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(54) **DISPENSING ASSEMBLY**

(57) The present invention relates to a dispensing assembly comprising a piston and a membrane.

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Description

[0001] The present invention relates to a dispensing assembly comprising a piston and a membrane.

[0002] A wide variety of ways of dispensing masses from cartridges is known in the prior art. The masses can be a so-called one-component mass, this means single component materials that e.g. harden via a chemical reaction which is brought about either by an external energy source, such as UV light or heat, or e.g. due to moisture etc. present in the surroundings of the position of application or air. Typical applications of one component materials can be found e.g. in the dental field or in the building industry, for example to bond products such as windows and concrete elements, or to provide seals between different components.

[0003] Another known type of mass is a multi-component mass. The materials to be dispensed are typically a matrix material and a hardener. The filled cartridges come in different ratios referred to as 1:1, 2:1, 4:1 and 10:1 etc., the numbers specifying the ratios of the amounts of each of the two materials that are to be dispensed. The reason for these different ratios is to allow a wide variety of different compositions to be mixed and dispensed. For example some compositions require more hardener and some require less hardener. Also some compositions require more mixing. Mixing tips are known from the prior art which are adapted to mix the compositions as they exit the cartridge.

[0004] Two-component materials are typically used as impression materials, e.g. on the formation of dental impressions, as a cement material for prosthetic restorations, as a temporary cement for trial cementing restorations or for cementing temporary crowns. Further applications of two-component materials are in the building industry where they are e.g. used as a replacement for mechanical joints that corrode over time. Adhesive bonding can be used to bond products such as windows and concrete elements. The use of multi-component protective coatings, for example moisture barriers, corrosion protection and anti-slip coatings, is also becoming increasingly common. Examples of flowable materials which can be used are, for example, distributed by the company Coltene using the tradename AFFINIS® or by the company DMG using the tradename PermaCem.

[0005] One-component and multi-component materials are frequently very expensive and thus it is desired to increase the storage life of these materials, particularly if the cartridges and the materials are designed not just for a single use, but such that they can be used a multiple amount of times over considerable periods of time of e.g. days, weeks or even months.

[0006] In order to increase the storage time of the components, the cartridges to be filled have to be made from materials which do not react with the masses stored therein. Moreover, the cartridges have to be clean, i.e. they should not include any water residue or air etc., in particular in connection with the storage of single component masses. On filling the cartridges, the cartridges are typically filled either via their outlet with the piston already being positioned in the cartridge or the cartridge is filled from the end where the piston is normally received before the installation of the piston.

[0007] In both cases air can be trapped between the piston and the material to be stored therein. This air can lead to a reaction of the materials present in the cartridge and hence reduce the storage life of the materials present in the cartridge.

[0008] Thus it is an object of the invention to provide a cartridge which facilitates an improved storage lifetime of a cartridge once filled with a component.

[0009] This object is satisfied by a dispensing assembly in accordance with claim 1.

[0010] Such a dispensing assembly comprises a piston and a membrane, wherein the piston has a dispensing end and an actuation end, wherein the actuation end can be acted on to move a piston for dispensing, wherein the membrane is arranged to cover at least a part of the dispensing end.

[0011] This membrane can move relative to dispensing end on assembling a dispensing assembly to reduce the amount of air included in the cartridge. The membrane can either be attached to the dispensing end or moveable relative thereto.

[0012] In this connection it should be noted that the dispensing end is that end of the piston that once assembled in a cartridge faces the material to be dispensed.

[0013] In this connection it should further be noted that the actuation end is arranged at the opposite side of the piston to the dispensing end and can be acted on by e.g. a plunger to move a piston in a cartridge-

[0014] The membrane may be connected to the dispensing end. In this way the membrane can be fixed relative to the cartridge in order to permit air to flow into a space between the membrane and piston to act as a buffer on the material stored in a cartridge.

[0015] The membrane may be fixedly connected to the piston. By fixedly connecting the membrane to the cartridge one can ensure that the space is hermetically sealed off with respect to a cartridge chamber.

[0016] The membrane may be bonded to the piston, for example by means of ultrasonic welding, overmolding and/or an adhesive bond. Such bonds ensure the hermetic seal if required and reduce the amount of air present in a cartrdige.

[0017] The membrane may not be connected to the dispensing end. A free floating membrane can act as a damper between the piston and the cartridge chamber.

[0018] The membrane may comprise an elastomer. For example natural rubber or synthetic rubber and blends comprising natural rubber and/or synthetic rubber.

[0019] The membrane may be formed by a multi-layered film comprises two or more layers with the two or more layers being connected to one another. Such films can be adapted to the function of the membrane and

one the one hand be chemically resistant with respect to the material filled in the cartridge. On the other hand through the appropriate selection of materials can also have the desired flexibility to act between the cartridge chamber and the piston.

[0020] The membrane may further comprise at least one metal layer comprising a metal or a metal alloy, such as aluminium or an aluminium alloy. Such metal layers provide sufficient stability and chemical resistance.

[0021] The film forming the membrane may be a multilayer film having at least two layers formed from different materials. In the preferred choice the film is a five-layer film comprising a sandwich structure in which the outer layer is formed of PE (20 to 40 μm thickness) which is connected to a layer of PA (10 to 20 μm) via a tie layer (1.5 to 2.5 μm). The PA layer in turn is connected via a further tie layer (1.5 to 2.5 μm) to an aluminum or aluminum alloy layer (5 to 10 μm). The aluminum or aluminum alloy layer is in turn connected to a further PA layer (10 to 20 μm) via a further tie layer (1.5 to 2.5 μm) which is then connected to an inner layer corresponding to the inner surface 42, via a via a further tie layer (1.5 to 2.5 μm) with the inner layer having a thickness selected in the range of 45 to 100 μm.

[0022] The film forming the membrane may be a three-layer film comprising a sandwich structure in which the first layer is formed of polyethylene (PE) (20 to 40 μm thickness), which is connected to a second layer of aluminum (Al) or of an aluminum alloy (Al alloy) (7 to 12 μm thickness) via a tie layer (1.5 to 2.5 μm thickness). The Al or AL alloy layer is in turn connected to a third PET layer (12 to 15 μm thickness) via a further tie layer (1.5 to 2.5 μm thickness).

[0023] The film forming the membrane may be a four-layer film comprising a sandwich structure in which the first layer is formed of PE (20 to 40 μm thickness), which is connected to a second layer of aluminum (Al) or of an aluminum alloy (Al alloy) (7 to 12 μm thickness) via a tie layer (1.5 to 2.5 μm thickness). The Al or Al alloy layer is in turn connected to a third layer of PA (10 to 20 μm thickness) via a tie layer (1.5 to 2.5 μm thickness). The third layer of PA is in turn connected to a fourth layer of PE (15 to 30 μm thickness) via a further tie layer (1.5 to 2.5 μm thickness).

[0024] It should be noted that the respective tie layers are not considered to be individual layers of a multi-layered film, they are merely present to ensure a bond is formed between the individual layers.

[0025] The materials of the film can differ from the above mentioned materials as can their respective thicknesses. It should be noted in this connection that the films respectively the membranes typically have a thickness selected in the range of 70 40 to 200 μm, in particular of 70 to 180, in particular of 120 to 170 μm.

[0026] The piston may comprise a piston body, a piston cover and one or more venting channels arranged between the piston body and the piston cover. Such a piston cover facilitates a venting of air from a cartridge chamber on filing of a cartridge chamber with material thereby further reducing the amount of air present in a cartridge chamber.

[0027] The piston cover may be arranged at the actuation end and the membrane is arranged adjacent to the piston cover, in particular directly adjacent to the piston cover and remote from the piston body. In this way the air can beneficially be removed from the cartridge chamber.

[0028] The piston cover may comprise a venting pin configured to lift the piston cover from the piston body during a venting process. In this way air can be removed from the cartridge chamber.

[0029] A sealing element, such as an O-ring, may be arranged on a peripheral surface of the piston. Such a sealing element avoids air from entering the cartridge chamber via the piston once inserted into the cartridge chamber.

[0030] The piston may further comprise one or more sealing lips arranged on a peripheral surface of the piston. Such sealing lips are further kinds of sealing elements that avoid air from entering the cartridge chambr.

[0031] A material of the piston may be selected from the group of members comprising PTFE, PEEK, POM, PA, PP, PPS, PPA, PET, PPE and blends of one or more of the foregoing, or a polymer or a thermoset material having a hardness measured with the Shore D Durometer selected in the range of 55D to 100D. Most preferably, the is made of only one composition, preferably comprises only one polymeric material.

[0032] The polymeric material may include polymer blends, i.e. may also contain additives, primers and/or polar groups and may not be one single virgin polymer.

[0033] In this connection it should further be noted that a material of the piston may be one of polyethylene (PE), high density polyethylene (HD-PE), polybutylene terephthalate (PBT), polyamide (PA) and polypropylene (PP).

[0034] Such materials have a high strength and stability and at the same time have good sliding properties reducing the friction between the cartridge and piston on dispensing.

[0035] The piston body may be of at least generally cylindrical shape and the O-ring is arranged on a peripheral surface of the piston body. Such shapes are simple to manufacture as are the complementary shaped cartridges.

[0036] The dispensing assembly may further comprise a cartridge and a material filled into the cartridge, wherein a positive or negative pressure can be applied between the membrane and the piston once the membrane and piston are inserted into the cartridge, with the positive or negative pressure acting on the material stored in the cartridge via the membrane. In this way one can avoid air from being trapped in the cartridge chamber once filled.

[0037] A pressure in the range of 0.001 mbar to 10 bar (absolute) can be applied between the membrane and the piston. Such pressures significantly reduce the

amount of air present in a cartridge and hence increase the longevity of materials stored therein.

[0038] The membrane may have a thickness selected in the range of 0.05 to 1 mm, especially in the range of 0.1 to 0.3 mm. Such thicknesses provide the membrane with sufficient flexibility to act on the material stored in the cartridge chamber and at the same time provide the membrane with sufficient stability so as not to burst in use.

[0039] The membrane may be arranged to cover at least 60% and at most 90 % of the actuation end. In this way a space formed between the membrane and the piston can be maximized.

[0040] A space arranged between the membrane and the piston may be in direct contact with atmosphere, i.e. open to atmosphere. In this way air can be sucked into the space in order to so to say inflate the space and thereby act as a barrier for air to push air out of the cartridge chamber once filled with material.

[0041] Alternatively a space arranged between the membrane and the piston may not be open to atmosphere. In this way one can inflate the space to a desired volume so that air can be pushed out of the cartridge.

