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(54) **CONSTANT VOLUME EJECTION MECHANISM, AND AEROSOL PRODUCT EQUIPPED WITH SAID CONSTANT VOLUME EJECTION MECHANISM**

(57) To reliably ensure prevention of after-draw of leakage of contents from an injection port after injection, in a constant volume injection mechanism in which a constant volume chamber is provided between a stem and an external space region of an aerosol container using compressed gas. A cylindrical portion 9c fitted to an outer periphery of an upward protruding portion 13a is provided at an intermediate valve (9b, 9c, 13a) between an upstream pressurization chamber A and a downstream constant volume chamber B formed by partitioning an inside of a tank 8 by a piston 11 so as not to be in an open state immediately after canceling a depressing operation of an operation button 5. Moreover, a shaft 14 of the downstream valve (14a, 14b, 14c, 16) between the constant volume chamber B and the external space region is immediately turned to a closed state by reduction of a passing flow force due to a returning force of a shaft spring 15 or a shaft gasket 16, and the closed state thereof is reliably ensured by a step portion 14c. As a result, the downstream valve is shifted to the closed state in advance by movement of the contents for next injection from the pressurization chamber A to the constant volume chamber B, thereby preventing the contents from leaking from the injection port of a nozzle tip 6.

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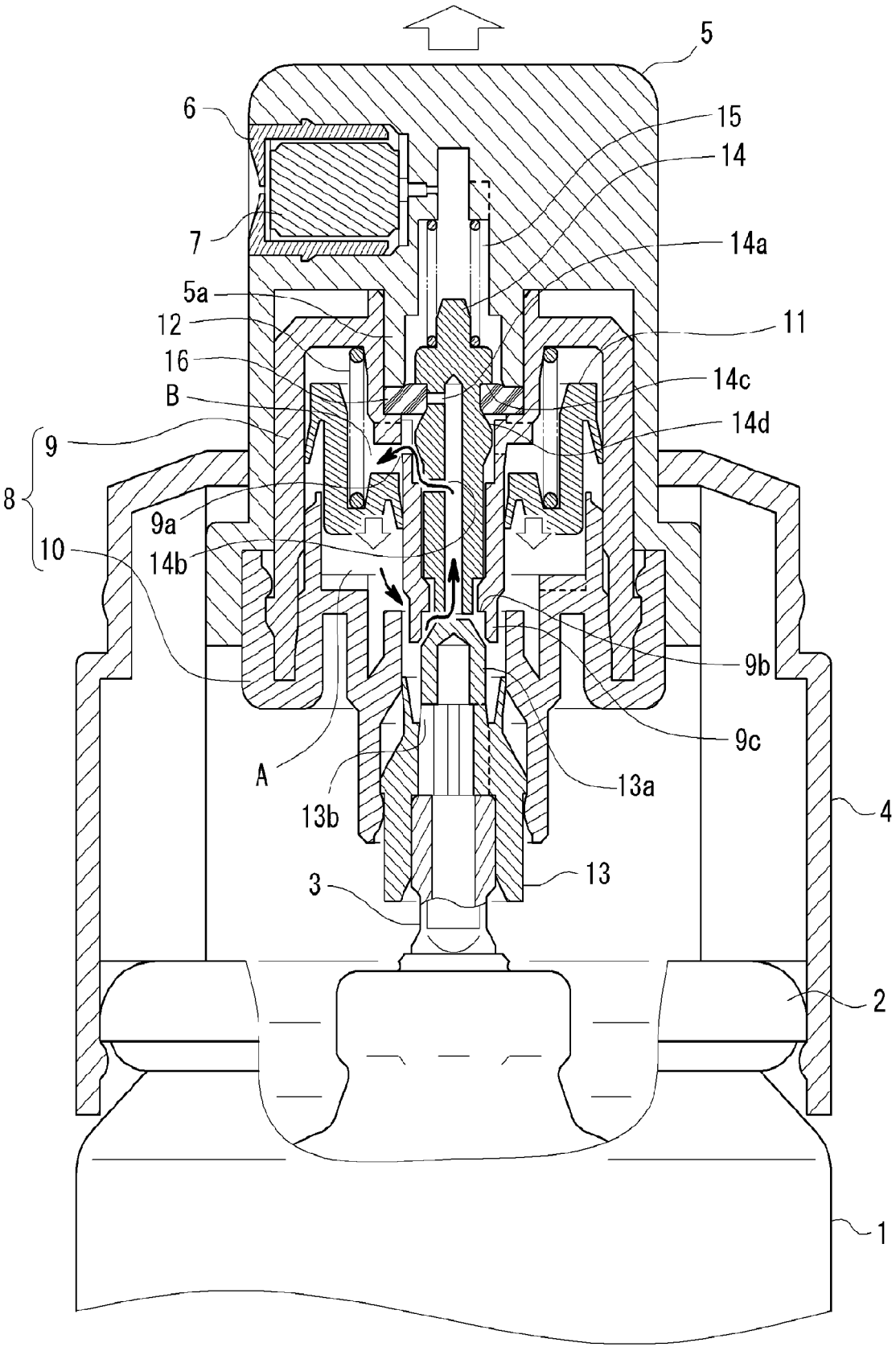
[FIG. 5]


5
6
15
14
7
14a
5a
12
11
16
14c
B
14d
9
8
9a
10
14b
9b
9c
A
13a
4
13b
13
3
2
1

Description

Technical Field

[0001] The present invention relates to a constant volume injection mechanism of an aerosol type product of a type of using compressed gas.

[0002] In particular, the present invention relates to a constant volume injection mechanism configured to form a constant volume chamber for contents injection between a stem-side member of an aerosol container and an operating-side member which moves with respect thereto, and to reduce a volume thereof (volume of the constant volume chamber) by driving a piston provided in the constant volume chamber with the contents which flow in due to an action of compressed gas inside the container, so that the contents already stored in the constant volume chamber at an ending stage of the immediately previous constant volume injection are injected to an external space region.

[0003] Namely, this is a constant volume injection mechanism directed to an aerosol type product in which a constant volume chamber is formed between a stem output unit and an operation unit and compressed gas is used, the constant volume injection mechanism having an aspect in that, when an operation unit is depressed in the same manner as when setting an operation mode, contents stored in the constant volume chamber are injected to an external space region.

[0004] Moreover, the present invention is directed to a constant volume injection mechanism including a function (after-draw prevention function) to close between a constant volume chamber region and a contents passage region on an injection port side at a stage when the piston moves to its final position (e.g., uppermost position) and has ended an original continuous injection of the contents, thereby preventing "after-draw" in which the contents leak into the external space region in a state where no injection is operated, through this closing action.

[0005] For mere convenience of explanation, the longitudinal direction of the stem, i.e., the up-and-down direction in each figure is referred to herein as "up" or "down", and the direction where the contents are injected to the external space region, i.e., the left direction in each figure is referred to herein as "front".

Background Art

[0006] The applicant has already proposed a constant volume injection mechanism of a type which forms a constant volume chamber between a stem output unit and an operation unit (refer to Patent Literature 1). Patent Literature 1 discloses also a constant volume injection mechanism including an after-draw prevention function (refer to Figs. 6 and 7 in Patent Literature 1).

[0007] The alphanumeric characters enclosed in the square brackets [] used in the following description indicate the reference signs used in the Patent Literature 1.

