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(54) IMPROVED FOAMING COMPOSITIONS AND AEROSOL DISPENSERS

VERBESSERTE SCHÄUMUNGSZUSAMMENSETZUNGEN UND AEROSOLSPENDER

COMPOSITIONS MOUSSANTES AMÉLIORÉES ET DISTRIBUTEURS D'AÉROSOLS

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Description

[0001] The present invention relates to improved aerosol dispensers and foaming compositions dispensed therefrom which provide improved delivery characteristics.

[0002] While hard surface and soft surface treatment compositions dispensed from aerosol dispensers are not unknown to the art, frequently the delivery characteristics of aerosol dispensers lead to undesired product delivery characteristics including (but not limited to): poor directional control of the dispensing treatment compositions, poor foaming of the surface treatment compositions when applied to a surface, such as a hard surface and particularly a non-horizontal inclined or vertical hard surface, unsatisfactory amounts of "bearding" (undesired buildup or residue of dispensed foamed treatment composition on the dispenser, typically in the proximity of and/or beneath the dispensing nozzle) of the treatment composition being dispensed, and/or unsatisfactory amounts of cavitation of the dispensing treatment composition resulting in uneven dispensing of the treatment compositions. To address these and other issues, the art has recognized that careful consideration of the constituents and formulation of the treatment compositions as well as the propellant used to drive or expel the treatment compositions from the container or can of the aerosol dispenser must be undertaken, and further that the performance characteristics and geometry of the dispenser, particularly the nozzle or nozzle assembly must also be carefully undertaken in order to reduce or eliminate one or all of the undesired product delivery characteristics noted above. US2009/078793, GB1164918, US2008/029621 describe nozzles for use with aerosol canisters.

[0003] It is to these objects, as well as further objects, that the present invention is directed.

[0004] The present invention provides a cap assembly mounted upon an aerosol canister, wherein the cap assembly includes a moveable trigger arm bearing a nozzle assembly, the nozzle assembly which includes a nozzle orifice insert which includes a sleeve part and a non-circular nozzle orifice having sharp edges which rapidly expand thereafter due to the presence of the chamber or bowl shaped horn immediately adjacent thereto, inserted within chamber body having a nozzle chamber, wherein the sleeve part includes an inlet zone and downstream thereof, a compression zone which compression zone comprises an upper tapered sidewall and a lower tapered sidewall angled with respect to one another by an angle "A" which is in the range of between 5 and 30 degrees of arc and wherein the nozzle assembly further includes an inlet conduit in engagement with a valve stem of the aerosol canister, a connecting bore connecting the inlet conduit with the nozzle chamber, wherein the nozzle chamber further comprises a center post which extends within the nozzle chamber and depends from and extends from a base wall of the chamber body, characterized in that the center post includes a distal tip end which is frustoconical in shape.

[0005] The aerosol dispenser having a specific improved nozzle assembly configuration which provides improved product delivery characteristics in the delivery of a pressurized foaming surface treatment composition is expected to be useful with a variety of formulations of foaming surface treatment compositions, and with a variety of propellants. Such may include one or more of: surfactants, solvents including organic solvents, water, chelating agents, corrosion inhibitors, pH adjusting agents such as acids and/or bases, pH buffers including inorganic and organic pH buffer compositions, fragrances, colorants such as dyes, as well as other conventional constituents known to the art. High foaming surfactants are preferred.

[0006] Numerous surfactants are known to those skilled in the art, and such may find use in pressurized foaming surface treatment compositions. Nonlimiting examples of the major surfactant types that can be used include the: alcohols, alkanolamides, alkanolamines, alkylaryl sulfonates, alkylaryl sulfonic acids, alkylbenzenes, amine acetates, amine oxides, amines, sulfonated amines and amides, betaine derivatives, block polymers, carboxylated alcohol or alkylphenol ethoxylates, carboxylic acids and fatty acids, diphenyl sulfonate derivatives, ethoxylated alcohols, ethoxylated alkylphenols, ethoxylated amines and/or amides, ethoxylated fatty acids, ethoxylated fatty esters and oils, fatty esters, fluorocarbon-based surfactants, glycerol esters, glycol esters, hetocyclic-type products, imidazolines and imidazoline derivatives, isethionates, lanolin-based derivatives, lecithin and lecithin derivatives, lignin and lignin deriviatives, maleic or succinic anhydrides, methyl esters, monoglycerides and derivatives, olefin sulfonates, phosphate esters, phosphorous organic derivatives, polyethylene glycols, polymeric (polysaccharides, acrylic acid, and acrylamide) surfactants, propoxylated and ethoxylated fatty acids alcohols or alkyl phenols, protein-based surfactants, quaternary surfactants, sarcosine derivatives, silicone-based surfactants, soaps, sorbitan derivatives, sucrose and glucose esters and derivatives, sulfates and sulfonates of oils and fatty acids, sulfates and sulfonates, ethoxylated alkylphenols, sulfates of alcohols, sulfates of ethoxylated alcohols, sulfates of fatty esters, sulfonates of benzene, cumene, toluene and xylene, sulfonates of condensed naphthalenes, sulfonates of dodecyl and tridecylbenzenes, sulfonates of naphthalene and alkyl naphthalene, sulfonates of petroleum, sulfosuccinamates, sulfosuccinates and derivatives, taurates, thio and mercapto derivatives, tridecyl and dodecyl benzene sulfonic acids, etc. One or more such surfactants may be used in any effective amount. Preferred surfactants as well as amounts thereof include those identified in the following example composition(s).

[0007] While one or more surfactants may be present in any effective amount, preferably the total amount of surfactants present is not in excess of 5%wt, and in preferred embodiments are not in excess of (in order of increasing preference, in %wt.): 4.7, 4.5, 4.25 4, 3.75, 3.5, 3.25, 3, 2.75, 2.5, 2.25, 2, 1.75, 1.5, 1.25, and 1%wt. based on the total weight of the compositions within which the surfactants are present.

[0008] In particularly preferred embodiments the foaming surface treatment compositions comprise one or both of a nonionic surfactant and/or a cationic surfactant, preferably to the exclusion of any further surfactants, e.g., anionic surfactants. The inventors have surprisingly found that with the use of the improved aerosol dispensers described herein, the foaming surface treatment compositions provide excellent foaming and good cleaning, with minimized "bearding" when being dispensed, even in the absence of one or more anionic surfactant compounds which are conventionally considered in the art as high foaming surfactants.

[0009] The propellants used to pressurize the foaming surface treatment composition may be any which are conventionally used in the art. Propellants which may be used include, for example, a hydrocarbon, of from 1 to 10 carbon atoms, such as n-propane, n-butane, isobutane, n-pentane, isopentane, and mixtures thereof; dimethyl ether and blends thereof as well as individual or mixtures of chloro-, chlorofluoro- and/or fluorohydrocarbons- and/or hydrochlorofluorocarbons (HCFCs). Useful commercially available compositions include A-70 (Aerosol compositions with a vapor pressure of 70 psig available from companies such as Diversified and Aeropress) and Dymel® 152a (1,1-difluoroethane from DuPont). Compressed gases such as carbon dioxide, compressed air, nitrogen, and possibly dense or supercritical fluids may also be used. Advantageously the propellant will generally be in an amount of from about 1% to about 50% of the total formulation as contained within the aerosol canister, with preferred amounts being from about 2% to about 25%, more preferably from about 5% to about 15%.

