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(54) **Title**: BUNG FOR SELF-RELEASE

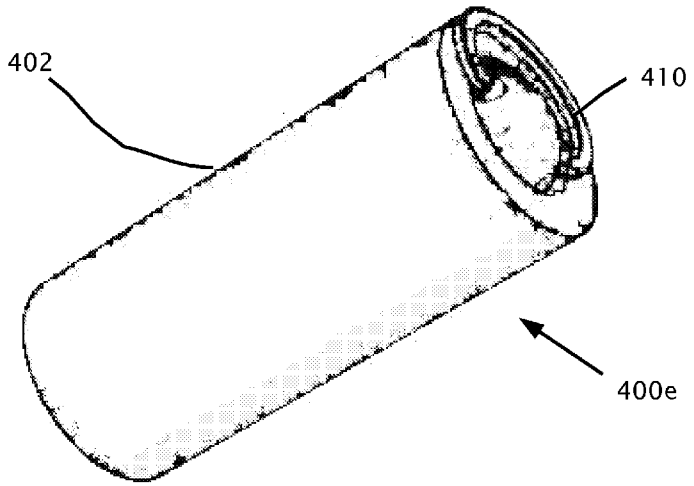

Fig. 4e

(57) **Abstract**: Various bungs including a bunging substance, for inserting into a neck of a bottle to seal the bottle. An ampule is disposed within the bunging substance. The ampule is configured to include a compressed gas. A hollow-bore needle having a hollow bore is disposed within the bung, and on activation of self-release, the hollow-bore needle is configured to convey a portion of the gas through the hollow bore into the bottle.

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BUNG FOR SELF-RELEASE

TECHNICAL FIELD

The present invention relates to the field of bungs, corks and particularly to a bung and releasing the bung from a bottle and for a method for maintaining beverage quality.

BACKGROUND ART

A bung is a cylindrical or conical closure for sealing a bottle, tube or barrel. Unlike a lid, which encloses the container from the outside without displacing the inner volume, the bung is at least partially inserted inside the container, i.e., into the bottle neck, to act as a seal.

Bungs used for wine bottles are often referred to as "corks", even when made from another material other than cork. A cork typically requires an external tool, *e.g.* corkscrew, for releasing it from the bottle neck. The external tool screws into the cork and a pulling action upwards is applied also on the inserted portion of the cork. However, releasing a cork from a bottle using a corkscrew may occasionally fail, especially when the material of the cork is disintegrated. A corkscrew may not be readily available.

Wine exposed to air before drinking is stripped it of its vibrancy as aromatic compounds in the wine evaporate and compounds in the wine oxidizes. Eventually the wine may begin to turn brown and bitter and into vinegar. Merely re-inserting a cork into a bottle of wine may be insufficient to prevent oxidation of the wine as significant air has entered the bottle.

There is thus a need for and it would be advantageous to have a method and apparatus for reliably releasing a bung without requiring any external tool. There is also a need for maintaining beverage quality such as protecting wine from oxidation after the wine bottle is first opened.

BRIEF SUMMARY

Various bungs are provided for herein including a bunging substance, for inserting into a neck of a bottle to seal the bottle. An ampule is disposed within the bunging substance. The ampule is configured to include a compressed gas. A hollow-bore needle having a hollow bore is disposed within the bung, and on activation of self-release, the hollow-bore needle is configured to convey a portion of the gas through the hollow bore into the bottle. The hollow-bore needle may include an aperture for releasing at least a portion of the gas into the bottle. The bung may be in one of two states: a bunged state in which the compressed gas is sealed from entering the bore through the aperture and a release state which allows the portion of the gas to enter the bore through the aperture and into the bottle to release the bung from the bottle. During the release state, the bung is configured to be released from the bottle assisted by gas pressure from the expanding gas inside the bottle. An activation mechanism may be configured to change the state of the bung irreversibly from the bunged state to the release state. The ampule may be sealed by a diaphragm and on activation of self-release, the hollow-bore needle is configured to pierce the diaphragm and release gas through the bore into the bottle. The hollow-bore needle may include a needle point for piercing the bunging substance at a bottom thereof to convey the portion of the gas into the bottle. The hollow-bore needle may include an aperture in the wall for releasing gas into the bore of the hollow-bore needle. The hollow-bore needle may be configured to slide relative to the ampule for bringing the aperture of the bore internal to the ampule in communication with the compressed gas. The bunging substance may be natural cork. The gas may be Carbon Dioxide, Argon, Helium, Xenon, Nitrogen and Krypton or mixtures thereof.

Various methods are provided herein for producing a bunged bottle enabled for self-release. An ampule is disposed within a bung configured to bung the bottle. The ampule is configured to include a compressed gas. Self-release may be activated to convey a portion of the gas through a hollow bore needle into the bottle. The bottle may be bunged with the ampule filled with compressed gas. The ampule may be sealed by a diaphragm. The diaphragm may be pierced by the hollow-bore needle to release the portion of gas into the bottle. The upper end of the hollow-bore needle may pierce the diaphragm. The lower end of the hollow-bore needle may pierce the bottom of the bung, may exit the bung and enter space inside the bottle. Release of the bung from the bottle is assisted by gas pressure from the expanding gas

inside the bottle. The activation may include sliding the hollow-bore needle relative to the ampule or sliding the ampule relative to the hollow-bore needle. The hollow-bore needle may include an aperture in the wall of the hollow-bore needle. Gas may be released into the bore of the hollow-bore needle by bringing the aperture of the bore internal to the ampule and in communication with the compressed gas.

The foregoing and/or other aspects will become apparent from the following detailed description when considered in conjunction with the accompanying drawing figures.

BRIEF DESCRIPTION OF DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is a sectional view of a bung, at the bunged state, according to a feature of the present invention.

Fig. 2 is the sectional view of the bung of Fig. 1 and at the state of Fig. 1 of bunging a bottle neck, according to a feature of the present invention.

Fig. 3 is a sectional view of the bung of Fig. 1 at the releasing state, according to a feature of the present invention.

Figures 4a-4e show a series of cross sectional assembly drawings for a bung, according to features of the present invention.

Figure 5a shows a bung in a bunged state, according to features of the present invention.

Figures 5b and Figure 6 show various features during a de-bunging state, according to a feature of the present invention.

Figure 7a shows a cross sectional drawing of a bung fitted internally with a simplified mechanism, according to a feature of the present invention.

Figures 7b and 7c which show drawings of a plan view as cross sectional view respectively of the top of second chamber, according to a feature of the present invention.

Figure 7d and Figure 7e which shows the effects of activation of an actuator, according to an embodiment of the present invention.

Figure 8 shows a flow chart of a method, according to a feature of the present invention

The foregoing and/or other aspects will become apparent from the following detailed description when considered in conjunction with the accompanying drawing figures.

DETAILED DESCRIPTION

Reference will now be made in detail to features of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like

elements throughout. The features are described below to explain the present invention by referring to the figures.

Before explaining features of the invention in detail, it is to be understood that the invention is not limited in its application to the details of design and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other features or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

By way of introduction, various embodiments of the present invention are directed to a bung which includes an internal mechanism to release a gas into the bottle. The bung may be released from the bottle without the need of a corkscrew or other external tool. In different embodiments of the invention: 1) the bung is removed with the assistance of gas pressure of gas released into the bottle. The gas may be a pressurized gas previously stored in the bung or the gas may be chemically produced within the bung and released into the bottle.

In alternative embodiments of the present invention, a bottle may be sealed multiple times by multiple insertions of the bung followed by a controlled released amount of the compressed gas contained in the tank into the bottle by a controlled release mechanism built into the device. The compressed gas may be Argon which is heavier than air so that when a bottle is stored upright, the heavier argon gas covers the beverage in the bottle so as to prevent oxidation of the beverage. Alternatively, the compressed gas may be carbon dioxide which may prevent further release of carbon dioxide of a carbonated beverage and/ or if the bottle is turned upside down, carbon dioxide may be re-introduced back into the carbonated beverage. Alternatively a bottle cap with a screw thread includes the device, according to another embodiment of the present invention and the compressed gas may be used to seal a screw top bottle to avoid beverages being oxidized or otherwise maintain beverages and/or re-introduce carbons dioxide into carbonated beverages.

Referring to the drawings, reference is now made to Fig. 1 which shows a sectional view of a bung **10**, in the bunged state **10A**, according to a feature of the present invention. The bunged bottle is not shown. Bung **10** includes a bunging substance **12**, the external shape is normally cylindrical. Bunging substance **12** may be cork, wood, plastic or other synthetic and natural

substance usable for bunging. Bunging substance **12** fills and seals the mouth of the bottle, except for a syringe-like device **40** shown embedded within bunging substance **12**.

Bung **10** includes a hollow-bore needle **42** and a tank **14**. Hollow-bore needle **42** may be slideable in relation to tank **14**. The inside volume **16** of tank **14** is filled by compressed air or another non-toxic gas **52**. Hollow-bore needle **42** may include a bore **22** containing air or gas.

Reference is now made to Fig. 2 which shows the sectional view of bung **10** of Fig. 1 during the state of bunging a bottle, according to an embodiment of the present invention.

Bung **10** is depicted bunging a bottle neck **46**. The bottle is typically supplied with beverage **44** leaving a relatively small volume **48** of air at the top of the bottle.

Device **40** may include a top peripheral seal **30**, for sealing the top of tank **14**, even upon sliding hollow-bore needle **42** in relation to tank **14**. Device **40** may include a bottom peripheral seal **28A**, for sealing the bottom of tank **14**, even upon sliding hollow-bore needle **42** in relation to tank **14**.

Thus, peripheral seals **28A** and **30A** maintain the high pressure of air/gas **52** within tank **14**.

Hollow-bore needle **42** may protrude above and/or below tank **14**. The top protrusion **60** of bore **54** of hollow-bore needle **42** includes an opening **24**, and the bottom protrusion **62** of bore **54** of hollow-bore needle **42** includes an opening **24**.

At the bunged state **10A**, each of aperture **24** and bottom opening **22** is blocked by substance **12**.

A physical obstacle **50** may be disposed between the handle **26** of hollow-bore needle **42** and the top of substance **12**, for disabling inadvertent activation by lowering of plunger **26** and hollow-bore needle **42**.

Reference is now made Fig. 3 which shows a sectional view of the bung of Fig. 1 during the releasing state **10B**.

Upon removing obstacle **50** if present, and upon pressing handle **26** downwards, as depicted by arrow **34**, hollow-bore needle **42** slides downwards in relation to tank **14**, and aperture **24** and bottom opening **22** are disposed lower.

At the low location of hollow-bore needle **42**, aperture **24** through the wall of hollow-bore needle **42** enters internal volume **16** of tank **14**, and bottom opening **22** of bore of hollow-bore needle **42** enters the space **48** inside bottle **46**.

Thus, compressed gas **52** expands, through aperture **24** through wall of hollow-bore needle **42**, from volume **16** of tank **14** into bore **54** of hollow-bore needle **42**. Further, compressed gas **52** expands from inside bore **54** of hollow-bore needle **42**, through bottom opening **22** of hollow-bore needle **42**, into top volume **48** of the bottle.

At the next step, gas **52** expands into space **48**, and exert pressure on the internal walls bottle neck **46** and on bottom **56** of bunging substance **12**. The upward pressure on bunging substance **12** assists removal of bung **10** from bottle **46**.

The bottom of hollow-bore needle **42** may include a bottom needle point **20** for piercing through the bottom of bunging substance **12**, for allowing hollow-bore needle **42** to slide in relation to the bottom of bunging substance **12**.

According to features of the present invention, bottom needle point **20** may be spiral, and handle **26** may be be rotated, for threading through the bottom of bunging substance **12**.

