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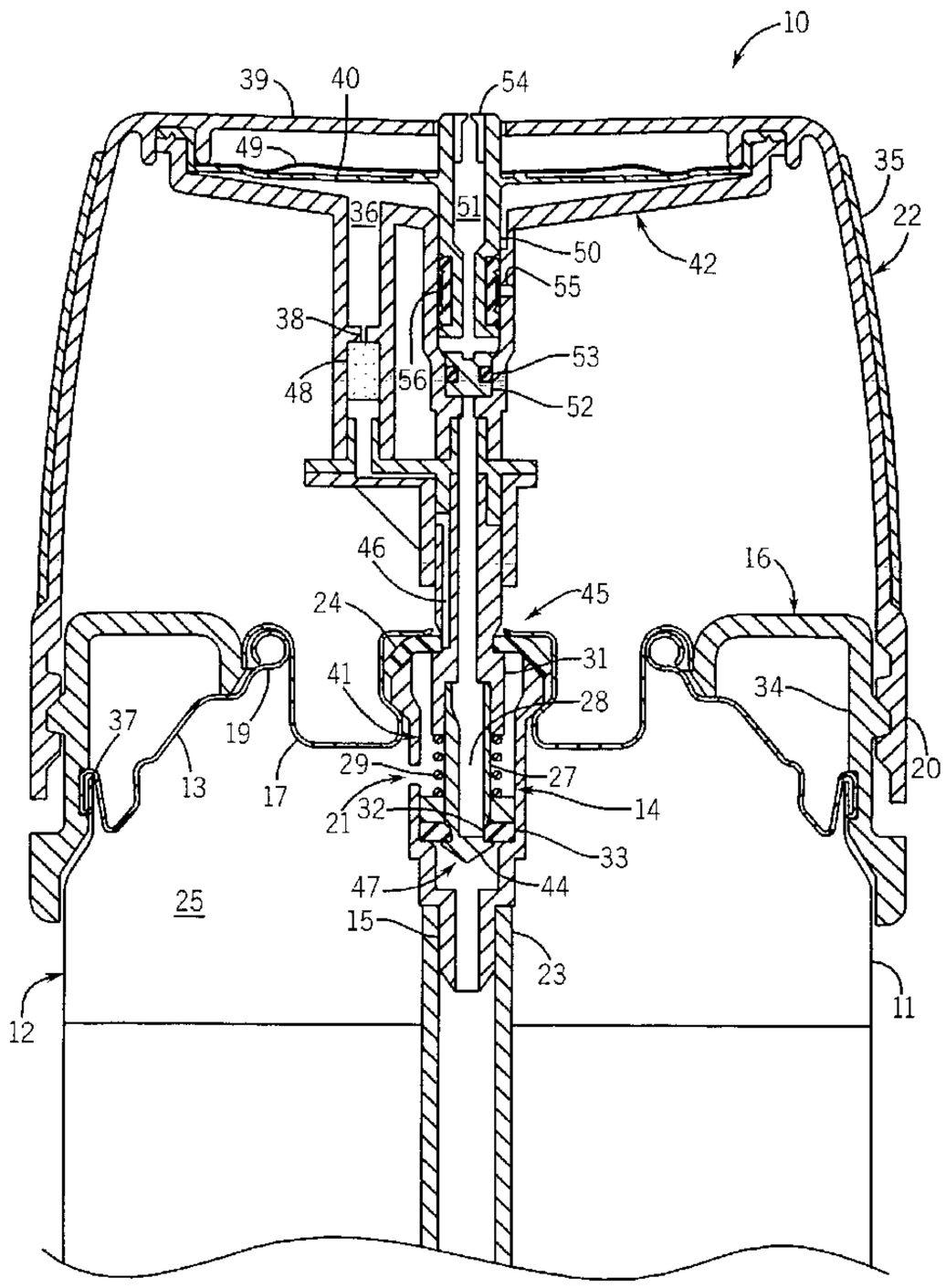

(57) Abrégé/Abstract:
A valve assembly can automatically dispense aerosol content from an aerosol container (12) at predetermined intervals without the use of electric power. A diaphragm (40) at least partially defines an accumulation chamber (36) that receives gas propellant from a portion of the can (12) during an accumulation phase. Once the internal pressure of the accumulation chamber (36) reaches a

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(57) Abrégé(suite)/Abstract(continued):
predetermined threshold, the diaphragm moves, carrying with it a seal so as to unseal an outlet channel (51), and thereby initiate a spray burst of the main active chemical. The diaphragm (40) assumes its original position when the pressure within the accumulation chamber (36) falls below a threshold pressure.

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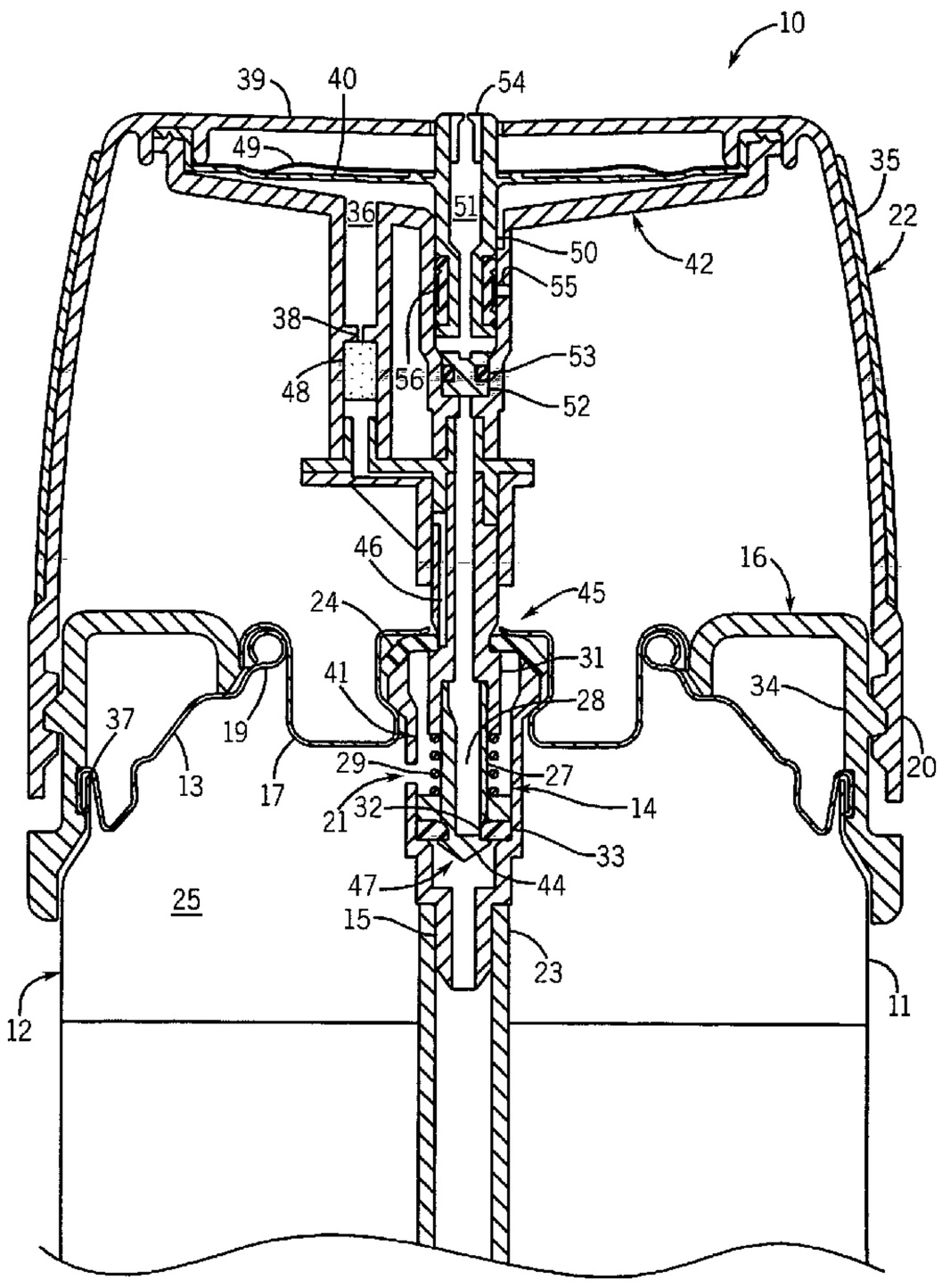
(54) Title: INTERMITTENT AEROSOL DISPENSING VALVE



(57) Abstract: A valve assembly can automatically dispense aerosol content from an aerosol container (12) at predetermined intervals without the use of electric power. A diaphragm (40) at least partially defines an accumulation chamber (36) that receives gas propellant from a portion of the can (12) during an accumulation phase. Once the internal pressure of the accumulation chamber (36) reaches a predetermined threshold, the diaphragm moves, carrying with it a seal so as to unseal an outlet channel (51), and thereby initiate a spray burst of the main active chemical. The diaphragm (40) assumes its original position when the pressure within the accumulation chamber (36) falls below a threshold pressure.

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~~DISPENSING VALVE~~

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH/DEVELOPMENT

~~Not applicable~~

BACKGROUND OF THE INVENTION

The present invention relates to aerosol dispensing devices, and in particular to valve assemblies that provide automatic dispensing of aerosol content at predetermined time intervals, without requiring the use of electrical power.

Aerosol cans dispense a variety of ingredients. Typically, an active is mixed with a propellant which inside the can is at least partially in a gas state, but may also be at least partially dissolved into a liquid containing active. Typical propellants are a propane/butane mix or carbon dioxide. The mixture is stored under pressure in the aerosol can. The active mixture is then sprayed by pushing down/sideways on an activator button at the top of the can that controls a release valve. For purposes of this application, the term "active chemical" is used to mean that portion of the content of the container (regardless of whether in emulsion state, single phase, or multiple phase), which is in liquid phase in the container (regardless of phase outside the container) and has a desired active such as an insect control agent (repellent or insecticide or growth regulator), fragrance, sanitizer, and/or deodorizer alone and/or mixed in a solvent, and/or mixed with a portion of the propellant.

Pressure on a valve control button is typically supplied by finger pressure. However, for fragrances, deodorizers, insecticides, and certain other actives which are sprayed directly into the air, it is sometimes desirable to periodically refresh the concentration of active in the air. While this can be done manually, there are situations where this is inconvenient. For example, when an insect repellant is being sprayed to protect a room overnight (instead of using a burnable mosquito coil), the consumer will not want to wake up in the middle of the night just to manually spray more repellant.

