Oct. 10, 1967 V. C. GROTH 3,346,195

AEROSOL SPRAY DEVICE

Filed Oct. 22, 1964

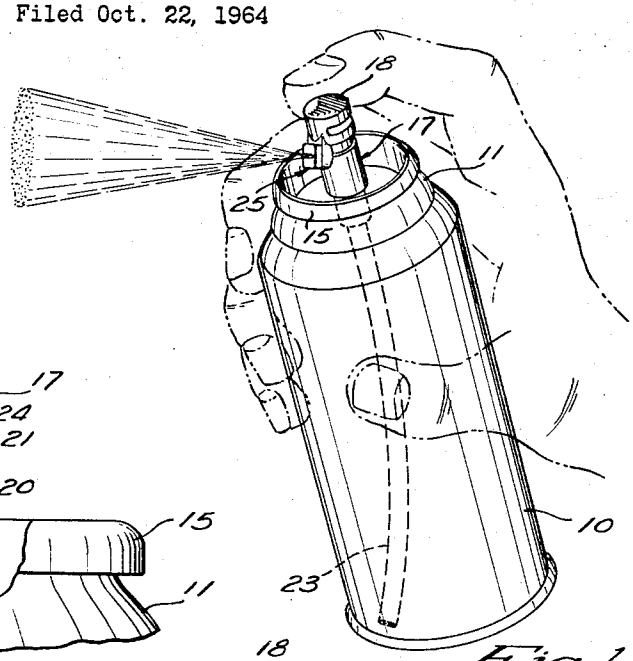

Fig. 1

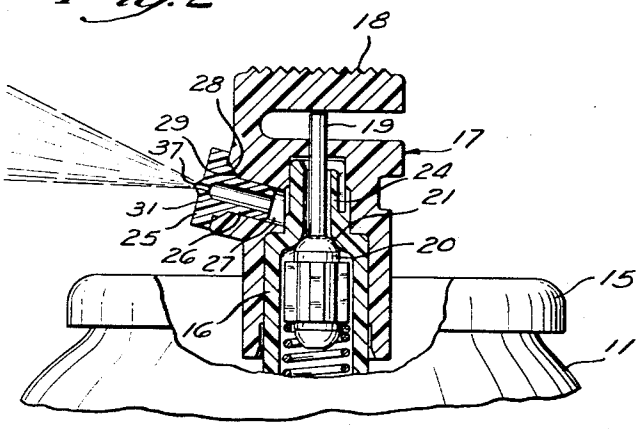

Fig. 2

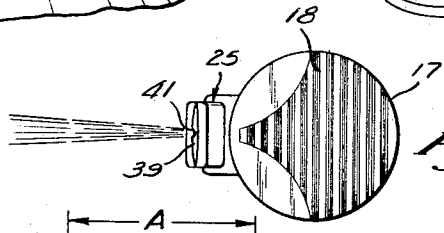

Fig. 3

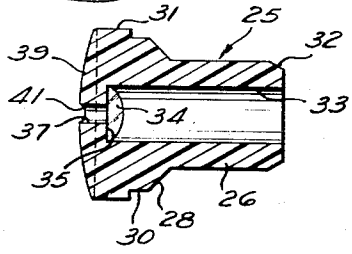

Fig. 6

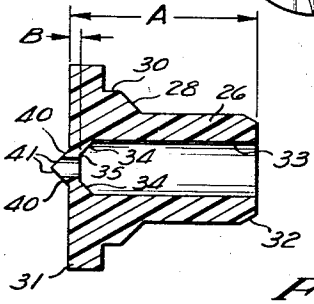

Fig. 7

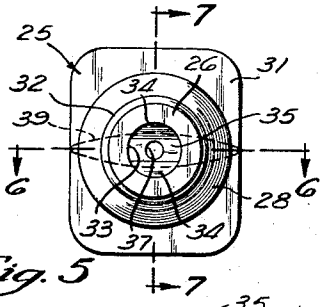

Fig. 5

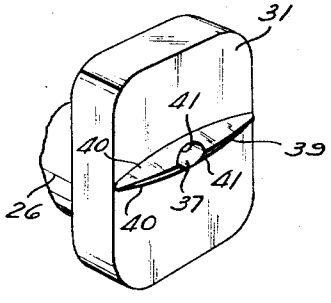

Fig. 4

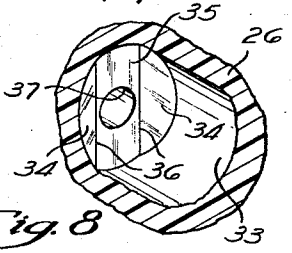

Fig. 8

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AEROSOL SPRAY DEVICE

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This invention relates to aerosol sprays and more particularly to a nozzle for aerosol spray cans whereby the material is discharged in a fan-shaped spray to produce an oval, or generally elliptical pattern, and in which the major axis of the pattern can be adjusted with respect to the can.

Aerosol spray cans containing paints, lacquers, enamels and the like, as well as other materials, such as cosmetics, insecticides, lubricants, medicaments and the like, are sold in large quantities. These cans contain the material to be dispensed, a liquified propellant gas such as dichlorodifluoromethane and, usually, a solvent to reduce the material to spraying consistency. The material is discharged through a discharge valve at the top of the can that is connected to a dip tube leading to a point near the bottom of the can. The discharge valve is controlled by an actuator in which a discharge nozzle is mounted. The actuator is arranged to be operated by the user's finger and the discharge nozzle ordinarily consists in a round orifice from which the material is discharged in a conical spray that produces a generally circular pattern. For effective and convenient spraying, particularly when the level of the material in the can is reduced, it is desirable to hold the spray can in a position that does not depart very much from the vertical. In spraying surface-coating materials such as paints, varnishes, enamels, and the like, lubricants, rustproofing compounds and certain cosmetics and medicaments, the conical spray that is produced by the conventional nozzle is inefficient in its use of material in that there is an excessive amount of overspray. The operator must develop skill in order to spray an even coating on a large surface and the spray can must be held from 10 to 12 inches away from the surface to be coated because the angle of the cone is quite narrow and if the spray can is too close, too thick a layer of material will be deposited and the material will sag or run.

