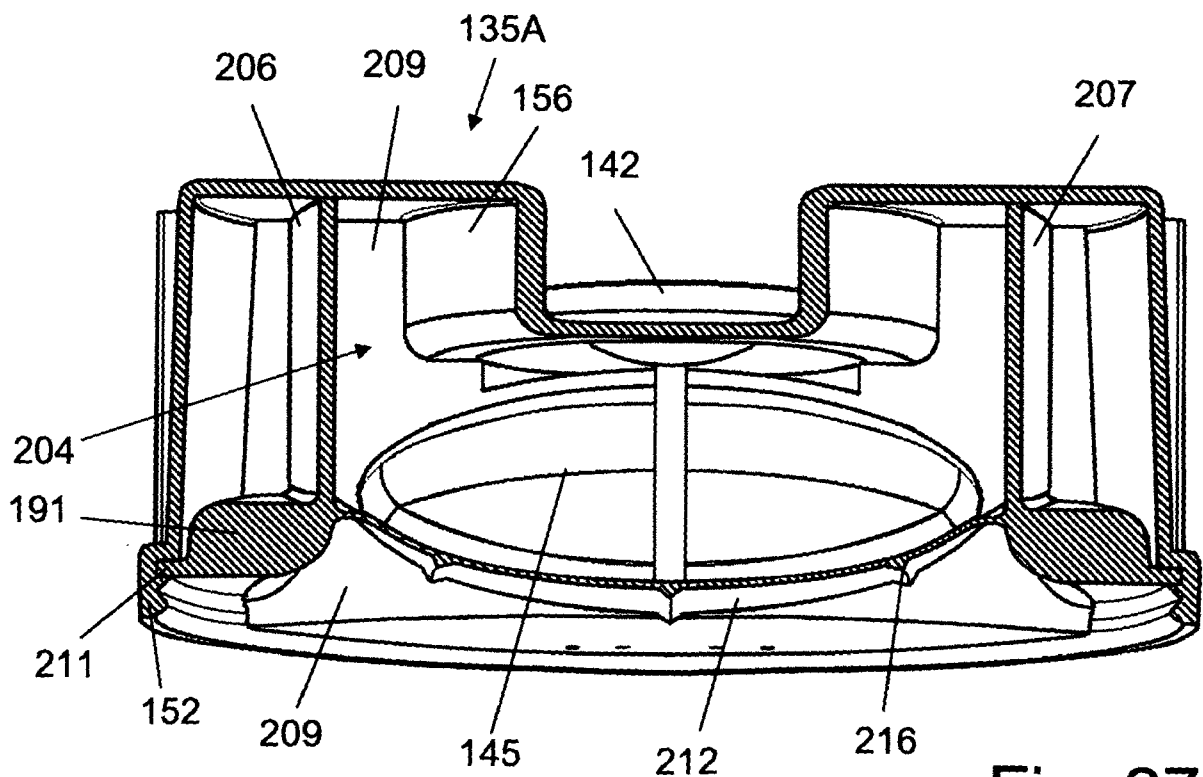
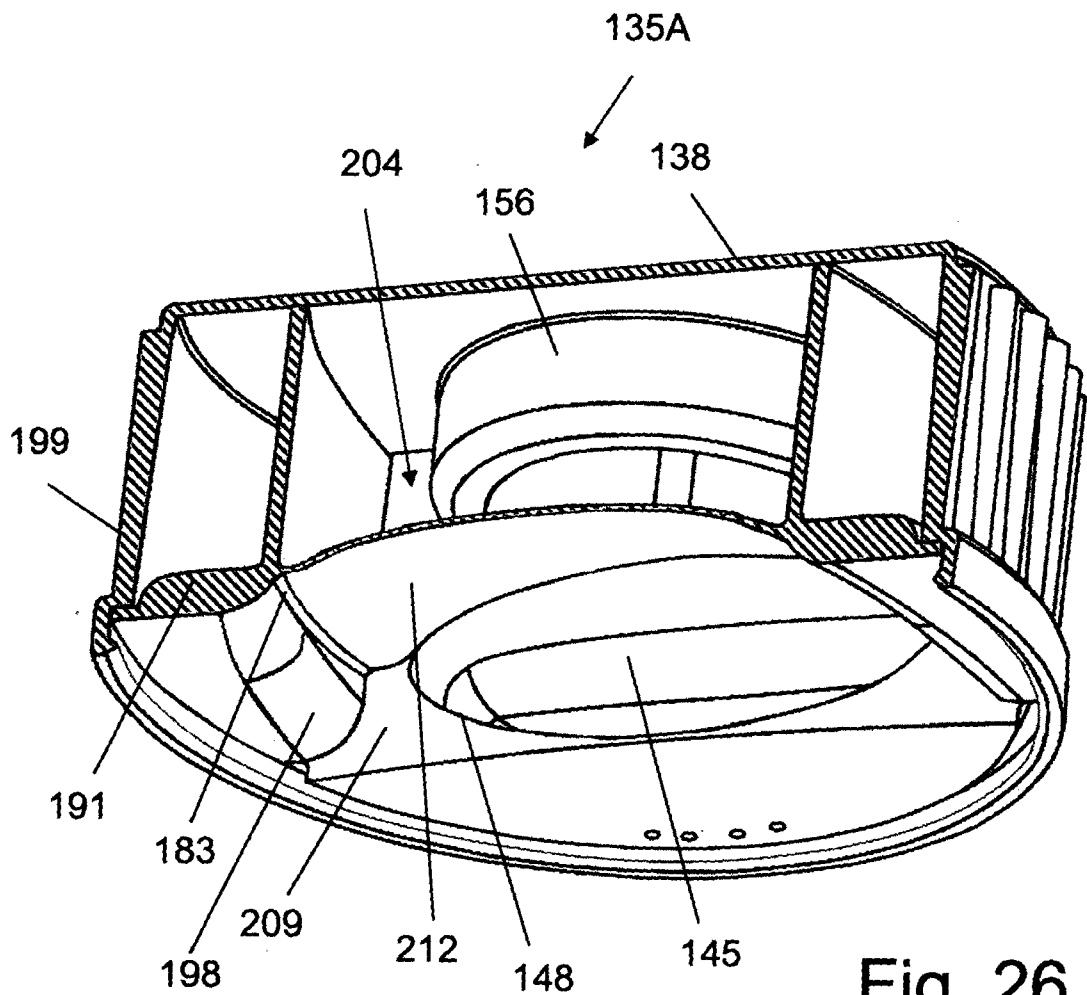


