

[54] **AEROSOL CAN FOR DISPENSING MATERIALS IN FIXED VOLUMETRIC RATIO**

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[51] Int. Cl.² **B65D 83/14**

[58] Field of Search . 222/136, 148, 402.11, 402.22, 222/402.21, 568, 145, 402.12, 402.18, 402.16, 402.2, 486, 520, 549

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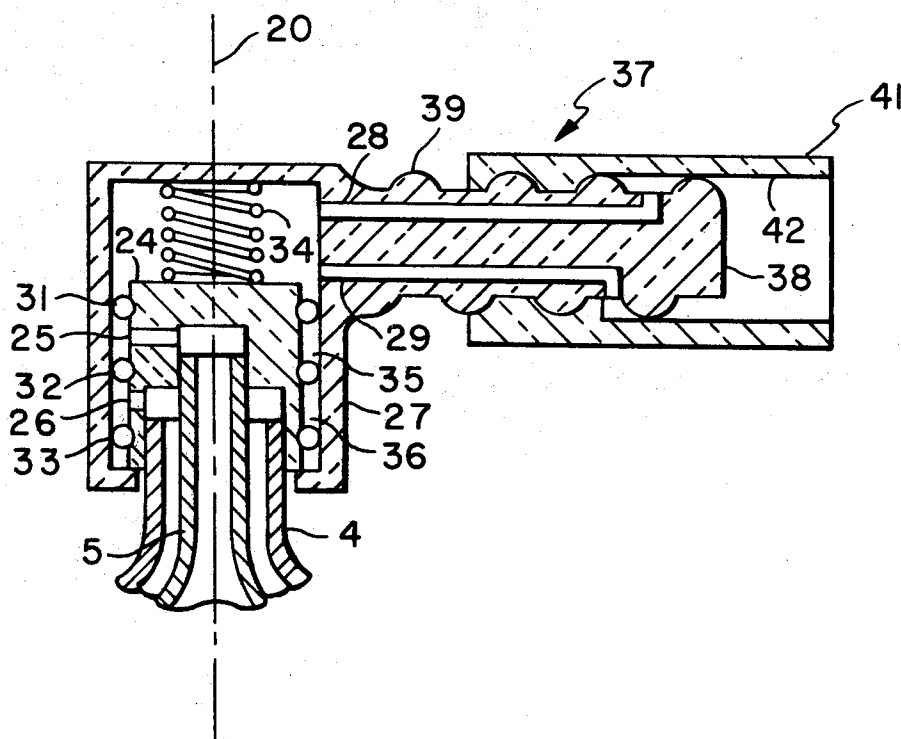
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[57] **ABSTRACT**

An aerosol can has two concentric compartments that connect to separate valves which in turn lead to a chamber for mixing the materials from the compartments and dispensing the materials mixed. A single unitary piston in the can has different portions which project into or against each of the compartments and a pressurizing fluid in the can drives the piston portions into or against the compartments so that the contents of the compartments are driven through the valves and into the mixing chamber in a fixed volumetric ratio.

