(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 November 2024 (28.11.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/242550 A1

(51) International Patent Classification:
B65D 83/66 (2006.01) *B65D 83/28* (2006.01)
B65D 83/20 (2006.01) *B65D 83/44* (2006.01)

(21) International Application Number:
PCT/MY2023/050064

(22) International Filing Date:
16 August 2023 (16.08.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PI2023003130 25 May 2023 (25.05.2023) MY

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: AN AEROSOL CONTAINER

(57) Abstract: The present invention belongs to the technical field of aerosol technology and relates to a kind of aerosol container. The aerosol container comprises a can body (100), a receptacle (300) located within the can body (100) for hermetically storing content, and a protection assembly (200) located within the can body (100) and external to the receptacle (300) for isolating the receptacle (300) from a space external to the protection assembly (200) prior to using the aerosol container. The described aerosol container provides improved operational reliability.

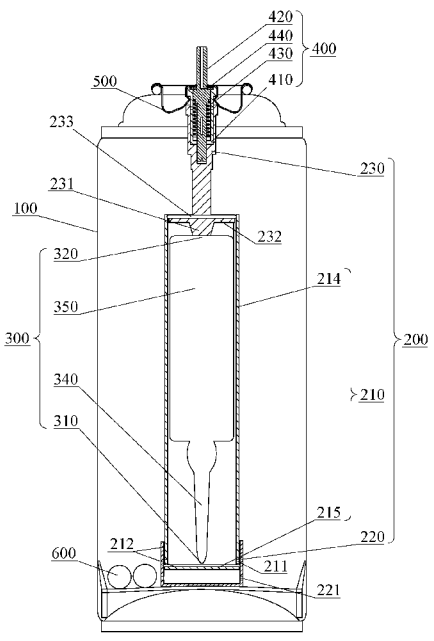

FIG. 1

WO 2024/242550 A1

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Published:

— *with international search report (Art. 21(3))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

AN AEROSOL CONTAINER

FIELD OF INVENTION

The present invention belongs to the technical field of aerosol technology and relates to a kind of aerosol container.

BACKGROUND OF THE INVENTION

It is known that polyester paint, which has seen wide use, cannot be used with conventional aerosol containers. This is because that polyester paint needs to be mixed with a modifier for it to be used. However, even though it has been mixed with a modifier, the mixture will solidify after a few hours, and as a result, it cannot be sprayed out from the aerosol container. Therefore, it is preferable that the modifier is mixed with the propellant and the coating (e.g., polyester paint) only when it is required. As such, it is necessary for the modifier to be stored hermetically within a receptacle as its content, within the aerosol container, which is only broken when required.

The receptacle may be made from a material that is the same as the aerosol container (i.e., aluminium) for storing the coating. However, considerations should also be made should it be required for the receptacle to store modifiers that are highly corrosive in nature (e.g., hydrochloric acid) as the receptacle will have a risk of being corroded. As such, it is preferable that the receptacle is made from corrosion-resistant material such as glass instead of aluminium.

However, a mixing member, such as a mixing ball, is also usually provided within the aerosol container. The mixing member may impact the receptacle having the modifier during transport or storage of the aerosol container, and the breakable nature of glass may further aggravate this. This may result in a premature leakage of the modifier, which shall eventually render the aerosol container unusable.

SUMMARY OF INVENTION

In order to improve the operational reliability of aerosol containers when in use, the present invention proposes an aerosol container.

The present invention intends to provide an aerosol container comprising a can body, a receptacle, and a protection assembly. The receptacle is located within the can body for hermetically storing content, and the protection assembly is located within the can body and external to the receptacle for isolating the receptacle from a space external to the protection assembly prior to use of the aerosol container.

Advantageously, by hermetically storing content within the receptacle and having the protection assembly to protect the receptacle, it is possible to prevent the receptacle from being impacted by the mixing balls during transport or storage of the aerosol container, which could have caused damage to the receptacle and premature leakage of the content. Moreover, it is possible to prevent the pressure force exerted by the propellant from damaging the receptacle. As such, the operational reliability of the receptacle in storing content is increased, thereby increasing the operational reliability of the aerosol container.

Preferably, the protection assembly comprises a protective casing, and a piston shaft in connection with the protective case that is configured to apply pressure to the receptacle for breaking it so that its content is released therefrom.

Preferably, the protective casing comprises an inner case and an outer case, with the outer case covering at least an outer lower portion of the inner case, and the inner case covering at least an outer lower portion of the receptacle.

Preferably, the inner case comprises a first connective channel at its lower portion, and

the outer case comprises a second connective channel at its lower portion.

Preferably, the inner case and the outer case are arranged to move relative to each other, with the inner case movable from a first position to a second position.

Preferably, the first connective channel and the second connective channel are blocked off from each other when the inner case is at the first position, and the first connective channel and the second connective channel are connected to each other when the inner case is at the second position.

Preferably, the first connective channel and the second connective channel, when the inner case is at the first position, are blocked off at locations being between the first connective channel and the second connective channel, and between the first connective channel and the top portion of the outer case.

Preferably, the inner case is connected to the outer case through a first sealing ring in a hermetic manner, or the inner case is connected to the outer case through an interference fit between them in a hermetic manner.

Preferably, wherein the piston shaft comprises a pressure-application section that applies pressure to the receptacle.

Preferably, the receptacle has its receptacle tip abutting base walls of the inner case, and the receptacle has an outer portion of its base being abutted by the pressure-application section of the piston shaft which applies pressure thereto.

Preferably, the piston shaft is connected to the protective casing through a second sealing ring in a hermetic manner, or the piston shaft is connected to the protective casing through an interference fit between them in a hermetic manner.

Preferably, the piston shaft has a flange portion, with a peripheral surface of the flange portion being connected to the protective casing through the second sealing ring in a hermetic manner, or connected to the protective casing through an interference fit between them in a hermetic manner.

Preferably, the receptacle has its base abutted by a projection of the inner case that formed on an inner surface portion of base walls of the inner case, and the receptacle has its shoulders abutted by a bottom portion of the piston shaft.

Preferably, the projection of the protective casing and lower edges of the inner case have an annular area therebetween, for abutting lower edges of the receptacle after the receptacle base is broken.

Preferably, the piston shaft is connected to the protective casing through a third sealing ring in a hermetic manner, or the piston shaft is connected to the protective casing through an interference fit between them in a hermetic manner.

Preferably, the piston shaft is connected to the inner case through the third sealing ring in a hermetic manner, or the piston shaft is connected to the inner case through an interference fit between them in a hermetic manner.

Preferably, the aerosol container further comprises a control valve, which comprises a

valve housing disposed within the can body in a hermetic manner, a valve stem, which is disposed within the valve housing, and a resilient member, for pushing the valve stem so that valve stem and valve housing remain connected in a hermetic manner.

Preferably, the valve stem has its tip passed through an upper portion of the valve housing along the axial direction; and the valve stem has its bottom end passed through a lower portion of the valve housing along the axial direction, such that when the valve stem moves towards the protective casing, the valve stem pushes the piston shaft for the piston shaft to break the receptacle so that the content is released therefrom.

Preferably, the aerosol container further comprises additional control valves.

Preferably, the receptacle is breakable and corrosion-resistant.

Preferably, the aerosol container further comprises mixing members disposed between the protection assembly and the can body.

Preferably, the valve housing has its side walls providing a third connective channel, which is used to connect a first space being space between the valve stem and the valve housing, and connect a second space being space between the valve housing and the inner surface of the can body. The piston shaft has its inner side surface connected to the valve housing in a hermetic manner, and its top portion is used to block or unblock the third connective channel.

Preferably, the valve stem has its lower portion connected to a through-hole at the base of the valve housing in a hermetic manner, and has its middle portion provided with a guide channel. When the lower portion of the valve stem protrudes out from the valve

housing at a maximum value, the guide channel establishes a connectivity between a first space and a second space. The first space is defined as a space between the valve housing and the valve stem, while the second space is defined as a space between valve housing and the internals of the can body. When the valve stem is not depressed, the entirety of the guide channel is to be within the valve housing.

Preferably, the guide channel further comprises a flow-guiding groove that is parallel to the radial direction of the valve stem or along the radial direction of the valve stem. The flow-guiding groove is at least recessed at the peripheral surface of the lower portion of the valve stem and extends along the axial direction of the valve stem. When the lower portion of the valve stem protrudes out from the valve housing at a maximum value, portions of the flow-guiding groove are located within the valve housing, and its remaining portions are located outside of the valve housing.

Preferably, the valve stem further comprises a discharge channel at its top portion, with the discharge channel encompassing an outlet located on the tip of the valve stem, and an inlet located on the upper surface portion of the valve stem.

One skilled in the art will readily appreciate that the invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. The embodiments described herein are not intended as limitations on the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of the aerosol container of the present invention in its first embodiment.

FIG. 2 is a schematic illustration of the aerosol container of the present invention in its

second embodiment.

FIG. 3 is a schematic illustration of the aerosol container of the present invention in its third embodiment in a configuration whereby its valve stem is yet to be depressed.

FIG. 4 is a schematic illustration of the aerosol container of the present invention in its third embodiment in a configuration whereby its piston shaft had pushed its inner case to assume a certain position.

FIG. 5 is a schematic illustration of the control valve of the aerosol container as per **FIG. 1**.

FIG. 6 is a schematic illustration of the aerosol container in a fourth embodiment whereby the upper portion of the piston shaft and the lower portion of the valve stem are in a threaded engagement with each other.

FIG. 7 is a schematic illustration of the aerosol container of the fourth alternative embodiment whereby its control valve is to receive a corresponding nozzle.

FIG. 8 is an illustration of an external perspective view of the aerosol container of the fourth embodiment, specifically showing its corresponding nozzle.

FIG. 9 is a schematic illustration of the aerosol container in a fifth embodiment having more than one valve stems, with a first valve stem being configured according to the third embodiment as shown in **FIG. 3**, and a second valve stem that is configured to dispense content from the aerosol container.

FIG. 10 is an illustration of an external perspective view of the aerosol container of the fifth embodiment, with its corresponding nozzles.

FIG. 11 is a schematic illustration of the aerosol container in a sixth embodiment having more than one valve stem, with a first valve stem being configured according to the fourth embodiment as shown in **FIG. 6**, and a second valve stem that is configured to dispense content from the aerosol container.

FIG. 12 is an illustration of an external perspective view of the aerosol container of the sixth embodiment, with its corresponding nozzles.

DETAILED DESCRIPTION OF THE INVENTION

For facilitating an understanding of the purpose, structure, and functionality of the present invention, the present invention is described in further detail below with reference to the accompanying drawings.

FIG. 1 is a schematic illustration of the aerosol container of the present invention in its first embodiment. **FIG. 2** is a schematic illustration of the aerosol container of the present invention in its second embodiment. **FIG. 3** is a schematic illustration of the aerosol container of the present invention in its third embodiment in a configuration whereby its valve stem is yet to be depressed. **FIG. 6** is a schematic illustration of the aerosol container of the present invention in its fourth embodiment. As shown in **FIGS 1, 2, 3** and **6,** each of these embodiments provides an aerosol container comprising a can body **100**, a receptacle **300** located within the can body **100** for hermetically storing content, and a protection assembly **200** located within the can body **100** but external to the receptacle **300** for isolating the receptacle **300** from a space external to the protection assembly **200** prior to use of the aerosol container.

It is to be noted that it is preferable that fluids (i.e. liquids or gases) are within the aerosol container. In particular, the aerosol container may be used in such a way that

propellant is stored in the space between the protection assembly **200** and the can body **100**, which may be high-pressure gas. Whereas, content (e.g., a paint base) is stored in the receptacle **300**. It is noted that the aerosol container may also be used in such a way that propellant and a paint base are stored in the space between the protection assembly **200** and the can body **100**, while modifiers (e.g., toluene diisocyanate, hydrochloric acid, etc.) is stored in the receptacle **300** as content.

When the aerosol container is to be used, the content from the receptacle **300** and the propellant are to be mixed first, for the mixed content to be then sprayed out from the aerosol container under the entrainment of the propellant. In order to improve the mixing between the content and the propellant, one or more mixing members **600**, such as mixing balls, is typically disposed in the space between the protection assembly **200** and the can body **100**.

By having the content stored within the receptacle **300** in a hermetic manner, and by having the protection assembly **200** protect the receptacle **300**, it is possible to prevent the receptacle **300** from being impacted by the mixing members **600** during transport or storage of the aerosol container, which could have caused damage to the receptacle **300** and premature leakage of the modifier. Moreover, it is possible to prevent the pressure force exerted by the propellant from damaging the receptacle **300**. As such, the operational reliability of the receptacle **300** in storing content is increased, thereby increasing the operational reliability of the aerosol container.

As shown in **FIGS 1, 2, 3** and **6**, preferably, the protection assembly **200** further comprises a protective casing, a piston shaft **230** that moves relative to the protective casing while being hermetically connected to it, with the piston shaft **230** used to apply a pressure force to the receptacle **300**, having content therein, for breaking it from its sealed state.

The piston shaft **230** is to be driven by an external force (e.g., pressure from a control valve) for it to exert a force onto the receptacle **300**. When the receptacle **300** experiences an external force exerted by the piston shaft **230** that is large enough, it shall break and its stored content will be released. With the piston shaft **230** and the protective casing being slidably movable relative to each other and while being hermetically connected together, the receptacle **300** may be shielded from the pressure force exerted by the high-pressure propellant within the can body **100**, thereby preventing the receptacle **300** from being broken by this pressure force. With this, the operational reliability of the receptacle **300** in storing content is increased.

As shown in **FIGS 1, 2, 3** and **6**, preferably, the protective casing further comprises an inner case **210** and an outer case **220**, with the outer case **220** at least covering an outer-lower portion of the inner case **210**, and with the inner case **210** at least covering an outer-lower portion of the receptacle **300**.

In particular, the outer case **220** is disposed externally to the inner case **210**, and the inner case **210** is disposed externally to the receptacle **300**. In a first, second and third embodiments which shall be described below, the outer case **220** covers the lower portion of the inner case side walls **214** and the inner case base walls **215**. Alternatively, the outer case **220** may cover the entirety of the inner case side walls **214** and the inner case base walls **215**. In the first embodiment and the second embodiment which shall be described below, the inner case **210** covers the entire side surfaces of the receptacle **300** and its illustrated base. In the third embodiment which shall be described below, the inner case **210** only covers the lower-half side surfaces of the receptacle **300** and its illustrated base.