According to the present invention, a nozzle is provided which discharges the material to be sprayed at approximately the same rate (in grams per minute, for example) as conventional aerosol spray nozzles, but the spray is fan-shaped with a small angle in one plane and an angle substantially greater than the normal angle of the conventional conical spray in a plane at right angles to the first plane. The pattern produced when the spray strikes a surface to be coated is oval or generally elliptical in shape. A sweep of the fan-shaped spray across a surface to be coated covers a substantially greater area than the conventional conical spray and the density of the spray throughout the width of the band that is sprayed is more uniform than usually obtained with a conventional conical spray. Also, it is possible to spray at distances of the order of 6 inches as distinguished from the 10- to 12-inch distance that is recommended for conventional spray cans. The result is that, as compared to conventional spray cans, air currents are much less of a problem, the accuracy of the spray is increased, the amount of overspray is greatly reduced, the efficiency of utilization of the material is increased, and unskilled operators can do better jobs.

Furthermore, tests have shown that, if desired, the amount of propellant can be decreased and the amount of solvent increased as compared to conventional practices, thus reducing the cost of the contents of the can without sacrificing quality. Also, if desired, an improved package can be produced by increasing the proportion of the material to be sprayed as compared to the propellant. This provides a package that for a given size contains more of the material in which the customer is interested. All of these factors contribute to more satisfactory and efficient usage of aerosol materials in cans embodying the present invention than in cans embodying conventional nozzles giving a conventional round spray pattern.

These advantageous results, coupled with the ability to adjust the long axis of the spray pattern with respect to the axis of the can readily and easily, are obtained at reasonable cost by the preferred form of the invention described herein, reference being made to the accompanying drawings in which:

FIGURE 1 shows a spray can made according to my invention and diagrammatically illustrates the pattern that is produced.