[0008] In the after-draw prevention function provided in the constant volume injection mechanism, by a valve action of a valve member [15] and a hole portion [13b] opened and closed by the valve member, a constant volume chamber [A'] is isolated from an external space region when no injection is operated, thereby preventing leakage of the contents.

[0009] In this valve action, a piston [14] moves upwards by a pressure of the contents flowing from a container into a pressurization chamber [B'] through an injection operation, and thereby the constant volume chamber [A'] is compressed and the valve member [15] moves upwards by a pressure of the contents stored therein, thereby being shifted to an "open state" where the contents can flow into the hole portion [13b].

[0010] During a process of relative movement of a push button [4] and a top plate-shaped member [12] immediately before returning from the injection operation and being shifted to a stationary mode, a valve member [15] is lowered relative to the hole portion [13b], thereby being shifted to the "open state" where the contents cannot flow into the hole portion [13b].

Citation List

Patent Literature

[0011] Patent Literature 1: Japanese Patent Application Laid-Open Publication No. 2007-326647

Summary of Invention

Technical Problem

[0012] Moreover, since the valve for preventing after-draw is shifted to the closed state immediately before being shifted to the stationary mode through the returning operation after releasing the injection operation, the contents moving from the pressurization chamber [B'] to the constant volume chamber [A'] during the returning operation may leak out to the external space region through the valve (hole portion [13b]) which is still in the open state.

[0013] Moreover, restriction of the movement of the contents from the pressurization chamber [B'] to the constant volume chamber [A'] is due to closing action by contact between a valve action portion [13c] and an upper opening portion of an inner upper-cylindrical portion [11b]. Accordingly, when a button-side base [13] and a stem-side base [11] move relative to each other even slightly from the contact state, the closed state is released, and therefore it is difficult to close the hole portion [13b] by moving the valve member [15] before the release of the closed state.

[0014] An object of the present invention is to reliably ensure prevention of after-draw by closing a downstream valve for preventing the after-draw which closes a passage to an injection port before movement of accommo-

dated contents to be injected next time, when returning from an injection operation.

Solution to Problem

[0015] The present invention solves the above-described problem having the following configuration aspects.

(1) A constant volume injection mechanism includes:

a stem for operating an upstream valve (e.g., a stem 3 described below) provided in an aerosol container (e.g., an aerosol container 1 described below) that uses compressed gas, and a stem holder (e.g., a stem holder 13 described below) through which contents to be injected pass formed to be integrated with the stem;
a tank (e.g., a tank 8 described below) which is engaged with an outer periphery of the stem holder in a liquid-tight slidable state in a release movement direction of the stem and an inside of which communicates with the cylindrical end portion through an upstream passage of the stem holder;
an operation unit (e.g., an operation button 5 described below) which moves the tank by a user's operation; and
a piston (e.g., a piston 11 described below) which is liquid-tight slidably provided so as to partition the inside of the tank is into an upstream pressurization chamber (e.g., an upstream storage region A described below) and a downstream constant volume chamber (e.g., a downstream storage region B described below), and is biased toward the pressurization chamber side, wherein
the constant volume injection mechanism further includes:

an intermediate valve (e.g., an annular step portion 9b, a cylindrical portion 9c, an upward protruding portion 13a, each described below) which is shifted to a closed state when the tank is substantially in contact with the stem holder in the release movement direction of the stem and shuts off the communication between the pressurization chamber and the constant volume chamber;
and
a downstream valve (e.g., an upper-side lateral hole 14a, a lower-side lateral hole 14b, a step portion 14c, a shaft gasket 16, each described below) which is provided on the constant volume chamber side of the tank, is shifted from the closed state to an open state when the intermediate valve is shifted to the closed state to communicate the constant volume chamber with an external space region, and is shifted to the closed state by at least reduction of passing flow force.

(2) The constant volume injection mechanism according to the above-described aspect (1), wherein

when the operation unit is operated from a stationary mode to an injection mode,
the tank moves in the release movement direction of the stem with respect to the stem holder and the intermediate valve is shifted to the closed state,
the communication between the pressurization chamber and the constant volume chamber is shut down,
the downstream valve is shifted to the open state and communicates the constant volume chamber with the external space region,
the tank is in contact with the stem holder, the stem integrated with the stem holder moves in the release movement direction, and the above-described upstream valve is shifted to the open state,
the contents of the aerosol container flow into the pressurization chamber through a passage of the stem holder, and the piston moves toward the constant volume chamber side,
the contents already accommodated in the constant volume chamber of which a volume is reduces thereby are injected into the external space region through the downstream valve,
when the operation unit is operated from the injection mode to the stationary mode after the volume of the constant volume chamber became a minimum and the injection of the contents is completed,
the stem moves in an opposite direction to the release movement direction and the above-described upstream valve is shifted to the closed state,
the downstream valve is shifted to the closed state when the tank moves in the opposite direction to the release movement direction of the stem with respect to the stem holder and the contact is released,
the tank further moves and the intermediate valve is shifted to the open state, and
the pressurization chamber and the constant volume chamber are communicated with each other and the contents of the pressurization chamber move to the constant volume chamber.

(3) The constant volume injection mechanism according to the above-described aspect (1) or (2),

wherein
the intermediate valve includes:

an intermediate valve element (e.g., an upward protruding portion 13a described below) formed of a tapered surface and a cylindrical surface following an outer periphery thereof and provided on the stem holder; and
an intermediate valve seat provided on the tank side and including an annular step portion (e.g., an annular step portion 9b described below) in which the tapered surface is in contact with an inner periphery and a cylindrical hanging portion (e.g., a cylindrical portion 9c described below) which is slidable and liquid-tightly fitted to a perimeter surface of the cylindrical surface.

(4) The constant volume injection mechanism according to any one of the above-described aspects (1) to (3), wherein

a valve element (e.g., a shaft 14 described below) of the downstream valve
can be in contact with the stem holder and is biased to a side thereof.

(5) The constant volume injection mechanism according to any one of the above-described aspects (1) to (4), wherein

a valve seat of the downstream valve is formed of
an annular gasket (e.g., a shaft gasket 16 described below) provided on the tank side, and
a valve element (e.g., a shaft 14 described below) of the downstream valve includes
a downstream-valve annular-step portion (e.g., a step portion 14c described below) held on an inner peripheral surface of the annular gasket and in contact with a contents outflow-side surface of the annular gasket, a downstream-valve tapered surface (e.g., a shaft tapered surface 14d described below) in contact with an opposite surface side to the contents outflow-side surface, and a communication hole portion (e.g., an upper-side lateral hole 14a described below) which is provided in an annular recessed portion between the downstream-valve annular-step portion and the downstream-valve tapered surface and is closed by the inner peripheral surface.

[0016] The present invention is directed to a constant volume injection mechanism formed of such a configuration, and an aerosol type product using compressed gas including the aforementioned constant volume injection mechanism.

Advantageous Effects of Invention

[0017] The present invention can reliably ensure prevention of after-draw by adopting the above-described configuration.

