

[54] **ONE-PIECE SPRAY HEAD AND CORE
PIN CONSTRUCTION THEREFOR**

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[57] **ABSTRACT**

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A spray head for aerosols has a flow channel recessed upwardly into the end surface of its bore; when seated on the tip of a hollow stem, the recessed flow channel controls the rate of flow by providing a cross-sectional area smaller than that of the spray orifice. From the flow channel, the flow leads upward into the aft side of a large circulation chamber; from its forward circular face a converging spray orifice, located below center, induces vortex circulation to produce a fine spray.

[52] U.S. Cl. 239/490, 239/337, 239/573

[51] Int. Cl. B05b 1/34

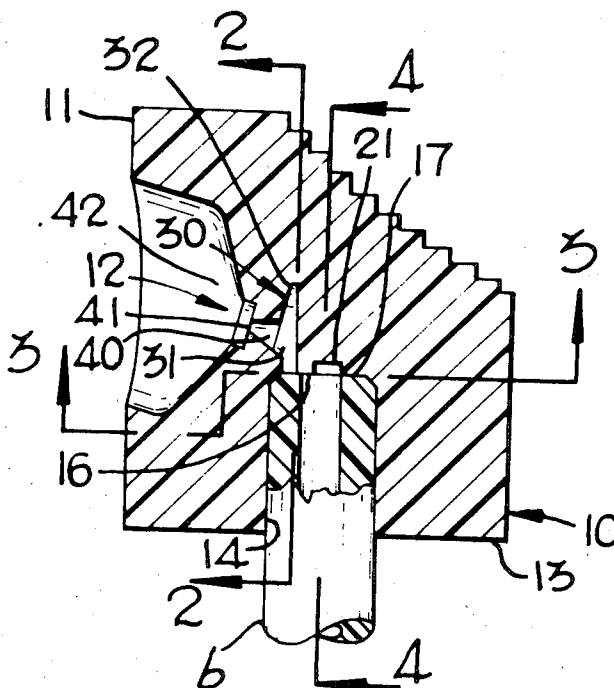
[58] Field of Search 239/490, 579, 573 X, 589, 337 X