[0010] The foaming surface treatment composition may include one or more chelating agents, non-limiting examples of which include one or more of gluconic acid, tartartic acid, citric acid, oxalic acid, lactic acid, ethylenediaminetetraacetic acid, N-hydroxyethylethylenediamine triacetic acid, nitrilotriacetic acid, diethylene triamine pentaacetic acid, and their water soluble salts, especially the alkali metal salts and particularly the sodium salts. Further useful chelating agents include amino-carboxylate compounds, such as ethylene diamine tetra acetates, diethylene triamine pentaacetates, diethylene triamine pentaacetate (DTPA),N-hydroxyethylethylenediamine triacetates, nitrilotri- acetates, ethylenediamine tetrapropionates, triethylenetetraaminehexa- acetates, ethanol-diglycines, propylene diamine tetracetic acid (PDTA) and methyl glycine di-acetic acid (MGDA), both in their acid form, or in their alkali metal, ammonium, and substituted ammonium salt forms. Particularly suitable amino carboxylates to be used herein are diethylene triamine penta acetic acid, propylene diamine tetracetic acid (PDTA) which is, for instance, commercially available from BASF under the trade name Trilon FS® and methyl glycine di-acetic acid (MGDA). Further carboxylate chelating agents to be used herein include salicylic acid, aspartic acid, glutamic acid, glycine, malonic acid or mixtures thereof.

[0011] When present, advantageously, the foaming surface treatment composition comprises up to 7%wt of the total composition of a chelating agent, or mixtures thereof, preferably from 0.005 to 4%wt. The inclusion of at least one chelating agent is preferred in sequestering or complexing with undesired free metal ions which may be present in the pressurized aerosol container containing the foaming surface treatment composition.

[0012] The foaming surface treatment composition may include one or more materials which are useful a pH adjusting agents or pH buffers. Such compositions include many which are known to the art and which are conventionally used. By way of non-limiting example pH adjusting agents include phosphorus containing compounds, monovalent and polyvalent salts such as of silicates, carbonates, and borates, certain acids and bases, tartrates and certain acetates. Further exemplary pH adjusting agents include mineral acids, basic compositions, and organic acids, which are typically required in only minor amounts. By way of further non-limiting example pH buffering compositions include the alkali metal phosphates, polyphosphates, pyrophosphates, triphosphates, tetraphosphates, silicates, metasilicates, polysilicates, carbonates, hydroxides, and mixtures of the same. Certain salts, such as the alkaline earth phosphates, carbonates, hydroxides, can also function as buffers. It may also be suitable to use as buffers such materials as aluminosilicates (zeolites), borates, aluminates and certain organic materials such as gluconates, succinates, maleates, and their alkali metal salts. Desirably the foaming surface treatment compositions include an effective amount of an organic acid and/or an inorganic salt form thereof which may be used to adjust and maintain the pH of the compositions to the desired pH range. Advantageously the pH adjusting agents or pH buffers comprise 0 - 1.5%wt., preferably 0.01 - 1%wt. of the foaming surface treatment compositions of which they form a part.

[0013] The foaming surface treatment compositions optionally but desirably include one or more corrosion inhibitor compounds or materials. Such may be one or more of the compounds or materials described above amongst the pH adjusting agents or pH buffers, or may be compounds or materials particularly suited to mitigate or reduce the likelihood of corrosion of the aerosol container (can) containing the pressurized foaming surface treatment compositions. Exemplary useful corrosion inhibitors include alkanolamine compounds such as mono - and triethanolamine, ammonium hydroxide, sodium molybdate and sodium benzoate, borates, carbonates and polycarbonates including bicarbonates, silicates, as well as other corrosion inhibitors well known to those of ordinary skill in the art. The corrosion inhibitor, when needed, is generally present in an amount of from about 0.01 to about 0.50 weight percent of the composition, preferably from about 0.05 to about 0.10 weight percent.

[0014] The foaming surface treatment compositions may optionally include one or more further constituents which may impart a further aesthetic benefit thereto, such as fragrances or coloring agents. Fragrances refer to and include any substance or mixture of such substances including those which are naturally derived (i.e., obtained by extraction of

flower, herb, blossom or plant), those which are artificially derived or produced (i.e., mixture of natural oils and/or oil constituents), and those which are synthetically produced substances (odiferous substances). Generally fragrance are complex mixtures or blends various organic compounds including, but not limited to, certain alcohols, aldehydes, ethers, alamatic compounds and varying amounts of essential oils such as from about 0 to about 85% by weight, usually from about 10 to about 70% by weight, the essential oils themselves being volatile odiferous compounds and also functioning to aid in the dissolution of the other components of the fragrance. The precise composition of the fragrance is of no particular consequence so long as it may be effectively included as a constituent of the compositions, and have a pleasing fragrance to a consumer. When present such fragrances typically comprise not more than 1.25%wt. of the foaming surface treatment composition of which they form a part.

[0015] While one or more thickeners, e.g., materials based polysaccharide polymers selected from cellulose, alkyl celluloses, alkoxy celluloses, hydroxy alkyl celluloses, alkyl hydroxy alkyl celluloses, carboxy alkyl celluloses, carboxy alkyl hydroxy alkyl celluloses, naturally occurring polysaccharide polymers such as xanthan gum, guar gum, locust bean gum, tragacanth gum, or derivatives thereof, polycarboxylate polymers, polyacrylamides, clays, and mixtures thereof might be considered for use, advantageously such materials are expressly excluded in preferred embodiments of the foaming surface treatment compositions.

Optionally the foaming surface treatment compositions may include one or more organic solvents. Non-limiting examples of such organic solvents include one or more of: alcohols, glycols, as well as glycol ether materials. Such materials tend to have aliphatic moieties containing 2 to 6 carbon atoms. Examples of such materials include ethanol, propanol, isopropanol, butanol, 2-butanol, 2-methyl-2-propanol, butoxy diglycol, ethoxy diglycol, polypropylene glycol, ethylene glycol methyl ether, ethylene glycol dimethyl ether, propylene glycol methyl ether, dipropylene glycol n-butyl ether, butoxy ethanol, phenoxy ethanol, methoxy propanol, propylene glycol, n-butyl ether, tripropylene glycol, n-butyl ether, propylene glycol, hexylene glycol and other similar oxygenated solvents. When present, such one or more organic solvents may be present in an amount of up to about 20%wt., more preferably in an amount not in excess of 10%wt. of the foaming surface treatment composition of which it forms a part. However, in certain preferred embodiments such one or more organic solvents are expressly excluded.

[0016] As the foaming surface treatment compositions are largely aqueous in nature, water is added to order to provide to 100% by weight of the compositions. The water may be tap water, but is preferably distilled and is most preferably deionized water. If the water is tap water, it is preferably substantially free of any undesirable impurities such as organics or inorganics, especially minerals salts which are present in hard water which may thus undesirably interfere with the operation of the constituents present in the foaming surface treatment compositions. Advantageously water comprises at least 80%wt., and in order of increasing preference comprises at least (in %wt.) 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, and 99%wt. based on the total weight of the foaming surface treatment compositions within which water is present.

[0017] In the foregoing, references made to %wt. of an amount of an identified composition based on the 'total weight of the foaming surface treatment compositions is to be understood to be based on the weight of the foaming surface treatment compositions prior to the addition of the propellant, unless indicated otherwise.

[0018] The foaming surface treatment composition is dispensed by activating the specific improved nozzle assembly of the aerosol dispenser onto the area in need of treatment, and in accordance with this manner, the above-described the area is treated (e.g., cleaned and/or sanitized and/or disinfected).

[0019] The improved aerosol dispenser having a specific improved nozzle assembly configuration, and a pressurized foaming hard surface and/or soft surface treatment composition may be used to intermittently dispense the said treatment composition when needed by a consumer, and in the interval therebetween may be used as a storage container.