FIGURE 2 is an enlarged sectional view through an actuator embodying a nozzle made according to my invention and illustrating a portion of the dispensing valve and the upper portion of the aerosol can.

FIGURE 3 is a plan view of the actuator of FIGURE 2.

FIGURE 4 is a fragmentary perspective, to an enlarged scale, illustrating the outer face of the nozzle member.

FIGURE 5 is an elevation of the nozzle member taken from the back.

FIGURES 6 and 7 are horizontal and vertical sections, respectively, through the nozzle member taken as indicated by lines 6—6 and 7—7 on FIGURE 5.

FIGURE 8 is a fragmentary perspective, to an enlarged scale, showing the interior of the nozzle member.

As shown in FIGURES 1, 2 and 3 of the drawings, the invention is adaptable to a typical aerosol can **10**. The upper end **11** of the can **10** is reduced in diameter as shown and has an opening that is closed by a conventional closure cap **15** which supports a discharge valve body **16** that may be of any conventional construction. In the form of the invention shown, the discharge valve is provided with an actuator **17** that snugly, but removably, fits the exterior of the valve body **16**. Actuator **17** has an actuating flap **18** and an actuating pin **19** that engages a valve plug **20** that seals against a valve seat **21** within the valve body **16**. The valve body is crimped or otherwise secured to the closure cap **15** and is also connected to a dip tube **23** that preferably extends toward one side of the bottom of the can as shown.

Upon depression of the flap **18** by the user's finger as shown in FIGURE 1, the pin **19** is moved downwardly and in turn moves the plug **20** away from seat **21**, permitting the pressurized contents of the can to flow upwardly through the dip tube, around the valve plug, out of the top of the valve body and into the space within the actuator surrounding the narrow portion **24** of the valve body. From this space, the contents of the can are discharged through a nozzle member **25** that has a cylindrical stem portion **26** that fits within a circular passageway **27** in the actuator that communicates with the space within the actuator.

According to the present invention, the nozzle member is constructed so as to discharge a finely divided, thoroughly atomized, fan-shaped spray having a narrow included angle of, for example, 5° to 7½° in one plane and a relatively wide included angle of, for example, 20° to 25° in a plane normal to the first plane. This is accomplished in the present invention by constructing the nozzle member as particularly shown in FIGURES 4 to 8.

As there shown, the nozzle member **25** is preferably a separate plastic (linear polyethylene, for example) piece that is molded with a hollow, cylindrical stem portion **26** that fits with a light press fit in the cylindrical passageway **27**. Beyond the stem portion of the nozzle member, there is a conical portion **28** that engages a complimentary conical portion **29** in the actuator. Beyond the conical portion **28** there is a short cylindrical portion **30** and a rectangular flange or face **31**. When the nozzle member is in place, the edges of the rectangular flange **31** can be grasped by the user's fingernails and the nozzle member can be readily rotated with respect to the actuator and can be removed from the actuator, if desired. The inner end of the stem **26** is beveled as at **32** to facilitate insertion of the stem in the passageway **27**. The nozzle or orifice itself, as will appear below, is constructed so that the long axis of the spray pattern coincides with the long axis of the rectangular flange **31**. Thus by rotating the nozzle member, the user can adjust the axis of the pattern to the most convenient position for the work being done.