Fig. 25

18/29



19/29

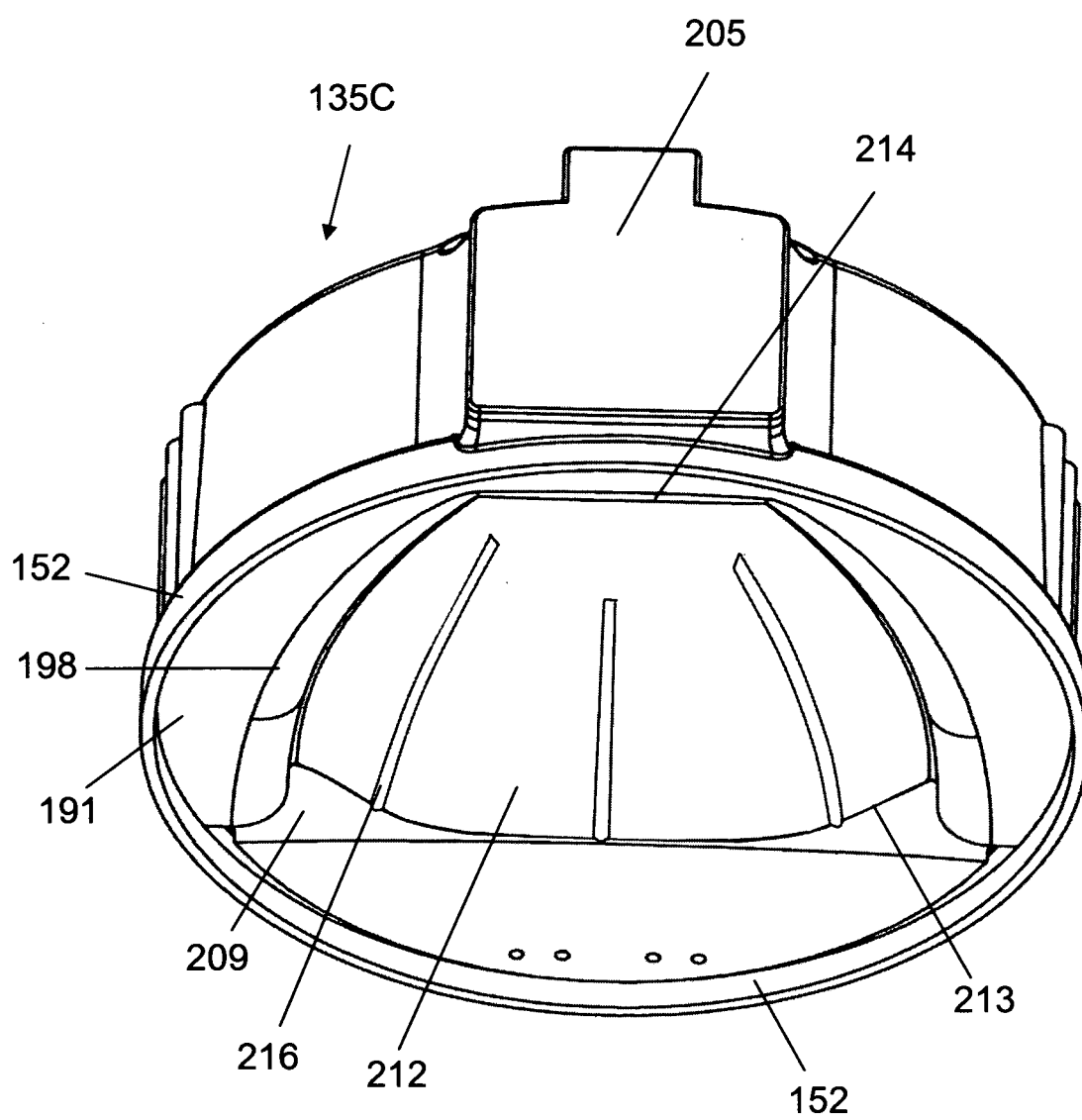


Fig. 28

20/29

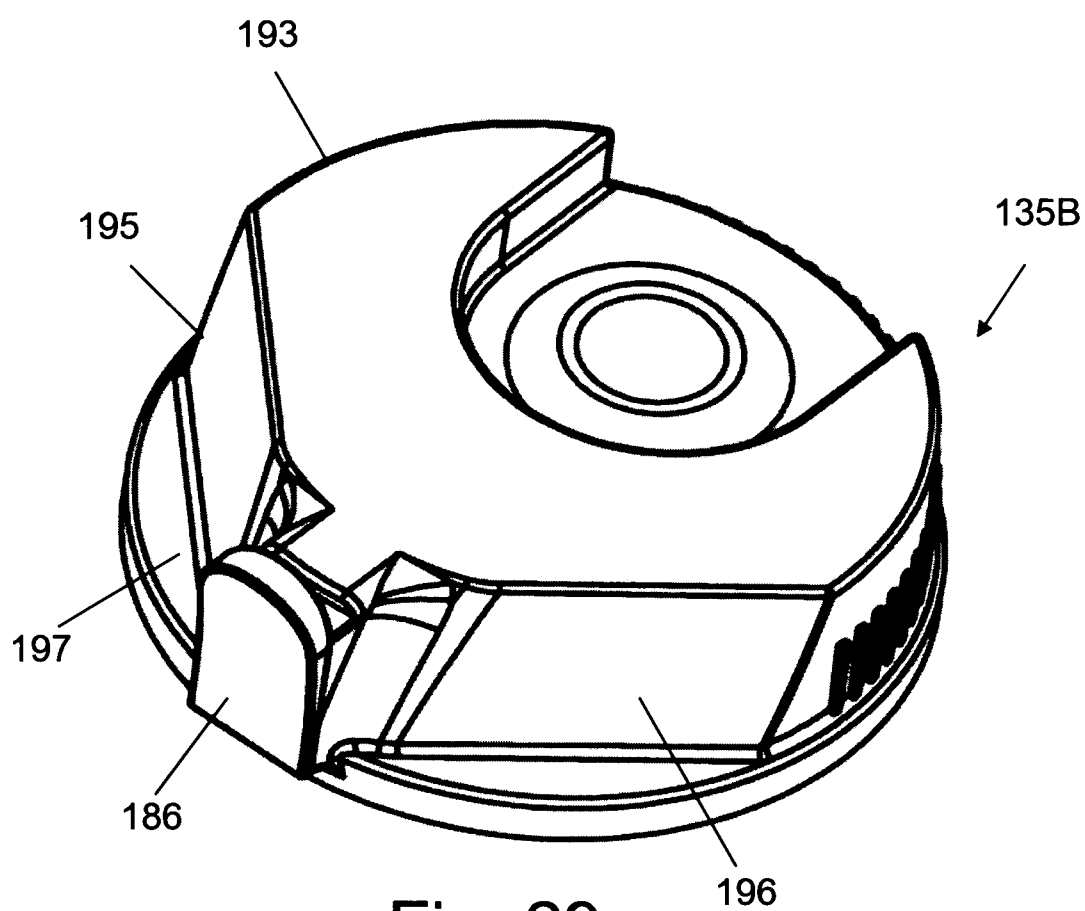


Fig. 29

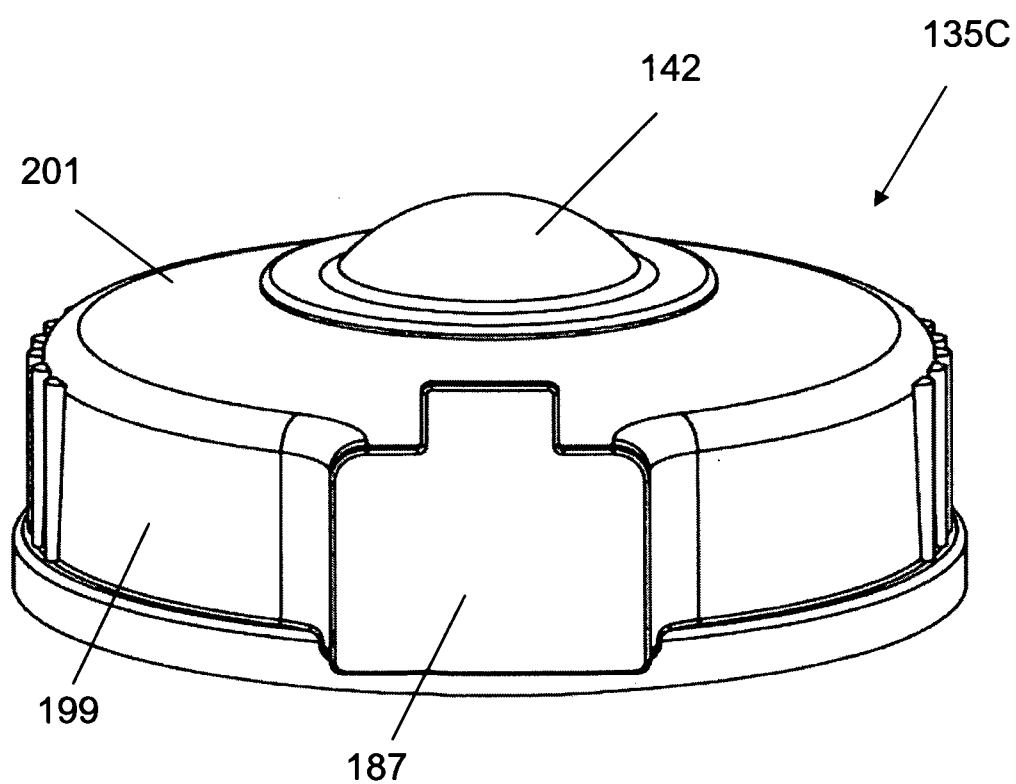


Fig. 30

21/29

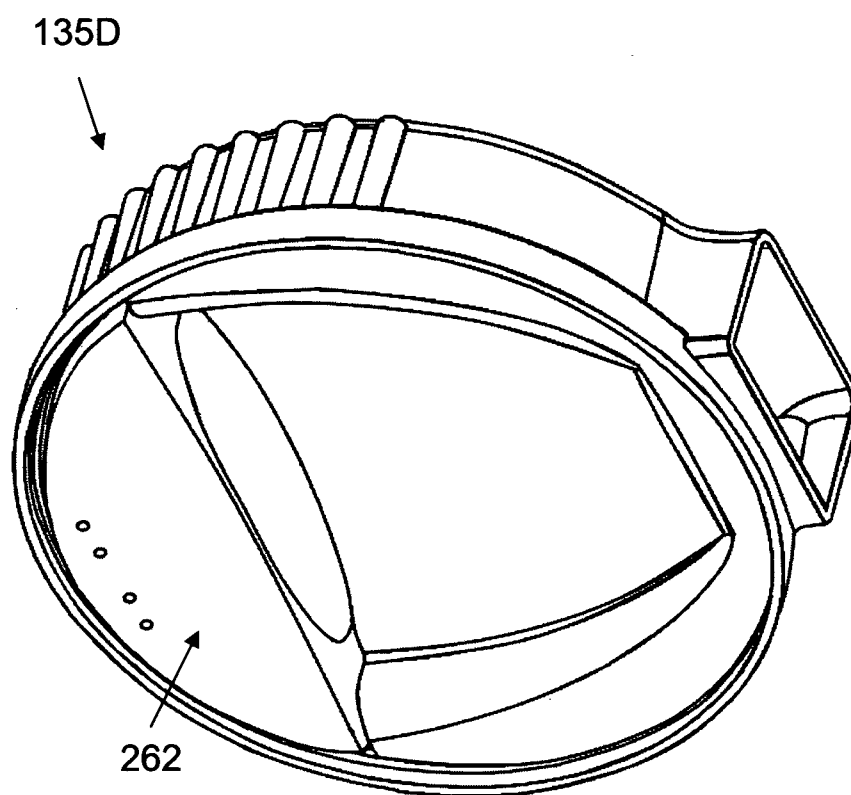


Fig. 31

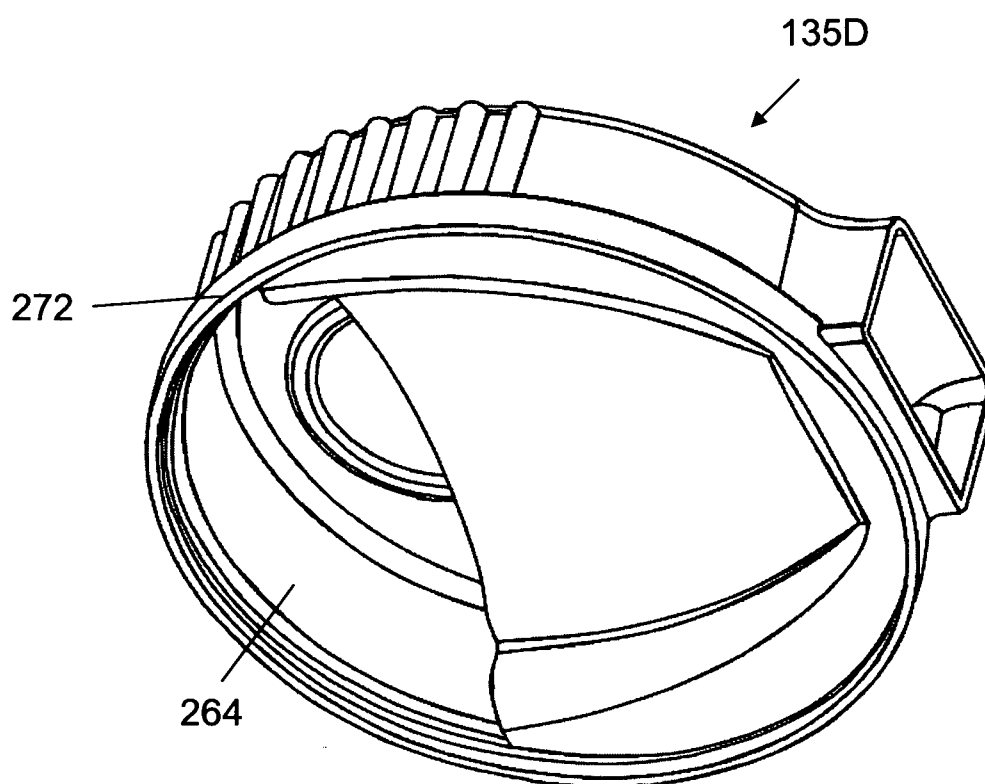


Fig. 32

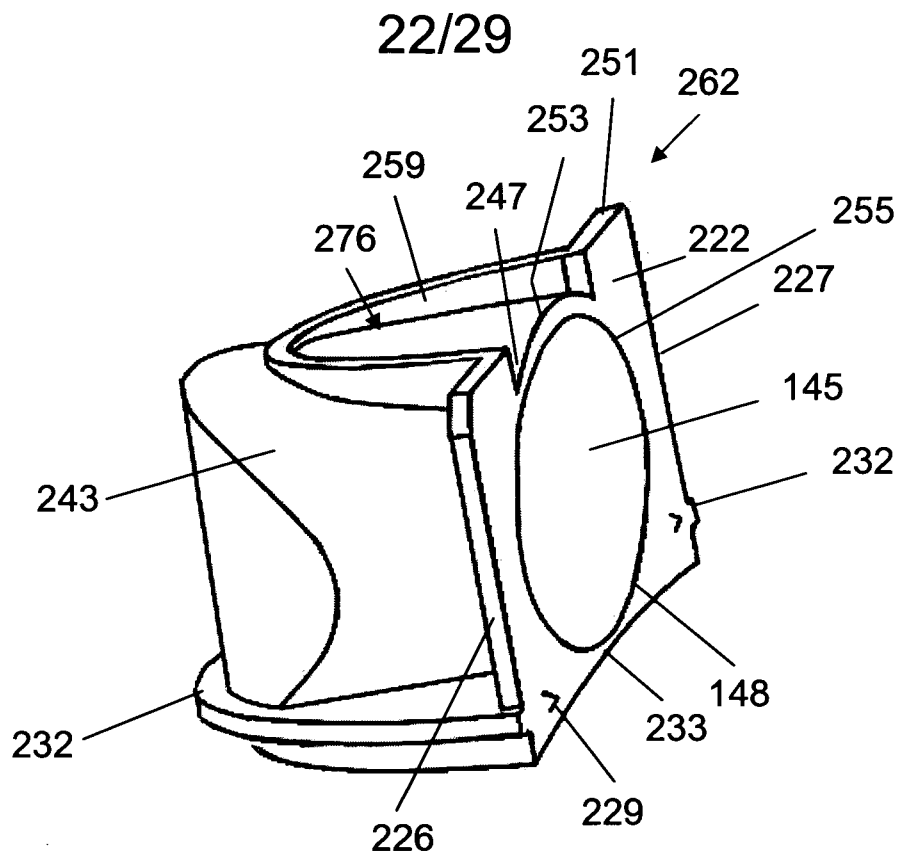


Fig. 33

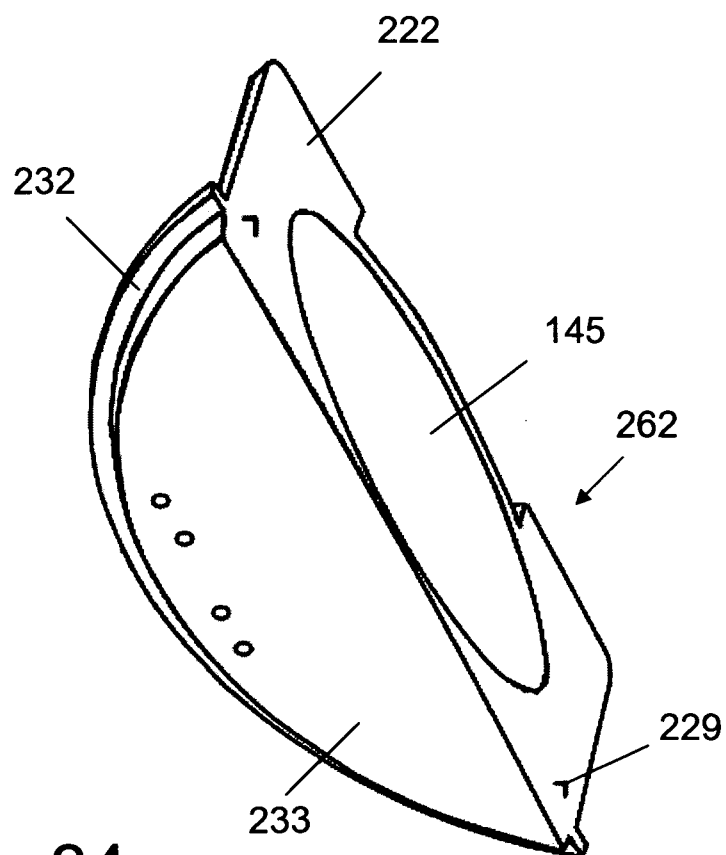


Fig. 34

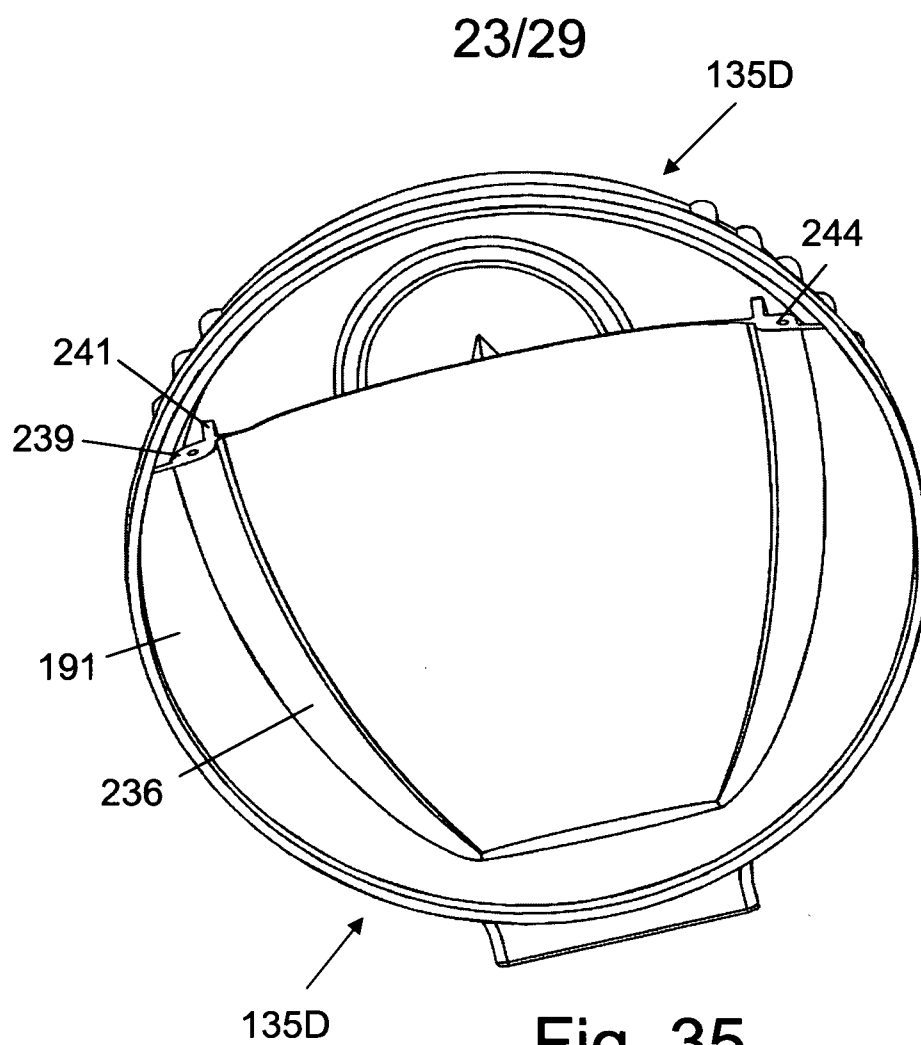