[0020] The improved aerosol dispenser having a specific improved nozzle assembly configuration, and a pressurized foaming hard surface and/or soft surface treatment composition may be a vendible product.

[0021] The improved aerosol dispenser having a specific improved nozzle assembly configuration, and a pressurized foaming hard surface composition may be used to dispense the said treatment composition onto hard surfaces to provide a treatment benefit thereto. By way of non-limiting example, hard surfaces include: surfaces composed of refractory materials such as: glazed and unglazed tile, brick, porcelain, ceramics as well as stone including marble, granite, and other stones surfaces; glass; metals; plastics e.g. polyester, vinyl; fiberglass, Formica®, Corian® and other hard surfaces known to the industry. Further hard surfaces which are to be denoted are those associated with kitchen environments and other environments associated with food preparation, including cabinets and countertop surfaces as well as walls and floor surfaces especially those which include refractory materials, plastics, Formica®, Corian® and stone. Still further hard surfaces include those associated with medical facilities, e.g., hospitals, clinics as well as laboratories, e.g., medical testing laboratories. The improved dispenser, nozzle assembly and foaming hard surface treatment composition is particularly useful in the treatment of lavatory surfaces, e.g., lavatory fixtures such as shower stalls, bathtubs and bathing appliances (racks, curtains, shower doors, shower bars) toilets, bidets, wall and flooring surfaces (including painted surfaces) especially those which include refractory materials including tiled and grouted surfaces and the like. Inclined surfaces, viz. those which are not horizontal such as the interior of a bathtub, bathtub surround, shower stall, the interior

of a sink especially a lavatory sink, as well as the interior and exterior surfaces of toilet appliances, e.g., toilet, urinals, bidets, are particularly advantageously treated with the improved dispenser, nozzle assembly and foaming hard surface treatment composition described herein.

[0022] The improved aerosol dispenser having a specific improved nozzle assembly configuration, and a pressurized foaming soft surface composition may be used to dispense the said treatment composition onto soft surfaces to provide a treatment benefit thereto. By way of non-limiting example, soft surfaces, include: carpets, rugs, upholstery, curtains and drapes, fabrics, textiles, garments, and the like

[0023] Particularly preferred embodiments of the improved aerosol dispenser having a specific improved nozzle assembly configuration, and a pressurized foaming hard surface and/or soft surface treatment composition are described hereinafter.

[0024] One preferred embodiment (identified as "E1") of a pressurized foaming surface treatment composition comprises the following constituents:

E1	%wt.
nonionic surfactant, C_9-C_{11} alcohol ethoxylate, avg. 5 mols EO (100%wt. actives)	0.56
cationic surfactant, quaternary ammonium compounds (Catigene® 818) (50%wt. actives)	0.23
ammonium hydroxide (55%wt. actives)	0.04
sodium hydroxide (50%wt. actives)	0.21
corrosion inhibitor, sodium molybdate (100%wt. actives)	0.10
chelating agent, disodium ethanol diglycinate (Dissolvine® EDG) (28% active)	13
fragrance (proprietary composition of its supplier, 100%wt. actives)	0.1
deionized water (100%wt. actives)	q.s. to 100

[0025] Subsequently, 550 grams of the foregoing formulation of "E1" was supplied to the interior of an aerosol canister (optionally lined to reduce internal can corrosion) to which is then added 45 g of a liquefied gas propellant and the aerosol canister was thereafter sealed by the installation of a conventional aerosol crimp cap having at one side a dip tube which extended downwardly and into the interior of the aerosol canister and thus into the pressurized foaming surface treatment composition, an intermediate valve and on the exterior a valve stem. A cap assembly which comprises a specific improved nozzle assembly configuration (as described with reference to the drawings) was thereafter affixed to the upper end of the sealed aerosol canister such that the valve stem engaged a part of the improved nozzle assembly which was thereafter used to dispense the pressurized foaming surface treatment composition. The interior pressure canister of the pressurized foaming surface treatment composition was in the range of about 2.9 - 3.3 bar (at 20°C), alternately was from about 6.2 - 6.9 bar (at 20°C).

[0026] Reference is now made to the accompanying figures which depict in several views a preferred embodiment of a cap assembly which comprises a specific improved nozzle assembly configuration. It is to be understood that the cap assembly forms part of an aerosol dispenser which also includes at least a canister, can or container which is used to contain a quantity of the pressurized foaming surface treatment composition, especially preferably the pressurized foaming hard surface treatment composition disclosed above.

[0027] In the accompanying figures, the reference numerals are used to indicate like elements which may be present in two or more of the figures.

[0028] Figure 1 depicts a perspective view of the cap assembly 10 which includes the said specific improved nozzle assembly configuration, and Figure 2 depicts the same in a cross-sectional elevation view, further illustrating the cap assembly 10 mounted on an aerosol canister 100 and in engagement with the valve stem 104. The cap assembly 10 includes two parts, a cowling 15 having a moveable trigger arm 20 which at its proximal end 22 extends from the base skirt 17 of the cowling 15, and a distal end 24 which supports and preferably includes an integral part of the improved nozzle assembly configuration 50. A second part of the cap assembly 10 is a nozzle orifice insert 70 which is also part of the improved nozzle assembly configuration 50. The forward end of the nozzle orifice insert 70 includes a horn 71 opening upwardly in the downstream direction, and a nozzle orifice 80 at or near the end of a nozzle post 82. The improved nozzle assembly configuration 50 includes an inlet conduit 52 which has an upwardly directed bore 54 and near the base thereof, a flanged section 56 which provides for engagement between the valve stem 104 and the inlet conduit 52. If the opposite end of the bore 54 and extending perpendicularly therefrom is further connecting bore 58 connecting the vertical bore 54 with the nozzle chamber 60. When the aerosol valve is actuated, the pressurized foaming treatment composition exits via the valve stem 104 and then flows outwardly through the vertical bore 54 of the inlet

conduit 52, and next is redirected and passes through the connecting bore 58 connecting the vertical bore 54 with the nozzle chamber 60. It is to be noted that the cross-sectional area and/or the diameter of the connecting bore 58 is less than the cross-sectional area and/or the diameter of the vertical bore 54. Preferably the respective ratios out of these air is and/or diameters is between 1:1.1-5. Before departing Figure 2, the figure also depicts that the cap assembly 10 maybe engaged upon the top of an aerosol canister 100 in a conventional manner, such via a snap ring part 13 near the base and on the interior of the base skirt 17 which engages with a suitable recess ring 102 of the aerosol canister or 100. Optionally, but preferably a shown in Fig. 2 are a series of support buttresses 110 within the hollow interior 105 of the cap assembly 10. When present, such support buttresses 110 provided degree mechanical stiffness to the cap assembly 10.

