

(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 199883216 B2**
(10) Patent No. **732591**

(54) Title
System and method for one-way spray/aerosol tip

(51)⁶ International Patent Classification(s)
B65D 083/44 B65D 083/48

(21) Application No: **199883216** (22) Application Date: **1998 .09 .09**

(30) Priority Data

(31) Number (32) Date (33) Country
08/927221 1997 .09 .10 US

(43) Publication Date : **1999 .03 .25**

(43) Publication Journal Date : **1999 .03 .25**

(44) Accepted Journal Date : **2001 .04 .26**

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(56) Related Art
US 4313569
US 5358179
US 5370317

SYSTEM AND METHOD FOR ONE-WAY SPRAY/AEROSOL TIP

Abstract

A nozzle mechanism (2) for generating an aerosol-type liquid discharge is provided, which nozzle mechanism ensures one-way movement of liquid during discharge and also has a substantially zero "dead volume" at the tip of the nozzle. The nozzle mechanism includes a flexible nozzle portion (10) with an outlet and a fluid channel (104), a rigid shaft (102) received within the flexible nozzle portion, and a rigid housing (101) surrounding the flexible nozzle portion and exposing the outlet. The rigid shaft interfaces the outlet to form a first normally-closed, one-way valve, as well as to define a swirling chamber for collecting the liquid which has been channelled from the liquid reservoir, prior to being discharged via the outlet. The outlet has a tubular wall with thickness that decreases along the elongated axis of symmetry for the outlet toward the tip of the outlet. The fluid channel is circumferentially positioned within the flexible nozzle portion to create swirling action of the liquid delivered to said swirling chamber. Once the pressure on the swirling liquid reaches a threshold pressure sufficient to radially deform the portion of the outlet forming the first normally-closed valve, the liquid in the swirling chamber is discharged through the outlet. The nozzle mechanism is coupled to a flexible body portion (107) which has a substantially tubular shape and a wall thickness which decreases from the bottom of the body portion toward the flexible nozzle portion (10). The rigid shaft (102) received within the flexible nozzle portions extends down into the flexible body portion so that a second portion of the rigid shaft interfaces the flexible body portion to form a second normally-closed, one-way valve in the fluid communication path between the liquid reservoir and the swirling chamber.

AUSTRALIA
PATENTS ACT 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

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Invention Title: System and Method for One-way Spray/Aerosol Tip

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

SYSTEM & METHOD FOR ONE-WAY SPRAY/AEROSOL TIP

5 Field of the Invention

This invention relates generally to a system and method for generating a spray and/or an aerosol-type discharge, and relates more particularly to a system and a
10 method for generating a spray and/or an aerosol-type discharge by means of an aerosol-tip mechanism which ensures one-way movement of liquid through the aerosol-tip mechanism.

Background of the Invention

In recent years, spray and/or aerosol-type dispensers have received attention for their use in dispensing liquids, particularly medicaments. One persistent problem in designing spray and/or aerosol dispensers for dispensing medicaments is preventing contamination of the medicament which can occur when the medicament that has been exposed to ambient air returns and/or remains in the aerosol outlet channel, e.g., within the aerosol nozzle. One solution to this problem is to simply add preservatives to the medicament being dispensed, thereby preventing bacterial growth. However, this solution has obvious disadvantages, e.g., added costs and toxicity of the preservatives. In order to prevent bacterial growth in medicament which does not contain preservatives while allowing dispensation of multiple doses of the medicament, the aerosol nozzle must prevent medicament that has been previously exposed to ambient air from being sucked back into the aerosol outlet channel.

Another problem in designing spray and/or aerosol dispenser for dispensing medicaments is minimizing the number of components which constitute the spray/aerosol dispenser. As the number of components increases, the

difficulty and cost of mass production increases.

Accordingly, it is an object of the present invention to provide an outlet nozzle or tip mechanism for dispensing liquid from a pump-type dispenser in aerosol or spray form, which nozzle or tip mechanism is adapted for combination with the pump-type dispenser without the need for additional components for, or modification of, the pump-type dispenser for facilitating the combination.

It is another object of the present invention to provide an outlet nozzle for an aerosol dispenser, which nozzle ensures one-way movement of liquid through the nozzle.

It is yet another object of the present invention to provide a method of dispensing liquid through an outlet nozzle for an aerosol dispenser, which method ensures one-way movement of liquid through the nozzle.

It is yet another object of the present invention to provide an outlet nozzle for an aerosol dispenser, which nozzle has a substantially zero "dead volume" in which liquid that has been exposed to ambient air can remain, i.e., the liquid is completely released once it passes through the outlet nozzle, or the combined effect of the surface tensions of the liquid and the surrounding outlet nozzle forces any remaining liquid out of, and away from,

the outlet portion.

It is yet another object of the present invention to provide a method of ensuring that no liquid which has been exposed to ambient air returns to the interior portion
5 of the nozzle of an aerosol dispenser.

It is yet another object of the present invention to provide an aerosol dispenser with a one-way nozzle, which dispenser minimizes the number of parts for manufacturing.

It is yet another object of the present invention
10 to provide an aerosol dispenser having a plurality of valve mechanisms in the fluid communication path between the liquid reservoir and the outlet nozzle to ensure minimization of contact between the content of the liquid reservoir and liquid which may have been previously exposed
15 to ambient air.

It is another object of the present invention to provide an outlet nozzle for an aerosol dispenser, which nozzle is adapted to generate an aerosol-type discharge by means of elastic, radial deformation along the circumference
20 of the nozzle which provides an integral spring, while substantially maintaining the physical profile in the direction of the longitudinal axis of the nozzle.

It is another object of the present invention to provide an aerosol-type dispenser which does not require

propellants such as CFCs, the release of which is harmful to the ozone layer, or the release pressure of which propellant is temperature dependent, thereby creating variations in dispensed dosages.