With the outer case **210** and the inner case **220** providing a double-layer protection, the protection of the receptacle **300** will be strengthened. Not only that, a relative movement between the outer case **210** and the inner case **220** for changing a

connectivity between the protective casing and its external environment is realised. This will allow control over the content within the receptacle **300** for it to be released and entrained with the propellant, for it to eventually be sprayed out from the aerosol container.

As shown in **FIGS 1, 2, 3** and **6**, preferably, the lower portion of the inner case **210** has a first connective channel **211** and the lower portion of the outer case **220** has a second connective channel **221**. With the inner case **210** and the outer case **220** configured to move relative to each other, the inner case **210** may move from a first position to a second position. When the inner case **210** is at the first position, the first connective channel **211** and the second connective channel **221** are blocked off from each other. Whereas, when the inner case **210** is at the second position, a clear path is formed between the first connective channel **211** and the second connective channel **221**.

In particular, the path of the first connective channel **211** includes a through-hole at the inner case side walls **214**, located at the base of the inner case side walls **214**. Whereas, the path of the second connective channel **221** includes a through-hole at the side walls of the outer case **220**, located at the base of the side walls of the outer case **220**. When the inner case **210** is at the second position, preferably, the opening of the first connective channel **211**, or partial areas of it, overlaps with the second connective channel **221**. But most preferably, the opening of the first connective channel **211** is aligned to the second connective channel **221**. With this, content within the inner case **210** is able to continuously flow through the first connective channel **211** and the second connective channel **221**.

In addition, regarding the first connective channel **211** and the second connective channel **221**, their angular positions relative to the circumference of the protective casing along its axial axis are not perfectly coincident. That is, such a condition shall not occur. When the inner case **210** and the outer case **220** are at a certain relative angle,

a clear path is correspondingly formed between the first connective channel **211** and the second connective channel **221**. Also, when the first connective channel **211** and the second connective channel **221** are rotated to be at another relative angle, the first connective channel **211** and the second connective channel **221** may be blocked off from each other. Hence, as long as both of them remain at a consistent height, a partially clear path should be formed between the first connective channel **211** and the second connective channel **221**. With this, a connectivity between a space internal to the inner case **210** and a space external to the outer case **220** is realised.

With the first connective channel **211** and the second connective channel **221** configured as such, a control over the position of the inner case **211** may allow for a control over the connectivity between the first connective channel **211** and the second connective channel **221**. Hence, a method for controlling the position of the inner case **210** can be employed to control the connectivity between a space internal to the inner case **210** and a space external to the outer case **220**. Furthermore, it is possible for a component that actuates a positional change of the inner case **210** and a component that breaks the receptacle **300** for releasing its contents to be one and the same, and under a unidirectional pressing operation, said component will independently perform both actions. With this, a coherency in actions is realised, thereby increasing the operational effectiveness of the aerosol container.

As shown in **FIGS 1** and **2**, preferably, when the inner case **210** is at the first position, a hermetic location of the inner case **210** and the outer case **220** is located between the first connective channel **211** and the second connective channel **221**, and between the ends of the first connective channel **211** and the second connective channel **221**. A first sealing ring **212** provides a hermetic connection between the inner case **211** and the outer case **221**. Alternatively, an interference fit between the inner case **211** and the outer case **220** provides a hermetic connection between them.

In particular, it is possible for the circumferential surface of the inner case base walls **215** (more specifically, the circumferential surface of the lowermost portion of the inner case side walls **214**) and the inner walls of the outer case **220** to have a hermetic connection between each other. More precisely, the first sealing ring **212** is at a location on the inner case side walls **214** that is relatively lower than the first connective channel **211**. Alternatively, an interference fit between the said location and the outer case **220** provides a hermetic connection between them. With this, when the inner case **210** is at the first position, the realised hermetic location is located between the first connective channel **211** and the second connective channel **221**, thereby making them blocked off from each other. Whereas, when the inner case **210** is at the second position, the first connective channel **211** and the second connective channel **221** are positionally aligned to one another, as the hermetic location is now located at a location relatively lower than the first connective channel **211**. As such, there is no obstruction between the first connective channel **211** and the second connective channel **221**, thereby forming a clear path for the flow of content from the inner case **210** to the outer case **220**.

In addition, it is also possible for a hermetic location between the first connective channel **211** and the top end of the outer case **220** to be at a location on the peripheral surface of the inner case **210** that is relatively higher than the first connective channel **211**. This shall also effectively provide a sealing effect when the inner case **210** is at the first position, in which a path for the first connective channel **211** to reach the space external to the outer case **220** through the upper side walls of the outer case **220** is blocked off.

With the use of the first sealing ring **212** or the interference fit between the first connective channel **211** and the second connective channel **221**, more specifically, between the ends of the first connective channel **211** and the second connective channel **221**, when the inner case **210** is at the first position, it is possible for the first connective channel **211** and the second connective channel **221** to be blocked off from each other,

thereby blocking off a path for the first connective channel **211** to reach the space external to the outer case **220**. With this, it is possible to prevent the receptacle **300** from being subjected to excess pressure force exerted by the propellant that is external to the outer case **220**, which could have affected the stability of the receptacle **300**. Whereas, when the inner case **210** is at the second position, the hermetic location, in which the seal or interference fit is located, will not affect the flow of content from the receptacle **300** to the space external to the outer case **220**.

As shown in **FIGS 1** and **2**, preferably, the piston shaft **230** further comprises a pressure-application section **231**, which exerts a pressure force onto the receptacle **300**.

In particular, as shown in the first embodiment and the second embodiment which are to be described below, the piston shaft **230** may have a body that is a column shape or a frustum shape, with the pressure-application section **231** situated at its bottommost portion. The body of the piston shaft **230** has a diameter that is smaller than the diameter of the receptacle **300**, so that it can fully act upon the receptacle base **320**. More specifically, the force applied by the body of the piston shaft **230** is concentrated onto the centre of the receptacle base **320**. Hence, when the piston shaft **230** applies a considerable amount of pressure force onto the receptacle base **320**, it may break the receptacle base **320**.

With the pressure-application section **231** of the piston shaft **230** applying a pressure force onto the receptacle **300**, the relative position between the inner case **210** and outer case **220** is changed, thereby changing a connectivity between the first connective channel **211** and the second connective channel **221** from them being blocked off to allowing a connection between the two. After the inner case **210** is pushed for it to move relative to the outer case **220** up to a certain position, there will be no relative change in position between the inner case **210** and the outer case **220**. Further application of pressure force will then cause the receptacle **300** to break for its content stored there

within to be released and entrained with the propellant to be sprayed out. With this, it is demonstrated that a movement of the piston shaft **230** towards a direction will cause both of the following to be done, namely, a change in connectivity between the space internally within the inner case **210** and the space external to the outer case **220**, and breaking of the receptacle **300**. Both of these may be done in one go by the piston shaft **230**, thereby providing increased efficiency of action as well as operational improvements.

As shown in **FIGS 1** and **2**, the receptacle **300** has characteristics such that its body is breakable, and may further be corrosion-resistant. The receptacle tip **310** abuts the inner case base walls **215**, and the pressure-application section **231** is configured to apply a pressure force onto the outer portion of the receptacle base **320**. It is also much preferred that the body of receptacle **300** is rigid, however, embodiments of the receptacle **300** may further extend to it having a pliable body that includes the aforementioned characteristics, with its pliable body breaking by being ruptured or punctured when receiving an external force that overcomes its structural integrity. Hence, the material composition of the receptacle **300** may be selected from a group of materials, which may be, but shall not be limited to glass, ceramics, corrosion-resistant plastics, plastics, or the like.

In particular, the receptacle **300** may have an appearance similar to that of an ampoule which is commonly used medically for the administration of injections. In particular, as well, the receptacle **300** has an upper portion **340** and a lower portion **350**. The receptacle's upper portion **340** may have a tapered structure, or it may have a dilated neck portion at the base of this tapered structure. Between the dilated neck portion and the receptacle's lower portion **350** is a reduced-diameter section. Should breaking of the receptacle **300** be required, a force is to be applied along the radial axis of the aforementioned tapered structure. Should the receptacle's upper portion **340** have a substantially tapered structure, when hit, the receptacle's upper portion **340** and the

receptacle's lower portion **350** may separate from each other due to a break occurring at the base of the tapered structure. Should the receptacle's upper portion **340** have a dilated neck portion, when hit, the receptacle's upper portion **340** and the receptacle's lower portion **350** may separate from each other due to a break occurring at the reduced-diameter section.

It should be noted that the receptacle **300** only has an appearance similar to an ampoule, and it does not necessarily have dimensions similar to a conventional ampoule or a shape that bears similarity to an ampoule. Should the need to store content at a volume that exceeds the volume of a conventional ampoule arises, it is possible to use a receptacle that has an appearance similar to a conventional ampoule, but having enlarged dimensions.

In addition, the concepts relating to the receptacle base **320**, the receptacle tip **310**, the receptacle shoulders **330**, the receptacle's upper portion **340**, and the receptacle's lower portion **350**, as put forward within this application, shall not be limited by the orientational arrangement of the receptacle **300**. More specifically, the arrangement orientation of the receptacle **300** is not to be limited to how it is conventionally done, and it may be in an upright manner or an inverted manner for the content stored therewithin and at the receptacle's lower portion **350** to be at the upper half or the lower half of the receptacle **300**. The receptacle base **320** refers to a position along the receptacle's lower portion **350** that is furthest from the receptacle's upper portion **340**. The receptacle tip **310** refers to a tapered end along the receptacle's upper portion **340**. The receptacle shoulders **330** refers to a joining between the receptacle's upper portion **340** and the receptacle's lower portion **350**, whereby the receptacle's upper portion **340** has a dilating diameter compared to the receptacle's lower portion **350**, or the receptacle's lower portion **350** has a tapering diameter compared to the receptacle's upper portion **340**. Accordingly, the receptacle's lower portion **350** refers to a main cylindrical body of the ampoule bottle that usually stores liquid content, while the

receptacle's upper portion **340** refers to portions of the ampoule having the tapered structure, which may include its dilated-diameter section.

The pressure-application section **231** is configured to apply a pressure force onto the outside of the receptacle base **320**, more precisely, the base of the ampoule, with the ampoule being arranged in an inverted manner. The receptacle tip **310**, more precisely the tip of the ampoule, is to face the bottom end of the inner case **210**. When the ampoule receives an applied, which may be more specifically a downward pressure force, its upper portion **340** may break. As such, content within the receptacle **300** is released into the lower half of the inner case **210**, which is closer to the first connective channel **211** located at the lower end of the inner case side walls **214**. With this, the content may quickly flow to the space external to the outer case **220**, thereby allowing spraying to be done instantaneously.

As shown in **FIGS 1** and **2**, preferably, the inner case **210** further comprises an inner case body.

In particular, the inner case body includes the inner case side walls **214** and the inner case base walls **215**. The inner case side walls **214** and the inner case base walls **215** are to be integrally formed as a single piece. With the exception of the first connective channel **211**, the inner case side walls **214** and the inner case base walls **215** are substantially joined. More specifically, only the first connective channel **211** provides a connectivity between the outside and the inside of the inner case **210**.

As shown in **FIGS 1** and **2**, preferably, a second sealing ring provides a hermetic connection between the piston shaft **230** and the protective casing. Alternatively, an interference fit between the piston shaft **230** and the protective casing provides a hermetic connection between them.

By using a second sealing ring or an interference fit to provide a hermetic connection between the piston shaft **230** and the protective casing, the high-pressure propellant external to the protective casing is prevented from entering the protective casing through spaces between the piston shaft **230** and the protecting casing. With this, the receptacle **300** is prevented from being subjected to pressure exerted by the propellant, which could have broken the receptacle **300**.

Preferably, the piston shaft **230** further comprises a flange portion **232**. A second sealing ring may provide a hermetic connection between the circumferential surface of this flange portion **232** and the protective casing. Alternatively, an interference fit between the circumferential surface of this flange portion **232** and the protective casing may provide a hermetic connection between them.

In particular, in the first, second and third embodiments to be described below, there is a hermetic connection between the circumferential surface of the flange portion **232** and the inner sidewalls of the inner case **210**. Amongst them, as shown in **FIG. 1**, in the first embodiment, a second sealing ring is provided on the circumferential surface of the flange portion **232** for a hermetic connection between it and the inner sidewalls of the inner case **210**. Whereas, as shown in **FIG. 2**, in the second embodiment, an interference fit between the flange portion **232** and the inner sidewalls of the inner case **210** provides a hermetic connection between them. In the case of a hermetic connection through interference fits, it should be noted that a person should be able to exert a force to cumulatively overcomes the aforementioned interference fit, as well as the interference fit between the inner case **210** and the inner walls of the inner case **210**, and the structural integrity of receptacle **300** for it to break. Else, a force of one or a few hundred kilograms would be required to overcome both interference fits, the operation of the aerosol container will be extremely difficult, and in turn, its efficiency is significantly reduced.

Through a hermetic connection between the circumferential surface of the flange portion **232** and the inner case **210**, the inner case **210** is protected from the high-pressure propellant external to it, which could have entered it from the outside through the piston shaft **230**. As such, an isolation of the internals of inner case **210** from the space external to it is achieved, which shall allow the receptacle **300** within the protective casing to be in a region of lower pressure, thereby preventing the receptacle **300** from being broken by the high-pressure propellant.

In an alternative implementation, the top end of the outer case **220** may also be at a position higher than the top end of the inner case **210**, with a hermetic connection between the circumferential surface of the flange portion **232** and the inner case **210**. Such an alternative implementation may also prevent the internals of the inner case **210** from having a connectivity with the space external to the inner case **210** through the top of the outer case **220**.

