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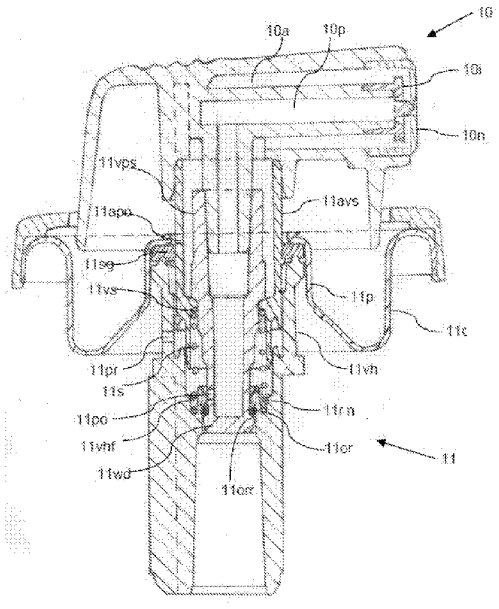

FIG. 1

(57) Abstract: A dual function aerosol valve assembly has a valve housing with first and second stem valves mounted for reciprocation within it. The first stem valve controls flow of gaseous propellant and the second stem valve is coaxially received within the first stem valve and controls flow of product. An actuator and nozzle assembly is connected with the stem valves so that the first stem valve is opened to admit propellant to the nozzle upon initial depression of the actuator, and the second stem valve is then opened to admit product to the nozzle. Closing of the stem valves is in reverse order so that flow of product to the nozzle is first interrupted and then flow of propellant is interrupted. A spring biases the stem valves to their closed positions. The valve housing is constructed to accommodate either a bag-on-valve system or a piston system.

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NON-CLOG NOZZLE, ACTUATOR AND VALVE ASSEMBLY FOR BAG-ON-VALVE OR CAN-ON-VALVE SYSTEMS

Technical Field:

[0001] The present invention relates to systems for dispensing product under pressure and to a method of manufacturing them. The invention uses compressed air or other gas to dispense product under pressure without causing detriment to the environment. More specifically, the invention is a non-clogging valve assembly usable with bag-on-valve or piston-driven-canister aerosol systems and is suitable to use for dispensing paints, liquid adhesives, starches, hair sprays and any product that has clogging issues, as well as products that need a preservative. The pressurizing gas and product remain separate until they are mixed at the nozzle.

Background Art:

[0002] A number of dispensing systems have been developed over the years. Some utilize special aerosol containers with high pressure propellant-driven systems. Others are alternatives to aerosol dispensers and eliminate some of the problems that exist with those systems but do not offer the same convenience as aerosols. All dispense a variety of products. While these devices typically work well initially, they tend to become partially or fully clogged as the product being dispensed dries and hardens in various flow channels and or orifices. Some actuators rely on mechanical force, such as a spring or other mechanism to open an orifice and flow channels by withdrawing a probe or plug from the orifice for dispensing product and then closing the orifice after dispensing the product by moving the probe or plug back towards or into the orifice.

[0003] Conventional aerosols are expensive and can be hazardous, giving rise to liability claims. Further, in addition to shipping and handling constraints which require extra care in getting product to the market place, the majority of existing systems have clogging issues. Actuators that currently exist are subject to clogging because of product formulation as well as to how they are constructed.

[0004] Also, the systems that are commonly in use do not quite meet expected criteria. Substantial data has been gathered over the years relating to adverse effects on the environment caused by use of such systems. The following patents are exemplary of existing prior art systems.

[0005] By way of example, U.S. Pat. No. 5,198,774 to Lund et al. discloses a combined lock and anti-clog actuator. The locked position cooperates with an anti-clog member, which has a nozzle seal for inhibiting the clogging of the product within the nozzle.

[0006] U.S Pat. No. 5,894,964 to Barnes et al. discloses an inner actuator chamber arranged in a way designed to minimize blockage of the actuator.

[0007] U. S. Pat. No. 5,480,095 to Stevenson et al. shows an actuator that attenuates the accumulation of solidified sprayer fluid.

[0008] U.S. Pat. No. 5,687,877 to Smolen Jr. discloses a pump dispenser with a check valve that moves forward during the pressure stroke and then closes and pulls liquid back during the suction stroke, minimizing blockage.

[0009] U. S. Pat. No. 5,560,544 to Merrit et al. discloses an anti-clogging atomizer nozzle

[00010] U. S. Pat. No. 5,358,149 to O'Neill discloses an anti-clogging means similar to U. S. Pat. No. 5,687,877 to Smolen, Jr.

[00011] U. S. Pat. No. 4,982,900 to Blake discloses a trigger pump sprayer with several nose piece valve configurations.

[00012] U. S. Pat. No. 5,855,322 to Py discloses a one-way valve system that utilizes a swirl chamber with a peripherally deformed expandable outlet flex valve means as part of a pouch reservoir system, in a sealed inclusive assembly.

[00013] U. S. Pat. No. 5,110,052 to Graf et al. discloses a pump means that employs air assist at the nozzle and requires venting.

[00014] U. S. Pat. No. 4,057,176 to Horvath discloses a pump means similar to that in Graf et al. in that it provides air assist to the nozzle and requires venting.

[00015] Despite the efforts of such devices as disclosed in the forgoing patents, there remains a need for an aerosol system that provides anti-clogging or non-clogging features combined with a system that can reduce a depending pressure-force and avoid the need to have a propellant embedded within the product to be dispensed, while offering the same convenience as provided by current aerosols.

[00016] Many other attempts have been made and are available in the form of bag-on-valve and piston driven can-on-valve systems, but these systems do not offer air assist at the nozzle and do not have non-clogging ability or utilize a very low pressure to dispense product.

[00017] Pumps and mechanically pressurized systems, although they do not use embedded propellants, do not have combined elements that provide the convenience of aerosol systems, wherein it is necessary only to depress an actuator to dispense a product and achieve atomization,

[00018] Therefore, there is still a need for systems that do not use embedded propellants that are harmful to the environment, that offer air assist at the nozzle, that are non-clogging, that can be used in bag-on-valve or piston driven can-on-valve systems, and that utilize a very low pressure to dispense product.

Summary of the Invention:

[00019] The present invention is a non-clog actuator and valve assembly that does not use embedded propellants that are harmful to the environment. It is usable in bag-on-valve or can-on-valve systems and offers air assist at the nozzle, with a positive shutoff. It utilizes a very low pressure to dispense product so that it does not require the use of harmful high pressure containers with the propellant embedded within the product.

[00020] The non-clog actuator and valve assembly of the invention employs a very low pressure gas driven system that can be manufactured economically while still achieving performance comparable to that provided by current aerosol systems.

[00021] The actuator and valve assembly of the invention utilizes a low pressure source that provides an air assist at the nozzle for atomization and to prevent clogging. It offers the option of employing a pressure vessel other than a metal type, thereby permitting various shapes to be used to enhance aesthetic considerations over a wide range of products.

[00022] The present invention provides an economic edge in shipping, storing and shelf life, allows the market place to retain the conveniences of aerosols over pumps and other alternatives, and enables the use of innovative designs that are more flexible to handle a wider range of product viscosities.

[00023] The dual functioning actuator and valve assembly of the invention keeps the product to be dispensed separate from the pressure source until they are mixed at the nozzle, and enables various different nozzles to be used, such as, for example, those disclosed in US patents 6,609,666, 6,543,703 and 4,982,900.

[00024] The invention is compatible with a plurality of bag-on-valve or piston driven can-on-valve systems that allow for innovative design, especially in the categories of custom low pressure plastic vessels. The invention permits selection of various gases to be used as pressure sources to propel the product via a pressurized bag or a piston within a cylinder, and isolates the pressure gas from the product until they are mixed or combined at the actuator nozzle.

[00025] The pressure gas and product are conveyed from their respective sources to the nozzle via two separate sequential paths within the actuator assembly. The different components that make up each assembly can have innovative geometry relating to the flow paths, such as, for example, by adjusting their cross-sectional areas.

[00026] Vessels of various plastics that can withstand the required much lower pressures can be used to deliver the product. Also, the means that attach the actuator-

valve assemblies to the container can have variously configured neck finishes that will accommodate the lower pressures encountered with the system of the invention.

[00027] The invention can be used for dispensing products that typically require the use of embedded propellants, such as, for example, mousse, shaving creams, liquid gels, certain food groups, and any product that tends to cause clogging.

[00028] The invention does not require venting and does not use typical aerosol propellants that are harmful to the environment.

[00029] Other features and advantages of the present invention will become clear from the following detailed description and accompanying drawings of particular embodiments of the actuator and valve assembly.

Brief Description of the Drawings:

[00030] The foregoing, as well as other objects and advantages of the invention, will become apparent from the following detailed description when taken in conjunction with the accompanying drawings, wherein like reference characters designate like parts throughout the several views, and wherein:

[00031] FIG. 1 is a longitudinal cross-sectional view of the preferred embodiment of the combined actuator and valve assembly at rest without a product bag or cylinder being shown in place.

[00032] FIG. 2 is a slightly enlarged longitudinal cross-sectional view of the actuator and valve assembly of FIG. 1, shown in the filling and/or dispensing mode.

[00033] FIG. 3 is a longitudinal cross sectional view showing the valve assembly of FIG. 1 without the actuator assembly being shown in place.

[00034] FIG. 4 is a view in side elevation, with portions shown in section, of a bag-on-valve dispensing system, showing the ratio of air to product, which may vary with different products.

[00035] FIG. 5 is an enlarged fragmentary partial cross-sectional view of a valve cup and valve housing, with the bag location ferruledout.

[00036] FIG. 6 is a further enlarged fragmentary longitudinal sectional view of the system shown in FIG. 3, but with a piston driven can-on-valve attachment to the valve housing and an insert molded-on-cup ferrule configuration as well as a customized container contour.

[00037] FIG. 7 is a greatly enlarged cross-sectional view of an actuator assembly having one example of a mechanically adjustable nozzle means that can be used with the system shown in FIGS. 3 and 6.

[00038] FIG. 8 is an end view showing the adjustable eye brow mechanical breakup feature used in FIG. 7.

[00039] FIG. 9 is a fragmentary view in section of a modification of the nozzle assembly shown in FIG. 8 and incorporating some of the features of the nozzle assembly disclosed in US patent 4,982.900.

[00040] FIG. 10 is a partial end view looking in the direction of arrow 10 in FIG. 9.

[00041] FIG. 11 is cross sectional assembly view illustrating another means as shown in patent 6,543,703 that can be used in the assembly of FIG.7.

[00042] FIG. 12 is a cross sectional view showing only the insert portion of FIG 11.

[00043] FIG. 13 is an enlarged fragmentary end view of the eye brow configuration taken in the direction of arrow 13 in FIG. 11.

[00044] FIG. 14 is a sectional view of the air assist vortex that could be threaded or snapped onto the system shown in FIGS. 1 or 7.

[00045] FIG. 15 is a view looking in the direction of the arrow 15 in FIG. 14 but with the threads omitted to emphasize the vortex channels.

[00046] FIG. 16 is a view looking in the direction or arrow 16 in FIG. 18, but with the vortex channels and the threads shown.

[00045] FIG. 17 is an end view looking in the direction of arrow 17 in FIGS. 14 and 18.

[00046] FIG. 18 is a side view in elevation of the air assist vortex shown in FIGS. 14-17.

[00047] Figs. 19 and 20 are isometric views of the mechanical breakup unit (MBU) insert shown in FIG. 24.

[00048] FIG. 21 is the same as FIG. 16 except that it has no vortex channels as in FIGS. 15 or 16.

[00049] FIG. 22 is cross sectional view of a test module for testing the system shown in FIGS. 1 through 21.