There a number of prior art systems for automatically distributing actives into the air at intermittent times. Most of these rely in some way on electrical power to activate or control the dispensing. Where electric power is required, the cost of the dispenser can be unnecessarily increased. Moreover, for some applications power requirements are so high

that battery power is impractical. Where that is the case, the device can only be used where linkage to conventional power sources is possible.

Other systems discharge active intermittently and automatically from an aerosol can, without using electrical power. For example, U.S. Pat. No. 4,077,542 relies on a biased diaphragm to control bursts of aerosol gas at periodic intervals. See also U.S. Pat. Nos. 3,477,613 and 3,658,209. However, biased diaphragm systems have suffered from reliability problems (e.g. clogging, leakage, uneven delivery). Moreover, they sometimes do not securely attach to the aerosol can.

Moreover, the cost of some prior intermittent spray control systems makes it impractical to provide them as single use/throw away products. For some applications, consumers may prefer a completely disposable product.

However, many dispensing devices permit liquid with active to pass through a variety of narrow control passages in the valve. Over time, this can lead to clogging of the valve, and thus inconsistent operation. In U.S. Pat. No. 4,396,152 an aerosol dispensing system was proposed which separately accessed the vapor and liquid phases of the material in the container. However, this device did not achieve reliable automatic operation.

Document JP 56 037070 - shows a valve assembly for intermittently spraying product from an aerosol can. The assembly has two conduits connecting to the interior of the can. One leads to the product in the bottom of the can. The other connects to the gas space at the top of the can and leads to an accumulation chamber. As the accumulation chamber fills a diaphragm releases pressure from the axially remote side of a main valve for the product. When the pressure reduces to below a critical pressure, a main product valve opens. This results in a burst of product exiting the device from the main nozzle. Further filling of the accumulation chamber pulls a diaphragm central stem fully away from the axially remote end of the main valve and uncovers a dedicated discharge passage for the propellant gas leading directly to atmosphere.

Document JP 56 070865 - shows another intermittently actuating valve for an aerosol can in which the can has separate channels for propellant gas and product. The propellant gas is fed via a control regulating valve through a side feed conduit to the far side of a diaphragm where it pressurizes the accumulation chamber. The diaphragm presses a button, which in turn operates a downstream main valve for the product. Actuation of the main valve stem also opens an ancillary valve allowing discharge of propellant gas from the accumulation chamber to atmosphere.

Yet another prior art arrangement is shown in JP 57 174173. In this arrangement a can has a valve with two stages of operation. A small movement allows only propellant gas to exit via a gas outlet. Further pressure allows product to exit via a product outlet. When the valve assembly is affixed to the can, the valve in the top of the can is actuated to the extent to allow the propellant gas to enter a conduit where it leads to the end of the assembly remote from the can. It passes via a control valve to an accumulation chamber. When it fills the accumulation chamber to a threshold pressure a diaphragm flips and presses the top of a valve body which presses further on the aerosol can valve allowing product to escape. When this happens, a vent orifice opens to allow the propellant gas in the accumulation chamber to escape directly to atmosphere.

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Thus, a need still exists for improved, inexpensive automated aerosol dispensers that do not require electrical power.

BRIEF SUMMARY OF THE INVENTION

In one aspect the invention provides a valve assembly as defined in claim 1 below. The assembly ~~that~~ is suitable to dispense an active chemical from an aerosol container where the container has a first region holding a gas propellant and a second region holding an active chemical. The assembly is of the type that can automatically iterate between an accumulation phase where the gas is received from the container, and a spray phase where the active chemical is automatically dispensed at intervals. The regions need not be physically separated from each other. In fact, the preferred form is that the first region be an upper region of the can where propellant gas has collected above a liquid phase of the remainder of the can contents.

There is a housing mountable on an aerosol container. A movable diaphragm is associated with the housing and linked to a seal, the diaphragm being biased towards a first configuration. An accumulation chamber is inside the housing for providing variable pressure against the diaphragm. A first passageway in the housing is suitable for linking

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the first region of the aerosol container with the accumulation chamber, and a second passageway links the second region with an outlet of the valve assembly.

When the diaphragm is in the first configuration the seal can restrict the flow of active chemical out the valve assembly. When the pressure of chemical inside the accumulation chamber exceeds a specified threshold, the diaphragm can move to a second configuration where the active chemical is permitted to spray from the valve assembly.

In preferred forms a porous material is disposed within the first passageway to regulate the flow rate of gas propellant there through. The diaphragm shifts back to the first configuration from the second configuration when pressure of the gas propellant in the accumulation chamber falls below a threshold amount.

The accumulation chamber will exhaust the gas when the diaphragm is in the second configuration. The gas propellant and active chemical ~~may mix~~ mixes in the valve assembly outside of the can. ~~Alternatively and preferably, the active chemical and gas propellant may exit the dispenser as separate streams.~~

There may also be a container that is linked to the valve assembly, and an actuator portion of the housing that rotates to allow gas propellant to leave the container and enter the first passageway. The seal may be displaceable in an axial direction to allow gas propellant to flow through the first passageway into the accumulation chamber.

Methods for using these valve assemblies with aerosol containers are also disclosed, and the invention provides a method as defined in claim 7 below.

The present invention achieves a secure mounting of a valve assembly on an aerosol can, yet provides an actuator that has two modes. In one mode the valve assembly is operationally disconnected from the actuator valve of the aerosol container (a mode suitable for shipment or long-term storage). Another mode operationally links the valve assembly to the aerosol container interior, and begins the cycle of periodic and automatic dispensing of chemical there from. Importantly, periodic operation is achieved without requiring the use of electrical power to motivate or control the valve.

The valve assembly has few parts, and is inexpensive to manufacture and assemble. Moreover the separate accessing of the gas propellant lets the gas (as distinguished from more viscous liquid) motivate the diaphragm and thus provides for cleaner and more reliable operation. By not requiring liquid and vapor to both pass through the porous media, there is much less likelihood for clogging due to extended use over months. Using the separation concepts described in this patent, product is released

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under full pressure with liquid propellant (as in a typical manually operated aerosol can), so as to provide for very effective particle break-up. If in a device like the present one the propellant gas was not separated from the main product, it might separate in the accumulation chamber or elsewhere in the device, thereby providing inconsistent results.

The foregoing and other advantages of the invention will appear from the following description. In the description reference is made to the accompanying drawings which form a part thereof, and in which there is shown by way of illustration, and not limitation, preferred embodiments of the invention. Such embodiments do not necessarily represent the full scope of the invention, and reference should therefore be made to the claims herein for interpreting the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

~~FIG. 1 is a schematic sectional view of a first preferred automated dispensing valve~~ assembly of the present invention in an off configuration, mounted on an aerosol can;

FIG. 2 is an enlarged view of the can valve portion of the dispensing valve assembly of FIG. 1;

FIG. 3 is an enlarged view of the dispensing portion of the dispensing valve assembly of FIG. 1;

FIG. 4 is a view similar to FIG. 1, with the device shown in the on configuration during an accumulation phase;

FIG. 5 is an enlarged view of a portion of the FIG. 1 device, but with the device shown in a spray phase;

FIG. 6 is a sectional view of the valve portion of a can valve assembly of an alternate embodiment;

FIG. 7 is a view similar to FIG. 6, with the valve in the "on" configuration;

FIGS. 8A-D are views of alternative dispensing valve plugs usable with the present ~~invention;~~

FIG. 9 is a sectional view of an automatic dispensing valve assembly ~~of another embodiment~~ in an "off" configuration;

FIG. 10 is a view similar to FIG. 9, but with the valve in an "on" configuration during the accumulation phase of the dispensing cycle;

FIG. 11 is an enlarged view of a part of the valve assembly of FIG. 9;

FIG. 12 is a view similar to FIG. 11, but with the valve in the spray phase of the dispensing cycle;

FIG. 13 is a sectional view of an automatic dispensing valve assembly ~~of yet another embodiment~~ embodying the present invention in an "off" configuration;

FIG. 14 is a view similar to FIG. 13, but with the valve in an "on" configuration during the accumulation phase of the dispensing cycle;

~~FIG. 15 is a sectional view of an automatic dispensing valve assembly of still another embodiment in an "off" configuration;~~

FIG. 16 is an enlarged view of a part of the valve assembly of FIG. 15;

FIG. 17 is a view similar to FIG. 15, but with the valve in an "on" configuration during the accumulation phase of the dispensing cycle;

FIG. 18 is an enlarged view of a valve portion of the valve assembly of FIG. 17;

FIG. 19 is an enlarged view of the accumulation chamber portion of the valve assembly of FIG. 17;

FIG. 20 is a view similar to FIG. 19, but with the valve in the spray phase of the dispensing cycle;

FIG. 21 is a sectional view of another embodiment of an automatic dispensing valve assembly of the present invention in an "off" configuration, mounted onto an aerosol can;

FIG. 22 is an enlarged sectional view of a part of the valve assembly of FIG. 21.

FIG. 23 is a view similar to FIG. 21, but with the valve in an "on" configuration;

FIG. 24 is a view similar to Fig. 22 of the valve assembly of FIG. 23, with the valve in an accumulation portion of the dispensing cycle;

FIG. 25 is an enlarged view of the accumulation chamber of the valve assembly of FIG. 23;

FIG. 26 is a view similar to a portion of FIG. 21, but with the valve assembly in a ~~spray configuration;~~

FIG. 27 is a sectional view of an automatic dispensing valve assembly of ~~yet~~ another embodiment in an "off" configuration;

FIG. 28 is a view similar to FIG. 27, but with the valve in an "on" configuration during the accumulation phase of the dispensing cycle;

FIG. 29 is a view similar to FIG. 28, but with the valve assembly in the spray phase;

FIG. 10 is an enlarged view of a gas propellant control valve of the valve assembly illustrated in FIG. 7; and

FIG. 11 is another enlarged view of the gas propellant valve of the valve assembly illustrated in FIG. 8, with the valve in a different configuration.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

~~Referring initially to FIG. 1, an aerosol can 12 includes a cylindrical wall 11 that is~~ closed at its upper margin by a dome 13. The upper margin of the can wall 11 is joined at a can chime 37. An upwardly open cup 17 is located at the center of the dome 13 and is joined to the dome by a rim 19.

The can 12 includes an axially extending conduit 23 that is centrally disposed therein, and opens into a mixed pressurized chemical (active and gas propellant) at one end (preferably towards the bottom of the can). The upper region 25 of the can interior above the active chemical line contains pressurized gas propellant. The lower region contains a mix of liquid gas and the active chemical. The upper end of conduit 23 receives a tee 15 that interfaces with the interior of dispenser 10, through which the chemical may be expelled.

Dispenser 10 includes a can valve assembly 45 that, in turn, includes a gas propellant valve assembly 41 and an active valve assembly 47. Dispenser 10 permits aerosol content to be automatically expelled into the ambient environment at predetermined intervals, as will be described in more detail below. Dispenser 10 is mostly polypropylene, albeit other suitable materials can be used.