Fig. 35

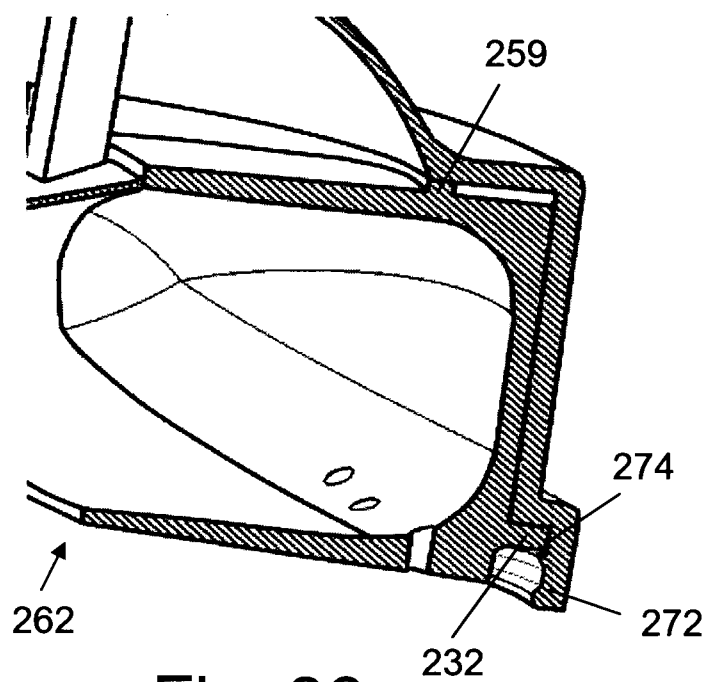


Fig. 36

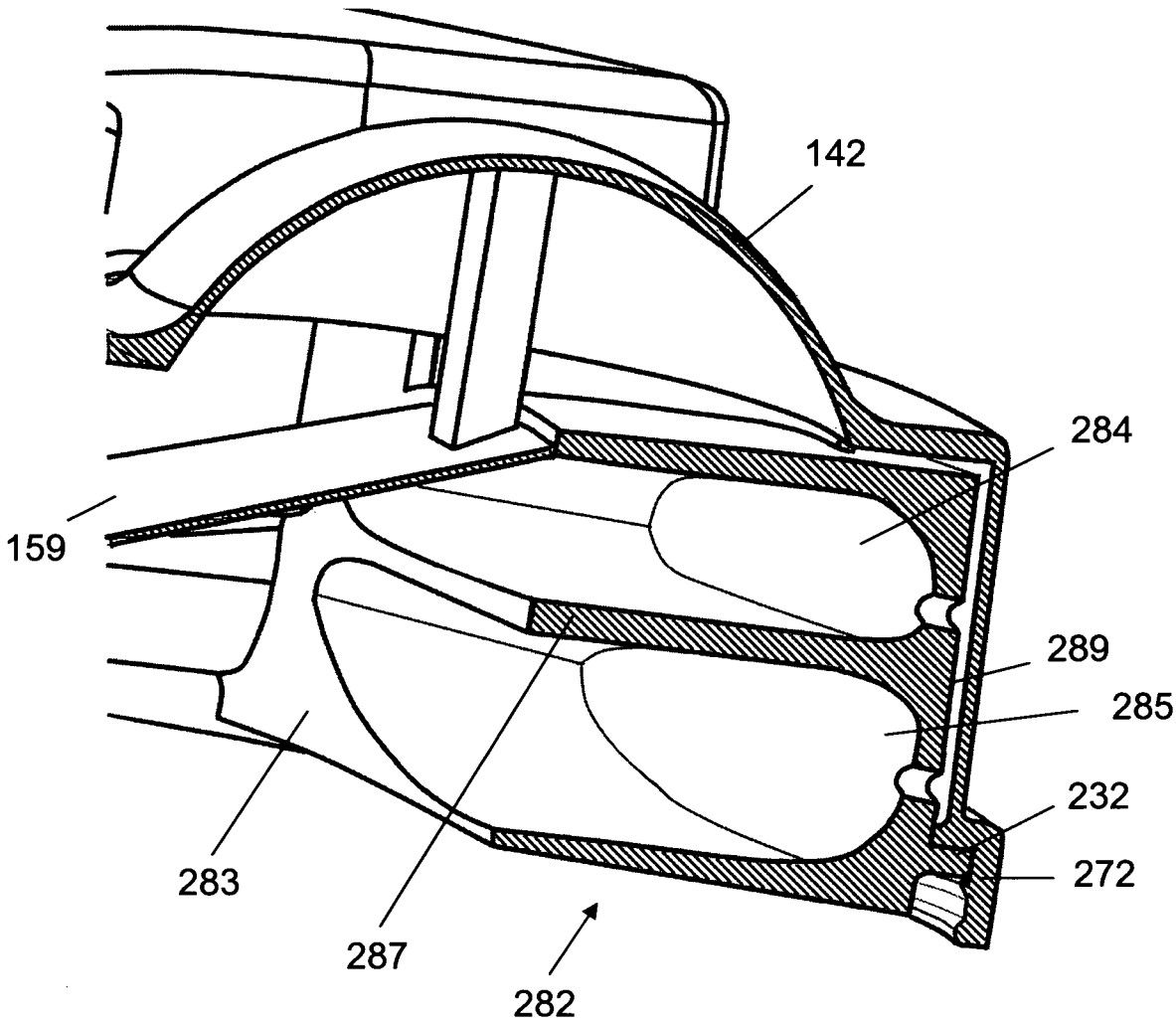


Fig. 37

25/29

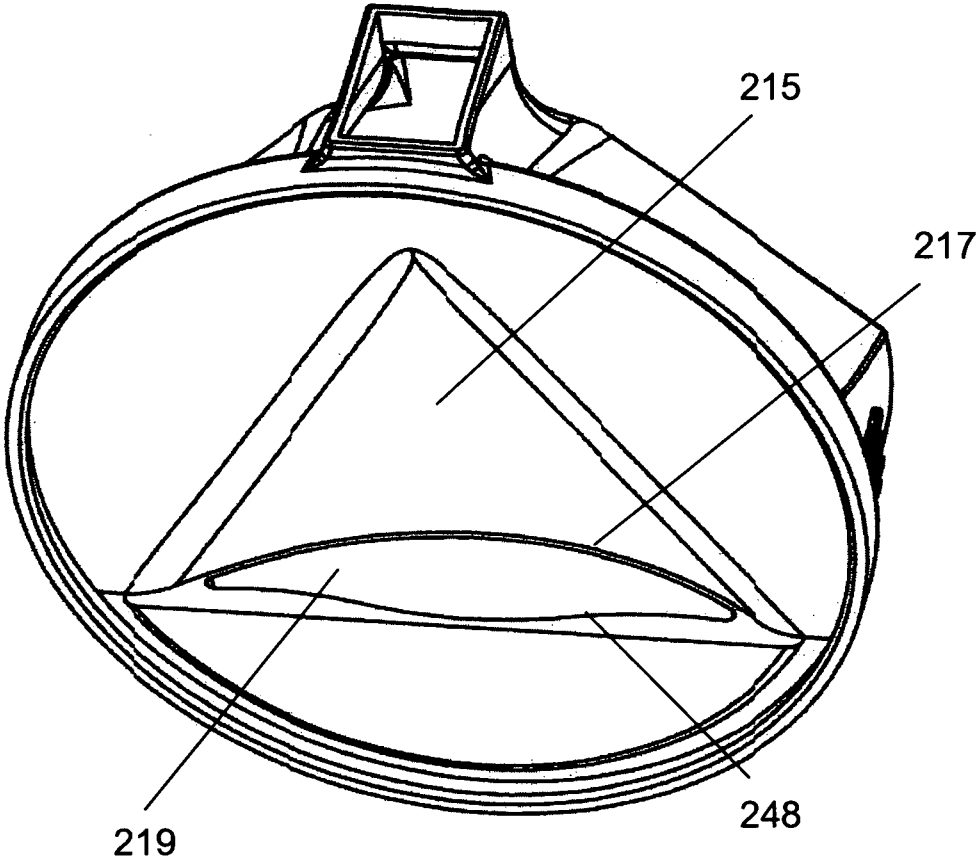


Fig. 38

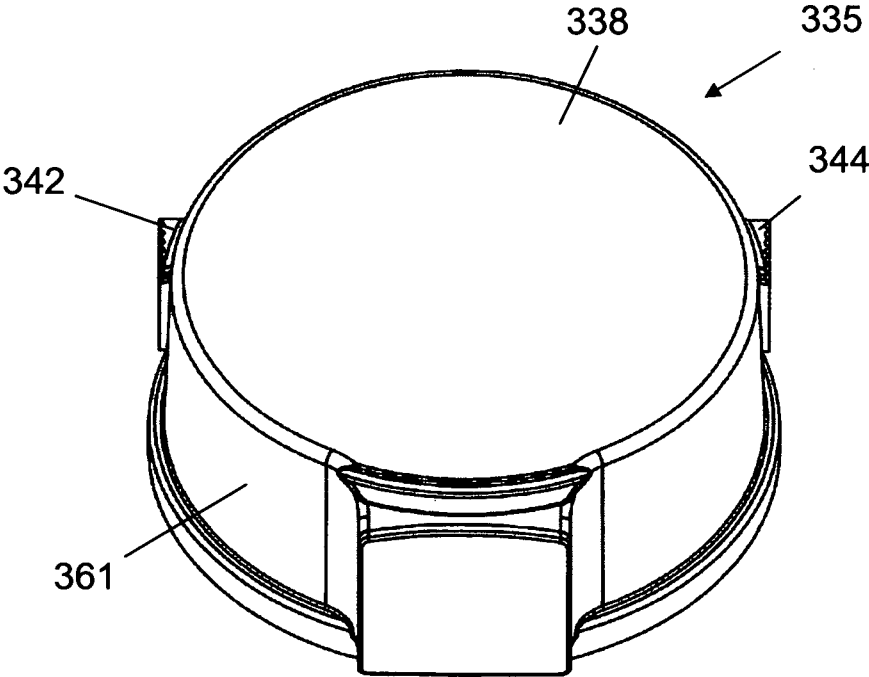


Fig. 39

26/29

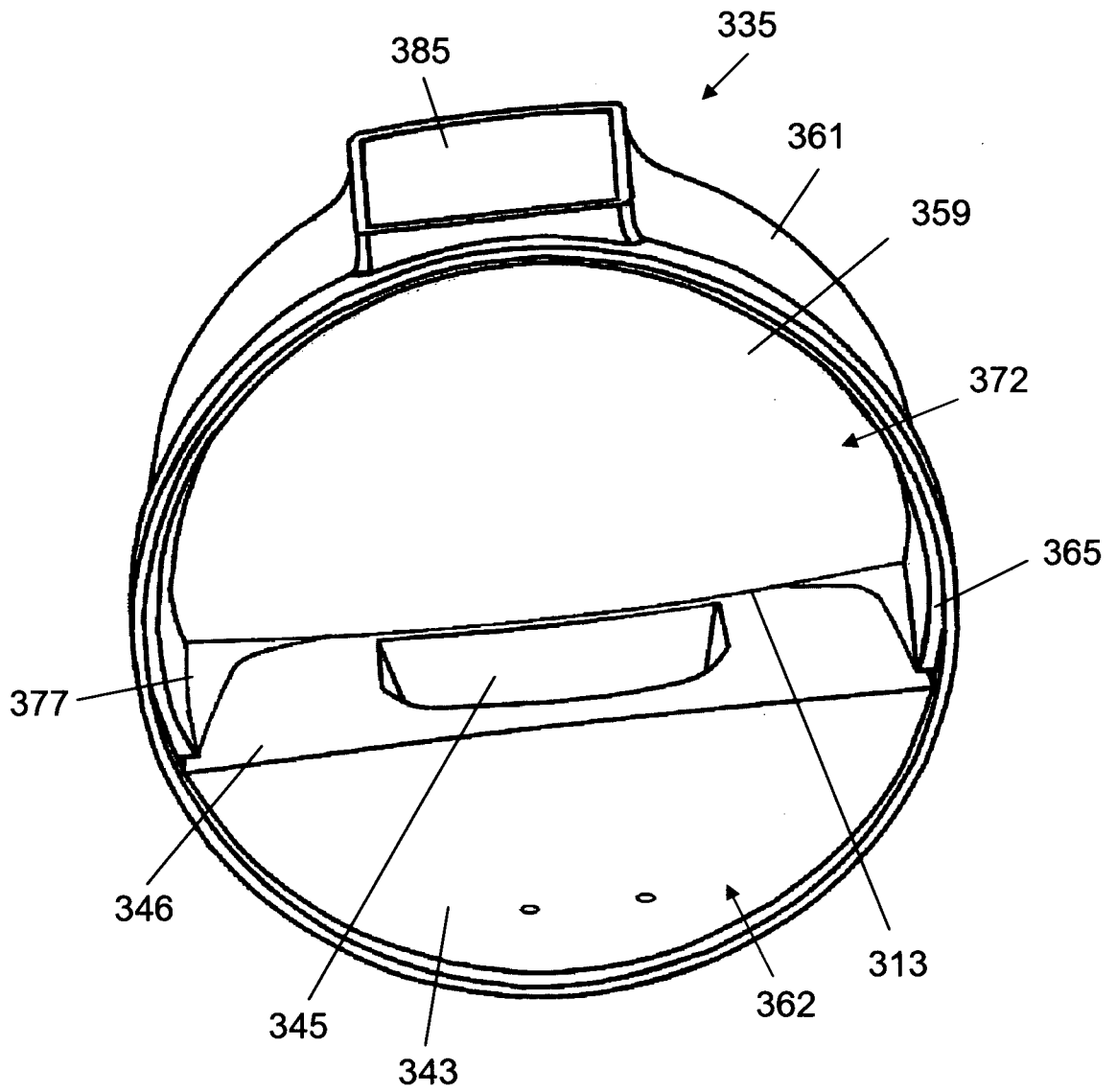


Fig. 40

27/29

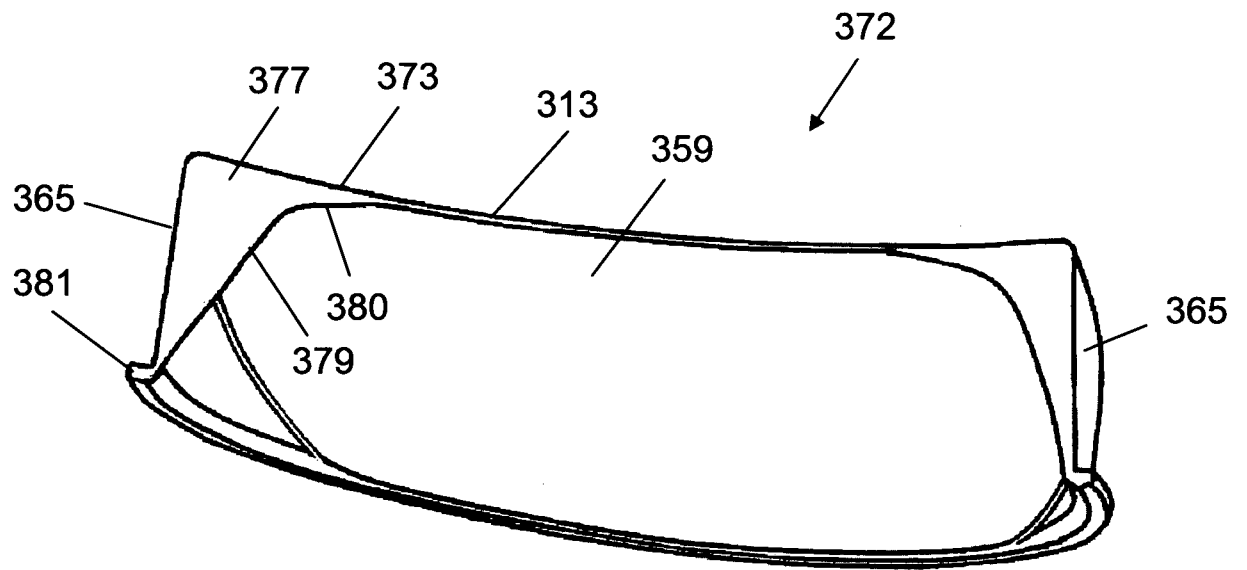


Fig. 41

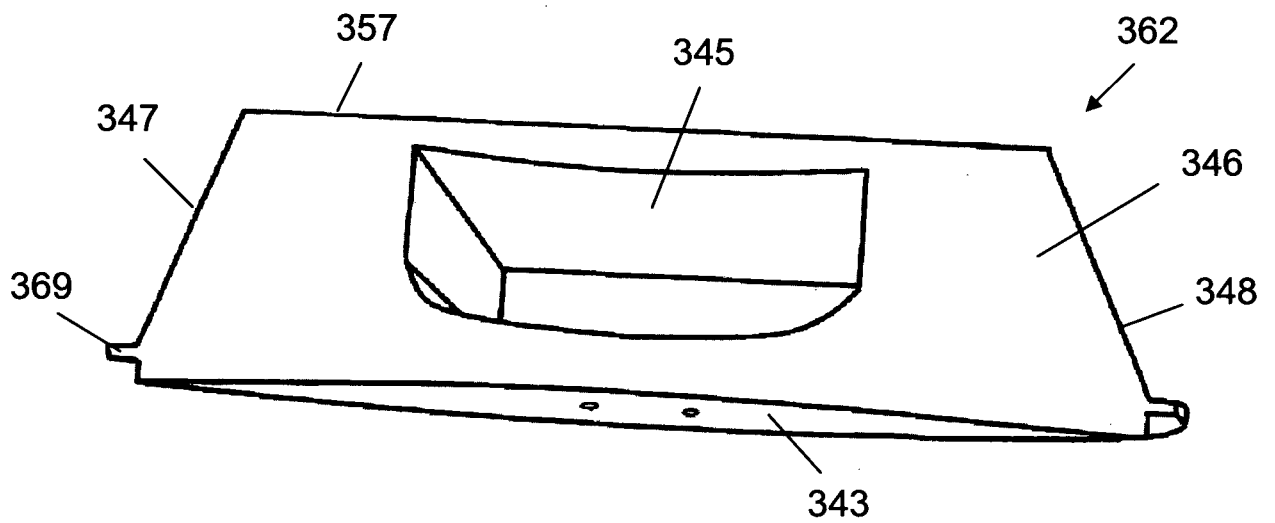


Fig. 42

28/29