Thus aspects of the present invention are directed to bung **10**, including a bunging substance **12**, for inserting a bottom **56** thereof into a bottle neck **46**, for sealing the bottle, a device **40** installed within bunging substance **12** including tank **14**, compressed gas **52** contained within the tank **14**; a hollow-bore needle **42**, for releasing the compressed gas **52** to expand between the bottom **56** of the bunging substance **12** and a beverage **44** inside the bottle, thereby pressing on the bottom **56** of the bunging substance **12** outward from bottle **46**. Hollow-bore needle **42** includes a bore **54**, the hollow-bore needle **42** may be partly disposed within the tank **14**, and may be longer than the tank **14**, and may be sealed to a top end **30** and to a bottom end **28** of the tank **14**, and may be slideable in relation to the tank **14** there-along, and compressed gas **52** may not be contained within the bore **54** at the bunged state **10A** of the bung **10**, and the bore **54** may include on aperture **24** through the wall of needle **42** into bore 54. Aperture **24** is disposed above top end **30** of tank **14** at the bunged state **10A**, for not allowing the compressed gas **52** to enter the bore **54** through aperture **24**, and for being disposed below the top end **30** of the tank **14**. Upon sliding hollow-bore needle **42** from the bunged state **10A** to a releasing state **10B**, the compressed gas **52** contained within the tank

14, is allowed to enter the bore **54** through t aperture **24**. A bottom opening **22** into bore **54**, is now disposed below the bottom **56** of bunging substance **12**, at least upon sliding of hollow-bore needle **42** from the bunged state **10A**. Gas **52** enters bore **54**, and bottle neck **46** through the bottom opening **22**. Hollow-bore needle **42** may protrude above the top **18** of the bunging substance **12** there-through, thereby top **26** of the hollow-bore needle **42** is accessible for allowing the user to slide hollow-bore needle **42** in relation to tank **14**. The bottom opening **22** of the bore **54** may be disposed above the bottom **56** of the bunging substance **12** at the bunged state **10A**. The bottom of the hollow-bore needle **42** may comprise a needle point **20**, for piercing through the bunging substance **12** at the bottom thereof.

In another aspect of the present invention is a method for releasing a bung **10**, the method comprising the steps of: installing a tank **14** within a bunging substance **12**, inserting at least the bottom **56** thereof into a bottle neck **46**, for sealing the bottle; containing compressed gas **52** within the tank **14**; and releasing the compressed gas **52** from the tank **14** to expand into bottle **46**, thereby exerting pressure on bottom **56** of the bunging substance **12** outward of bottle **46**. The step of releasing the compressed gas **52** from the tank **14** to expand between the bottom **56** of the bunging substance **12** and a beverage **44** of the bottle, may comprise the steps of: releasing the compressed gas **52** from the tank **14** to expand into a bore **54** within a hollow-bore needle **42** within the tank **14**; and releasing the compressed gas **52** from the bore **54** to expand into between the bottom **56** of the bunging substance **12** and beverage **44** of bottle **46**. The step of releasing the compressed gas **52** from the tank **14** to expand into the bore **54** within the hollow-bore needle **42** within the tank **14** may comprise the step of sliding the hollow-bore needle **42** in relation to the tank **14** and bringing an opening **24** through the wall of needle **42** to enter tank **14**. The step of releasing the compressed gas **52** from the bore **54** to expand into between bottom **56** of the bunging substance **12** and beverage **44** of the bottle may comprise the step of bringing an opening **22** of the bore **54** to enter space **48** between the bottom **56** of the bunging substance **12** and the surface of beverage **44** inside bottle **46**.

Alternatively according to a feature of the present invention there are provided methods/systems for resealing a bottle neck **46** of a bottle using a bung **10**. As described above device **40** is provided within a bunging substance **12** and tank **14** contains a compressed gas **52**. Bung **10** is inserted into bottle neck **46**. Once bung **10** is inserted

compressed gas **52** from tank **14** is released by a press of hollow-bore needle **42**. The press of hollow-bore needle **42** causes needle point **20** to pierce through the bottom of bunging substance **12** and gas **52** is released into the space **48** between the bottom **56** of the bunging substance **12** and surface of beverage **44**. An amount of compressed gas **52** expands into space **48**.

Multiple releases of compressed gas **52** may allow for multiple resealing(s) of a bottle neck **46** of a bottle may be provided by bung **10**. Depressing hollow-bore needle **42** allows the return of needle point **20** back into the bottom of bunging substance **12** by virtue of the decompression of spring **32**. The return of needle point **20** back into the bottom of bunging substance **12** closes opening **24**, so that the seal of bottle neck **46** is maintained.

The compressed gas **52** may be argon gas which is heavier than the air in space **48** between the bottom **56** of the bunging substance **12** and the surface of beverage **44** of bottle **46**. Argon gas rests predominantly on top of the beverage **44** when the bottle is vertical and tends to prevent further oxidation of beverage **44**.

Alternatively compressed gas **52** may be carbon dioxide which is the same as the gas used or produced in a carbonated beverage **44**, beer, ale and/or sparkling wine, which may help to prevent further release of carbon dioxide contained in beverage **44** and may maintain the flavor and sparkle. Gas **52** is preferably inert and may be Nitrogen, Carbon Dioxide, Argon, Helium, Xenon, and Krypton or mixtures thereof.

Thus, according to other aspects of the present invention are provided herein method for resealing a bottle neck **46** of a bottle using a bung **10**, the method comprising the steps of: providing a tank **14** within a bunging substance **12**; inserting a bottom **56**) thereof into the bottle neck **46**; containing compressed gas **52** within tank **14**; and releasing gas 52 from tank **14** to expand between bottom **56** of bunging substance **12** and surface of beverage **44** of a bottle **46**; thereby sealing a bottle neck **46**. Gas **52** may be heavier than the air in the space **48** between bottom **56** of bunging substance **12** and the surface beverage **44** of a bottle, thereby reducing oxidization of beverage **44**. Gas **52** may be a gas, *e.g* carbon dioxide, which is the same as a gas dissolved in beverage **44**, *e.g* carbonated beverage, thereby preventing further release of the gas from beverage **44**.

In the figures and/or description herein above, the following reference numerals have been mentioned: numeral **10** denotes a bung, according to one feature of the present invention; numeral **10A** denotes the bunged state of the bung; numeral **10B** denotes the releasing state of the bung; numeral **12** denotes the bunging substance; the prior art bung normally includes only this element; numeral **14** denotes a tank disposed within the bunging substance; numeral **16** denotes the inside volume of the tank, not including the bore of the hollow-bore needle **42**; numeral **18** denotes the top of the bunging substance; numeral **20** denotes a spearhead disposed at one end of the hollow-bore needle **42**; numeral **22** denotes the bottom opening of the bore of the hollow-bore needle **42**; numeral **24** denotes the aperture through the wall of the hollow-bore needle **42** communicating with the bore of the hollow-bore needle **42**; numeral **26** denotes the handle of the hollow-bore needle **42**; the handle may include the top of the bore of the hollow-bore needle **42**; numeral **28** denotes the bottom end of the tank; numeral **28A** denotes a peripheral seal disposed at the bottom end of the tank; numeral **30** denotes the top end of the tank; numeral **30A** denotes a peripheral seal disposed at the top end of the tank; numeral **32** denotes a spring, for returning the hollow-bore needle **42** upwards, after sliding it to the releasing state; this spring may allow the user cease the expansion of the gas, for limiting the pressure applied on the bottom of the bunging substance, for avoiding extreme release of the bung; numeral **34** denotes an arrow, depicting the sliding of the hollow-bore needle **42** in relation to the tank; numeral **42** denotes the hollow-bore needle **42**, being surrounded by the tank, and being slideable in relation thereto; numeral **44** denotes the beverage of the bottle; numeral **46** denotes the bottle neck; numeral **48** denotes the volume of air at the top of the bottle; numeral **50** denotes a physical obstacle, for not allowing hollow-bore needle **42** to be lowered inadvertently; numeral **52** denotes air or non-toxic air being at a compressed stated within the tank; numeral **54** denotes the bore within the hollow-bore needle **42**; numeral **56** denotes the bottom of the bunging substance; numeral **60** denotes the part of the hollow-bore needle **42** protruding above the tank, at the bunged state; and numeral **62** denotes the part of the hollow-bore needle **42** protruding below the tank, at both states.

Reference is now made to Figures 4a-4e which show a series of cross sectional assembly drawings for a bung **400**, according to a feature of the present invention. In Figure 4a, a view **400a** is shown of bung body **402** which may be made of cork or other suitable substance to seal neck **46** of a bottle. Bung body **402** is shown hollowed out so as to accommodate and/or

locate sleeve guide **404** which may include an 'o' ring gasket **404a**. Sleeve guide **404** is located in bung body **402** as shown in view **400b**, Figure 4b. Sleeve guide **404** may be attached inside bung body **402** with an adhesive. Sleeve guide **404** allows the free movement of pin **406** inside sleeve guide **404** parallel to axis **ZZ** as shown in view **400c**, Figure 4c. Gas ampule **408** may include a ring push or ring twist **410**. Gas ampule **408** is shown located with pin **406** in sleeve guide **404** in the hollowed out portion of bung body **402** as shown in view **400d**, Figure 4d. Gas ampule **408** may hold a compressed gas such as carbon dioxide for example. The fully assembled bung **400** is shown in internal view **400d** in Figure 4d, and external view **400e**, Figure 4e. The fully assembled bung **400** may then be inserted into a neck **46** of a bottle so as to seal the bottle and its contents.

Reference is now made to Figure 5a which shows bung **400** in a bunged state and Figures 5b and 6 which shows a de-bunged state respectively, according to a feature of the present invention. The bunged state means that bung **400** is inserted into a neck **46** of a bottle (not shown) so as to seal the bottle and its contents. Gas ampule **408** is shown located in sleeve guide **404** along with pin **406**. The narrow portion of pin **406** is located in and is not pierced through the material of bung body **402** so that bung body **402** is maintaining the bunged state with the aid of 'o' ring gasket **404a**. The wider portion of pin **406** is located and is in contact with diaphragm **500** of gas ampule **408**. Pin **406** has a hollow bore (shown by dotted lines) which extends from the narrow portion to the wider portion parallel to axis **ZZ**. Diaphragm **500** seals gas ampule **408**. Both pin **406** and gas ampule **408** move inside sleeve guide **404** parallel to axis **ZZ**.

In the discussion that follows for Figures 5b and 6 the same parts are as described in Figure 5a and Figures 5b and 6 refer to the removal of bung **400** from a bottle (not shown in Figure 5b). The bottle neck **46** of the bottle is shown in Figure 6.

Reference is now made to Figure 5b which shows gas ampule **408** pushed further into bung body **402** such that the narrow end of pin **406** pierces through the bottom of bung **400**. The narrow end of pin **406** is shown as a point which is similar to the point of a hypodermic needle. The narrow end of pin **406** may have other pointed shapes known in the art to pierce through the bottom of bung **400**. Gas ampule **408** pushed further into bung body **402** is achieved by a direct push on the end of bung body **402** where ring twist **410** is located. Alternatively a screw and/or cam mechanism as a part of bung body **402** and/or gas ampule

408 may allow a rotation of ring twist **410** which causes gas ampule **408** to be pushed further into bung body **402**.