[0029] Figures 3 and 4 respectively depict a side cross sectional view of a detail of the improved nozzle assembly configuration 50 as well as parts of the cap assembly 10, and a top cross-sectional view of a detail of the improved nozzle assembly configuration, as well as parts of the cap assembly 10. As is seen in these figures, the nozzle assembly configuration 50 includes a nozzle chamber 60 having an open end defined by the transverse gap coincident with an end wall 62, a chamber body 64 extending from the end wall 62 towards the interior of the cap assembly 10 and the connecting bore 58 and terminating at a base wall 66. For sake of illustration a center line "AX" coincident with the central axis of the chamber 60, as well of the center post 69 is also shown. (Further portions of, or certain elements of the improved nozzle assembly configuration are symmetrical about AX.) A portion of the nozzle orifice insert 70, namely an insert sleeve part 72 is inserted, preferably by a sealing, friction type fitting engagement between the sleeve part 72 and a part of the inner sidewall 63 of the chamber body 64. In such a manner, any pressurized foaming treatment composition and entering the nozzle chamber 60 from the connecting bore 58 may only exit therefrom by passing downstream towards, and outward from the nozzle orifice 80. However, and as the pressurized foaming treatment composition passes in the downstream direction, between the connecting bore 58 and a nozzle orifice 80 it is further compressed. As visible from the figures, a part of the sleeve part 72 of the nozzle orifice insert 70 includes a first generally cylindrical inlet zone 73 upstream of the nozzle orifice 80, and adjacent thereto and downstream therefrom a compression zone 75. The compression zone 75 is funnel shaped, and includes an upper tapered sidewall 77a and opposite thereto, a lower tapered sidewall 77b, which extend between two generally parallel flat vertical sidewalls, 78a, 78b which funnel shaped section of the compression zone 75 causes further compression of the foaming surface treatment composition passing from the inlet zone 73 through the compression zone 75 prior to exiting via the nozzle orifice 80. The upper tapered sidewall 77a and the lower tapered sidewall 77b are angled with respect to one another, by an angle "A", which is preferably in the range of between 5 and 30 degrees of arc; a particularly preferred angle is as depicted in the figures. As also depicted, portions of the nozzle insert 70 include two inwardly directed side restrictions 65a, 65b which are dimensioned to define a gap therebetween which gap is sized to engage the center post 69 which extends within the nozzle chamber 60 and depends from and extends perpendicularly from the base wall 66 of the chamber body 64. The center post 66 is of a length which is of sufficient length to extend inwardly into the sleeve part 72 of the nozzle orifice insert 70 so to engage the two side restrictions 65a, 65b of the cylindrical inlet zone 73 and preferably not so far as to extend into, the compression zone 75. Advantageously the distal tip end 69a of the center post 69 is frustoconical in shape.

[0030] Further details of the configuration of the improved nozzle assembly configuration 50, particularly the of the nozzle orifice insert 70 are depicted on Figure 5 which is a perspective through sectional view of a part of the nozzle orifice insert 70, and on Figure 6 which is a detail part of the depiction of Figure 5. As is visible thereon, the exit orifice 80 has a rectangular cross-section with the two opposite wider sides 81a, 81b being coincident with the respective upper tapered sidewall 77a and opposite thereto, a lower tapered sidewall 77b. The exit orifice 80 opens into a bowl-shaped horn 88 immediately adjacent thereto, which can be formed by a chamfer 84 extending outwardly from a least the wider sides 81a, 81 b of the exit orifice 80, were preferably but very advantageously a chamfer extends outwardly from a wider sides, as well as the narrower sides 83a, 83b of the exit orifice 80. Advantageously the ratio of the wider length sides 81a, 81b of the rectangular shaped exit orifice 80 to the shorter length sides 83a, 83b is at least 1:1 preferably at least 1.2:1, yet more preferably is at least 4-1.2:1, and especially preferably is in the range of 3.5-2:1. Particularly preferred ratios may be derived from the Figures, particularly from Figs. 8 and 9.

[0031] The depicted embodiment of the cap assembly 10 which includes the said specific improved nozzle assembly configuration is believed to be optimized for the delivery of the specific composition of E1 at the indicated internal pressures disclosed above. The indicated configuration and dimensions of the improved nozzle assembly configuration can be readily derived from the accompanying figures. In particularly preferred embodiments, the following dimensions are exant as identified on Fig. 10, wherein the indicated dimensions are in millimeters. With reference to Fig. 10, it is expected that the indicated dimensions may be slightly varied, e.g., by +/- 10%, preferably by not more than about +/- 10% from the indicated dimensions of angles and lengths, in this particularly preferred embodiment. In this particularly preferred and depicted embodiment of the cap assembly 10, the exit orifice 80 may be a rectangularly shaped exit orifice having a "height " (corresponding to the distance between opposite sides 81a, 81b) of 0.4 mm +/- 0.1 mm and wherein these opposite sides 81a, 81 b are straight parallel sides as illustrated in Figs. 1 - 8. The exit orifice 80 has a "width" (corresponding to the distance between opposite sides 83a, 83b) of 1 - 1.5 mm +/- 0.1 mm, but is preferably between

about 1.2 - 1.4 mm +/- 0.1 mm, and especially preferably is 1.3 mm +/- 0.1 mm, and also, wherein these opposite sides 83a, 83b are straight parallel sides as illustrated in Figs. 1 - 8. Alternately, as illustrated on Fig. 9, the exit orifice 80 may be a rectangularly shaped exit orifice having a "height " (corresponding to the distance between opposite sides 81a, 81b) of 0.4 mm +/- 0.1 mm at its ends, which however may extend at the midpoint between the ends to 0.45 - 0.5 +/- 0.1, such that these sides 81a, 81 b are slightly concave or bowed outwardly from the line AX. The exit orifice 80 has a "width" (corresponding to the distance between opposite sides 83a, 83b) of 1 - 1.5 mm +/- 0.1 mm, but is preferably between about 1.2 - 1.4 mm +/- 0.1 mm, and especially preferably is 1.3 mm +/- 0.1 mm, and also, wherein these opposite sides 83a, 83b are straight parallel sides as illustrated in Fig. 9, however, although not illustrated in Fig. 9 the opposite sides 83a, 83b can also be slightly curved or bowed outwardly from the line AX as well by up to about 0.1 mm at their midpoints.

[0032] In a particularly preferred embodiment of cap assembly 10, and with reference to the drawings: the angle between 77a, and 77b is preferably 30° +/1°; the angle of the horn 84, or alternately the angle between the midpoint of a reference plane between sides 81a, 81 b and the exterior edges of the horn 84 is between 115 - 140°, preferably between 115 - 122°, and especially preferably is 120° +/- 1°; the angle of the nozzle horn sidewalls 70a, 70b is between 70 - 95°, preferably between 80 - 90°, and is especially preferably about 85° +/- 0.5° as measured along a vertical line bisecting sides 81 a, 81 b of the nozzle orifice 80; the distance between the end of the plug 69c and the end of the outlet orifice 80 is between 4.5 and 5.5 mm, preferably is 5 mm +/- 0.2 mm; the diameter of the plug 69 is between 2.5 - 2.8 mm, preferably is 2.7 mm +/- 0.15 mm, the maximum inner diameter of the insert is between 3.2 - 3.6 mm, preferably is 3.4 mm +/- 0.1 mm.

[0033] While not wishing to be bound by the following, is believed that the combined effects of the (a) increasing pressure upon the flowing, foaming surface treatment composition passing through the compression zone 75, which suddenly exits via a non-circular exit orifice 80 and preferably were in a least two opposite sides are edges of his non-circular exit orifice 80 are sharp edges which rapidly expand thereafter due to the presence of the chamfer or bowl shaped horn 88 immediately adjacent thereto and downstream of the exit orifice 80 provides for both an excellent degree of directional control of the dispensed aerosol foaming surface treatment composition and simultaneously, the initiation of foaming via rapid air entrainment as the sprayed dispensed aerosol foaming surface treatment composition exhibits increased foaming as it transits through the ambient air even prior to its deposition on a surface. It is believed that the sharp edges of at least two opposite sides of the exit orifice 80, e.g., 81a, 81b immediately followed by the chamfer or bowl shaped horn 88 imparts turbulence to the exiting composition, and the chamfer or bowl shaped horn 88 permits for immediate volumetric expansion of the exiting composition and capture of air, hence air entrainment at even the initial stages of its flight through ambient air or the ambient environment. This effect is noted with the exit orifice configuration according to Fig. 8, and even moreso with the exit nozzle configuration according to Fig. 9.