A mounting structure 16 is snap-fit to the valve cup rim 19 at its radially inner end, and to the can chime 37 at its radially outer end. The radially outer wall 34 of mounting structure 16 extends axially, and is threaded at its radially outer surface. The dispenser 10 has a radially outer wall 35 that includes a lower skirt portion 20 which forms part of a control assembly 22. Skirt 20 has threads disposed on its radially inner surface that intermesh with threads on outer wall 34 to rotatably connect the dispenser 10 to the aerosol can 12. The axially outer end of wall 35 terminates at a radially extending cover having a centrally disposed outlet that contains a dispensing nozzle 54 which enables active to be sprayed out the dispenser 10 at predetermined intervals, as will be described in more detail below. In operation, the dispenser 10 may be switched "ON" and "OFF" by ~~rotating member 22 relative to the can 12, as will be apparent from the description below~~.

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~~seal provided by~~ plug 52 and o-ring 53~~'~~ ~~thus provides further assurance that any minimal~~ active mixture that seeps past plug 52'' will not travel into channel 51.

Referring to FIGS. 8C–8D, a plug 52''' is presented with ~~in~~ combination with a spring 57 that extends between the axially outer surface of the plug and the axially inner surface of conduit 50. In particular, the ~~base~~ of the plug 52''' is disposed within a slot 58 formed in the wall 50 that enables the plug to travel .03 inches in accordance with the preferred embodiment. The clearance provided in this embodiment enables the diaphragm to expand slightly prior to the active mixture flowing through outlet 51. The spring 57 ~~provides additional compliance.~~

Referring ~~best~~ to FIG. 9, a dispenser 120 ~~in accordance with another embodimen~~ is mounted onto can 122 via outer wall 144 that has a threaded inner surface so as to intermesh with threads on the outer surface of wall 136. A cover 149 extends substantially radially inwardly from the axially outer end of wall 144. Wall 136 has a flange at its axially inner surface that engages can chime 139. Wall 136 is integrally connected to an angled wall 147 that extends radially inwardly, and axially downstream, there from. Wall 147 is integrally connected at its radially inner edge to wall 154 that extends axially upstream and has a flange that engages rim 129.

Control assembly 120 further includes a lever 171 that is rotated along with wall 144 to displace the control assembly 132 in the axial direction, as described above. Additionally, lever 171 could include a perforated tab (not shown) between itself and wall 144 that is broken before the dispenser can be actuated, thereby providing means for indicating whether the dispenser has been tampered with.

Can 122 includes first and second valves 137 and 140, respectively, that extend into can 122. Valve 137 is connected to a conduit 133 that extends axially towards the bottom of the can so as to receive the chemical mixture. Valve 140 terminates in the upper region 135 of can 122 so as to receive gaseous propellant. Valves 137 and 140 includes a downwardly actuatable conduit 138 and 143, respectively, that extend axially out of the can 122. Accordingly, dispenser 120 may be provided as a separate part that is mountable onto can 122 by rotating wall 144 with respect to wall 136.

Referring to FIG. 13, active valve assembly 157 includes an annular wall 177 whose axially inner end slides over conduit 137. A flange 173 extends radially inwardly from wall 177, and engages the outer end of conduit 138. Flange 173 defines a centrally disposed channel 165 that extends axially there through and aligned with conduit 138. An

annular wall 141 fits inside wall 177 and extends axially downstream from flange 173, and defines an axially extending conduit 175 that is in fluid communication with channel 165. Channel 165 extends out the dispenser 120 to provide an outlet 167 to the ambient environment. Wall 141 further defines a second channel 152 that extends axially between a propellant outlet vent 156 and the ambient environment.

A plug 164 is disposed between channels 175 and 165, and blocks channel 165 so as to prevent the active chemical from exiting from the dispenser 120 when not in the spray phase. A pair of o-rings 163 are disposed between the inner surface of wall 177 and the outer surface of wall 141 to further ensure that no active chemical or propellant is able to exit dispenser 120 through vent 156 that extends through wall 141. An annular channel 153 surrounds plug 164 and joins channels 165 and 175 in fluid communication during the spray phase, as will be described in more detail below.

The propellant valve assembly 151 includes an annular wall 179 defining a conduit 142 that extends axially from valve stem 143 into an accumulation chamber 146. Accumulation chamber is defined by a diaphragm 150 that extends radially from a wall 161 that is disposed at the interface between cover 149 and the axially outer end of wall 179, axially inner portion of wall 161, inner surface of wall 179, and outer surface of wall 141. Diaphragm 150 is further connected at its radially inner end to wall 141.

Wall 179 includes a flange 159, similar to flange 173 of wall 177, that engages valve stem 143, and defines a channel 181 extending there through that joins valve stem 143 and conduit 142 in fluid communication. A porous flow control media 158 is disposed within channel 142 axially downstream from flange 159 so as to regulate the flow of propellant into accumulation chamber 146.

When the dispenser 120 is initially mounted onto can 122, neither conduit 138 or 143 are actuated. However, referring now to FIG. ~~10~~ 2, once the dispenser 120 is rotated to the "ON" position, thereby beginning the accumulation phase, flanges 159 and 173 are translated axially upstream and depress valve stems 143 and 138, respectively. Active chemical thus travels through conduit 133, valve 137, and into conduit 165. The active is prevented, however, from flowing into conduit 175 by the seal provided by plug 164 and o-rings 163.

The propellant travels through valve 140, channel 181, porous media 158, conduit 142, and into accumulation chamber 146. Once the pressure of propellant acting on the axially inner surface of diaphragm 150 exceeds a predetermined threshold, the diaphragm

becomes deformed from the normal closed position illustrated in FIG. 9 to the open position illustrated in FIG. 12.

This initiates a spray phase, during which the diaphragm 150 causes wall 141 to become displaced axially upstream, thereby removing the inlet to channel 175 from the plug 164. Accordingly, active chemical flows along the direction of arrow N from conduit 138, through channel 153, and into conduit 175 where it exits the dispenser 120 at outlet 167. Additionally, when wall 141 is displaced, the outer o-ring is removed from the inner surface of wall 141.

As a result, propellant travels from accumulation chamber 164 through the gap formed between the radially inner surface of wall 177 and the radially outer surface of wall 141 along the direction of arrow O, through channel 156, and into channel 152 where it exits the dispenser as a separate stream. Once the pressure within accumulation chamber 146 abates, the diaphragm snaps back to the closed position to begin a subsequent accumulation phase.

Referring next to FIG. 13, a dispenser 220 is illustrated in accordance with ~~another embodiment of~~ the invention but otherwise having similar construction to ~~the last~~ that described above embodiment. The primary other differences reside in the active valve assembly 257 and propellant valve assembly 251.

In particular, the active valve assembly 257 includes an annular lip 225 that extends axially upstream into conduit 233, and defines and interior cavity 224. The axially upstream end of lip 225 fits inside conduit 233 to deliver active to valve 237.

The propellant valve assembly 251 includes a flexible seal 234 extending radially outwardly from member 225 such that the axially outer surface of seal 234 rests against the axially inner surface of a seat 254. Seat 254 is disposed within the cup 234, and receives inner and outer fork members 259 therein. Fork 259 defines the axially inner end of a wall 279 that encloses a conduit 242 that flows into accumulation chamber 246. A porous flow control media 258 is disposed within conduit 242.

When the dispenser is in the "OFF" position illustrated in FIG. 15, seal 234 prevents propellant from entering channel 242. However, referring to FIG. 14, when assembly 232 is further rotated to switch the dispenser "ON," fork members 259 are displaced axially upstream against seal 234 which deflects outwardly away from seat 254. Because inner fork member is displaced axially downstream from outer fork member, the

inlet to channel 242 is exposed to upper portion 235 of can 222, thereby enabling propellant to enter accumulation chamber 246 via conduit 242.

~~Referring now to FIGS. 15 and 16, a dispenser 320 in accordance with yet another~~ embodiment is mounted onto can 322 in the same manner as described above in accordance with the last embodiment. However, a spring 339 is seated within annular member that biases tee 334 axially outwardly and against the cup 327.

Tee 334 is disposed within the cavity 324. Annular member 325 defines a channel 385 that extends from conduit 333 into conduit 324. Housing 334 defines a first conduit 353 that extends partially there through in the radial direction, and terminates at an axially extending conduit 355. Conduit 355 is in fluid communication, at its axially outer end, with a conduit 375 that extends axially out the dispenser as an active chemical outlet 364a. Conduit 375 is defined by an axially extending annular wall 377 in combination with an axially extending separator 341. However, when the dispenser is either "OFF" or in the accumulation phase, a plug 364 blocks the entrance into conduit 375. Furthermore, when the dispenser 320 is in the "OFF" position, conduits 385 and 353 are not in radial alignment.

Annular member 325 further defines a propellant intake channel 331 extending radially there through and in fluid communication with upper region 335 of can 322. Tee 334 defines a channel 381 extending partially there through in the radial direction, and terminates at the axially upstream end of an axially extending conduit 383. Conduit 383, at its axially outer end, is in fluid communication with a conduit 342 that opens into accumulation chamber 346. A porous media 358 is disposed in conduit 342 to regulate the flow of propellant into accumulation chamber 346. However, when the dispenser is in the "OFF" position, conduits 331 and 381 are not aligned.

An annular seal 328 is disposed around the periphery of tee 334, and positioned between wall 325 and cup 327. A pair of o-rings 363 are disposed at the radial interface between walls 325 and 334 at a position axially inwardly and outwardly of channels 353 and 331. The seal 328 and o-rings 363, in combination with the offset of the propellant and active channels, described above, prevents the flow of active and propellant into dispenser 320 when the dispenser is in the "OFF" position.

Referring now to FIGS. 17-20, when the dispenser 320 is turned "ON" by rotating the control assembly 332, the accumulation phase begins whereby tee 334 is displaced ~~axially upstream against the force of spring 339. Accordingly, channel 353 thus becomes~~

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~~propellant continues to flow into the accumulation chamber 446 in the manner described~~ above to initiate the next spray phase. The cycle is automatic and continuously periodic until the can contents are exhausted.

It should be appreciated that the dispenser 420 and can 422 may be sold to an end user as a pre-assembled unit. In operation, the user rotates the assembly 432 to displace the valve assembly 455 axially inwardly, thereby causing the aerosol contents to flow out of can 422, and beginning the accumulation cycle. The gas propellant flows through conduit 442 and into the accumulation chamber 446. Once the spray phase is initiated, the active mixture flows through conduit 438, and exits the nozzle 464 as a "puff" into the ambient environment. Advantageously, because no active chemical enters the accumulation chamber 446, liquid pooling within the accumulation chamber is prevented.