In order to provide the desired pattern of the spray and secure proper atomization of the material being sprayed, the nozzle is formed with a circular passageway **33** that extends through the stem portion **26** and terminates in an end wall that is formed by two oppositely sloped plane surfaces **34** that extend substantially at right angles to each other as shown. These surfaces intersect a narrow, flat, bottom surface **35** that is at right angles to the axis of the passageway **33**. The lines of intersection, **36**, are at right angles to the long or major axis of the fan-shaped spray and to the long axis of the flange **31**. A circular cylindrical discharge orifice **37** having a diameter slightly less than the width of bottom surface **35** extends through the end face **31** and is coaxial with the passageway **33**. The orifice **37** extends through the center of a V-shaped protuberance or rib **39** disposed on the exterior of the flange **31** and extending at right angles to the long axis of the flange and of the pattern. The sloping exterior sidewalls **40** of the rib **39** are preferably disposed substantially at right angles to each other. It will be noted that the width of the base of the rib in the central portion thereof preferably is greater than the diameter of the orifice **37** so that the orifice intersects the sloping walls **40** rather than the face of flange **31**. The intersection of the cylindrical orifice with the sloping walls **40**, which are disposed at angles of 45° to the axis of the orifice, gives the outer edge **41** of the orifice the shape of two semi-ellipses that lie in planes at right angles to each other. The apex of the rib **39** is shown as being arcuate in form. This is merely a matter of design and convenience in molding; the shape of the rib in regions spaced from the orifice is unimportant insofar as operation of the nozzle is concerned.

The configuration of the parts just described produces the desired fan-shaped, finely divided spray. The passageway **33** within the nozzle member constitutes an expansion chamber, in addition to the expansion chambers provided within the actuator and surrounding the valve body, in which a portion of the liquified propellant gas changes from the liquid state to the gaseous state and in so doing partially atomizes the material to be sprayed. The material flows through the passageway **33** at a high rate of speed and impinges upon the sloping surfaces **34** and **35** which create turbulence in the flow and additionally break up the liquid material into finely divided form. The surfaces **34** tend to cause the spray to assume a fan-shape because, as seen in FIGURES 2 and 7, their slopes are such that they tend to deflect the material upwardly and downwardly rather than laterally. The shape of the exit end of the orifice **37** cooperates with the internal configuration to produce the desired fan-shaped discharge. The sloping elliptical edges **41** of the orifice permit the spray pattern to diverge more in directions parallel to the long axis of the flange **31** and at right angles to the axis of the rib **39** and narrow the discharge angle of the material in directions parallel to the rib **39**.

In a preferred embodiment of the invention, the nozzle member **25** has the following dimensions:

Length (dimension A on FIGURE 7)	.170"–.174"
Diameter of bore **33**	.050"–.051"
Width of bottom surface **35**	.023"–.022"
Distance from bottom surface **35** to face of flange **31** (dimension B on FIGURE 7)	.008"–.009"
Diameter of orifice **37**	.018"±.0005"
Height of rib **39** at center	.015"–.016"
Width of base of rib at intersection with flange **31**	.030"–.032"
Radius of curvature of apex of rib **39**	¼"

(NOTE: It is important that the orifice 37 be round, accurately centered and free from flash and burns.)

A nozzle having these dimensions and spraying normally formulated paints with the usual pressure of the order of 70 pounds per square inch gauge within the can produces a fan-shaped spray that at 6 inches gives an oval or elliptical pattern in which the relatively dense central area of the pattern at 6 inches is about 2 to 2½ inches long and about ½ to ¾ of an inch wide. The angles of discharge are about 20° to 25° in one direction and 5° to 7½° in the other. The density of the pattern is remarkably uniform throughout the relatively dense area and a pass at right angles to the major axis of the pattern provides excellent coverage of a band having a width of 2 inches to 2½ inches with remarkably little overspray. As distinguished from this, the usual aerosol spray can discharges a conical spray giving a round pattern in which the relatively dense central portion has a diameter of about 1½ inches at a spraying distance of 12 inches, with considerable overspray and non-uniformity. At 6 inches, the center of the sprayed pattern is too dense for good results and the diameter of the pattern is less.

Because of improved mechanical atomization within the nozzle, a smaller percentage of liquified propellant gas is required in cans embodying nozzles made according to the present invention than in cans embodying conventional nozzles. Overspray is greatly reduced. The narrow, elongated pattern of improved uniformity makes it possible for unskilled operators to obtain excellent results. The short spraying distance lessens the effect of air currents and improves the accuracy of the spray. The adjustable nozzle contributes greatly to the ease of use of the cans and to efficient use of the material. Furthermore, if desired, the fan-spray nozzle can be removed readily for cleaning, or to permit replacement by a nozzle having a conventional round orifice adapted to produce a conventional circular conical spray.