[0034] Although the above dimensions are optimized for the E1 composition tested, at the indicated pressures and temperatures, nonetheless small modifications to the configuration and dimensions of one or more parts for elements of the improved nozzle assembly configuration may be beneficial or desirable when a composition different than that of E1 is to be dispensed without a deleterious increase in one or more of the following technical shortcomings: (a) unsatisfactory directional control of the dispensing treatment compositions; (b) unsatisfactory foaming of the surface treatment compositions when applied to a surface, such as a hard surface and particularly a non-horizontal inclined or vertical hard surface; (c) unsatisfactory amounts of "bearding" of the treatment composition being dispensed; and, (d) unsatisfactory amounts of cavitation of the dispensing treatment composition resulting in uneven dispensing of the treatment compositions, also referred to as "spitting".

Testing:

[0035] A plurality of pressurized aerosol dispensers were prepared by providing 550 of formulation of "E1" to an aerosol canister (optionally lined to reduce internal can corrosion), thereafter adding 45 g of a liquefied gas propellant, thereafter the canister was sealed by the installation of a conventional aerosol crimp cap having at one side a dip tube which extended downwardly and into the interior of the aerosol canister and thus into the pressurized foaming surface treatment composition, an intermediate valve and on the exterior a valve stem. A cap assembly as depicted on Figs. 1 - 7 was thereafter affixed to the upper end of the sealed aerosol canister such that the valve stem engaged a part of the improved nozzle assembly as shown in Fig. 2. The interior pressure canister of the pressurized foaming surface treatment composition was in the range of about 2.9-3.3 bar (at 20°C).

[0036] Each of the pressurized aerosol dispensers (10 replicates) was tested for the delivery characteristics of the foaming treatment composition which they contained according to the following protocol. An aerosol dispenser was held in a vertical position, 30 cm away from a parallel vertical wall upon which had been taped a sheet of brown paper (kraft paper). The foaming surface treatment composition was dispensed by depressing the moveable trigger arm 20 for 5 seconds, after which pressure was removed from the moveable trigger arm 20. The applied foamed treatment composition was thereafter measured for the height of the, and the canister was visually inspected.

[0037] The deposited sprayed foamed surface treatment compositions for the 10 tested aerosol dispensers were as indicated on the following table; also indicated was the observed ranking of "bearding" observed:

aerosol dispenser (replicate)	height of sprayed foamed treatment composition (centimeters)	"bearding" rating
1	40	4
2	40	4
3	35	4
4	35.5	4
5	35	4
6	35	4
7	35.5	4
8	40	4
9	37	4
10	37.5	4

As evident from the foregoing, the average spray height was 37.05 cm.

[0038] The "bearding" rating related to the amount of excess foam that is being developed as the product is in use. Reference is made to the figures (photographs) of Fig. 11 which illustrates this "bearding" rating system. Bearding that occurs during actuation of the cap, according to the following rating system; visual examples of the foregoing rating system are as follows:

- Evaluate from side in-use bearding.
- Rate each can on 1-4 scale

Unacceptable	Moderately Acceptable	Very Acceptable	Standard
1	2	3	4

As reported in the table, the replicates of the pressurized aerosol dispensers were found to have acceptable ratings.

Claims

1. A cap assembly (10) mounted upon an aerosol canister (100), wherein the cap assembly (10) includes a moveable trigger arm (20) bearing a nozzle assembly (50), the nozzle assembly (50) which includes a nozzle orifice insert (70) which includes a sleeve part (72) and a non-circular nozzle orifice (80) having sharp edges which rapidly expand thereafter due to the presence of the chamber or bow shaped horn (88) immediately adjacent thereto, inserted within chamber body (64) having a nozzle chamber (60), wherein the sleeve part (72) includes an inlet zone (73) and downstream thereof, a compression zone (75) which compression zone (75) comprises an upper tapered sidewall (77a) and a lower tapered sidewall (77b) angled with respect to one another by an angle "A" which is in the range of between 5 and 30 degrees of arc and wherein the nozzle assembly (50) further includes an inlet conduit (52) in engagement with a valve stem (104) of the aerosol canister (100), a connecting bore (58) connecting the inlet conduit (52) with the nozzle chamber (60), wherein the nozzle chamber (60) further comprises a center post (69) which extends within the nozzle chamber (60) and depends from and extends from a base wall (66) of the chamber body (64), **characterized in that** the center post (69) includes a distal tip end (69a) which is frustoconical in shape.

2. A cap assembly (10) mounted upon an aerosol canister (100), according to claim 1, wherein nozzle chamber (60) further includes two generally parallel flat vertical sidewalls (78a, 78b) extending between the upper tapered sidewall (77a) and the lower tapered sidewall (77b).

3. A cap assembly (10) mounted upon an aerosol canister (100) according to claim 2, wherein the center post (69) extends within the sleeve part (72) of the nozzle orifice insert (70).

4. A cap assembly (10) mounted upon an aerosol canister (100) according to claim 3 wherein the nozzle orifice insert (70) includes two inwardly directed side restrictions (65a, 65b) which are dimensioned to define a gap therebetween which gap is sized to engage the center post (69).

Patentansprüche

1. Kappenanordnung (10), die auf einer Aerosoldose (100) montiert ist, wobei die Kappenanordnung (10) einen beweglichen Auslöserarm (20) aufweist, der eine Düsenanordnung (50) trägt, wobei die Düsenanordnung (50) einen Düsenöffnungseinsatz (70) aufweist, der einen Hülsenteil (72) und eine nicht kreisförmige Düsenöffnung (80) mit scharfen Kanten aufweist, die danach schnell expandieren aufgrund des Vorliegens des kammer- oder schüsselförmigen Horns (88) in unmittelbarer Nachbarschaft dazu, das in den Kammerkörper (64), der eine Düsenkammer (60) hat, eingeführt ist, wobei der Hülsenteil (72) einen Einlassbereich (73) und stromabwärts davon einen Kompressionsbereich (75) aufweist, wobei der Kompressionsbereich (75) eine obere sich verjüngende Seitenwand (77a) und eine untere sich verjüngende Seitenwand (77b) umfasst, die in einem Winkel "A" bezüglich einander abgewinkelt sind, der im Bereich zwischen 5 und 30 Grad liegt, und wobei die Düsenanordnung (50) ferner einen Einlasskanal (52) in Eingriff mit einem Ventilschaft (104) der Aerosoldose (100) aufweist, wobei eine Verbindungsbohrung (58) den Einlasskanal (52) mit der Düsenkammer (60) verbindet, wobei die Düsenkammer (60) ferner einen Mittelpfosten (69) umfasst, der sich in der Düsenkammer (60) erstreckt und von einer Basiswand (66) des Kammerkörpers (64) herabhängt und sich davon erstreckt, **dadurch gekennzeichnet, dass** der Mittelpfosten (69) ein distales Spitzenende (69a) aufweist, das kegelstumpfförmig ist.

2. Kappenanordnung (10), die auf einer Aerosoldose (100) montiert ist, nach Anspruch 1, wobei die Düsenkammer (60) ferner zwei allgemein parallele, flache, vertikale Seitenwände (78a, 78b) aufweist, die sich zwischen der oberen sich verjüngenden Seitenwand (77a) und der unteren sich verjüngenden Seitenwand (77b) erstrecken.