The duration of the accumulation phase may be controlled, for example, by adjusting the stiffness of diaphragm 450, the internal volume of chamber 446, and/or the porosity of porous flow media 458. The duration of the spray phase may be controlled, for example, by adjusting the clearance provided by channel 453 and the porosity of the accumulation chamber 446 with respect to the ambient environment, thereby controlling ~~the depressurization time of chamber 446.~~

Referring next to FIGS. ~~27-30~~ 10, a dispenser 520 is mounted onto a can 522 in accordance with a second embodiment. A more conventional container exit valve 537 extends upwardly from the center of the valve cup 527. The valve 537 has an upwardly extending valve stem 538, biased outwardly by a spring 569, through which the active mixture of the can 522 may be expelled. Valve 537 is shown as a vertically actuated valve, which can be opened by moving the valve stem 538 directly downwardly. Instead, one could use a side-tilt valve where the valve is actuated by tipping the valve stem laterally and somewhat downwardly.

Control assembly 532 includes an outer wall 544 threaded on its inner surface that intermesh with threads of wall 536 that is connected to the can chime 539. Accordingly, the user may rotate wall 544 to switch the dispenser between the "OFF" position (FIG. ~~27~~) and the "ON" position (FIG. ~~28~~)

Wall 544 is supported at its axially outer end by wall 552 that receives, in a groove disposed at its lower end, the upper end of a retainer wall 541. An o-ring 563 is disposed at the interface between walls 552 and 541. A monostable, flexible diaphragm 550 extends radially from the interface between the o-ring 563 and wall 552. O-ring 563 thus

provides a seal to prevent gas from escaping from the accumulation chamber 546 during the accumulation phase. Wall 541 further includes a flange 543 extending axially downstream towards diaphragm 550. An inverted "L" shaped wall 561 is attached to the inner surface of diaphragm 550, and receives the axially outer end of flange 543 to prevent the escape of gas propellant during the accumulation phase.

Referring in particular to FIG. 10, dispenser 520 also includes a gas propellant valve assembly 551 and an active valve assembly 557. The gas propellant valve assembly 551 includes wall 541, which defines a void that is occupied by a porous media 558. A plunger 556 having a tip 559 is disposed within a seat 554 axially upstream of the porous media 558. Seat 554 is affixed to the cup 527. Plunger 556 is annular, and defines a channel 553 extending there through at a location axially downstream from tip 559. Channel 535 defines the mouth of accumulation chamber 546.

A flexible seal 534 extends radially outwardly from tee 525 such that it rests against the axially inner surface of seat 554. Two seals thus prevent the gas propellant from entering accumulation chamber 546 when the dispenser is "OFF." Seal 534 minimizes leakage during filling of the can and provides a redundant seal to the plunger. Channel is in radial alignment with seat 554, thus forming a seal to prevent gas propellant from entering into the plunger.

An active valve assembly 557 (see Fig. 17) includes a hub 515 that is formed from the radially inner surface of annular retainer wall 541. The hub defines a channel 569 through which the active mixture flows from the valve stem 538 during a spray phase. A plug 564 is attached to the axially inner surface of diaphragm 550, and extends axially inwardly to seal channel 569, thus preventing active chemical from exiting the dispenser 520 during the accumulation phase. An annular opening 567 is disposed in the diaphragm 550 at a position adjacent the plug 567 to enable active chemical to flow from the hub and out the dispenser 520 during the spray phase, as will be described below.

When the control assembly 532 is rotated to switch the dispenser 520 to the "ON" position, the accumulation phase begins. In particular, wall 541 and plunger 556 are biased downwardly such that tip 559 deflects seal 534 away from the seat 554 in the direction of arrow H. The plunger 556 is depressed such that channel 553 is translated to a position axially upstream of seat 554, thereby permitting pressurized gas propellant to enter the channel 553 along the direction of arrow I.

Plug 564 is biased against hub 565, which depresses valve stem 538, thereby pressurizing active chemical against the plug. The seal formed between the plug 564 and hub 565 prevents any active chemical from exiting the dispenser during the accumulation phase.

The gas propellant travels through the porous media and into inlet 560 of the accumulation chamber 546. The constant supply of gas propellant flowing into the accumulation chamber 546 causes pressure to build therein, and such pressure acts against the inner surface of diaphragm 550. Once the accumulation chamber 546 is sufficiently charged with gas propellant, such that the pressure reaches a predetermined threshold, the mono-stable diaphragm 550 becomes deformed from the normal closed position illustrated in FIG. 28 to the open position illustrated in FIG. 29.

This initiates the spray phase, during which the diaphragm 550 is biased axially downstream, thereby also biasing plug 564 axially downstream. An outlet channel is thus formed between plug 564 and hub 565 that permits the pressurized active material to flow along the direction of arrow J out the dispenser 520 into the ambient environment as a "puff." Furthermore, wall 561 is translated axially downstream of flange 543, thereby allowing the gas propellant stored in the accumulation chamber 546 during the previous accumulation phase to travel along the direction of arrow K, mix with the active chemical, and exit the dispenser 520.

Because the channel 553 is disposed below seat 554 during the spray phase, gas propellant continues to flow into the accumulation chamber 546. However, because more propellant exits accumulation chamber 546 than the propellant entering, the pressure within the accumulation chamber quickly abates during the spray phase. Once the pressure within chamber 546 falls below a predetermined threshold, the diaphragm 550 snaps back to its normal position, re-establishing the seal between plug 564 and channel 569. The propellant continues to flow into the accumulation chamber 546 to initiate the next spray phase.

The above description has been that of preferred embodiments of the present invention. It will occur to those that practice the art, however, that many modifications may be made without departing from the ~~spirit and~~ scope of the invention as defined in ~~, In order to advise the public of the various embodiments that may fall within the scope of the invention,~~ the following claims ~~are made~~.

AMENDED SHEET

27-02-2004

US0301996

INDUSTRIAL APPLICABILITY

The present invention provides automated dispenser assemblies for dispensing aerosol can contents without the use of repeated electric power or manual activation.

AMENDED SHEET

S.C. Johnson & Son, Inc.
PCT/US03/01996
Attorney's Ref: J 1468 HP

March 29, 2004

Claims

1. A valve assembly (257) that is suitable to dispense a chemical from an aerosol container (222) that has a first region (235) with a gas propellant and a second region with an active chemical, the valve assembly being of the type that can automatically iterate between an accumulation phase where the gas propellant is received from the container (222), and a spray phase where the active chemical is automatically dispensed at intervals, the valve assembly (257) comprising:

a housing (232, 247) mountable on an aerosol container (222);

a movable diaphragm (250) associated with the housing (232, 247) and linked to a seal, the diaphragm (250) being biased towards a first configuration;

an accumulation chamber (246) inside the housing (232, 247) for providing variable pressure against the diaphragm (250);

a first passageway (242) in the housing (232, 247) suitable for linking the first region (235) of the aerosol container (222) with the accumulation chamber (246);

a second passageway (265, 275) linking the second region with an outlet (267) of the valve assembly;

whereby when the diaphragm (250) is in the first configuration the seal restricts the flow of the active chemical out of the valve assembly (257); and

whereby when the pressure of gas propellant inside the accumulation chamber (246) exceeds a specified threshold the diaphragm (250) can move to a second configuration where active chemical is permitted to spray from the valve assembly (257);

characterized in that the accumulation chamber (246) will at least partially exhaust the gas propellant when the diaphragm (250) is in the second configuration, and the gas propellant and active chemical mix in the valve assembly (257) prior to exiting the valve assembly.

2. The valve assembly as recited in claim 1, wherein the diaphragm (250) will shift back to the first configuration from the second configuration when pressure of the gas propellant in the accumulation chamber (246) falls below a threshold amount.

3. The valve assembly as recited in claim 1, wherein the seal is displaceable in an axial direction.

4. The valve assembly as recited in claim 1, further comprising a container (222) that is linked to the valve assembly (257) where the active chemical is at least partially in a liquid phase in the container, and an actuator portion (232) of the housing (232, 247) rotates to allow gas propellant to leave the container (222) and enter the first passageway (242).

5. The valve assembly as recited in claim 1, wherein the active chemical is selected from the group consisting of insect repellents, insecticides, fragrances, sanitizers, and deodorizers.

6. A method of automatically delivering an active chemical from an aerosol container to an ambient environment at predetermined intervals, the method comprising the steps of:

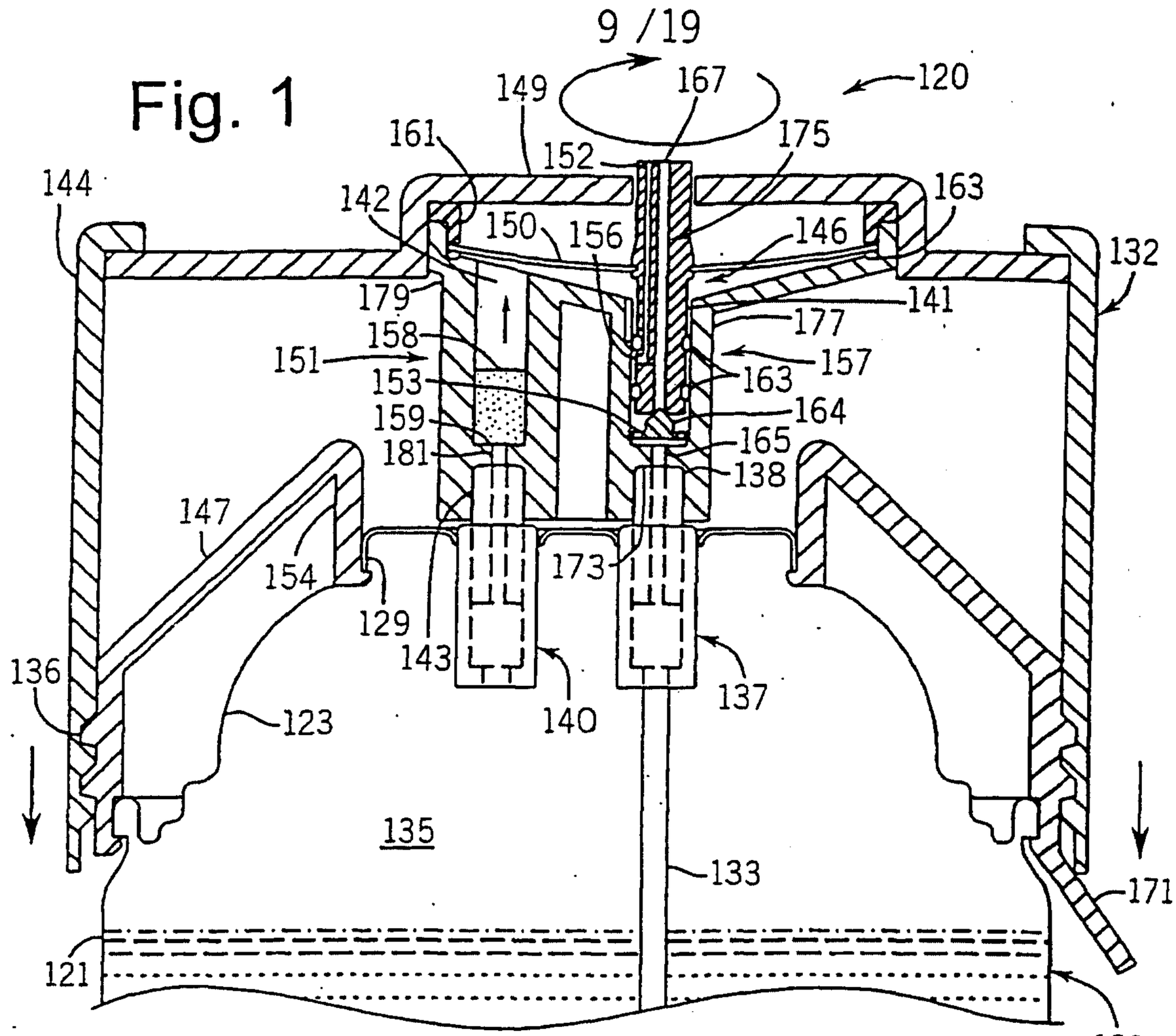
(a) providing a valve assembly (257) according to any preceding claim