[56] **References Cited**

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6 Claims, 5 Drawing Figures



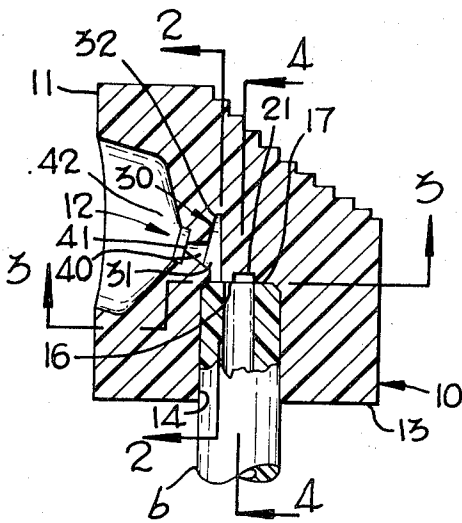


FIG. 1

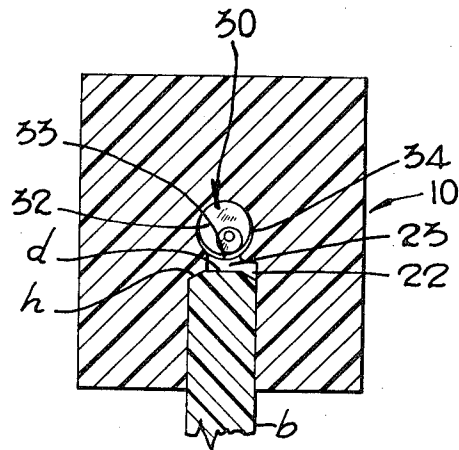


FIG. 2

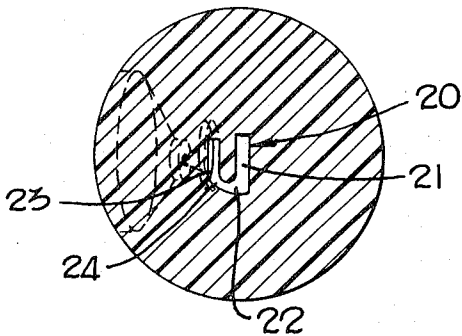


FIG. 3

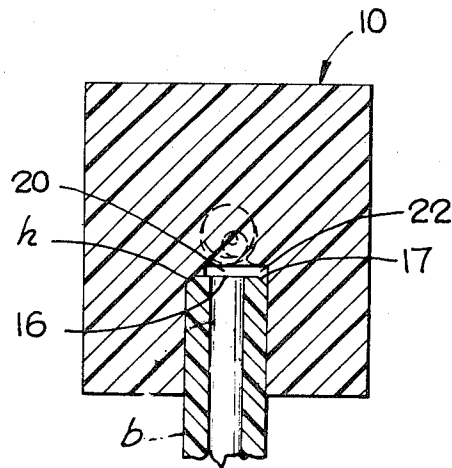


FIG. 4

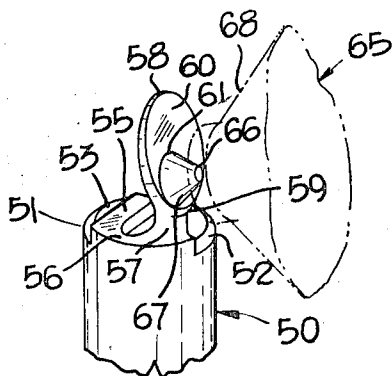


FIG. 5

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ONE-PIECE SPRAY HEAD AND CORE PIN CONSTRUCTION THEREFOR

BACKGROUND OF THE INVENTION

Spray heads for single-use aerosol containers must be constructed inexpensively, yet must in operation emit a fairly even fine spray over a desired pattern, preferably a hollow cone. Spray heads formed of a single piece have usually produced poor spray patterns, with heavy droplets of liquid accumulating in some parts of the pattern. For this reason, where a fine uniform spray is requisite, the present commercial practice is to utilize spray nozzles formed of two pieces, a body and an orifice insert, which so fit together as to provide a desired pattern of small passages meeting tangentially at the orifice.

Such construction is not possible in one-piece spray heads, which have heretofore been constructed according to no single consistent principle. In some such spray heads, droplets of liquid under pressure merely splutter through a small-diameter orifice. In others, the liquid may be forced at high speed tangentially along the wall of what is often referred to as a swirl chamber, whose outlet is an orifice opposite the center of the swirl chamber. Spray orifices have been used which are straight, or which either converge or diverge from such chamber to the atmosphere, usually without any teaching as to why the orifice was shaped as it was, or the effect of its shape upon the spray pattern.

SUMMARY OF THE INVENTION

The present invention provides a one-piece spray head, and mating core pin construction therefor, designed to produce a uniform fine spray pattern comparable to the spray patterns of two-piece heads. A one-piece spray head with an orifice located at its front has molded in its lower end a bore of circular cross section, to receive the tip of the hollow tubular valve stem of a conventional aerosol valve. A flow channel is recessed upwardly into the end surface of the bore, so that when the spray head is seated on the tube tip, its recessed channel will function as a flow control passage whose cross-sectional area is at least as small as the smallest cross section of the spray orifice. From this flow control portion of the channel, the flow rises vertically in a throat, into the rear side of a hollow circulation chamber. The chamber has the general configuration of a tapered disk, whose thickened lower portion projects forwardly of the throat, forming an arcuate chin. A converging-diverging spray orifice adjacent to the chin leads outward from below the center of the forward circular face of the chamber.