Those skilled in the art will appreciate that various changes can be made in the preferred form of the invention disclosed herein without departing from the spirit and scope of the invention. The essential features of the invention are defined in the appended claims.

I claim:

1. A nozzle for discharging aerosol material in a fan-shaped spray comprising a member having a bore having an open inner end adapted to receive material from an aerosol can, the outer end of the bore terminating in an end wall formed by two oppositely sloping plane surfaces extending substantially at right angles to each other and intersecting a narrow flat bottom surface disposed at right angles to the axis of the bore, the lines of intersection of said sloping surfaces with said flat bottom surface being parallel to each other, said member having a circular cylindrical discharge orifice of slightly less diameter than the width of the flat bottom surface of said bore extending through the bottom of the bore to the outer surface of the member, said orifice being coaxial with said bore, the outer surface of the member having a V-shaped projection adjacent the orifice, the V-shaped projection being formed by sloping side walls disposed substantially at right angles to each other and intersecting

in a line that is a diameter of the orifice and extends parallel to said parallel lines of intersection on the end wall of said bore, the orifice intersecting the sloping side walls thereby giving the outer edge of the orifice the general shape of two semi-ellipses that lie in planes at substantially right angles to each other, each sloping plane surface in the end wall of the bore tending to deflect material passing through the bore in directions generally at right angles to the plane of the semi-ellipse that is on the opposite side of the axis of the bore from the sloping plane surface, whereby when material is discharged through the nozzle the discharge is in the form of a fan-shaped spray.

2. A nozzle for aerosol cans of the type embodying a discharge valve and an actuator for opening the valve, the actuator having a cylindrical passageway through which the material in the can is discharged, the nozzle comprising a member having a stem fitting within the passageway with a light press fit, a rectangular end flange adjacent the outer end of the stem and disposed in a plane normal to the axis of the bore, the member being rotatable within the passageway by grasping the rectangular flange, the stem having a bore that opens into the passageway in the actuator at the inner end of the stem and terminates adjacent the outer end of the stem in an end wall, the member having a circular discharge orifice of lesser diameter than the bore extending from said bore through the end wall and the end flange and the outer surface of the end flange having a V-shaped rib projecting therefrom, the orifice extending through the rib, the rib having sloping side walls that are disposed substantially at right angles to each other and the width of the base of the rib adjacent the orifice being greater than the diameter of the orifice so that the orifice intersects the sloping side walls of the rib, thereby giving the outer edge of the orifice the general shape of two semi-ellipses that lie in planes at right angles to each other, the end wall of the bore having two oppositely sloping planar surface portions located on opposite sides of said orifice, the planes of said surface portions having an angle of intersection bisected by the axis of said bore and said angle being of a size that said surface portions deflect material passing through the orifice in directions toward opposite sides of the rib, whereby when material is discharged from the can the discharge is in the form of a fan-shaped spray, the major axis of the spray being adjustable with respect to the actuator by rotating the member by means of the rectangular end flange.

3. A nozzle for aerosol cans of the type embodying a discharge valve and an actuator for opening the valve, the actuator having a cylindrical passageway through which the material in the can is discharged, the nozzle comprising a member having a stem fitting within the passageway with a light press fit, a rectangular end flange adjacent the outer end of the stem and disposed in a plane normal to the axis of the bore, the end flange overlying the surface of the actuator adjacent the passageway, the member being rotatable within the passageway by grasping the rectangular flange, the stem having a bore that opens into the passageway in the actuator at the inner end of the stem and terminates adjacent the outer end of the stem in an end wall, the member having a circular discharge orifice extending from said bore through the end wall and the end flange and the outer surface of the end flange having a V-shaped rib projecting therefrom and extending at right angles to the major axis of the rectangular end flange, the orifice extending through the rib, the rib having sloping side walls that are disposed substantially at right angles to each other and the width of the base of the rib adjacent the orifice being greater than the diameter of the orifice so that the orifice intersects the sloping side walls of the rib, thereby giving the outer edge of the orifice the general shape of two semi-ellipses that lie in planes at right angles to each other, the end