As shown in **FIGS. 3** and **6**, the receptacle **300** has characteristics such that its body is breakable, and may further be corrosion-resistant, with the base walls of the inner case **220** configured to have a projection **217**. The projection **217** abuts the receptacle base **320**, and the base of the piston shaft **230** abuts the receptacle shoulders **330**. It is also much preferred that the body of receptacle **300** is rigid, however, embodiments of the receptacle **300** may further extend to it having a pliable body that includes the aforementioned characteristics, with its pliable body breaking by being ruptured or punctured when receiving an external force that overcomes its structural integrity. Hence, the material composition of the receptacle **300** may be selected from a group of materials, which may be, but shall not be limited to glass, ceramics, corrosion-resistant plastics, plastics, or the like.

In particular, the projection **217** is configured to be at the centre of the inner case base walls **215**, having a frustoconical or conical shape that projects inwardly towards the

internals of the inner case **210**. After the receptacle **300** receives an applied force, preferably one that is in the downward direction, the projection **217** may break the receptacle base **320** of the receptacle **300**, causing content stored therein, to be released therefrom. The bottom portion of the piston shaft **230** may be provided with an accommodation space that accommodates the receptacle's upper portion **340**.

With the base of the piston shaft **230** being configured to abut the receptacle shoulders **330**, it is possible for the force exerted by the piston shaft **230** to be borne by the receptacle shoulders **330**, which may also be borne by the side walls of the receptacle's lower portion **350** in a shared manner. As such, there will be a transfer of forces to the receptacle base **320**, which shall cause it to abut the projection **217**, and may thereby cause the receptacle base **320** to break. This ensures that content stored within the bottle **300** flows out from the receptacle base **320**, and flows towards an internal space of the lower portion of the inner case **210**. The content will flow through the first connective channel **211** and the second connective channel **221** to flow out from the outer case **220** immediately thereafter. Finally, the content will then be sprayed out from the aerosol container under the entrainment of the propellant. With this, there is an increase in operational efficiency.

As shown in **FIGS. 3** and **6**, preferably, there is an annular area provided between the base of the projection **217** and the lower edges of the inner case side walls **214**, with it being the area in which the lower edges of the side walls of the receptacle abuts thereto after the receptacle base **320** is broken.

Though the annular area provided between the base of the projection **217** and the lower edges of the inner case side walls **214**, after the receptacle base **320** is broken, the lower edges of the side walls of the receptacle abut the annular area, thereby preventing further breakage of the receptacle through the lower edges of the side walls of the receptacle after the receptacle is broken. With this, the downward force exerted by the

receptacle side walls is then borne by the inner case base walls **215**. It is noted that it is possible as well to raise the angle between the side surfaces of the projection **217** and the horizontal plane while the height of the projection **217** remains the same. As such, this facilitates the concentration of an applied force, preferably in a downward direction, towards the upper ends of the side surface of the projection **217**, thereby causing the receptacle base **320** of the receptacle **300** to break.

As shown in **FIGS 3** and **6**, preferably, there is a third sealing ring between the piston shaft **230** and the protective casing that provides a hermetic connection between them. Alternatively, an interference fit between the piston shaft **230** and the protective casing provides a hermetic connection between them.

Through the third sealing ring or interference fit that provides a hermetic connection between the piston shaft **230** and the protective casing, the high-pressure propellant external to the protective casing is prevented from reaching the internals of the protective casing through spaces between the piston shaft **230** and the protective casing. Hence, the receptacle **300** is prevented from being subjected to the pressure force exerted by the propellant, which could have caused the receptacle **300** to break.

As shown in **FIGS 3** and **6**, preferably, the third sealing ring (not shown) provides a hermetic connection between the piston shaft **230** and the inner case **210**. Alternatively, an interference fit between the piston shaft **230** and the inner case **210** provides a hermetic connection between them.

In particular, in the embodiments that shall be described below, the height of the outer case **220** can be much shorter than the height of the inner case **210**. For example, the height of the outer case **220** may be 1/3, 1/4, or 1/5 the height of the inner case **210**. This shall allow the immediate realization of a hermetic connection between the piston shaft **230** and the upper body portion of the inner case **210**. Hence, this shall prevent

the high-pressure propellant external to the inner case **210** from entering it through spaces between the piston shaft **230** and the inner case **210**, which could have caused the receptacle **300** to break due to being subjected to high-pressure forces exerted by the propellant.

Evidently, in the embodiments that shall be described below, the protective casing of the protection assembly **200** protects the receptacle **300** from being broken. However, if the receptacle **300** breaks, perchance, while the inner case **210** is in the first position, as long as the inner case **210** remains in the first position, the protective casing may still prevent a mixing of fluids between (i) the fluid content that was stored in the receptacle **300** and (ii) the fluid in the place between the protection assembly **200** and the can body **100**, by retaining the fluid content that was stored in the receptacle **300** within the protective casing until the inner case **210** is made to move to the second position. Hence, the protective casing may be made of durable and non-breakable material, and it may further be corrosion-resistant.

Evidently, in the embodiments that shall be described below, upon breaking of the receptacle **300**, the remains of the broken receptacle **300** may be retained within the protective casing of the protection assembly **200** and shall not freely move about within the aerosol container.

FIG. 5 is a schematic illustration of the control valve of the aerosol container as per **FIGS. 1** to **3**. As shown in **FIG. 5**, preferably, the aerosol container further comprises a control valve **400**. The control valve **400** is positioned within the can body **100**, and provides a hermetic connection between the can body **100** and its components, which include a valve housing **410**, a valve stem **420** within the valve housing **410**, and a resilient member **430** for moving the valve stem **420** and for causing the valve housing **410** and the valve stem **420** to be in contact in a hermetic manner. The top end of the valve stem **420** axially passes through the top portion of the valve housing **410** in a

hermetic manner, while the bottom end of the valve stem **420** axially passes through the bottom portion of the valve housing **410**. When the valve stem **420** receives an applied force, the valve stem **420** acts upon the protective casing, whereby it shall move, preferably by means of pushing, the piston shaft **230** towards the receptacle **300**, having content therein, for the piston shaft **230** to exert the applied force onto the receptacle **300** to break it from its sealed state.

In particular, the aerosol container comprises a can body **100** and a mounting cup **500** is fitted onto the can body **100** in a hermetic manner. Whereas, the control valve **400** is positioned at the top portion of the can body **100** and is connected to it in a hermetic manner through the mounting cup **500**. More specifically, the valve housing **410** is positioned at the upper portion of the can body **100**, and an inner gasket **440** provides a hermetic connection between it and the mounting cup **500**. Moreover, the valve stem **420** and valve housing **410** are configured to slide relative to each other. When the valve housing **410** is in an initial state, the location in which the valve stem **420** passes through the top portion of the valve housing **410** is connected to the valve housing **410** in a hermetic manner, while the location in which the valve stem **420** passes through the bottom portion of the valve housing **410** is connected to the valve housing **410** in a hermetic manner. The resilient member **430** is installed onto the valve stem **420**, with one of its ends abutting the inner walls of the base of the valve housing **410**, and with the other end abutting locations along the valve stem body **423**, with it providing an upward elastic force to the valve stem **420**. This is so that when the valve stem **420** does not receive an externally applied force, the resilient member **430** does not experience compression, and continuously pushes the valve stem body **423** of the valve stem **420** to abut against the inner gasket **440**. It is noted that the resilient member may be a cylindrical helical compression spring.

The upper portion of the piston shaft **230** is to be configured to move relative to the valve housing **410** as well, with it being installed about the circumferential centre of

the valve housing **410** and the lower side portion of the valve housing **410**. Moreover, there is a counterbore present at the circumferential centre of the top end of the piston shaft **230**. When the valve stem **420** receives an applied force and is made to extend from the base of the valve housing **410** by a distance that is large enough, the valve stem **420** may penetrate the said counterbore and transfer the applied force to the base of the counterbore. This will cause a movement in the piston shaft **230**, which shall also cause a movement in the inner case **210** for eventually causing the receptacle **300** to break.

By having the valve stem **420** configured as such, it can cause a movement in the pistons shaft **230**, thereby converting an applied force originating from the outside of the aerosol container into a movement in the piston shaft **230**, so as to break the receptacle **300**, thereby increasing operational convenience of the aerosol container. Moreover, when there is no applied force originating from the outside of the aerosol container, the valve stem **420** remains in contact with the valve housing **410** in a hermetic manner under the influence of the resilient member **430**, thereby preventing propellant from leaking out from the can body **100**.

As shown in **FIG. 5**, preferably, the side walls of the valve housing **410** are configured to have a third connective channel **411**. This third connective channel **411** is to provide a connectivity between a first space and a second space. The first space is defined to be a space between the valve housing **410** and the valve stem **420**, while the second space is defined to be a space that is the internals of the can body **100**. The inner-side surfaces of the top portion of the piston shaft **230** are to be connected to the valve housing **410** in a hermetic manner. The top portion of the piston shaft **230** is to be used for blocking or unblocking the third connective channel **411**.

In particular, there is a hermetic connection between the inner side surfaces of the top portion of the piston shaft **230** and the valve housing **410**. When the valve stem **420** is

moved downwardly to be at a position above the third connective channel **411** while not causing a movement in the piston shaft **230**, the propellant may be prevented from flowing through the third connective channel. Moreover, after the valve stem **420** pushes piston shaft **230** for breaking the receptacle **300**, the aforementioned hermetic connection will now be positioned below the third connective channel **411**, which shall not disturb the propellant and content flowing within the third connective channel **411**.

Through the provision of a third connective channel **411**, the propellant may enter the valve housing **410** through the sidewalls of the valve housing **410**. Moreover, when the valve stem **420** is at a closed position while not causing a movement in the piston shaft **230**, the piston shaft **230** may block off the third connective channel **411**. With the piston shaft **230** blocking off the propellant from entering the third connective channel **411**, the leakage of propellant from the aerosol container is prevented, thereby providing the aerosol container with an enhanced leakage prevention. Moreover, when the aerosol container is to be used in an inverted manner after the receptacle **300** is broken, the content, having been released from the receptacle **300** and entrained with the propellant external to the outer case **220**, may enter the valve housing **410** through the third connective channel **411** to be eventually sprayed out from the aerosol container.

As shown in **FIG. 5**, preferably, there is a hermetic connection between the lower portion of the valve stem **420** and a through-hole at the base of the valve housing **410**. The centre portion of the valve stem **420** has a guide channel **421**. When the lower portion of the valve stem **420** passes through and protrudes out from the valve housing **410** at a maximum value, the guide channel **421** establishes a connectivity between a first space and a second space. The first space is defined as a space between the valve housing **410** and the valve stem **420**, while the second space is defined as a space between valve housing **410** and the internals of the can body **100**. When the valve stem **420** is not depressed, the entirety of the guide channel **421** is to be within the valve housing **410**.

In particular, the location of a hermetic connection between the lower portion of the valve stem **420** and the through-hole at the base of the valve housing **410** is located below the aforementioned guide channel **421**. When the valve stem **420** is not depressed, the hermetic connection between the lower portion of the valve stem **420** and the through-hole at the base of the valve housing **410** remains unchanged, and the entirety of the guide channel **421** remains within the valve housing **410**. Hence, no connectivity is established between the inside and outside of the valve housing **410** at its base.

With the guide channel **421** being at the base of the valve stem **420**, and with a hermetic connection between the lower portion of the valve stem **420** and the through-hole at the base of the valve housing **410**, when the valve stem **420** is not depressed, it is possible for the valve stem **420** block off the connectivity between the inside and outside of the valve housing **410** at the base of the valve housing **410**. Whereas, when the valve stem **420** is depressed, it is possible for the valve stem **420** to establish the connectivity between the inside and outside of the valve housing **410** at the base of the valve housing **410**. Hence, this will result in an increased velocity in spray flow as there is now an increased channel area for gas within the can body **100** to flow out through the valve housing **410**.

As shown in **FIG. 5**, preferably, the guide channel **421** further comprises a flow-guiding groove that is parallel to the radial direction of the valve stem **420** or along the radial direction of the valve stem **420**. The flow-guiding groove is at least recessed at the peripheral surface of the lower portion of the valve stem **420** and extends along the axial direction of the valve stem **420**, When the lower portion of the valve stem **420** passes through and protrudes out from the valve housing **410** at a maximum value, portions of the flow-guiding groove are located within the valve housing **410**, and its remaining portions located outside of the valve housing **410**.

In particular, the guide channel **421** may be formed by the flow-guiding groove that is machined onto the middle portion of the valve stem **420**, with the flow-guiding groove machined in a direction that is parallel to the radial direction of the valve stem **420** or along the radial direction of the valve stem **420**. The flow-guiding groove that forms the guide channel **421** may be in the form of a counterbore groove, which may or may not extend transversely through the middle portion of the valve stem **420**. In an alternative embodiment, the flow-guiding groove that forms the guide channel **421** may be in the form of a trench groove that is dug at the sides of the middle portion of the valve stem **420**, as long as the cross-sectional shape of through-holes (e.g., circular shape) that may be along valve stem **420** is compromised. In a further alternative embodiment, the flow-guiding groove that forms the guide channel **421** may be in the form of blind holes whereby two parallel blind holes are drilled onto the middle portion of the valve stem **420** along its radial direction, with a third blind hole drilled at the base of the valve stem **420** for connecting both of the aforementioned blind holes. The outer end of the third blind hole will then be plugged.

As shown in **FIG. 5**, the top portion of the valve stem **420** has a discharge channel **422**, which further comprises an outlet on the tip of the valve stem **420** and an inlet at the upper side portions of the valve stem **420**.

In particular, when the valve stem **420** is not depressed, the inlet is to be located at the through-hole at the top portion of the valve housing **410**. The location of a hermetic connection between the valve stem **420** and the inner gasket **440**, for example, the location where the top portion of the aforementioned valve stem body **423** abuts the inner gasket **440**, is to be located below the inlet. When the valve stem **420** is depressed, the inlet of the discharge channel **422** will now be located below the through-hole at the top portion of the valve housing **410**, and the inlet shall not be restricted by the sealed connection between the valve stem **420** and the top portion of the valve housing **410**. Hence, when the valve stem **420** is depressed, a mixture of propellant and content

in the space within the valve housing **410** will be discharged out through the discharge channel **422**, and will be sprayed out from the aerosol container through a spray nozzle which is to be described below.

Not only that, the aerosol container further comprises a spray nozzle (not shown), which is to be installed over the top portion of the valve stem **420** and above the mounting cup **500**. The spray nozzle may be referred to as a press-type spray nozzle or a cap-type spray nozzle, and is to be primarily used for actuating the valve stem **420** for spraying content out from the container. Since this component is to be a conventional product within the art, it shall not be described further.