Brief Description of Drawings

[0018]

[Fig. 1] Fig. 1 is an explanatory diagram illustrating a stationary mode of a constant volume injection mechanism.
[Fig. 2] Fig. 2 is an explanatory diagram illustrating an injection mode of the constant volume injection mechanism illustrated in Fig. 1.
[Fig. 3] Fig. 3 is an explanatory diagram illustrating an upstream-valve closed mode of the constant volume injection mechanism illustrated in Fig. 1.
[Fig. 4] Fig. 4 is an explanatory diagram illustrating a downstream-valve closed mode of the constant volume injection mechanism illustrated in Fig. 1.
[Fig. 5] Fig. 5 is an explanatory diagram illustrating an intermediate-valve open mode of the constant volume injection mechanism illustrated in Fig. 1.

Description of Embodiments

[0019] Embodiments of the present invention will be described with reference to Figs. 1 to 5.
[0020] In principle, in the following description, a component (e.g., a cylindrical hanging portion 5a) denoted by a reference sign including an alphabetical suffix indicates a part of a component (e.g., an operation button 5) denoted by a numeral part of the reference sign.
[0021] In Figs. 1 to 5,

reference sign 1 denotes an aerosol container accommodating contents to be injected and compressed gas as a propellant for pressurizing the contents to be released from a stem 3 described below;
reference sign 2 denotes a mounting cup attached to an upper opening of the aerosol container 1 together with a gasket;
reference sign 3 denotes a cylindrical stem (an upstream valve) provided so as to pass through a center opening of the mounting cup 2 and releases the contents of the aerosol container 1 from an upper-end hole portion by depressing operation;
reference sign 4 denotes a cylindrical shoulder cover which is engaged and fixed to a perimeter surface of the mounting cup 2 and guides an operation button 5 described below in an up-and-down direction by means of a vertical rib-shaped portion provided on an inner surface;
reference sign 5 illustrates an operation button having a top surface to be depressed by a user and

accommodating a tank 8 described below inside a lower part;
reference sign 5a denotes a cylindrical hanging portion formed on a lower surface of the operation button 5, an outer periphery of which is fitted to an upper inner surface of the inner cylindrical portion of a tank main body 9 described below, and inside of which is communicated with a back surface of a nozzle tip 6 described below;
reference sign 6 denotes a cap-shaped nozzle tip which is provided on a side surface of the operation button 5 and injects the contents have passed through the inside of the cylindrical hanging portion 5a from a front central hole portion into an external space region;
reference sign 7 denotes a cylindrical core which is disposed inside the nozzle tip 6 and sets a bypass flow passage for the contents on an outer periphery thereof;
reference sign 8 denotes a tank which is engaged with inside a lower side of the operation button 5 and is formed of a tank main body 9 and a tank lid 10, each described below;
reference sign 9 denoted a tank main body formed of an annular top plate and an outside cylindrical portion and an inner cylindrical portion which hang respectively from inside and outside peripheries and configured as upper side of the tank;
reference sign 9a denotes a lateral hole portion which is formed at an upper side of the inner cylindrical portion of the tank main body 9 and communicates the inside and outside of the inner cylindrical portion;
reference sign 9b denotes an annular step portion (an intermediate valve) which is provided at a lower end of the inner cylindrical portion in the tank main body 9 and serves as a valve seat of a needle valve;
reference sign 9c denotes a cylindrical portion (an intermediate valve) which hangs down from an outer periphery of the annular step portion 9b;
reference sign 10 denotes an annular tank lid fitted to a lower end of the outside cylindrical portion of the tank main body 9;
reference sign 11 denotes an annular piston sliding in an up-and-down direction between the outside cylindrical portion and the inner cylindrical portion of the tank main body 9 in a sealed state;
reference sign 12 denotes a piston spring which is provided between the annular top plate of the tank main body 9 and the piston 11 and biases the piston 11 downward;
reference sign 13 denotes a stem holder which is a stem-side member which is engaged with a central cylindrical portion of the tank lid 10 slidably in the up-and-down direction in a sealed state and a lower end of which is fitted to the stem;
reference sign 13a denotes an upward protruding portion (an intermediate valve) which is provided at an upper side of the stem holder 13, is formed of a horizontal top surface, an upward tapered surface, and a perimeter surface, and serves as a valve element of the needle valve;
reference sign 13b denotes an upstream communication hole which communicates between the stem 3 and the perimeter surface of the upward protruding portion 13a;
reference sign 14 denotes a sheath-like shaft having a lower opening accommodated in the inner cylindrical portion of the tank main body 9;
reference sign 14a denotes an upper-side lateral hole (a downstream valve) which is provided so as to communicate between an inside and an outside of the shaft 14 and through which the contents to be injected from an upper side of the tank to the external space region pass during the injection mode;
reference sign 14b denotes a lower-side lateral hole which is provided so as to communicate the inside and the outside of the shaft 14 and through which the contents to move in the tank in the up-and-down direction during the intermediate-valve open mode in the returning operation and the contents to be injected from the upper side of the tank to the external space region pass during the injection mode;
reference sign 14c denotes a downward step portion which is provided on an upper perimeter surface of the upper-side lateral hole 14a and is in contact with a shaft gasket 16 described below during other than the injection mode;
reference sign 14d denotes an upward shaft tapered surface provided between the upper-side lateral hole 14a and the lower-side lateral hole 14b;
reference sign 15 denotes a shaft spring which is provided between the operation button 5 and an upper end of the shaft 14 so as to be accommodated inside the cylindrical hanging portion 5a and biases the shaft 14 downward;
reference sign 16 denotes an annular shaft gasket (a downstream valve) of which an outer periphery is sandwiched between the operation button 5 and upper-side tank 8 and through which the shaft 14 passes through a central hole portion;
reference sign A denotes an upstream accommodating region (a pressurization chamber), which is a lower-side region of the piston 11 inside the tank 8, which accommodates the contents flowing from the stem 3 during the injection mode and biases the piston 11 upward; and
reference sign B denotes a downstream accommodating region (a constant volume chamber), which is an upper-side region of the piston 11 inside the tank 8, which accommodates the contents from the upstream accommodating region A during the intermediate-valve open mode of the returning operation.

[0022] Herein, the stem 3, the shoulder cover 4, the operation button 5, the nozzle tip 6, the core 7, the tank 8

(the tank main body 9 plus the tank lid 10), the piston 11, the stem holder 13, and the shaft 14 are, for example, formed of plastics such as polypropylene, polyethylene, polyacetal, nylon, or polybutylene terephthalate.

[0023] The aerosol container 1, the piston spring 12, and the shaft spring 15 are, for example, formed of plastics or metals, the mounting cup 2 is, for example, formed of metal, and the shaft gasket 16 is, for example, formed of an elastomer or rubber.

[0024] In a central lower portion of the mounting cup 2, there are provided a stem gasket forming an upstream valve together with the stem 3, a stem spring biasing the stem 3 upwards and holds this upstream valve in the closed state, and a housing holding these members with a lower end side of the stem 3 (not illustrated).

[0025] Moreover, a returning force to the stationary mode by the shaft spring 15 is set sufficiently weaker than a returning force of the stem 3 to the closed state.

[0026] Fig. 1 illustrates a stationary mode in which the operation button 5 is not depressed.

[0027] At this time, the stem 3 (the upstream valve) is the closed state located above, and the downstream valve is the closed state in which the shaft 14 is lowered and the upper-side lateral hole 14a is closed by the shaft gasket 16.

[0028] Then, the piston 11 is located in the lowermost end, the volume of the upstream storage region A becomes the minimum, and the contents at the time of previous operation are still accommodated in the downstream accommodating region B.