wall of the bore having two oppositely sloping planar surface portions located on opposite sides of said orifice, the planes of said surface portions having an angle of intersection bisected by the axis of said bore and said angle being of a size that said surface portions deflect material passing through the orifice in directions toward opposite sides of the rib, whereby when material is discharged from the can the discharge is in the form of a fan-shaped spray with the major axis of the spray parallel to the major axis of the rectangular end flange, the major axis of the spray being adjustable with respect to the actuator by rotating the member by means of the rectangular flange.

4. A nozzle for aerosol cans of the type embodying a discharge valve and an actuator for opening the valve, said actuator having a cylindrical passageway through which the material in the can is discharged, said nozzle comprising a one-piece molded plastic member having a hollow cylindrical stem portion fitting within the passageway in the actuator with a light press fit and a rectangular end flange on the outer end of the member, the end flange overlying the surface of the actuator adjacent the passageway, the member being rotatable within the passageway by grasping the rectangular end flange, the stem having a cylindrical bore that opens into the passageway in the actuator at the inner end of the stem and terminates adjacent the outer end of the stem in an end wall, the end wall being formed by two oppositely sloping plane surfaces extending substantially at right angles to each other and intersecting a narrow flat bottom surface disposed at right angles to the axis of the bore, the lines of intersection of said sloping surfaces with said flat bottom surface being at right angles to the major axis of the outer flange of the member, the member having a circular cylindrical discharge orifice of slightly less diameter than the width of the flat bottom surface of said bore extending through the flat bottom surface of the bore and the end flange of the member, the orifice being coaxial with said bore, and the outer surface of the end flange having a V-shaped rib projecting therefrom and extending substantially at right angles to the major axis of the flange, the rib having sloping side walls disposed substantially at right angles to each other and the width of the base of the rib adjacent the orifice being greater than the diameter of the orifice so that the orifice intersects the sloping side walls of the rib, giving the outer edge of the orifice the shape of two semi-ellipses that lie in planes substantially at right angles to each other, whereby when material is discharged from the can the discharge is in the form of a fan-shaped spray having its long axis parallel to the long axis of said flange and perpendicular to said rib, the axis of the spray being adjustable with respect to the actuator by rotating the member with respect to the actuator by means of the end flange.

5. A nozzle for aerosol cans of the type embodying a discharge valve and an actuator for opening the valve, the actuator having a passageway through which the material in the can is discharged, the nozzle comprising a member having a stem fitting within the passageway, a rectangular end flange adjacent the outer end of the stem and overlying the surface of the member adjacent the passageway, the member being rotatable within the passageway by grasping the rectangular flange, the stem having a bore that opens into the passageway in the actuator at the inner end of the stem and terminates adjacent the outer end of the stem in an end wall, the member having a circular discharge orifice of lesser diameter than the bore and short as compared to the bore extending from said bore through the end wall and the end flange and the outer surface of the end flange having a V-shaped rib projecting therefrom, the orifice extending through the rib, the rib having sloping side walls and the width of the base of the rib adjacent the orifice being greater than the diameter of the orifice so that the orifice intersects the

sloping side walls of the rib, thereby giving the outer edge of the orifice the general shape of two semi-ellipses that lie in angularly related planes, the end wall of the bore having two oppositely sloping plane surfaces disposed substantially at right angles to each other for deflecting material passing through the bore in directions at acute angles to the axis of the bore and generally parallel to the axes of said semi-ellipses, whereby when material is discharged from the can the discharge is in the form of a fan-shaped spray.

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