[00050] FIG. 23 is a blowup detail of the circled area in FIG. 22, without the insert shown in FIGS. 19 or 20 or air vortex fitment shown in FIGS. 14-16.

[00051] FIG. 24 is a blowup detail similar to FIG. 23, but with the mechanical breakup (MBU) fitment of FIGS. 19 and 20 in place.

[00052] FIG. 25a is an isometric view of the back housing, or housing bottom cap, in the test module assembly shown in FIG. 22.

[00053] FIG. 25b is a side view in elevation of the back housing of FIG. 25a.

[00054] FIG. 25c is a longitudinal sectional view taken along line 25c-25c in FIG. 25b.

[00055] FIG. 25d is an end view taken in the direction of the arrow 25d in FIG. 25b.

[00056] FIG. 25e is an end view taken in the direction of the arrow 25e in FIG. 25b.

[00057] FIG. 26a is an isometric view of the housing bottom cap in the test module assembly shown in FIG. 22.

[00058] FIG. 26b is a side view in elevation of the housing cap of FIG. 26a.

[00059] FIG. 26c is a longitudinal sectional view taken along line 26c-26c in FIG. 26b.

[00060] FIG. 26d is an end view taken in the direction of the arrow 26d in FIG. 26b.

[00061] FIG. 26e is an end view taken in the direction of the arrow 26e in FIG. 26b.

[00062] FIG. 27a is a top isometric view of the non-clog housing in the test module assembly shown in FIG. 22.

[00063] FIG. 27b is a bottom isometric view of the non-clog housing.

[00064] FIG. 27c is a side elevation view of the non-clog housing.

[00065] FIG. 27d is a longitudinal sectional view taken along line 27d-27d in FIG. 27c.

[00066] FIG. 27e is an end view taken in the direction of the arrow 27e in FIG. 27c.

[00067] FIG. 27f is an end view taken in the direction of the arrow 27f in FIG. 27c.

[00068] FIG. 28a is a bottom isometric view of the non-clog tip in the assembly of FIG. 22.

[00069] FIG. 28b is a top isometric view of the non-clog tip.

[00070] FIG. 28c is a side elevation view of the tip of FIG. 28a.

[00071] FIG. 28d is a side elevation view of the tip, taken at 90 to the view in FIG. 28c.

[00072] FIG. 28e is an end view of the tip, taken in the direction of the arrow 28e in FIG. 28d.

[00073] FIG. 28f is a longitudinal sectional view taken along line 28f-28f in FIG. 28d.

[00074] FIG. 28g is a longitudinal sectional view taken along line 28g-28g in FIG. 28e.

[00075] Fig. 28h is an end view of the tip, taken in the direction of the arrow 28h in Fig. 28d.

[00076] Fig. 29a is a top isometric view of the spray housing in the test module shown in FIG. 22.

[00077] FIG. 29b is a side elevation of the spray housing of FIG. 29a.

[00078] FIG. 29c is a longitudinal sectional view taken along line 29c-29C in FIG. 29b.

[00079] FIG. 29d is an end view taken in the direction of the arrow 29d in FIG. 29b

[00080] FIG. 29e is an end view taken in the direction of the arrow 29e in FIG. 29b.

[00081] FIG. 30a is a side view in elevation of the cylinder in the test module assembly of FIG. 22.

[00082] FIG. 30b is a longitudinal sectional view taken along line 30b-30b in FIG. 30c.

[00083] FIG. 30c is an end view of the cylinder of FIG. 30a.

Best Mode for Carrying Out the Invention:

[00084] As summarized generally below, and as described more specifically hereinafter, the invention is a dual function aerosol valve system, comprising:

[00085] (a) a valve cup having means for attachment to a container holding a pressurized gas propellant and a product to be dispensed;

[00086] (b) a valve housing having an upper end and a lower end and assembled at its upper end to said valve cup and depending therefrom so that said valve housing extends into a container when said valve cup is assembled to a container, said valve housing having

a tubular side wall with an inner surface and an upper end and a lower end, the lower end of said hollow interior defining a first product flow path, wherein said valve housing is constructed so that a bag-on-valve system or to a piston system can be applied to it;

[00087] (c) first seal means engaged between said valve housing upper end and said valve cup;

[00088] (d) a first stem valve having upper and lower ends and a tubular side wall with a hollow interior and an inner surface, said first stem valve being reciprocal in the valve housing and defining between it and the valve housing upper end a first propellant flow path, said first stem valve side wall being slidable within and sealed relative to said first seal means;

[00089] (e) a second stem valve coaxially received within the hollow interior of said first stem valve and being free of attachment to said first stem valve, said second stem valve having upper and lower ends and a tubular side wall with a hollow interior defining a second product flow path, and the upper ends of said first and second stem valves defining between them a second propellant flow path;

[00090] (f) second seal means engaged between the lower end of said second stem valve and an interior surface of said valve housing side wall;

[00091] (g) a first propellant side port extending through the side wall of said valve housing into the first propellant flow path;

[00092] (h) a second propellant side port extending through the side wall of said first stem valve into the second propellant flow path;

[00093] (i) a product side port extending through the side wall of said second stem valve into the second product flow path;

[00094] (j) spring means engaged with said stem valves to urge them into a first, at-rest position where the first seal means blocks communication through said second propellant port from said first propellant flow path to said second propellant flow path, and said second seal means blocks communication through said product side port from said first product flow path to said second product flow path; and

[00095] (k) an actuator and nozzle means assembly connected with said stem valves to reciprocate them in said valve housing into a second, depressed dispensing position wherein the second propellant side port moves into an unblocked position relative to said first seal means so that propellant can flow from said first propellant flow path to said second propellant flow path, and said product side port moves into an unblocked position relative to said second seal means so that product can flow from said first product flow path to said second product flow path, said propellant and product side ports being spaced relative to said first and second seal means so that when said actuator is depressed said first stem valve first moves to an open position wherein said second propellant side port is unblocked and then said second stem valve moves to an open position wherein said product side port is unblocked, said first and second stem valves thereby being sequentially opened when said actuator is depressed and sequentially closed in reverse order when said actuator is released, whereby propellant gas flows through said actuator and nozzle means before product and flows through said actuator and nozzle means after flow of product is interrupted.

[00096] The actuator defines a propellant flow path extending from said second propellant flow path to said nozzle means, and a product flow path extending from said second product flow path to said nozzle means, said propellant and product remaining separate until they reach the nozzle means where they are mixed and dispensed as a spray.

[00097] The first and second stem valves are attached to said actuator so they reciprocate in unison when said actuator is reciprocated and the first stem valve has a downwardly facing first shoulder on its inner surface. The valve housing has an upwardly facing second shoulder on its inner surface at a location between said first product flow path and said first propellant flow path, and the spring means is engaged between said first and second shoulders to bias said stem valves and actuator upwardly relative to said valve housing and valve cup.

[00098] The first shoulder defines a center opening in said first stem valve, the second shoulder defines a center opening in said valve housing, and the lower end of said second stem valve has a reduced diameter relative to the upper end thereof, said reduced diameter lower end extending through the center openings defined by said shoulders.

[00099] A plurality of upstanding retaining nibs are formed on said second shoulder, and the second stem valve lower end has a radially enlarged head, said nibs being engaged behind said head to retain said second stem valve in said valve housing against the bias of said spring means.

[000100] The second seal means comprises an O-ring seal engaged around said lower end of said second stem valve at said enlarged head, and the first seal means comprises a diaphragm seal gasket compressed between the upper end of said valve housing and said valve cup.

[000101] The valve cup has an upstanding central pedestal with a central opening therethrough, and said valve housing is secured to said valve cup below and in alignment with said central opening.

[000102] In a preferred embodiment, product to be dispensed is contained within a bag attached to said valve housing. In an alternate embodiment, a can-on-valve system can be used, wherein the product is in a can with a piston in the can for pushing the product out when the valve is opened.

[000103] The lower end of said valve housing is open for flow of product axially into said first product flow path, and the upper ends of said first and second stem valves open axially upwardly through the upper end of said valve housing, said second propellant flow path and said second product flow path opening axially upwardly through said open upper ends of said first and second stem valves.

[000104] The actuator comprises an actuator base having depending tubular projections attached axially with the open upper ends of said first and second stem valves, said product flow path and said propellant flow path in said actuator extending upwardly through said projections to lateral product and propellant flow paths extending forwardly through said actuator base to said nozzle means. The nozzle means comprises a generally cup-shaped aeration fitment rotatable relative to said actuator base but constrained against axial movement relative thereto, said aeration fitment having a side wall with an open end secured to a forward lateral side of said actuator base in circumscribing relationship to said

product and propellant flow paths, and an end wall spaced forwardly of said actuator base, said end wall having a central opening therethrough.

[000105] A generally cup-shaped threaded sleeve is assembled to said actuator base coaxially within said aeration fitment and is rotatable with said aeration fitment but constrained against axial movement relative to said actuator base, said sleeve having a cylindrical side wall with internal threads and an open end at said actuator base and a forward wall disposed adjacent to and behind the end wall of said aeration fitment, said forward wall having a discharge orifice in alignment with the central opening through the end wall of said aeration fitment. An adjustable nozzle is disposed coaxially within said threaded sleeve and is constrained against rotational movement relative to said actuator base but is movable axially relative to said actuator base. The nozzle has external threads engaged with said internal threads in said threaded sleeve so that rotation of said sleeve causes axial movement of said nozzle toward and away from said discharge orifice in the forward wall of said sleeve, said nozzle having a center post that extends forwardly to adjacent said discharge orifice in said forward wall of said threaded sleeve, whereby axial movement of said nozzle adjusts the position of said post relative to said discharge orifice to adjust the spray pattern of product discharged through said discharge orifice.

[000106] A propellant flow path is defined between the aeration fitment side wall and the threaded sleeve side wall and between said aeration fitment end wall and said threaded sleeve forward wall, and the adjustable nozzle defines a product flow path extending through a center portion thereof around said center post to the discharge orifice in the forward wall of said threaded sleeve.

[000107] In one embodiment of the invention the valve cup is made of metal material, and in other embodiments it can be made of different materials to accommodate the valve assembly and different container neck finishes of a container to which said valve assembly is to be secured.

[000108] With the above summary of the assemblies in mind, the following detailed description is provided with reference characters to enable a better understanding of the features of the invention.

[000109] More specifically, and with reference to Figs. 1-3, the actuator assembly **10** provides two paths, an air path **10a** and a product path **10p**, which come together at the nozzle **10n** and insert **10i**, creating a spray.

[000110] Below the actuator assembly there is a valve assembly **11**. The valve assembly is made up of a valve cup **11c**, shown before crimping which takes place at assembly. The valve cup **11c** has an upstanding central pedestal **11p** which houses a valve seal gasket **11sg** that seals against the upper portion of the valve housing **11vh**. Two valve stems are reciprocable in the valve housing, one being an air valve stem **11avs** and the other being a product valve stem **11vps**. The air valve stem and product valve stem operate sequentially when the actuator assembly **10** is depressed against the spring **11s** that fits between the valve housing floor pocket **11vhf** and the shoulder **11vs** of the air valve stem **11avs**. The spring **11s** normally biases the valve stems to the sealed position as shown in FIG. 1. In the sealed position, pressure orifice **11pr** in the side of the valve housing **11vh** is closed, and in the unsealed position as shown in FIG. 2, pressure orifice **11pr** is open.

[000111] A set of retaining nibs **11rn** on the inner surface of the valve housing **11vh** are spaced around the lower end of product valve stem **11vps** for cooperation with an O-ring **11or** seated in an O-ring race **11orr** in the base of the product valve stem **11vps** to prevent the product valve stem from being withdrawn up through the opening defined by seat **11wd**. When the product valve stem is in closed position as shown in FIG. 1, the O-ring **11or** seals within the walls of the diameter **11wd** beneath the retainer nibs **11rn**.