[0029] It is to be noted that when it is unused and air is accommodated in the downstream storage region B, once the injection operation is performed, the air is injected into the external space region and the contents from the container is accommodated therein.

[0030] Fig. 2 illustrates an injection state (an injection mode) of the contents when the operation button 5 is depressed, from the state illustrated in Fig. 1.

[0031] From the stationary mode illustrated in Fig. 1, when the operation button 5 is depressed, a lower end of the shaft 14 is in contact with the stem holder 13, the operation button 5 and the tank 8 and the like integrated with each other move downward, and the upper-side lateral hole 14a is shifted to the open state.

[0032] Then, an upper-end tapered surface of the upward protruding portion 13a and the inner periphery of the annular step portion 9b is in contact with each other, and the intermediate valve is shifted to the closed state.

[0033] Due to the contact, the stem holder 13 moves downward together with the stem 3 while being integrated with the operation button 5 and the tank 8, the stem 3 (the upstream valve) is shifted to the open state, and the contents in the container flow out upwards from the inside of the cylindrical inside of the stem 3.

[0034] The contents from the stem 3 flow into the upstream accommodating region A via the stem holder 13, and the pressure thereof pushes the piston 11 up against the piston spring 12.

[0035] As pushing up the piston 11, the downstream accommodating region B is reduced, and the contents already accommodated therein are injected into the external space region passing sequentially through the lateral hole portion 9a, the lower-side lateral hole 14b, an inside passage of the shaft 14, the upper-side lateral hole 14a, a gap between the nozzle tip 6 and the core 7, and an injection port at the center of the front surface of the nozzle tip 6.

[0036] Since the inner periphery of the annular step portion 9b and the tapered surface of the upward protruding portion 13a are in a state of being strongly in contact with each other, the intermediate valve can block the strong pressure of the contents released from the stem 3.

[0037] When the piston 11 moves upward until it comes into contact with an upper end of the tank 8 and the volume of the downstream storage region B becomes the minimum, the injection of the contents is completed (constant volume injection).

[0038] It is to be noted that the shaft 14 may separate from the stem holder 13 and move upward due to the pressure of the contents attempting to flow out from a lower side of the shaft gasket 16.

[0039] Fig. 3 illustrates an upstream-valve closed mode, which is an initial stage of the returning operation in which the pressing-down of the operation button 5 is released from the state where the injection of the contents is completed.

[0040] When the depression of the operation button 5 is gradually released, the operation button 5, the tank 8, the piston 11, the stem holder 13, the shaft 14, and the like first move upward integrally with the stem 3, and the stem 3 (upstream valve) is shifted to the closed state.

[0041] Fig. 4 illustrates a downstream-valve closed mode, which is a middle stage of the returning operation in which the depression of the operation button 5 is further released from the state illustrated in Fig. 3.

[0042] When the depression is further released, the operation button 5, the tank 8, and the like move upward with respect to the stem 3, the stem holder 13, and the shaft 14 in contact therewith.

[0043] This is because the contents in the upstream accommodating region A pressurized by the piston 11, biased by the piston spring 12, depress the stem holder 13 relative to the tank lid 10, and because the returning force of the shaft spring 15 or shaft gasket 16 depresses the shaft 14 in contact with the stem holder 13.

[0044] At this time, the shaft gasket 16 depresses the shaft 14 by the returning force to a flat plate state and a reduction force of the central hole portion expanded by the shaft tapered surface 14d.

[0045] Moreover, since the shaft spring 15 also biases the shaft 14 downward, the shaft 14 moves relative to the shaft gasket 16 without delay, the inner peripheral surface of the shaft gasket 16 is stored in an annular recessed portion formed between the step portion 14c and the shaft tapered surface 14d, and the upper-side lateral

hole 14a is reliably in the closed state.

[0046] In this way, since the step portion 14c closely contacts and positions the upper surface of the shaft gasket 16, the inner peripheral surface of the shaft gasket 16 closes the upper-side lateral hole 14a without misalignment and increases a closely contacted area, thereby reliably ensuring that the contents are prevented from passing therethrough.

[0047] Although the lateral hole portion 9a is separated from the tapered surface of the upward protruding portion 13a, the cylindrical portion 9c remains liquid-tightly fitted to the perimeter surface of the upward protruding portion 13a, and the intermediate valve is still in the closed state.

[0048] At this time, since the upstream valve by the stem 3 is shifted to the closed state, the intermediate valve does not receive strong pressure of the contents from the container, but merely receives weak pressure generated by the piston 11 on the contents in the upstream accommodating region by the biasing force of the piston spring 12.

[0049] Moreover, since the time period during which the intermediate valve resists the weak pressure is only in the middle stage of the returning operation and an is not permanent, the closed state can be sufficiently ensured even by the internal and external fitting of the circumference surface between the inner peripheral surface of the cylindrical portion 9c and the perimeter surface of the upward protruding portion 13a.

[0050] Thus, the closed state of the intermediate valve can be set not only to the contact state between the lateral hole portion 9a forming the needle valve and the tapered surface of the upward protruding portion 13a, but also to a somewhat separated state (substantially contact state).

[0051] As a result, since the intermediate valve remains in the closed state until the upper-side lateral hole 14a (downstream valve) that communicates between the downstream storage region B and the external space region is reliably in the closed state, the contents flowing from the upstream storage region A to the downstream storage region B is blocked, thereby after-draw is prevented.

[0052] Fig. 5 illustrates an intermediate-valve open mode, which is a final stage of the returning operation in which the depression of the operation button 5 is further released from the state illustrated in Fig. 4.

[0053] When the depressing operation to the operation button 5 is further released from the state illustrated in Fig. 4, the operation button 5, the tank 8, the shaft 14, and the like move upward with respect to the stem 3 and the stem holder 13, and the upper-side lateral hole 14a is reliably in the closed state.

[0054] At this time, since the cylindrical portion 9c is separated from the perimeter surface of the upward protruding portion 13a and the intermediate valve is shifted to the open state, the upstream accommodating region A and the downstream accommodating region B are communicated with each other, and the contents in the upstream accommodating region A are pushed out by the piston 11, which moves downward by the returning force of the piston spring 12 and flow into the downstream accommodating region B through the intermediate valve, the lower-side lateral hole 14b, and the lateral hole portion 9a in this order.

[0055] Then, when the piston 11 is in contact with the tank lid 10 and the volume of the upstream accommodating region A is in a minimum state, it is shifted to the stationary mode illustrated in Fig. 1.

[0056] The contents in the downstream accommodating region B which flowed at this time is to be injected in the next operation.

[0057] Naturally, the present invention is not limited to the above-described embodiments but may be modified as follows:

(11) the operation button 5 may be integrated with the tank main body 9;
(12) the inner cylindrical portion of the tank main body 9 may be provided on the tank lid 10 side;
(13) the stem holder 13 may be made larger in diameter to omit the tank lid 10;
(14) the piston 11 may be integrally molded with the piston spring 12;
(15) the shaft 14 may be integrally molded with the shaft spring 15; and/or
(16) the tank lid 10 may be integrally molded with the stem holder 13 via a diaphragm.