Reference is now made to Figure 6 which shows the effect of a pushing of gas ampule **408** further into bung body **402**. The pushing of gas ampule **408** further into bung body **402** cause diaphragm **500** of gas ampule **408** to be pierced. The compressed gas in gas ampule **408** is released through the bore of pin **406** (shown by dotted line) into volume **48** which in between the bottom of bung body **402** and beverage **44**. The expansion of compressed gas released into volume **48** causes bung **400** to be released upwards and out of bottle neck **46**. The expansion of compressed gas released into volume **48** is maintained in volume **48** by virtue of the compression of 'o' ring **404a** between pin **406** and sleeve guide **404** and compression between the wider part of needle **406** with diaphragm **500**.

Reference is now made to Figure 7a which shows a cross sectional drawing of a bung **71** fitted internally with a simplified mechanism, according to a feature of the present invention. Bung **71** includes a bung housing **72** made from cork, rubber, synthetic material, composite material and/ or made from another material suitable to be able to seal a bottle using bung **71**. Located and attached into bung housing **72** are the various parts of the mechanism. The mechanism includes a mechanism housing **712** which is made from a metal alloy or other composite material with sufficient wall thickness to allow compression of bung housing **72**. Compression of bung housing **72** allows bung **71** to be inserted into the neck of a bottle without damaging the mechanism and in order to seal the bottle.

Symmetrically placed around longitudinal axis **ZZ** are the various parts of the mechanism. A 'I' shaped actuator **76** at one end is hermetically held against the walls of mechanism housing **712** with 'o' rings **720**. The other end of actuator **76** which sticks out from bung **71** includes a button which allows actuator **76** to be pressed down into mechanism housing **712** along longitudinal axis **ZZ**. Actuator **76** includes an inverted 'T' shaped first chamber **78** which holds a first chemical reactant which may be in solid, *e.g.* powder, or liquid state The first chemical reactant may be held and hermetically sealed in first chamber **78** by a membrane **78a**. Actuator **76** is prevented from moving out of the mechanism by a bushing **714**.

Included further is a second chamber **710** in which a second chemical reactant is stored and may be in powdered form. The top end of second chamber **710** includes a piercing point **710a** and the bottom end of chamber **710** is attached to a needle **716**. Needle **716** is hermetically

sealed and held against a reduced diameter walls **712a** of mechanism housing **712** with 'o' rings **718**. Needle **716** is shown hermetically sealed between apertures **716a** and **716b**. Apertures **716a** and **716b** are connected together by an internal bore shown by dotted lines. Two pairs of apertures **716a** and **716b** with respective bores are shown but one pair of apertures **716a** and **716b** with bore may implemented. Both needle **716** and second chamber **710** are capable of moving up and down longitudinal axis **ZZ**. Further attached around the diameter of chamber **710** is a droplet separator **74** which allows the movement of chamber **710** up and down longitudinal axis **ZZ** between the walls of mechanism housing **712**.

Reference is now made to Figures 7b and 7c which show drawings, a plan view and cross sectional view respectively of the top of second chamber **710**, according to a feature of the present invention. The top of second chamber **710** is shown with triangular piercing point **710a** which is used to pierce membrane **78a** and four apertures **110** located between the triangular sections of piercing point **710a**. Any number of apertures **110** beginning with one aperture **110** may be located in the vicinity of piercing point **710a**. A further four apertures **100** are also shown located at an outer diameter of the top of second chamber **710**. As with apertures **110**, any number of apertures **100** beginning with one aperture **100** may be located on the outer diameter of the top of second chamber **710** as shown.

Reference is now made to Figure 7d and Figure 7e which shows the effects of activation of actuator **76** and Figure 8, a flow chart of **801** respectively, according to features of the present invention. Figure 7d shows actuator **76** pressed down (step **803**) by a user in order for the user to open a bottle which is sealed by bung **710**. Actuator **76** pressed down in step **803** causes piercing point **710a** to pierce membrane **78a** which causes the liquid chemical reactant in first chamber **78** to run into second chamber **710** through apertures **110**. The chemical reactant, *e.g.* liquid, in first chamber **78** reacting with the chemical reactant, *e.g.* powder, held in second chamber **710** produces a chemical reaction which releases carbon dioxide or other similar inert gas in second chamber **710** (step **805**).

Now making reference to Figure 7e, the release of carbon dioxide in second chamber **710** expands out of second chamber **710** through apertures **100**. The expansion of carbon dioxide in the gap between actuator **76** and second chamber **710**, causes actuator **76** to move upwards until actuator **76** can no longer move upwards because of bushing **714**. The expansion of carbon dioxide in the gap between actuator **76** and second chamber **710**, also causes second

chamber **710** attached to needle **716** to move downwards (step **807**) and for the carbon dioxide to pass through droplet separator **74** into the first top apertures **716a/ 716c** of needle **716** (step **809**). Passing the carbon dioxide gas through droplet separator **74** allows droplet separator **74** to prevent any slurry from the chemical reaction in step **805** to enter the first top aperture **716a/ 716c** of needle **716**.

In decision **811** if enough gas has caused needle **716** to move downwards (step **807**) through bung housing **72**, the carbon gas is able to pass through the internal bores of needle **716** and out of respective apertures **716b/ 716d** into the space between the bottom of bung body **72** and the beverage inside the bottle sealed by bung **710** (step **813**). The build up and expansion of gas in the space between the bottom of bung body **72** and the beverage inside the bottle as the chemical reaction in step **805** continues is sufficient to force bung **710** out of the bottle. Otherwise the carbon dioxide continues to pass through droplet separator **74** into the first top apertures **716a/ 716c** of needle **716** through bung housing **72** in step **809**.

With respect to the nature of the two chemical reactants, the gas generated, *e.g.* carbon dioxide, is preferably non-toxic and devoid of smell. Carbon dioxide may be generated from sodium bicarbonate by a reaction with an acid such as phosphoric acid. In order to avoid caking by insoluble salts which may prevent the reaction from going to completion and thus give less gas, sufficient solvent, *e.g.* water should be present to dissolve most or all of the salts formed.

Carbon dioxide can be generated by the reaction of sodium bicarbonate with 85% phosphoric acid. Of the three salts that can be prepared by this reaction, the mono sodium phosphate is the most soluble, so the reaction stoichiometry is as follows:

$H_3PO_4 + NaHCO_3 \rightarrow NaH_2PO_4 + CO_2\uparrow + H_2O$

In gram moles:

98g + 84g → 120g + 48g (1 mole) + 18g

Since technical phosphoric acid is 85% by weight, the actual mass required to produce one gram mole of carbon dioxide is 115g.

The solubility of mono-sodium phosphate is 59.9g/100ml water at 0°C. Thus in order to dissolve one gram mole (120g) of the sodium mono-phosphate formed, about 200ml of water are used. These are added to the phosphoric acid. Thus the acid stored prior to the reaction is

about 33% by weight. Some extra water may be available from the phosphoric acid and 18g are produced by the reaction. Thus complete solubility of the mono-sodium phosphate produced is ensured as is complete evolution of carbon dioxide.

Thus, various bungs for self-release are provided for herein, the bung including at least two chambers containing at least two chemical reactants. The bung includes an activation mechanism, *e.g* lever, ring, button, and on activation, *e.g* press or twist, the chemical reactants are combined and react to form a gas. The gas is conveyed to the space interior to the bottle and the gas pressure increase inside the bottle assists release of the bung from bottle. The bung includes a droplet separator which is configured to prevent residual reactants, solvent and reaction products other than the gas produced from entering the bottle. The self-release of the bung is performed when the bunged bottle is vertical and the upper chamber holding a first reactant is pierced. The first reactant falls into the second chamber holding the second reactant. A method for producing a bunged bottle for self-release includes preparing a bung with two chambers including the two chemical reactants respectively.

The term "bung" as used herein refers a round piece of rubber, wood, cork etc. that is used to close the hole in a container such as a bottle, a barrel, a cask, or a keg.

The terms "bung", "cork" and "stopper" are used herein interchangeably.

The term "aperture" refers to one or more holes with fluid communication with a bore of a hollow-bore needle which may be: a hole at either end of the needle, both ends of the needle and/or through a wall of the needle.

The terms "tank", and "ampule" are used herein interchangeably. The term "disposed" in the context of the ampule "disposed" within the bung as used herein means that the ampule is installed substantially entirely within the bung.

The terms "upper", "lower", "top", "bottom" refer to a bunged bottle standing vertically.

The term "communication" or "fluid communication" is used herein refers to a path over which gas may flow.

The term "space" as used herein in the context of inside the bottle refers to the space outside the bung and interior to the bottle belong the bung in a volume normally occupied by air.

The indefinite articles "a", "an" as used herein, such as "a bung", "a bore" has the meaning of "one or more" that is"one or more bungs", "one or more bores".

All optional and preferred features and modifications of the described embodiments and dependent claims are usable in all aspects of the invention taught herein. Furthermore, the individual features of the dependent claims, as well as all optional and preferred features and modifications of the described embodiments are combinable and interchangeable with one another.

Although selected features of the present invention have been shown and described, it is to be understood the present invention is not limited to the described features. Instead, it is to be appreciated that changes may be made to these features are defined by the claims.

CLAIMS

1. A bung comprising:

a bunging substance, for inserting into a neck of a bottle for sealing the bottle;

an ampule disposed within the bunging substance, wherein the ampule is configured to include a compressed gas; and

a hollow-bore needle having a hollow bore is disposed within the bung, and on activation of self-release, the hollow-bore needle is configured to convey a portion of the gas through the hollow bore into the bottle.

2. A bung according to claim 1, wherein the hollow-bore needle includes an aperture for releasing at least a portion of the gas into the bottle, wherein the bung is in a state selected from the group consisting of:

a bunged state, wherein the compressed gas is sealed from entering the bore through the aperture; and

a release state which allows the portion of the gas to enter the bore through the aperture and into the bottle to release the bung from the bottle.

3. A bung according to claim 2, wherein during the release state, the bung is configured to be released from the bottle assisted by gas pressure from the expanding gas inside the bottle

4. A bung according to claim 2, further comprising an activation mechanism configured to change the state of the bung irreversibly from the bunged state to the release state.

5. A bung according to claim 2, wherein the ampule is sealed by a diaphragm and on activation of the self-release, the hollow-bore needle is configured to pierce the diaphragm and release the portion of the gas through the bore into the bottle.

6. A bung according to claim 2, wherein the hollow-bore needle includes a needle point for piercing the bunging substance at a bottom thereof to convey the portion of the gas into the bottle.

7. A bung according to claim 1, wherein the hollow-bore needle includes an aperture in the wall of the hollow-bore needle, for releasing at least a portion of the gas into the bore of the hollow-bore needle.

8. A bung according to claim 7, wherein hollow-bore needle is configured to slide relative to the ampule for bringing the aperture of the bore internal to the ampule and in communication with the compressed gas.

9. A bung according to claim 1, wherein the bunging substance is natural cork.

10. A bung according to claim 1, wherein the gas is selected from the group of gases consisting of: Carbon Dioxide, Argon, Helium, Xenon, Nitrogen and Krypton.

11. A method for producing a bunged bottle enabled for self-release, the method comprising :

disposing an ampule within a bung configured to bung the bottle, wherein the ampule is configured to include a compressed gas; and

enabling activation of the self-release to convey a portion of the gas through a hollow bore needle into the bottle.

12. The method according to claim 11, further comprising:

bunging the bottle with the ampule filled with the compressed gas disposed within the bung.

13. The method according to claim 11, wherein the ampule is sealed by a diaphragm, the method further comprising:

enabling piercing of the diaphragm by the hollow-bore needle to release the portion of the gas into the bottle.

14. The method according to claim 13, wherein the upper end of the hollow-bore needle is configured to pierce the diaphragm, the method further comprising:

enabling the lower end of the hollow-bore needle to pierce the bottom of the bung, exit the bung and enter space inside the bottle.