[000112] After the actuator assembly **10** is depressed as shown in FIG. 2, air and product are released through the two valve stems, which operate sequentially so that air or other propellant gas is first and last to be emitted through the nozzle. This sequence keeps the system purged and prevents clogging.

[000113] There are two separate paths within the valve assembly **11**, one being the valve air path **11vap** and the other the valve product path **11vpp**, each with their own feed orifices. Thus, the valve air path **11vap** is supplied through air path orifice **11apo** in the side of air valve stem **11avs** and the valve product path **11vpp**

is supplied through product feed orifice **11po** in the side of the air valve stem **11avs**.

[000114] With all as described above, the system allows for separation of product and pressurizing gas and maintains them separate until both meet at the nozzle, at which time product is mixed with air at the orifice and the mixture is dispensed as a spray. The system requires a very low pressure, which enables a much lower pressure vessel to be employed than in conventional systems while obtaining equivalent spray patterns to conventional aerosol dispensers.

[000115] FIG. 3 shows the system of FIGS. 1 and 2 without the actuator assembly **10**.

[000116] FIG. 4 shows the general arrangement for a bag-on-valve system that would be suited for the present invention, wherein pressurizing gas **CA** is in the space surrounding a bag containing product **P**.

[000117] FIG. 5 is an enlarged fragmentary view of how a bag can be applied to a valve assembly as depicted in FIG. 4. Other arrangements could be employed, such as a piston reciprocable in a can or container, described below.

[000118] FIG. 6 illustrates an embodiment wherein a piston driven cylinder-on-can is employed in lieu of the bag-on-valve of FIGS. 4 and 5. In the embodiment shown in FIG. 6, a piston **P** within a cylinder **C** is employed within a custom container **CC**. This arrangement may be adapted to the valve cup in two ways. One way is by a conventional crimp on a valve cup or, as shown in this FIG., by a crimp on an insert molded valve cup **IM** and/or on the valve cup pedestal **CP** that could be insert molded as a custom means that accommodates a complemental finish to be injection blow molded. Finishes could be crimped, solvent or sonic welded assemblies.

[000119] A spring **S** is used to move the piston **P** upwards for pushing the product into the dual valve housing **DVH**. A one-way valve **OWV** located at the base of the product cylinder **C** is not shown but an arrow points toward where the one-way valve is located. This valve is used to facilitate the pre-charged air cycle of the container **POMC** before product is filled into the product chamber above the piston **P**. The one-way valve allows the pressure within the product chamber **PC** to be

employed as an effective portion of the initial preloaded air pressure before product is introduced into the product chamber.

[000120] FIGS. 7 and 8 show an actuator assembly **10'** with an adjustable nozzle **AN** engaged within a threaded sleeve **TS** that is coupled to an aerating fitment **AF** rotatably mounted on an actuator base **AB** so that rotation of the aerating fitment causes rotation of sleeve **TS** and axial adjustment of the nozzle **AN**. An air path **10a'** and a product path **10p'** are formed in the base **AB** for separately conveying product and pressurized air to the nozzle.

[000121] The fitment **AF** is attached to the base **AB** so that it can rotate relative to the base but cannot move axially relative to it. The sleeve **TS** and aerating fitment **AF** have interengaged guide ribs **ATS** and **AFgr** to transmit rotational movement of the fitment **AF** to the sleeve **TS**. The adjustable nozzle **AN** has a threaded outer surface **10s'** that interfaces with a threaded inner surface **Tsi** of the sleeve **TS**. Guide ribs **TSgr** on the adjustable nozzle **AN** are engaged with anti-rotational ribs **ABarr** within the actuator base **AB** to prevent rotation of the nozzle **AN** but permit axial movement of it relative to the base when the aeration fitment **AF** and sleeve **TS** are rotated. Thus, when the aeration fitment **AF** is turned, the anti-rotational ribs **AFgr** engage slots **ATs** within a flange **ATf** at the leading edge of the threaded sleeve **TS**, and the anti-rotational ribs **TSgr** extending from the base of the adjustable nozzle **AN** engage ribs **ABarr** on the base **AB** to restrain the nozzle **AN** from turning, thereby causing the nozzle to move along the threaded interface **TSi** between it and sleeve **TS**, thus causing the probe **P** to move in and out of the vortex eyebrows **ve**, allowing for an adjustable spray.

[000122] An internal sleeve bore **10'sb** within nozzle **AN** works in conjunction with a sliding sealing bead **Tsb** on a central part of threaded sleeve **TS** to constrain flow of product to the space between post **P** and bore **10'sb** as the product moves from product path **10p'** to vortex eyebrows **ve**.

[000123] An air inlet orifice **apo** within the actuator base **AB** supplies air through angular slots **TSas** into the orifice pocket **TSop** of the aeration fitment **AF**. A sealing flange **sf** within the actuator base **AB** rides within a second bore **ANsb** at the trailing

edge portion of the actuator nozzle **AN**, and a series of stabilizer ribs **TSsr** surround the eyebrows **ve** within the threaded sleeve **TS** as shown in FIG. 8.

[000124] FIGS. 9 and 10 show an arrangement that is similar to FIGS. 7 and 8 but does not provide a separate aeration fitment **AF**. In this embodiment, the adjustable nozzle **TS'** is a single piece that replaces the fitment **AF** and sleeve **TS** in the FIG. embodiment. All the same features are otherwise present for obtaining atomization.

[000125] FIGS. 11 and 12 show another means to provide non-clogging action, wherein a diaphragm **d** extends across one end of a nozzle fitment **NF**. Eyebrows **ve"** are located centrally within the diaphragm to cooperate with a probe as previously described. The probe is not shown in FIGS. 11 or 12 but is shown at **P** in FIGS. 7 and 9. FIG. 11 shows the membrane of FIG. 12 being retained by a threaded fitment **TF** over a container **C'**.

[000126] FIG. 13 is an enlarged fragmentary view of the nozzle fitment **NF**, taken in the direction of arrow 13 in FIG. 11, and in particular showing the feed slots **fs** that are part of the vortex eyebrows **ve"** configuration. As in FIGS. 11 and 12, there is no aeration nozzle **AN**.

[000127] FIGS. 14-18 and FIG. 21, respectively, depict two types of aeration nozzles to be used with FIGS. 1 and 2 as well as FIG. 3. FIGS. 15 and 16 show four aeration vortex channels **AVC** that receive the air from the non-clog insert **NCA** shown in FIGS. 19 and 20 to further enhances the spray pattern. FIG. 21 shows the same arrangement but without the aeration vortex channels. The aeration nozzles in both forms have three flex braces **fb** to support the flexible diaphragm **d'** (see FIG. 17) required to support a non-clog action, if necessary. In any case, both types have threads for retention onto an actuator. For purpose of simplicity in illustration, the threads are not shown in the bottom view of FIG. 15.

[000128] FIGS. 22 through 30c are all part of a test module **TM** constructed to prove the concept of the embodiments described above. The test module comprises an aeration nozzle **AN**, non-clog insert **NCA**, cap housing **AN**, non-clog housing **NCH**, non-clog tip **NCT**, spray housing **SH**, cylinder bore housing **CBH**, back housing **BH**

and piston **P'**. There are two air feeds, a top one **AAI** and a bottom one **API**. The top one feeds air to the actuator nozzle and the bottom one feeds air to the piston **P'** within the cylinder bore housing **CBH**.

[000129] The cylinder bore housing **CBH** is threaded on both ends at **SHT** and **CHT** to retain the cylinder bore housing **CBH** in place. The actuator nozzle **AN** and the cap housing **CH** are threaded onto the spray housing **SH** and cap housing **CH** at **ANT** and **CHT** locations shown in FIG. 22. The spray housing has internal threads at top and bottom locations **AHT** and **SHT** and a number of O-ring seals **OR** are placed at all required seal points within the module. This module does not have the actuator assembly **10** and valve assembly **11** as shown in FIGS. 1 and 2 for delivering the sequential feed of air and product. Instead, the module **TM** directs the two air feeds so that the product and air travel directly onto the piston within the cylinder and to the nozzle orifice of the actuator assembly, where the air and product become mixed and atomized to demonstrate the results intended for the structure shown in FIGS. 1 and 2.

[000130] Resort may be made to all suitable modifications and equivalents that fall within the scope of the present invention as defined by the appended claims. The words "comprise", "comprising", "include(s)", and "including" when used in this specification and in the following claims are intended to specify the presence of stated features or steps, but they do not preclude the presence or addition of one or more other features or means, steps or groups thereof.

WHAT IS CLAIMED IS:

1. A dual function aerosol valve system, comprising:

(a) a valve cup having means for attachment to a container holding a pressurized gas propellant and a product to be dispensed;

(b) a valve assembly and an actuator and nozzle means assembly mounted to said valve cup, said valve assembly being below said valve cup and said actuator and nozzle means assembly being above said valve cup.

(c) said valve assembly including a valve housing having an upper end and a lower end and assembled at its upper end to said valve cup and depending therefrom so that said valve housing extends into a container when said valve cup is assembled to a container, said valve housing having a tubular side wall with an upper end and a lower end and an inner surface defining a hollow interior, a lower end of said hollow interior defining a first product flow path, wherein said valve housing is constructed so that a bag-on-valve system or a piston system can be applied to said valve housing;

(d) first seal means engaged between said valve housing upper end and said valve cup;

(e) a first stem valve having upper and lower ends and a tubular side wall with a hollow interior and an inner surface, said first stem valve being reciprocal in the valve housing and defining between it and the valve housing upper end a first propellant flow path, said first stem valve being open ended and its side wall being slidable within and sealed relative to said first seal means;

(f) a second stem valve coaxially received within the hollow interior of said first stem valve and being free of attachment to said first stem valve, said second stem valve having upper and lower ends and a tubular side wall with a hollow interior defining a second product flow path, the upper end of said second stem valve being open and the lower end being closed, and the upper ends of said first and second stem valves defining between them a second propellant flow path;

(g) second seal means engaged between the lower end of said second stem valve and an interior surface of said valve housing side wall;

(h) a first propellant side port extending through the side wall of said valve housing into the first propellant flow path;

(i) a second propellant side port extending through the side wall of said first stem valve into the second propellant flow path;

(j) a product side port extending through the side wall of said second stem valve into the second product flow path;

(k) spring means engaged with said stem valves to urge them into a first, at-rest position where the first seal means blocks communication through said second propellant port from said first propellant flow path to said second propellant flow path, and said second seal means blocks communication through said product side port from said first product flow path to said second product flow path; and

(l) said actuator and nozzle means assembly is connected with each of said stem valves to reciprocate them in said valve housing into a second, depressed dispensing position wherein the second propellant side port moves into an unblocked position relative to said first seal means so that propellant can flow from said first propellant flow path to said second propellant flow path, and said product side port moves into an unblocked position relative to said second seal means so that product can flow from said first product flow path to said second product flow path, said propellant and product side ports being spaced relative to said first and second seal means so that when said actuator is depressed said first stem valve first moves to an open position wherein said second propellant side port is unblocked and then said second stem valve moves to an open position wherein said product side port is unblocked, said first and second stem valves thereby being sequentially opened when said actuator is depressed and sequentially closed in reverse order when said actuator is released, whereby propellant gas flows through said actuator and nozzle means before product and flows through said actuator and nozzle means after flow of product is interrupted

2. The dual function aerosol valve system claimed in claim 1, wherein:

said actuator defines a propellant flow path extending from said second propellant flow path to said nozzle means, and a product flow path extending from said second product flow path to said nozzle means, said propellant and product remaining separate until they reach the nozzle means where they are mixed and dispensed as a spray.

3. The dual function aerosol valve system claimed in claim 2, wherein:

said first and second stem valves are attached to said actuator so they reciprocate in unison throughout their travel when said actuator is reciprocated.

