An adjustable spray rate actuator for a pressurized dispensing package includes a base member having a passage coupled to the dispensing valve, a transverse upper surface and a plurality of grooves extending radially outward from the passage. A cooperating cap member has a stem which is snap fitted into the passage, a discharge port in the stem, a transverse surface that mates with the transverse surface of the base member, and a discharge orifice aligned with the discharge port. Rotation of the cap member relative to the base member changes the spray rate as a function of the dimensions of the groove aligned with the discharge port and discharge orifice.
ADJUSTABLE SPRAY RATE ACTUATOR

SUMMARY OF INVENTION

This invention relates to pressurized dispensing packages. Pressurized dispensing packages having the capability of dispensing ingredients at more than one user-selected rate are particularly desirable for dispensing certain products such as hair spray. To provide such selectivity without departing substantially from conventional single-spray rate package construction, the package should have a spray selecting system compatible for use with a conventional container and valve assembly. Economical spray selecting systems should also be designed in a minimum of easy to mold and easy to assemble pieces, which nonetheless provide reliable spray rate selection and ingredient dispensing.

An object of this invention is to provide a reliable, durable, easily molded, and readily assembled selectively variable spray system for dispensing ingredients at selected rates from a conventional container and valve assembly.

Another object is to provide a selectively variable spray system which can be fixed at a number of selected spray rates and has easy to read indicating means for the spray rate selected, all in a small number of easily molded parts.

The invention features a variable spray rate actuator for a conventional pressurized dispensing package of the type comprising a container and a tubular valve assembly including a valve opening for dispensing ingredients from the container.

In one aspect of the invention, the variable spray rate actuator comprises a first actuator member and a second actuator member, the second actuator member being secured to the dispensing package for rotation relative to the first actuator member. The first actuator member comprises: first indicator means; stem structure having an axial discharge passage disposed for fluid communication with the valve opening and a radial discharge aperture for passing fluid radially out through the stem structure from its axial discharge passage; and, outer wall structure surrounding and radially spaced from the stem structure which has an orifice substantially aligned with the radial aperture of the stem structure. The second actuator member comprises: second indicator means; spray rate selector structure disposed within the first actuator member between the stem structure and the outer wall structure of the first actuator member, this spray rate selector structure having a plurality of discrete fluid flow channels therethrough adapted to be selectively disposed between said radial aperture and said outlet orifice, each of the channels being constructed to have a different fluid flow rate through it. The flow channels extend radially outwardly from the stem structure of the first actuator member and are circumferentially spaced from one another such that only a selected one of the channels is aligned for fluid communication with the radial aperture at any one time. The first and second indicator means of the actuator members are cooperatively constructed and arranged to indicate the one of the channels which is so selected.

According to one preferred embodiment, the second actuator member has an outer surface designed for friction fit with the container, retards rotation of that member relative to the container, so that the first actuator member may be rotated to achieve spray rate selecting relative rotation of the actuator members.

A preferred second actuator member also has a coupling structure, formed as an integral coaxial extension of the selector structure and which is secured to the tubular valve assembly of the container in a fluid tight seal, further retardation of the second actuator member relative to the container. The second actuator member further has a single axial bore through the selector structure and the coupling structure with the tubular valve assembly being located in one end of the axial bore, and the stem structure of the first actuator member is located in the outer end and abutting the tubular valve assembly. Thus, material discharged from the tubular valve assembly immediately enters the stem structure of the first actuator member. Preferably, this axial bore has a shoulder located at abut an annular protuberance provided on the exterior surface of the stem structure received within he bore, retaining the stem structure within the axial bore in a manner preventing relative axial movement between the two actuator members, and hence also securing the first actuator member to the total package.

In a preferred combination the first actuator member has a first or planar wall closing an end of its stem structure opposite to that communicating with the valve opening, and the radial aperture of the member is at this closed end. The second actuator member of this preferred combination has a second planar surface parallel to and disposed adjacent the aforesaid interior planar surface of the first valve member. The surfaces are biased together to form a fluid tight seal therebetween. The fluid flow channels are then defined by grooves of different cross-sectional area formed in the first surfaces and sealed along their length by the second surface. The surfaces slide relative to one another as the actuator members are rotated relative to one another, to change the identity of the groove aligned with the outlet orifice.

To provide for break-up and mixing of ingredients between the valve opening and the outlet orifice, the flow selector structure of the second actuator member preferably has an outer cylindrical surface, through which each flow channel exits, and which is recessed in the region where each flow channel so exits so as to define a mixing chamber at the recessed region. In particular, each of these recessed regions may also have a rounded protuberance located opposite the outlet orifice, when the respective flow channel is aligned with the outlet orifice, which defines a restrictive flow path in the region of the outlet orifice to provide for swirling and mixing of ingredients between the flow selector structure and the outlet orifice of the package. In addition, another mixing or break-up chamber may be located within the stem structure itself, by closing the axial end of the stem opposite to that in communication with the valve opening, and axially spacing the radial aperture of the stem from its closed end.

To indicate the particular flow channel selected, the first actuator member preferably has exposed indicator tab structure defining the first indicator means, and the second actuator member has exposed dial structure...
defining the second indicator means. The dial structure is located so that the tab structure passes along the dial structure as the actuator members are rotated relative to one another. The dial structure is provided with a plurality of spaced indicia corresponding to the plurality of flow channels through the flow selector structure such that, for any selected flow channel, the tab is located adjacent and thereby points out one of the indicia which corresponds to the flow channel selected.