1 Claim, 6 Drawing Figures



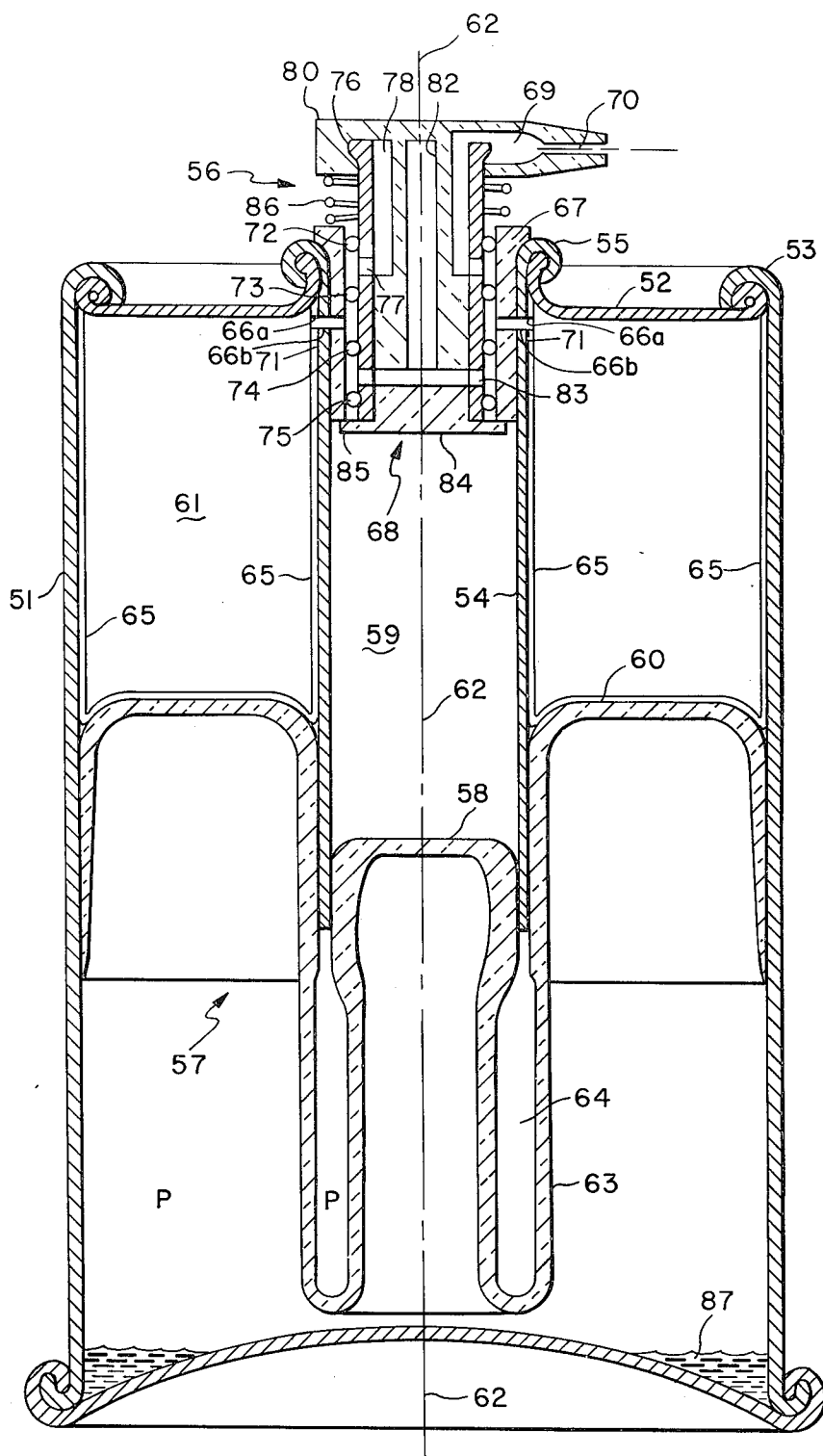


FIG. 2

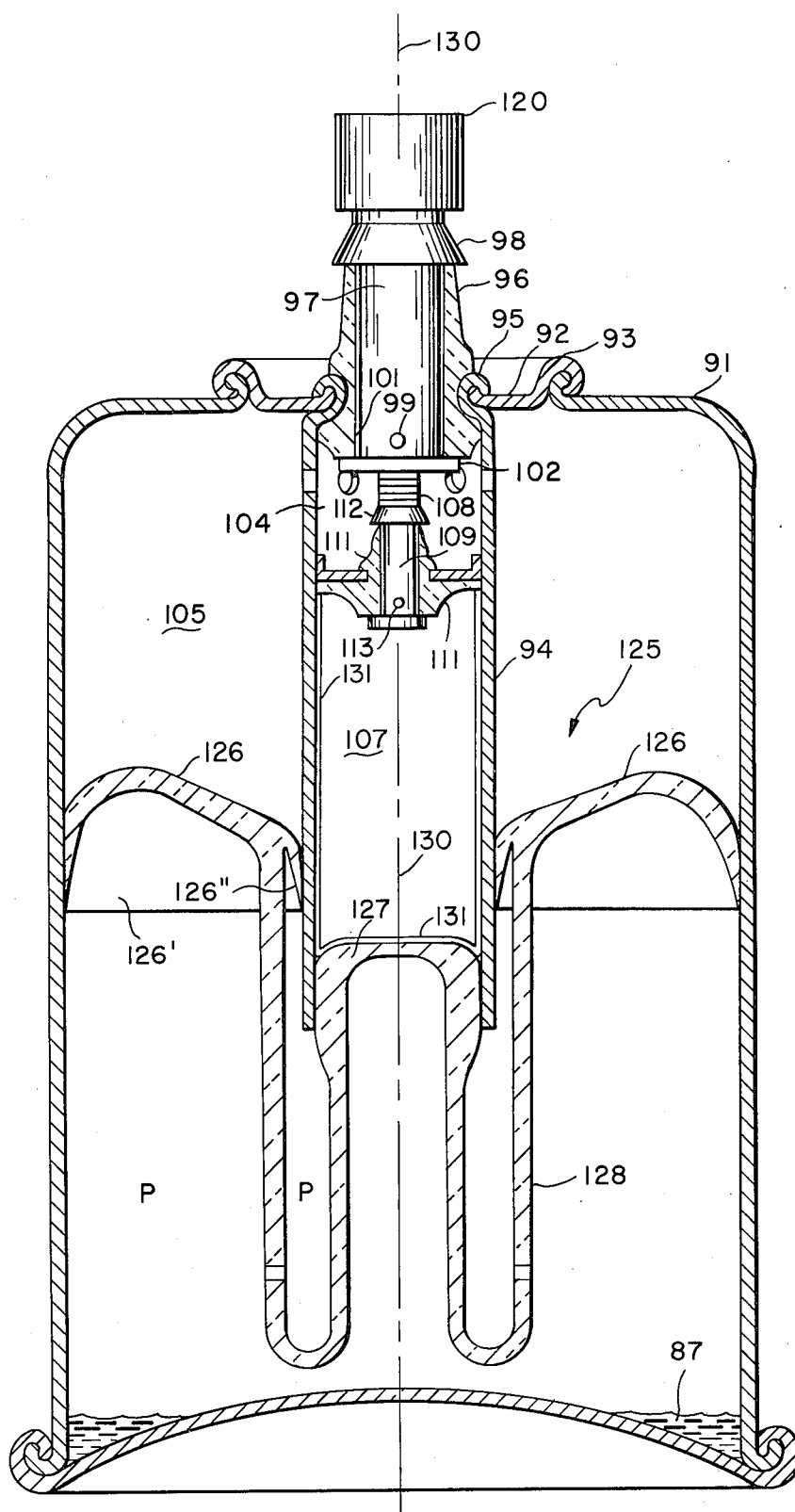


FIG. 3

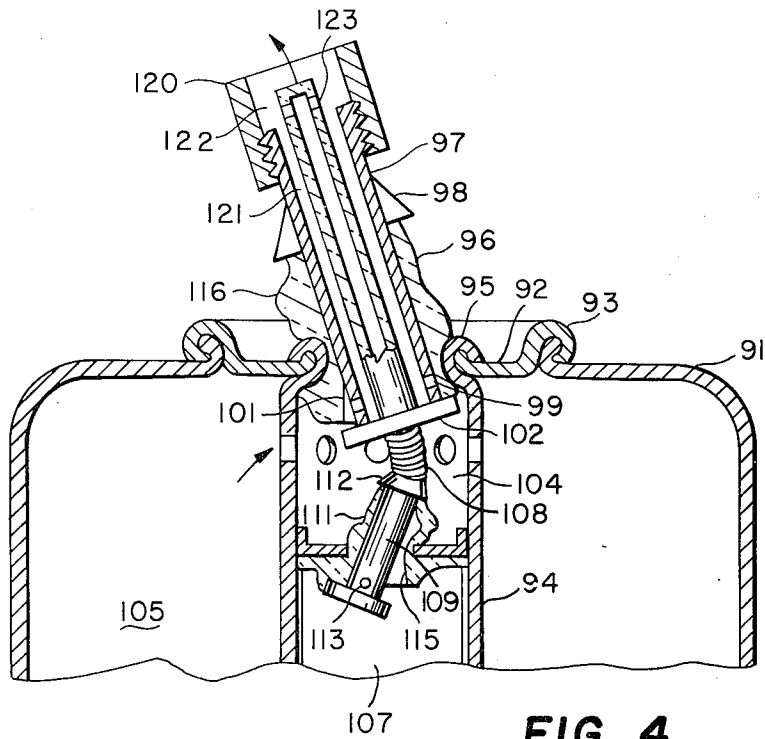


FIG. 4

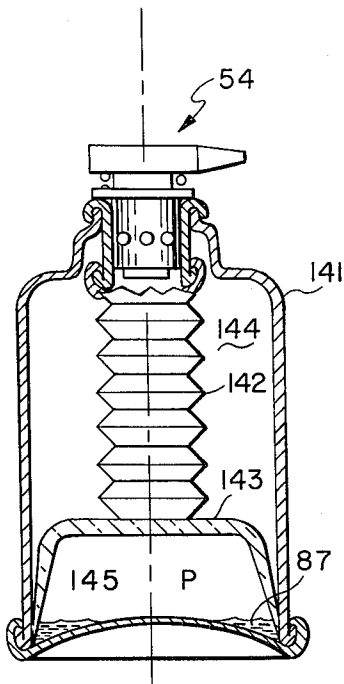


FIG. 5

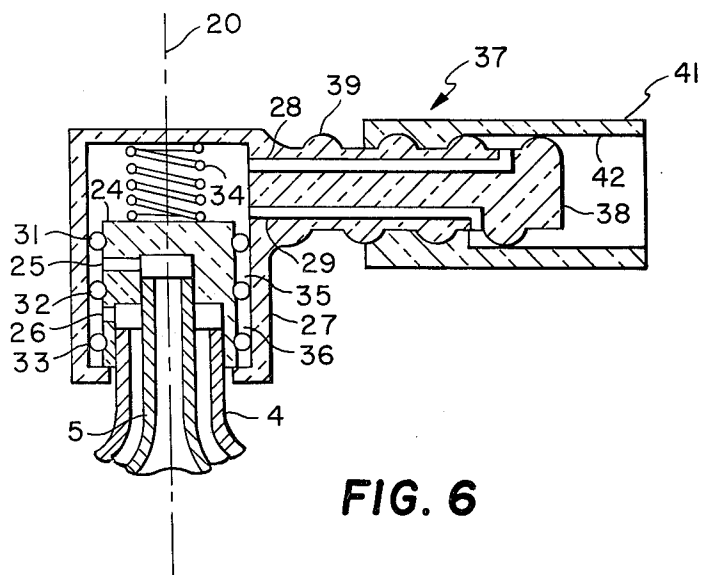


FIG. 6

AEROSOL CAN FOR DISPENSING MATERIALS IN FIXED VOLUMETRIC RATIO

RELATED APPLICATIONS

This application is a division of copending application Ser. No. 142,330, now U.S. Pat. No. 3,813,011, entitled *Aerosol Can For Dispensing Materials In Fixed Volumetric Ratio* and filed on May 11, 1971.

The present invention relates to dispensers for flowable substances and more particularly to such dispensers containing a plurality of segregated flowable substances and a valve through which the substances are forced by a compressed gas inside the dispenser.