[0058] Aerosol type products to which the invention is applied include products for various applications such as cleaner, cleaning agents, coolant, anti-inflammatory agents, hair restorer, hair dyes, hair styling agents, hair treatment agents, sunscreen, lotion, cleansing agents, antiperspirants, cosmetics, shaving foam, food, liquid droplet products (e.g., vitamin), medical supplies, non-medical products, gardening agents, insecticide, pest repellents, animal repellents, deodorizers, laundry starch, fire extinguisher, paint, adhesives, lubricants, and urethane foam.

[0059] The contents accommodated in the aerosol container may be of any of various forms, such as a liquid, cream, or gel types. Examples of the ingredients mixed with the contents are powdered materials, oil components, alcohols, surfactants, high molecular compounds, components effective for individual applications, water, and the like.

[0060] The powdered materials that may be used are a metal salt powder, an inorganic powder, a resin powder and the like. The usable powdered materials include, for example, talc, kaolin, aluminum hydroxychloride (aluminum salt), calcium alginate, gold powder, silver powder, mica, carbonate, magnesium chloride, silica, zinc oxide, titanium oxide, zeolite, nylon powder, barium sulfate, cellulose, a mixture thereof, and the like.

[0061] The oil components that may be used include, for example, silicone oil such as dimethylpolysiloxane, ester oil such as myristate isopropyl, oils and fats such as

palm oil, eucalyptus oil, camellia oil, olive oil, and the jojoba oil, hydrocarbon oil such as liquid paraffin, a fatty acid such as myristic acid, palmitic acid, stearic acid, linoleic acid, linolenic acid, and the like.

[0062] The alcohols that may be used include, for example, monohydric lower alcohols such as ethanol, monohydric higher alcohols such as lauryl alcohol and cetanol, and polyalcohols such as ethylene glycol, 1,3-butylene glycol, glycerin, and the like.

[0063] The surfactants that may be used include, for example, an anionic surfactant such as sodium lauryl sulfate, a nonionic detergent such as polyoxyethylene alkyl ether and polyglycerin fatty acid ester, an amphoteric surfactant such as lauryl dimethyl aminoacetic acid betaine, and a cationic surfactant such as alkyl trimethyl ammonium chloride.

[0064] The high molecular compounds that may be used include, for example, hydroxyethyl cellulose, methyl cellulose, gelatin, starch, casein, xanthan gum, carboxyvinyl polymer, and the like.

[0065] The components effective for individual applications that may be used include, for example, dyes such as paraphenylenediamine and aminophenol, oxidizers such as hydrogen peroxide solution, set agents, such as acrylic resin and wax, ultraviolet ray absorbents, such as 2-ethylhexyl p-methoxycinnamate, vitamins such as retinol and dl-α-tocopherol, humectants such as hyaluronic acid, antiphlogistic balms such as methyl salicylate and indomethacin, sanitization agents such as sodium benzoate and cresol, pest repellents such as pyrethroid and diethyltoluamide, antiperspirants such as zinc paraphenolsulfonate, refreshments such as camphor, menthol, antiasthmatic drugs such as ephedrine and adrenalin, sweeteners such as sucralose or aspartame, adhesives and paint such as epoxy resin and urethane, dyes such as paraphenylenediamine and aminophenol, oxidizers such as hydrogen peroxide solution, and fire extinguishing agents such as ammonium dihydrogenphosphate, and sodium/potassium bicarbonate.

[0066] Furthermore, it is possible to use, besides the above-described contents, for example, suspending agents, emulsifying agents, antioxidants, and sequestering agents, and the like.

[0067] The gas for injecting the contents in the aerosol type product that may be used include, for example, compressed gas, such as carbon dioxide gas, nitrogen gas, compressed air, nitrous suboxide, oxygen gas, rare gas, and mixed gas thereof.

Reference Signs List

[0068]

1: Aerosol container
2: Mounting cup
3: Stem (upstream valve)
4: Shoulder cover
5: Operation button
5a: Cylindrical hanging portion
6: Nozzle tip
7: Core
8: Tank
9: Tank main body
9a: Lateral hole portion
9b: Annular step portion (intermediate valve)
9c: Cylindrical portion (intermediate valve)
10: Tank lid
11: Piston
12: Piston spring
13: Stem holder
13a: Upward protruding portion (intermediate valve)
13b: Upstream communication hole
14: Shaft
14a: Upper-side lateral hole (downstream valve)
14b: Lower-side lateral hole
14c: Step portion (downstream valve)
14d: Shaft tapered surface (downstream valve)
15: Shaft spring
16: Shaft gasket (downstream valve)
A: Upstream accommodating region (pressurization chamber)
B: Downstream accommodating region (constant volume chamber)

Claims

1. A constant volume injection mechanism comprising:

a stem for operating an upstream valve provided in an aerosol container that uses compressed gas, and a stem holder through which contents to be injected pass formed to be integrated with the stem;
a tank which is engaged with an outer periphery of the stem holder in a liquid-tight slidable state in a release movement direction of the stem and an inside of which communicates with the cylindrical end portion through an upstream passage of the stem holder;
an operation unit which moves the tank by a user's operation; and
a piston which is liquid-tight slidably provided so as to partition the inside of the tank is into an upstream pressurization chamber and a downstream constant volume chamber, and is biased toward the pressurization chamber side, wherein
the constant volume injection mechanism further comprises:

an intermediate valve which is shifted to a closed state when the tank is substantially in contact with the stem holder in the release movement direction of the stem and shuts off the communication between the pres-

surization chamber and the constant volume chamber;
and
a downstream valve which is provided on the constant volume chamber side of the tank, is shifted from the closed state to an open state when the intermediate valve is shifted to the closed state to communicate the constant volume chamber with an external space region, and is shifted to the closed state by at least reduction of passing flow force.

2. The constant volume injection mechanism according to claim 1, wherein

when the operation unit is operated from a stationary mode to an injection mode,
the tank moves in the release movement direction of the stem with respect to the stem holder and the intermediate valve is shifted to the closed state,
the communication between the pressurization chamber and the constant volume chamber is shut down,
the downstream valve is shifted to the open state and communicates the constant volume chamber with the external space region,
the tank is in contact with the stem holder, the stem integrated with the stem holder moves in the release movement direction, and the upstream valve is shifted to the open state,
the contents of the aerosol container flow into the pressurization chamber through a passage of the stem holder, and the piston moves toward the constant volume chamber side,
the contents already accommodated in the constant volume chamber of which a volume is reduces thereby are injected into the external space region through the downstream valve,
when the operation unit is operated from the injection mode to the stationary mode after the volume of the constant volume chamber became a minimum and the injection of the contents is completed,
the stem moves in an opposite direction to the release movement direction and the upstream valve is shifted to the closed state,
the downstream valve is shifted to the closed state when the tank moves in the opposite direction to the release movement direction of the stem with respect to the stem holder and the contact is released,
the tank further moves and the intermediate valve is shifted to the open state, and
the pressurization chamber and the constant volume chamber are communicated with each other and the contents of the pressurization chamber move to the constant volume chamber.

3. The constant volume injection mechanism according to claim 1 or 2, wherein
the intermediate valve includes:

an intermediate valve element formed of a tapered surface and a cylindrical surface following an outer periphery thereof and provided on the stem holder; and
an intermediate valve seat provided on the tank side and including an annular step portion in which the tapered surface is in contact with an inner periphery and a cylindrical hanging portion which is slidable and liquid-tightly fitted to a perimeter surface of the cylindrical surface.