3. Kappenanordnung (10), die auf einer Aerosoldose (100) montiert ist, nach Anspruch 2, wobei sich der Mittelpfosten (69) im Hülsenteil (72) des Düsenöffnungseinsatzes (70) erstreckt.

4. Kappenanordnung (10), die auf einer Aerosoldose (100) montiert ist, nach Anspruch 3, wobei der Düsenöffnungseinsatz (70) zwei nach innen gerichtete Seitenverengungen (65a, 65b) aufweist, die so bemessen sind, dass sie einen Spalt zwischen sich definieren, der so bemessen ist, dass er den Mittelpfosten (69) in Eingriff nimmt.

Revendications

1. Ensemble de capuchon (10) monté sur un récipient à aérosol (100), l'ensemble de capuchon (10) comportant un bras de gâchette mobile (20) portant un ensemble de buse (50), l'ensemble de buse (50), qui comporte un insert d'orifice de buse (70) qui comporte une partie de manchon (72) et un orifice de buse non circulaire (80) ayant des bords vifs qui s'élargissent rapidement ensuite en raison de la présence de la chambre ou de la corne en forme d'arc (88) immédiatement adjacente à ceux-ci, insérée à l'intérieur du corps de chambre (64) ayant une chambre de buse (60), la partie de manchon (72) comportant une zone d'entrée (73) et en aval de celle-ci, une zone de compression (75), laquelle zone de compression (75) comprend une paroi latérale effilée supérieure (77a) et une paroi latérale effilée inférieure (77b) inclinées l'une par rapport à l'autre d'un angle "A" qui est dans la plage de 5 à 30 degrés d'arc et l'ensemble de buse (50) comportant en outre un conduit d'entrée (52) en prise avec une tige de valve (104) du récipient à aérosol (100), un alésage de connexion (58) reliant le conduit d'entrée (52) à la chambre de buse (60), la chambre de buse (60) comprenant en outre une colonne centrale (69) qui s'étend à l'intérieur de la chambre de buse (60) et qui est attachée à et s'étend à partir d'une paroi de base (66) du corps de chambre (64), **caractérisé en ce que** la colonne centrale (59) comporte une extrémité de pointe distale (69a) de forme tronconique.

2. Ensemble de capuchon (10) monté sur un récipient à aérosol (100) selon la revendication 1, dans lequel la chambre de buse (60) comporte en outre deux parois latérales verticales planes généralement parallèles (78a, 78b) s'étendant entre la paroi latérale effilée supérieure (77a) et la paroi latérale effilée inférieure (77b).

3. Ensemble de capuchon (10) monté sur un récipient à aérosol (100) selon la revendication 2, dans lequel la colonne centrale (69) s'étend à l'intérieur de la partie de manchon (72) de l'insert d'orifice de buse (70).

4. Ensemble de capuchon (10) monté sur un récipient à aérosol (100) selon la revendication 3, dans lequel l'insert

d'orifice de buse (70) comporte deux restrictions latérales orientées vers l'intérieur (65a, 65b) qui sont dimensionnées de manière à définir entre elles un espace dimensionné pour s'engager avec la colonne centrale (69).