Heretofore, pressurized dispensing containers commonly referred to as "aerosol" containers or cans have been used for dispensing more than one flowable substance contained in the container through a single nozzle. Some of these dispense one substance at a time and others dispense more than one substance at a time and provide a chamber for mixing the substances just before they flow from the nozzle. The latter type of dispensers have been suggested for dispensing materials in a premixed form, but which cannot be mixed until used. Such compositions as creamy whipped foods, paints, lacquers, sprays, insecticides, cosmetics, and the like require two different materials to be separated in the dispenser and brought together at the time of use. These dispensers have independent drive mechanisms for each material. They mix the materials after passing through metering valves and so the valves must be actuated simultaneously at precise positions to be sure that the materials are mixed in the proper ratio. This imposes a considerable burden on the valving and the manner in which the valves are actuated. The ratio is not maintained when the viscosity of one of the materials changes substantially more than the other.

It is one object of the present invention to provide a dispenser containing two or more materials in separate compartments which are mixed and dispensed simultaneously in a fixed volumetric ratio and where the valves and their operation are not critical to maintaining a desired volumetric ratio.

It is another object of the present invention to provide such a dispenser where no materials can be dispensed unless all valves leading from the materials in the dispenser are open and where the ratio of flow rates through the valves are independent of the size of the valve openings.

It is another object of the present invention to provide such a dispenser wherein the volumetric ratio is constant while dispensing from a full to an empty condition, and remains constant regardless of the total flow rate from the dispenser.