(b) mounting the valve assembly (257) to such an aerosol container (222); and

(c) actuating the valve assembly (257).

AMENDED SHEET

Fig. 1



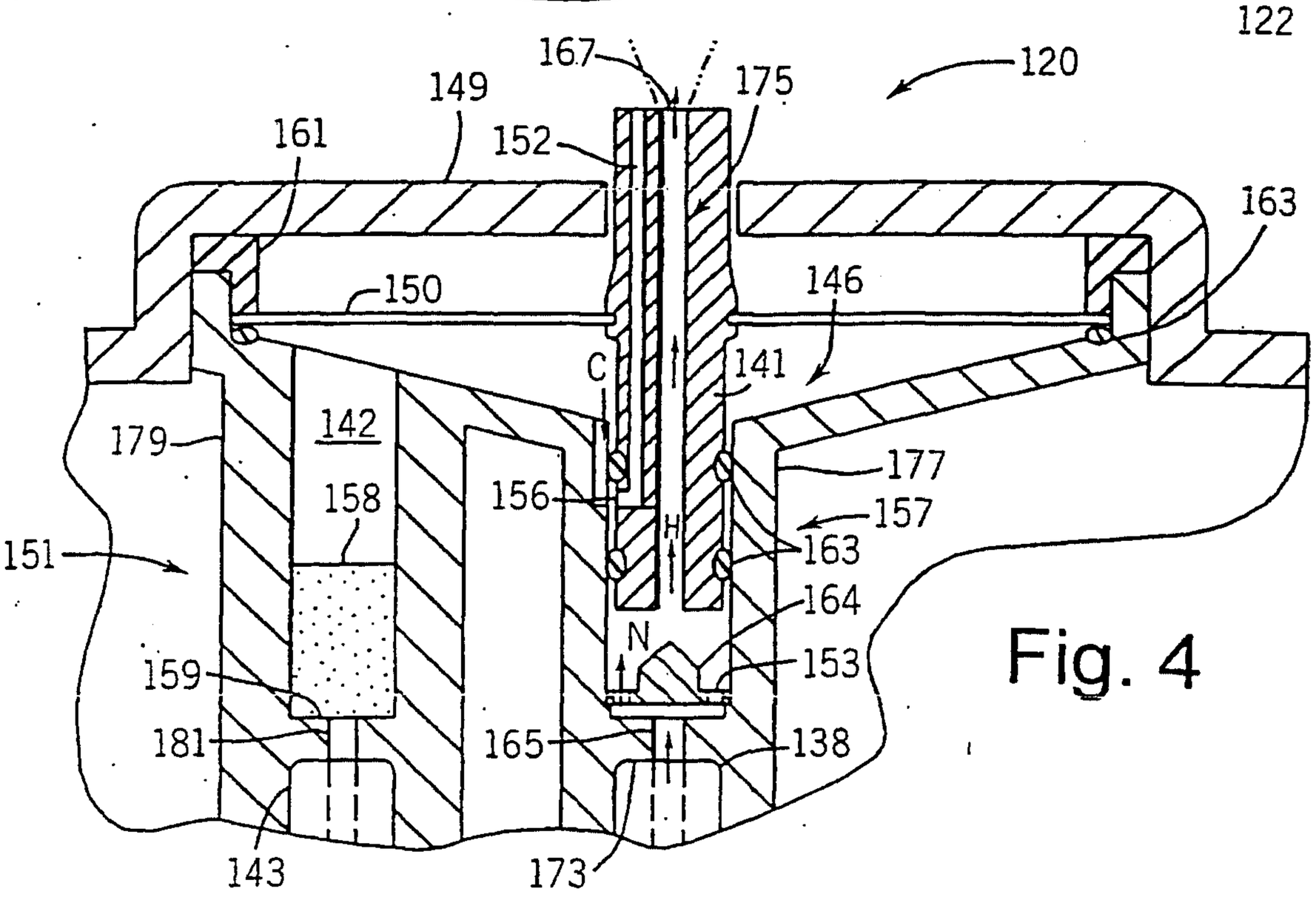


Fig. 4

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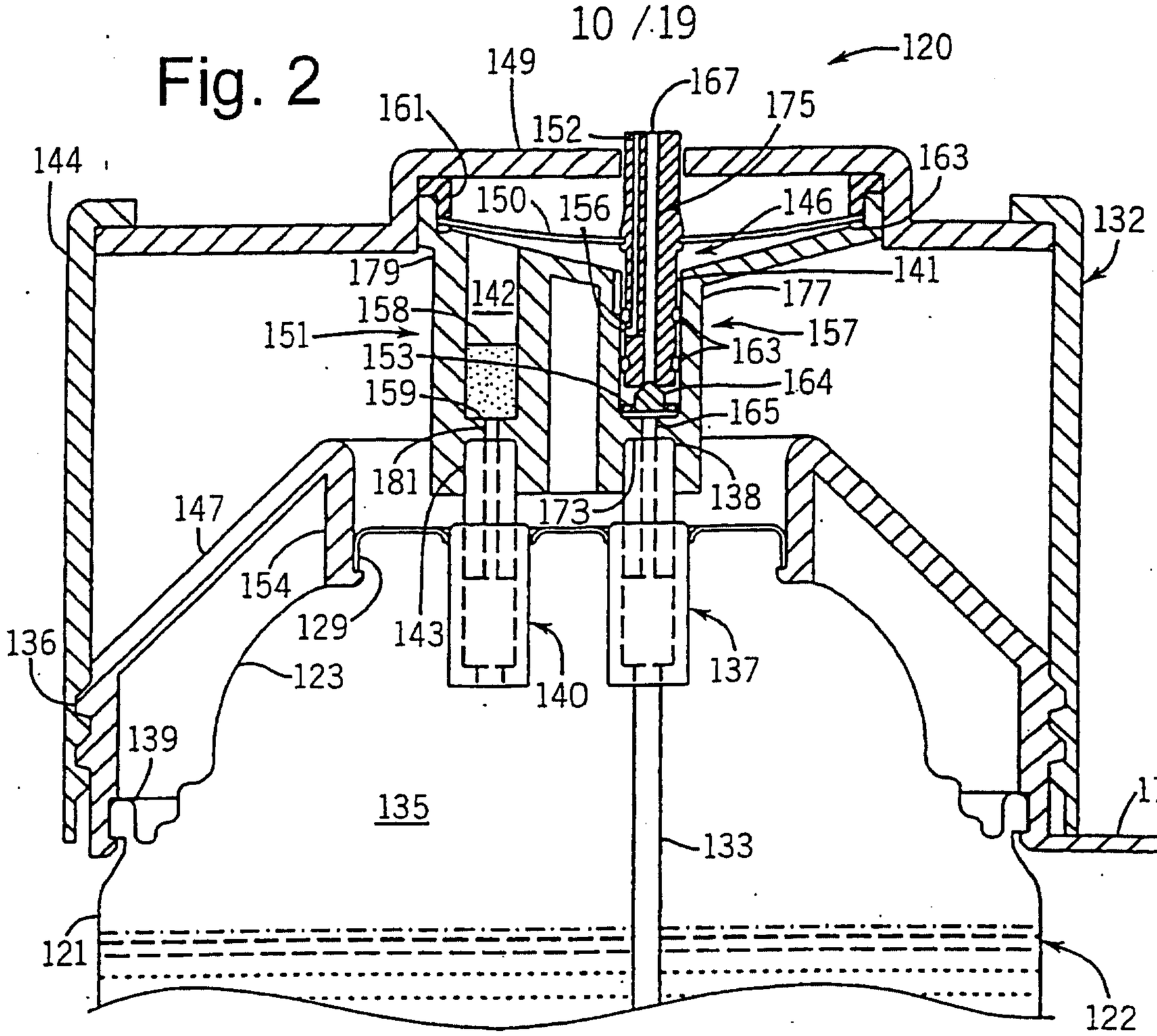
Fig. 2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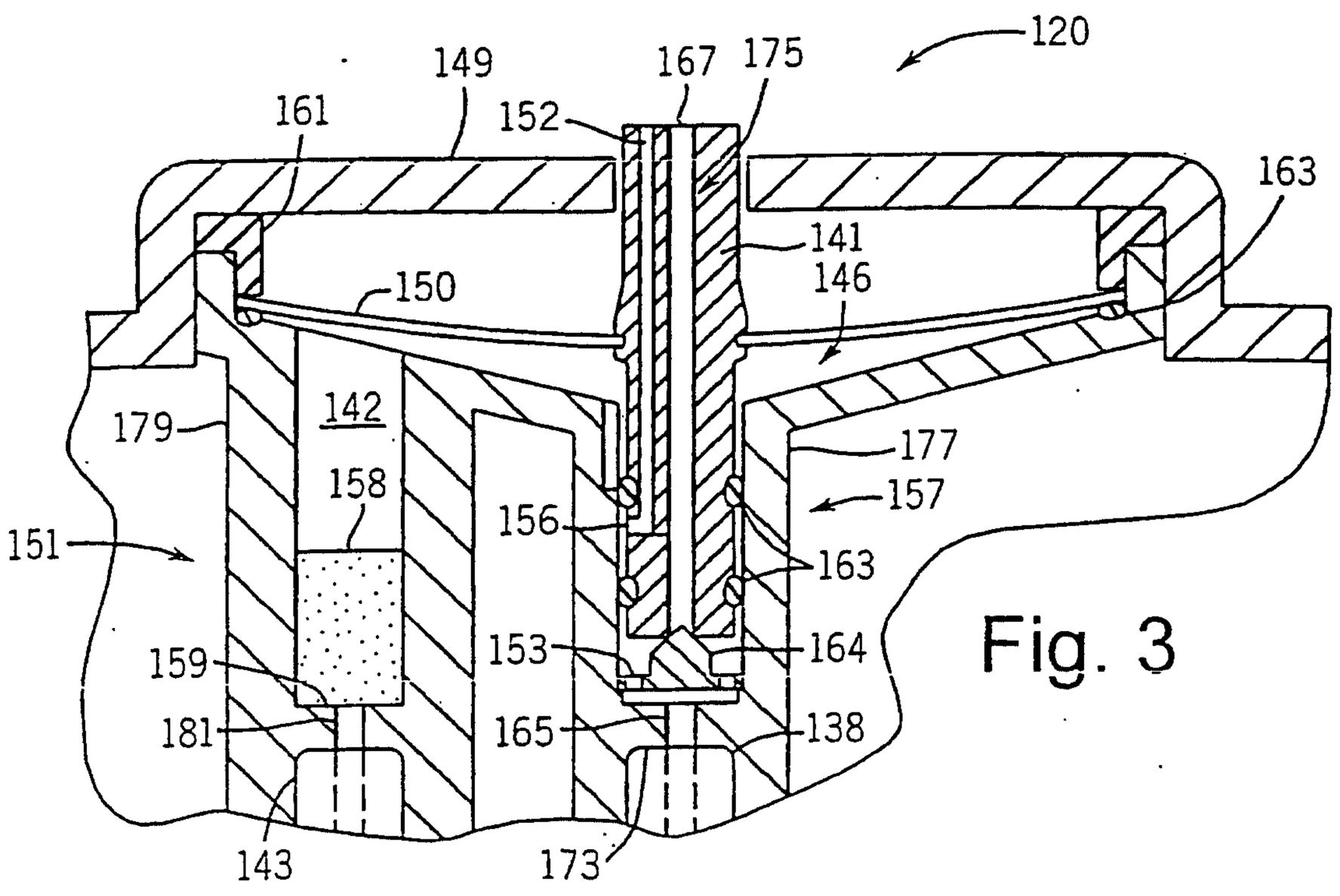
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Fig. 3