5 It is another object of the present invention to provide a pump-and-nozzle system for generating an aerosol-type discharge via a swirling chamber by means of an integral spring effect achieved by elastic, radial deformation along the circumference of the nozzle, which
10 aerosol-type discharge is achieved with a minimum of "head loss."

Summary of the Invention

15 In accordance with the above objects, the present invention provides a nozzle mechanism for generating an aerosol-type liquid discharge, which nozzle mechanism ensures one-way movement of liquid and also has a
20 substantially zero "dead volume" at the tip of the nozzle. The nozzle mechanism according to the present invention may be adapted for use with a variety of types of liquid-dispensing apparatuses, for example, medicament dispensers which channel liquid from a liquid reservoir through the

nozzle mechanism by application of pressure via a pump mechanism.

In one embodiment of the nozzle mechanism according to the present invention, the nozzle mechanism includes a flexible nozzle portion with an outlet and a fluid channel, a rigid shaft received within the flexible nozzle portion, and a rigid housing surrounding the flexible nozzle portion and exposing the outlet. The rigid shaft interfaces the outlet to form a first normally-closed, circumferential valve as well as to define a collecting chamber, or a "swirling chamber," for temporarily collecting the liquid which has been channeled from the liquid reservoir, prior to being discharged via the outlet. The outlet has an elastic outer wall, the thickness of which decreases along the elongated axis of symmetry of the outlet from a bottom portion of the outlet toward the tip of the outlet, thereby facilitating one-way movement of liquid through, and out of, the outlet.

In the above-described embodiment, the fluid channel, which defines a portion of a fluid communication path between the liquid reservoir and the collecting chamber, is circumferentially positioned within the flexible nozzle portion. The circumferentially positioned fluid channel provides uniform pressure with a minimum of head

loss. As a result, the liquid pressure is uniformly applied at the entry point of the swirling chamber once the pressure within the circumferentially positioned fluid channel reaches a threshold pressure sufficient to radially deform a
5 second normally-closed, circumferential valve forming a portion of the fluid communication path between the liquid reservoir and the collecting chamber, which second normally-closed valve is described in further detail below.

The above-described embodiment of nozzle mechanism
10 according to the present invention may be coupled to a flexible body portion which has a substantially tubular shape and a wall thickness which decreases from the bottom of the body portion toward the flexible nozzle portion, along the elongated axis of symmetry of the body portion.
15 The rigid shaft received within the flexible nozzle portions extends down into the flexible body portion so that a second portion of the rigid shaft interfaces the flexible body portion to form the second normally-closed, circumferential valve in the fluid communication path between the liquid
20 reservoir and the collecting chamber. As with the first normally-closed, circumferential valve, the second normally-closed, circumferential valve is opened when the pressure on the liquid in the fluid communication path reaches a threshold pressure sufficient to radially deform the portion

of the flexible body portion forming the second normally-closed, circumferential valve.

One advantage of the nozzle mechanism according to the present invention is that the configuration of the outlet portion substantially eliminates the possibility that liquid in the nozzle mechanism will come in contact with ambient air and subsequently return and/or remain in the interior portion of the nozzle mechanism. The nozzle mechanism achieves this result by means of the first normally-closed valve, which facilitates one-way movement of liquid from the nozzle mechanism through the outlet portion during discharge. Due to the first normally-closed valve, the outlet portion has a substantially zero "dead volume", i.e., a space in which liquid that has been exposed to ambient air can remain.

In addition to the first normally-closed valve, the second normally-closed valve positioned along the fluid communication path between the liquid reservoir and the outlet adds further assurances that liquid in the liquid reservoir will not be contaminated by liquid that has been exposed to ambient air and subsequently reintroduced into the nozzle mechanism. Because the first and second normally-closed valves are positioned along the fluid communication path to open asynchronously during fluid

communication leading to discharge through the outlet, failure of either one of the valves will not affect the integrity of the nozzle mechanism to prevent contamination of the liquid in the liquid reservoir.

5 Another advantage of the nozzle mechanism according to the present invention is that the nozzle mechanism experiences substantially no deformation along the direction of the discharge path through the outlet, i.e., the elongated axis of symmetry for the outlet. As a result,
10 the physical profile of the fluid channel, which induces swirling action of the liquid in the collecting chamber of the nozzle mechanism, is maintained during liquid discharge.

 Another advantage of the nozzle mechanism according to the present invention is that the number of
15 parts which constitute the nozzle mechanism and, in turn, the dispensing system which includes a pump mechanism in combination with the nozzle mechanism, is significantly reduced in comparison to conventional nozzle mechanisms. The reduced number of parts reduces costs and manufacturing
20 complexity.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view along the length of aerosol dispenser including one embodiment of a nozzle mechanism according to the present invention.

Fig. 2 is a cross-sectional view illustrating the flow path of liquid through the fluid communication path between the liquid reservoir and the nozzle mechanism of the aerosol dispenser shown in Fig. 1.

Fig. 3 is a cross-sectional view along line A-A shown in Fig. 1.

Fig. 4A is an enlarged cross-sectional view showing one stage of deformation of a valve in the nozzle mechanism according to the present invention shown in Fig. 1.

Fig. 4B is an enlarged cross-sectional view showing another stage of deformation of the valve in the nozzle mechanism according to the present invention shown in Fig. 1.

Fig. 5A is an enlarged cross-sectional view showing one stage of deformation of a valve in the body portion of the aerosol dispenser shown in Fig. 1.

Fig. 5B is an enlarged cross-sectional view showing another stage of deformation of the valve in the

body portion of the aerosol dispenser shown in Fig. 1.

Fig. 6A is a cross-sectional view showing a second embodiment of the nozzle mechanism according to the present invention.