15. The method according to claim 11, further comprising:

enabling release of the bung from the bottle assisted by gas pressure from the expanding gas inside the bottle.

16. A method according to claim 15, wherein the activation includes sliding the hollow-bore needle relative to the ampule.

17. A method according to claim 15, wherein the activation includes sliding the ampule relative to the hollow-bore needle.

18. A method according to claim 11, wherein the hollow-bore needle includes an aperture in the wall of the hollow-bore needle, the method further comprising:

releasing at least a portion of the gas into the bore of the hollow-bore needle by bringing the aperture of the bore internal to the ampule and in communication with the compressed gas.

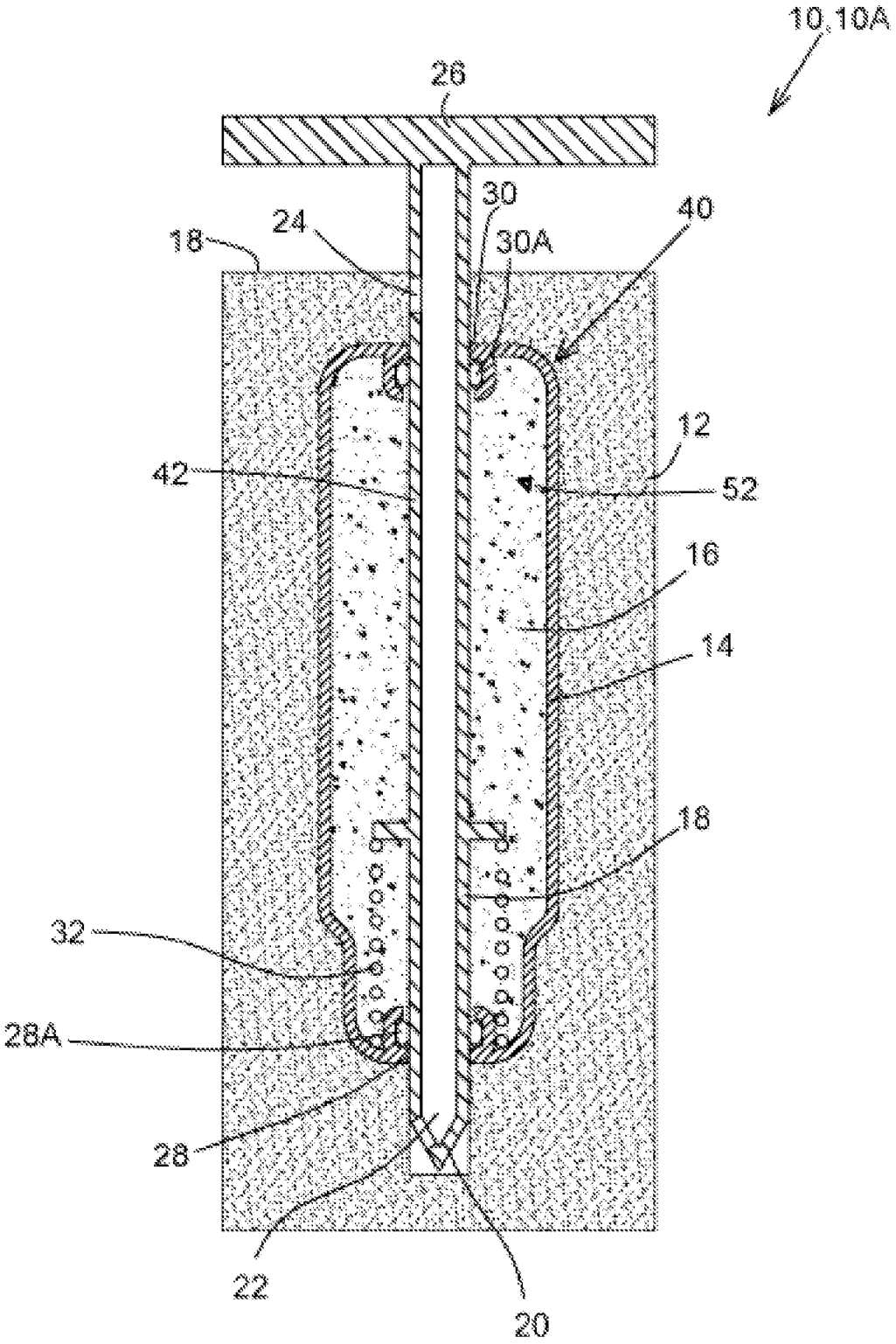
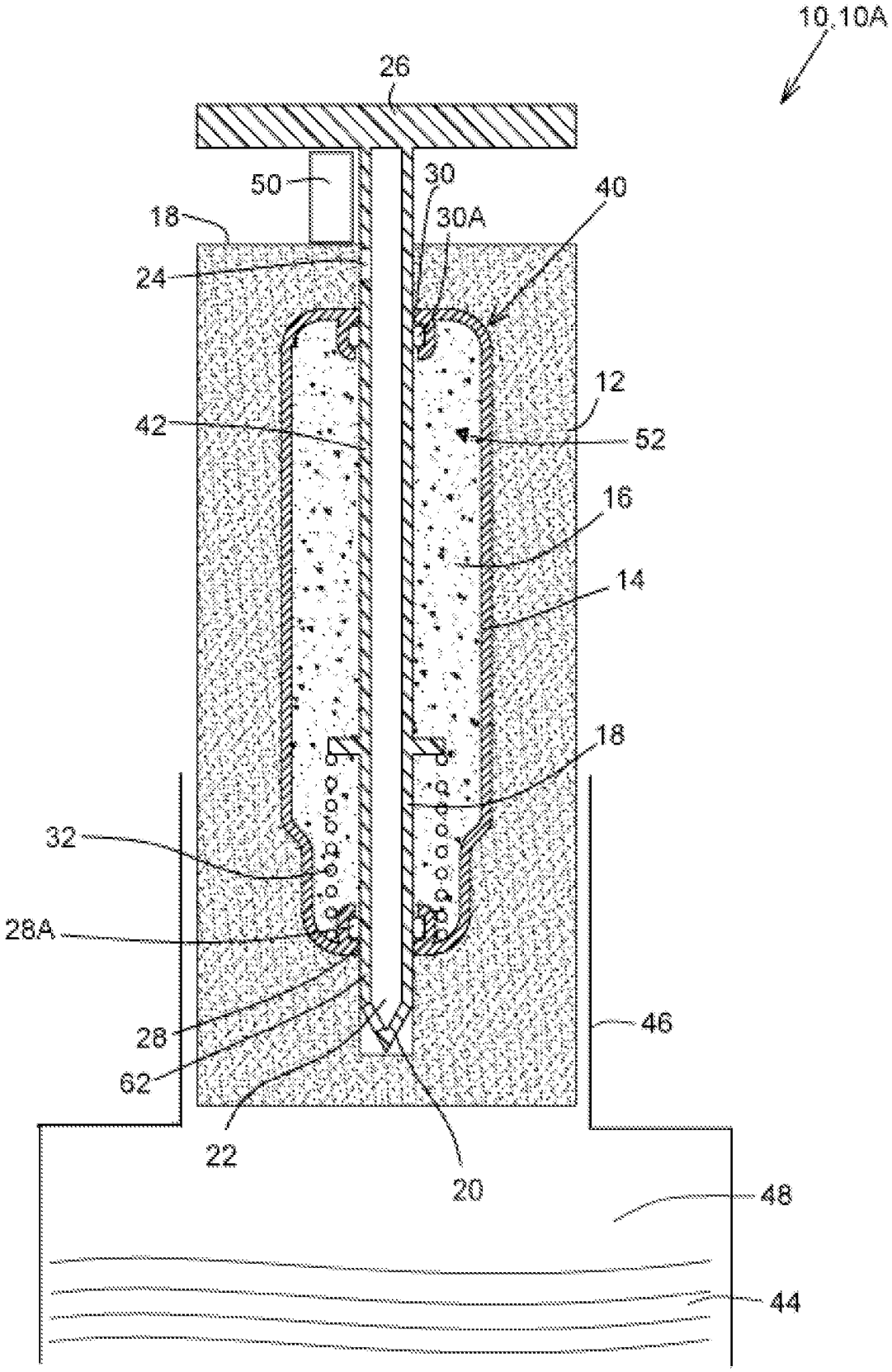


Fig. 1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26
50
30
40
18
30A
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42
52
16
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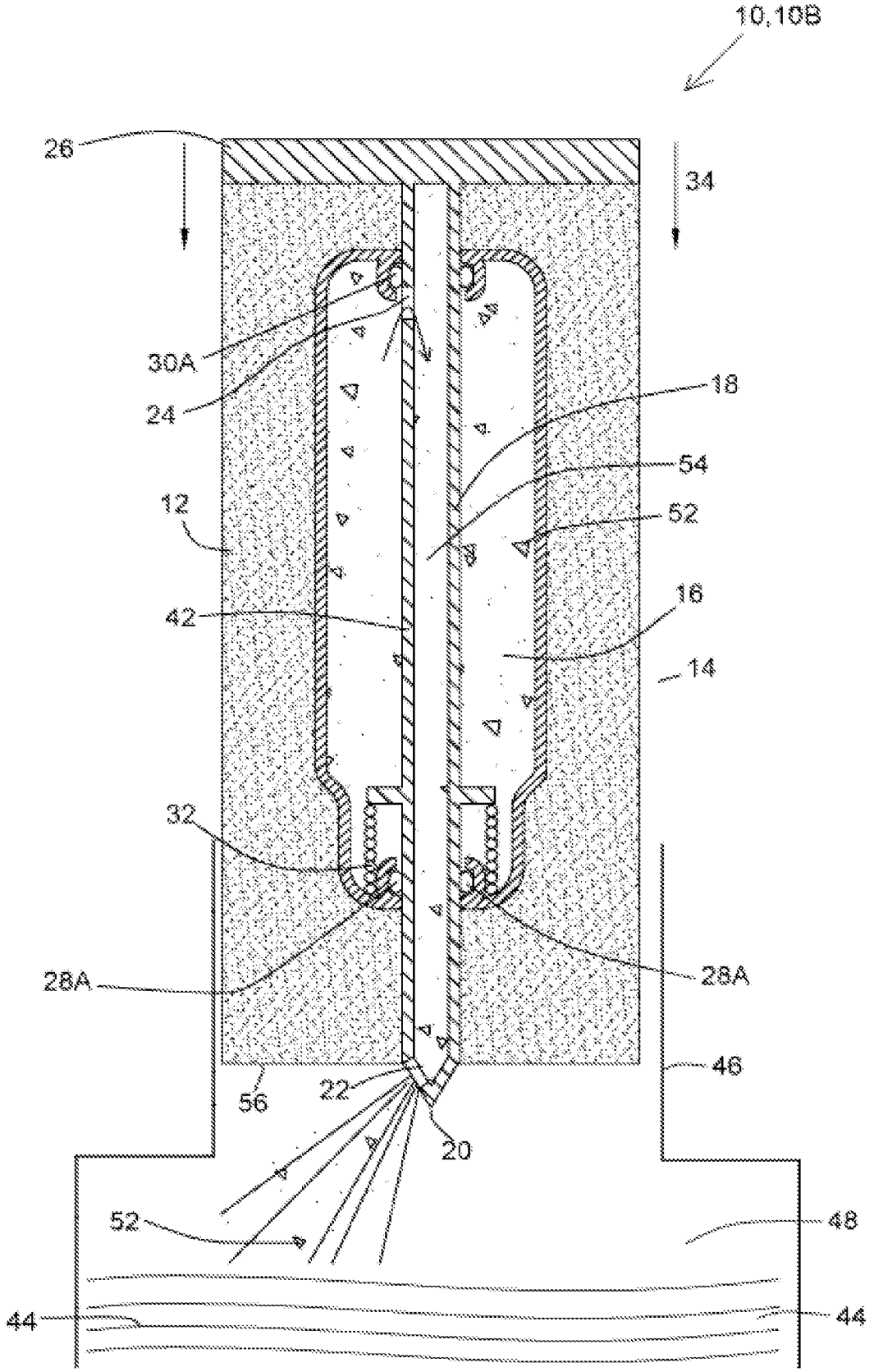
18
32
28A
28
62
46
22
20
48
44