[0042] A material of the membrane may be selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

[0043] The dispensing assembly may further comprise a cartridge filled with a material and the piston may then be arranged within the cartridge. In the industrial sector, in the construction industry, for example of buildings, and also in the dental sector, cartridges are frequently used to store liquid flowable, frequently pasty or viscous to highly viscous substances and to dispense them for the respective application as required. Examples for such substances are joint sealing compounds, compounds for chemical dowels or chemical anchors, adhesives, pastes or impression materials in the dental sector.

[0044] Further embodiments of the invention are described in the following description of the Figures. The invention will be explained in the following in detail by means of embodiments and with reference to the drawings in which is shown:

Fig. 1A & B: first views of a cartridge;
Fig. 2A & B: views of the outlet of the cartridge of Fig. 1;
Fig. 3A & B: further views of the outlet of Fig. 1;
Fig. 4A to C: views of a plug for the outlet of Fig. 3;
Fig. 5: views of a first kind of dispensing assembly;
Fig. 6: views of a second kind of dispensing assembly;
Fig. 7A to D: views of a third kind of dispensing assembly;
Fig. 8: a sectional view of the piston of Fig. 7C;
Fig. 9: a view of a further type of piston;
Fig. 10 process chart for filing a dispensing assembly;
Fig. 11 further process chart for filing a dispensing assembly.

[0045] Fig. 1A & B show first views of a cartridge 10 for storage and dispensing of materials M from a chamber 12 of the cartridge 10. The cartridge 10 comprising an outlet 20 having an outlet passage 24 extending from an inlet opening 36 arranged at an end face 34 of the cartridge 10 bounding the chamber 12 to an outlet opening 38 projecting away from the cartridge 10 (see e.g. Fig. 3A).

[0046] The outlet 20 in the present example is sealed off by means of a plug 16 inserted into the outlet passage 24. The plug 16 is fixed to the outlet 20 by means of a closure ring 14.

[0047] As is visible from Fig. 1B the plug 16 is a component separate from the closure ring 14 in the present example. It should be noted in this connection that the plug 16 could also be integrally formed with the closure ring 14 (not shown).

[0048] The closure ring 14 in the present example acts like a bayonet closure, in other designs could also comprise a threaded connection (also not shown).

[0049] The cartridge 10 further comprises cartridge walls 18 extending from the end face 34 to a rear end 92 of the cartridge 10. The rear end 92 comprises an opening into which a piston 60 (see e.g. Figs. 5, 6 or 7A) can be inserted.

[0050] In order to facilitate the insertion of the piston 60 into the cartridge chamber 12, the cartridge 10 comprises tapered walls 96 at the rear end 92. It should be noted in this connection that such tapered walls 96 are not required for insertion of the piston 60 they merely facilitate the insertion of the piston 60 into the cartridge chamber.

[0051] The piston 60 is generally inserted into the cartridge chamber 12 along the longitudinal axis A that extends from the opening 94 through the outlet 20. The piston 60 is moveable along the longitudinal axis A in order to dispense the material M stored in the cartridge 10 when the piston 60 is acted on e.g. by means of a plunger rod of a dispenser or the like (not shown).

[0052] The cartridge 10 further comprises orientation means 22 at the end face 34. The orientation means are provided so that the cartridge 10 can be held in the correct orientation during a filling process.

[0053] Fig. 2A shows a sectional view of the outlet 20 of Fig. 1. In order to correctly insert the plug 16 into the outlet 20, the outlet 20 comprises outlet alignment apertures 28 that are shaped complementary to plug alignment means 26 present on the plug 16.

[0054] By shaping the respective plug alignment means 26 and the outlet alignment apertures 28 complementary to one another the plug 26 can be installed at the outlet in the correct orientation. If the two provided plug alignment means 26 are shaped different from one another then the plug 26 can only be installed at the outlet in one orientation only.

[0055] The plug 16 comprises a stopper 30 inserted into the outlet passage 24. The stopper stops material M

from exiting the cartridge 10 when the plug 16 is inserted into the outlet 20.

[0056] Fig. 2B shows a top view of the cartridge 10. Two orientation means 22 are provided for gripping the cartridge 10 in the correct orientation during filling of the cartridge 10.

[0057] Fig. 3A shows a sectional view of the outlet 20. A further seal 44 is provided in the region of the outlet opening 38. In this connection it should be noted that the further seal 44 is not necessarily required. If provided the further seal 44 extend from the outlet opening 38 into the outlet passage 24 by up to 50% of a length of the outlet passage from the outlet opening 38 to the inlet opening 36.

[0058] The abutment 50 of the outlet 20 acts as coupling means 42 for coupling the closure ring 14 to the outlet 20. Fig. 3B shows a top view of the coupling means 42. The coupling means also comprise the outlet alignment apertures 28.

[0059] Fig. 4A to C show views of the plug 16 for the outlet 20 of Fig. 3. The plug 16 comprises a body 54 having a grip 52 for gripping the plug 16. As can be seen from Fig. 4A the plug alignment means 26 extend in parallel to the stopper 30 from the abutment 32.

[0060] The stopper 30 is shaped complementary to the outlet passage 24. The outlet passage 24 comprises a seal 40, the seal 40 extending from the inlet opening 36 into the outlet passage 24. The seal 40 extends into the outlet passage 24 by up to 50% of a length of the outlet passage 24. In the present example the seal extends into the outlet passage by 40% of the length of the outlet passage 24 between the inlet opening 36 and the outlet opening 38.

[0061] The stopper 30 comprises a first stopper part 46 and a second stopper part 48. The first stopper part 46 is formed complementary to the seal 40 and the second stopper part 48 is formed complementary to the further seal 44 if provided.

[0062] The seal 40 is formed by an overlap, with the overlap having a thickness of 0.02 to 0.06 mm. In the present example the overlap has a thickness of 0.03 mm. If provided the further seal 44 is likewise formed by an overlap, with the overlap of the further seal 44 having a thickness of 0.02 to 0.06 mm. In the present example the overlap has a thickness of 0.03 mm.

[0063] The outlet passage 24 has a cylindrical cross-section in the region of the outlet opening 38. In this connection it should be noted that the outlet passage 24 can also have a cone shaped cross-section at the outlet opening 38, in particular wherein the cone shaped cross-section has an angle of 0.5 to 2° with respect to a longitudinal axis A of the outlet 20.

[0064] The plug 16 further comprises an abutment 32 that abuts a ledge of the outlet 20 and prevents the plug 16 from being inserted too far into the outlet 20.

[0065] Fig. 4C shows a sectional view of the plug 16. The plug 16 comprises a recess 56 surrounding the second stopper part 48 and is recessed from a plane 58 of the abutment 32.

[0066] As can eb seen from Figs 4A to C, the plug alignment means 26 can have a generally T-shaped cross-section, it should be noted that also other cross-sections, such as a cylindrical cross-section are likewise possible.

[0067] The outlet passage 24 shown has a cone-shaped cross-section but can also have a cylindrical cross-section in the region of the inlet opening. If provided, the cylindrical cross-section in the region of the inlet opening has a smaller inner diameter than the cylindrical or cone shaped section in the region of the outlet opening.

[0068] The cylindrical or cone shaped cross-section in the region of the outlet opening 38 can extend over a length of 20 to 80% of a length of the outlet passage 24 from the outlet opening 38 towards the inlet opening 36. In this way an improved seal can be provided in the region of the outlet 20 reducing the amount of air that can be trapped between the plug 16 and the cartridge chamber 12.

[0069] The cylindrical cross-section in the region of the inlet opening 36 can extends over a length of 20 to 80% of a length of the outlet passage 24 from the inlet opening 36 towards the outlet opening 38. In this way an improved seal can be provided in the region of the outlet 20 reducing the amount of air that can be trapped between the plug 16 and the cartridge chamber 12.

[0070] The outlet passage 24 can has a truncated cone shaped cross-section in the region of the inlet opening 36. In this way an improved seal can be provided in the region of the outlet 20 reducing the amount of air that can be trapped between the plug 16 and the cartridge chamber 12.

[0071] The truncated cone shaped cross-section of the outlet passage 24 extends over a length of 20 to 80% of a length of the outlet passage 24 from the inlet opening 36 towards the outlet opening 38. In this way an improved seal can be provided in the region of the outlet 20 reducing the amount of air that can be trapped between the plug 16 and the cartridge chamber 12.

[0072] The outlet passage 24 can have an outer diameter selected in the range of 6 to 10 mm at the outlet opening 38.

[0073] The outlet passage 24 can have an inner diameter selected in the range of 4 to 8 mm at the outlet opening 38.

[0074] The outlet passage 24 comprises no inner thread. In this way an improved seal can be provided in the region of the outlet 20 reducing the amount of air that can be trapped between the plug 16 and the cartridge chamber 12.

[0075] The outlet 20 is integrally formed with the cartridge 20 in an injection molding process. In this way no air can be trapped between separate components.

[0076] The cartridge 10 may have a dome shaped or a convex shaped surface extending from the end face 34 into the chamber 12 of the cartridge 10.

[0077] The cartridge 10 may have a concave shaped surface extending from the end face 34into the chamber 12 of the cartridge 10 (see e.g. Fig. 7A).

[0078] A material of the cartridge may be selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

[0079] Fig. 5 shows a view of a first kind of dispensing assembly 100. The dispensing assembly 100 comprises the piston 60 and a membrane 80. The piston 60 has a dispensing end 66 and an actuation end 64, wherein the actuation end 64 can be acted on to move the piston for dispensing, wherein the membrane 80 is arranged to cover at least a part of the dispensing end 64. In the present example the membrane 80 is fixedly connected to the dispensing end 66. Specifically the membrane is bonded to the piston, for example by means of ultrasonic welding, overmolding and/or an adhesive bond.

[0080] In the present example the membrane 80 comprises an elastomer. In this connection it should be noted that the membrane 80 can also be formed by a multi-layered film as shown e.g. in Fig. 6. The multi-layered film comprises two or more layers with the two or more layers being connected to one another.

[0081] The piston 60 comprises a piston body 72, a piston cover 70 and one several venting channels 74 arranged between the piston body 72 and the piston cover 70.

[0082] The piston cover 70 is arranged at the actuation end 64 and the membrane 80 is arranged adjacent to the piston cover 70, in particular directly adjacent to the piston cover 70 and remote from the piston body 72.

[0083] The piston cover 70 comprises a venting pin 68 configured to lift the piston cover 70 from the piston body 72 during a venting process.