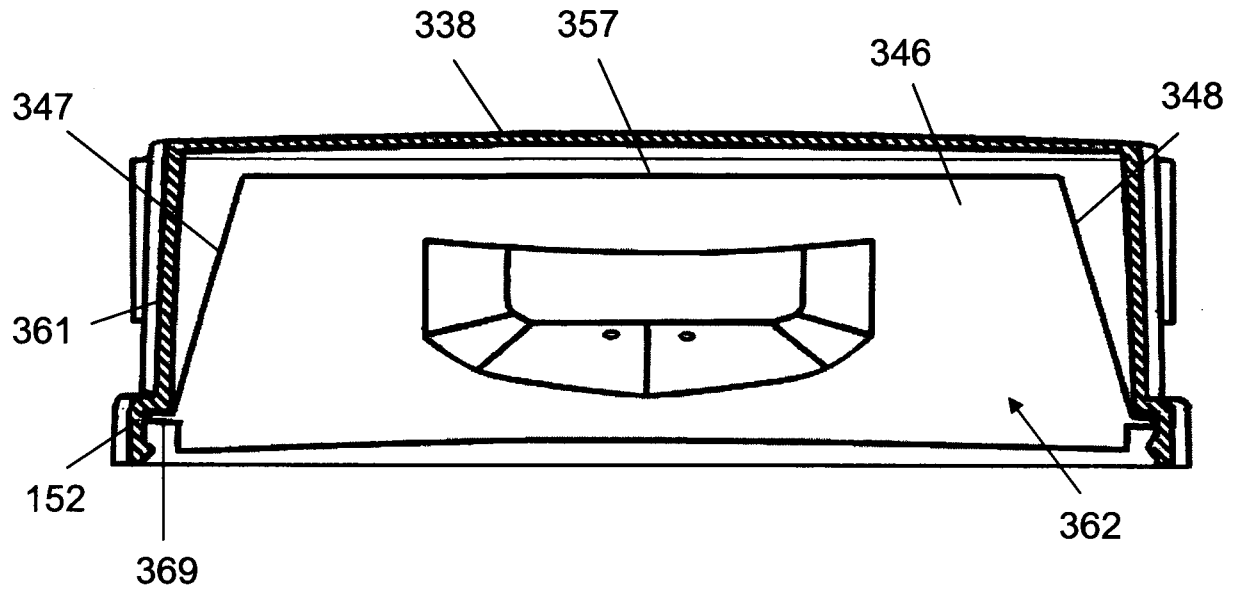


Fig. 43

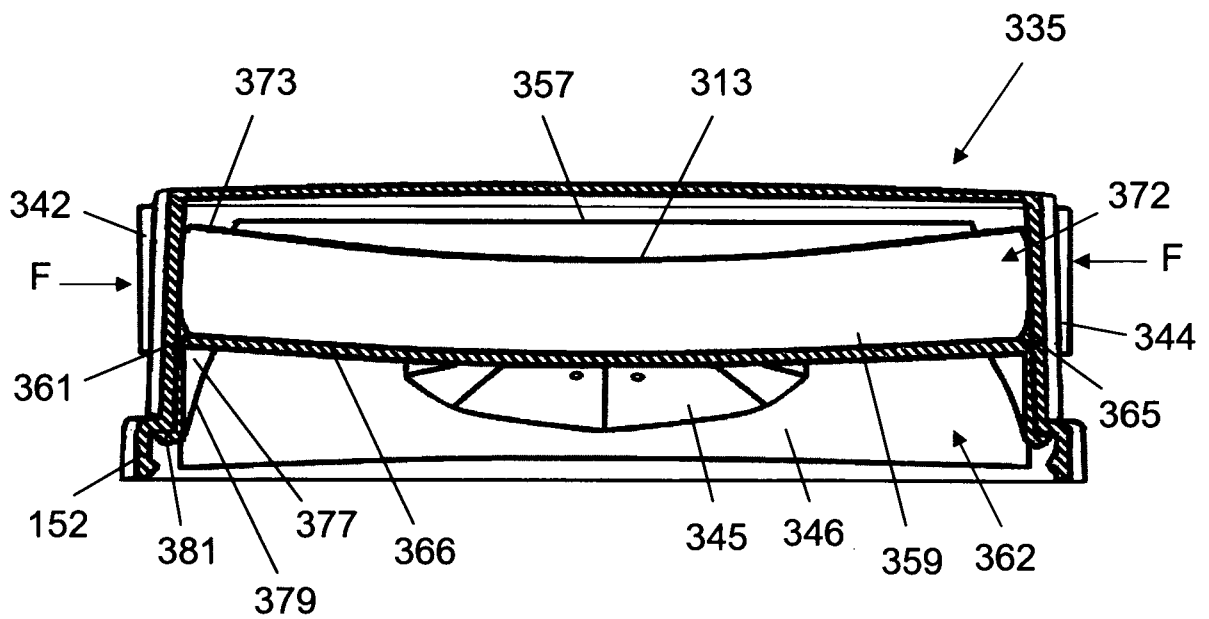


Fig. 44

29/29

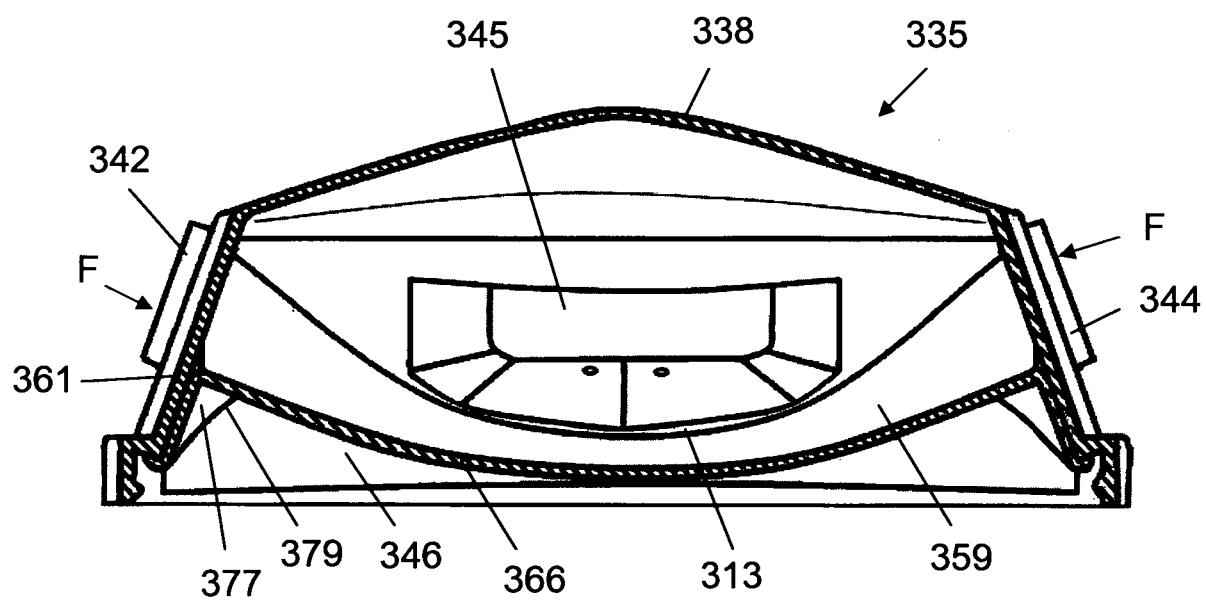


Fig. 45

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL 11/00133

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01F 11/26 (2011.01)

USPC - 222/168.5

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)

USPC: 222/168.5

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