4. The dual function aerosol valve system claimed in claim 3, wherein:

said first stem valve has a downwardly facing first shoulder on its inner surface;

said valve housing has a reduced diameter section on its inner surface defining an elongate cylindrical valve seat and an upwardly facing second shoulder at a location between said first product flow path and said first propellant flow path; and

said spring means is engaged between said first and second shoulders to bias said stem valves and actuator upwardly relative to said valve housing and valve cup.

5. The dual function aerosol valve system claimed in claim 4, wherein:

said first shoulder defines a center opening in said first stem valve;

said second shoulder defines a center opening in said valve housing; and

said lower end of said second stem valve has a reduced diameter relative to the upper end thereof, said reduced diameter lower end extending through the center openings defined by said first and second shoulders.

6. The dual function aerosol valve system claimed in claim 5, wherein:

a plurality of upstanding retaining nibs is formed on said second shoulder; and

said second stem valve lower end has a radially enlarged head, said nibs being engaged behind said head to retain said second stem valve in said valve housing against the bias of said spring means.

7. The dual function aerosol valve system claimed in claim 6, wherein:

said second seal means comprises an O-ring seal engaged around said lower end of said second stem valve at said enlarged head for sliding sealing engagement with said cylindrical valve seat.

8. The dual function aerosol valve system claimed in claim 7, wherein:

said first seal means comprises a diaphragm seal gasket compressed between the upper end of said valve housing and said valve cup.

9. The dual function aerosol valve system claimed in claim 8, wherein:

said valve cup has an upstanding central pedestal with a central opening therethrough, and said valve housing is secured to said valve cup below and in alignment with said central opening.

10. The dual function aerosol valve system claimed in claim 9, wherein:

product to be dispensed is contained within a bag attached to said valve housing.

11. The dual function aerosol valve system claimed in claim 1, wherein:

the lower end of said valve housing is open for flow of product axially into said first product flow path.

12. The dual function aerosol valve system claimed in claim 2, wherein:

the upper ends of said first and second stem valves open axially upwardly through the upper end of said valve housing, said second propellant flow path and said second product flow path opening axially upwardly through said open upper ends of said first and second stem valves; and

said actuator comprises an actuator base having depending tubular projections, each of which is attached axially with a respective one of the open upper ends of said first and second stem valves, said product flow path and said propellant flow path in said actuator extending upwardly through said projections to lateral product and propellant flow paths extending forwardly through said actuator base to said nozzle means.

13. The dual function aerosol valve system claimed in claim 12, wherein:

said nozzle means comprises a generally cup-shaped aeration fitment rotatable relative to said actuator base but constrained against axial movement relative thereto, said aeration fitment

having a side wall with an open end secured to a forward lateral side of said actuator base in circumscribing relationship to said product and propellant flow paths, and an end wall spaced forwardly of said actuator base, said end wall having a central opening therethrough;

a generally cup-shaped threaded sleeve secured to said actuator base coaxially within said aeration fitment and being rotatable with said aeration fitment but constrained against axial movement relative to said actuator base, said sleeve having a cylindrical side wall with internal threads and an open end at said actuator base and a forward wall disposed adjacent to and behind the end wall of said aeration fitment, said forward wall having a discharge orifice in alignment with the central opening through the end wall of said aeration fitment; and

an adjustable nozzle disposed coaxially within said threaded sleeve, said nozzle being constrained against rotational movement relative to said actuator base but movable axially relative to said actuator base and having external threads engaged with said internal threads in said threaded sleeve so that rotation of said sleeve causes axial movement of said nozzle toward and away from said discharge orifice in the forward wall of said sleeve, said nozzle having a center post that extends forwardly to adjacent said discharge orifice in said forward wall of said threaded sleeve, wherein axial movement of said nozzle adjusts the position of said post relative to said discharge orifice to thereby adjust the spray pattern of product discharged through said discharge orifice.

14. The dual function aerosol valve system claimed in claim 13, wherein:

a propellant flow path is defined between said aeration fitment side wall and said threaded sleeve side wall and between said aeration fitment end wall and said threaded sleeve forward wall.

15. The dual function aerosol valve system claimed in claim 14, wherein:

said adjustable nozzle defines a product flow path extending through a center portion thereof around said center post to the discharge orifice in the forward wall of said threaded sleeve.

16. The dual function aerosol valve system claimed in claim 1, wherein:
said valve cup is made of metal material.

17. The dual function aerosol valve system claimed in claim 1, wherein:
the valve cup is made of different materials to accommodate the valve assembly and different container neck finishes of a container to which said valve assembly is to be secured.

18. The dual function aerosol valve system claimed in claim 12, wherein:
the first propellant flow path defined between the first stem valve and the valve housing upper end is annular.

19. The dual function aerosol valve system claimed in claim 1, wherein:
product to be dispensed is held in a cylinder mounted in said container, and a piston reciprocable in the cylinder exerts pressure on the product to dispense it through the nozzle means assembly.

20. A dual function non-clogging actuator and valve assembly, comprising:
a valve cup having means for attachment to a container holding a pressurized gas propellant and a product to be dispensed;
a valve assembly mounted to said valve cup above said valve cup;
an actuator and nozzle assembly mounted to said valve cup below said valve cup;
said valve assembly including a valve housing constructed to accommodate either a bag-on-valve system or a piston driven can-on-valve system, said valve housing having a tubular side wall with an upper end and a lower end and an inner surface defining a hollow interior, a lower end of said hollow interior defining a first product flow path;
first and second stem valves having upper and lower ends and mounted for reciprocation within said valve housing, said first stem valve controlling flow of gaseous propellant and said second stem valve controlling flow of product, said second stem valve being coaxially received within said first stem valve;
said actuator and nozzle assembly connected with the stem valves so that upon initial depression of the actuator the first stem valve is opened to admit propellant to the nozzle and upon continued depression of the actuator the second stem valve is then opened to admit product to the nozzle, and closing of the stem valves is in reverse order when the actuator is

released so that flow of product to the nozzle is first interrupted and then flow of propellant is interrupted; and

a spring connected to bias the stem valves to their closed positions.

21. The dual function actuator and valve assembly claimed in claim 20, wherein:

said actuator comprises an actuator base having a propellant flow path and a separate product flow path extending to said nozzle, whereby propellant and product remain separate until they reach the nozzle where they are mixed and dispensed as a spray.

22. The dual function actuator and valve assembly claimed in claim 21, wherein:

said first and second stem valves are attached to said actuator and nozzle assembly so they reciprocate in unison throughout their travel when said actuator is reciprocated.

23. The dual function actuator and valve assembly claimed in claim 22, wherein:

said first stem valve has an inner surface;

a downwardly facing first shoulder is on said inner surface;

said valve housing inner surface has a reduced diameter section defining an elongate cylindrical valve seat and an upwardly facing second shoulder; and

said spring is engaged between said first and second shoulders to bias said stem valves and actuator upwardly relative to said valve housing and valve cup.

24. The dual function actuator and valve assembly claimed in claim 23, wherein:

said first shoulder defines a center opening in said first stem valve;

said second shoulder defines a center opening in said valve housing; and

said lower end of said second stem valve has a reduced diameter relative to the upper end thereof, said reduced diameter lower end extending through the center openings defined by said first and second shoulders.

25. The dual function aerosol valve system claimed in claim 24, wherein:

a plurality of upstanding retaining nibs is formed on said second shoulder; and

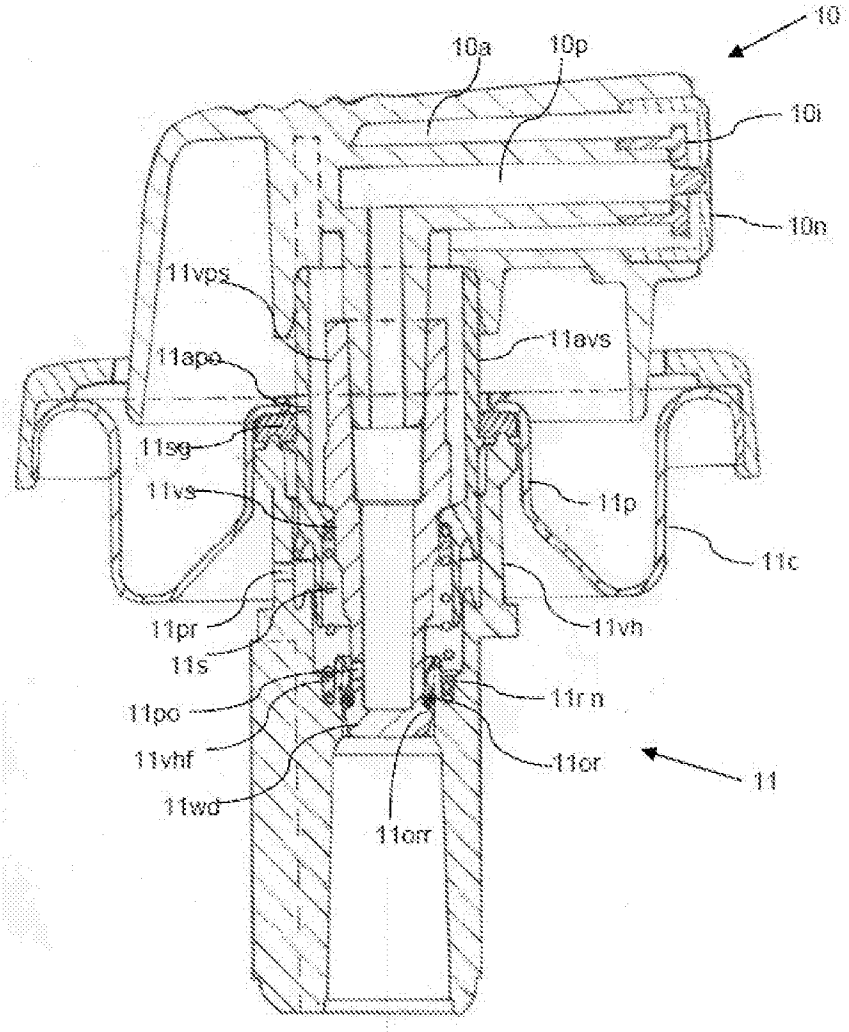
said second stem valve lower end has a radially enlarged head, said nibs being engaged behind said head to retain said second stem valve in said valve housing against the bias of said spring.

