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(54) Title of Utility Model: Spray Nozzle

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Specification

1. Title of the Utility Model

Spray Nozzle

2. Claims

A spray nozzle obtained by forming a cylindrical chamber 12 between a rear wall surface of an end wall 11 and a front wall surface of a wall body 2 by restricting with the wall body 2 the rear end portion of the axial hole in a barrel 1 having an end wall 11 in the front, forming a spray hole 13 in the end wall 11, opening an injection passage 21 in the front wall surface of the wall body 2, and loosely inserting a columnar piece 3 in the cylindrical chamber 12, the piece 3 having cut grooves 34 formed in at least the front wall surface 35 of the piece 3 connecting the peripheral surface 31 of the piece 3 to a recess 32 in a cutting direction relative to the fixed direction of rotation of the piece 3 from the peripheral surface 31 to the recess 32 in the center and in a cutting direction towards the peripheral wall 33 of the recess 32.

3. Detailed Description of the Utility Model

(Purpose of the Utility Model)

The present utility model relates to an aerosol spray device using a propellant such as a compressed liquefied gas and to a spray nozzle for a spraying device for various types of liquid operated using manually applied pressure such as finger pressure. It is the purpose of the present utility model to provide spraying means able to spray a mist of fine particles even under fairly light spray pressure or under pressure from liquified gas or insoluble compressed gas which is not very compatible with the sprayed liquid.

In ordinary mass-consumption aerosol spray containers, organofluorine liquefied gases such as freon gas are commonly used as the propellant because they are inflammable, harmless to humans, and compatible with the alcohols used as solvents in sprays. However, a comprehensive ban on the use of organofluorine gases is scheduled to go into effect in response to demands to protect the ozone layer of the atmosphere. It is essential to obtain fine particle sprays in which the solvents and propellants used in conventional aerosol spray devices are compatible. Therefore, substitute gases must be found and developed by the time the comprehensive ban on organofluorine gases comes into effect. Various substitute gases such as LP gas and carbon dioxide gas have been proposed, but ones with properties comparable to those of organofluorine gases have not yet been found.

Therefore, it is the purpose of the present utility model to propose a means for achieving an atomized spray that is not dependent on the characteristics of the spray gas by improving the structure of a spray nozzle.

(Constitution of the Utility Model)

The following is an explanation of the present utility model with reference to the illustrated examples. Here, 1 is a barrel fitted with an end wall 11 in the front. A cylindrical chamber 12 is formed between a rear wall surface of the end wall 11 and a front wall surface of a wall body 2 by restricting the rear end portion of the axial hole in the barrel 1. A spray hole 13 is formed in the end wall 11 and an injection passage 21 is opened in the front wall surface of the wall body 2. A columnar piece 3 is loosely inserted into the cylindrical chamber 12. The piece 3 has a recess 32 and cut grooves 34 formed in at least the front wall surface 35. The recess 32 is formed so as to be centered with respect to the peripheral surface of the piece 3, and the cut grooves 34 connect the peripheral surface 31 of the piece 3 to the recess 32 in a cutting direction relative to the fixed direction of rotation of the piece 3 and in a cutting direction towards the peripheral wall 33 of the recess 32.

While the present utility model has the general configuration described above, in the example shown in FIG. 1 and FIG. 2, the barrel 1 is fitted into a recess formed in the front surface of the push button 4 for an aerosol spray device so that the end wall 11 protrudes. In this case, the portion on the bottom of the recess forms the front wall surface of the wall body 2 in which the rear end of the cylindrical chamber 12 is restricted. The following is a description of the pieces 3 in the illustrated examples. The piece shown in FIG. 3 through FIG. 6 is a modified example of the piece 3 shown in FIG. 1 and FIG. 2. In this modified example, the recess 32 and cut grooves 34 in the piece are in both the front wall surface 35 and the rear wall surface 36. When it is necessary for the piece to rotate in a single direction, the arrangement of the cut grooves 34 in the front wall surface 35 and the rear wall surface 36 is antisymmetric. In contrast to the modified example, a recess 32 is formed on both the front wall surface and the rear wall surface of the piece 3 shown in FIG. 1 and FIG. 2, but cut grooves 34 similar to those shown in FIG. 3 are only formed in the front wall surface 35. The cut grooves 34 are absent from the rear wall surface 36 as shown in FIG. 7. The modified example of the piece shown in FIG. 8 is similar to the other examples except for the recess 32 and cut grooves 34 formed in the front wall surface 35 of the piece. Notches 37 corresponding to the cut grooves 34 are formed which make the piece look like a pinwheel. These notches 37 receive the fluid passing through the cylindrical chamber 12 to apply strong torque to the piece.