The flow control passages and circulation chamber, with its sloping circular front face and projecting chin, are provided by the upper end of a principal core pin. A ridge provides the flow channel; it leads into a tapered disklike head which provides the circulation chamber. The converging-diverging orifice is provided by an auxiliary core pin; a circular face on the aft end of its converging portion is presented abuttingly against the forward circular face on the head of the principal core pin.

In use, liquid dispensed through the valve stem is throttled at the flow control channel. The liquid then flows within the chamber at a slowed rate of speed in a circular path, around, forwardly and down toward the orifice. The orifice induces high-speed vortex flow, which breaks the liquid into a spray as it emerges from the orifice. The outer, diverging portion of the orifice controls, to some extent, the angle of the cone-shaped pattern in which the spray is emitted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a one-piece spray head incorporating the present invention, shown in place on a hollow tubular valve stem.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 1.

FIG. 5 is a fragmentary perspective view of mating core pin construction utilized in molding the spray head shown in the other figures.

DESCRIPTION OF THE PREFERRED EMBODIMENT

It is conventional to seal valves in the top openings of aerosol dispensers and leave their hollow tubular valve stems projecting upward. Such a valve stem *b* is shown in FIGS. 1, 2 and 4. It terminates upwardly in an annular tip surface *d*, formed with a bevel *h* at its radially outer side.

The spray head of the present invention is to be pressed onto the valve stem *b*. It is molded of a conventional plastic material using the mating core pin construction shown in FIG. 5 and described later in the specification.

The present spray head consists solely of a one-piece body generally designated 10. At its front 11 it has a spray orifice generally designated 12. Within its lower surface 13, a bore 14 of circular cross section is molded, to receive the tip of the tubular valve stem *b*. The bore 14 terminates upwardly in a bore end surface 16 whose radially outer portion 17 is shaped, except as hereinafter noted, to conform with the tip surface *d* and bevel *h* of the valve stem *b*, for seating thereon as shown in FIG. 1.

Recessed upwardly into the bore end surface 16 is a flow channel generally designated 20, best shown in FIG. 3. It is formed by a principal core pin generally designated 50 shown in FIG. 5, to which reference will be made hereafter. A central portion 21 of the flow channel 20 extends across from the middle of the end surface 16 to a radially outer portion 22, which in turn extends arcuately along a part of the radially outer portion 17, as shown in FIGS. 3 and 4, forwardly of the bore of the valve stem *b*. At this point it merges into the cross section shown in FIG. 2. Here it extends again inward substantially parallel to the central portion 21, to join an upward extending throat portion 23 best shown in FIG. 2.

Midway between the central portion 21 and the throat portion 23, the radially outer flow channel portion 22 is necked down to form a flow control portion 24 of smallest cross-sectional area. When the tip of the tube 10 is seated against the outer portion 17 of the spray head end surface 16, this flow control portion 24 provides the smallest cross-sectional area through which liquid to be dispensed through the valve stem will pass; thus, the minimum area of the spray orifice, to be described hereafter, is as large as or larger than that of the flow control portion 24.

The throat 23 leads upward to means which causes such flow to slow to a smoothly circulating flow. The preferred means includes a large circulation chamber generally designated 30, seen in cross section in FIG. 1 and from the rear in FIG. 2. The chamber 30 has the general configuration of a tapered disk positioned upwardly of the throat 23 and laterally of the body 10. The aft side of the throat 23 and chamber 30 coincide and are vertical. Forwardly, the chamber 30 has a thickened lower portion 31 which projects forward of the throat 23 and terminates in a circular forward face 32, presented at an angle of approximately 15° from vertical. The forward projection from the throat 23 at the underside of the thickened lower portion 31 is referred to as a chin 33; the circulation chamber 30 itself may be thought of as a head atop the throat 23. When viewed from the rear, as in FIG. 2, the chamber 30 is somewhat larger than its circular forward face 32, having side portions 34, which, like the chin portion 33, converge slightly toward the forward face 32.