Foam plastic materials such as polyurethane foam are formed by mixing two component materials together which immediately foam and solidify. The components for polyurethane foam are a polyisocyanate and a polyhydroxyl. These are both liquid at room temperature and one may contain a blowing agent such as water. The ratio of the mix and the amount of blowing agent determines the density of the foam and the time to foam and solidify. This ratio must be closely controlled to insure the efficient formation and quality of the foam.

It is a further object of the present invention to provide an aerosol type dispenser for discharging polyure-

thane foam in a soft state such that it rapidly cures into hard foam of a preferred density.

The various embodiments of the present invention which represent the best known uses of the invention are described herein with reference to the accompanying figures in which:

FIG. 1 is a cross section view taken through the axis of an aerosol can incorporating the principal features of the present invention including a unitary piston with lip seals on piston portions projecting into inner and outer compartments for dispensing materials contained therein in fixed volumetric ratio;

FIG. 2 is a cross section view taken through the axis of another embodiment including a rolling diaphragm seal in the outer compartment for separating the materials in the can and sleeve valves for feeding the materials to a mixing chamber from which the mixture is dispensed;

FIG. 3 is a cross section view of another embodiment in which tandem tilt valves are substituted for the sleeve valves and a rolling diaphragm seal is inside the inner compartment;

FIG. 4 shows the tandem tilt valves in position to discharge;

FIG. 5 is a cross section view of another embodiment in which the center compartment is a bellows tube and a simple piston in the can collapses the bellows to drive both ingredients from the can in a fixed volumetric ratio; and

FIG. 6 is a cross section view showing a suitable valve and mixing chamber for use on the can shown in FIG. 1.

Many of the parts shown in the figures are bodies of revolution about the axis of the can as will be apparent from the descriptions set forth herein.

Turning first to FIG. 1, there is shown in cross section an aerosol type can having two separate compartments which are sealed from each other for containing separate flowable ingredients. The ingredients are forced from the can in fixed volumetric ratio by a piston. They can then be mixed in a chamber and discharged from a nozzle. Thus, the ingredients are separately contained and sealed from each other until just before mixing and use. A suitable valve and mixing chamber for attachment to this can is shown in FIG. 6. The can is particularly useful for discharging soft urethane foam which is a mixture of two ingredients which must be stored separate. The soft foam quickly sets and provides an ideal caulking. The dispenser facilitates application of the foam as caulking, permitting the user, for example, to apply desired amounts of the foam caulking along a gap in a convenient manner. In this use, the foam expands to fill the gap and so it seals. Other compositions of materials that could be dispensed from a can of this type include food mixes, cosmetics, paints, lacquers, sprays, insecticides, glue, and so forth.

In FIG. 1, the container body cylinder 1 rigidly connects to the inner cylinder 2 at a rolled seam 3 at the top of the can. Concentric discharge tubes 4 and 5 extend from the top of the can. They project from outer and inner discs 6 and 7 respectively, that seal at their perimeters to the body cylinder 1 at the rolled seal 3. The discs are spaced apart by dimples 8 and the inner disc is sealed by, for example, soldering to the flared top 9 of inner cylinder 2. Holes such as 10 provide passage from the outer (annular) compartment 11 to the space 12 between the discs and out of tube 4. The inner compartment 13 leads directly to discharge tube 4.

The inner cylinder 2 extends part way toward the bottom of the can and, preferably to a little more than half way from the flare 9 on the cylinder to the bottom of the can. The piston 15 contains a center portion 16 which projects into the inner compartment 13 and an outer annular portion 17 which projects into the annular (outer) compartment 11 formed between the inner cylinder and the container body. The piston may be made of polyethylene, rubber, or any other suitable material which is preferably slightly resilient so that a reasonably good seal can be obtained between the piston and the cylinders. The entire piston is an integral piece and is a body of revolution about the can axis 20. It includes the two projecting portions 16 and 17 which project into the inner and outer compartments and connecting structure 18 which connects these two portions. The connecting structure is designed to permit the inner cylinder 2 to project into the connecting structure as the entire piston moves upward into the compartments 11 and 13.

The piston portions 16 and 17 seal against the walls of their compartments by skirts or lips. The lip 16' on portion 16 and the lips 17' and 17'' on portion 17 are forced against their compartment walls by the gas pressure P inside the can beneath the piston. This gas is the propellant and may be compressed air, nitrogen, oxygen, carbon dioxide, or various forms of methane, butane, propane, or freon. Some of the propellant may exist in liquid form at the bottom of the can as at 19. Upon agitation of this liquid, the pressure P increases.