4. The constant volume injection mechanism according to any one of claims 1 to 3, wherein

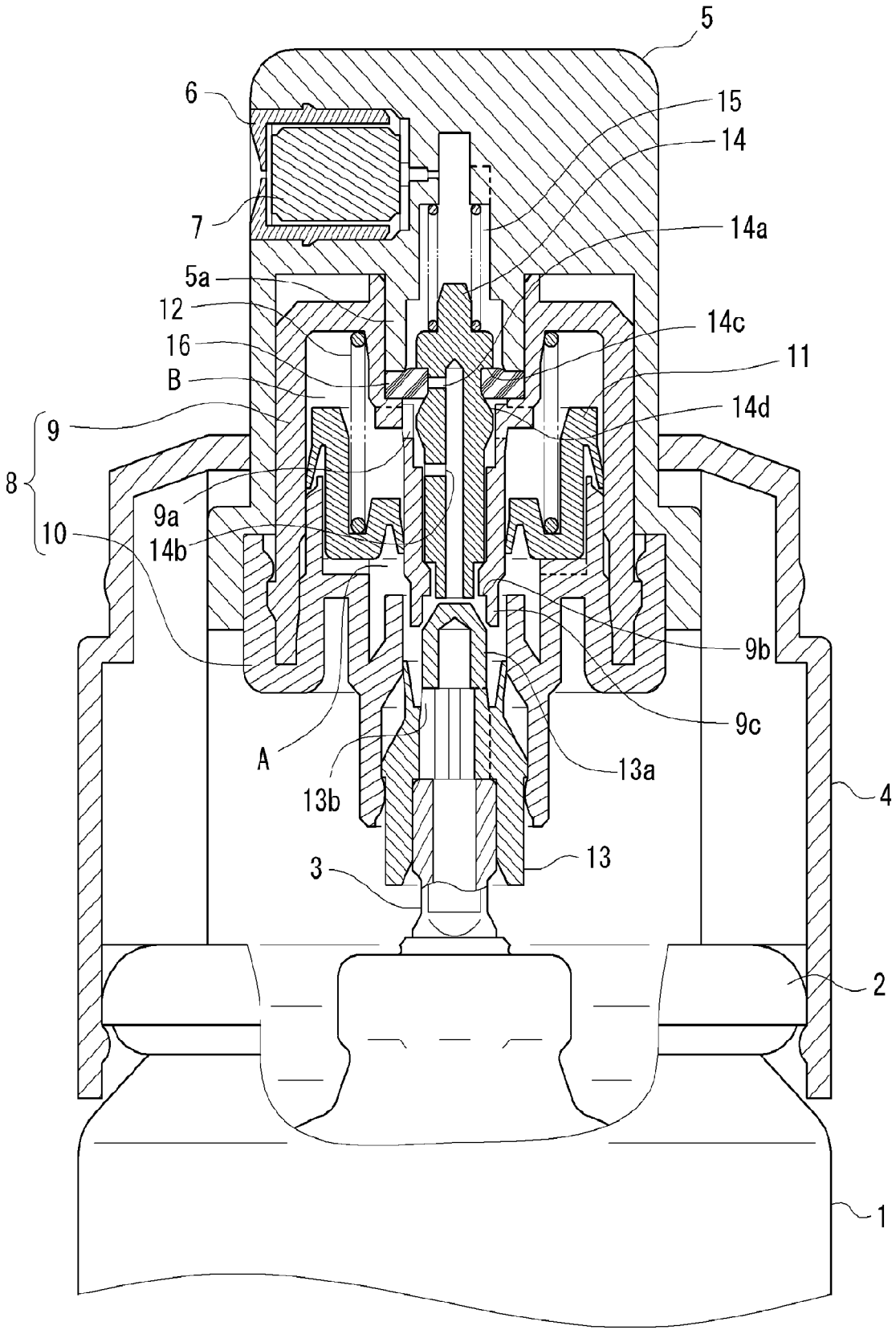
a valve element of the downstream valve
can be in contact with the stem holder and is biased to a side thereof.

5. The constant volume injection mechanism according to any one of claims 1 to 4, wherein

a valve seat of the downstream valve is formed of
an annular gasket provided on the tank side, and
a valve element of the downstream valve comprises
a downstream-valve annular-step portion held on an inner peripheral surface of the annular gasket and in contact with a contents outflow-side surface of the annular gasket, a downstream-valve tapered surface in contact with an opposite surface side to the contents outflow-side surface, and a communication hole portion which is provided in an annular recessed portion between the downstream-valve annular-step portion and the downstream-valve tapered surface and is closed by the inner peripheral surface.

6. An aerosol type product
comprising the constant volume injection mechanism according to any one of claims 1 to 5, and configured to accommodate compressed gas for injecting and the contents.