5 Fig. 6B is a cross-sectional view along line B-B shown in Fig. 6A.

DETAILED DESCRIPTION OF THE INVENTION

10

Referring generally to Figs. 1 and 3, an aerosol-type dispenser system including a first exemplary embodiment of an aerosol tip or nozzle mechanism 2 according to the present invention is indicated generally at 1. The first
15 exemplary embodiment of the aerosol tip mechanism 2 includes a flexible nozzle portion 10 having an outlet portion 108 and a fluid channel or swirling channel 104, a rigid shaft 102 received within the flexible nozzle portion 10, and a rigid external housing 101 surrounding the flexible nozzle
20 portion 10 and exposing the outlet portion 108. The rigid shaft 102 interfaces the interior of the outlet portion 108 to form a first normally-closed valve 105, as well as to define a swirling chamber or collecting chamber 103 for liquid which has been channeled from a liquid reservoir,

prior to being discharged via the outlet portion 108 of the aerosol tip mechanism 2.

As shown in Figs. 1 and 3, for the first exemplary embodiment of the aerosol tip mechanism, the swirling
 5 channel or fluid channel 104 includes gaps between walls 1021a and 1021b circumferentially surrounding the rigid shaft 102. The swirling channel 104, which is described in further detail below, channels fluid into the swirling chamber 103.

10 A second exemplary embodiment of the aerosol tip or nozzle mechanism 2 according to the present invention is shown in Figs. 6A and 6B. The second exemplary embodiment is substantially similar to the first exemplary embodiment, with one exception. In contrast to the first exemplary
 15 embodiment shown in Figs. 1 and 3, the second exemplary embodiment of the aerosol tip or nozzle mechanism does not include walls 1021a and 1021b circumferentially surrounding the rigid shaft 102. Accordingly, in the second embodiment shown in Figs. 6A and 6B, the swirling channel 104 is simply
 20 an integral part of the swirling chamber 103.

As shown in Fig. 1, the first exemplary embodiment of the aerosol tip or nozzle mechanism 2 according to the present invention is coupled to a flexible body portion 107 which has a substantially tubular shape and a wall thickness

which decreases from the bottom of the body portion toward the flexible nozzle portion 10, along the elongated axis of symmetry of the body portion. The rigid shaft 102 received within the flexible nozzle portion 10 extends down into the flexible body portion 107 so that a second portion 102a of the rigid shaft interfaces the flexible body portion 107 to form a second normally-closed valve 106.

Referring generally to Figs. 1 and 2, the fluid communication path 201 of liquid from the liquid reservoir to the outlet portion 108 successively traverses the first and second normally-closed valves 105 and 106, respectively. A pump mechanism 110 of the dispenser system 1, acting in concert with a pump-body portion 111 of the dispenser system, channels the liquid from the liquid reservoir along the fluid communication path 201 by application of pressure. It should be noted that the nozzle mechanism according to the present invention is intended to be used in conjunction with a wide variety of liquid dispensing systems, one example of which is illustrated in applicant's commonly owned U.S. patent application Serial Number 08/534,609 filed on September 27, 1995, entitled "Fluid Pump Without Dead Volume," which is expressly incorporated herein by reference. Accordingly, it should be understood that the pump mechanism 110 and the pump-body portion 111 of the

dispenser system shown in Figs. 1 and 2 are merely exemplary and generic representation of a wide variety of dispensing systems.

As shown in Figs. 1 and 2, the liquid from the liquid reservoir is initially channeled through a circumferential channel or groove 109 formed on the exterior of the second portion 102a of the rigid shaft. Once the pressure on the liquid in the fluid communication path reaches a threshold pressure sufficient to radially deform the flexible body portion 107, a portion 501 of the flexible body portion 107 forming a lower segment of the second normally-closed valve 106 is radially deformed by the liquid, thereby opening the second normally-closed valve 106, as shown in Fig. 5A. As the liquid passes through the second normally-closed valve 106 toward the flexible nozzle portion 10, sequential segments of the flexible body portion 107 forming the second normally-closed valve 106 are radially deformed, as shown in Figs. 5A and 5B, until the liquid finally passes through the upper-most segment 502 of the flexible body portion 107 forming the second normally-closed valve 106.

As shown in Figs. 5A and 5B, because the wall thickness of the flexible body portion 107 decreases from the lower segment 501 to the upper segment 502 of the second

normally-closed valve 106, i.e., along the elongated axis of symmetry S of the nozzle mechanism, the lower segment 501 of the valve 106 is substantially closed by the time the liquid has reached the upper segment 502. Because the energy
5 required to open the lower segment 501 of the valve 106 is greater than the energy required to open the upper segment 502, the liquid is naturally biased to maintain its forward movement through the second valve 106 in the flexible body portion 107 once the lower segment 501 has been opened. In
10 this manner, the second normally-closed valve 106 ensures liquid movement only in the direction towards the flexible nozzle portion 10.

Once the liquid in the fluid communication path 201 has traversed the second normally-closed valve 106, the
15 liquid then enters the fluid channel 104 within the flexible nozzle portion 10 of the first embodiment of the aerosol tip mechanism 2, as shown in Figs. 1, 2 and 3. The fluid channel 104, which defines a portion of the fluid communication path 201 between the liquid reservoir and the
20 collecting chamber 103, is circumferentially positioned within the flexible nozzle portion, as shown in Fig. 3. The circumferentially positioned fluid channel 104 creates swirling action of the liquid, indicated in Fig. 3 by the directional arrow 301, as it is channeled into the swirling

chamber 103. For the second embodiment of the aerosol tip mechanism shown in Figs. 6A and 6B, the liquid directly enters the swirling chamber 103 via the space 601 once the liquid in the fluid communication path 201 has traversed the second normally-closed valve 106. The swirling action of the liquid is maintained in the swirling chamber until the liquid is discharged via the outlet portion 108, the mechanics of which discharging action is described in detail below.