The bottom of the can is a concave disc 21 sealed at rolled seam 22 to the can body.

A valve mechanism attaches to the concentric discharge tubes 4 and 5. FIG. 6 shows one suitable plug-type valve and mixing nozzle. In FIG. 6, the valve plug 24 fits over and seals to the discharge tubes 4 and 5. Passages in the plug lead to inner and outer ports 25 and 26. The valve sleeve 27 containing inner and outer output ports 28 and 29 fits over the plug and seals against three O rings 31, 32, and 33 carried by the plug. The ports 25, 26, 28, and 29 are spaced so that when the sleeve is pressed toward the plug against the action of spring 34 to align ports 28 and 29 with the annular passages 35 and 36 that lead from ports 25 and 26, respectively, the valve opens both compartments 13 and 11 to the mixing chamber and discharge nozzle 37. Then the piston 15 moves into the compartments driven by the gas pressure P and drives the materials contained therein into the mixing chamber. Unless both ports 28 and 29 are opened by the valve to their respective chambers, the piston cannot move. Thus, neither of the contained materials can be discharged without the other and the volumetric ratio of discharge is always constant regardless of the valve openings and changes in the viscosity of the materials. The ratio is fixed by the ratio of the cross section areas of the compartments 11 and 13.

The mixing chamber and discharge nozzle 37, in FIG. 6, includes the projecting stem 38 which may be an integral part of the sleeve 27 and contains the ports 28 and 29. The stem is threaded by coarse thread 39 to accommodate the discharge cap 41. The inside of the cap is partially threaded. When the cap is screwed onto the stem to the position shown in FIG. 6, the ports 28 and 29 emerge from the stem inside the unthreaded portion 42 of the cap; this is the mixing chamber. The passage between the stem threads and 42 is helical and so the

discharged materials are, in effect, spun into the chamber enhancing the mixing action.

After use, the mixing chamber 42 can be cleaned of hardened material by screwing the cap 41 onto the stem 38 which pushes the material out of the chamber. The cap is then returned to the position shown in FIG. 6 for the next use.

Another embodiment shown in FIG. 2 includes a rolling diaphragm seal that seals the material in the outer or annular compartment and so it is sealed from the material in the inner compartment and from the propellant gas at pressure P. In FIG. 2, the container body cylinder 51 rigidly connects to the end closure plate 52 at a rolled seam 53 at the top of the can. The end closure plate connects to the inner cylinder 54 at rolled seam 55 and the valve assembly 56 fits into the top end of the inner cylinder and is sealed thereto. The inner cylinder extends part way toward the bottom of the can and, preferably to a little more than half way between the bottom of the valve assembly and the bottom of the can. The piston 57 contains a center portion 58 which projects into the inner compartment 59 (defined by the inner cylinder 54) and an outer portion 60 which projects into the annular compartment 61 formed between the inner cylinder and the container body. The piston is made of rubber or polyethylene or any other suitable material which is sufficiently resilient so that a reasonably good seal can be obtained between the piston and the cylinders. The entire piston 57 is an integral unit and a body of revolution about the axis 62. It includes the two projecting portions 58 and 60 which project into the inner and outer compartments and connecting structure 63 which connect these two portions. The connecting structure is designed to permit the inner cylinder 54 to project into the span 64 in the connecting structure as the entire piston moves upward into the compartments 59 and 61.

The rolling diaphragm seal 65 is, in effect, an annular bag of thin flexible material. This bag fits inside the outer compartment and sets on top of the piston portion 60 to which it may be fixed by an adhesive. The open ends of this annular bag roll into seals 53 and 55 at the top of the can. This rolling diaphragm seal provides a positive separation between the material in the outer compartment 61 and everything else in the can. Holes in the bag at 66 align with parts in the valve assembly 56 that conduct the material from the bag to the valve mixing chamber. This arrangement of the rolling diaphragm seal is preferred where the material contained in outer compartment 61 is likely to have greater back pressure than the material contained in the inner compartment 59.

Lip seal 58' tends to prevent the propellant gas from leaking into chamber 59 and mixing with the material contained therein. This contained material should be compatible with the propellant gas in case of some leakage. If that is not possible, then a rolling seal in the inner compartment as well may be required.