[0084] Fig. 6 shows a further kind of piston 60 having an O-ring 98 is arranged on a peripheral surface of the piston. The O-ring is arranged between sealing lips 62 arranged on the peripheral surface of the piston 60.

[0085] In order to vent the pistons 60 of Fig.s 5 and 6, the piston 60 comprises a peripheral groove 76 surrounding the piston cover 70. The piston cover can be lifted from the piston body and relative to the groove 76 by means of a venting plug. The air present at the dispensing end 66 can then be guided via the groove 76 and the venting channels 74 to a buffer space 78 in which the venting plug 82 can sit and can be removed at the actuation end 64 of the piston 60.

[0086] A material of the piston 60 is selected from the group of members comprising PTFE, PEEK, POM, PA, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

[0087] The piston body 72 shown herein is of at least generally cylindrical shape and the O-ring, if provided, is arranged on a peripheral surface of the cylindrical shaped piston body 72. The O-ring can be provided at all pistons shown herein. A different shaped piston 60, such as a D-shaped piston (not shown) can also be provided if required.

[0088] The membrane is generally arranged to cover at least 60% and at most 90 % of the actuation end. Regarding the piston 60 of Fig. 5 a space 99 arranged between the membrane 80 and the piston 60 is in direct contact with atmosphere, i.e. open to atmosphere. Regarding the piston 60 of Fig.6 the space 99 arranged between the membrane 80 and the piston 60 is not open to atmosphere.

[0089] A wherein a material of the membrane may be selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

[0090] Fig. 7A to D show views of a third kind of dispensing assembly 100. The piston 60 has a dispensing end 66 and an actuation end 64, wherein the actuation end 64 can be acted on to move the piston 60 for dispensing, and wherein the dispensing end 66 has a concave shaped portion 84.

[0091] The piston 60 of Fig. 7 can also comprise a venting passage 74 extending from the actuation end 64 to the dispensing end 66 for venting via the venting channel 75.

[0092] Thus, the dispensing end 66 comprises one or more venting channels that can extending over the concave shaped portion 84 towards the venting passage 74.

[0093] The piston further comprises a venting plug 82 arranged at the actuation end 64 for sealing off the buffer space 48 of the piston 60 when inserted into the cartridge 12.

[0094] The venting plug 82 is moveable with respect to the actuation end 64.

[0095] The piston of Fig. 7 can also comprise one, two, three or more sealing elements arranged on a peripheral outer surface of the piston 60. Such sealing elements can comprise sealing lips 62 and/or O-rings 98.

[0096] The section view of the piston of Fig. 8 shows that the concave shaped portion 84 is arranged to cover at least 60% and at most 90 % of the dispensing end 66 of the piston 60. The concave shaped portion 84 has the shape of an inverted rounded dome. A sealing lip 62 extends from the concave shaped portion 84.

[0097] The concave shaped portion can have a radius of curvature selected in the range of 2 mm to 300 mm, in particular 3 to 150 mm.

[0098] An inner diameter of the venting passage can be selected in the range of 0.1 to 5 mm, preferably in the range of 0.2 to 4 mm.

[0099] A material of a least the concave shaped portion of the piston can be selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

[0100] Fig. 9 shows a view of a further type of piston 60. This likewise comprises the concave shaped portion. This is arranged adjacent to a cone shaped portion 86 forming the sealing lip 62. A chamfer 88 is provided as an additional sealing element between the concave shaped portion 84 and the cone shaped portion 86.

[0101] As indicated in Figs. 7A and 7B the piston of Figs. 7 and 8 is inserted in a cartridge 10 having a dome shaped end face projecting into the cartridge chamber. This dome shaped end face is shaped and formed complementary to the piston 60 in order to minimize an amount of air that can be trapped between the piston 60 and the end face 34 of the cartridge 10.

[0102] Fig. 10 shows a process chart for filing a dispensing assembly 100 such as the assembly shown in Fig. 5 and 6.The method of filling comprising the steps of:

- providing a cartridge 10;
- filing the cartridge 10 with said material M;
- inserting a piston 60 into the cartridge especially into the final assembly position; and subsequently releasing the cartridge 10 from a holder not shown.

[0103] Once the cartridge 10 is filled with material a vacuum is applied in order to remove excess air from the cartridge 10. For this purpose a vacuum in the range of 0.01 to 100000 Pascal, especially in the range of 1 to 10000 Pascal can be applied. Thereafter the piston 60 is inserted into the cartridge 10 via the rear end 92 after the application of the vacuum.

[0104] As indicated in the method shown in Fig. 11 the cartridge and the material M provided therein can be installed in a centrifuge (not shown) in order to facilitate the removal of air bubbles 90. The centrifuge can be operated at an rpm (revolutions per minute) in the range of 1 to 18000, especially in the range of 500 to 15000. The centrifuge can be operated for a duration of 1 to 1000 seconds, especially for a duration of 5 to 120 seconds.

[0105] The piston 60 can comprises a venting pin and the method further comprises the step of actuating said venting pin in order to release over pressure from within the cartridge 10.

[0106] As indicated in the process of Fig. 11 depicting a piston as shown in Figs. 7 to 9, the piston 60 comprises the plug 82 and the plug 82 is moved relative to a piston body 72 in order to close the piston 60.

[0107] The process steps indicated in Figs. 10 and 11 can be mixed, e.g. the cartridge and piston of Figs. 5 and 6 can also be subjected to centrifuging as shown in Fig. 11 and the piston of Figs. 7 to 9 can have the vacuum released as indicated in Fig. 10.

[0108] Further exemplary embodiments of the invention are described in the following:

1. A cartridge for storage and dispensing of materials from a chamber of the cartridge, the cartridge comprising an outlet having an outlet passage extending from an inlet opening arranged at an end face of the cartridge bounding the chamber to an outlet opening projecting away from the cartridge, the outlet passage comprising a seal, the seal extending from the inlet opening into the outlet passage.

2. A cartridge in accordance with embodiment 1, wherein the seal extends into the outlet passage by up to 50% of a length of the outlet passage.

3. A cartridge in accordance with embodiment 1 or embodiment 2, wherein the seal is formed by an overlap, with the overlap having a thickness of 0.02 to 0.06 mm.

4. A cartridge in accordance with one of the preceding embodiments, wherein the outlet passage has a cylindrical or cone shaped cross-section in the region of the outlet opening, in particular wherein the cone shaped cross-section has an angle of 0.5 to 2° with respect to a longitudinal axis of the outlet..

5. A cartridge in accordance with one of the preceding embodiments, wherein the outlet passage has a cylindrical cross-section in the region of the inlet opening.

6. A cartridge in accordance with embodiment 5, wherein the cylindrical cross-section in the region of the inlet opening has a smaller inner diameter than the cylindrical or cone shaped section in the region of the outlet opening.

7. A cartridge in accordance with one of embodiments 4 to 6, wherein the cylindrical or cone shaped cross-section in the region of the outlet opening extends over a length of 20 to 80% of a length of the outlet passage from the outlet opening towards the inlet opening.

8. A cartridge in accordance with one of embodiments 5 to 7, wherein the cylindrical cross-section in the region of the inlet opening extends over a length of 20 to 80% of a length of the outlet passage from the inlet opening towards the outlet opening.

9. A cartridge in accordance with one or more of the preceding embodiments, wherein the outlet passage has a truncated cone shaped cross-section in the region of the inlet opening.

10. A cartridge in accordance with embodiment 9, wherein the truncated cone shaped cross-section of the outlet passage extends over a length of 20 to 80% of a length of the outlet passage from the inlet opening towards the outlet opening.

11. A cartridge in accordance with one of the preceding embodiments, wherein the outlet passage has an outer diameter selected in the range of 6 to 10 mm at the outlet opening.

12. A cartridge in accordance with one of the preceding embodiments, wherein the outlet passage has an inner diameter selected in the range of 4 to

8 mm at the outlet opening.

13. A cartridge in accordance with one of the preceding embodiments, wherein the inlet passage comprises no inner thread.

14. A cartridge in accordance with one of the preceding embodiments, wherein a coupling means, such as a bayonet type coupling means, for coupling an accessory to the cartridge is provided on an outer surface of the outlet passage.

15. A cartridge in accordance with one of the preceding embodiments, wherein the outlet is integrally formed with the cartridge in an injection molding process.

16. A cartridge in accordance with one of the preceding embodiments, wherein the cartridge has a dome shaped or a convex shaped surface extending from the end face into the chamber of the cartridge.

17. A cartridge in accordance with one of the preceding embodiments 1 to 15, wherein the cartridge has a concave shaped surface extending from the end face into the chamber of the cartridge.

18. A cartridge in accordance with one of the preceding embodiments, further comprising a second seal in the outlet extending from the outlet opening into the outlet passage.

19. A cartridge in accordance with one of the preceding embodiments, wherein the end face of the cartridge comprises one or more orientation features at an outer surface thereof; and/or
wherein a material of the cartridge is selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

20. A piston for a dispensing assembly, wherein the piston has a dispensing end and an actuation end, wherein the actuation end can be acted on to move the piston for dispensing, and wherein the actuation end has a concave shaped portion.

21. A piston according to embodiment 21, further comprising a venting passage extending from the actuation end to the dispensing end.

22. A piston y according to embodiment 21, wherein the actuation end comprises one or more venting channels extending over the concave shaped portion towards the venting passage.

23. A piston according to one of the preceding embodiments 20 to 22, further comprising a venting plug arranged at the dispensing end.

24. A piston according to one of the preceding embodiments 20 to 23, further comprising a buffer space arranged at the dispensing end.

25. A piston according to embodiment 23 and 24, wherein the venting plug is configured to seal off the buffer space.

26. A piston according to one of embodiments 23 to 25, wherein the venting plug is moveable with respect to the dispensing end.

27. A piston according to one of the preceding embodiments 20 to 26, further comprising one, two, three or more sealing elements arranged on a peripheral outer surface of the piston.

28. A piston according to embodiment 27, wherein the sealing elements are selected from the group of members comprising a sealing lip and an O-ring.

29. A piston according to one of embodiments 20 to 28, wherein the piston has an at least generally cylindrical outer shape or has a cylindrical outer shape.

30. A piston according to embodiment 29, wherein the piston body is of at least generally cylindrical shape and an O-ring is arranged on a peripheral surface of the piston body.

31. A piston according to one of embodiments 20 to 30, wherein the concave shaped portion is arranged to cover at least 60% and at most 90 % of the actuation end.

32. A piston according to one of embodiments 20 to 31, wherein the concave shaped portion has the shape of an inverted rounded dome.