26. The dual function aerosol valve system claimed in claim 21, wherein:

said nozzle comprises a generally cup-shaped aeration fitment rotatable relative to said actuator base but constrained against axial movement relative thereto, said aeration fitment having a side wall with an open end secured to a forward lateral side of said actuator base in circumscribing relationship to said product and propellant flow paths in said actuator base, and an end wall spaced forwardly of said actuator base, said end wall having a central opening therethrough;

a generally cup-shaped threaded sleeve secured to said actuator base coaxially within said aeration fitment and being rotatable with said aeration fitment but constrained against axial movement relative to said actuator base, said sleeve having a cylindrical side wall with internal threads and an open end at said actuator base and a forward wall disposed adjacent to and behind the end wall of said aeration fitment, said forward wall having a discharge orifice in alignment with the central opening through the end wall of said aeration fitment; and

said nozzle comprises an adjustable nozzle disposed coaxially within said threaded sleeve, said adjustable nozzle being constrained against rotational movement relative to said actuator base but movable axially relative to said actuator base and having external threads engaged with said internal threads in said threaded sleeve so that rotation of said sleeve causes axial movement of said adjustable nozzle toward and away from said discharge orifice in the forward wall of said sleeve, said adjustable nozzle having a center post that extends forwardly to adjacent said discharge orifice in said forward wall of said threaded sleeve, wherein axial movement of said adjustable nozzle adjusts the position of said post relative to said discharge orifice to thereby adjust the spray pattern of product discharged through said discharge orifice.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10a
10p
10i
10n
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11avs
11apo
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11p
11c
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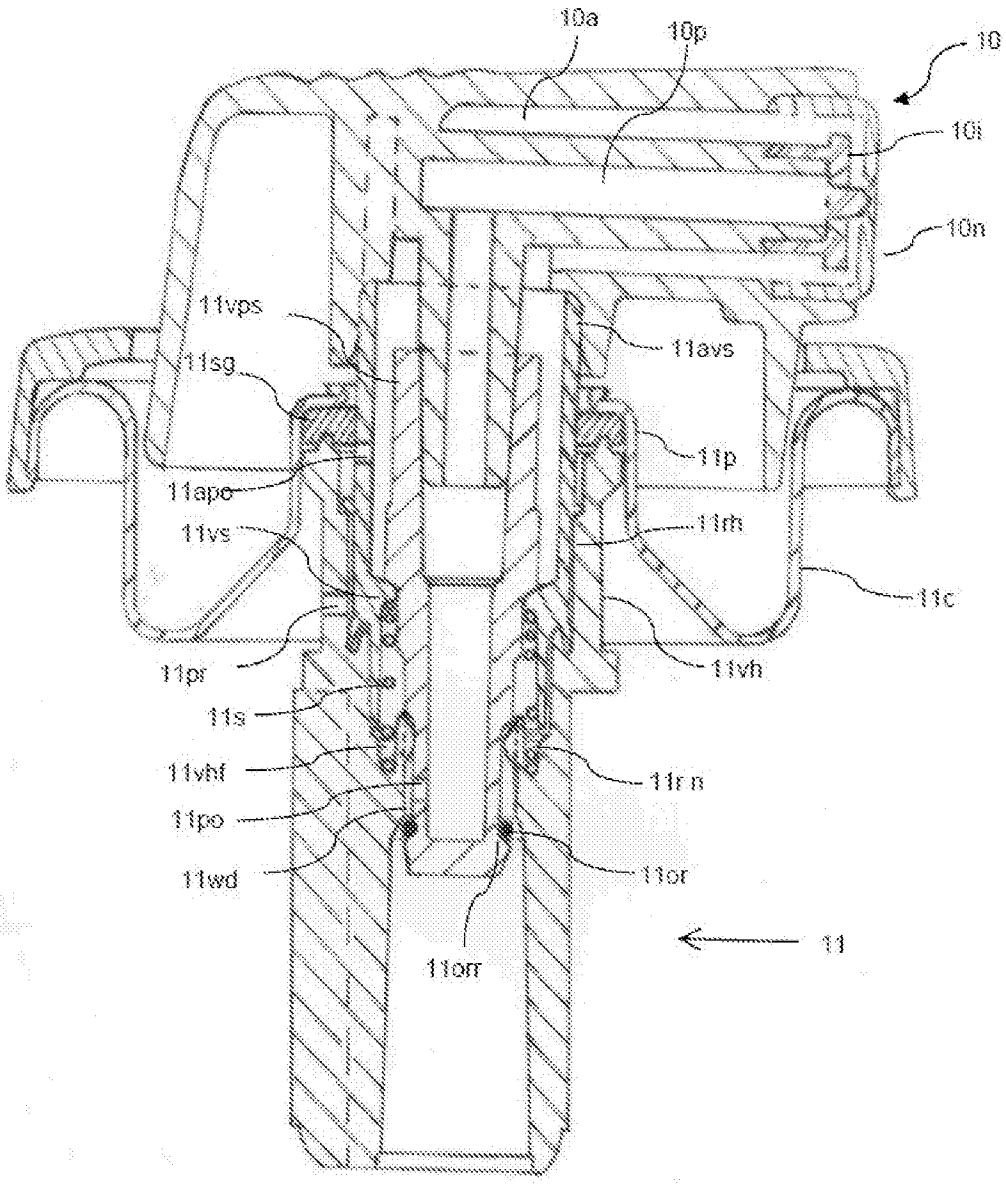
11or
11
11wo
11orr

FIG. 1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10p
10
10i
10n
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11p
11ape
11vs
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11pr
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11or
11orr
11