A recess 32 is formed in the rear wall surface 36 of the piece in each of the examples, but a recess 32 does not have to be formed in the rear wall surface 36. For example, a protrusion 22 corresponding to the size of the recess 32 in the rear wall surface of a piece can be formed in the front wall surface of the wall body 2 in the examples shown in FIG. 1 and FIG. 2. When the piece 3 rotates, the protrusion 22 forms a shaft-like structure facilitating smoother rotation.

In the present utility model, pressurized liquid introduced into the cylindrical chamber 12 from the injection passage 21 reaches the recess 32 formed in the front wall surface 35 of the piece 3 from the peripheral surface 31 of the piece 3 via the cut grooves 34. As mentioned above, the cut grooves 34 are formed in a cutting direction relative to the fixed direction of rotation of the piece 3 and connect the peripheral surface 31 of the piece 3 and the recess 32 in a cutting direction towards the peripheral wall 33 of the recess 32. As a result, the pressurized liquid passing at rapid speed through the cut grooves 34 apply torque to the piece 3 in the direction of rotation of the piece 3 and the piece 3 rotates at high speed.

When the piece is fixed in the usual manner which differs from that of the present utility model, the pressurized fluid introduced to the recess 32 from the cut grooves 34 forms a swirling flow inside the recess 32, the swirling flow is introduced into the spray hole 13 under pressure, the fluid forming the swirling flow forces itself towards the edge on the cylindrical chamber 12 side of the spray hole 13, and turbulence forms. As turbulence forms, the liquid is broken up, there is a rapid decrease in pressure after the liquid passes through the spray hole 13, and the liquid particles are destroyed. In this way, a spray is formed from the pressurized liquid inside the container.

However, in the present utility model, as described above, the piece 3 is loosely inserted into the cylindrical chamber 12. When pressurized liquid is supplied from the injection passage 21 in the rear wall surface of the cylindrical chamber 12, the piece 3 is pressed into the end wall 11 formed in the front wall surface of the cylindrical chamber 12. However, the pressurized liquid supplied to the cylindrical chamber 12 is supplied from the space between the peripheral surface of the cylindrical chamber 12 and the peripheral surface of the piece 3 to the recess 32 via the cut grooves 34, and the pressurized liquid supplied to the recess 32 is discharged from the spray hole 13. Because the cross-sectional area of the spray hole 13 is very small, the liquid in the recess 32 is still under a certain amount of pressure and the pressure is applied to the rear in the piece 3. This forms a stable liquid layer between the piece 3 and the end wall 11, and the lubricating action of this liquid layer allows the piece 3 to rotate while being pressed against the end wall 11.

The pressurized liquid entering the recess 32 from the cut grooves 34 forms a swirling flow along the peripheral wall before being discharged from the spray hole 13. However, because the piece 3 rotates, the positions of the outlets from the cut grooves 34 at the base end forming the swirling flow constantly move rapidly in the forward direction of the swirling flow in the same direction of rotation as the swirling flow. As a result, the velocity of the swirling flow relative to a fixed position on the front wall surface of the cylindrical chamber 12 with the rotational velocity of the piece 3 superimposed is greater than the velocity when the piece is fixed and the positions of the outlets from the cut grooves 34 are also fixed. Because the faster swirling flow of pressurized liquid in the present utility model collides with the inner end of the spray hole 13, strong, low-amplitude vibrations occur, and the movement of the piece 3 rotating while floating inside the cylindrical chamber 12 furthers this vibration. The collisions and vibrations wildly separate and disrupt the liquid, resulting in the discharge of a fine mist from the spray hole 13.

(Effects of the Utility Model)

Because, as mentioned above, the present utility model is able to generate a significantly faster swirling flow and generate intense vibrations in the liquid inside the spray hole itself, a fine mist of particles can be discharged from the spray hole. Because the fine disruption of the liquid particles is caused only by the swirling flow of the pressurized liquid, a fine spray effect can be generated in a spray device using a propellant other than a compressed liquefied gas, such as a propellant compatible with the solvent, or no propellant at all. Therefore, the present utility model can completely eliminate the use of organofluorine gases, which are a root cause of atmospheric degradation, from mass-produced spray containers for personal and commercial use.

4. Brief Explanation of the Drawings

FIG. 1 is a vertical cross-sectional view of the spray nozzle in an example of the present utility model applied to the push button of an aerosol spray device. FIG. 2 is a horizontal cross-sectional view of FIG. 1. FIG. 3 is a front view of a modified example of the piece. FIG. 4 is a horizontal cross-sectional view of FIG. 3. FIG. 5 is a rear view of the piece shown in FIG. 3 and FIG. 4. FIG. 6 is a perspective view of the same. FIG. 7 is a rear view of the piece shown in FIG. 1 and FIG. 2. FIG. 8 is a front view of another modified example of the piece.