Another design of a rolling diaphragm seal shown in the embodiment in FIG. 3 is preferred where the material in the inner compartment is likely to have greater back pressure.

In FIG. 2, the valve assembly 56 includes a plug-type valve defined by the cock sleeve 67 and the plug 68, which includes the mixing chamber 69, and discharge nozzle 70. Outer compartment valve ports 71 through the cock sleeve, the inner cylinder 52, and the diaphragm seal 65 connect the outer compartment to the

inside of the cock sleeve. On the inside of the cock sleeve are four O-ring seals 72 to 75 which are held by plug cylinder 76 and play forcibly against the inside of the sleeve.

One set of ports 77 in the plug cylinder 76 connect the space between the cock sleeve and plug cylinder to the space 78 leading to the mixing chamber 79 in the cap 80. The center body 81 and cylinder 76 form the passage space 78. This center body, the cap and the discharge nozzle may be formed as an integral piece which may be molded of plastic. A chamber 82 in the center body extends to the bottom of the body and connects through the inner compartment ports 83 to the space between O-rings 74 and 75. A plug 84 inserted into the bottom of the plug cylinder seals the chamber 82 from compartment 59 and provides a stop 85 that limits the upward motion of the plug in the cock. The spring 86 acting between the cap and the cock sleeve urges the cock upwards so that the stop 85 abuts the sleeve and in this position all ports are closed and the materials cannot flow from the compartments.

Pressure in the can for forcing the piston upward is derived from a suitable gas contained beneath the piston 57. The gas is of such kind that it will not react with the material in the inner compartment 59. Some of the gas propellant may exist as liquid 87 at the bottom of the can. Thus, the piston is at all times under substantial pressure and discharge is accomplished by opening the valves. The valves are opened by pressing the can 80 downward so that the ports 77 pass the O-ring 73 and the ports 83 pass the O-ring 75. At this point, material flows from the outer compartment 61 through the ports 71 and ports 77 into the mixing chamber 69 and material flows from the inner compartment 59 through ports 83 into chamber 82 and from chamber 82 through the orifices 88 in the center body, into the mixing chamber 69. From there, the materials are substantially mixed and discharged through the nozzle 70. Upon releasing pressure on the cap 80, the spring urges the plug upwards sealing all ports between O-rings.

When the valves open, the propellant forces the piston upward and since the portions 58 and 60 of the piston are rigidly connected, they move together and displace volumes in their respective compartments which are in fixed ratio. If the ports from either compartment are blocked or do not open for some reason, then the piston cannot move and so there is no discharge of either material from the nozzle. The ports need not determine the flow rates of the materials. It is only necessary that both sets of ports open for any material to flow into the mixing chamber. The fixed displacement ratio of the piston portions projecting into the compartments insures that either both materials flow at the fixed volumetric ratio or none flows. Thus, the valves for the inner and outer compartments do not meter flow of the individual materials; they only provide a passage for the materials into the mixing chamber. Metering of the total mixture is controlled and determined by the pressure of gas and the maximum flow restriction imposed by the valve assembly.

A lateral push type valve assembly is shown in FIGS. 3 and 4. With this type of valve, the user need only bend the external portion of the valve stem laterally to dispense the materials from the can. In FIG. 3, the valve assembly is shown closed as when no materials are dispensed and in FIG. 4, it is shown displaced laterally to dispense the mixture.

In FIGS. 3 and 4, at the open end of the cylinder body 91, a cover 92 is clenched to it by a double seam flange 93. At an aperture in the cover, it clenches to the inner cylinder 94 at seam 95 and this aperture receives the valve assembly. The assembly includes an elongated annular gasket 96 which seals inside cylinder 94.

Rotatably positioned inside the gasket 96 is the discharge tube 97 which has a flared flange 98 providing an abutment for the upper end of the gasket 96. At the lower end of the discharge nozzle is the outer compartment valve consisting of a plurality of ports 99 which open from the inside of the nozzle at the base and seat against the resilient valve seat 101. This valve seat is formed by the lower end of the annular gasket 96 which normally extends to the valve flange 102. When the valve stem is not deflected laterally, but is in the normal position shown in FIG. 3, the ports 99 are flush against the seal 101 and so these ports are closed.