FIG. 2

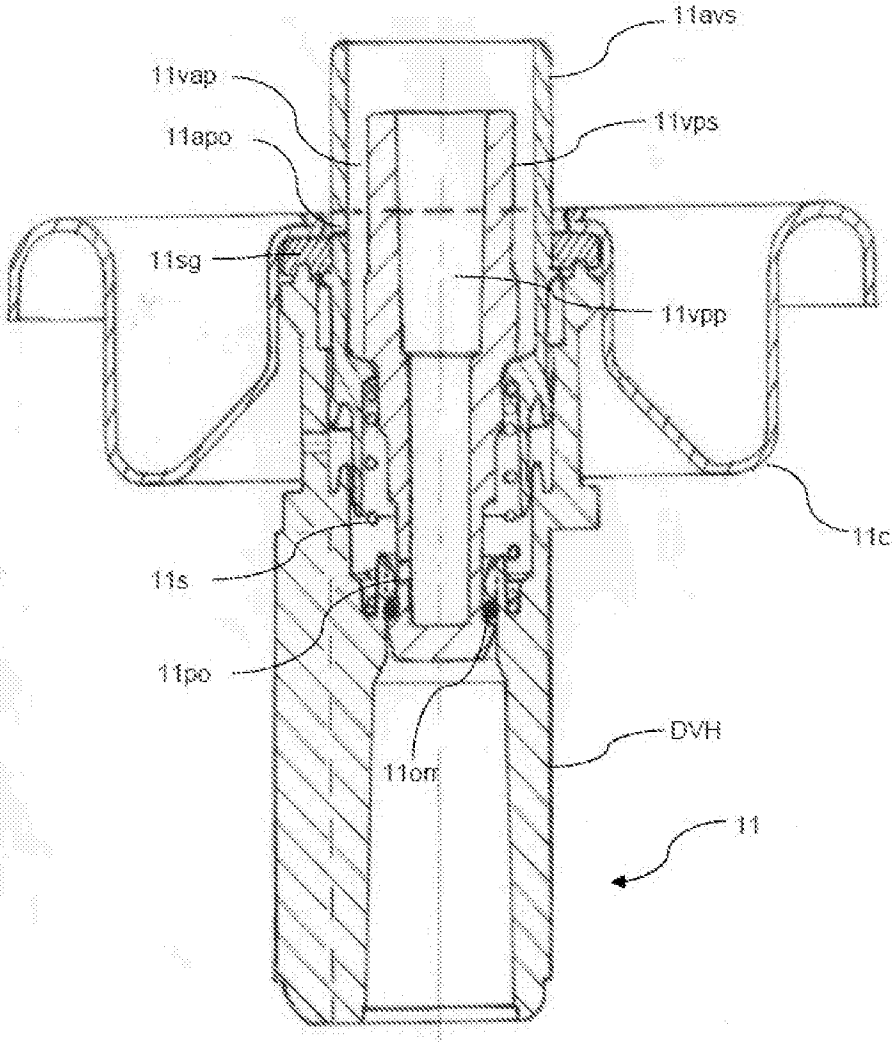

FIG. 3

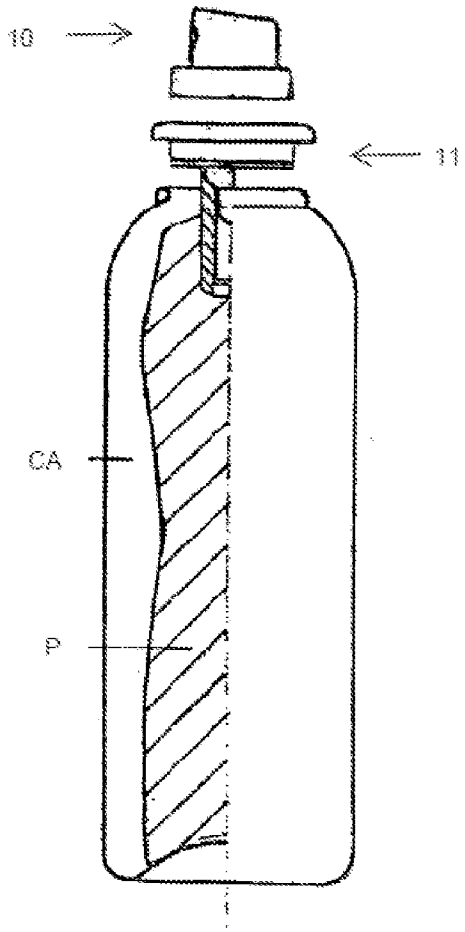

FIG. 4

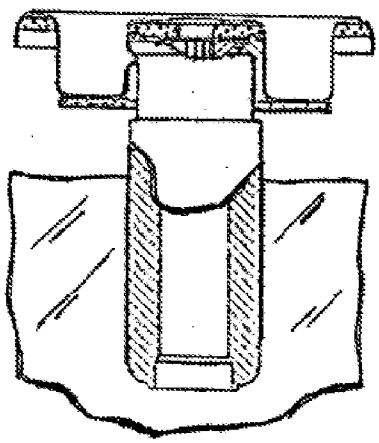

FIG. 5

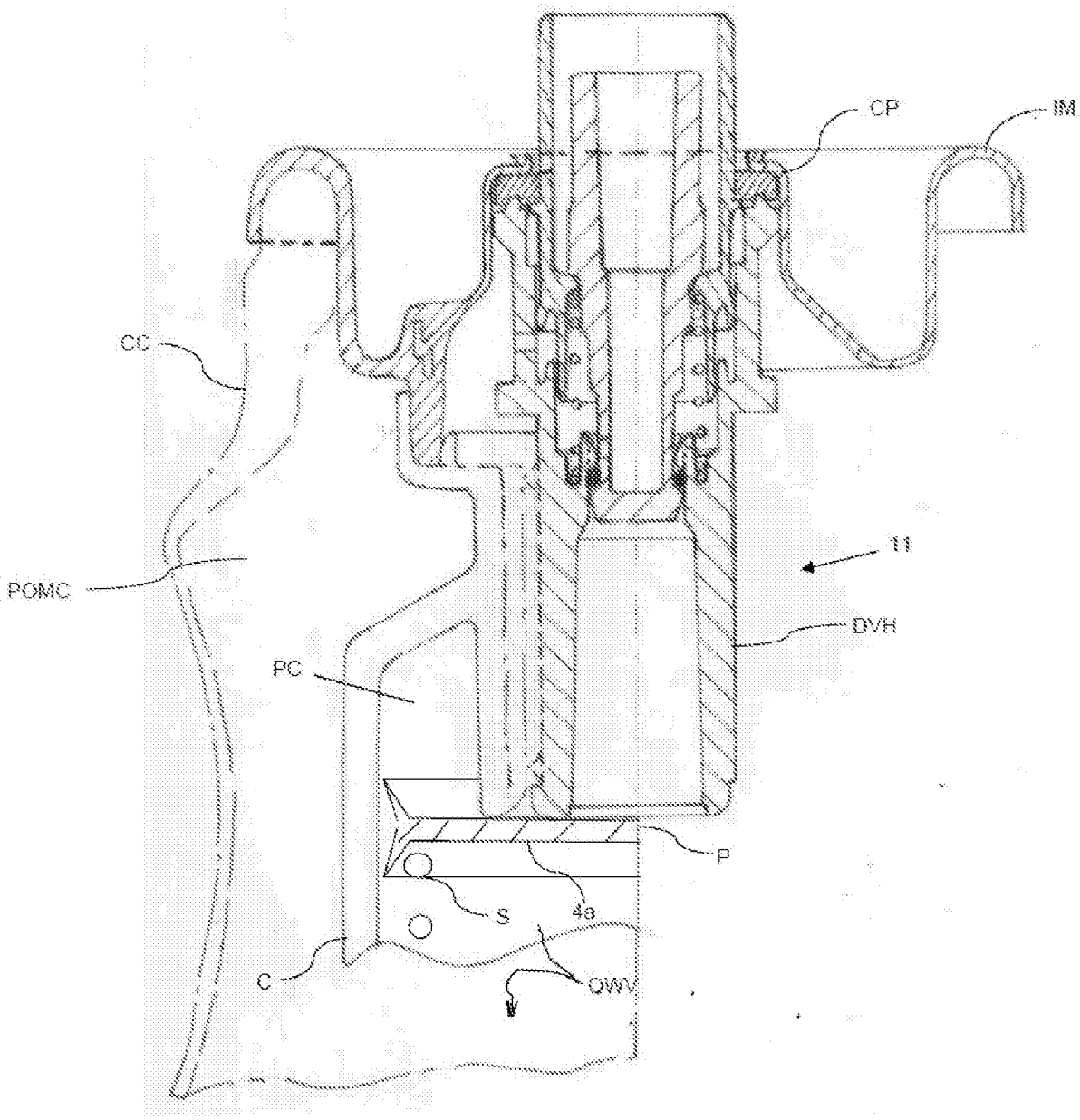

FIG. 6

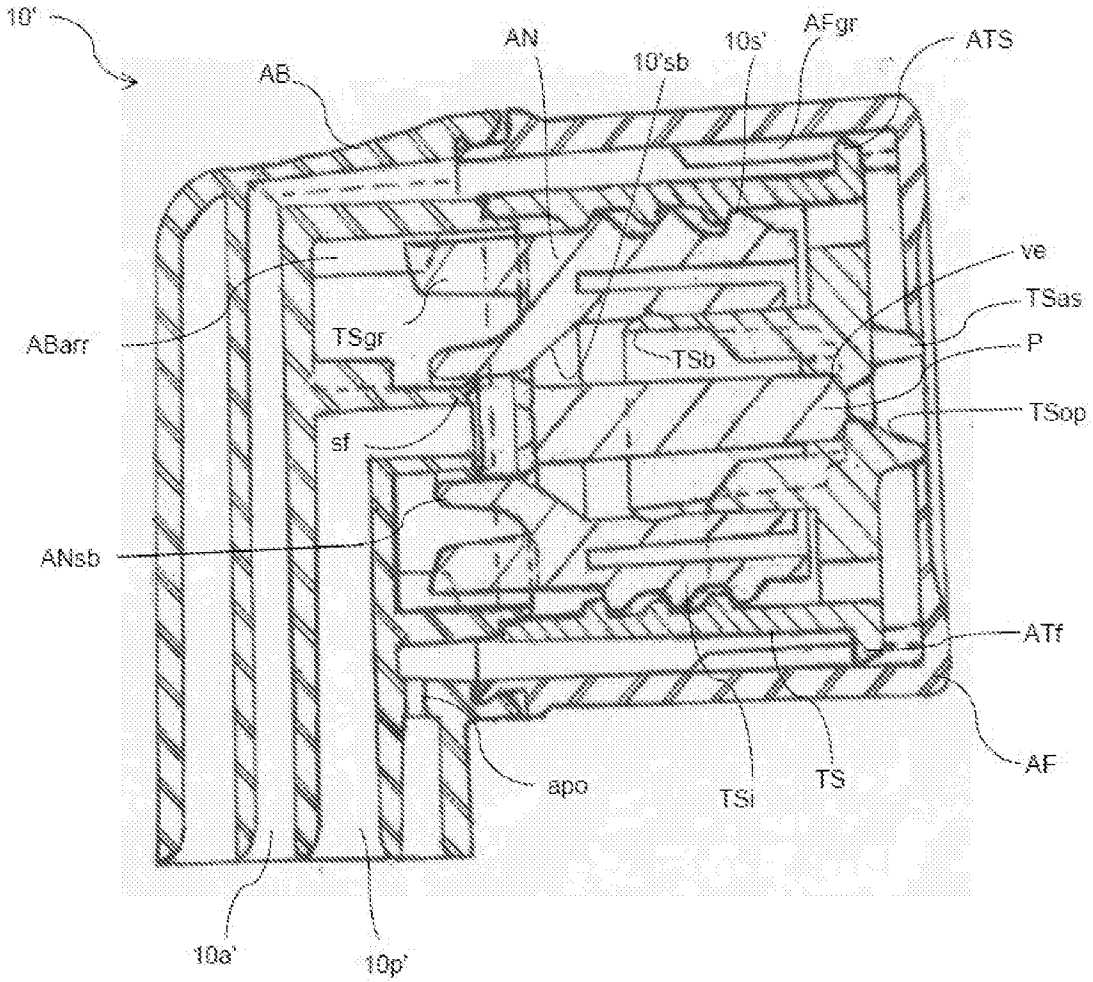
10'
AB
AN
10'sb
10's'
AFgr
ATS
ve
TSas
P
TSop
ABarr
TSgr
TSb
sf
ANsb
ATf
AF
apo
TSi
TS
10a'
10p'