Furthermore, besides the control valve **400** as shown in **FIG. 5**, the control valve **400** may be of the embodiment that has been previously disclosed in the Chinese Patent CN113631488A. The description of such an embodiment shall not be repeated herein.

As shown in **FIGS 1, 2, 3,** and **6**, preferably, the aerosol container further comprises mixing members **600** in the form of mixing balls, which are disposed between the protective casing and the can body **100**.

Normally, when the aerosol container is stored or transported, it is in an upright manner with its top portion oriented upwards. The mixing members **600** will then be located at the bottom of the space between the protective casing and the can body **100**. Hence, in the third and fourth embodiments to be described below, even though the outer case **220** is configured to only cover the bottom portion of the inner case **210**, the protective function of the protective casing will still be provided.

In order to provide a clearer presentation of the implementation of the present application, its three embodiments shall now be described in detail. These three embodiments differ mainly in the manner in which the inner case **210** and the outer case

220 are arranged, and the manner in which the receptacle **300** is made broken by the components of the aerosol container. Hence, only these aspects shall be described for each of the following embodiments. The remaining descriptions that may pertain to the structure and principles of these embodiments are regarded to have been completely described above, and thus, shall not be repeated.

First Embodiment:

As shown in **FIG. 1**, in this embodiment, the top portion of the outer case **220** is located at the lower portion of the inner case **210**, with the inner case **210** having the inner case body. The pressure-application section **231** of the piston shaft **230** is to abut the top surface of the inner case **210**. But prior to the use of the aerosol container, the pressure-application section **231** of the piston shaft **230** may or may not abut the top surface of the inner case **210**. Whereas, the receptacle **300** is positionally orientated in an inverted manner, with its receptacle tip **310** abutting the inner walls of the inner case base walls **215**. The circumferential surface of the flange portion **232** of the piston shaft **230** has a second sealing ring **233** disposed thereupon, which provides a hermetic connection between the flange portion **232** and the top portion of the inner case **210**. Regardless of the relative movement between the piston shaft **230** and the inner case **210**, the hermetic connection between the flange portion **232** and the top portion of the inner case **210** remains.

Moreover, a first sealing ring **212** provides a hermetic connection between the base of the inner case side walls **214** and the outer case **220**. Prior to the use of the aerosol container, the first sealing ring **212**, the first connective channel **211**, the first sealing ring **212**, and the second sealing ring **233** are arranged in a sequential manner from top to bottom. The first sealing ring **212**, which is positioned below the first connective channel **211**, blocks off a connectivity between the first connective channel **211** and the second connective channel **221**. The first sealing ring **212**, which is

positioned above the first connective channel **211**, blocks off a connectivity between the first connective channel **211** and the top portion of the outer case **220**.

The principle of operation of the first embodiment is as follows:

Prior to the use of the aerosol container, the valve stem **420** is pushed upwards by the resilient member **430**, for an end of the valve stem body **423** of the valve stem **420** to be in a hermetic connection with the inner gasket **440**. Hence, there will be no connectivity between the internals of the valve housing **410** and the upper portion of the valve housing **410**, and as such, there will be no connectivity to the discharge channel **422**. The entirety of the guide channel **421** located in the middle portion of the valve stem **420** remains within the valve housing **410**, and will not establish a connectivity between the inside and the outside of the valve housing **410**. The top portion of the piston shaft **230** blocks the third connective channel **411** that is located at the side walls of the valve housing **410**. As such, the propellant within the can body **100** will not be allowed to enter the internals of the valve housing through the third connective channel **411**.

As the inner case **210** is located at the aforementioned first position, the first connective channel **211**, the first sealing ring **212**, and the second sealing ring **233** are arranged sequentially from top to bottom. The first sealing ring **212** blocks off a connectivity between the first connective channel **211** and the second connective channel **221**. Moreover, there is a hermetic connection between the top portion of the inner case **210** and the flange portion **232** of the piston shaft **230**. With this, the receptacle **300** will not be subjected to the pressure force exerted by the propellant, which could have broken the receptacle **300**.

When the valve stem **420** starts being depressed by an applied force, the valve stem **420** moves the base of the counterbore located on the top portion of the piston

shaft **230**, thereby causing a downward movement in the piston shaft **230**. With this, first, the pressure-application section **231** of the piston shaft **230** transfers the applied force to the receptacle base **320** of the receptacle **300**. Then, the receptacle tip **310** of the receptacle **300** moves the inner case base walls **215** of the inner case **210**. Then, the inner case **210** will move relative to the outer case **220**, preferably in a downwards manner, for the inner case **210** to reach the aforementioned second position. This causes the first sealing ring **212** to move downwards and move past the second connective channel **221**, thereby allowing a connectivity to be established between the first connective channel **211** and the second connective channel **221**. It is most preferable that both of these channels **211, 221** are aligned to each other.

After the inner case **210** fully moves to its proper position, should the applied force be continuously applied in a gradually increasing manner, the piston shaft **230** will continuously exert this applied force onto the receptacle **300**. When the receptacle **300** is finally unable to withstand this applied force, the receptacle base **320** of the receptacle **300** will be broken by the pressure-application section **231**, and as such, the content stored within the receptacle **300** is released therefrom into the inner case **210**. Then, the content within the inner case **210** will flow out from the outer case **220** through the first connective channel **211** and the second connective channel **221**. With this, the content is then mixed with the propellant with the aid of the mixing members **600** for an improved mixing effect.

At this point, since the valve stem **420** has moved relative to the valve housing **410**, preferably in a downward manner, the guide channel **421**, which is located in the middle portion of the valve housing **410**, has its upper end and lower end each now located above and below the base of the valve housing **410** respectively. This shall allow the guide channel **421** to establish a connectivity between the inside and the outside of the valve housing **410**. However, since the base of the valve housing **410** is in a hermetic contact with the piston shaft **230**, the propellant and the content will not

enter the valve housing **410** through the guide channel **421**. The third connective channel **411** located on the side walls of the valve housing **410** will not be covered by the piston shaft **230**. Should the aerosol container be used in an inverted manner though, a mixture of propellant and content may enter the internals of the valve housing **410** through the guide channel **421**. Hence, the mixture of propellant and content located between the valve housing **410** and can body **100** may still enter the valve housing **410**. At this point as well, the inlet of the discharge channel **422** at the upper portion of the valve stem **420** will now be located within the valve housing **410**, which will naturally allow the mixture to be sprayed out from the aerosol container by it flowing through the discharge channel **422** and the nozzle (not shown).

Second Embodiment:

As shown in **FIG. 2**, the differences between the first embodiment and this second embodiment are as follows:

(i) in the first embodiment, a first sealing ring **212** provides a hermetic connection between the inner case **210** and the outer case **220**, whereas, in this second embodiment, an interference fit between the inner case **210** and the outer case **220** provides a hermetic connection between them; and

(ii) in the first embodiment, a second sealing ring **233** provides a hermetic connection between the circumferential surface of the flange portion **232** and the top portion of the inner case, whereas, in the second embodiment, an interference fit between the circumferential surface of the flange portion **232** and the top portion of the inner case **210** provides a hermetic connection between them.

The remaining descriptions that may pertain to the structure and principles of the second embodiment are similar to that of the first embodiment, and thus, shall not be repeated.

It should be noted that in alternative embodiments, the means that provide a hermetic connection between the inner case **210** and the outer case **220** may differ from the means that provide a hermetic connection between the circumferential surface of the flange portion **232** and the top portion of the inner case **210**. For example, the first sealing ring **212** may provide a hermetic connection between the inner case **210** and the outer case **220**, while an interference fit between the circumferential surface of the flange portion **232** and the top portion of the inner case **210** provides a hermetic connection between them. Other than that, an interference fit between the inner case **210** and the outer case **220** provides a hermetic connection between them, while a second sealing ring **233** may provide a hermetic connection between the circumferential surface of the flange portion **232** and the top portion of the inner case **210**.

Third Embodiment:

FIG. 4 is a schematic illustration of the aerosol container of the present invention in its third embodiment in a configuration whereby its piston shaft **230** had moved its inner case **210** to assume a certain position. As shown in **FIGS 3** and **4**, in this embodiment, the outer case **220** does not fully cover the entire height of the inner case **210**, for example, it may only cover the lower portion of the inner case **210** by 1/4, 1/5, or 1/6 of the height of the inner case **210**.

Moreover, the first connective channel **211** of the inner case **210** is configured to be at the base of the inner case **210**. As such, the outer case **220** is only required to cover the lower portion of the inner case **210**, thereby preventing a connectivity between the first connective channel **211** of the inner case **210** and the externals of the outer case **220**. In particular, in this embodiment, at the above and the below of the first connective channel **211**, the inner case **210** has an essentially hermetic connection with the outer case **220**, the means by which may be done through, for example, an interference fit between them, for preventing a connectivity between the first connective channel **211** and the externals of the outer case **220**. Hence, the outer case

220 may cover a local height of the lower portion of the inner case **210**. The height of the outer case **220** plays a role in guiding the movements of the inner case **210**, as well as indirectly guiding the movements of the piston shaft **230**. As such, it is not necessary for the outer case **220** to have a height that covers the entire height of the inner case **210** or the receptacle **300**.

The inner sides of the top portion of the inner case **210** and the outer sides of the piston shaft **230** may have a hermetic connection between them through a third sealing ring or an interference fit between them. This shall prevent pressure exerted by the propellant from the can body **100** from acting upon the receptacle **300**.

In this embodiment, the receptacle **300** is configured to be oriented in an upright manner, with the receptacle tip **310** of the receptacle **300** facing upwards and the receptacle base **320** of the receptacle **300** facing downwards. The base of the piston shaft **230** may abut the receptacle shoulders **330** of the receptacle **300**. Moreover, the inner side surfaces of the inner case base walls **215** are configured to have projection **217**. When the receptacle **300** is subjected to an applied force, the receptacle base **320** of the receptacle **300** may break for content stored therein to be released. Moreover, at the inner case base walls **215**, there is an annular area in between the projection **217** and the inner case side walls **214**.

The principle of operation of the third embodiment is as follows:

Components and operations related to the control valve **400** may be referenced from the descriptions of the first embodiment, and thus, shall not be repeated. The following shall only describe operations relating to the breaking of the receptacle **300**, and the relative movements between the inner case **210** and the outer case **220**.

As shown in **FIG. 3**, when the aerosol container is not in use, since the inner case is at its aforementioned first position, the first connective channel **211** and the

second connective channel are blocked off from each other. Moreover, there is a hermetic connection between the top portion of the inner case **210** and the piston shaft **230**. As such, the receptacle **300** will not be subjected to the pressure force exerted by the propellant, and the receptacle **300** shall not be broken by this pressure force.

When the valve stem **420** is depressed by an applied force, the valve stem **420** moves the base of the counterbore on the piston shaft **230**, thereby causing a movement in the piston shaft **230**, preferably in the downward direction. With this, first, the base of the piston shaft **230** abuts the bottle shoulder **330** of the receptacle **300**, with the applied force being transferred across the bottle's lower portion **350**, so that the receptacle base **320** is eventually held against the projection **217**. As the piston shaft **230** continuously moves in a downwards manner, the receptacle **300** shall begin to move and abut the inner case **210**, causing them to move together, preferably in a downwards manner. With this, the inner case **210** shall then reach the aforementioned second position, where a connectivity is established between the first connective channel **211** and the second connective channel **221**. It is most preferable that both of these channels **211, 221** are aligned to each other.

After the inner case **210** has fully moved into position, the applied force is exerted onto the piston shaft **230** by the valve stem **420**. The receptacle base **320** of the receptacle **300** may not withstand this increasing applied force and may be broken by the projection **217**, thereby causing content stored within the receptacle **300** to be released into the inner case **210**. With this, the content, now within the inner case **210** will flow out to the outside of the outer case **220** through the first connective channel **211** and the second connective channel **220**. The content will then be then mixed with the propellant with the aid of the mixing members **600** for an improved mixing effect.

In this embodiment, since the lower portion of the piston shaft **230** has a through-hole that runs across it in a vertical direction, the ends of the through-hole

provide a connectivity between a space external to the outer sides of the receptacle tip **310** of the receptacle **300** and a counterbore at the circumferential centre of the top surface portion of the piston shaft **230**. Hence, after the receptacle **300** is broken, the content, under the entrainment of the propellant, may move upwards through this through-hole to reach a space within the counterbore at the circumferential centre of the top surface portion of the pistons shaft **230**. Then, it will flow through the guide channel **421** to enter the valve housing **410**, and eventually, be sprayed out from the aerosol container by it flowing through the discharge channel **422** and the nozzle (not shown).

Fourth Embodiment:

FIG. 6 is a schematic illustration of the aerosol container in a fourth embodiment, which is similar to the aerosol container in the third embodiment as shown in **FIGS 3** and **4** but with some differences in its construction and operation.

The difference between the third embodiment and this fourth embodiment is as follows:

(i) in the third embodiment, its piston shaft **230** and its valve stem **420** are configured to move axially with respect to each other when an applied force is applied onto the valve stem **420** so that the applied force is transferred and exerted onto the receptacle **300** for it to eventually break. Whereas, in this fourth embodiment, its piston shaft **230** and its valve stem **420** are configured to move axially and radially with respect to each other. More specifically, in this fourth embodiment its piston shaft **230** and its valve stem **420** are in a threaded engagement with each other. When an applied force is exerted onto the valve stem **420** in the form of torque, this applied force is transferred and exerted onto the receptacle **300** by the piston shaft **230**, for the receptacle **300** to eventually break. The rotational motion of the applied force in the form of torque may be in a clockwise or anti-clockwise direction depending on threads on the piston shaft **230** and its valve stem **420**.

The remaining descriptions that may pertain to the structure and principles of this fourth embodiment are similar to that of the third embodiment, and thus, shall not be repeated. The structure and principles of this fourth embodiment may similarly be further extended to the first embodiment and the second embodiment.

It should be noted that besides this fourth embodiment as shown, there may be further alternative embodiments with alternative configurations that allow the piston shaft **230** to provide a force that breaks the receptacle **300**.