Fig. 2


10,10B
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30A
24
18
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42
16
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32
28A
28A
46
56
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52
48
44
44

Fig. 3

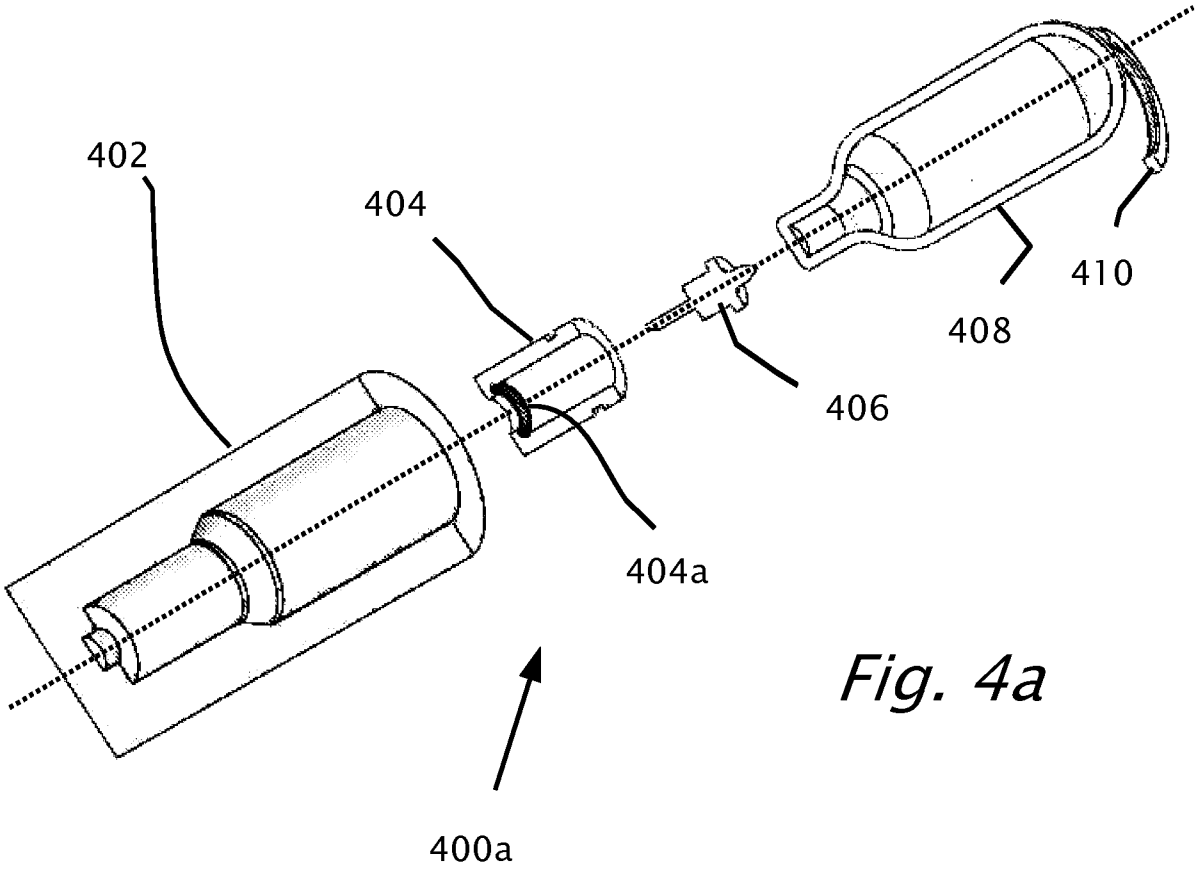

Fig. 4a

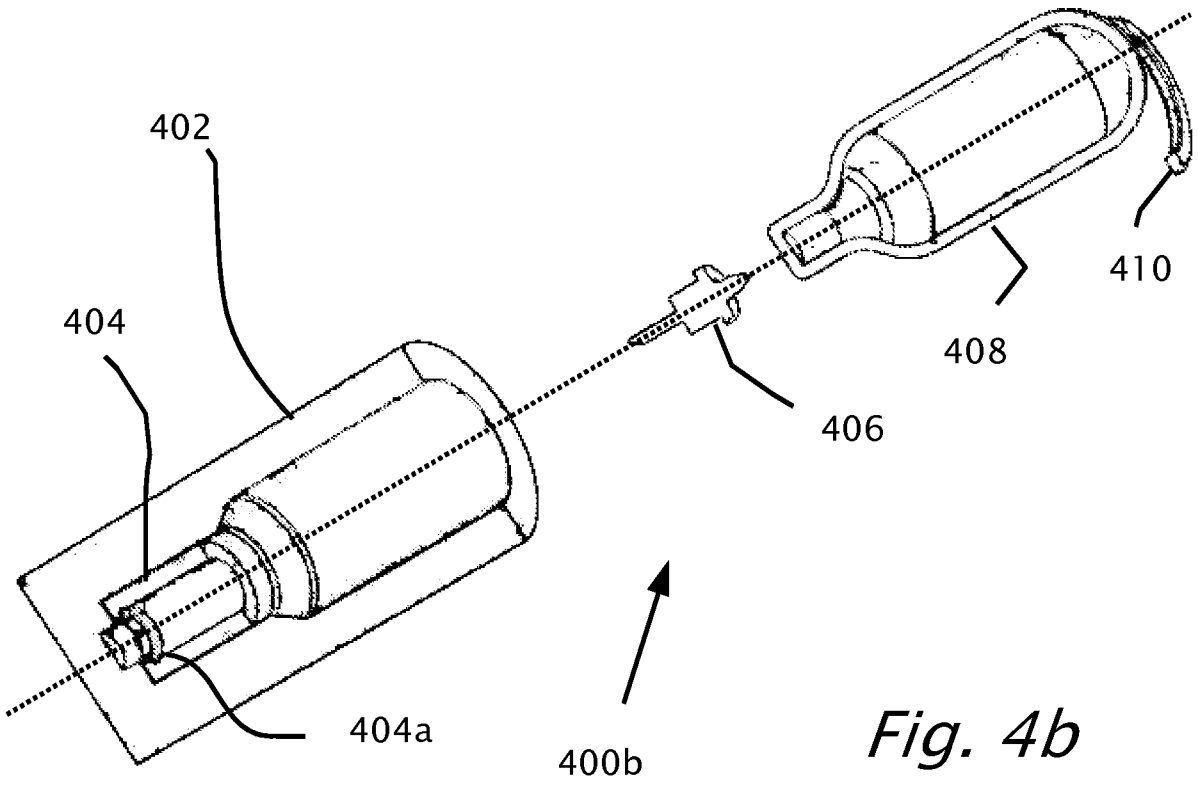

Fig. 4b

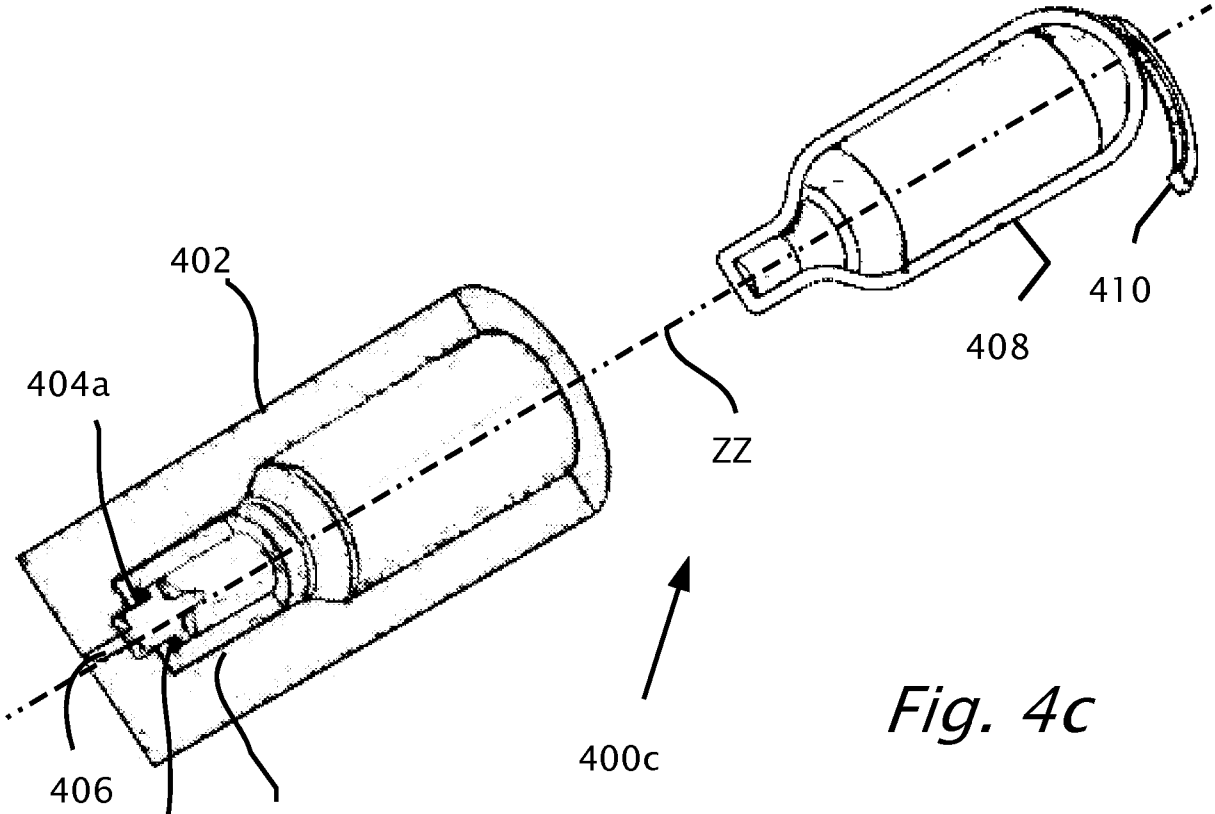
402
404a
406