FIG. 7

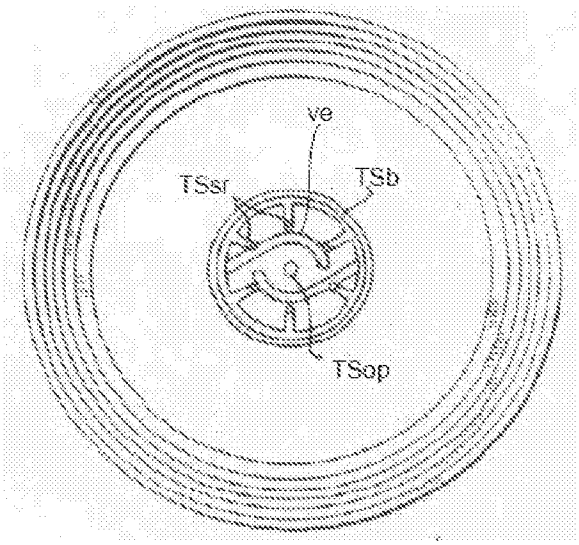
ve
TSsr
TSb
TSop

FIG. 8

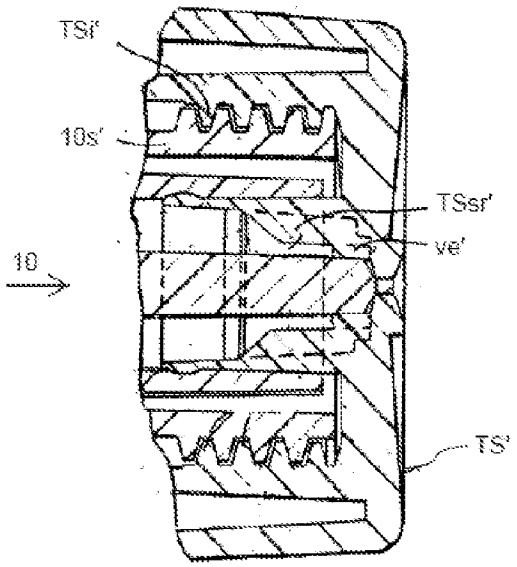

FIG. 9

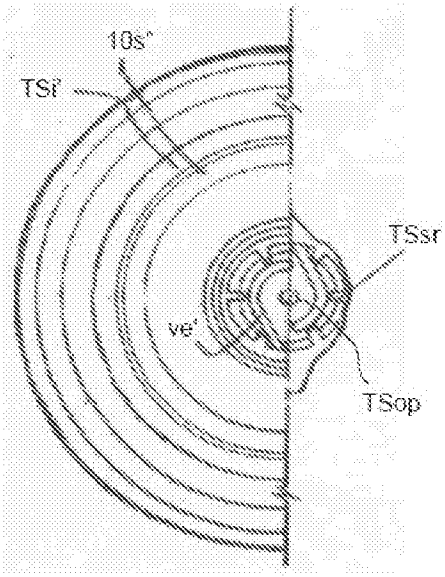

FIG. 10

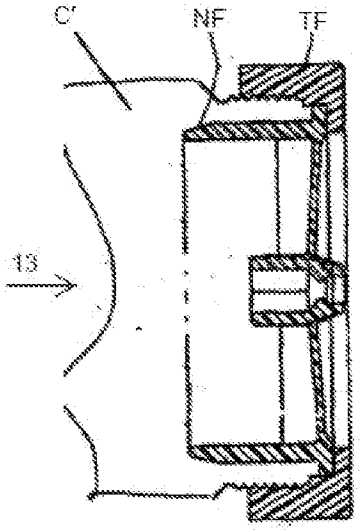

FIG. 11

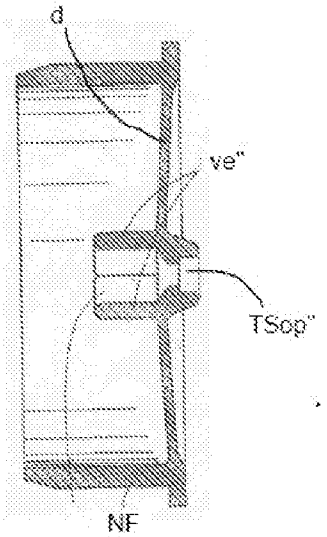

FIG. 12

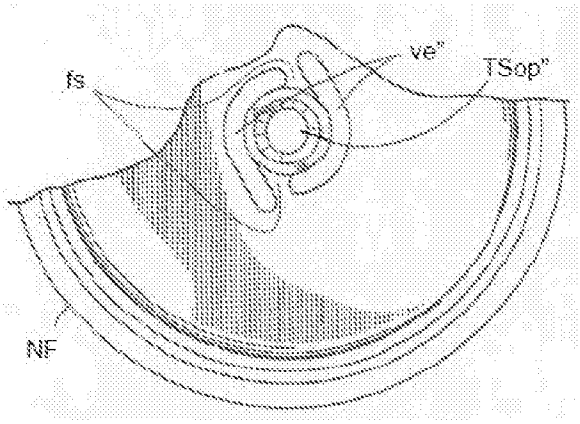

FIG. 13

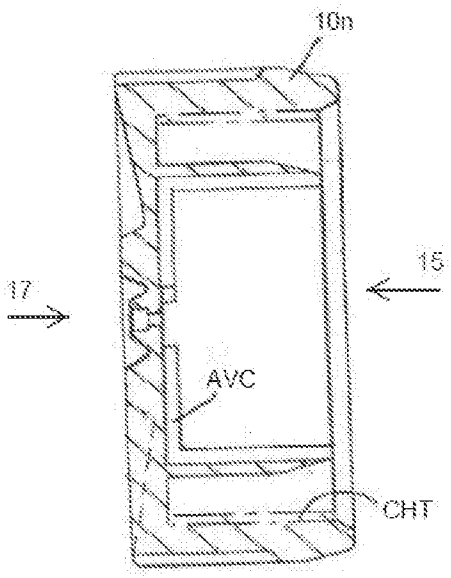

FIG. 14

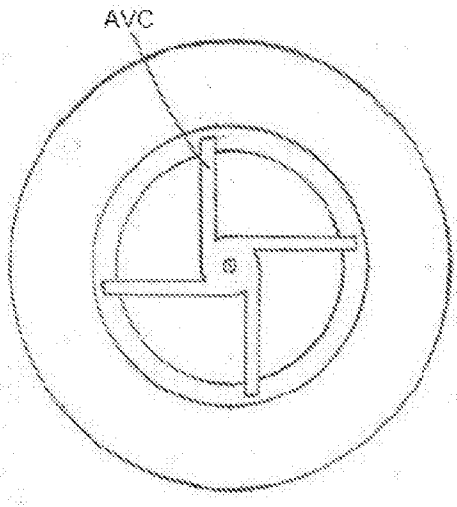

FIG. 15

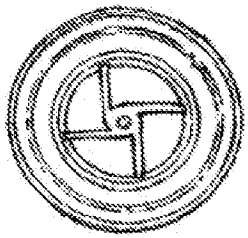

FIG. 16

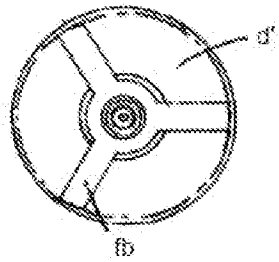

FIG. 17

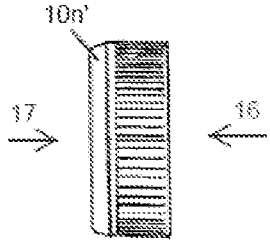

FIG. 18

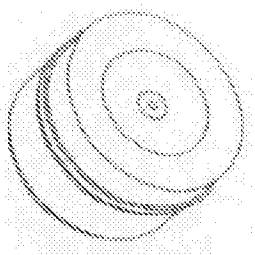

FIG. 19

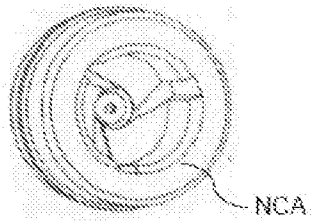

FIG. 20

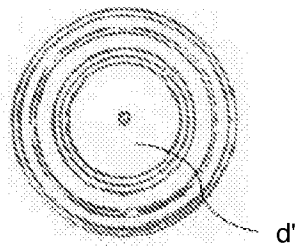

FIG. 21

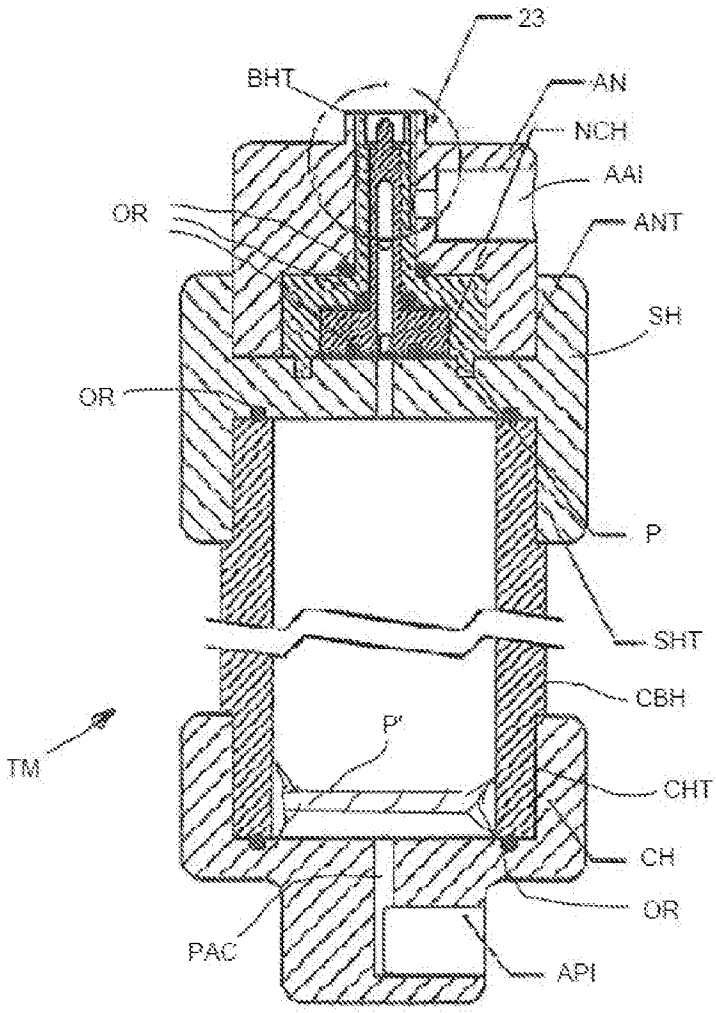

FIG. 22

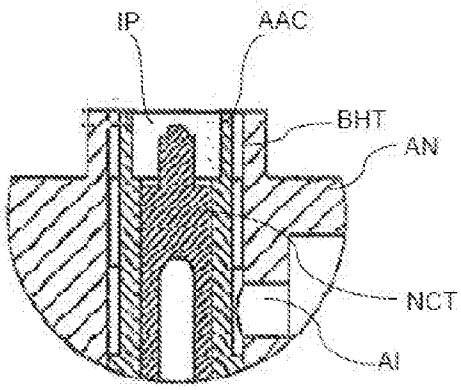

FIG. 23

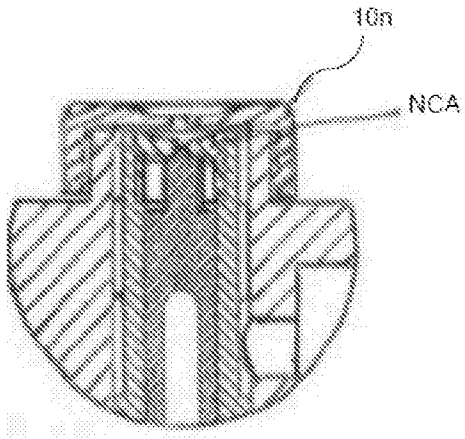

FIG. 24

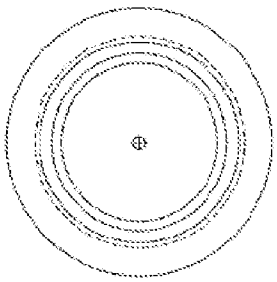

FIG. 25d

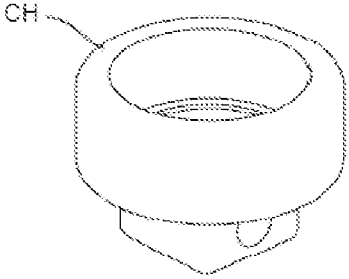

FIG. 25a

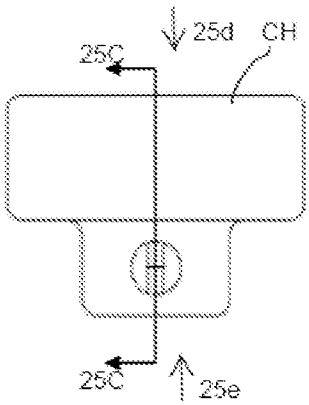

FIG. 25b

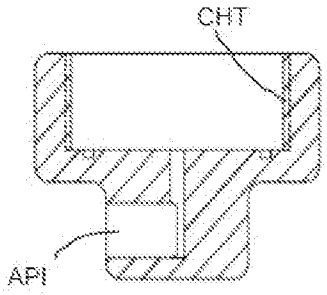

FIG. 25c

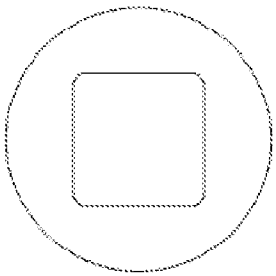

FIG. 25e

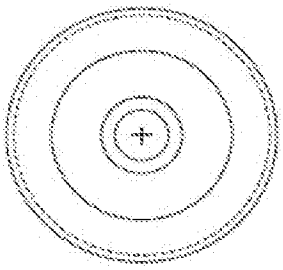

FIG. 26d

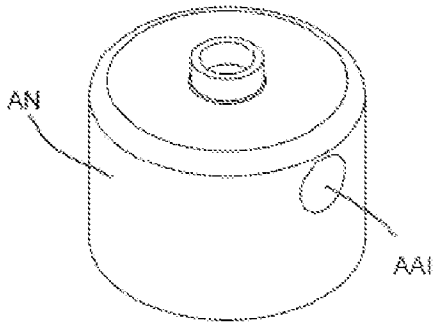

FIG. 26a

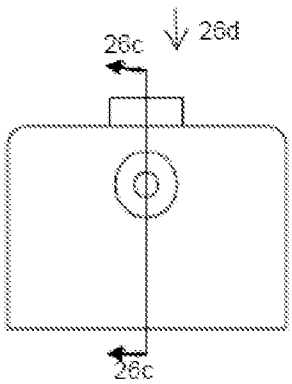

FIG. 26b

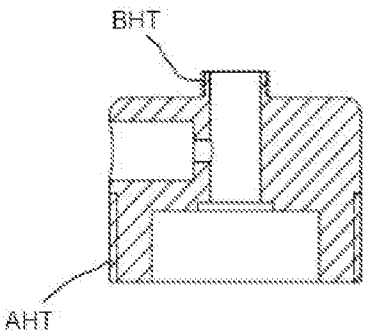

FIG. 26c

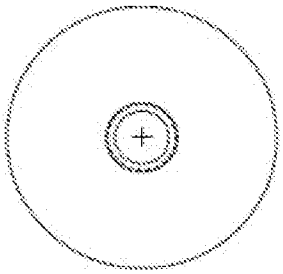

FIG. 26e

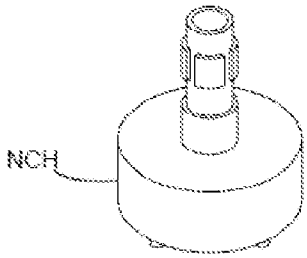

FIG. 27a

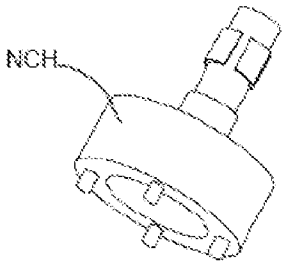

FIG. 27b

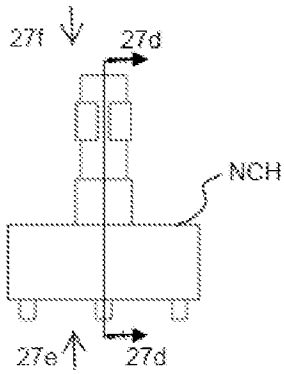

FIG. 27c

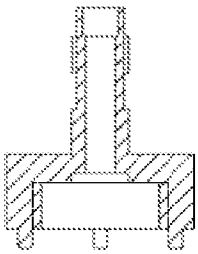

FIG. 27d

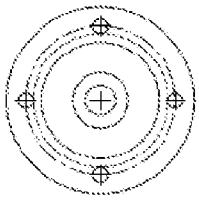

FIG. 27e

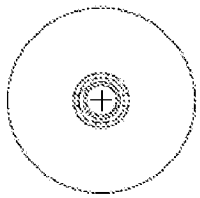

FIG. 27f

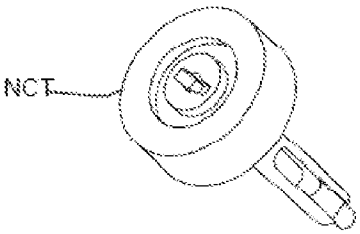

FIG. 28a

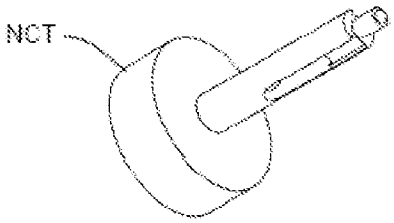

FIG. 28b

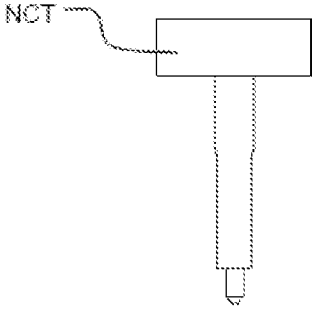

FIG. 28c

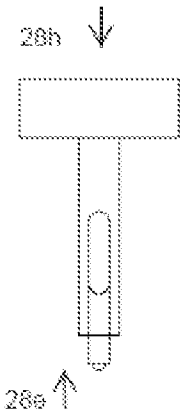

FIG. 28d

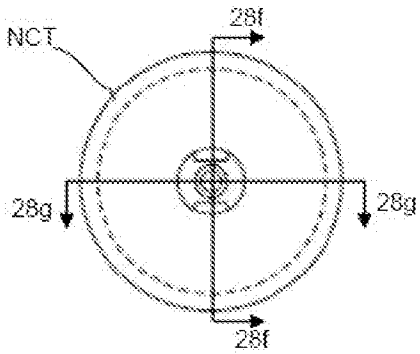

FIG. 28e

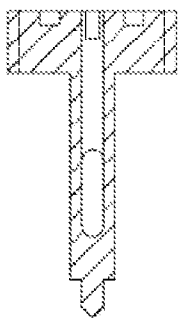

FIG. 28f

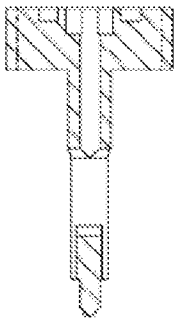

FIG. 28g

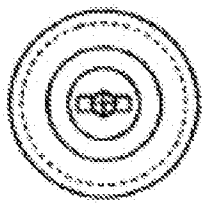

FIG. 28h

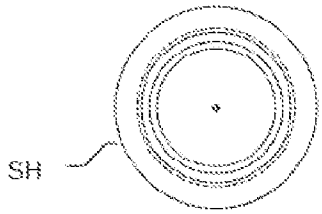

FIG. 29d

FIG. 29a

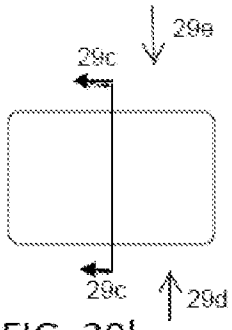

FIG. 29b

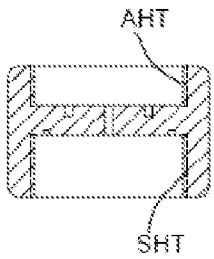

FIG. 29c

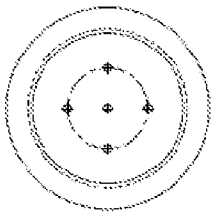

FIG. 29e

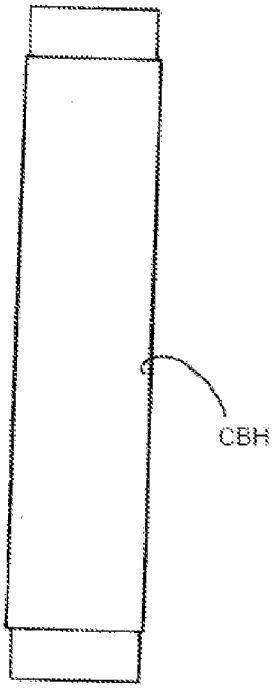

FIG. 30a

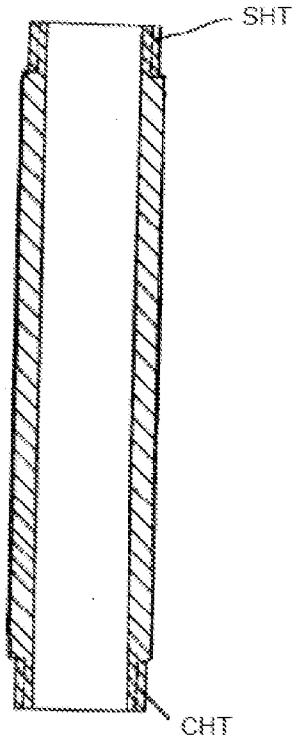

FIG. 30b

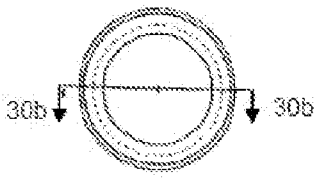

FIG. 30c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US16/34693

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B65D 83/20, 83/34, 83/44, 83/48, 83/60, 83/62, 83/64, 83/66 (2016.01)
CPC - B65D 83/20, 83/345, 83/44, 83/48, 83/60, 83/62, 83/64, 83/66
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)
IPC(8): B05B 7/00, 9/00, 9/03, 12/00; B65D 83/14, 83/16, 83/20, 83/34, 83/44, 83/48, 83/60, 83/62, 83/64, 83/66 (2016.01)
CPC: B05B 7/00, 9/00, 9/03, 12/002; B65D 83/14, 83/16, 83/20, 83/34, 83/345, 83/44, 83/48, 83/60, 83/62, 83/64, 83/66

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)
PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, Other Countries (INPADOC), RU, AT, CH, TH, BR, PH), EBSCO, Google/Google Scholar, Product, Propellant, Pressur*, Valve, Reciproca*, Slidabl*, Slideabl*, Sliding*, Movabl*, Moveabl*, Co_axial*, Bag, Pouch*, Piston, Seal, Gasket, O_ring, Spring, Bias*, Elastic*, Nozzle, Actuat*, Non_clog*, Anti_clog*, Purg*, sequenc*, consecutiv*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,431,119 A (STOODY WR) 14 February 1984; entire document	1-19
A	US 7,341,169 B2 (BAYER C) 11 March 2008; entire document	1-19
A	US 4,396,152 A (ABPLANALP RH) 02 August 1983; entire document	1-19
A	US 2011/0007987 A1 (DAVIDEIT DE et al.) 13 January 2011; entire document	1-19
E,X	US 9,387,977 B1 (BLAKE WS) 12 July 2016; entire document	1-19

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 August 2016 (04.08.2016)	04 OCT 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US16/34693

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

-***-Continued Within the Next Supplemental Box-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-19

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US16/34693

-***-Continued from Box No. III Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-19 are directed toward a dual function aerosol valve system comprising: a valve assembly being below a valve cup and an actuator and nozzle means assembly being above said valve cup.

Group II: Claims 20-26 are directed toward a dual function non-clogging actuator and valve assembly comprising: a valve assembly mounted to a valve cup above said valve cup; an actuator and nozzle assembly mounted to said valve cup below said valve cup.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I includes a valve assembly being below a valve cup and said actuator and nozzle means assembly being above said valve cup; a valve housing having an upper end and a lower end and assembled at its upper end to said valve cup and depending therefrom so that said valve housing extends into a container when said valve cup is assembled to a container; first seal means engaged between said valve housing upper end and said valve cup; a first stem valve having a tubular side wall with a hollow interior and an inner surface, said first stem valve being reciprocal in the valve housing and defining between it and the valve housing upper end a first propellant flow path, said first stem valve being open ended and its side wall being slidable within and sealed relative to said first seal means; (f) a second stem valve coaxially received within the hollow interior of said first stem valve and being free of attachment to said first stem valve; said second stem valve having a tubular side wall with a hollow interior defining a second product flow path, the upper end of said second stem valve being open and the lower end being closed, and the upper ends of said first and second stem valves defining between them a second propellant flow path; (g) second seal means engaged between