33. A piston according to one of the preceding embodiments 20 to 32, wherein the concave shaped portion has a radius of curvature selected in the range of 2 mm to 300 mm, in particular 3 to 150 mm.

34. A piston according to one of the preceding embodiments 21 to 33, wherein an inner diameter of the venting passage is selected in the range of 0.1 to 5 mm, preferably in the range of 0.2 to 4 mm.

35. A piston according to one of the preceding embodiments 20 to 34, wherein a material of a least the concave shaped portion of the piston is selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

36. A dispensing assembly comprising a piston in accordance with one of the preceding embodiments and a cartridge, the cartridge having an outlet arranged at an end face thereof, wherein the cartridge has a dome shaped surface extending from the end face into the chamber of the cartridge, with the dome shaped surface being shaped complementary to the concave shaped portion of the piston.

37. A dispensing assembly in accordance with embodiment 36, wherein the cartridge is filled with a material, optionally with the material being selected form the group of members comprising: .

38. A cartridge in accordance with embodiment 18 or embodiment 19, wherein the second seal extends into the outlet passage by up to 50% of a length of the outlet passage from the outlet opening.

38. A method of filing a cartridge with a material, the method comprising the steps of:

- providing a cartridge, especially a cartridge as described herein;
- filing the cartridge with said material;
- inserting a piston, especially a piston as described herein, into the cartridge into the final assembly position; and
- releasing the cartridge.

39. A method according to embodiment 38, further comprising the step of applying a vacuum.

40 A method in accordance with embodiment 39, wherein the vacuum is applied after the step filing the cartridge with material.

41. A method in accordance with embodiment 39, wherein the vacuum is applied before the step filing the cartridge with material.

42. A method in accordance with one of embodiments 39 to 41, wherein a vacuum in the range of 0.01 to 100000 Pascal, especially in the range of 1 to 10000 Pascal.

43. A method in accordance with one of embodiments 39 to 42, wherein the piston is inserted into the cartridge after the application of the vacuum.

44. A method in accordance with one of embodiments 39 to 43, wherein the piston is moved into the final assembly position after the application of the vacuum.

45. A method in accordance with one of embodiments 38 to 44, further comprising the step of centrifuging the cartridge.

46. A method in accordance with embodiment 46, wherein the centrifuge is operated at an rpm (revolutions per minute) in the range of 1 to 18000, especially in the range of 500 to 15000.

47. A method in accordance with embodiment 45 or embodiment 46, wherein the centrifuge is operated for a duration of 1 to 1000 seconds, especially for a duration of 5 to 120 seconds.

48. A method in accordance with one of embodiments 38 to 47, wherein the piston comprises a venting pin and the method further comprises the step of actuating said venting pin in order to release over pressure from within the cartridge.

49. A method in accordance with one of embodiments 38 to 47, wherein the piston comprises a plug and the plug is moved relative to a piston body in order to close the piston.

List of reference numerals:

[0109]

10	cartridge
12	cartridge chamber
14	closure ring
16	plug
18	cartridge walls
20	outlet
22	orientation means
24	outlet passage
26	plug alignment means
28	outlet alignment apertures
30	stopper
32	abutment
34	end face
36	inlet opening
38	outlet opening
40	seal
42	coupling means
44	further seal
46	first stopper part
48	second stopper part
50	ledge of outlet
52	grip of 16
54	body
56	recess
58	plane of abutment
60	piston
62	sealing lip
64	actuation end
66	dispensing end
68	venting plug
70	piston cover
72	piston body
74	venting channels

76 peripheral groove
78 buffer space
80 membrane
82 venting plug
84 concave shaped portion
86 cone shaped portion
88 chamfer
90 air bubbles
92 rear end of cartridge
94 opening at 92
96 tapered walls of 92
98 O-ring
99 space
100 dispensing assembly

A longitudinal axis
M material

Claims

1. A dispensing assembly comprising a piston and a membrane, wherein the piston has a dispensing end and an actuation end, wherein the actuation end can be acted on to move a piston for dispensing, wherein the membrane is arranged to cover at least a part of the dispensing end.

2. A dispensing assembly according to claim 1, wherein the membrane is connected to the dispensing end.

3. A dispensing assembly according to claim 1 or claim 2, wherein the membrane is fixedly connected to the piston.

4. A dispensing assembly according to claim 3, wherein the membrane is bonded to the piston, for example by means of ultrasonic welding, overmolding and/or an adhesive bond.

5. A dispensing assembly according to claim 1, wherein the membrane is not connected to the dispensing end.

6. A dispensing assembly according to one of claims 1 to 5, wherein the membrane comprises an elastomer.

7. A dispensing assembly according to one of claims 1 to 6, wherein the membrane is formed by a multilayered film comprises two or more layers with the two or more layers being connected to one another.

8. A dispensing assembly according to claim 6 or claim 7, wherein the membrane further comprises at least one metal layer comprising a metal or a metal alloy, such as aluminium or an aluminium alloy.

9. A dispensing assembly according to one of claims 1 to 8, wherein the piston comprises a piston body, a piston cover and one or more venting channels arranged between the piston body and the piston cover.

10. A dispensing assembly according to claim 9, wherein the piston cover is arranged at the actuation end and the membrane is arranged adjacent to the piston cover, in particular directly adjacent to the piston cover and remote from the piston body.

11. A dispensing assembly according to claim 9, or claim 10 wherein the piston cover comprises a venting pin configured to lift the piston cover from the piston body during a venting process.

12. A dispensing assembly according to one of claims 1 to 11, wherein an O-ring is arranged on a peripheral surface of the piston;

and/or wherein the piston further comprising one or more sealing lips arranged on peripheral surface of the piston; and/or
wherein a material of the cartridge is selected from the group of members comprising PTFE, PEEK, POM, PA, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

14. A dispensing assembly according to claims 9 and 12, and optionally of claim 10, claim 11 or claim 13, wherein the piston body is of at least generally cylindrical shape and the O-ring is arranged on a peripheral surface of the piston body.

15. A dispensing assembly according to one of claims 1 to 14, further comprising a cartridge and a material filled into the cartridge, wherein a positive or negative pressure can be applied between the membrane and the piston once the membrane and piston are inserted into the cartridge, with the positive or negative pressure acting on the material stored in the cartridge via the membrane; and/or

wherein a pressure in the range of 0.001 mbar to 10 bar (absolute) can be applied between the membrane and the piston; and/or
wherein the membrane has a thickness selected in the range of 0.05 to 1 mm, especially in the range of 0.1 to 0.3 mm.

16. A dispensing assembly according to one of claims 1 to 15, wherein the membrane is arranged to cover at least 60% and at most 90 % of the actuation end.

17. A dispensing assembly according to one of claims 1 to 18, wherein a space arranged between

the membrane and the piston is in direct contact with atmosphere, i.e. open to atmosphere, or wherein a space arranged between the membrane and the piston is not open to atmosphere.

18. A dispensing assembly according to one of claims 1 to 17, wherein a
wherein a material of the membrane is selected from the group of members comprising PTFE, PEEK, POM, Polyamide, PPS, PPA, PET, PPE and blends of one or more of the foregoing.

19. A dispensing assembly according to one of claims 1 to 18, further comprising a cartridge filled with a material and the piston is arranged within the cartridge.