10 Referring generally to Figs. 1, 4A and 4B, the liquid in the swirling chamber is discharged via the outlet portion 108 when the liquid pressure reaches a threshold pressure sufficient to radially deform the outlet portion 108 forming the first normally-closed valve 105. As with
15 the second normally-closed valve 106 described above, the liquid movement through the first normally-closed valve 105 involves sequential deformation of segments of the outlet portion 108. As shown in Fig. 4A, a portion 401 of the outlet portion 108 forming a lower segment of the first
20 normally-closed valve 105 is radially deformed by the liquid, thereby opening the first normally-closed valve 105. As the liquid passes through the first normally-closed valve 105 toward the tip of the outlet portion 108, sequential segments of the outlet portion 108 forming the first

normally-closed valve 105 are radially deformed, as shown in Figs. 4A and 4B, until the liquid finally passes through the upper-most segment 402 of the outlet portion 108 forming the first normally-closed valve 105.

5 As shown in Figs. 1, 4A and 4B, the wall thickness of the outlet portion 108 decreases from the lower segment 401 towards the upper segment 402 of the first normally-closed valve 105, i.e., along the elongated axis of symmetry S of the aerosol tip or nozzle mechanism. Due to this
10 steady decrease in wall thickness, the lower segment 401 of the valve 105 is substantially closed by the time the liquid has reached the upper segment 402, as shown in Figs. 4A and 4B. Because the energy required to open the lower segment 401 of the valve 105 is greater than the energy required to
15 open the upper segment 402, the liquid is naturally biased to maintain its forward movement through the first valve 105 in the outlet portion 108 once the lower segment 401 has been opened. Accordingly, the valve 105 ensures liquid
20 movement only in the direction towards the exterior tip of the nozzle portion 10.

During the discharge of liquid through the outlet portion 108, the only segment of the flexible nozzle portion 10 which experiences deformation along the elongated axis of symmetry S of the aerosol tip or nozzle mechanism is the

outlet portion 108. The remaining segments of the flexible nozzle portion are prevented by the rigid housing 101 from deformation along the elongated axis of symmetry S. Even the outlet portion 108 experiences only minimal deformation
 5 along the axis S; the significant deformation is along the radial direction. Furthermore, the outlet portion 108 does not exert a force along the axis S on the rigid shaft 102, i.e., the outlet portion 108 does not rub the rigid shaft during opening or closing of the first valve 105.

10 Accordingly, because of the absence of any rubbing contact between the outlet portion 108 and the rigid shaft 102, the chances of contaminants entering the swirling chamber 103 are minimized.

One advantage of the aerosol tip or nozzle mechanism according to the present invention is the above-
 15 described prevention of axial deformation of the flexible nozzle portion 10 by the rigid housing 101. Because the flexible nozzle portion 10, with the exception of the outlet portion 108, experiences substantially no deformation along
 20 the elongated axis of symmetry S shown in Fig. 4A, the physical profile of the fluid channel 104, which induces swirling action of the liquid channeled into the swirling chamber 103, is maintained during liquid discharge. An axial deformation of the flexible nozzle portion 10 along

the direction of liquid discharge would deform the fluid channel 104, which in turn would prevent the swirling action from occurring.

In the above-described embodiment of the aerosol tip or nozzle mechanism according to the present invention, the flexible nozzle portion 10, the flexible body portion 107 and the pump-body portion 111 may be made of any one of several materials well known in the art, including butadiene polyethylene styrene (KRATON™), polyethylene, polyurethane or other plastic materials, thermoplastic elastomers or other elastic materials. KRATON™ is particularly well suited for this purpose because of its characteristic resistance to permanent deformation, or "creep," which typically occurs with passage of time.

Another advantage of the aerosol tip or nozzle mechanism according to the present invention is that the number of parts which constitute the nozzle mechanism and, in turn, the dispensing system which includes a pump mechanism in combination with the nozzle mechanism, is significantly reduced in comparison to conventional nozzle mechanisms. As can be seen from Fig. 1, an aerosol-type dispensing system incorporating the nozzle mechanism according to the present invention can be made using only three discrete parts: the rigid housing 101; an integral,

flexible piece encompassing the flexible nozzle portion 10,
the flexible body portion 107 and the pump-body portion 111;
and the rigid shaft 102 formed integrally with the pump
mechanism 110. Because only three discrete parts are
5 required, the cost and complexity of manufacturing an
aerosol-type dispensing system is significantly reduced.

Yet another advantage of the aerosol tip or nozzle
mechanism according to the present invention is that the
first normally-closed, one-way valve 105 with its decreasing
10 wall thickness of the outlet portion 108 substantially
eliminates the possibility that liquid in the nozzle
mechanism will come in contact with ambient air and
subsequently return to the interior portion of the nozzle
mechanism. Due to the decreasing wall thickness of the
15 outlet portion 108, the liquid is naturally biased to
maintain its forward movement through the first valve 105 in
the outlet portion 108 once the thicker base portion of the
valve has been opened. Accordingly, the outlet portion 108
has a substantially zero "dead volume," i.e., a space in
20 which liquid that has been previously exposed to ambient air
can remain.

Still another advantage of the aerosol tip or
nozzle mechanism according to the present invention is that
the outlet portion 108 does not rub the rigid shaft 102

during opening or closing of the first valve 105.

Accordingly, because of the absence of any rubbing contact between the outlet portion 108 and the rigid shaft 102, the chances of contaminants entering the swirling chamber 103 are minimized.

Still another advantage of the aerosol tip or nozzle mechanism according to the present invention is the presence of multiple valves along the fluid communication path leading to the outlet portion 108. In addition to the first normally-closed valve, the second normally-closed valve positioned along the fluid communication path between the liquid reservoir and the outlet adds further assurances that liquid in the liquid reservoir will not be contaminated by liquid that may have been accidentally exposed to ambient air and subsequently reintroduced into the nozzle mechanism. Because the first and second normally-closed valves are positioned along the fluid communication path to open sequentially, and hence asynchronously, during fluid communication leading to discharge through the outlet, failure of either one of the valves will not affect the integrity of the nozzle mechanism to prevent contamination of the liquid in the liquid reservoir.