USPC: All classes

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

PubWEST (PGPB,USPT,EPAB,JPAB); Google (Patents, Web)

Keywords: level\$4, powder\$4, dry\$4, dri\$4, dry, drying, dried, dries, grain, granul\$6, partic\$4, press\$4, compress\$4, depress\$4, measur\$4, meter\$4, tilt\$4, rotat\$4, pour\$4, dispens\$4, container, spout, flex\$7, valv\$4, milk, formula, tube, tubing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,850,944 A (Robbins III et al.) 22 December 1998 (22.12.1998) Fig. 1, 2, 5, 20-22; col 1, ln 16-21; col 5, ln 26-37; col 7, ln 45-53; col 8, ln 3-31	1-63
Y	US 1,273,012 A (Souther) 16 July 1918 (16.07.1918) Fig. 2-5; page 1, ln 86-107	1-63
Y	US 2007/0251954 A1 (Fazekas et al.) 01 November 2007 (01.11.2007) Fig. 3; para [0044]	12-14, 25-28, 56, 57
Y	US 4,102,477 A (Yoon) 25 July 1978 (25.07.1978) Fig. 1; col 1, ln 39-41; col 3, ln 65 to col 4, ln 10	22-24, 61, 62
Y	US 5,975,364 A (Kaufman) 02 November 1999 (02.11.1999) Fig. 6; col 5, ln 43-51	30, 59
Y	US 4,645,097 A (Kaufman) 24 February 1987 (24.02.1987) Fig. 1, 3; col 3, ln 22-27; col 6, ln 29-39	30, 32-36, 38-46, 48, 49, 53, 58, 59
Y	US 7,150,380 B2 (Hoepner et al.) 19 December 2006 (19.12.2006) Fig. 1-3; col 5, ln 24-35; col 6, ln 29-65	35, 36, 38-46, 48, 58

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

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"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

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Date of the actual completion of the international search

08 June 2011 (08.06.2011)

Date of mailing of the international search report

21 JUN 2011

Name and mailing address of the ISA/US

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