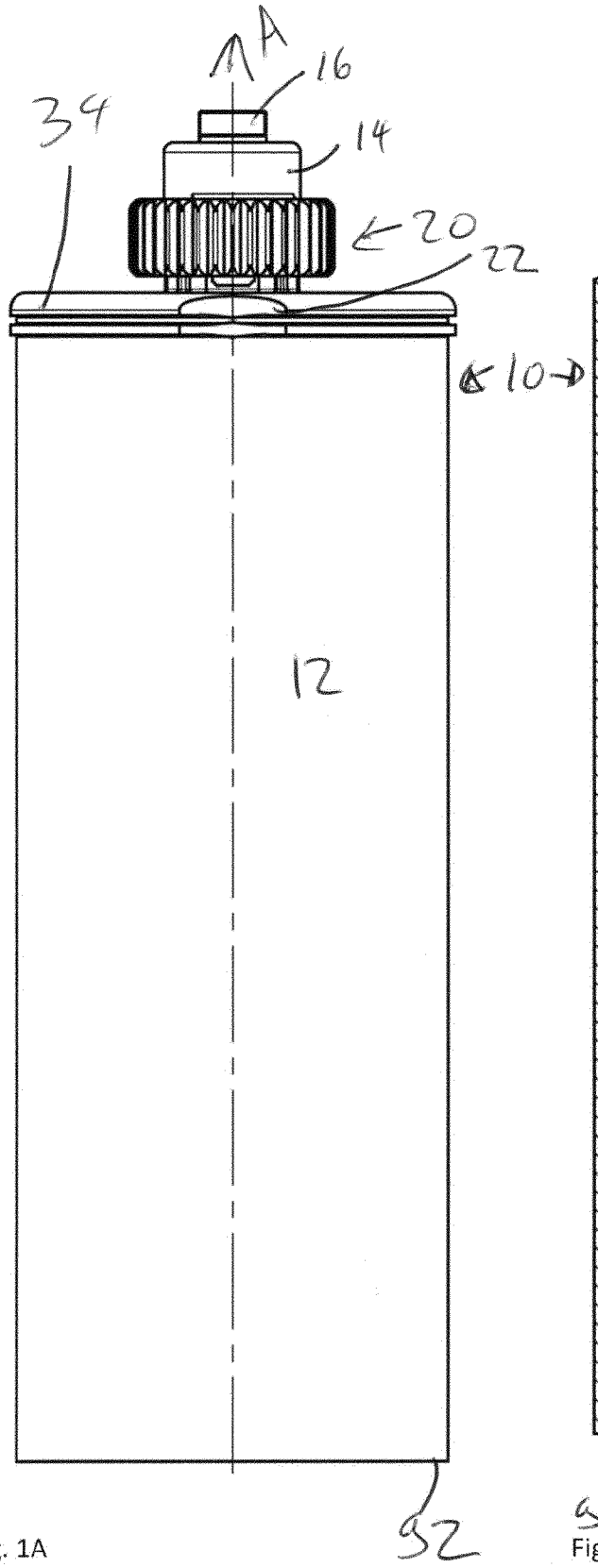


Fig. 1A

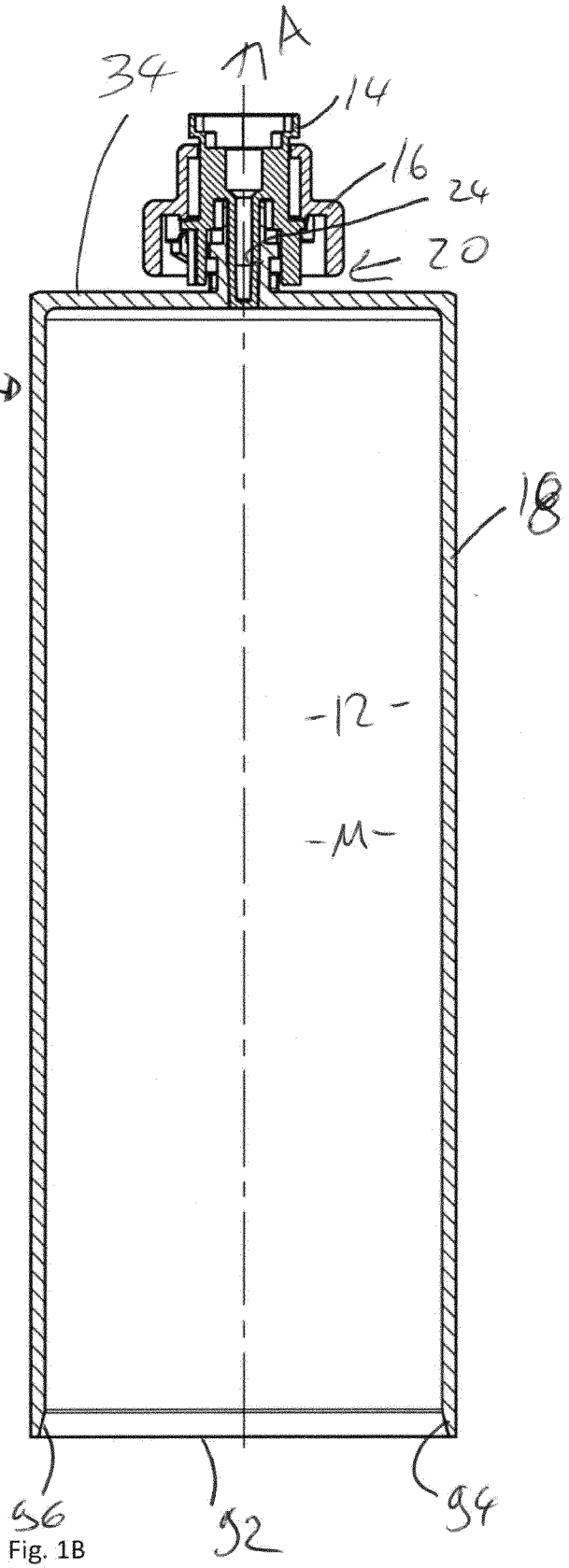
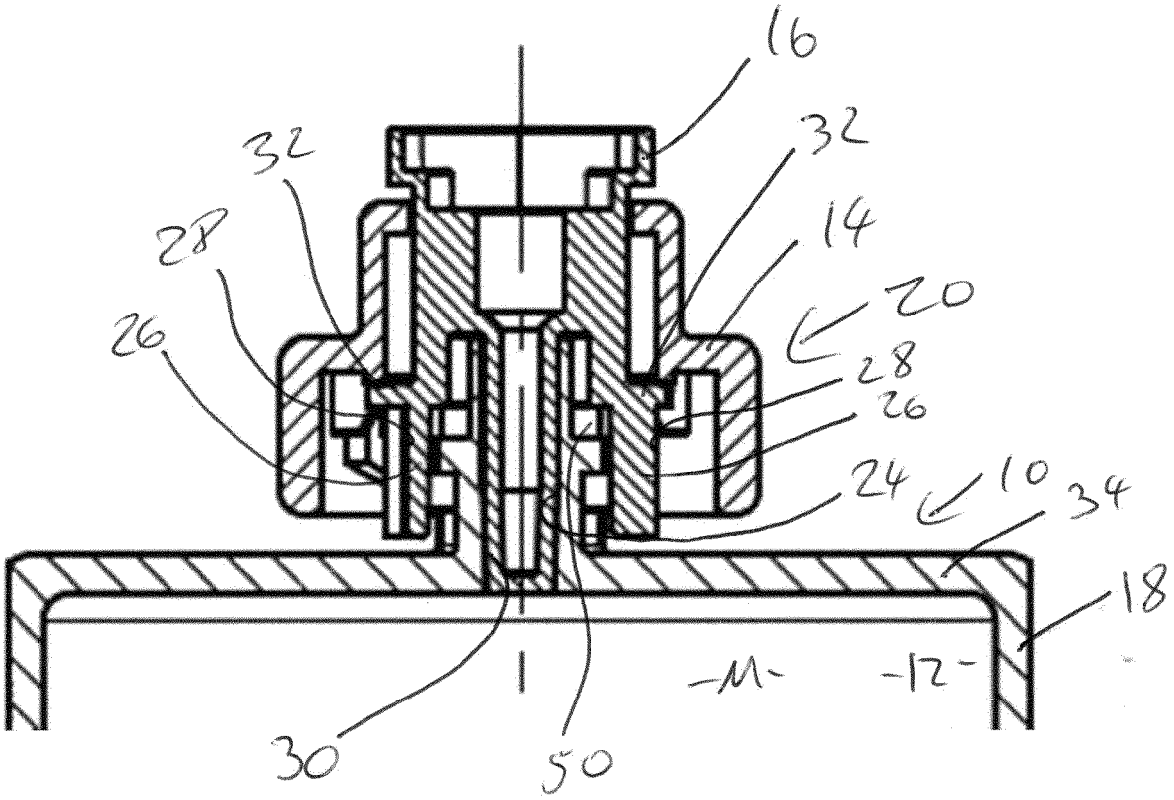