A similarly constructed valve connects to the center body 105 inside the nozzle just below the chamber 104. This valve permits flow from the inner chamber 107. A flexible tubular extension 108 from the center body connects to the inner chamber nozzle 109 which is contained within the second elongated gasket 111. This gasket seals to the inside of the inner cylinder 94 and the upper end of the gasket abuts the flared flange 112 on the nozzle 109. At the other end of the nozzle 109, are the inner ports 113 which are closed by the valve seal 115 formed by the bottom of the flange 111. Thus, in the normal position of the valve assembly shown in FIG. 3, when the discharge tube is not deflected laterally, the ports 99 which provide passage from the outer compartment 105 and the ports 113 which provide passage from the inner compartment 107 are sealed. The ports 99 seal against the resilient seat 101 at the bottom of gasket 96 and the ports 113 seal at the seat 115 at the bottom of resilient gasket 111.

When the discharge tube 97 is deflected laterally as shown in FIG. 4, the gasket 96 is distorted as at 116 and some of the ports 99 are uncovered. The lateral swing of the discharge tube causes a lateral swing of the flange 102 at the inside end of the nozzle and this in turn causes a lateral swing of the nozzle 109 which conducts material from the inner chamber 107. The lateral displacement of the nozzle 109 distorts the flange 111 in a similar fashion and unseats the ports 113 permitting the material from compartment 107 to flow into the nozzle 109. This nozzle leads to passage 121 in the center body located inside the tube 97. The annular space defined between the center body and the cap 120 is the mixing chamber 122. Orifices 123 connect the inside of the center body to the mixing chamber where the materials are mixed and discharged.

The cap 120 is preferably removable from the tube 97 so that it can be taken off the tube and cleaned. For this purpose, the cap threadably connects to the tube.

The piston 125 in FIG. 3 is similar to piston 57 in FIG. 2. It includes two integral portions 126 and 127 joined by structure 128. Skirts 126' and 126'' are included at the edge of the piston portion 126 in the outer compartment. This piston as well as many other parts is a body of revolution about the axis 130 of the can.

A rolling diaphragm seal 131 fits inside the inside cylinder 94 and extends from just beneath the gasket 111 down the length of the cylinder to the portion 127 of the piston. This diaphragm is made of thin flexible material such as polyethylene or rubber and has the gen-

eral shape of a cylinder. The open end extends up into the inner compartment 107 to the top of that compartment and the closed end fits over the piston portion 127. It seals at the top of the compartment and to the top of this piston portion.

The arrangement of seal 131 shown in FIG. 3 is suitable in the case where the material in compartment 107 is under highest back pressure during dispensing due to the effects of viscosity or orifice size and/or where the material in the inner compartment must be sealed from the propellant positively.

The embodiment in FIG. 5 includes within the container body 141 a bellows container 142 and a more or less conventional piston 143. The inner compartment is inside the bellows and the outer compartment 144 is the space between the bellows and the container body. A substantial skirt 145 extending from the edge of the piston effects a seal with the inside of the container body. When the valve assembly 54 is actuated by pressing on the top, the piston moves upward in the can collapsing the bellows 142 and forcing the material contained in the bellows along with the material in the compartment 144 into the mixing chamber in the valve assembly. These materials flow into the mixing chamber in a fixed volumetric ratio, because the reduction in the volume of the bellows and the reduction in the volume of the compartment 144 are in fixed ratio.

The foregoing described several embodiments of the present invention. The best known use of the invention

is an aerosol type can for dispensing two or more materials simultaneously in fixed volumetric ratio. While the invention has been described with reference to these particular embodiments, it will be apparent to those skilled in the art that variations and modifications can be made and that equivalents can be substituted without departing from the principles and spirit of the invention as set forth in the claims.

What is claimed is:

1. In an aerosol can for simultaneously dispensing from separate chambers two different materials which react with one another, a nozzle structure which facilitates removal of the reaction product therefrom, said nozzle structure comprising:

an inner, generally cylindrical part; and
an outer, ferrule-like part, one of said parts being threaded over substantially its entire length with the other having mating threads over only a portion of its length, the remaining portion of said other part being generally cylindrical thereby forming with the threads on the one part a helical passage, there being a pair of ports which are connected to the respective chambers and which open between the thread turns of said one part, said ports being open when said other part is in a first position exposing said ports whereby, when said other part is screwed to a second position, the reaction product is driven out of said helical cavity.

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