404a
404
400c
ZZ
408
410

Fig. 4c

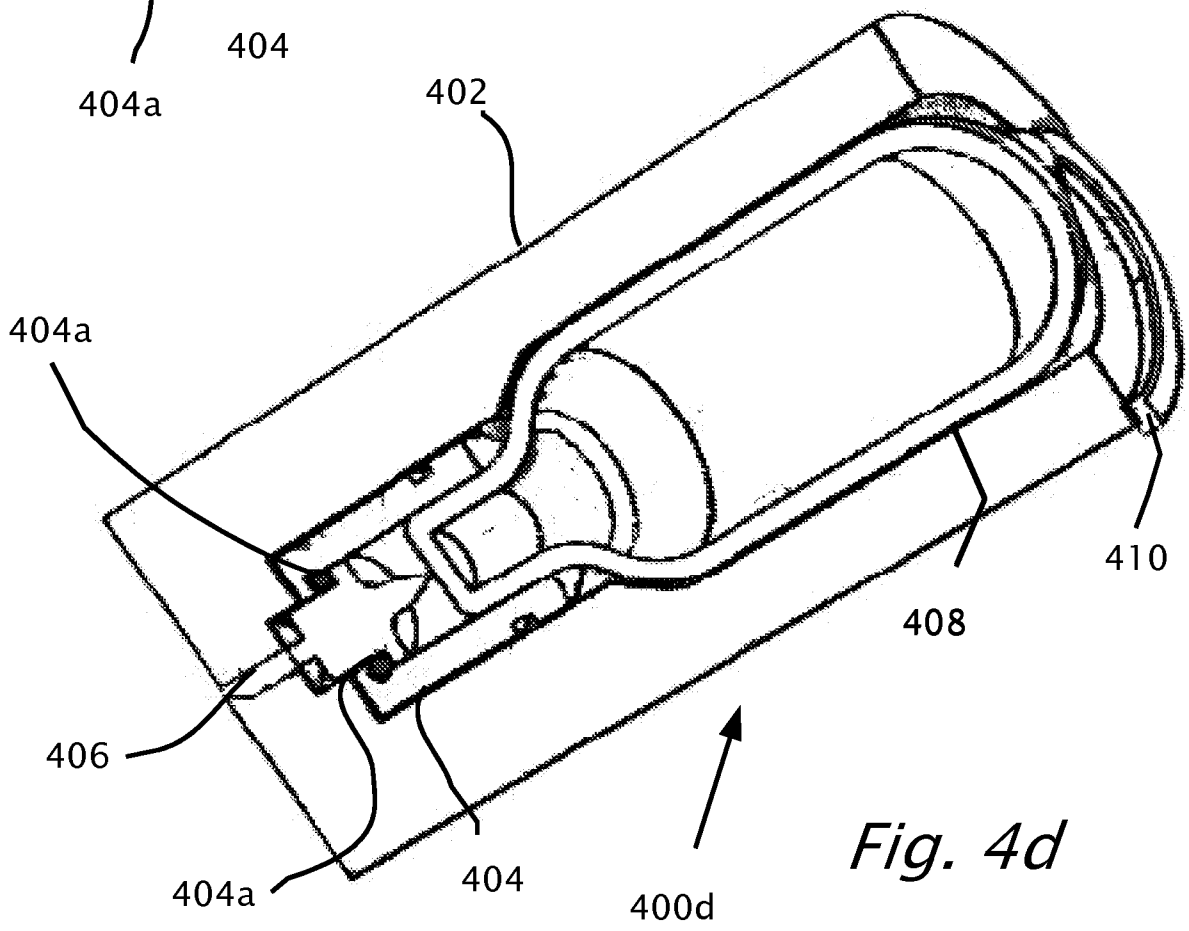
402
404a
406
404a
404
400d
408
410

Fig. 4d

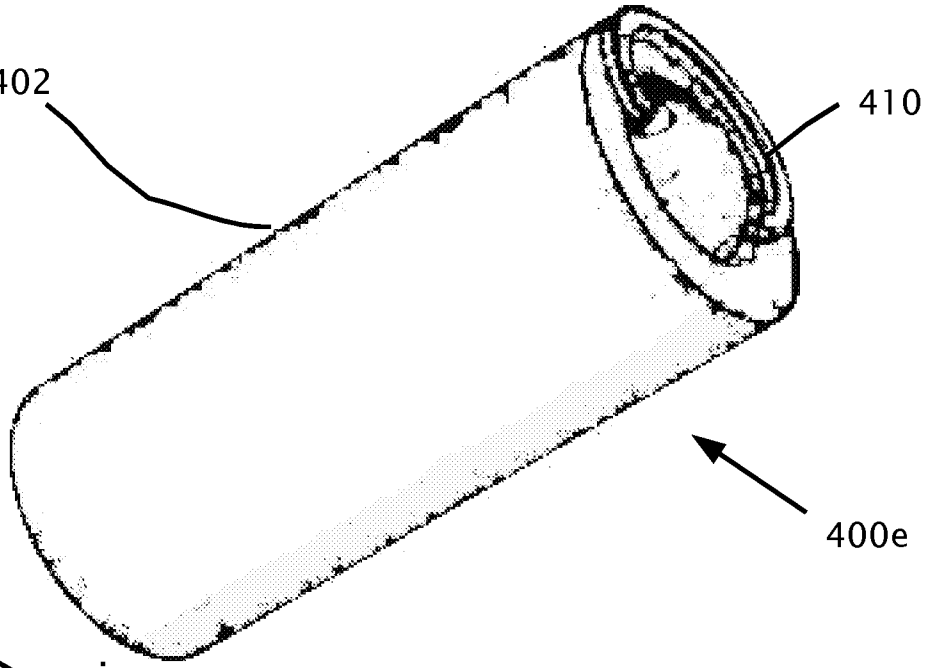

Fig. 4e

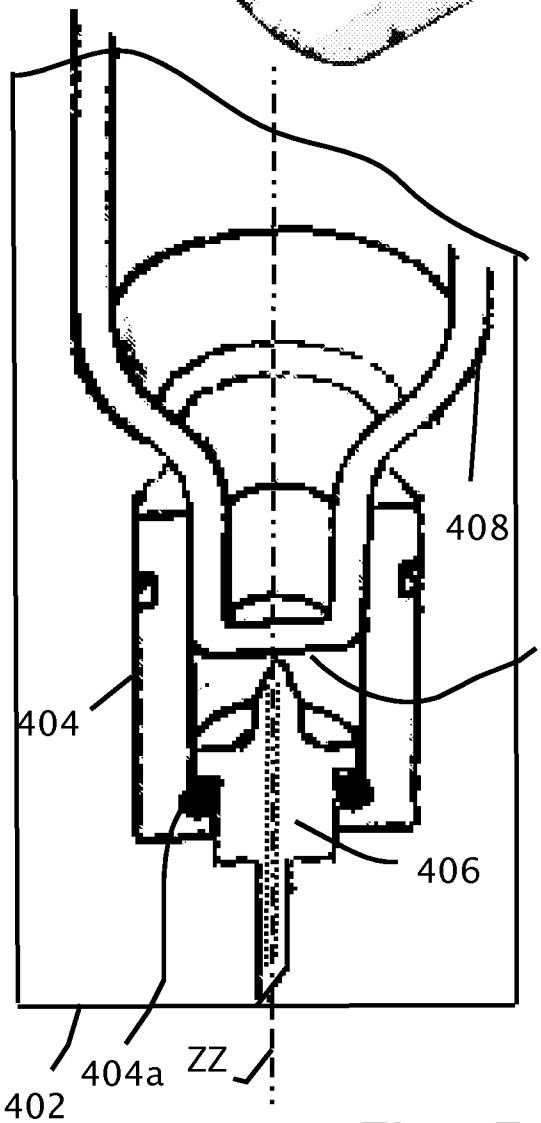

Fig. 5a

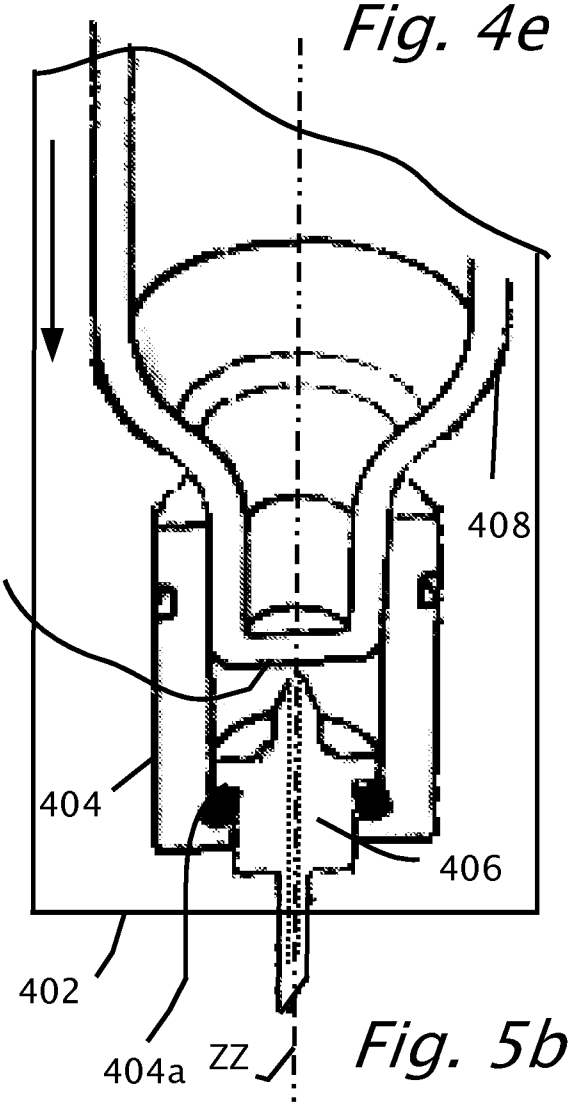

Fig. 5b

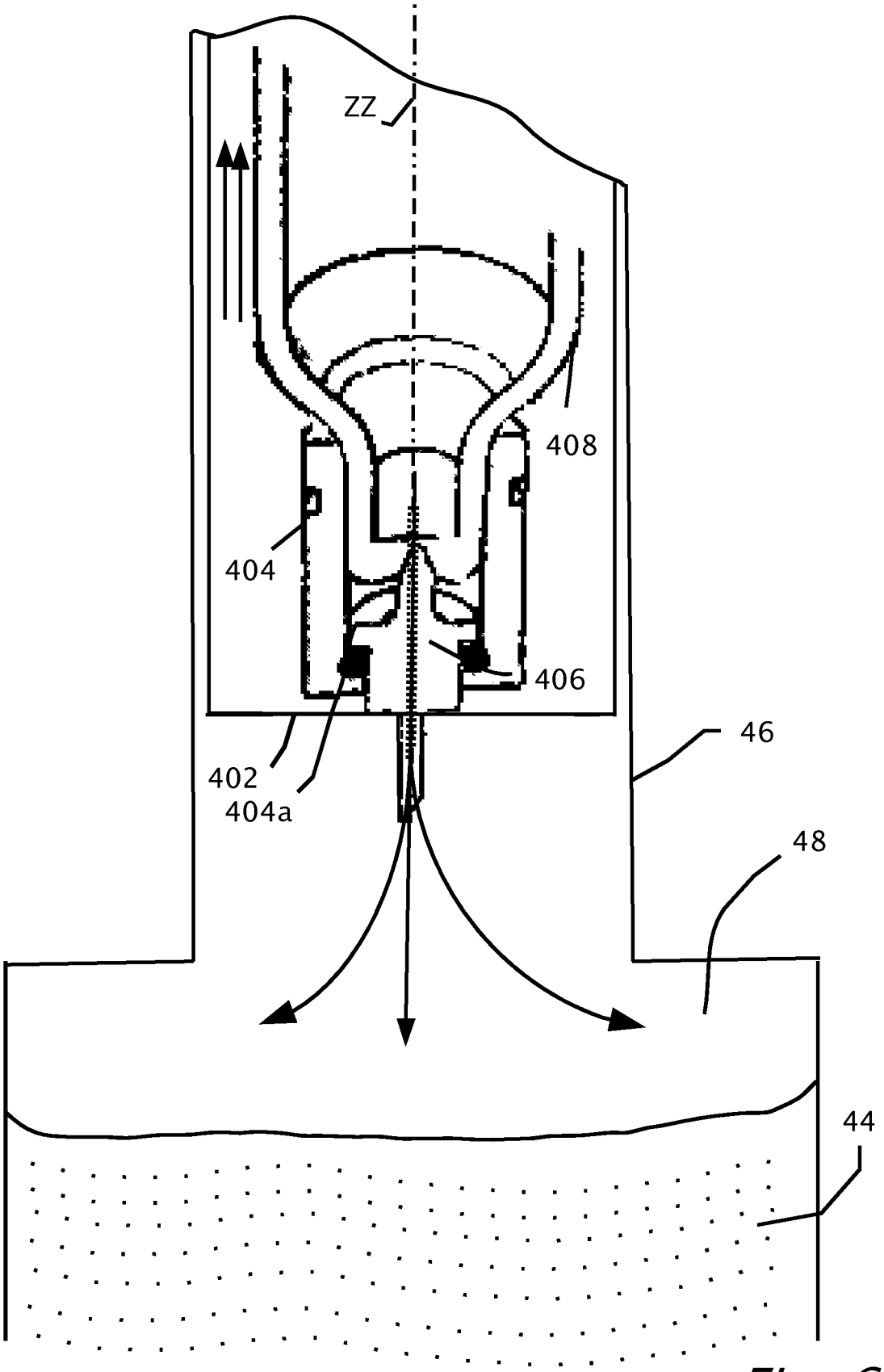

Fig. 6

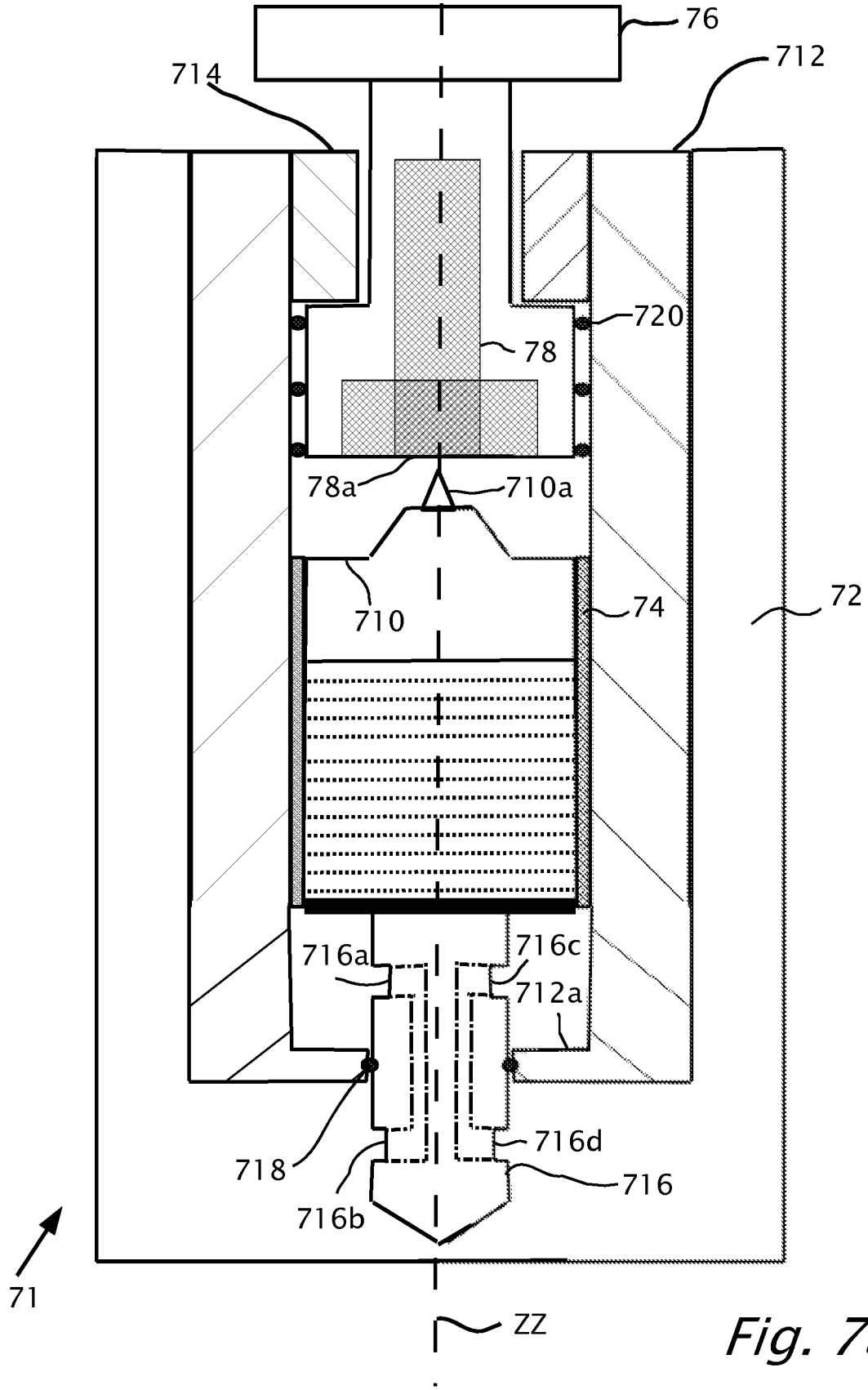
76
712
714
720
78
78a
710a
710
74
72
716a
716c
712a
716d
718
716
716b
71
ZZ