Fig. 5

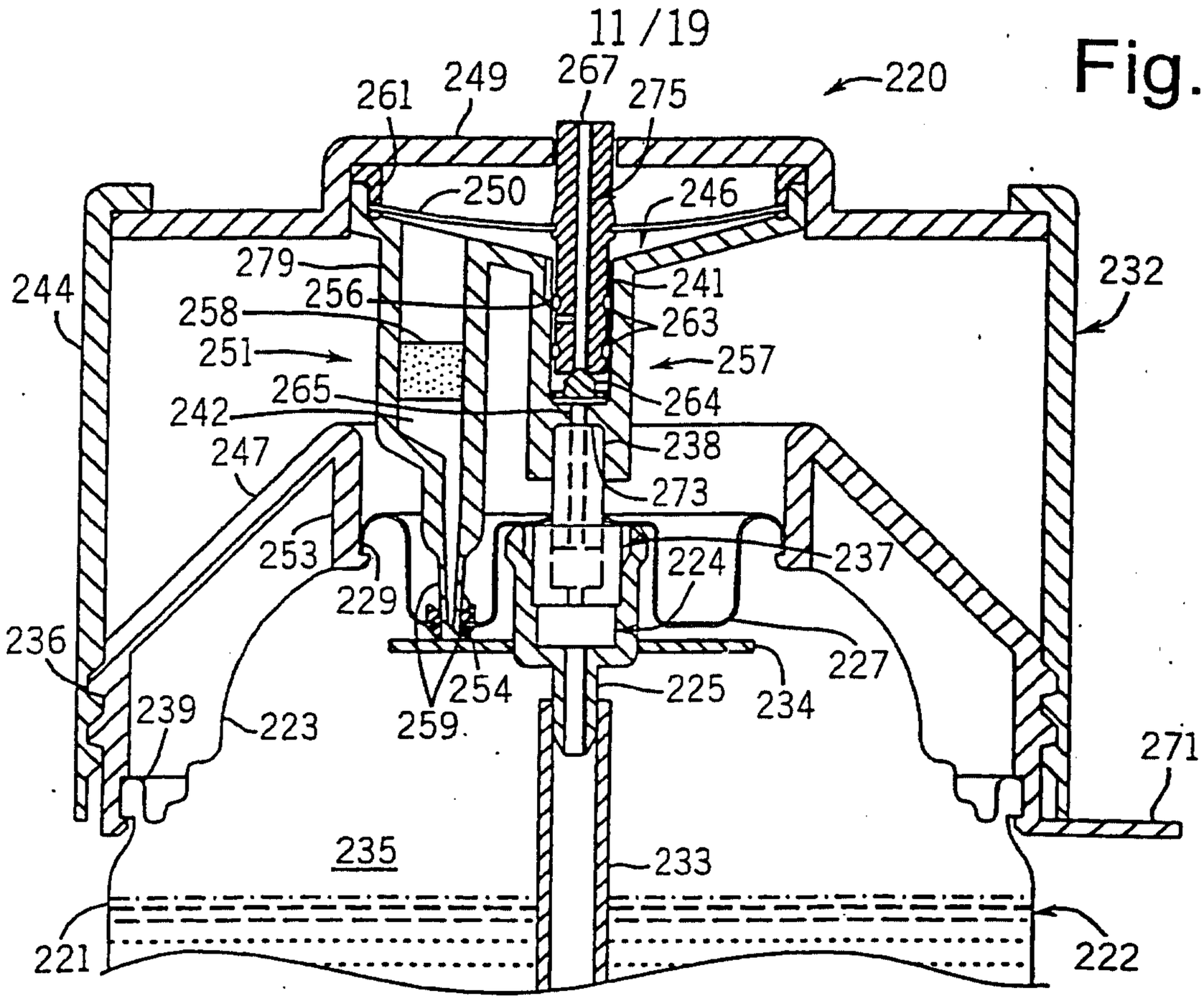
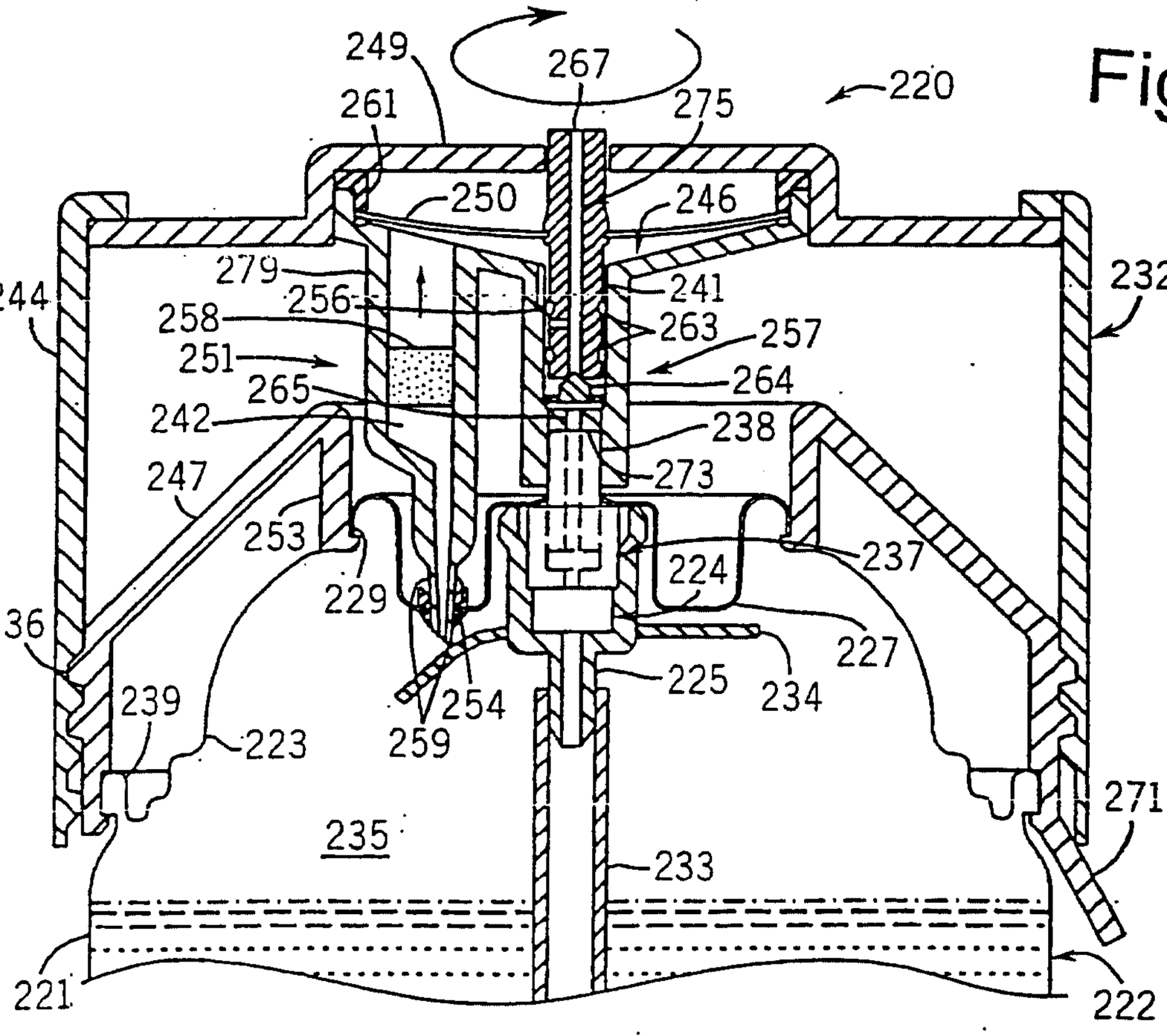