1: barrel; 11: end wall; 12: cylindrical chamber; 13: spray hole; 2: wall body; 21: injection passage; 22: protrusion; 3: piece; 31: peripheral surface; 32: recess; 33: peripheral surface; 34: cut groove; 35: front wall surface; 36: rear wall surface; 37: notch

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FIG. 1

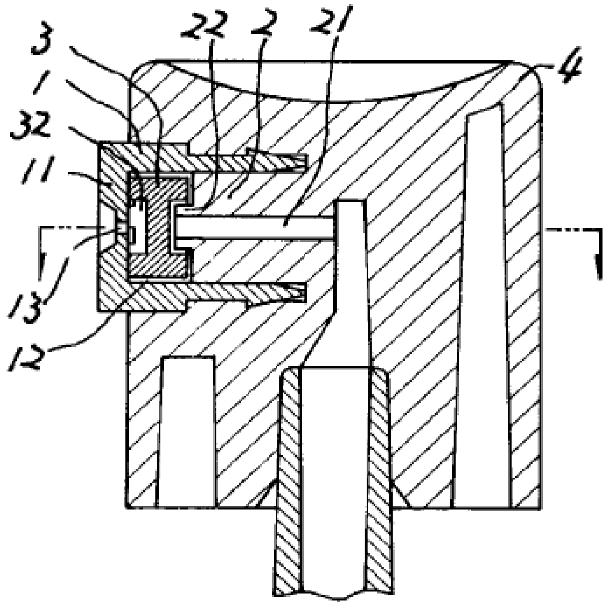

FIG. 2

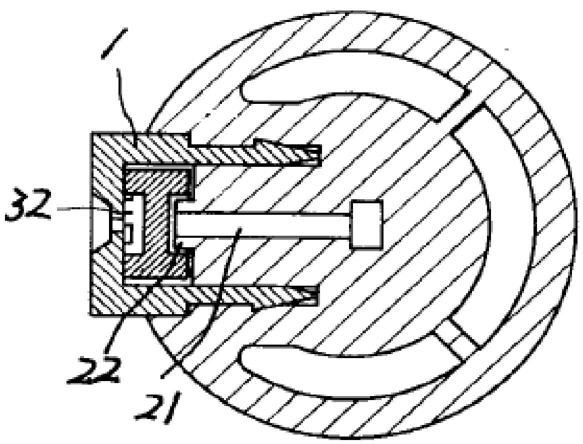

FIG. 3

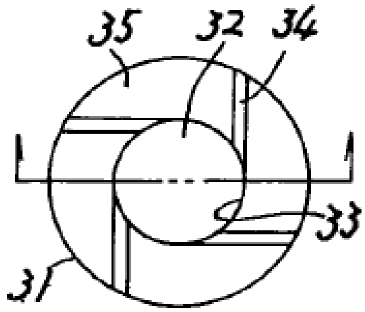

FIG. 4

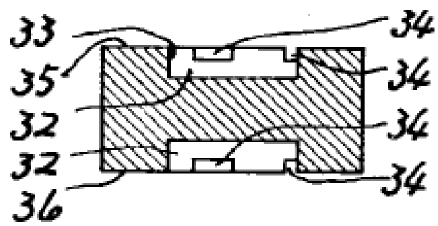

FIG. 5

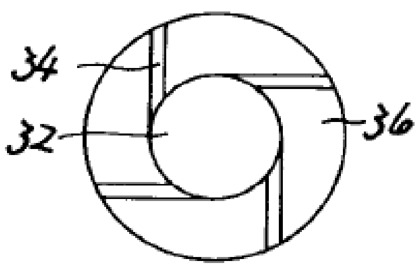

FIG. 6

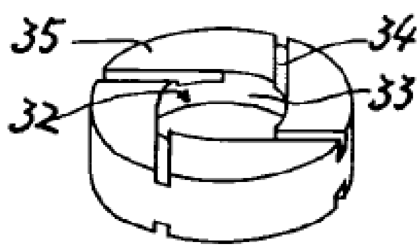

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FIG. 7

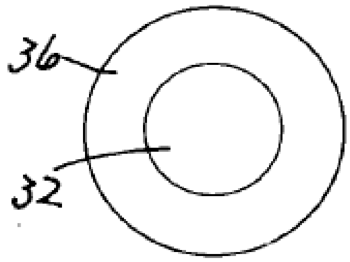
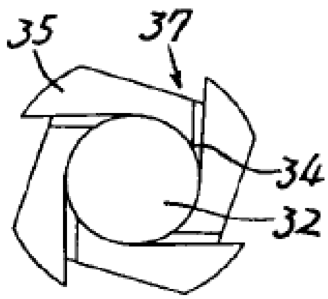


FIG. 8



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Date: May 15, 2018

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