While specific embodiments have been described above, it should be readily apparent to those of ordinary

skill in the art that the above-described embodiments are
exemplary in nature since certain changes may be made
thereto without departing from the teachings of the
invention, and the exemplary embodiments should not to be
5 construed as limiting the scope of protection for the
invention as set forth in the appended claims. For example,
while the exemplary embodiment of the aerosol tip or nozzle
mechanism according to the present invention has been
described as having tubular-shaped outlet portion, other
10 shapes, e.g., square or rectangle, may be used for the
outlet portion.

The claims defining the invention are as follows:

I CLAIM:

- 1 1. A nozzle mechanism for an aerosol-type dispenser
- 2 for dispensing liquid content by application of pressure,
- 3 comprising:
- 4 a flexible nozzle portion having an outlet portion
- 5 for dispensing said liquid content, said outlet portion
- 6 having a substantially tubular shape and having a wall
- 7 thickness which decreases from a first point along a
- 8 direction of elongated axis of symmetry of said nozzle
- 9 mechanism toward a tip of the flexible nozzle portion;
- 10 a rigid shaft received within the flexible nozzle
- 11 portion and interfacing said outlet portion to form a first
- 12 normally-closed valve, said rigid shaft and interior of said
- 13 flexible nozzle portion defining a swirling chamber for said
- 14 liquid content prior to expulsion via said outlet; and
- 15 a rigid housing surrounding said flexible nozzle
- 16 portion and exposing said outlet portion;
- 17 wherein said liquid in said chamber is expelled
- 18 via said first normally-closed valve upon reaching a
- 19 threshold pressure sufficient to radially deform said outlet
- 20 portion to open said first normally-closed valve, and
- 21 wherein said rigid housing prevents deformation of said
- 22 outlet portion along said axial direction during expulsion
- 23 of said liquid content of said chamber via said outlet

24 portion.

1 2. The system according to claim 1, wherein said
2 dispenser is in fluid communication with a liquid reservoir,
3 and wherein said flexible nozzle portion further comprises a
4 fluid channel defining a portion of a fluid communication
5 path between said liquid reservoir and said swirling
6 chamber, said channel inducing swirling action of liquid
7 delivered to said swirling chamber.

1 3. The system according to claim 2, wherein said
2 fluid channel is positioned circumferentially in said
3 flexible nozzle portion.

1 4. The system according to claim 2, wherein said
2 rigid housing further prevents axial deformation of said
3 fluid channel.

1 5. The system according to claim 3, wherein said
2 rigid housing further prevents axial deformation of said
3 fluid channel.

1 6. The system according to claim 1, wherein said
2 radial deformation of said outlet portion to open said first

3 normally-closed valve comprises sequential deformation of
4 portions of said outlet portion interfacing said rigid shaft
5 along the axial direction, whereby an initial point of
6 separation along the axial direction between said outlet
7 portion and said rigid shaft is substantially closed when a
8 final point of separation along the axial direction between
9 said outlet portion and said rigid shaft is open.

1 7. The system according to claim 2, wherein said
2 radial deformation of said outlet portion to open said first
3 normally-closed valve comprises sequential deformation of
4 portions of said outlet portion interfacing said rigid shaft
5 along the axial direction, whereby an initial point of
6 separation along the axial direction between said outlet
7 portion and said rigid shaft is substantially closed when a
8 final point of separation along the axial direction between
9 said outlet portion and said rigid shaft is open.

1 8. The system according to claim 7, wherein said
2 fluid channel is positioned circumferentially in said
3 flexible nozzle portion.

1 9. The system according to claim 8, wherein said
2 rigid housing further prevents axial deformation of said

3 fluid channel.

1 10. The system according to claim 7, wherein said
2 rigid housing further prevents axial deformation of said
3 fluid channel.

1 11. A fluid-dispensing mechanism for an aerosol-type
2 dispenser in fluid communication with a liquid reservoir,
3 comprising:

4 a flexible nozzle portion having an outlet portion
5 for dispensing liquid content of said dispenser, said outlet
6 portion having a substantially tubular shape and a wall
7 thickness which decreases from a first point along a
8 direction of elongated axis of symmetry of said nozzle
9 mechanism toward a tip of said flexible nozzle portion;

10 a flexible body portion connected to said flexible
11 nozzle portion, said body portion having a substantially
12 tubular shape and a wall thickness which decreases from a
13 second point along said axial direction toward said tip of
14 said flexible nozzle portion;

15 a rigid shaft member received within said flexible
16 nozzle portion and said flexible body portion, a first
17 portion of said rigid shaft member interfacing said outlet
18 portion to form a first normally-closed valve, said first

19 portion of said rigid shaft and interior of said flexible
20 nozzle portion defining a swirling chamber for collecting
21 liquid from said liquid reservoir prior to expulsion via
22 said outlet portion, a second portion of said rigid shaft
23 member interfacing said flexible body portion to form a
24 second normally-closed valve; and

25 a rigid housing surrounding said flexible nozzle
26 portion and said flexible body portion and exposing said
27 outlet portion;

28 wherein a content of said fluid reservoir is
29 channeled into said swirling chamber from said liquid
30 reservoir via said second normally-closed valve upon
31 application of sufficient pressure to open said second
32 normally-closed valve, and wherein said liquid in said
33 chamber is expelled via said first normally-closed valve
34 upon reaching a pressure sufficient to radially deform said
35 outlet portion to open said first normally-closed valve, and
36 wherein said rigid housing prevents deformation of said
37 outlet portion along said axial direction during expulsion
38 of said liquid content of said swirling chamber via said
39 outlet portion.

1 12. The system according to claim 11, wherein said
2 flexible nozzle portion further comprises a fluid channel

3 defining a portion of a fluid communication path between
4 said liquid reservoir and said swirling chamber, said fluid
5 channel inducing swirling action of liquid delivered to said
6 swirling chamber.

1 13. The system according to claim 12, wherein said
2 fluid channel is positioned circumferentially in said
3 flexible nozzle portion.

1 14. The system according to claim 12, wherein said
2 rigid housing further prevents axial deformation of said
3 fluid channel.

1 15. The system according to claim 13, wherein said
2 rigid housing further prevents axial deformation of said
3 fluid channel.