Since the disklike circulation chamber 30 is positioned laterally, and the flow channel portion 22 enters the throat 23 from one side of center, the inflow into and through the throat portion 23 will be from that side of center, upward, around and across to the other side of the circulation chamber 30. The progressive increases in cross section, from the flow control portion 24 to the throat 23 and then to the circulation chamber 30, cause the flow to slow its speed. The chin 33, which spaces the forward circular face 32 substantially for-

ward of the throat portion 23, aids the development of smooth circulating flow by minimizing interference from inflow at the throat 23.

The spray orifice, generally designated 12, is best shown in FIG. 1. The orifice 12 has a funnellike converging portion 40, which, at a juncture of smallest cross section 41, connects to a diverging orifice portion 42. The converging portion 40 leads outward from the forward face 32 of the circulation chamber 30 at its thickened lower portion 31; the forward spacing of the face 32 relative to the throat portion 23 permits the converging portion 40 to draw a vortex from the slowly circulating liquid, unaffected by rough inflow from the throat portion 23 into the circulation chamber 30.

For best results, the converging portion 40 is located as shown in FIG. 2, below the center of the forward face 32, and with its lower edge at the chin 33. It is positioned spacedly to that side of center of the face 32 from which the flow channel 20 enters into the throat 23, to further minimize any interference between the inflow into the chamber 30 and the vortex formation within the funnellike orifice portion 40. The low offcenter position of the converging portion 40, when used with the tapered disc circulation chamber 30, aids in inducing vortex flow at the converging orifice portion 40.

Since the juncture 41 in the spray orifice 12 is no smaller in cross section than the flow control portion 24 of the flow channel 20, the spray orifice 12 has no flow-restraining function. This appears to aid it in inducing rapid vortex flow in liquid which circulates slowly in the circulation chamber 30. As it leaves the smallest orifice cross section, the liquid vortex breaks into a spray. The angle of divergence of the diverging orifice portion 42 controls to some extent the angle at which spray is emitted from the orifice 12.

In order to achieve the spray head structure so described, I utilize the mating core pin construction shown in FIG. 5, in connection with conventional metal mold cavity parts, not shown. A principal core pin generally designated 50 forms all the interior portions of the spray head which have been described above, except the spray orifice 12 which extends forward from the forward face 32 of the circulation chamber 30. The principal core pin 50 has a coring end 51 including a shoulder 52, here tapered corresponding to the bevel *h*, which extends around approximately three-fourths of the perimeter of the end 51. The shoulder 52 terminates in a flat upper surface 53 which, on molding, forms the end surface 16 of the bore 14 within the body 10.

At about center of the coring end 51 is an upward projecting ridge portion 55, being the reverse of the central portion 21 of the flow channel 20. The ridge portion 55 extends laterally and radially outward from center, to merge into a forward arcuate extending flow control ridge portion 56. As seen in FIG. 5, this arcuate portion 56 is higher than the shoulder 52. As seen in FIG. 3, it is narrower than the combined widths of the tip surface *d* and bevel *h* which together equal the wall thickness of the tubular valve stem *b*.

The flow control ridge portion 56 leads into a neck portion 57 which arises from the pin upper surface 53, forward of the position of the hollow in the valve stem *b*. Atop the neck portion 57 is a head portion 58 having the general configuration of a tapered disk broader at the bottom, its aft side extending straight upward. The broader bottom part of the head portion 58 extends forwardly from the neck portion 57, providing a projecting chin portion 59 which slopes slightly upward and forward. At its forward side, the head portion 58 has a circular forward face 60, which slopes slightly aft.

Against the forward face 60 of the principal core pin 50 is presented, during molding, the aft circular face 61 at the extreme inner end of an auxiliary core pin generally designated 65. The diameter of its aft circular face 61 does not exceed the radius of the forward face 60. In position for molding, the lower edge of the aft face 61 meets the forward face 60 at the chin portion 59, preferably slightly to that side of center at which the flow control ridge portion 56 enters the neck 57.