In certain alternative embodiments, the piston shaft **230** may interact with other components within the aerosol container other than the valve stem **420** for it to provide a force that breaks the receptacle **300**, which may be, by way of example, include other components of the control valve, the protection assembly **200** (if so configured), mounting cup **500** (if so configured), or the mixing members **600** (is so configured).

In certain alternative embodiments, the force applied by the piston shaft **230** onto the receptacle **300** for breaking it may originate from any other direction besides as described. For example, the piston shaft **230** may apply or exert a force in an upwards direction, sideways direction, or diagonal direction for breaking the receptacle **300**. The piston shaft **230** may also be configured to receive and exert forces in one or more directions for breaking the receptacle **300**. However, it is preferred that it is still ensured that connective channels **211**, **221** of the protective casing become connected during or after breaking the receptacle **300**, so that contents of the receptacle **300** are released therefrom to a space external to the protective casing.

The principle of operation of the fourth embodiment is as follows:

Components and operations related to the protective casing of the protection assembly **200** and certain components of the control valve **400** may be referenced from the descriptions of the third embodiment, and thus, shall not be repeated. The following

shall only describe operations relating to the breaking of the receptacle **300** due to relative movements between the valve stem **420** of the control valve **400** and the piston shaft of the protection assembly **200**.

As shown in **FIG. 6**, when the aerosol container is not in use, threaded portions of the valve stem **420** are to be substantially within a threaded counterbore of the piston shaft **230** that is located at the top portion of the piston shaft **230**. Preferably, the threads of the valve stem **420**, or portions thereof, are in engagement with the threads of the piston shaft **230**.

As shown in **FIG. 7** and **FIG. 8**, this fourth embodiment may further include a corresponding nozzle **A1** that may be fitted over its control valve **400** that is configured to facilitate the provision of an applied force to the valve stem **420**. More specifically, as shown in **FIG. 8**, the corresponding nozzle **A1** may further be integrated with one or more rods **A11** that act as levers that receive an applied force in the form of torque through a rotational motion.

As this fourth embodiment undergoes use, the rods **A11** on the nozzle **A** are rotated to rotate the valve stem **420**. With this, the valve stem **420** moves axially and radially according to the threads of the counterbore of the piston shaft **230**, preferably in a downward direction. The valve stem **420** is to travel along said counterbore until it reaches the base of the counterbore. Preferably, upon a continued application of torque onto the valve stem **420**, the torque is transferred to the piston shaft **230** as an applied force that is exerted onto the base of the said counterbore. With this, the piston shaft **230** exerts the applied force onto the receptacle **300** so that the receptacle **300** breaks and releases its contents. While doing so, the conductive channels **211**, **221** of the protective casing may become connected for the content to reach the space external to the protective casing.

Fifth Embodiment:

FIG. 9 is a schematic illustration of the aerosol container in a fifth embodiment, and **FIG. 10 is** an illustration of an external perspective view of the aerosol container of the fifth embodiment, with its corresponding nozzles **B1**, **B2**. This fifth embodiment is a derivative of the aerosol container of the third embodiment as shown in **FIGS 3** and **4**. More specifically, this fifth embodiment has at least two control valves to provide a multi-spray configuration. Preferably, this fifth embodiment has a first control valve **700** which is similar to the control valve **400** of the third embodiment that may be fitted with a corresponding nozzle **B1**, and a second control valve **800** which is an additional control valve that may be with a corresponding nozzle **B2** that serves to spray content out from the aerosol container under the entrainment of the propellant.

Preferably, the descriptions that may pertain to the structure and principles of the first control valve **700** are similar to that of control valve **400** of the third embodiment, and thus, shall not be repeated. Alternatively, the first control valve **700** may be of the embodiment that has been previously disclosed in the Chinese Patent CN113631488A, and the description of such an embodiment shall not be repeated herein

Preferably, the second control valve **800** may substantially be similar to a conventional control valve connected to a dip tube **810**, for spraying content from the aerosol container to the external environment under the entrainment of the propellant. Alternatively, the second control valve **800** may substantially be similar to the embodiment that has been previously disclosed in the Chinese Patent CN113631488A, and the description of such an embodiment shall not be repeated herein.

In particular, in this fifth embodiment, the first control valve **700** and the second control valve **800** are preferably positioned along the aerosol container to be aligned with each other, with the protection assembly **200**, having the receptacle **300** therein,

disposed in-between them. Preferably, the components of the first control valve **700** interact with protection assembly **200** for breaking the receptacle **300** therein. Preferably, the second control valve **800** supports the protection assembly **200** by providing a support structure **820** for the protective casing of the protection assembly **200** to rest against. With this, the protection assembly **200** may remain substantially upright between the first control valve **700** and the second control valve **800**.

The remaining descriptions that may pertain to the structure and principles of this fifth embodiment are similar to that of the third embodiment, especially regarding the protection assembly **200** and the receptacle **300**, and thus, shall not be repeated. The structure and principles of this fifth embodiment may similarly be further extended to the protection assembly **200** and the receptacle **300** of the first embodiment and the second embodiment.

The principle of operation of the fifth embodiment is as follows:

Components and operations related to the protective casing of the protection assembly **200** and certain components of the first control valve **700** may be referenced from the descriptions of the third embodiment as shown in **FIGS 3** and **4**, and thus, shall not be repeated. Operations relating to the breaking of the receptacle **300** due to relative movements between the valve stem **420** of the first control valve **700** and the piston shaft of the protection assembly **200** may be referenced from the descriptions of the third embodiment as shown in **FIGS 3** and **4**, and thus, shall not be repeated.

Sixth Embodiment:

FIG. 11 is a schematic illustration of the aerosol container in a sixth embodiment, and **FIG. 12** is an illustration of an external perspective view of the aerosol container of the sixth embodiment, with its corresponding nozzles **C1**, **C2**. This sixth embodiment is derivative of the aerosol container of the fourth embodiment as shown in **FIGS 6** to **8**. More specifically, this sixth embodiment has at least two control

valves to provide a multi-spray configuration. Preferably, this sixth embodiment has a first control valve **900** which is similar to the control valve **400** of the third embodiment that may be fitted with a corresponding nozzle **C1** having one or more rods **C11** that act as levers, and a second control valve **1000** which is an additional control valve that may be fitted with a corresponding nozzle **C2** that serves to spray content out from the aerosol container under the entrainment of the propellant.

Preferably, for this sixth embodiment, the descriptions that may pertain to the structure and principles of its first control valve **900** are similar to that of control valve **400** of the fourth embodiment, and thus, shall not be repeated. Alternatively, its first control valve **900** may be of the embodiment that has been previously disclosed in the Chinese Patent CN113631488A, and the description of such an embodiment shall not be repeated herein

Preferably, for this sixth embodiment, its second control valve **1000** may substantially be similar to a conventional control valve connected to a dip tube **1010**, for spraying content from the aerosol container to the external environment under the entrainment of the propellant. Alternatively, the second control valve **1000** may substantially be similar to the embodiment that has been previously disclosed in the Chinese Patent CN113631488A, and the description of such an embodiment shall not be repeated herein.

In particular, in this sixth embodiment, its first control valve **900** and its second control valve **1000** are preferably positioned along the aerosol container to be aligned with each other, with the protection assembly **200**, having the receptacle **300** therein, disposed in-between them. Preferably, the components of its first control valve **900** interact with its protection assembly **200** for breaking the receptacle **300** therein. Preferably, the second control valve **1000** supports the protection assembly **200** by providing a support structure **1020** for the protective casing of the protection assembly

200 to rest against. With this, the protection assembly **200** may remain substantially upright between the first control valve **900** and the second control valve **1000**.

The remaining descriptions that may pertain to the structure and principles of this sixth embodiment are similar to that of the fourth embodiment, especially regarding the protection assembly **200** and the receptacle **300**, and thus, shall not be repeated. The structure and principles of this sixth embodiment may similarly be further extended to the protection assembly **200** and the receptacle **300** of the first embodiment and the second embodiment.

The principle of operation of the sixth embodiment is as follows:

Components and operations related to the protective casing of the protection assembly **200** and certain components of the first control valve **900** may be referenced from the descriptions of the fourth embodiment as shown in **FIGS 6** to **8**, and thus, shall not be repeated. Operations relating to the breaking of the receptacle **300** due to relative movements between the valve stem **420** of the first control valve **900** and the piston shaft of the protection assembly **200** may be referenced from the descriptions of the fourth embodiment as shown in **FIGS 6** to **8**, and thus, shall not be repeated.

It is to be noted that, unless stated otherwise, the technical or scientific terms used herein are to be taken as terms that are commonly understood by those persons having ordinary skill in the art to which this invention belongs.

Within the description of the present application, it shall be understood that terms that indicate an orientation or positional relationship based on the drawings such as "length", "width", "thickness", or the like, are intended for providing a convenient and simplified description of the invention. These terms are not intended to indicate or imply that devices or elements as described are required to have a particular orientation, or to be

constructed and operated in a particular orientation. As such, these terms may not be construed as limiting to the present invention.

Furthermore, it will be understood that, the terms “first”, “second”, etc. used in the description are for descriptive purposes. These terms are not intended to be interpreted as an indication or implication of a relative importance in the features, or as an implicit indication of the number of features.

Furthermore, it will be understood that, spatially relative terms, such as “upper”, “lower”, “top”, “bottom”, “downwards”, “upwards”, and the like, may be used herein for ease of description to describe one element or feature's relationship to another element or feature as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the aerosol container in use or operation in addition to the orientation depicted in the figures. For example, if the aerosol container in the figures is turned over, elements described as “upper” other elements or features would then be oriented “lower” the other elements or features. Thus, the exemplary term “upper” can encompass both an orientation of above and below. The aerosol container may be otherwise oriented and the spatially relative descriptors used herein are interpreted accordingly.

Finally, it should be noted that the descriptions of the above embodiments are to illustrate the technical solutions provided by the present invention in a non-limiting manner. Although the present invention has been described in detail with reference to the foregoing embodiments, it will be understood by those skilled in the art that the technical solutions as described in these foregoing embodiments may be modified or substituted with equivalents for some or all of the technical features thereof. Such modifications or substitutions will not cause a substantial departure from the scope of the embodiments of the present invention, and are intended to be included in the claims and the description of the present invention. Numerous changes in the details of

construction and the combination and arrangements of features in the various embodiments may be resorted thereto as long there are no structural conflicts. As a final note, the present invention shall not be limited to any particular disclosed embodiments, but will include all technical solutions that fall within the scope of the claims.

CLAIMS

1. An aerosol container comprising

a can body (100);

a receptacle (300); and

a protection assembly (200);

wherein

the receptacle (300) is located within the can body (100) for hermetically storing content; and

the protection assembly (200) is located within the can body (100) and external to the receptacle (300) for isolating the receptacle (300) from a space external to the protection assembly (200) prior to use of the aerosol container.

2. The aerosol container according to claim 1, wherein the protection assembly (200) comprises a protective casing, and a piston shaft (230) in connection with the protective case that is configured to apply pressure to the receptacle (300) for breaking it so that its content is released therefrom.

3. The aerosol container according to claim 2, wherein the protective casing comprises an inner case (210) and an outer case (220), with

the outer case (220) covering at least an outer lower portion of the inner case (210); and

the inner case (210) covering at least an outer lower portion of the receptacle (300).

4. The aerosol container according to claim 3, wherein

the inner case (210) comprises a first connective channel (211) at its lower portion; and

the outer case (220) comprises a second connective channel (221) at its lower portion.

5. The aerosol container according to claim 4, wherein the inner case (210) and the outer case (220) are arranged to move relative to each other, with the inner case (210) movable from a first position to a second position.

6. The aerosol container according to claim 5, wherein

the first connective channel (211) and the second connective channel (221) are blocked off from each other when the inner case (210) is at the first position; and

the first connective channel (211) and the second connective channel (221) are connected to each other when the inner case (210) is at the second position.

7. The aerosol container according to claim 6, wherein the first connective channel (211) and the second connective channel (221), when the inner case (210) is at the first position, are blocked off at locations being

between the first connective channel (211) and the second connective channel (212); and

between the first connective channel (211) and the top portion of the outer case (220).

8. The aerosol container according to claim 7, wherein the inner case (210) is connected to the outer case (220) through a first sealing ring (212) in a hermetic manner; or

the inner case (210) is connected to the outer case (220) through an

interference fit between them in a hermetic manner.

9. The aerosol container according to any one of claims 2 to 8, wherein the piston shaft (230) comprises a pressure-application section (231) that applies pressure to the receptacle (300).

10. The aerosol container according to any one of claim 9, wherein the receptacle (300)

has its receptacle tip (310) abutting base walls (215) of the inner case (210); and

has an outer portion of its base (320) being abutted by the pressure-application section (231) of the piston shaft (230) which applies pressure thereto.

11. The aerosol container according to any one of claims 2 to 10, wherein

the piston shaft (230) is connected to the protective casing through a second sealing ring in a hermetic manner; or

the piston shaft (230) is connected to the protective casing through an interference fit between them in a hermetic manner.

12. The aerosol container according to claim 11, wherein the piston shaft (230) has a flange portion (232), with a peripheral surface of the flange portion (232) being

connected to the protective casing through the second sealing ring in a hermetic manner; or

connected to the protective casing through an interference fit between them in a hermetic manner.

13. The aerosol container according to any one of claims 2 to 12, wherein the receptacle (300) has

its base (320) abutted by a projection (217) of the inner case (210) that formed on an inner surface portion of base walls (215) of the inner case (210); and

its shoulders (330) abutted by a bottom portion of the piston shaft (230).

14. The aerosol container according to claim 13, wherein the projection (217) of the protective casing and lower edges of the inner case (210) have an annular area therebetween, for abutting lower edges of the receptacle (300) after the receptacle base (320) is broken.

15. The aerosol container according to any one of claims 2 to 14, wherein

the piston shaft (230) is connected to the protective casing through a third sealing ring in a hermetic manner; or

the piston shaft (230) is connected to the protective casing through an interference fit between them in a hermetic manner.

16. The aerosol container according to claim 15, wherein

the piston shaft (230) is connected to the inner case (210) through the third sealing ring in a hermetic manner; or

the piston shaft (230) is connected to the inner case (210) through an interference fit between them in a hermetic manner.