Fig. 7a

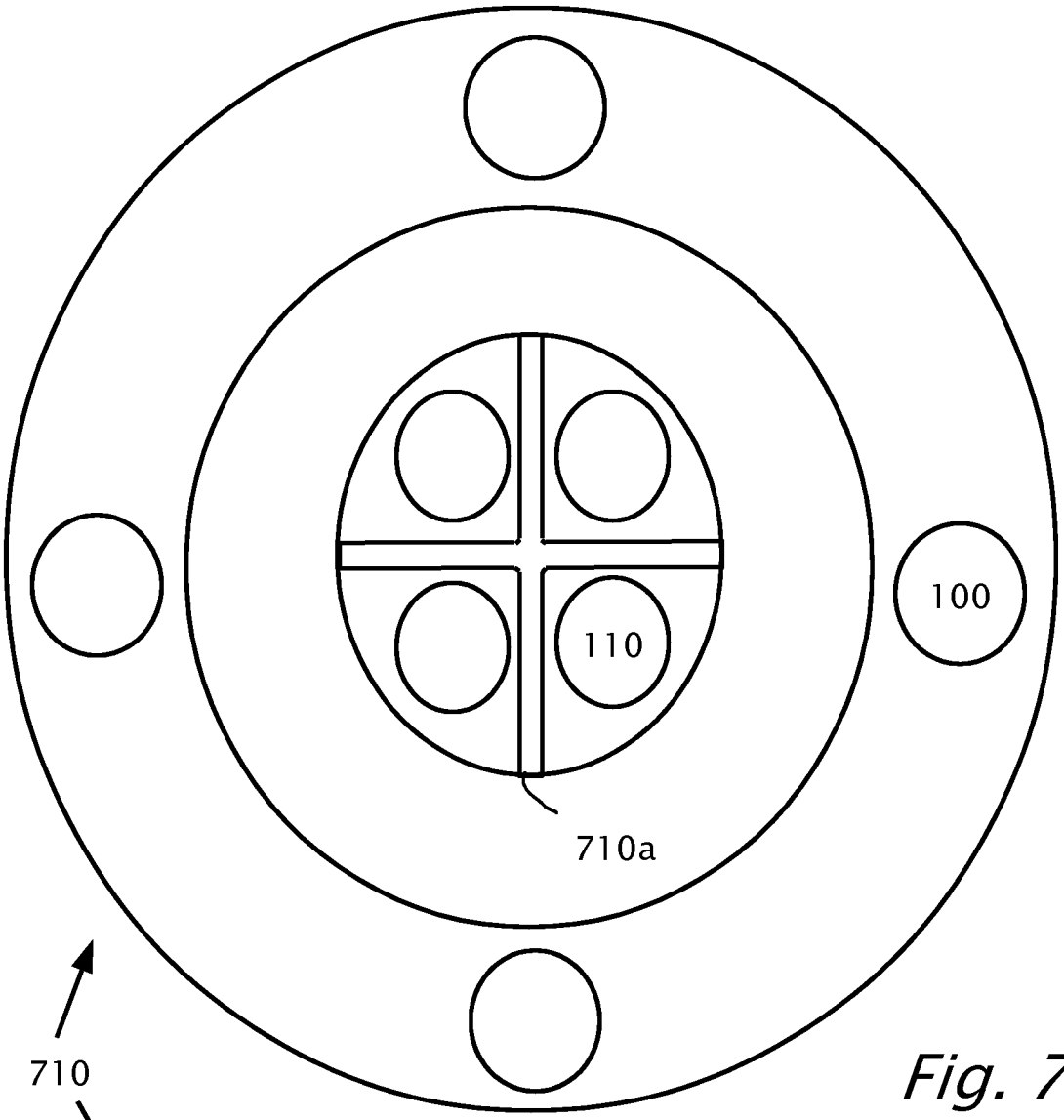

Fig. 7b

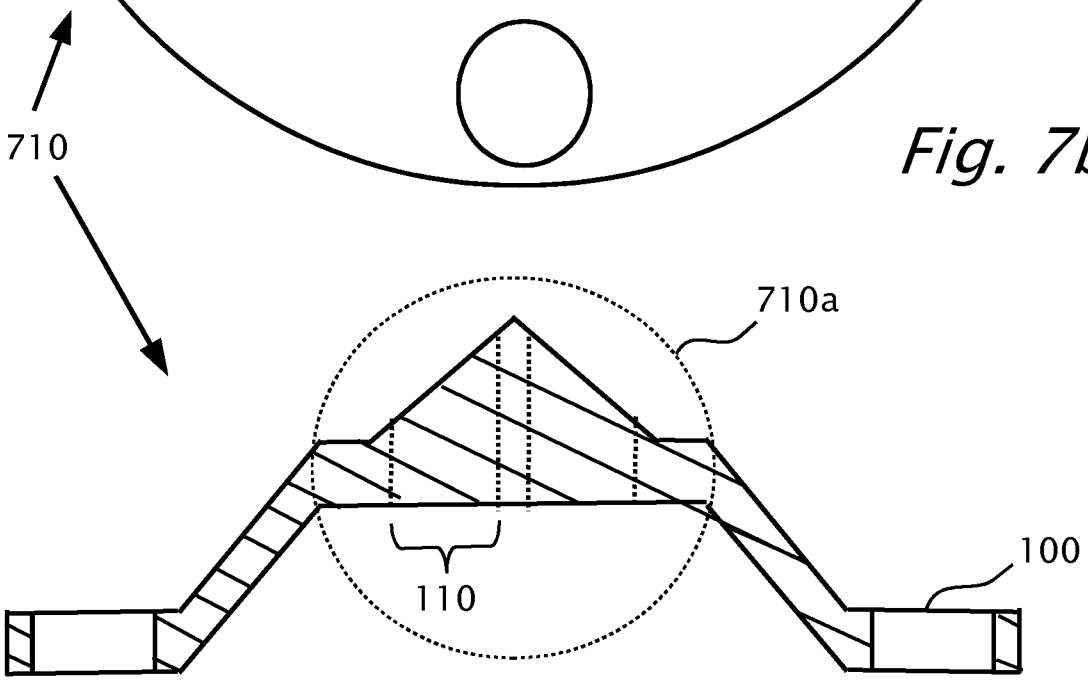

Fig. 7c

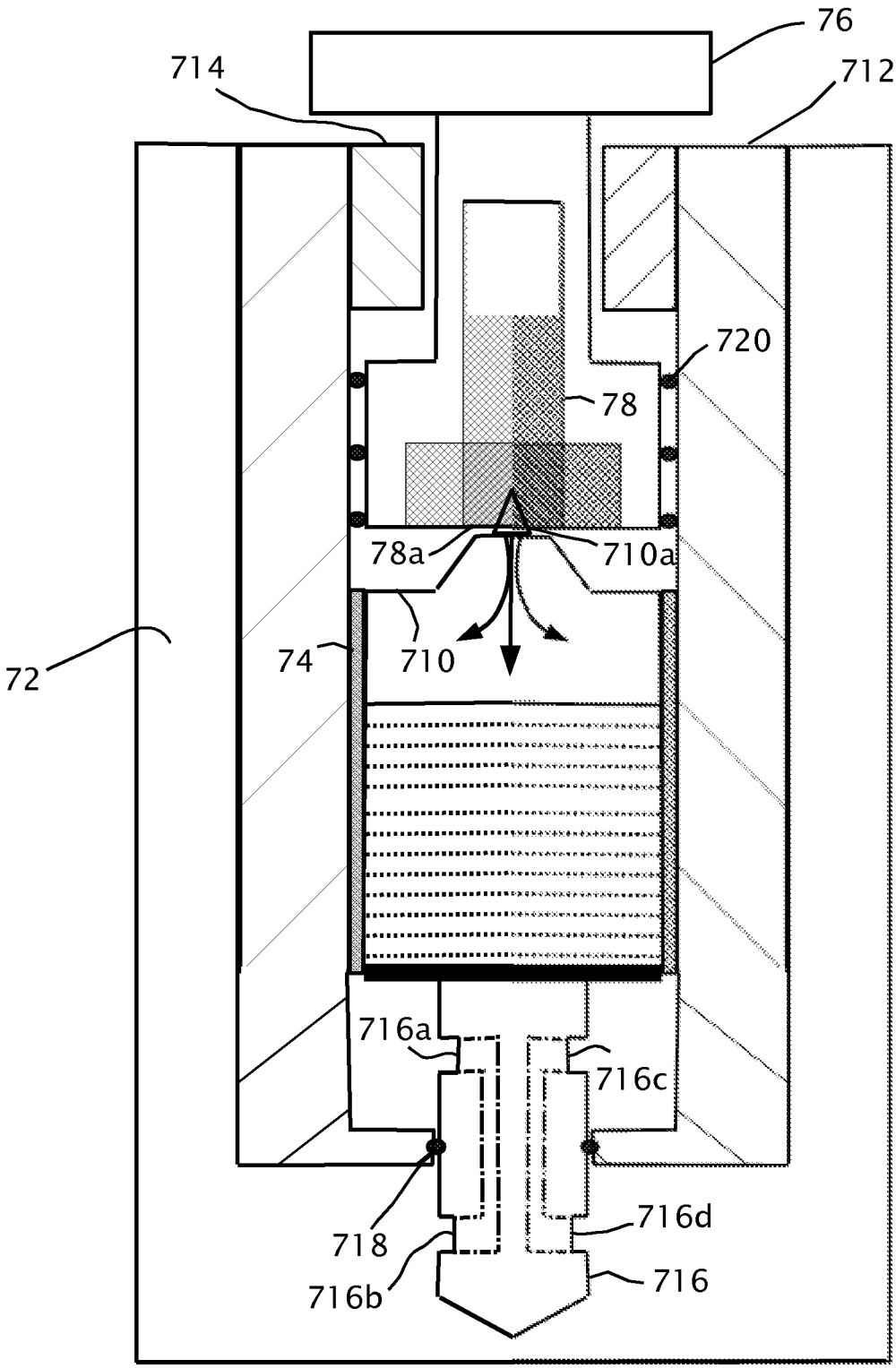

Fig. 7d

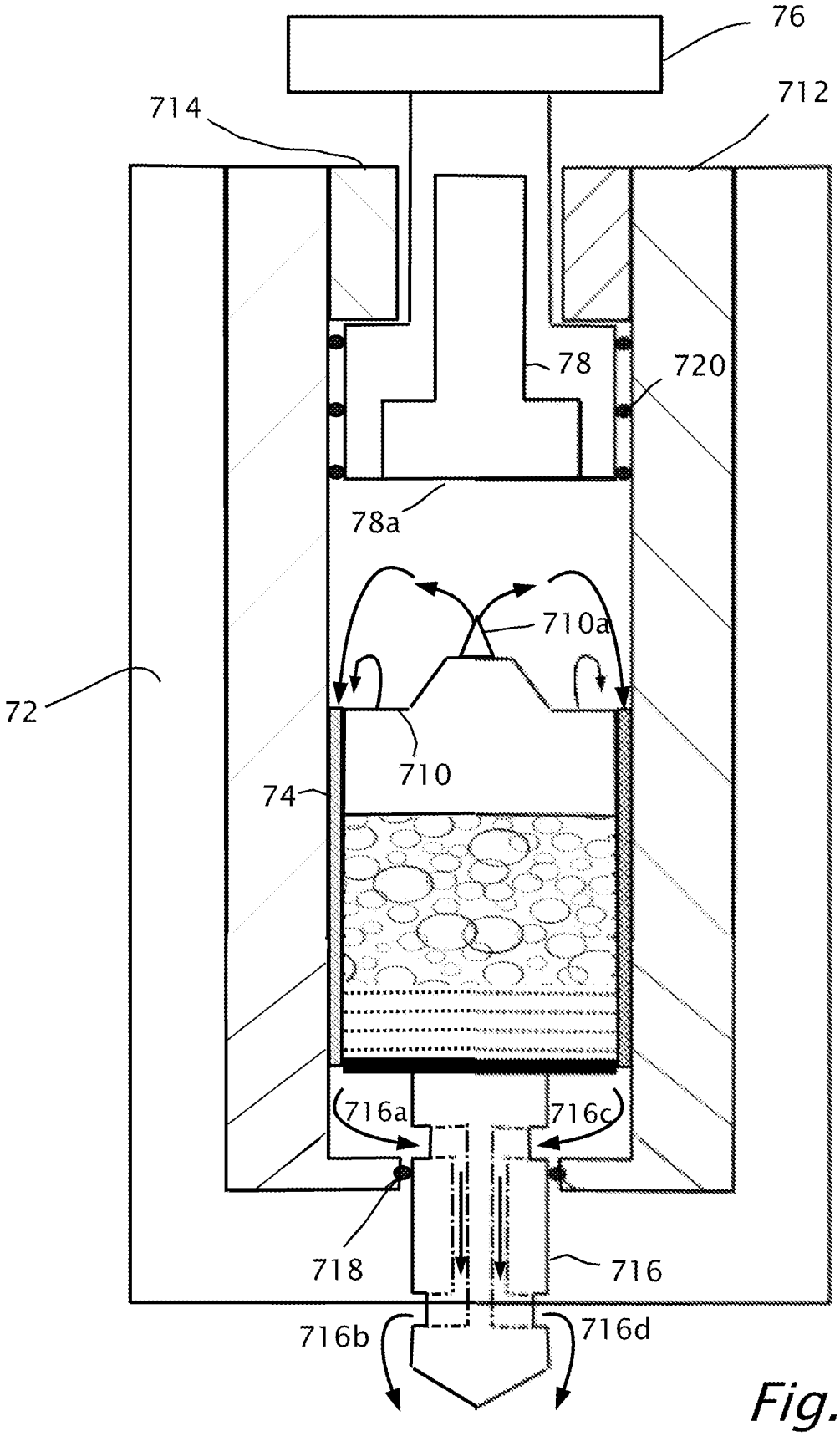

Fig. 7e

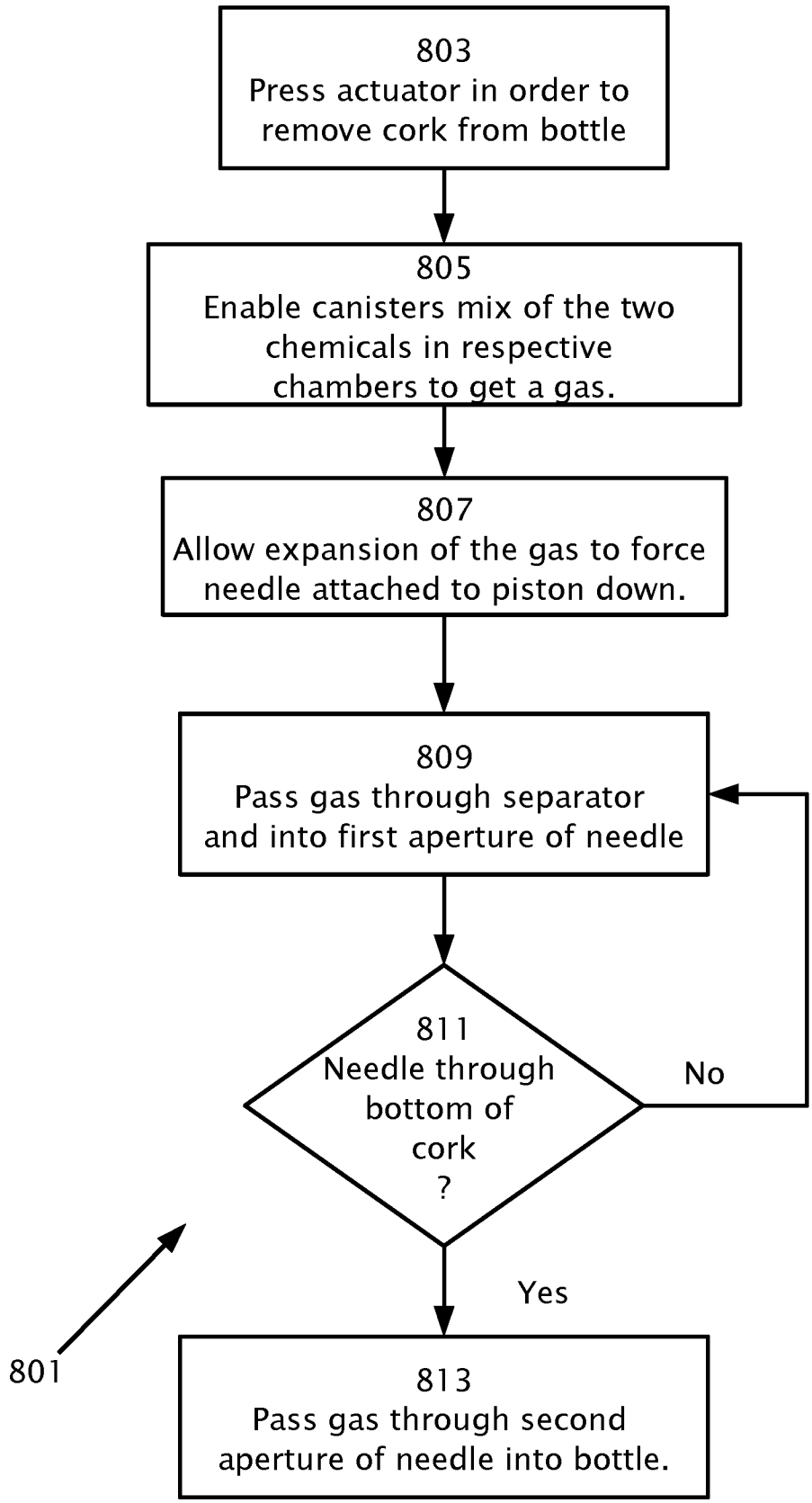
803
Press actuator in order to remove cork from bottle
805
Enable canisters mix of the two chemicals in respective chambers to get a gas.
807
Allow expansion of the gas to force needle attached to piston down.
809
Pass gas through separator and into first aperture of needle
811
Needle through bottom of cork ?
No
Yes
801
813
Pass gas through second aperture of needle into bottle.

Fig. 8