From its aft circular face 61, the auxiliary core pin 65 narrows convergently to a section 66 of minimum cross section, which is at least as great as the cross section provided by the flow control ridge portion 56 upwardly of the shoulder 52. The pin portion from the face 61 to the minimum section 66 is referred to as its converging portion 67. Outward of the minimum section 66, the pin 65 increases in diameter in a diverging portion 68.

As will be understood, the principal core pin 50 is supported by conventional structure and mechanism within a conventional metal mold cavity, not shown, shaped to provide the body 10 of the spray head; and the auxiliary core pin 65 is positioned and supported withdrawably in such conventional mold structure.

Utilizing one of the injection-molding plastic materials, such as polyethylene, the auxiliary core pin 65 may be withdrawn, despite its taper to the minimum section 66, when the plastic is still warm, without damaging the molded shape of the converging-diverging spray orifice 12. The tapered disc configuration of the head portion 58 likewise permits removal of the part from the principal core pin 50, although the chin portion 59 juts forwardly from the neck portion 57.

I claim:

1. For use on an aerosol dispenser of the type having a hollow tubular valve stem terminating in a tube tip having an annular surface,

a one-piece spray head, comprising

a body having at its front a spray orifice, and

having within its lower end a bore of circular cross section within which such tube tip is received,

the bore terminating upwardly in an end surface having a radially outer portion against which a portion of such tube tip annular surface may seat,

a flow channel recessed upwardly into said end surface commencing inwardly of its radially outer portion and extending outward to and forwardly along a part of such outer portion,

the flow channel having a constriction whose cross-sectional area does not exceed that of the smallest cross section of the spray orifice,

whereby, when such tube tip is so seated, to provide thereabove a flow control portion of said channel, together with

a circulation chamber in the flow path from said constriction to and immediately before the orifice.

2. A one-piece spray head as defined in claim 1,

wherein the spray orifice converges from a larger orifice inlet portion at the circulation chamber to its said smallest cross section outwardly thereof,

whereby its convergence aids in inducing rapid vortex flow from the circulation chamber to and through the orifice.

3. A one-piece spray head as defined in claim 2, wherein the spray orifice diverges forwardly of its portion of smallest cross section,

whereby to control the angle at which spray is emitted from the orifice.

4. For use on an aerosol dispenser of the type having a hollow tubular valve stem terminating in a tube tip having an annular surface,

a one-piece spray head, comprising

a body having at its front a spray orifice, and having within its lower end

a bore of circular cross section within which such tube tip is received,

the bore terminating upwardly in an end surface having a radially outer portion against which a portion of such tube tip annular surface may seat,

a flow channel recessed upwardly into said end surface commencing inwardly of its radially outer portion and extending outward to and forwardly along a part of such outer portion,

a throat connected to the forward end thereof and extending upwardly, and

a circulation chamber at the upper end of said throat,

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the circulation chamber having the general configuration of a disk whose thickness tapers narrowly upward, said circulation chamber being positioned laterally of the body, its thickness at its lower portion being substantially greater than that of the throat, such excess thickness projecting forward from the throat, the chamber having a generally circular forward face, together with a spray orifice located below center of said forward face and leading outward forwardly from the thickened lower portion of the circulation chamber.

5. A one-piece spray head as defined in claim 4, wherein the flow channel enters into the throat from one side of

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center of said laterally positioned chamber and the orifice joins the circular forward face at a position spacedly to the same side of center of said face, whereby inflow from the throat circulates first to that side of the chamber opposite to the flow channel and thence upwardly, around and downwardly forwardly to the region of the orifice at said first side of center, thereby avoiding intermixing the inflow with the vorticity induced at the orifice.

6. A one-piece spray head as defined in claim 4, wherein the circulation chamber has side portions converging toward the forward face.

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