the lower end of said second stem valve and an interior surface of said valve housing side wall; (h) a first propellant side port extending through the side wall of said valve housing into the first propellant flow path; (i) a second propellant side port extending through the side wall of said first stem valve into the second propellant flow path; (j) a product side port extending through the side wall of said second stem valve into the second product flow path; (k) spring means engaged with said stem valves to urge them into a first, at-rest position where the first seal means blocks communication through said second propellant port from said first propellant flow path to said second propellant flow path, and said second seal means blocks communication through said product side port from said first product flow path to said second product flow path; and (1) said actuator and nozzle means assembly is connected with each of said stem valves to reciprocate them in said valve housing into a second, depressed dispensing position wherein the second propellant side port moves into an unblocked position relative to said first seal means so that propellant can flow from said first propellant flow path to said second propellant flow path, and said product side port moves into an unblocked position relative to said second seal means so that product can flow from said first product flow path to said second product flow path, said propellant and product side ports being spaced relative to said first and second seal means so that when said actuator is depressed said first stem valve first moves to an open position wherein said second propellant side port is unblocked and then said second stem valve moves to an open position wherein said product side port is unblocked, said first and second stem valves thereby being sequentially opened when said actuator is depressed and sequentially closed in reverse order when said actuator is released, whereby propellant gas flows through said actuator and nozzle means before product and flows through said actuator and nozzle means after flow of product is interrupted, which are not present in Group II.

Group II includes a valve assembly mounted to said valve cup above said valve cup; an actuator and nozzle assembly mounted to said valve cup below said valve cup; first and second stem valves mounted for reciprocation within said valve housing, said second stem valve being coaxially received within said first stem valve; said actuator and nozzle assembly connected with the stem valves so that upon initial depression of the actuator the first stem valve is opened to admit propellant to the nozzle and upon continued depression of the actuator the second stem valve is then opened to admit product to the nozzle, and closing of the stem valves is in reverse order when the actuator is released so that flow of product to the nozzle is first interrupted and then flow of propellant is interrupted; and a spring connected to bias the stem valves to their closed positions, which are not present in Group I.

The common technical features of Groups I-II are a valve cup having means for attachment to a container holding a pressurized gas propellant and a product to be dispensed; a valve assembly and an actuator and nozzle means assembly mounted to said valve cup; said valve assembly including a valve housing constructed to accommodate either a bag-on-valve system or a piston driven can-on-valve system, said valve housing having a tubular side wall with an upper end and a lower end and an inner surface defining a hollow interior, a lower end of said hollow interior defining a first product flow path; first and second stem valves having upper and lower ends; said first stem valve controlling flow of gaseous propellant and said second stem valve controlling flow of product; and said actuator and nozzle assembly connected with the stem valves; and a spring.

-***-Continued within the Next Supplemental Box-***-

-***-Continued from the previous Supplemental Box-***-

These common features are disclosed by US 4,431,119 A to Stoody (hereinafter "Stoody"). Stoody discloses a valve cup (27; figure 2) having means for attachment (means for affixing; column 2, lines 55-60) to a container (11; figure 1) holding a pressurized gas propellant (propellant 13; column 2, lines 45-50) and a product (second fluid 19; figure 1; column 2, lines 50-55) to be dispensed (expelled; column 2, lines 50-55); a valve assembly (valve mechanism 25; figure 2) and an actuator and nozzle means assembly (dispensatory actuator 35; figure 2) mounted to said valve cup (as shown; figure 2); said valve assembly including a valve housing (41; figure 2) constructed to accommodate either a bag-on-valve system or a piston driven can-on-valve system (expansible container 17; figure 1; column 2, lines 45-50), said valve housing having a tubular side wall (cylindrical; column 3, lines 20-25) with an upper end (53; figure 2) and a lower end (49; figure 2) and an inner surface defining a hollow interior (concentrically bored; column 3, lines 20-25), a lower end of said hollow interior defining a first product flow path (bottom 49 receives conduit 31 permitting second fluid 19 (product) entrance into housing 41; figure 2); first (sleeve 67 together with gaskets 63 and 65; figure 2) and second (valve seat 71 together with gaskets 63 and 65; figure 2) stem valves having upper and lower ends (as shown; figure 2); said first stem valve controlling flow of gaseous propellant (propellant 13 flows into sleeve 67 using gaskets 63 and 65; column 3, lines 45-50) and said second stem valve controlling flow of product (second fluid 19 (product) flows through valve seat 71 and port 85 into passageway 81 using gaskets 63 and 65; column 4, lines 12-60); and said actuator and nozzle assembly connected with the stem valves (dispensatory actuator 35 connected to sleeve 67 and valve seat 71 as shown; figure 2); and a spring (73; figure 2).

Since the common technical features are previously disclosed by Stoody, these common features are not special and so Groups I-II lack unity.