1 16. The system according to claim 11, wherein said
2 radial deformation of said outlet portion to open said first
3 normally-closed valve comprises sequential deformation of
4 portions of said outlet portion interfacing said first
5 portion of said rigid shaft member along the axial
6 direction, whereby an initial point of separation along the
7 axial direction between said outlet portion and said first

8 portion of said rigid shaft member is substantially closed
9 when a final point of separation along the axial direction
10 between said outlet portion and said first portion of said
11 rigid shaft member is open.

1 17. The system according to claim 16, wherein said
2 second normally-closed valve is opened upon application of
3 sufficient pressure to radially deform said flexible body
4 portion interfacing said second portion of said rigid shaft
5 member, and wherein said radial deformation of said flexible
6 body portion comprises sequential deformation of portions of
7 said flexible body portion interfacing said second portion
8 of said rigid shaft member, whereby an initial point of
9 separation between said flexible body portion and said
10 second portion of said rigid shaft member along the axial
11 direction and away from said swirling chamber is
12 substantially closed when a final point of separation
13 between said flexible body portion and said second portion
14 of said rigid shaft member along the axial direction and
15 near said swirling chamber is open.

1 18. The system according to claim 17, wherein said
2 first and second normally-closed valves are opened
3 asynchronously.

1 19. The system according to claim 12, wherein said
2 radial deformation of said outlet portion to open said first
3 normally-closed valve comprises sequential deformation of
4 portions of said outlet portion interfacing said first
5 portion of said rigid shaft member along the axial
6 direction, whereby an initial point of separation along the
7 axial direction between said outlet portion and said first
8 portion of said rigid shaft member is substantially closed
9 when a final point of separation along the axial direction
10 between said outlet portion and said first portion of said
11 rigid shaft member is open.

1 20. The system according to claim 19, wherein said
2 second normally-closed valve is opened upon application of
3 sufficient pressure to radially deform said flexible body
4 portion interfacing said second portion of said rigid shaft
5 member, and wherein said radial deformation of said flexible
6 body portion comprises sequential deformation of portions of
7 said flexible body portion interfacing said second portion
8 of said rigid shaft member, whereby an initial point of
9 separation between said flexible body portion and said
10 second portion of said rigid shaft member along the axial
11 direction and away from said swirling chamber is

12 substantially closed when a final point of separation
13 between said flexible body portion and said second portion
14 of said rigid shaft member along the axial direction and
15 near said swirling chamber is open.

1 21. The system according to claim 20, wherein said
2 first and second normally-closed valves are opened
3 asynchronously.

1 22. The system according to claim 21, wherein said
2 fluid channel is positioned circumferentially in said
3 flexible nozzle portion.

1 23. The system according to claim 22, wherein said
2 rigid housing further prevents axial deformation of the
3 fluid channel.

1 24. The system according to claim 19, wherein said
2 fluid channel is positioned circumferentially in said
3 flexible nozzle portion.

1 25. The system according to claim 24, wherein said
2 rigid housing further prevents axial deformation of the
3 fluid channel.

1 26. A method of generating an aerosol-type fluid
2 discharge from a dispenser in fluid communication with a
3 liquid reservoir, said dispenser comprising a flexible
4 nozzle portion having an outlet portion for dispensing said
5 liquid content, said outlet portion having a wall thickness
6 which decreases from a first point along a direction of
7 elongated axis of symmetry of said nozzle mechanism toward a
8 tip of the flexible nozzle portion, a first portion of a
9 rigid shaft member received within the flexible nozzle
10 portion and interfacing said outlet portion to form a first
11 normally-closed valve, said first portion of said rigid
12 shaft member and interior of said flexible nozzle portion
13 defining a swirling chamber for said liquid content prior to
14 expulsion via said outlet, said flexible nozzle portion
15 further comprising a circumferentially positioned fluid
16 channel defining a portion of a fluid communication path
17 between said liquid reservoir and said swirling chamber, and
18 a rigid housing surrounding said flexible nozzle portion and
19 exposing said outlet portion, which method comprises:
20 channeling liquid content of said liquid reservoir
21 into said fluid communication path by application of
22 pressure;
23 channeling said liquid content into said swirling

24 chamber via said circumferentially positioned fluid channel
25 by application of pressure, thereby creating swirling
26 movement of said liquid content in said swirling chamber;
27 and

28 expelling said liquid content of said swirling
29 chamber through said outlet via said first normally-closed
30 valve by application of pressure sufficient to radially
31 deform said outlet portion to open said first normally-
32 closed valve while substantially preventing deformation of
33 said outlet portion along the axial direction by relative
34 urging of said rigid housing;

35 wherein said radial deformation of said outlet
36 portion to open said first normally-closed valve comprises
37 sequential deformation of portions of said outlet portion
38 interfacing said first portion of said rigid shaft member
39 along the axial direction, whereby an initial point of
40 separation along the axial direction between said outlet
41 portion and said first portion of said rigid shaft member is
42 substantially closed when a final point of separation along
43 the axial direction between said outlet portion and said
44 first portion of said rigid shaft member is open.

1 27. The method according to claim 26, wherein said
2 dispenser further comprises a flexible body portion

3 connected to said flexible nozzle portion, said body portion
 4 having a wall thickness which decreases from a second point
 5 along said axial direction toward said tip of said flexible
 6 nozzle portion, and wherein said rigid shaft member further
 7 comprises a second portion interfacing said flexible body
 8 portion to form a second normally-closed valve in said fluid
 9 communication path, which method further comprises, prior to
 10 the step of channeling said liquid content into said
 11 swirling chamber via said circumferentially positioned fluid
 12 channel, the step of;
 13 channeling said liquid content through said second
 14 normally-closed valve into said circumferentially positioned
 15 fluid channel by application of pressure to radially deform
 16 said flexible body portion interfacing said second portion
 17 of said rigid shaft member to open said second normally-
 18 closed valve, wherein said radial deformation of said
 19 flexible body portion comprises sequential deformation of
 20 portions of said flexible body portion interfacing said
 21 second portion of said rigid shaft member, whereby an
 22 initial point of separation between said flexible body
 23 portion and said second portion of said rigid shaft member
 24 along the axial direction and away from said
 25 circumferentially positioned fluid channel is substantially
 26 closed when a final point of separation between said

flexible body portion and said second portion of said rigid shaft member along the axial direction and near said circumferentially positioned fluid channel is open.