17. The aerosol container according to any one of claims 2 to 16, further comprising a control valve (400), which comprises

a valve housing (410) disposed within the can body (100) in a hermetic manner;

a valve stem (420), which is disposed within the valve housing (410); and

a resilient member (430), for pushing the valve stem (420) so that the valve stem (420) and valve housing (410) remain connected in a hermetic manner.

18. The aerosol container according to claim 17, wherein the valve stem (420) has its tip passed through an upper portion of the valve housing (410) along the axial direction; and

its bottom end passed through a lower portion of the valve housing (410) along the axial direction, such that when the valve stem (420) moves towards the protective casing, the valve stem (420) pushes the piston shaft (230) for the piston shaft (230) to break the receptacle (300) so that the content is released therefrom.

19. The aerosol container according to claim 17 or 18, further comprising additional control valves.

20. The aerosol container according to any one of the preceding claims, wherein the receptacle (300) is breakable and corrosion-resistant.

21. The aerosol container according to any one of the preceding claims, further comprising mixing members (600) disposed between the protection assembly (200) and the can body (100).

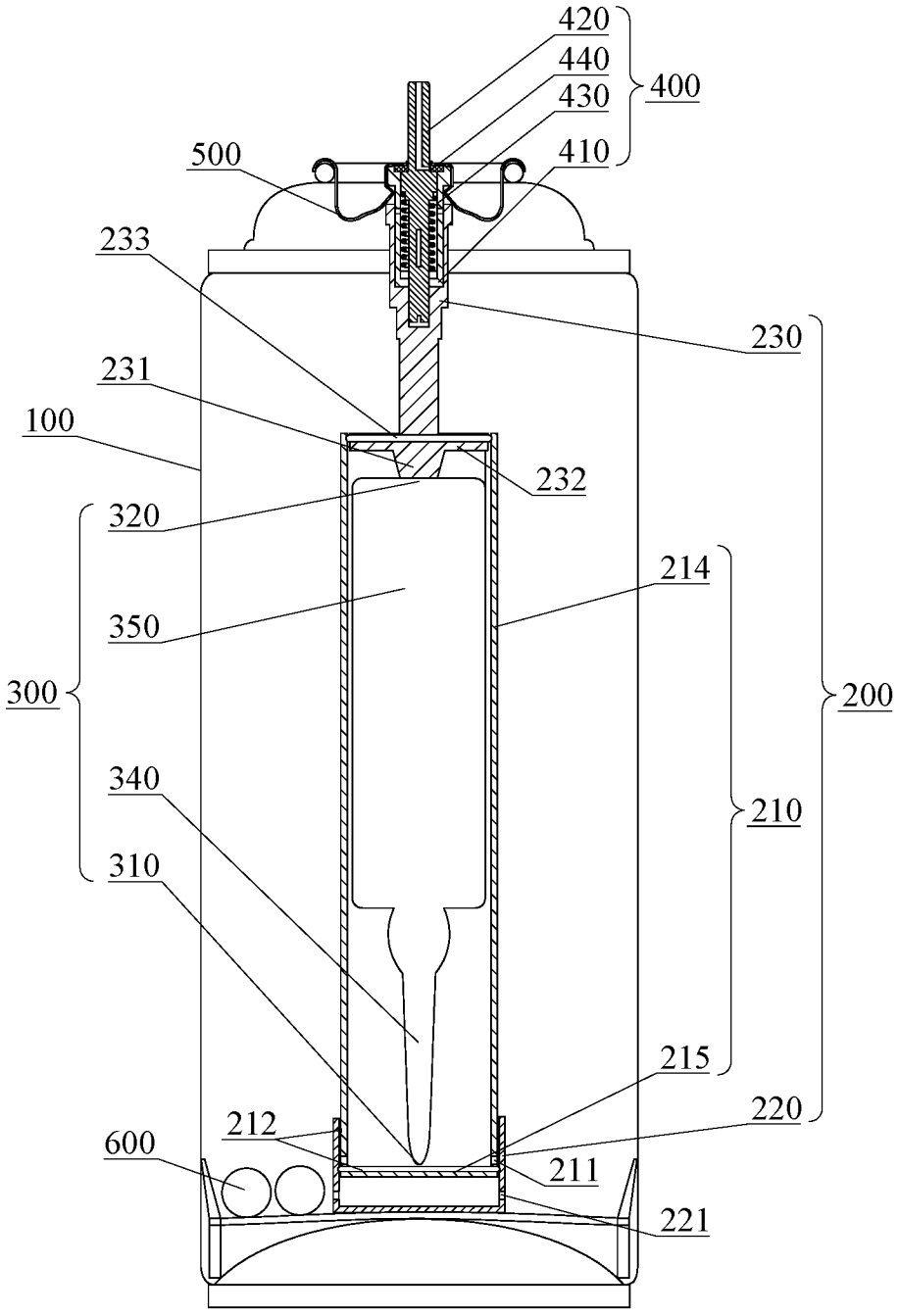
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FIG. 1

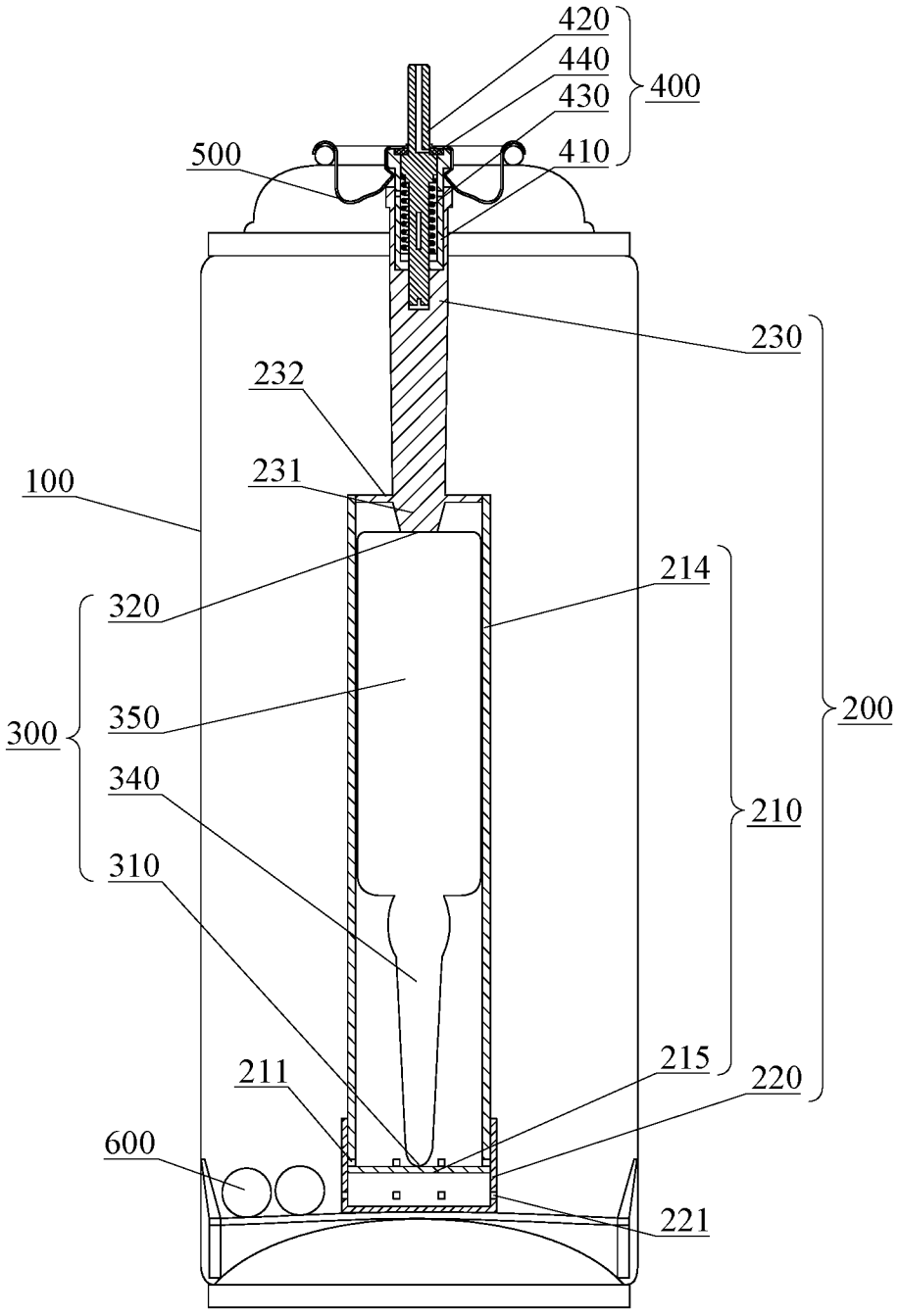
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FIG. 2

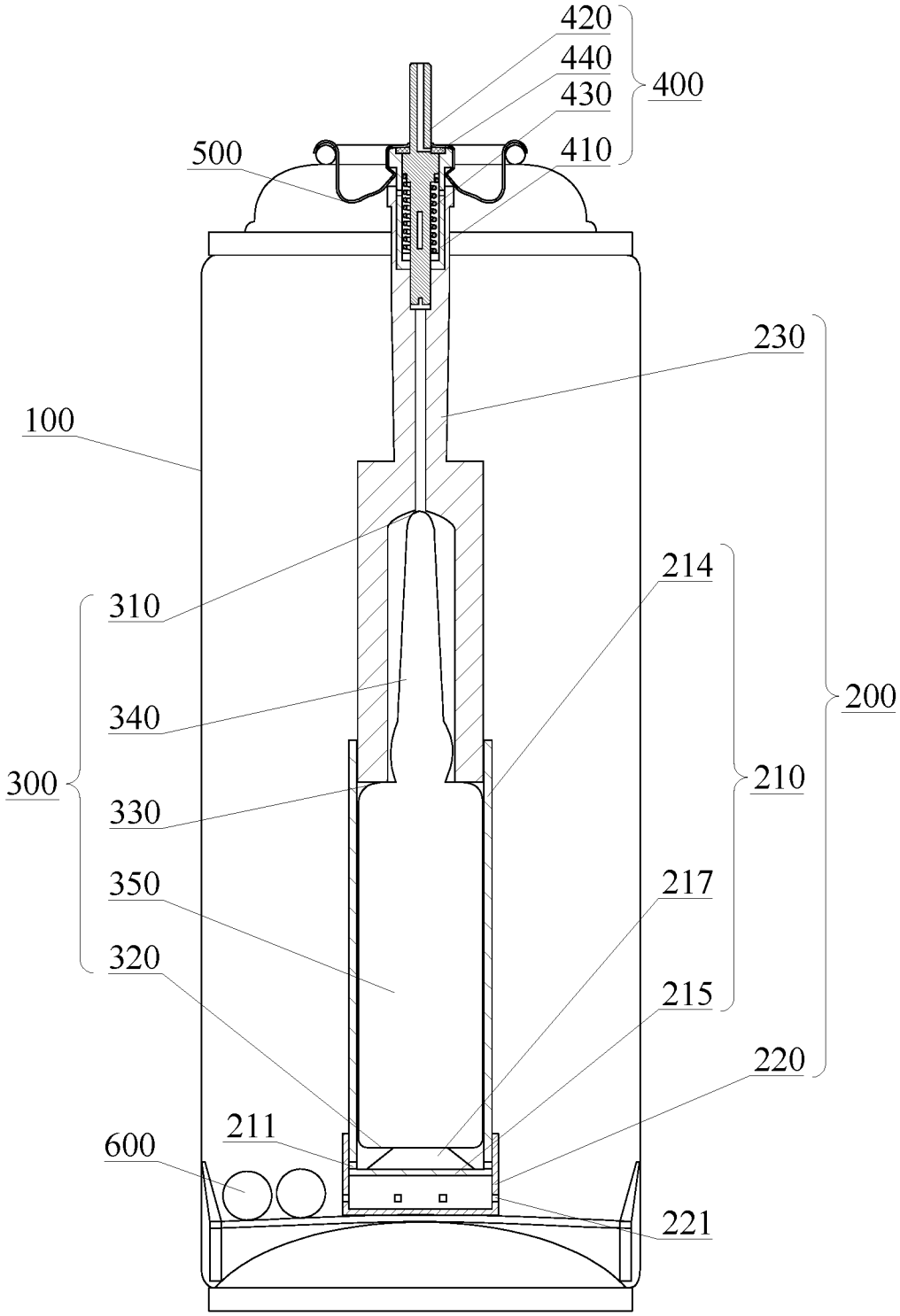
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FIG. 3