Fig. 1B

Fig. 2A



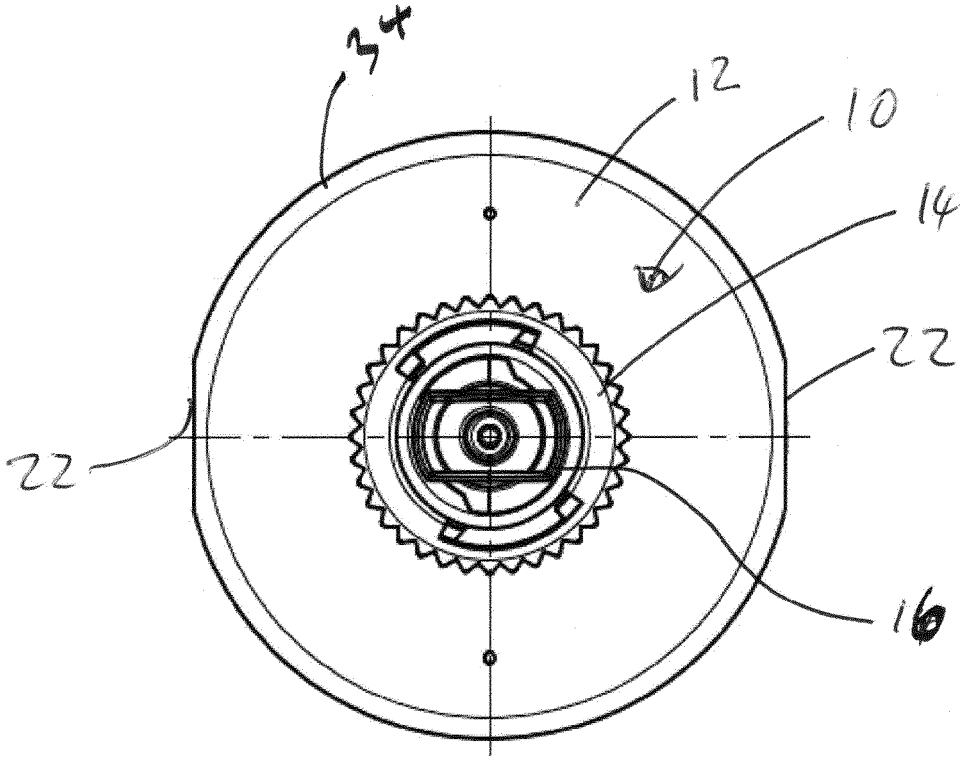


Fig. 2B

Fig. 3A

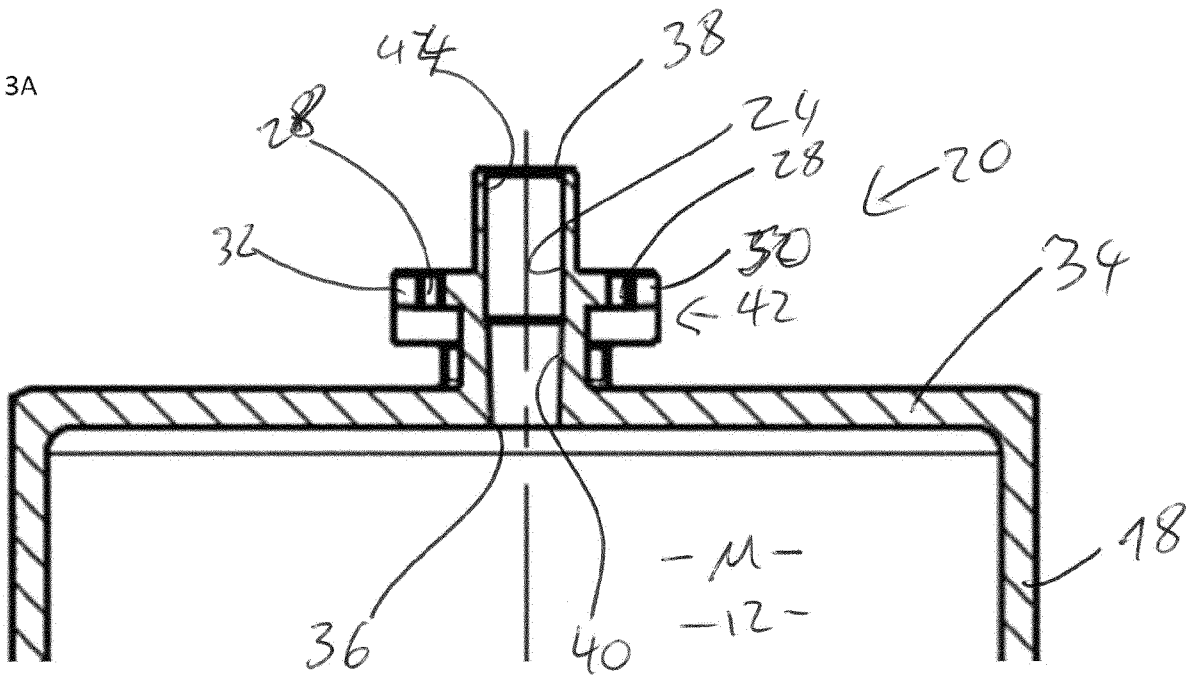


Fig. 3B

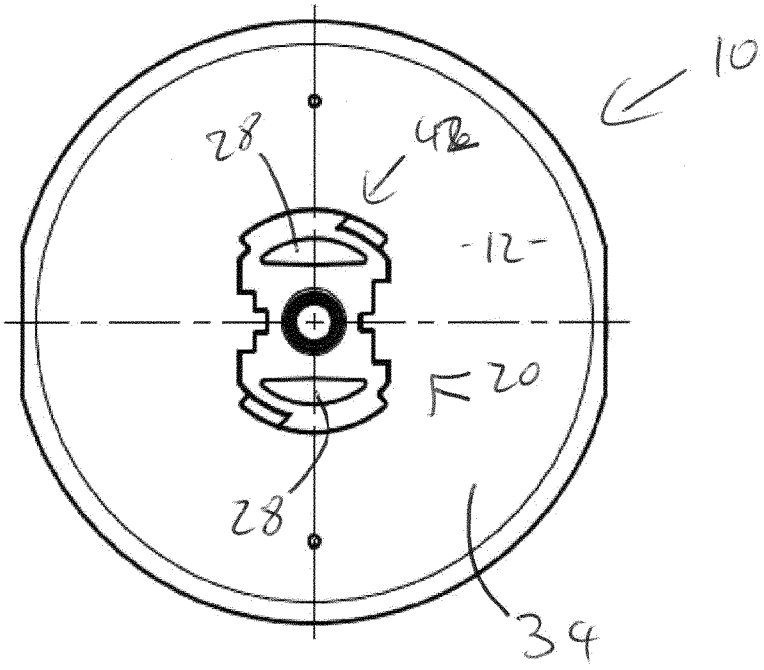


Fig. 4A

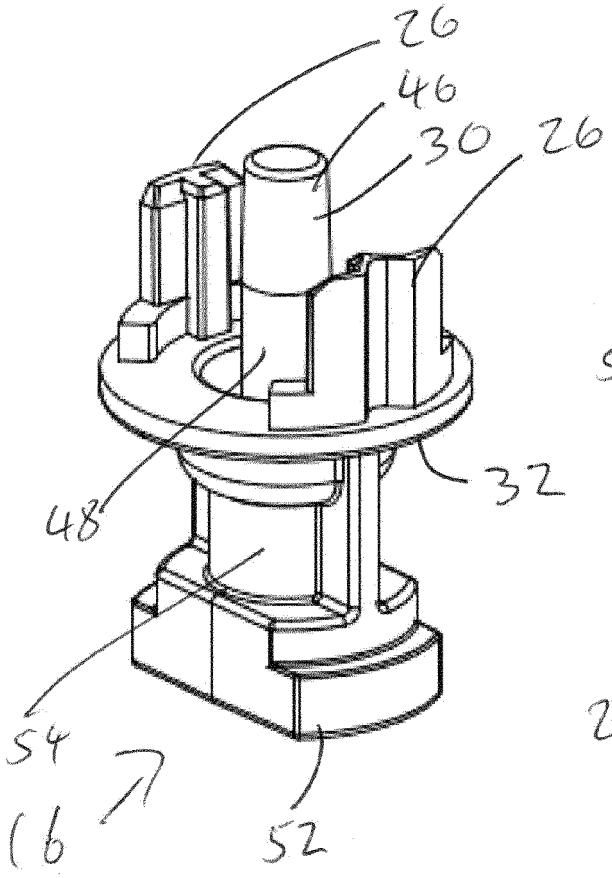


Fig 4B

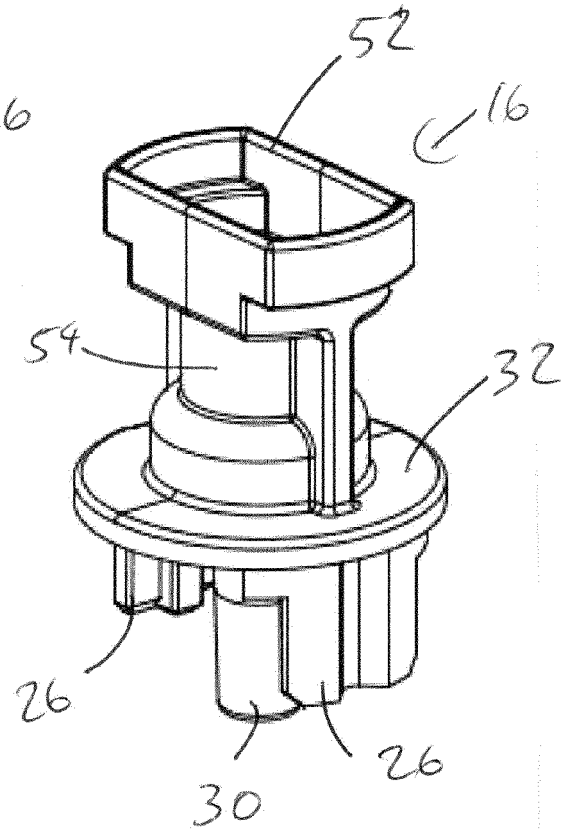


Fig. 4C

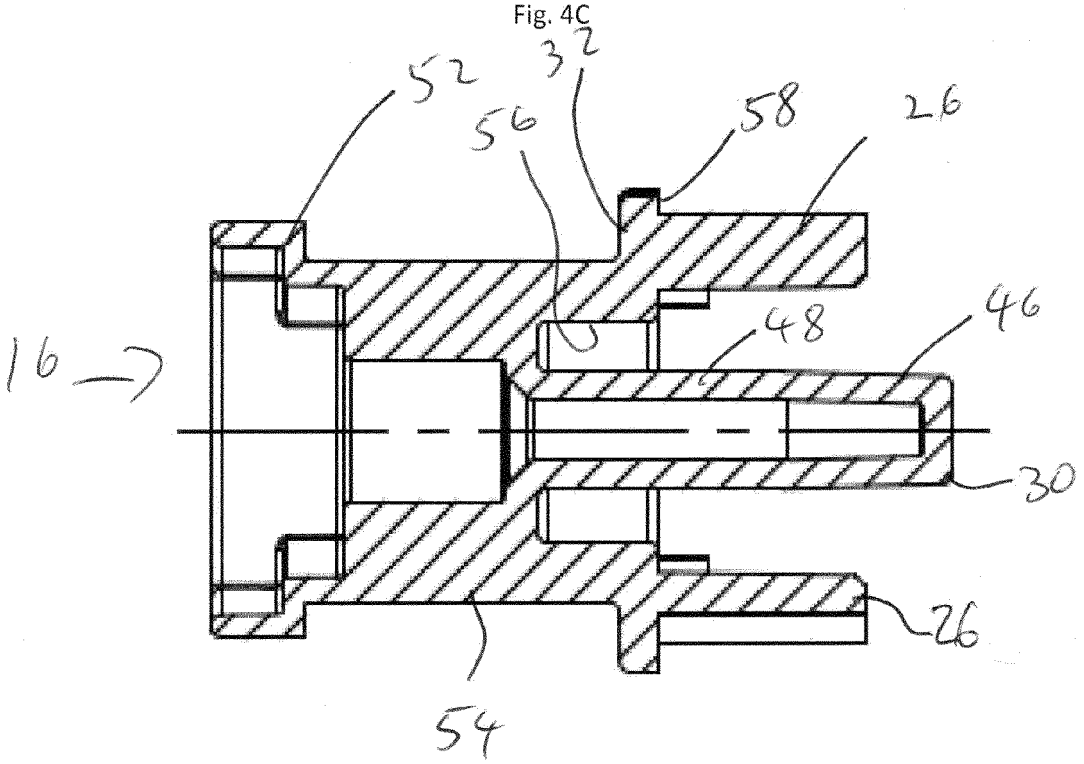
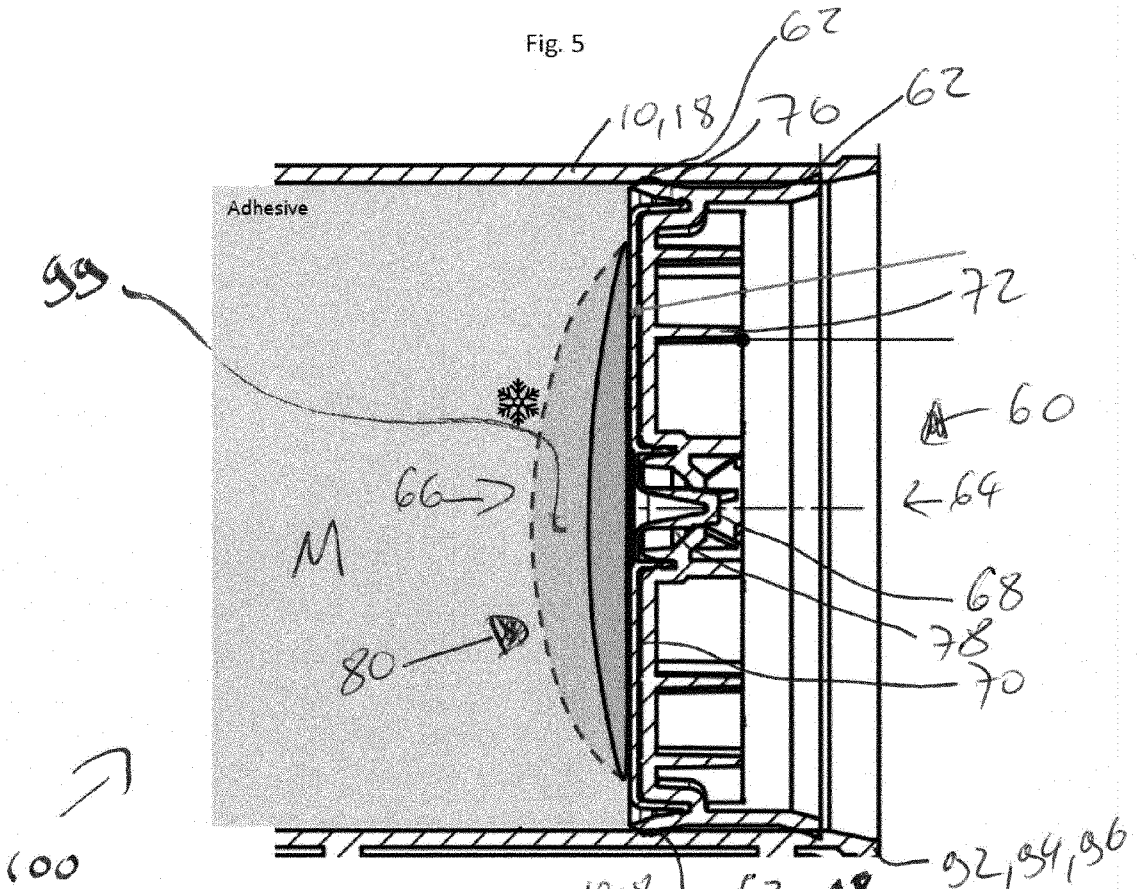