[FIG. 1]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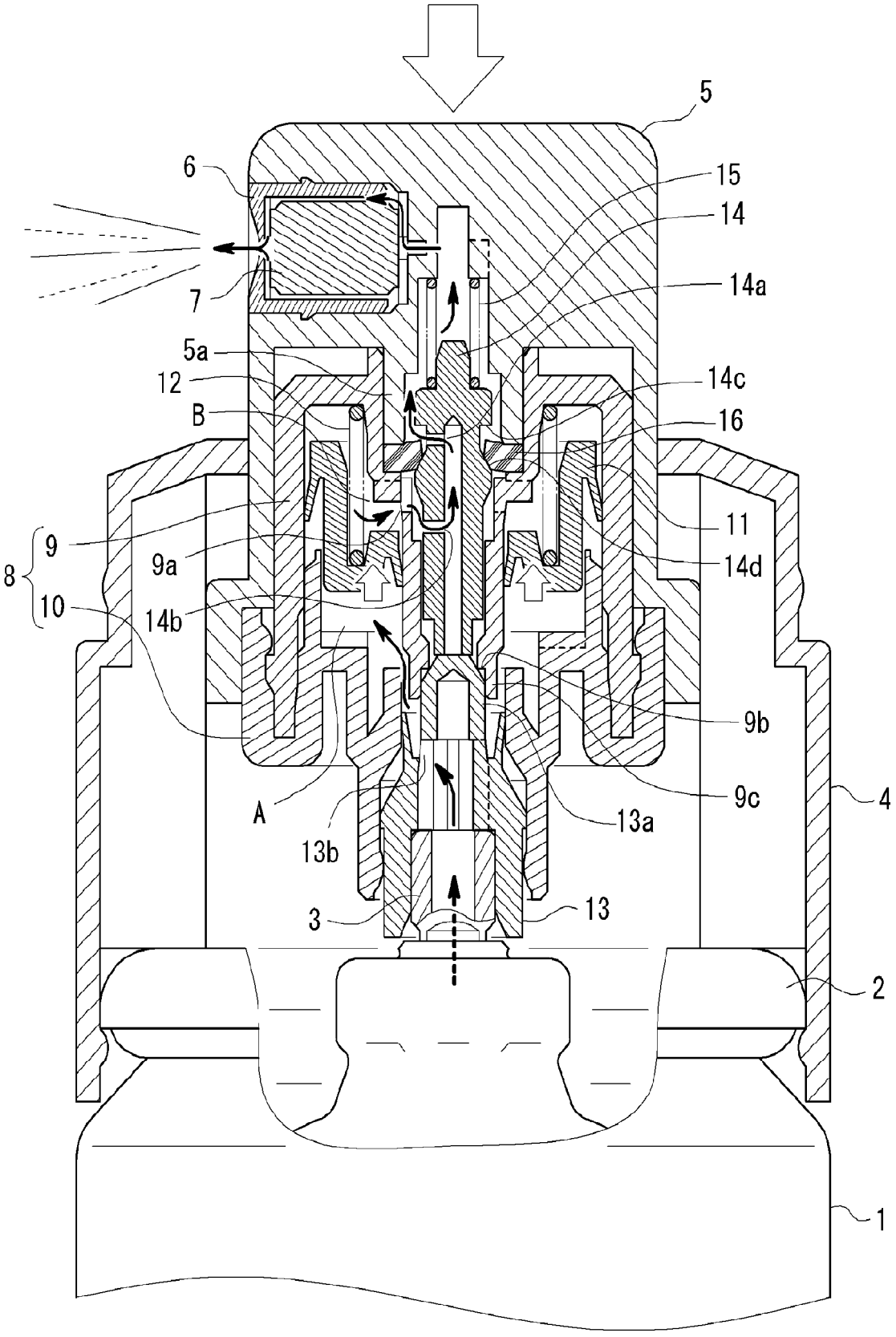
[FIG. 2]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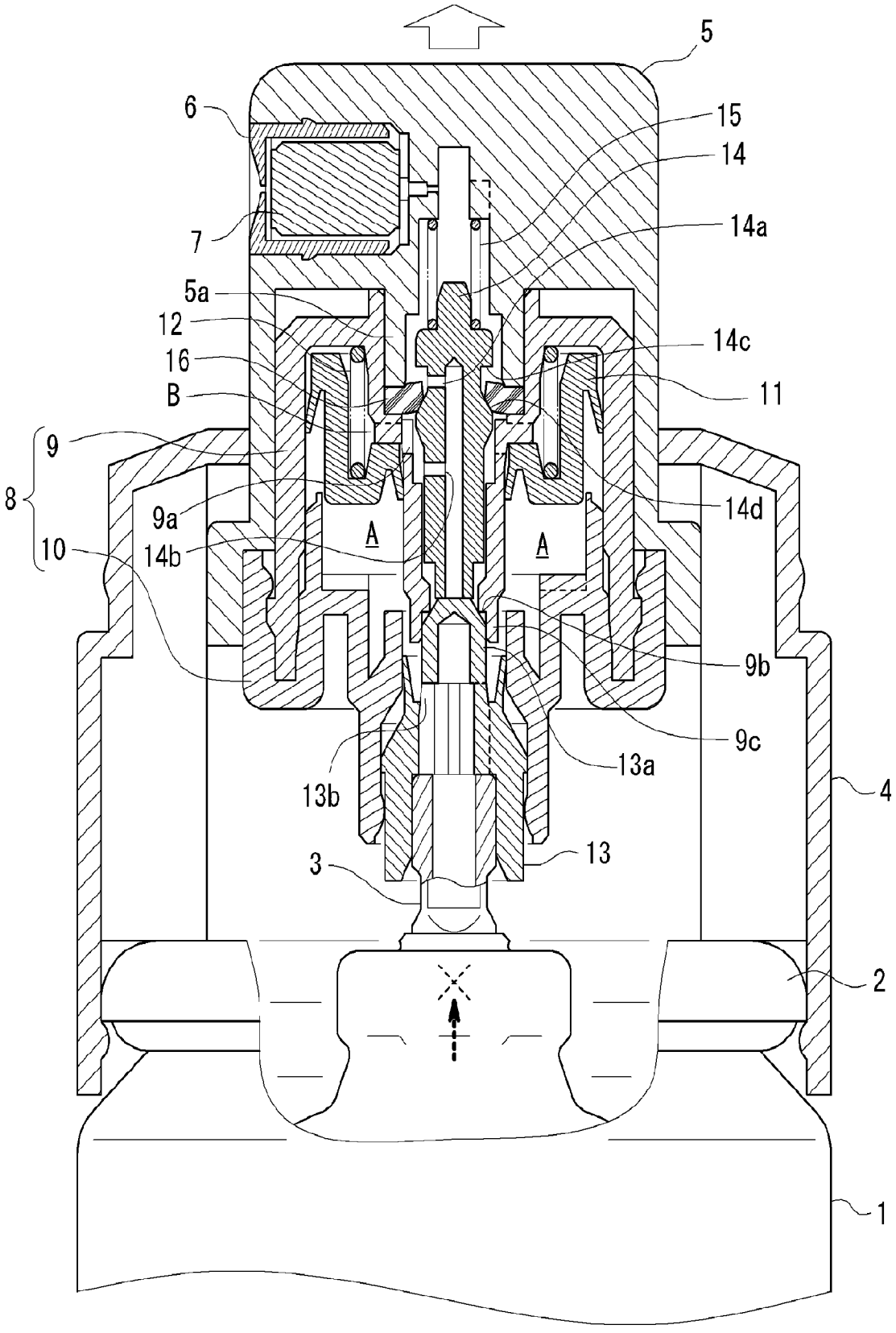
[FIG. 3]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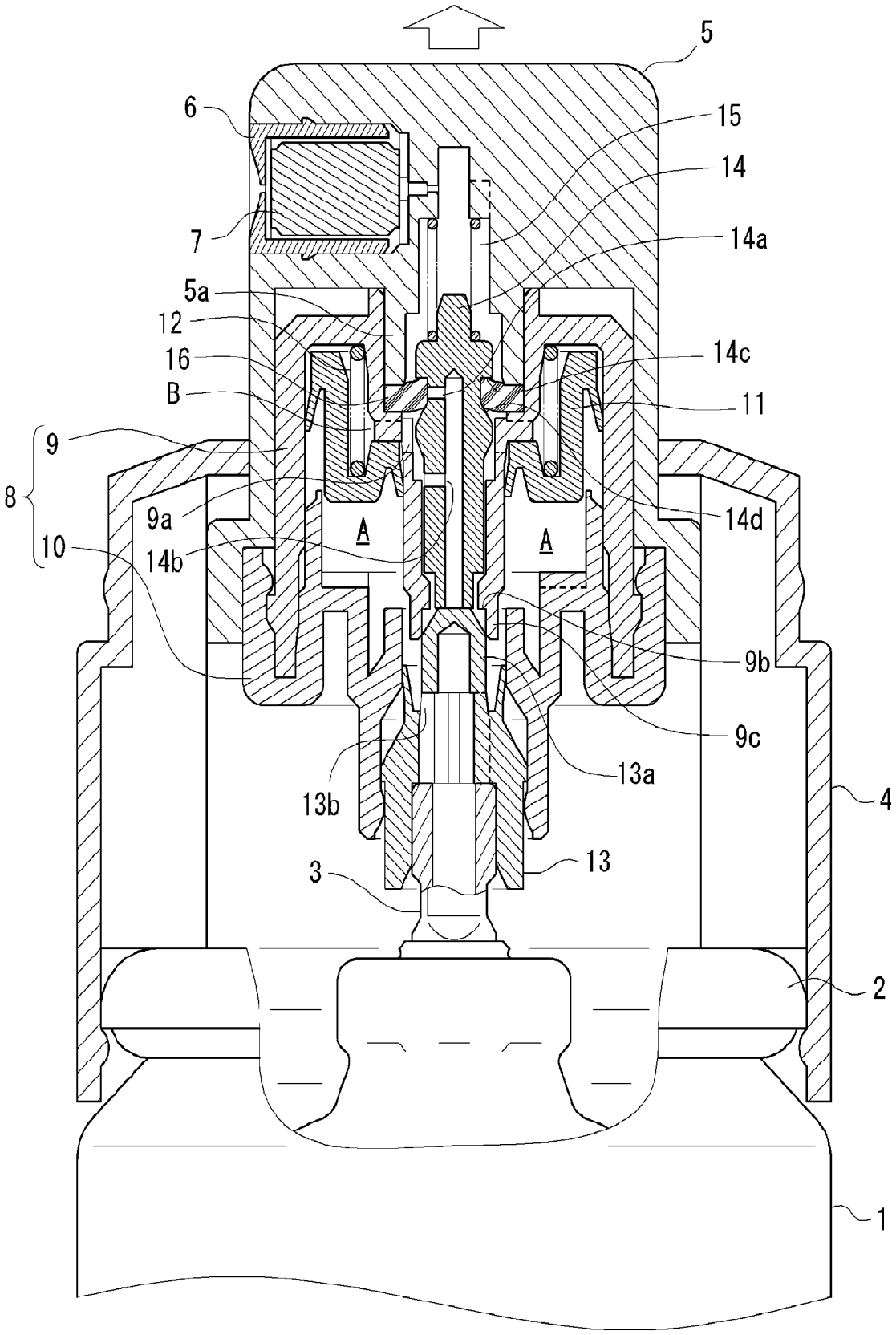
[FIG. 4]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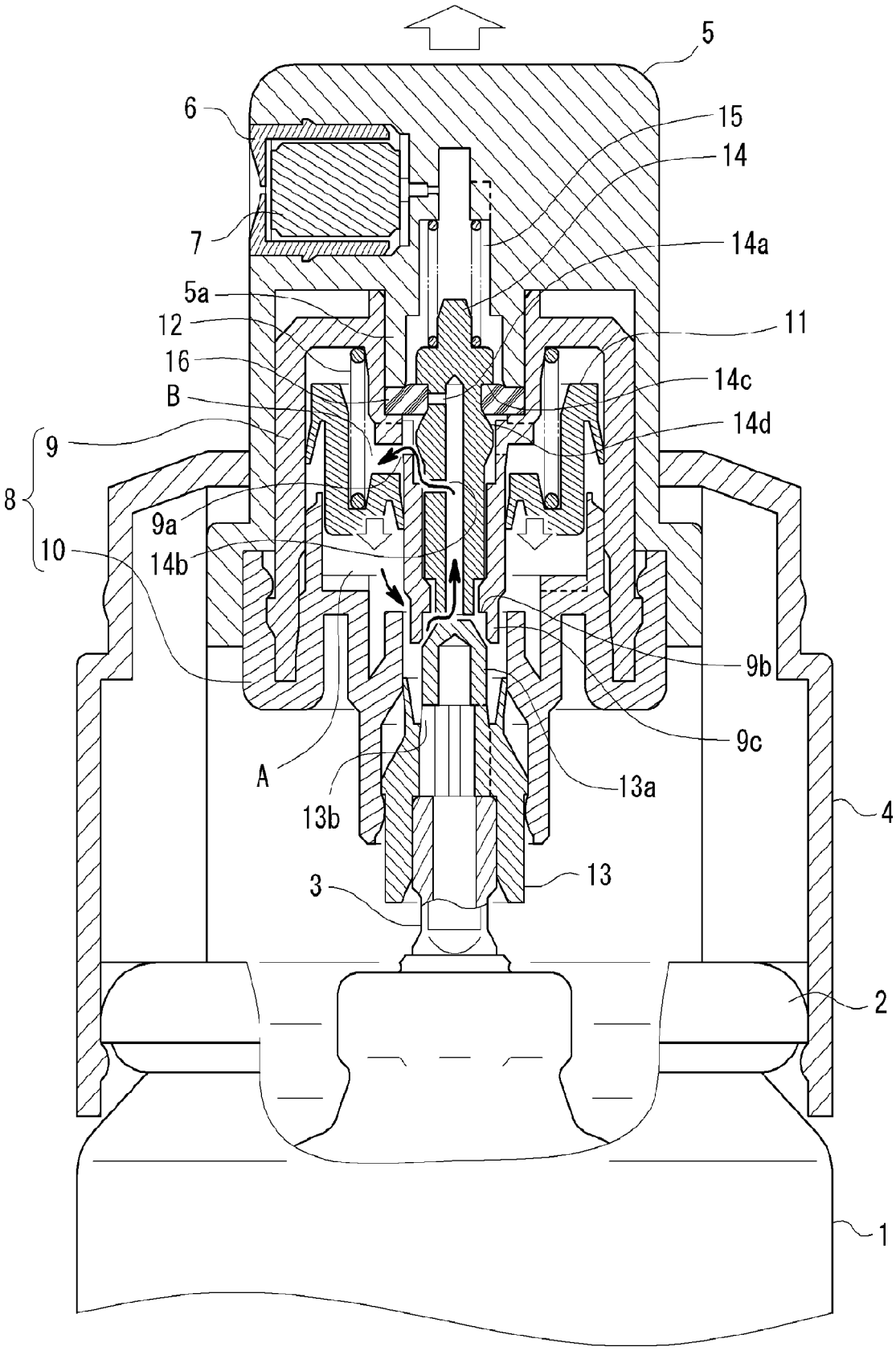
[FIG. 5]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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/003651