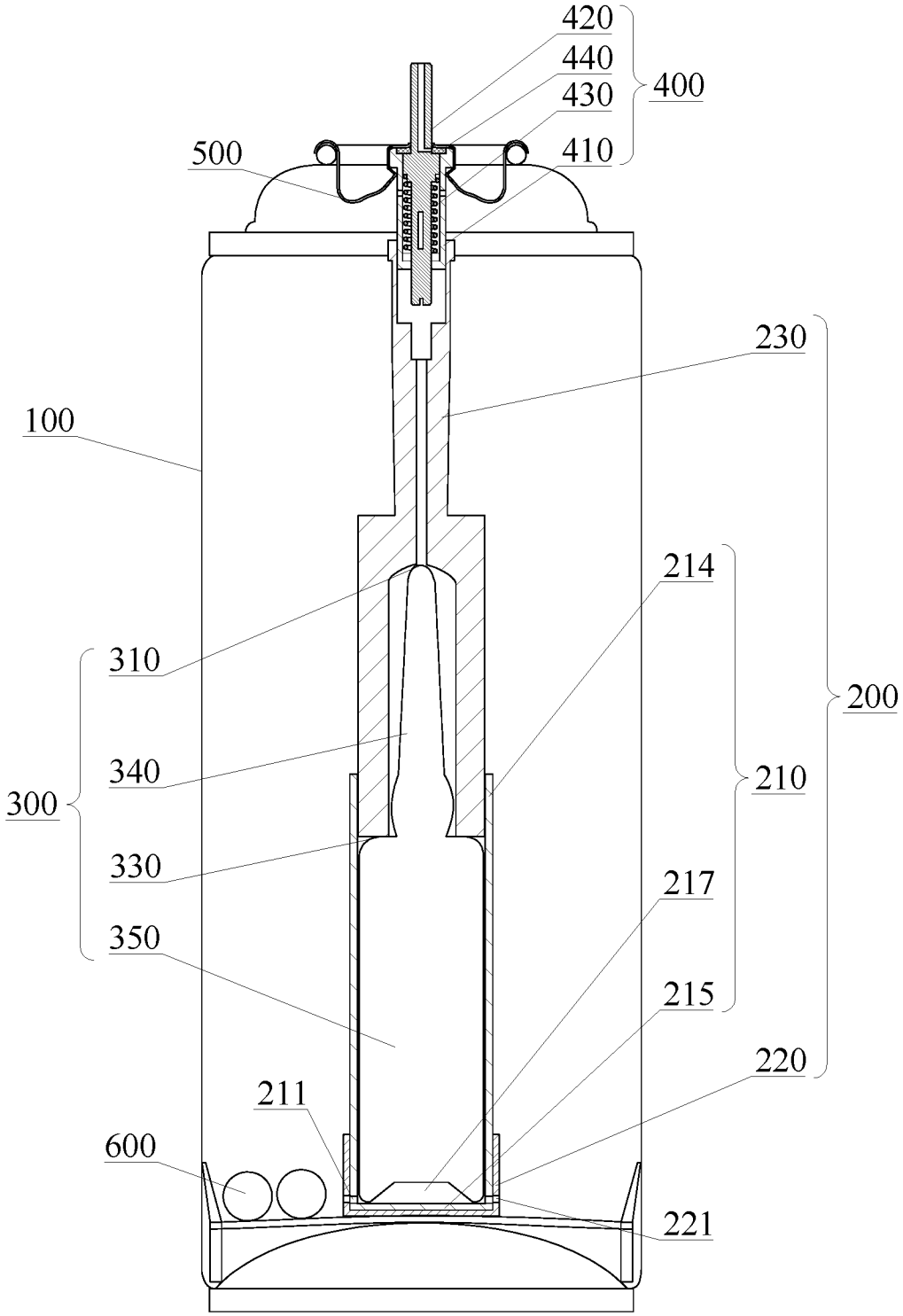
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FIG. 4

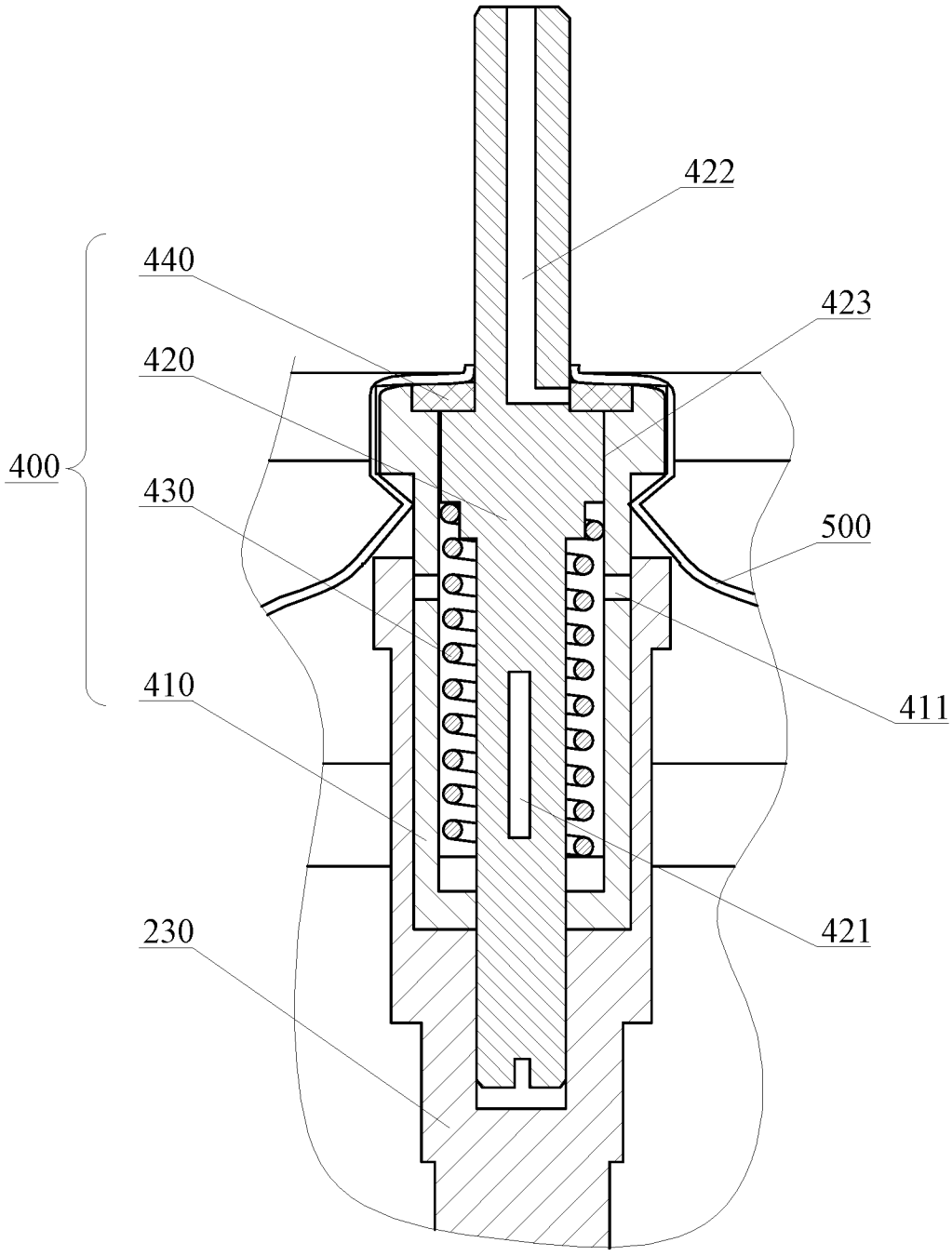
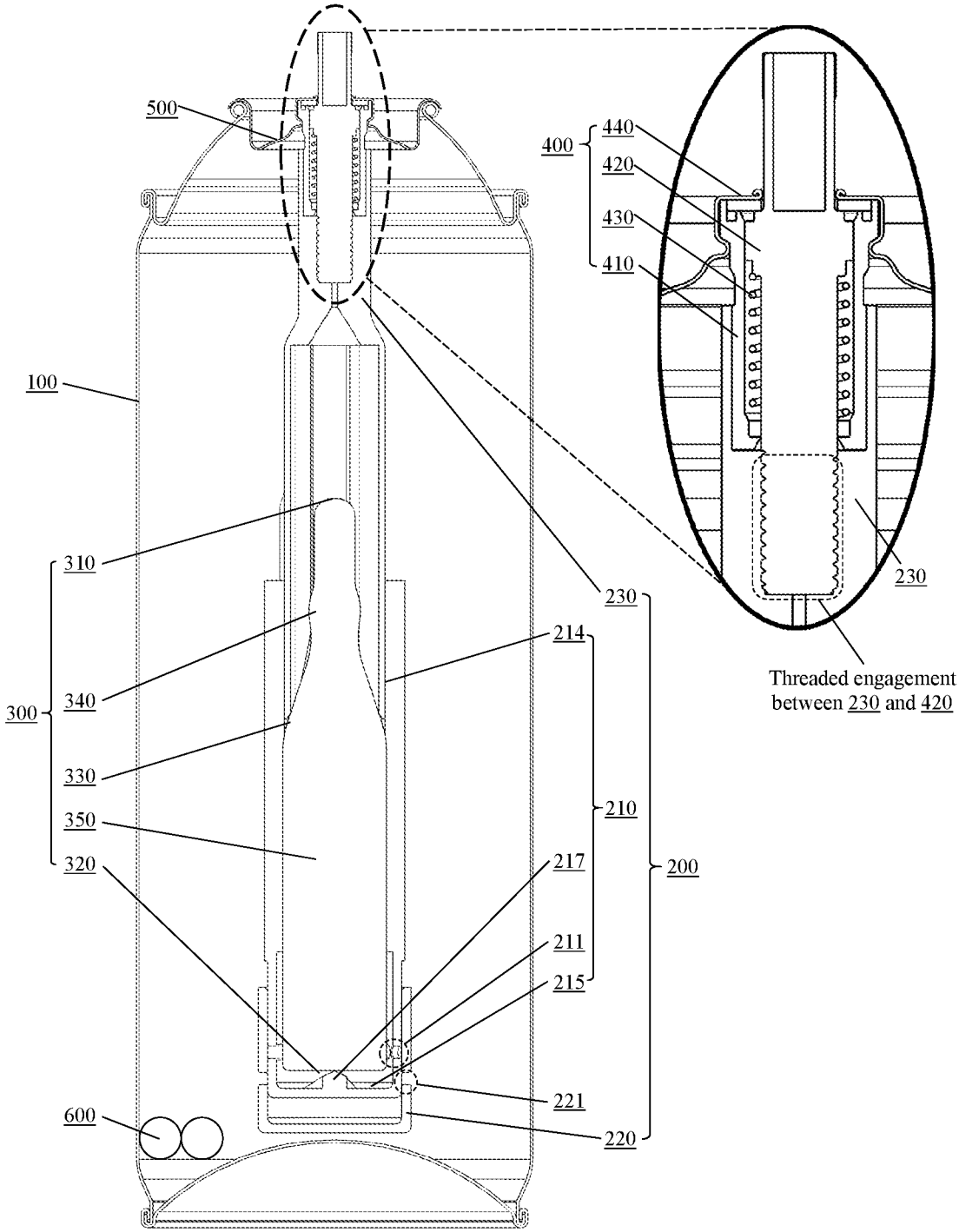


FIG. 5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Threaded engagement
between 230 and 420

FIG. 6

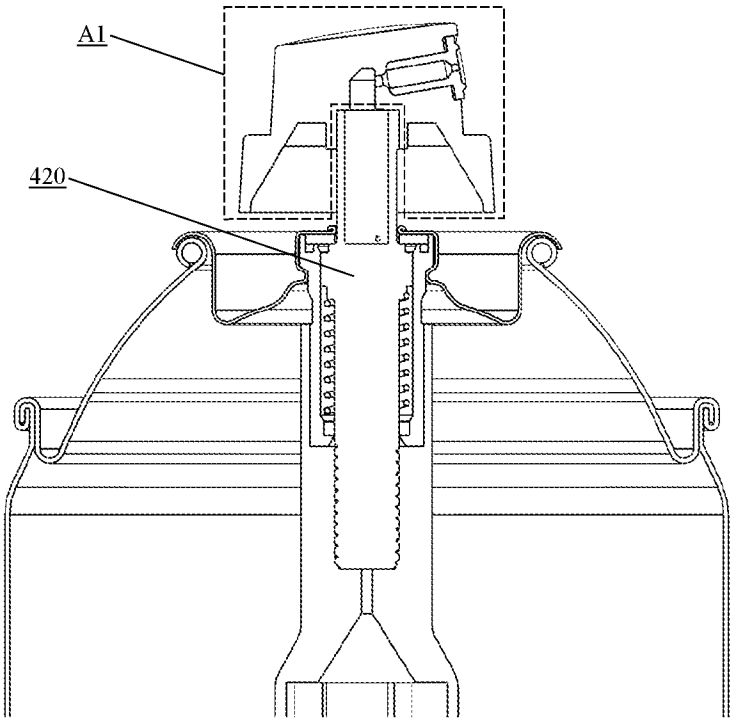


FIG. 7

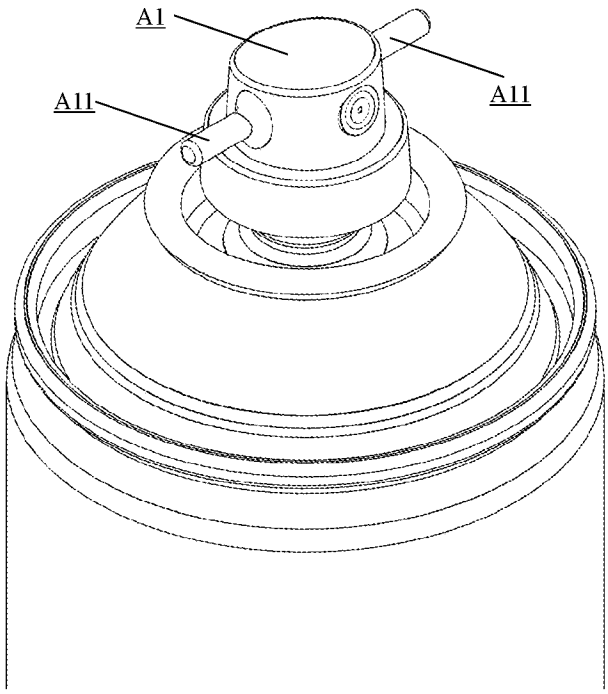
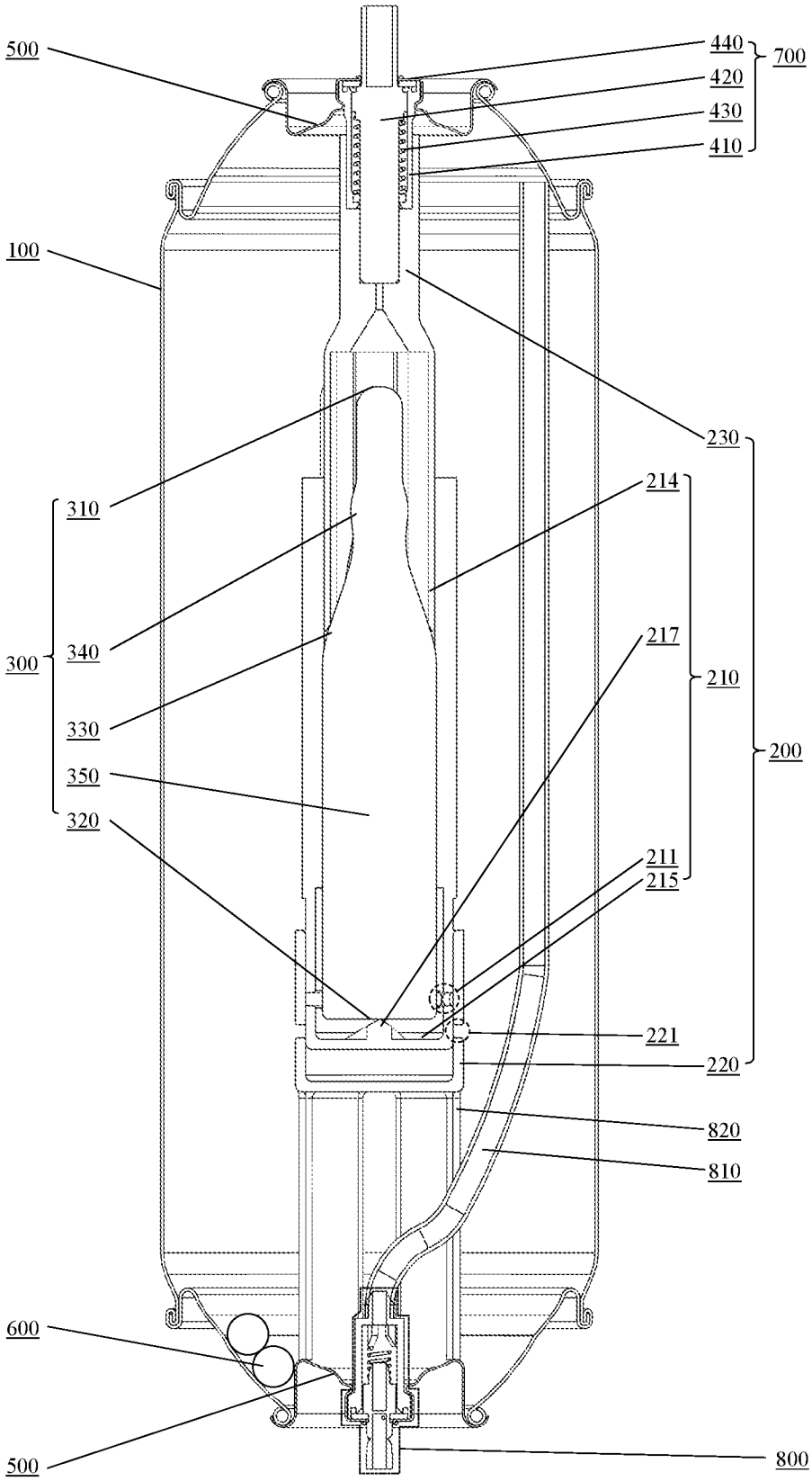