28. The method according to claim 27, wherein said first and second normally-closed valves are opened asynchronously.

5 29. A nozzle mechanism, substantially as hereinbefore described with reference to the accompanying drawings.

30. A fluid-dispensing mechanism, substantially as hereinbefore described with reference to the accompanying drawings.

31. A method of generating an aerosol-type fluid discharge from a dispenser in
10 fluid communication with a liquid reservoir, the method being substantially as hereinbefore described with reference to the accompanying drawings.

Dated 9 September, 1998

Daniel Py

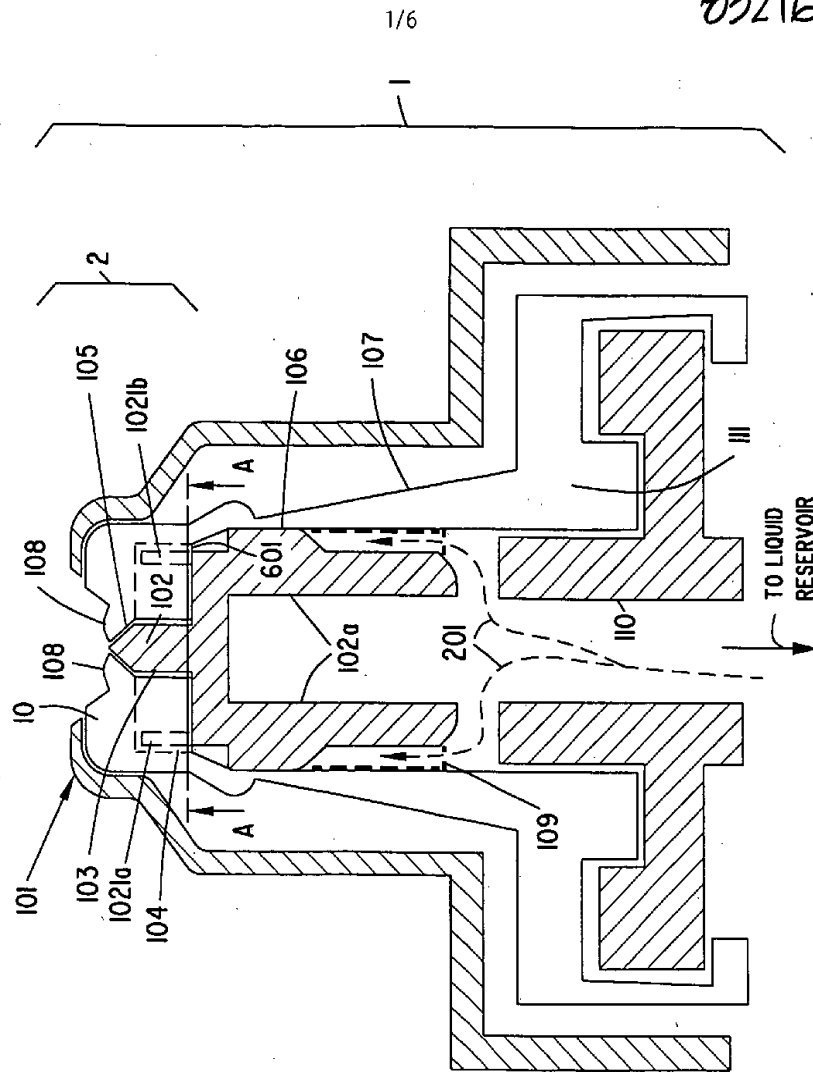
Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

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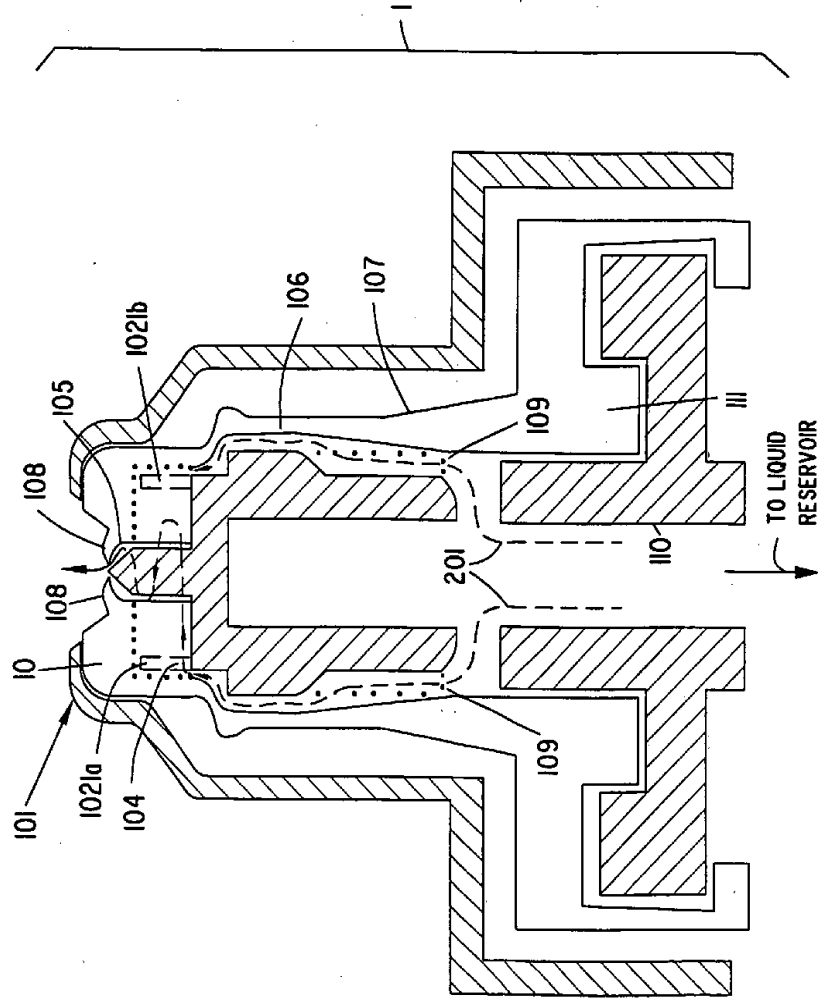
FIG. 1