A. CLASSIFICATION OF SUBJECT MATTER

B65D 83/54(2006.01)i; ***B05B 9/04***(2006.01)i
FI: B65D83/54 200; B05B9/04

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)

B65D83/14-B65D83/74; B05B9/04

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-84444 A (TOYO AEROSOL IND. CO., LTD.) 28 March 2000 (2000-03-28)	1-6
A	US 3138301 A (SEARY LTD.) 23 June 1964 (1964-06-23)	1-6
A	FR 2730219 A1 (SOCIETE D'INNOVATION RECHERCHE PLASTIQUE) 09 August 1996 (1996-08-09)	1-6
A	WO 2021/29121 A1 (MITANI VALVE CO., LTD.) 18 February 2021 (2021-02-18)	1-6
A	US 2019/0275541 A1 (SCHMID, Felix) 12 September 2019 (2019-09-12)	1-6
A	JP 2008-207873 A (MITANI VALVE CO., LTD.) 11 September 2008 (2008-09-11)	1-6
A	JP 8-104380 A (OSAKA SHIP BUILDING CO., LTD.) 23 April 1996 (1996-04-23)	1-6
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 46921/1988 (Laid-open No. 152746/1989) (MITANI VALVE CO., LTD.) 20 October 1989 (1989-10-20)	1-6

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
07 April 2023	**25 April 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/003651

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FR 2730219 A1	09 August 1996	(Family: none)	
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JP 2008-207873 A	11 September 2008	(Family: none)	
JP 8-104380 A	23 April 1996	(Family: none)	
JP 1-152746 U1	20 October 1989	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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