FIG. 8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820
810
600
500
800

FIG. 9

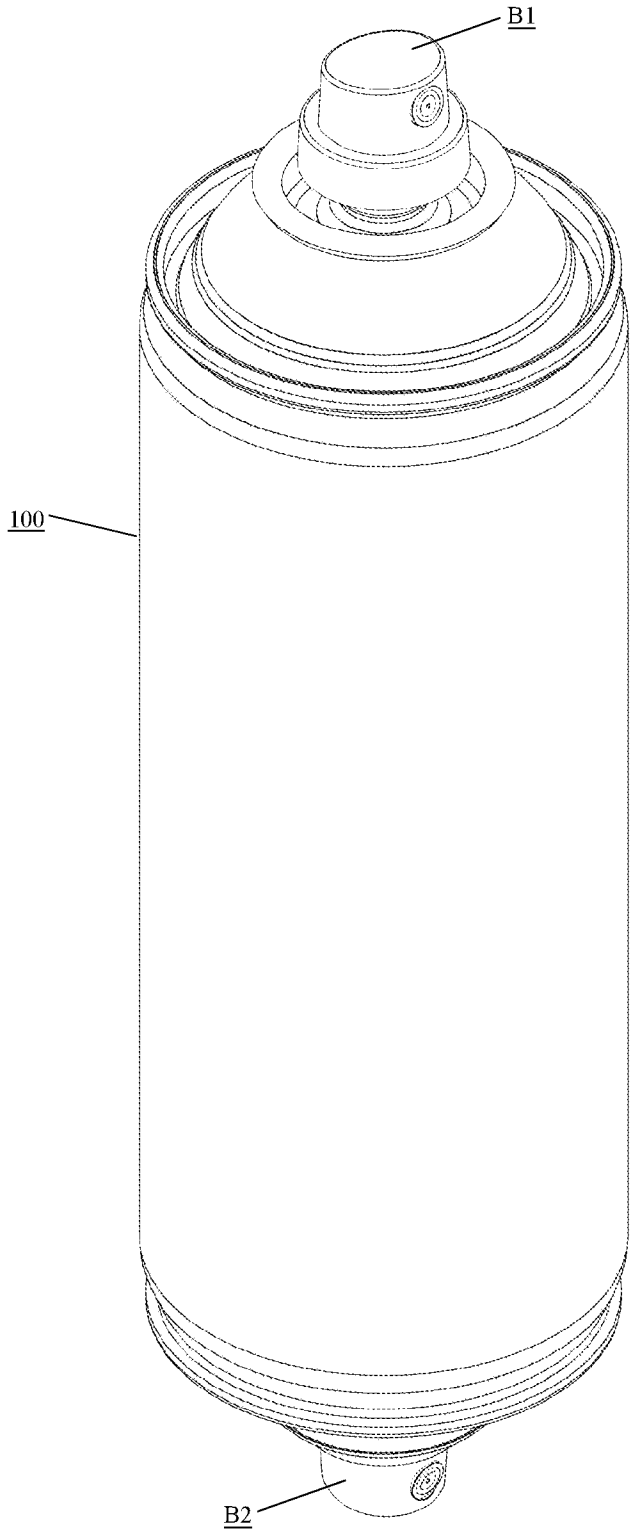

FIG. 10

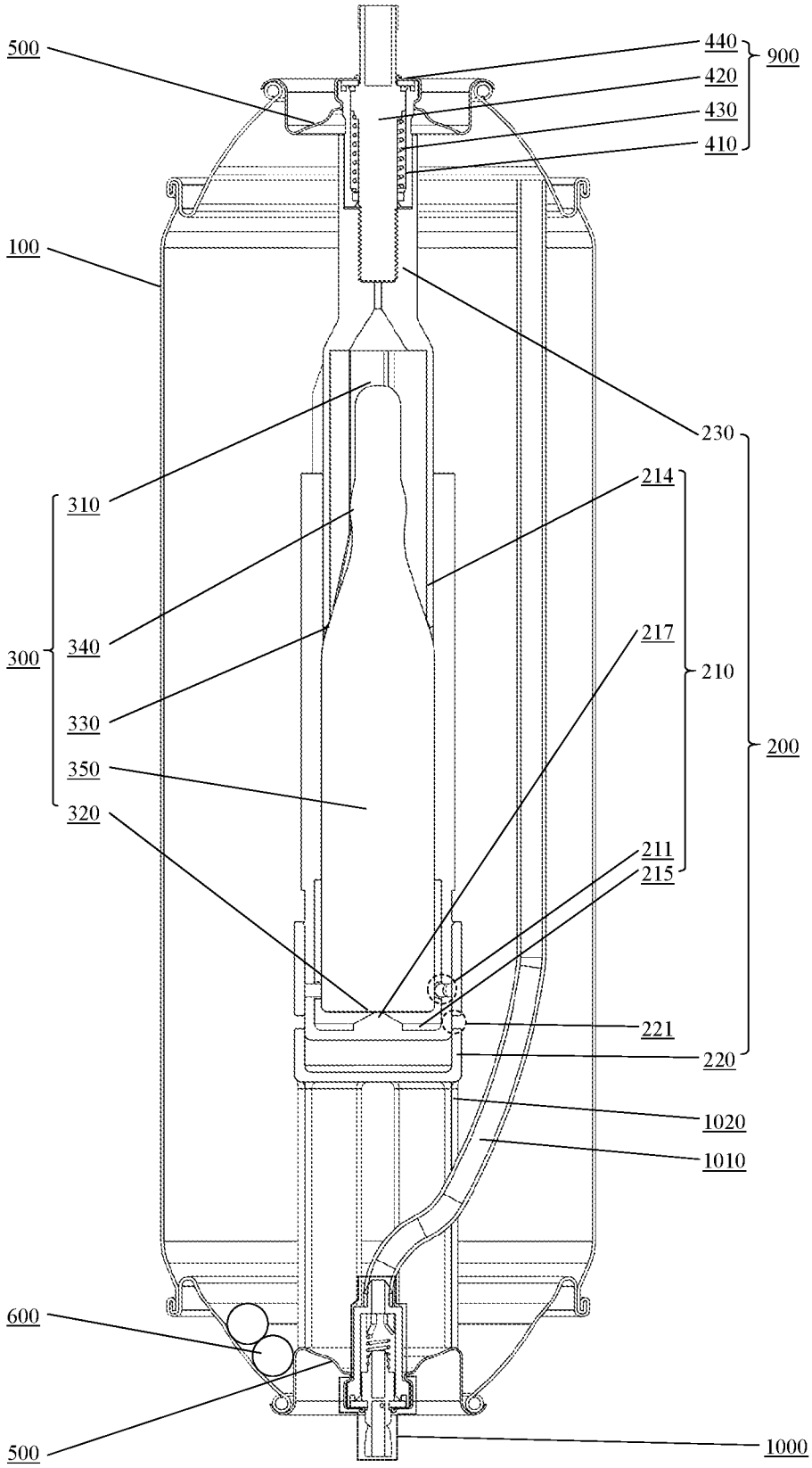
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FIG. 11

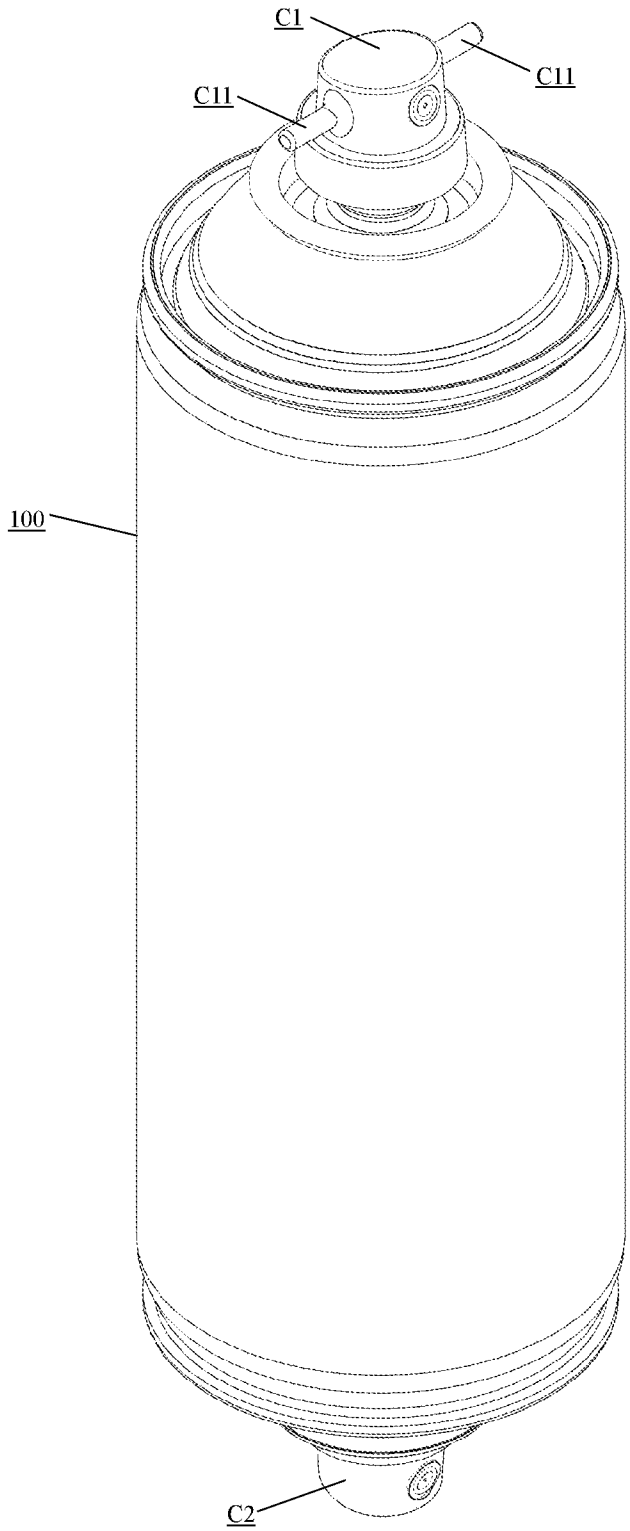

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2023/050064

A. CLASSIFICATION OF SUBJECT MATTER

B65D 83/66 (2006.01) B65D 83/20 (2006.01) B65D 83/28 (2006.01) B65D 83/44 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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

IPC/CPC: B65D83/666, B65D83/687, B44D3/12, B65D83/66, B65D83/682, B65D81/3216, B65D81/3233 and/or keywords - puncture, pierce, rupture, break, inner, outer, dual, double, case, housing, cylinder, align, meet, passage, aperture, channel, slide, push, move, propellant, proppant, gas and similar keywords.

Applicant/Inventor name searched in internal databases provided by IP Australia.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
20 December 2023	20 December 2023
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Ashwin Lazaro AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61 2 6283 2181

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/MY2023/050064**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009106813 A (TOYO AEROSOL IND CO) 21 May 2009, English description translation retrieved from Espacenet. Abstract, figures 1, 3, 5, paragraphs [0024]-[0025]	1-3, 9-21
X	US 4469252 A (Obrist) 04 September 1984 Abstract, figures 3, 5, 7, col. 7, lines 19-45, col. 6, lines 8-18	1-2, 9, 11-12, 15-21
A	WO 2023/055228 A1 (SAMURAI 2K AEROSOL SDN. BHD.) 06 April 2023 Figures 1-2	17-18, 21
A	CN 104609045 A (ZHONGSHAN MEIJIESHI PACKAGING PRODUCT CO LTD) 13 May 2015 Figure 2	19

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/MY2023/050064**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
JP 2009106813 A	21 May 2009	JP 2009106813 A	21 May 2009
		JP 4947792 B2	06 Jun 2012
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		EP 0062817 A1	20 Oct 1982
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		TW 202327954 A	16 Jul 2023
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End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.