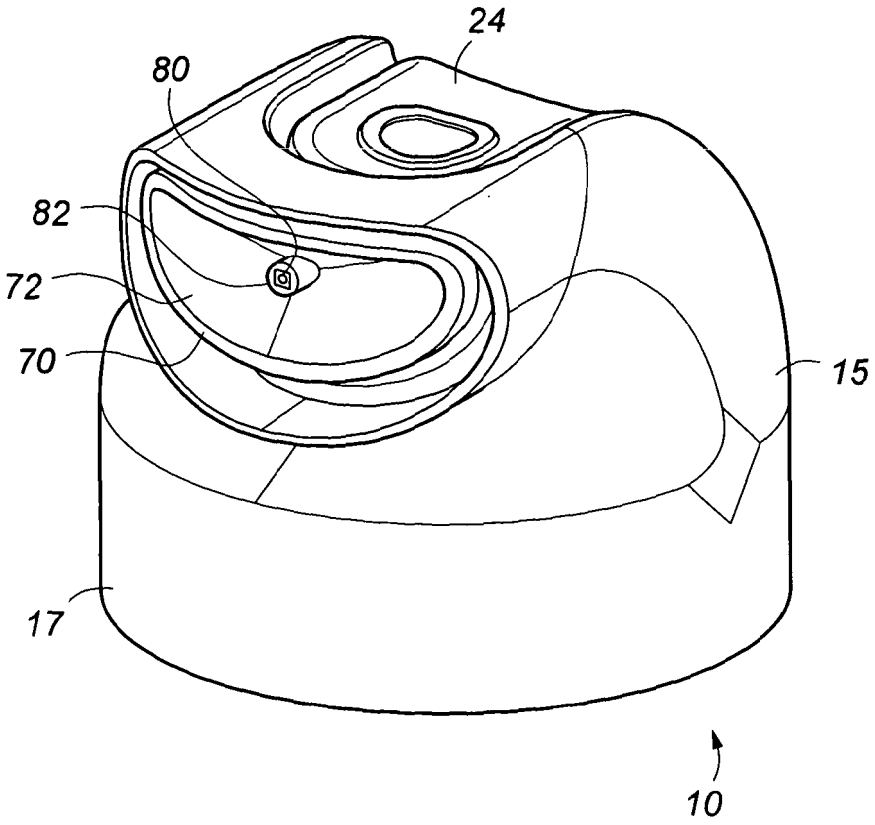


Fig. 1

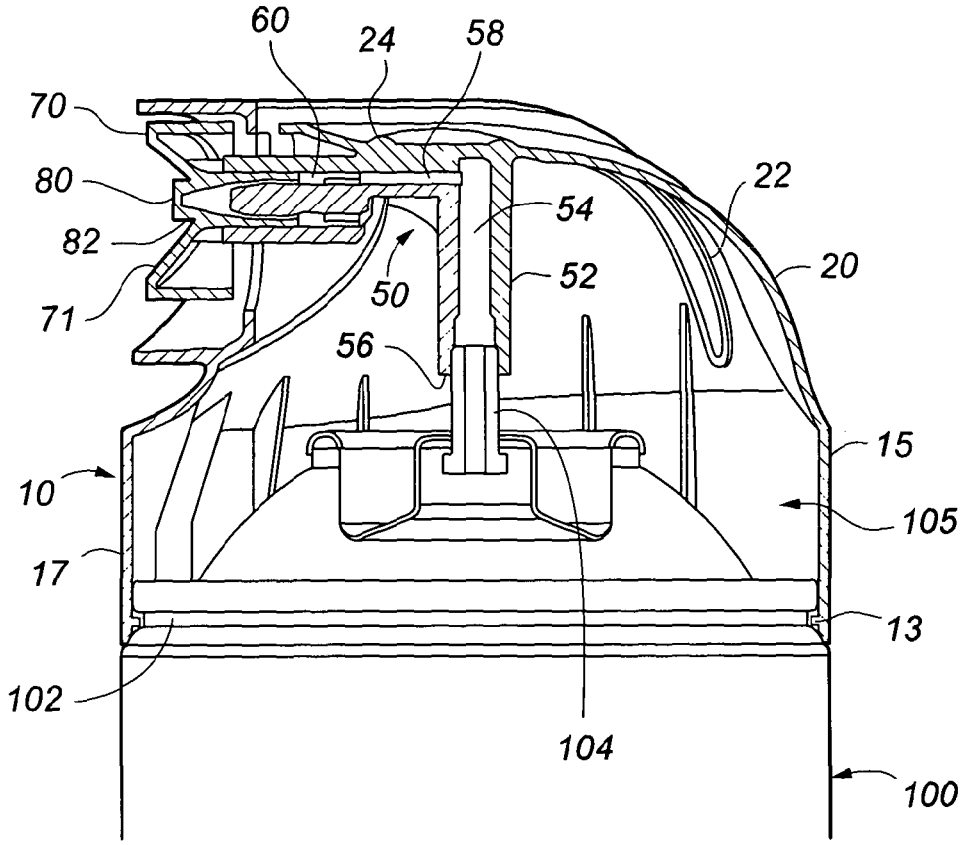
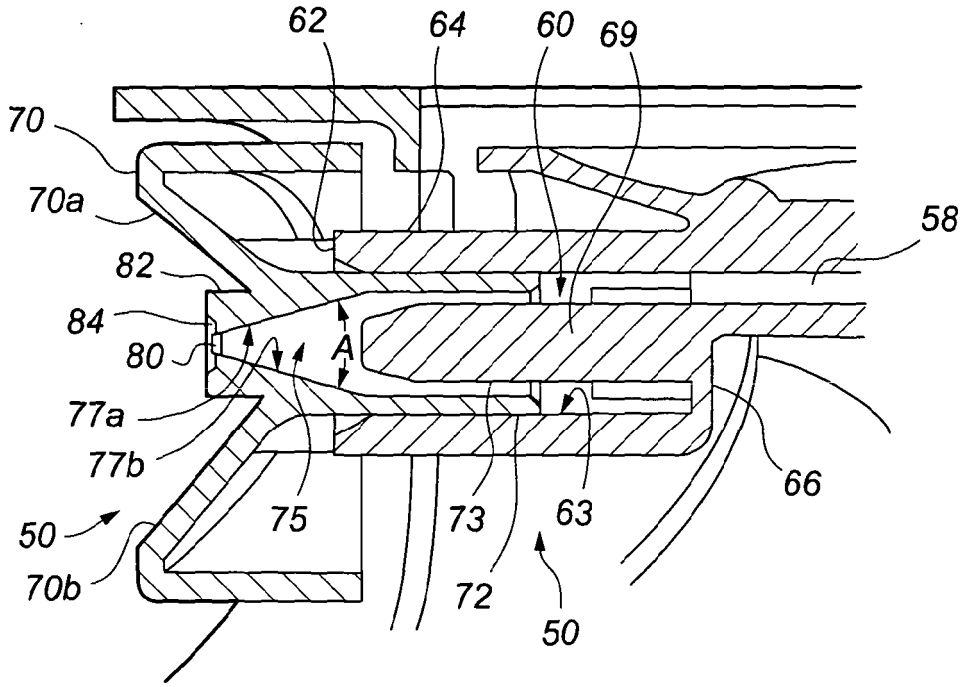


Fig. 2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60
69
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A
77a
77b
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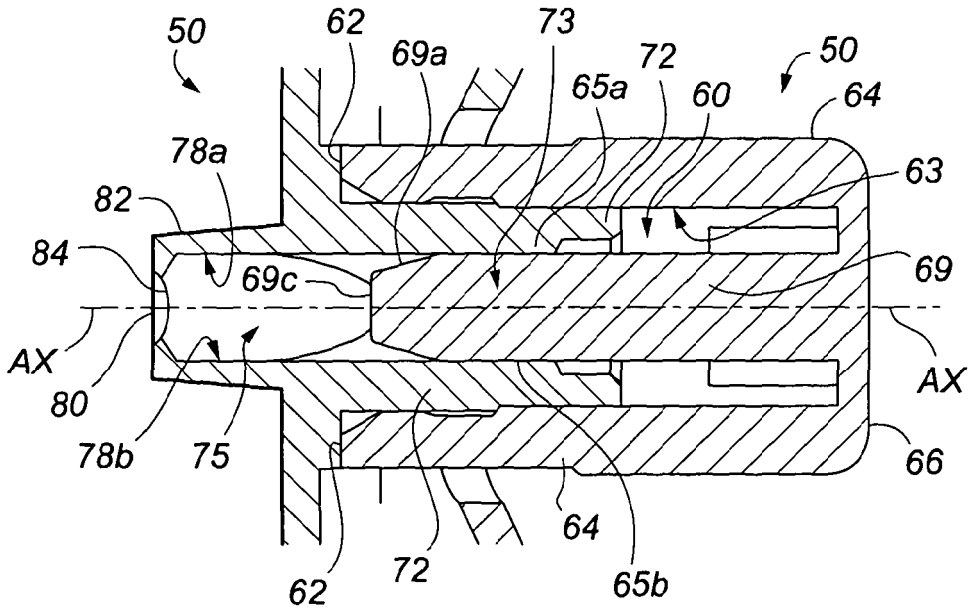
70b
72
50