Fig. 6



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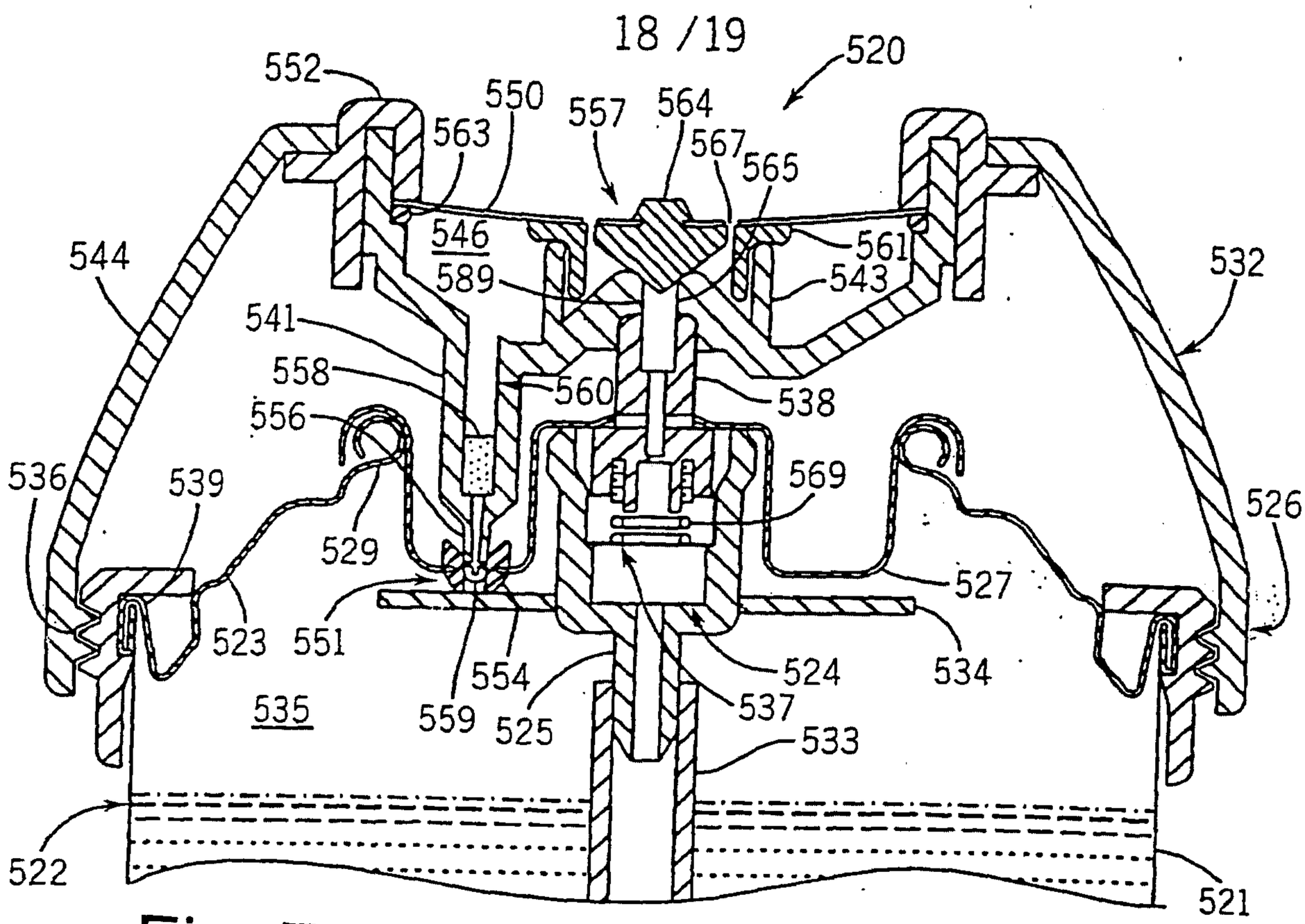
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Fig. 7

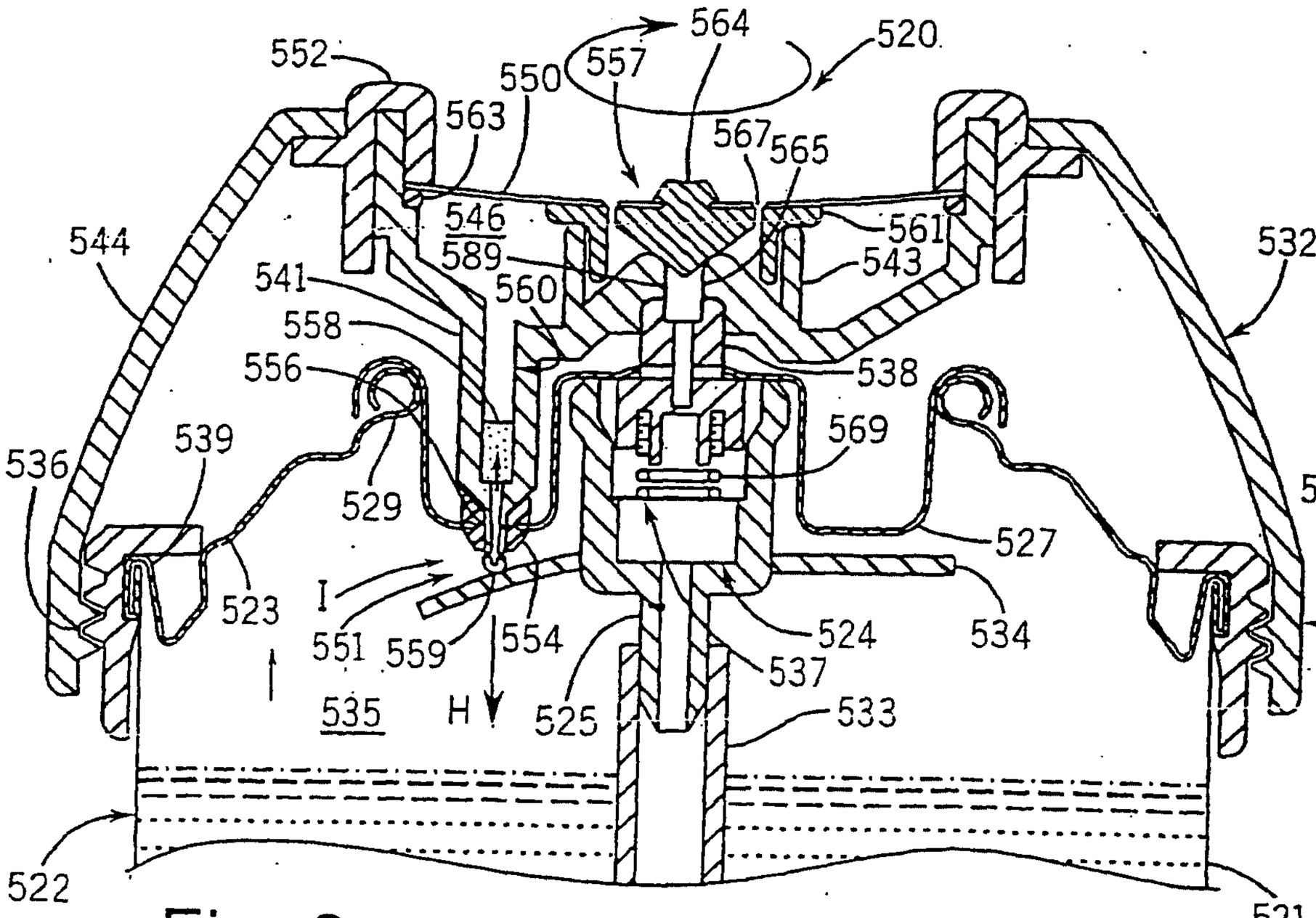
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Fig. 8