Fig. 5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M
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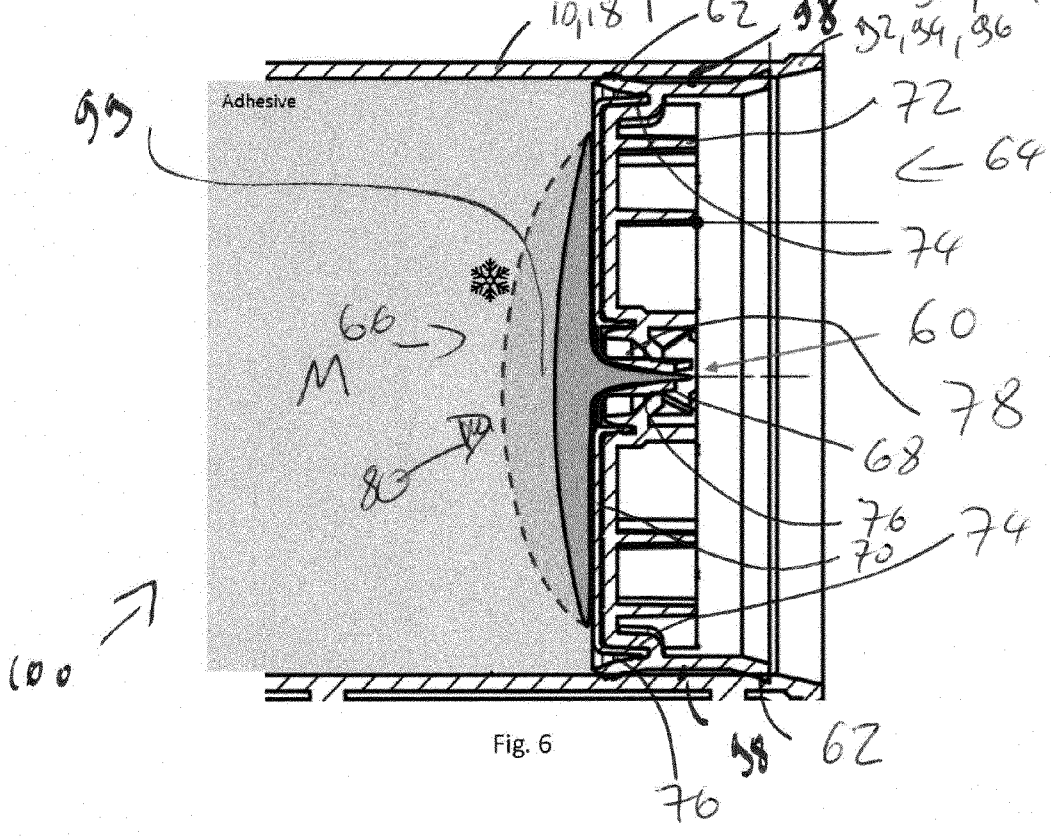
100
92,94,96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92,94,96
Adhesive
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Fig. 6

Fig. 7A

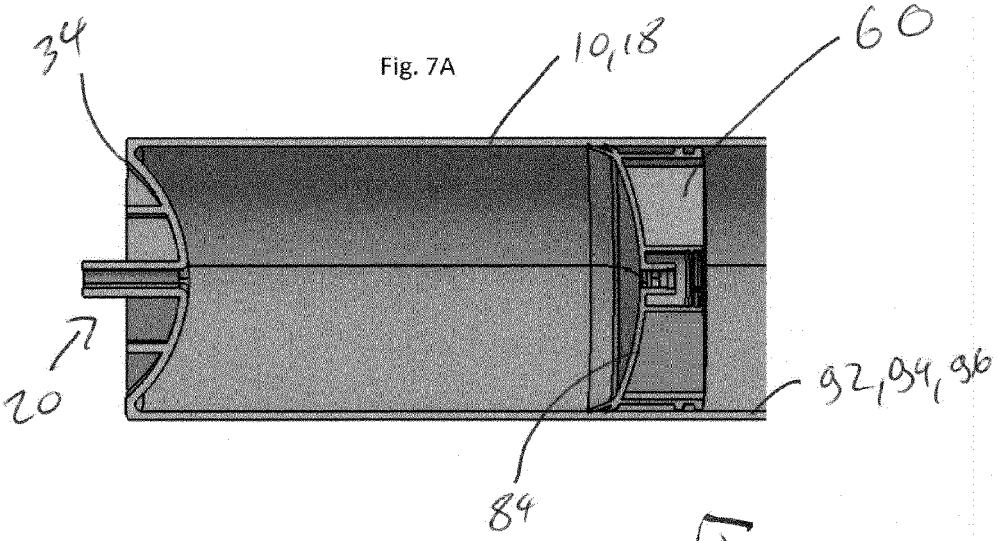


Fig. 7B

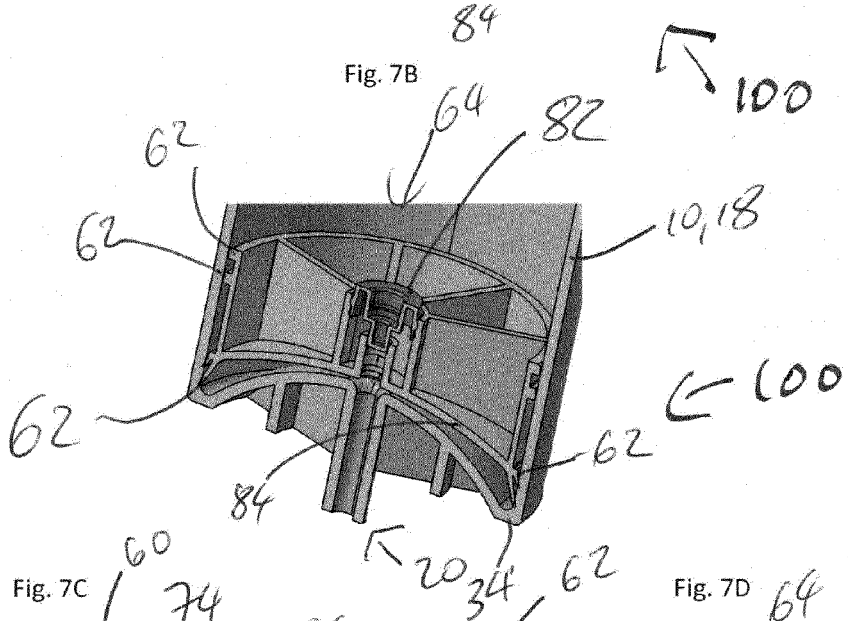


Fig. 7C

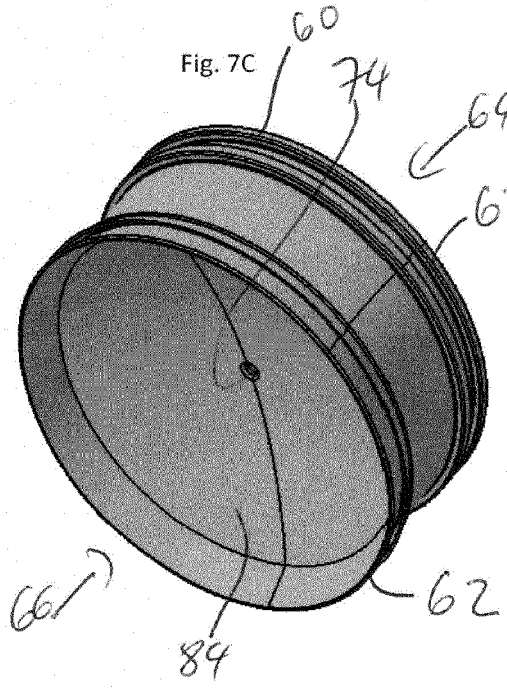
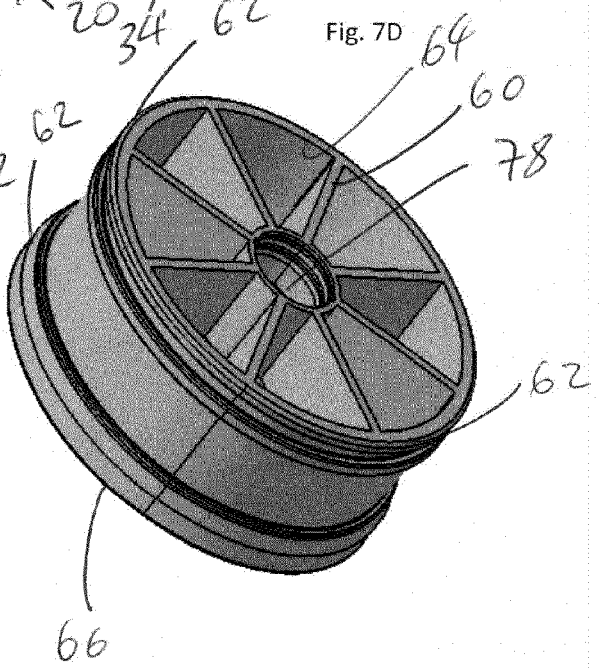