Fig. 3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72
65b

Fig. 4

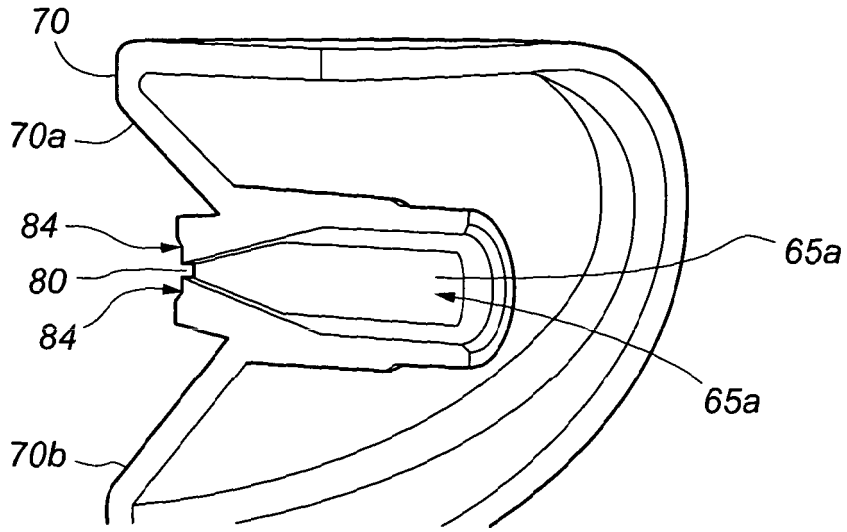


Fig. 5

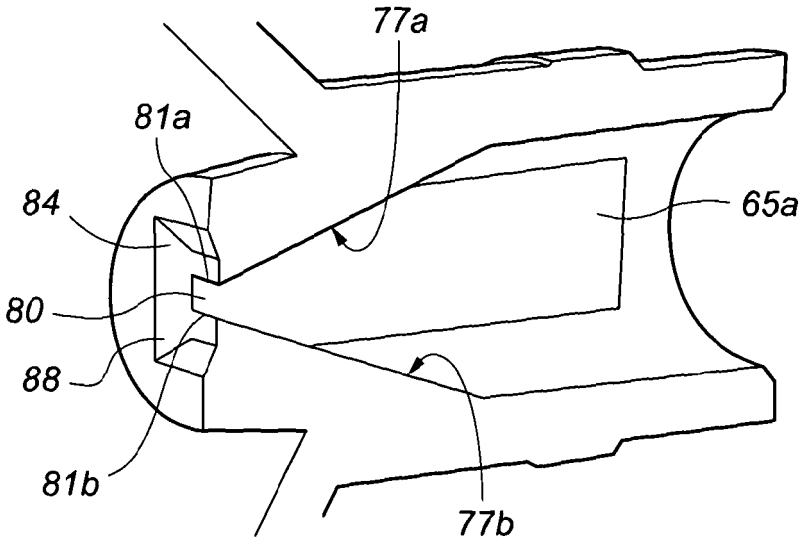


Fig. 6

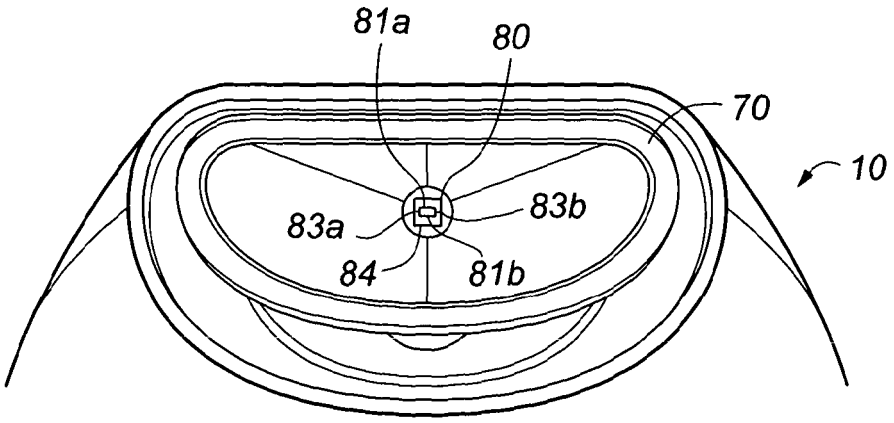


Fig. 7

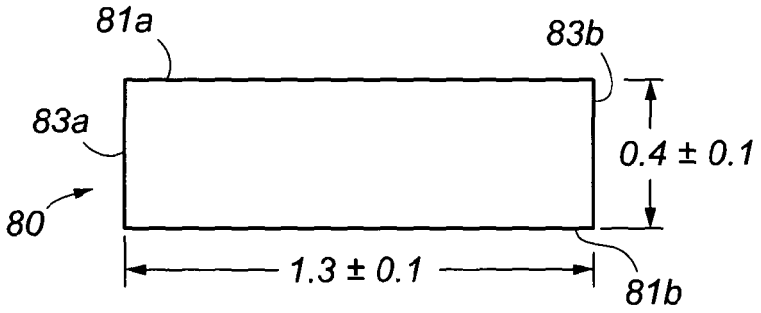


Fig. 8

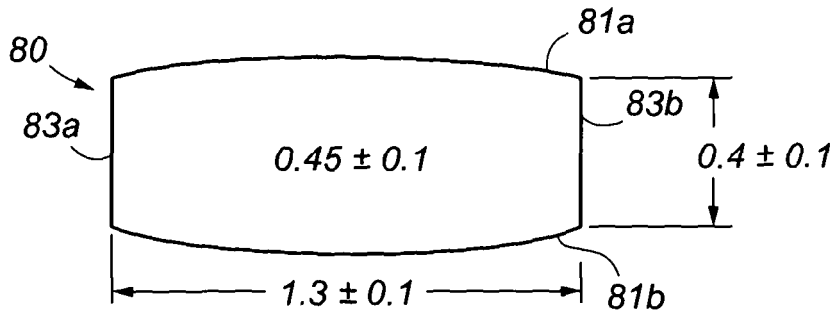


Fig. 9

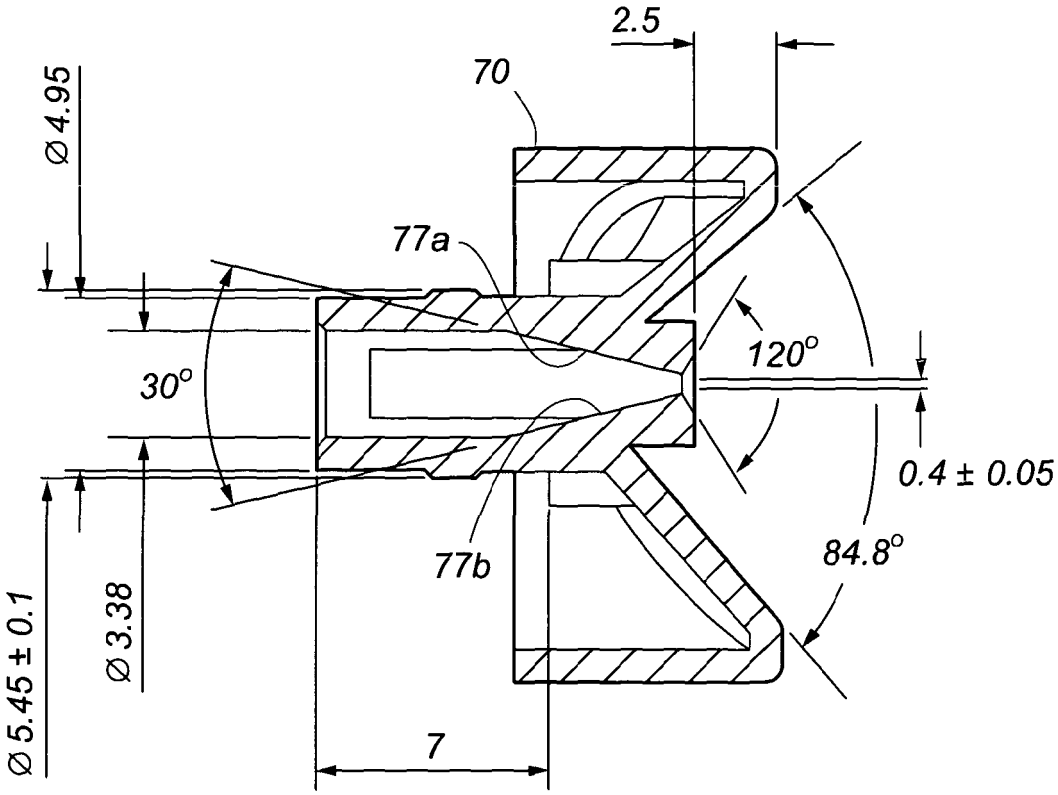
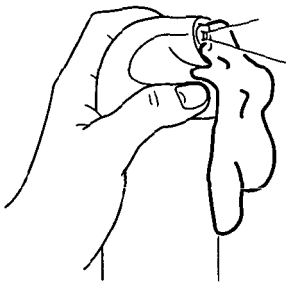
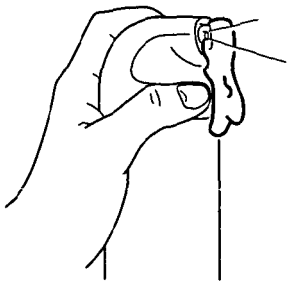


Fig. 10



RATING 1



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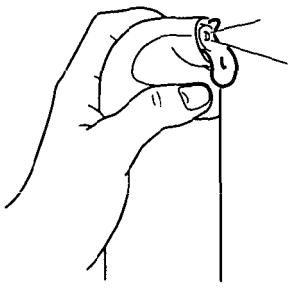
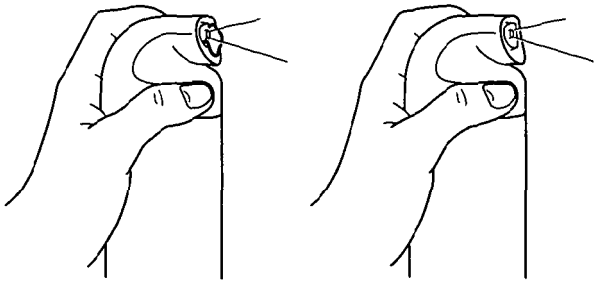


RATING 3



RATING 4

Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- GB 1164918 A **[0002]**
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