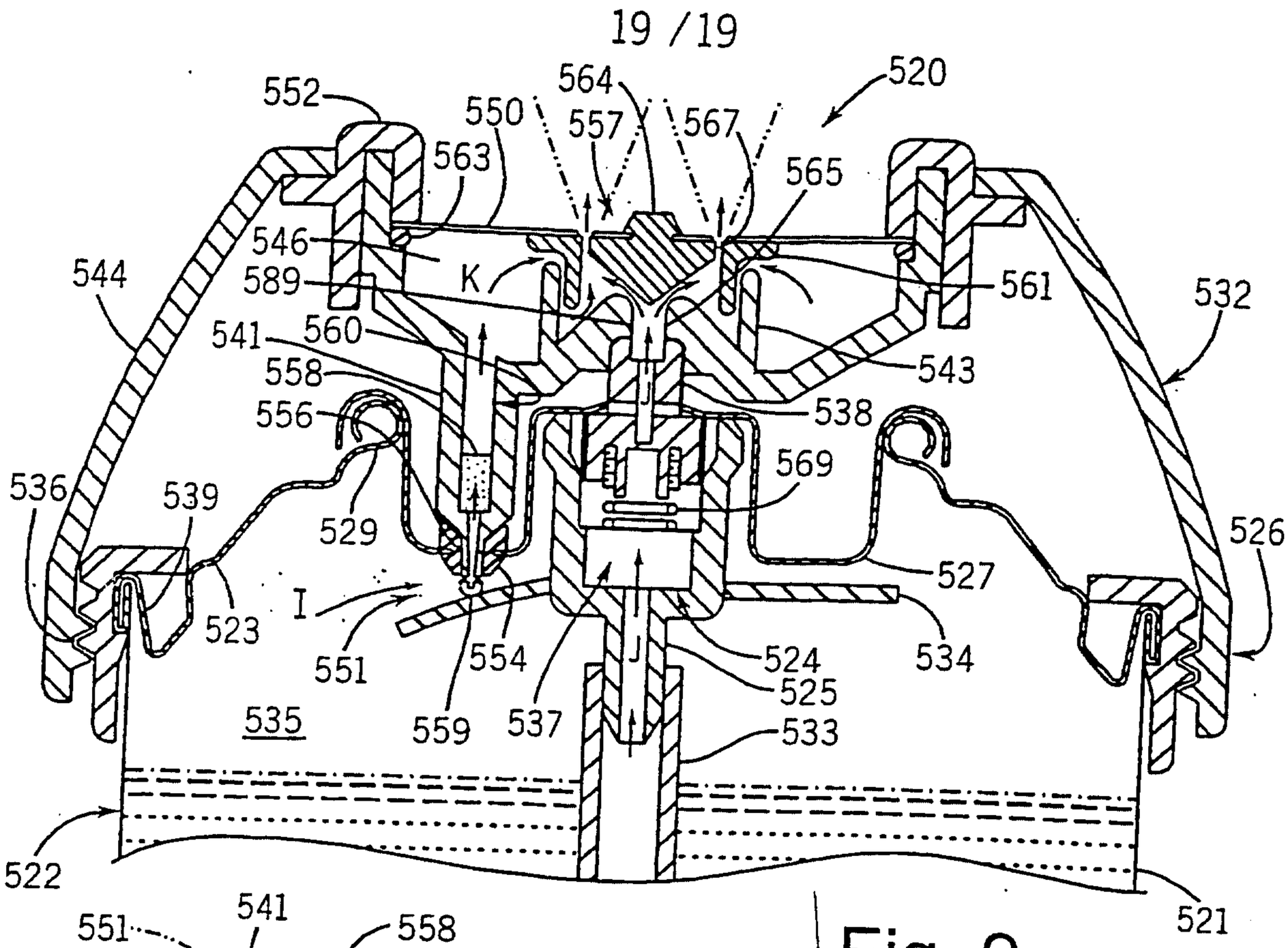


Fig. 9

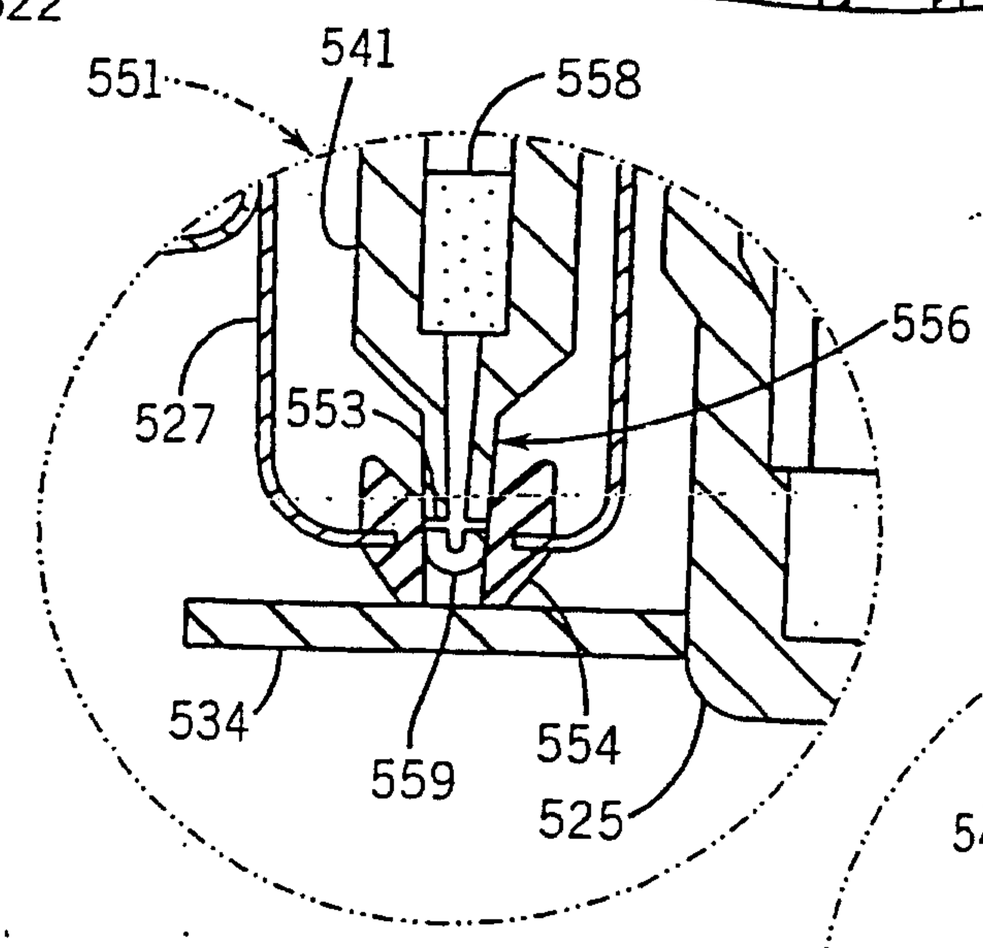


Fig. 10

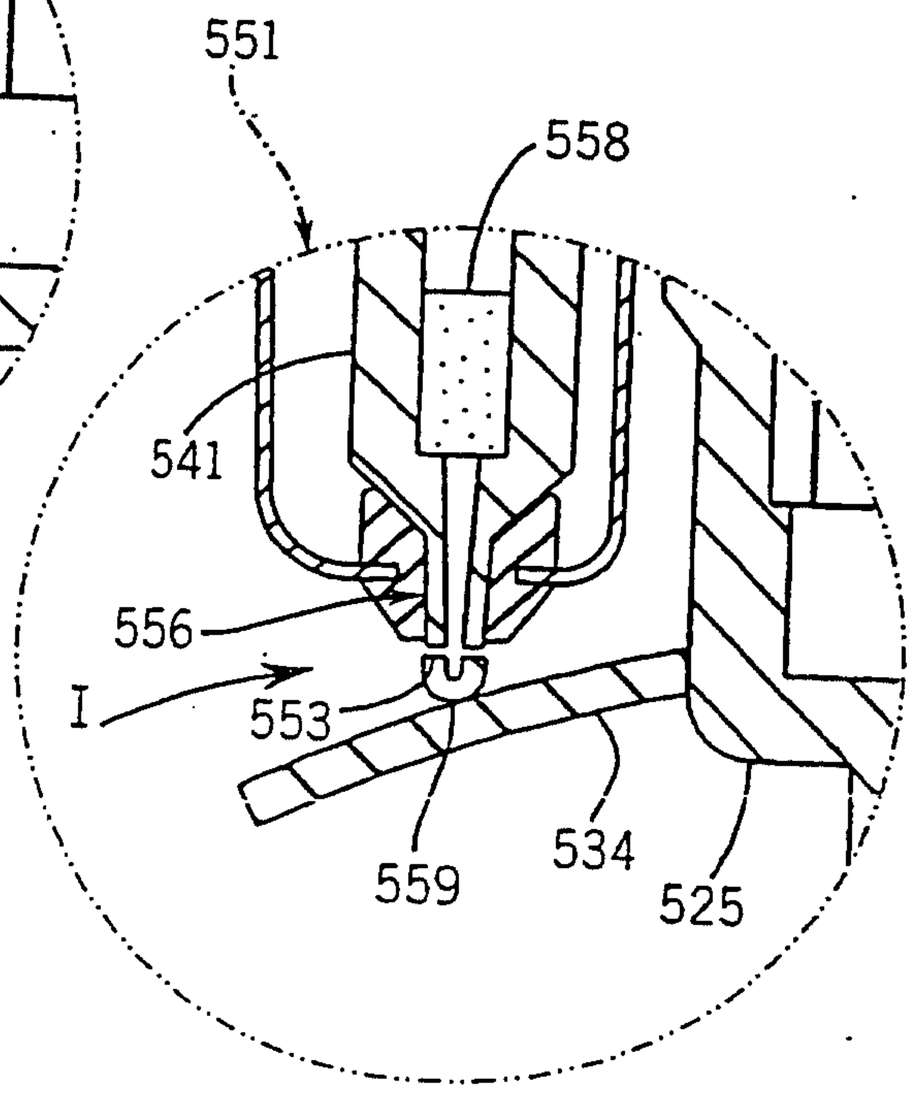
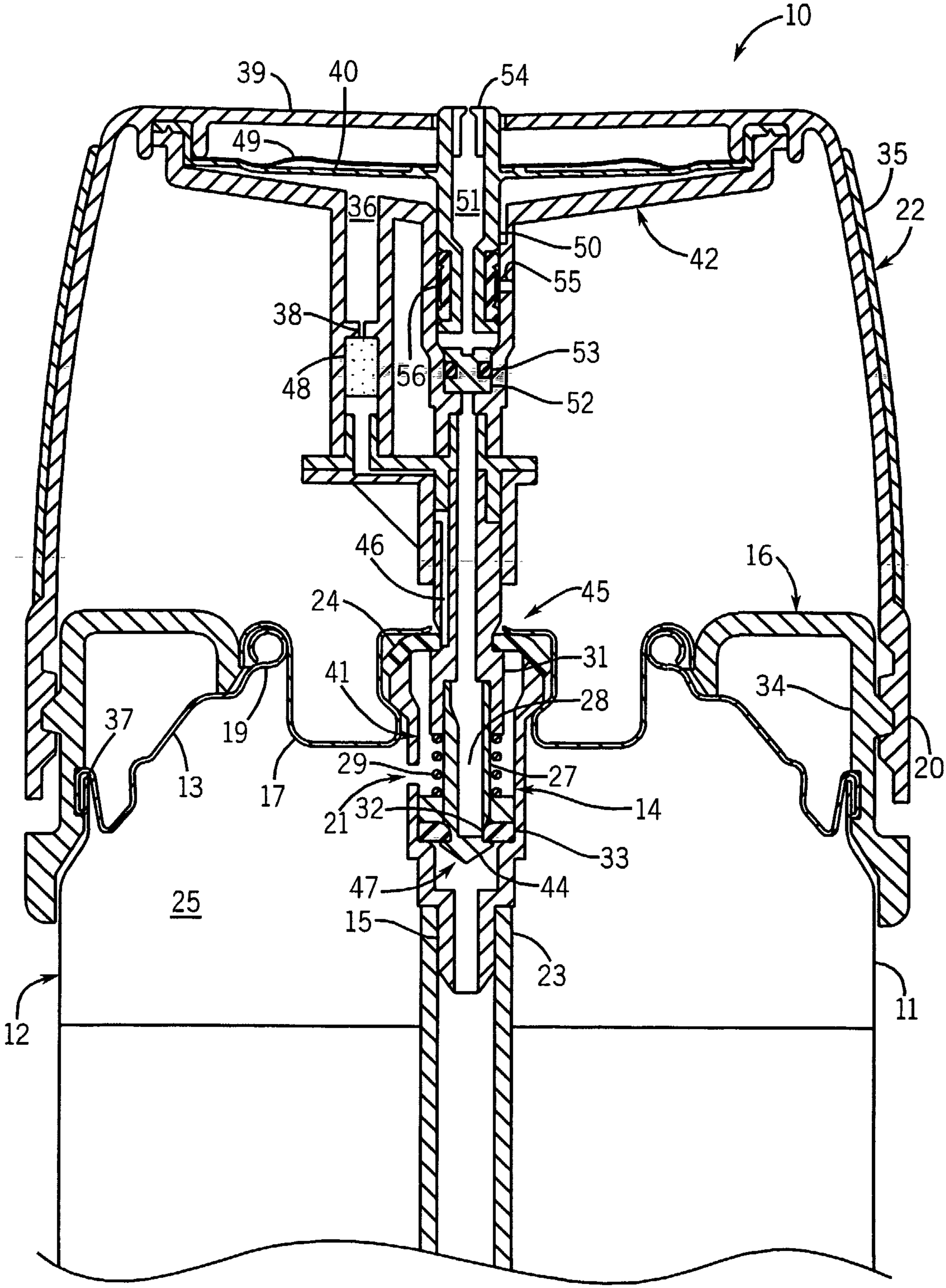


Fig. 11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