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FIG. 2



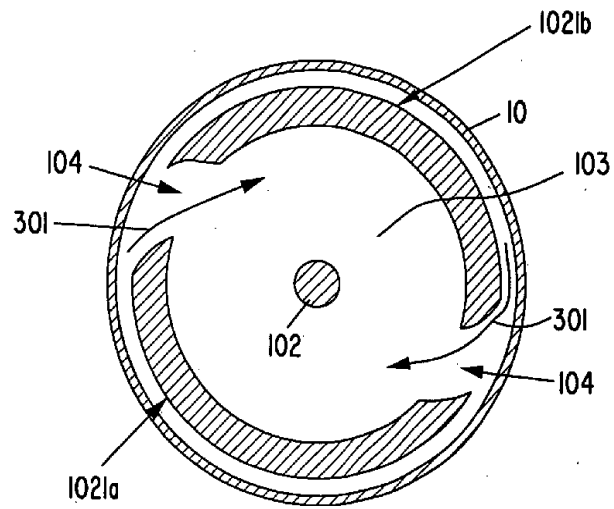


FIG. 3

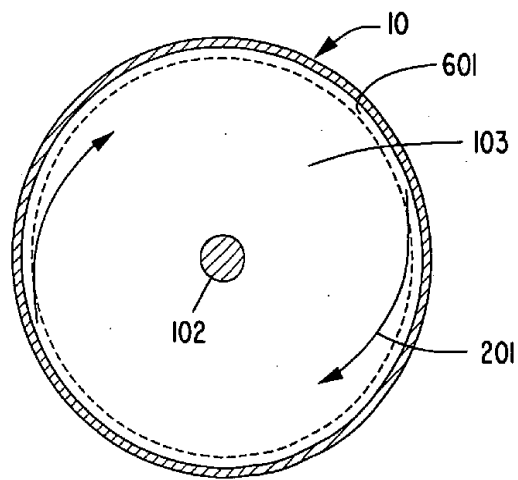


FIG. 6B

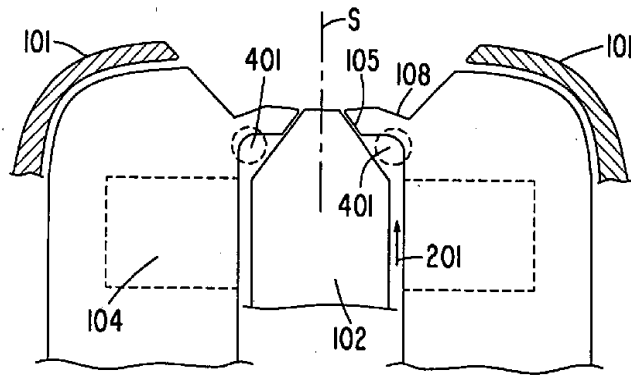


FIG. 4A

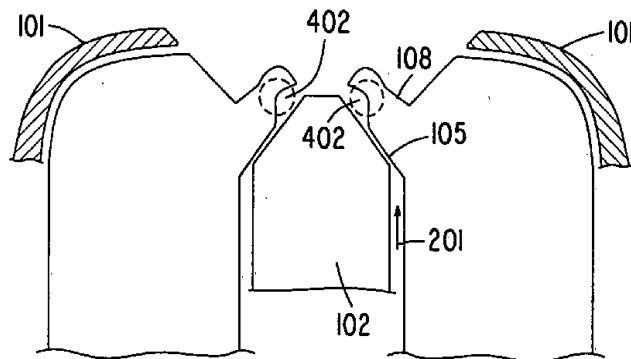


FIG. 4B

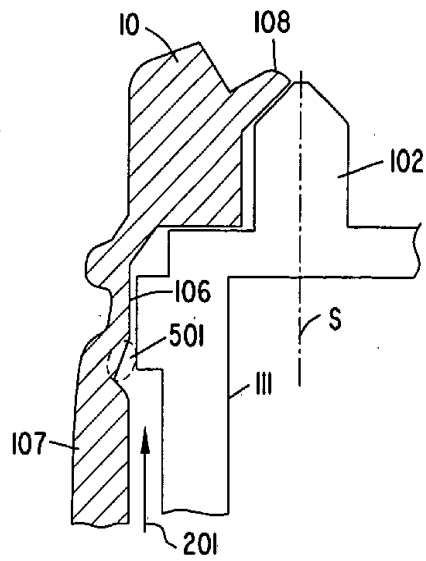


FIG. 5A

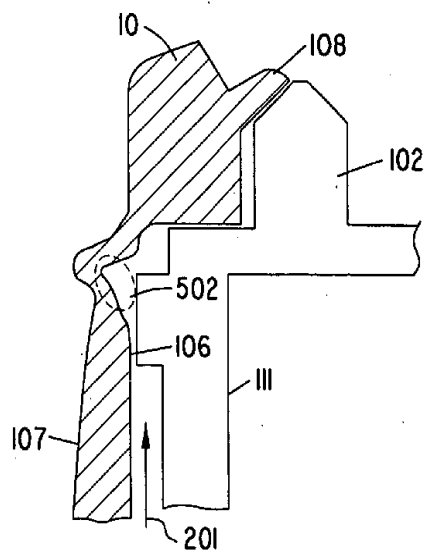


FIG. 5B

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FIG. 6A