Fig. 7D



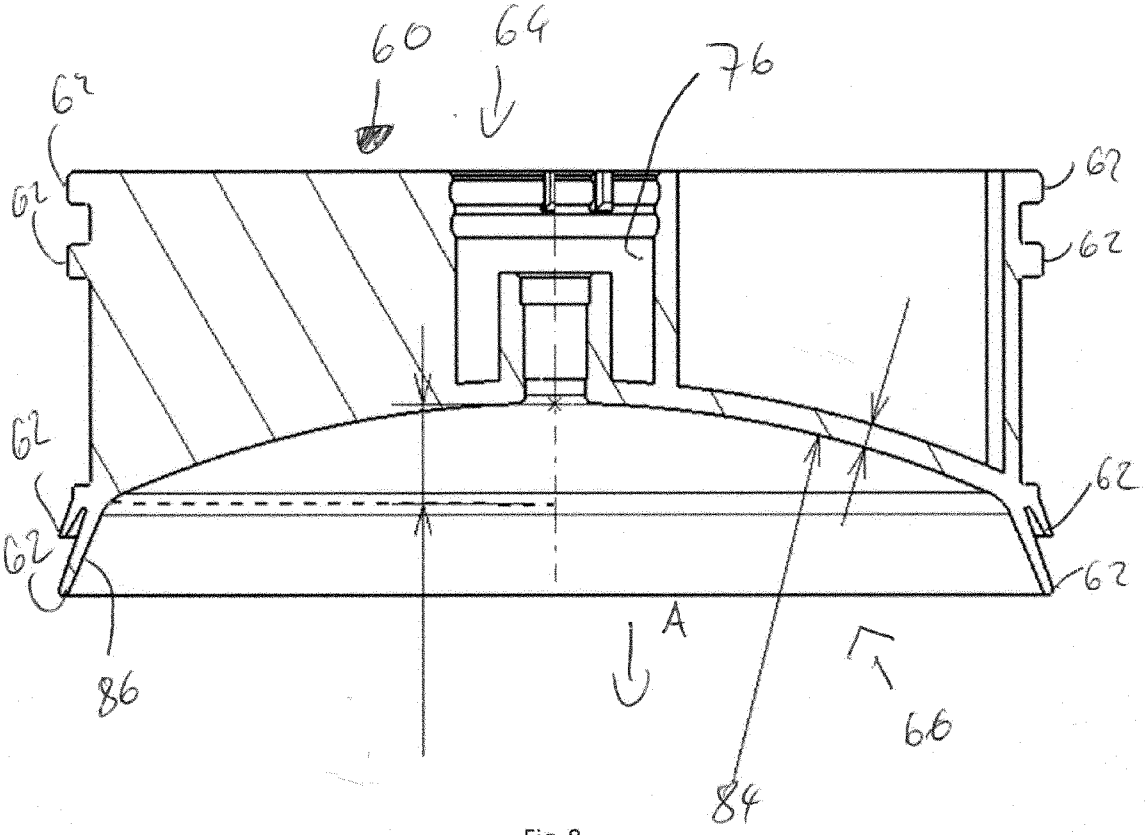


Fig. 8

Fig. 9

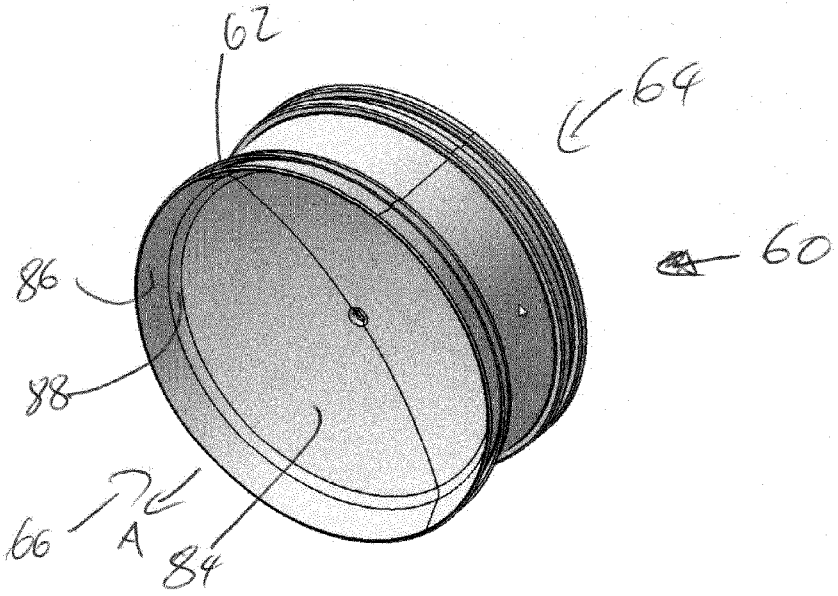


Fig. 10

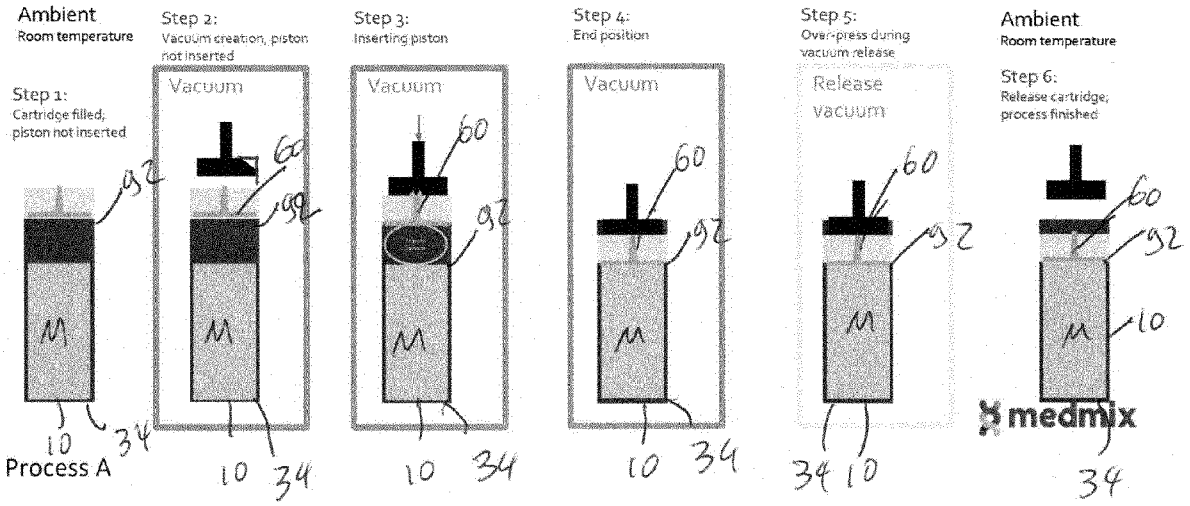
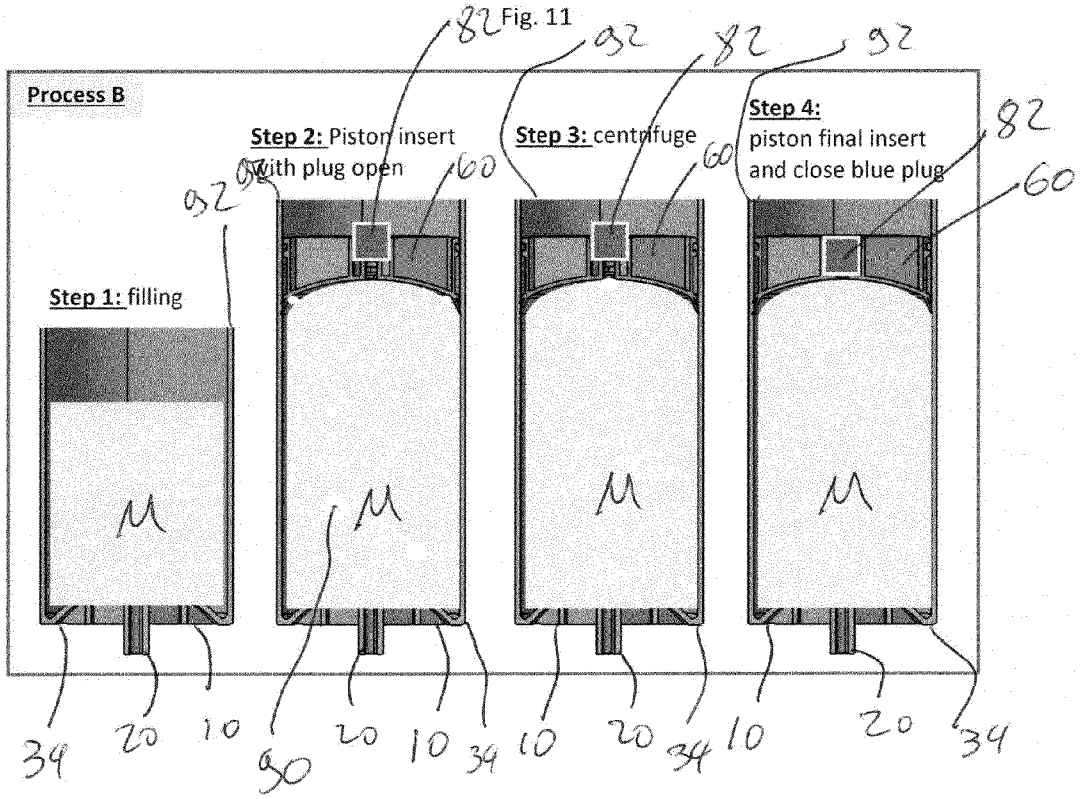

Ambient
Room temperature
Step 1:
Cartridge filled, piston not inserted
Step 2:
Vacuum creation, piston not inserted
Vacuum
Step 3:
Inserting piston
Vacuum
Step 4:
End position
Vacuum
Step 5:
Over-press during vacuum release
Release vacuum
Ambient
Room temperature
Step 6:
Release cartridge; process finished
Process A
medmix

Fig. 11


Process B
Step 1: filling
Step 2: Piston insert with plug open
Step 3: centrifuge
Step 4: piston final insert and close blue plug

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 0942

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 886 937 A1 (3M INNOVATIVE PROPERTIES CO [US]) 13 February 2008 (2008-02-13) * the whole document *	1-18	INV. B05C17/005
A	US 7 748 577 B2 (SUELZER CHEMTECH AG [CH]) 6 July 2010 (2010-07-06) * figure 6 *	11	

TECHNICAL FIELDS SEARCHED (IPC)

B05C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 June 2024	Ibarrondo, Borja

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 15 0942

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19-06-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1886937 A1	13-02-2008	EP 1886937 A1	13-02-2008
		WO 2008021732 A1	21-02-2008
US 7748577 B2	06-07-2010	AT E512091 T1	15-06-2011
		CA 2603438 A1	06-04-2008
		CN 101157409 A	09-04-2008
		DE 102006047289 A1	24-04-2008
		EP 1908703 A1	09-04-2008
		ES 2364287 T3	30-08-2011
		JP 5160177 B2	13-03-2013
		JP 2008094497 A	24-04-2008
		KR 20080031821 A	11-04-2008
		US 2008083789 A1	10-04-2008

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