To assure that the flow channel selected is precisely aligned with the radial aperture out of the stem and the outlet orifice out of the first actuator member, the first actuator member is provided with an exposed tab and the second actuator member with an exposed interlocking surface lying along the arcuate path traced by the tab when the actuator members are rotated relative to one another. The tab and the exposed interlocking surface are mutually constructed to removably interlock at arcuately spaced positions corresponding to the coincidence of one of the selected one of the flow channels with the radial aperture. These positions are located on a circle of which the flow channels define radii and each position is on a common diameter with the corresponding flow channel. The second actuator member may also have an indicator dial located adjacent each of the aforesaid positions indicating the flow channel selected at that position. A preferred interlocking arrangement is in the form of a plurality of axial elongated recesses spaced along the exposed interlocking surface into which removably snap-fits an axially elongated detent located on the inside surface of the tab.

In another aspect, the invention features first and second relatively rotatably actuator members which have interfitting portions constructed to have first and second engaging surfaces, respectively. These surfaces are disposed transverse to the axis of rotation of the members and slidably engage one another along an interface. One of the actuator members has a fluid passage from the valve opening into an inner region of this interface. The second parallel surface (of the second actuator member) is interrupted at spaced intervals by radial grooves, each groove being of different cross-sectional area, and extending from the inner region of the interface out to its outer edge. The first actuator member has a closure arranged to overlie the outer edge of the interface to seal the outer end of each groove, and an outlet orifice through the closure arranged for alignment with a selected one of the grooves upon a correspondingly selective relative rotation of the actuator members. Such grooved flow-controlling surfaces are easily and precisely molded to provide accurate and reliable ingredient dispensing.

Other objects, features and advantages will be apparent to one skilled in the art from the following description of a preferred embodiment of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a perspective view of the upper part of a pressurized dispensing package having secured thereto an actuator collar and an actuator button embodying the present invention;

FIG. 2 is an exploded view of the package of FIG. 1 with the collar and button each partially broken away, and the button rotated forward from the orientation it would have if assembled;

FIG. 3 is a sectional view of the actuator collar and actuator button, with the container broken away, where attached to the collar and button, along the same section as the collar and button;

FIG. 4 is a top view of the actuator collar;

FIG. 5 is an elevational view of the actuator collar;

FIG. 6 is a bottom view, partially broken away, of the actuator collar; and

FIG. 7 is an elevational view, partially broken away, of the actuator button.

DESCRIPTION OF PARTICULAR EMBODIMENT

The figures show the upper portion of a pressurized dispensing package 10 including a container 12 for containing ingredient to be dispensed as well as a suitable propellant in the usual manner. A valve mounting cup 14 is secured to container 12 by crimping its outer periphery about bead 16, as shown in FIG. 3, and has an inner portion 18 through which slidably protrudes tubular valve stem 20. Valve stem 20 is biased, in the usual manner, to a closed position, and is opened to discharge ingredient from the container through the valve opening 22 by axially depressing the stem in towards the interior of the container. When pressure is released, the valve stem automatically returns to the closed position shown in FIGS. 2 and 3.

Actuator collar 30, formed of a resiliently deformable material such as polyethylene has an outer cylindrical wall 31 (about 0.040 inch thick) containing a plurality (72) of spaced serratations 34 (each in the shape of right-angle grooves) on its outside surface, each serration being about 0.012 to 0.015 inch deep. The outer cylindrical wall 32 has an outer diameter of 0.965 inch at its lower edge 36, is inwardly tapered at an angle of 3° to its axis toward its upper edge 38, and is 0.455 inch long between lower edge 36 and upper edge 38, measured parallel to the axis. The upper ledge 40 is tapered at an angle of about 7° to the plane perpendicular to the axis of collar 30, and encloses a generally cylindrical crown 42 (outer diameter 0.403 inch at base—i.e., adjacent ledge 40—and 0.385 inch at top), which is spaced from ledge 40 by groove 43 and which is constructed to accept actuator button 44 (also formed of polyethylene as hereinafter described). Three drain slots 45 extend through the base of groove 43. Collar 30 juts inwardly at a distance 0.300 inch up from edge 36 of surface 32 to define a rear ledge 46, which has the letters “L” (low), “M” (medium) and “H” (high) printed thereon to define an indicator dial. Ledge 46 is tapered at an upward 7° angle to the plane perpendicular to the axis of collar 30 between outer wall 32 and surface 48. Axially elongated recesses 50, 52, 54 each having in the shape of a right-angle groove, protrude to a maximum depth of 0.020 inch into surface 48, and are spaced 60° apart. Stops 56, 58 located at each end of ledge 46 are each parallel to and spaced about 0.075 inch from a radial line drawn through the recesses 50, 54, respectively.

The top wall 60 of crown 42 tapers downwardly and inwardly at an angle of 10° to axial bore 64. An arcuate groove 62 extends downwardly from wall 60. Axial bore 64 (inner diameter 0.121 inch) defines at its transition with axial counterbore 66 (inner diameter 0.155 inch), an annular shoulder 68 which is located about ¼ inch below the plane defined by the outer edge
of top wall 60. Flange 70, which projects inwardly 0.010 inch and has a thickness of 0.032 inch defines a surface 72. The skirt portion of stem 74 below surface 72 defines a bore 76, the inner diameter of which is 0.155 inch for receiving valve stem 20.

The forward face of crown 42 has three U-shaped recesses 78, 80, 82, each 0.130 inch high by 0.055 inch wide by 0.018 to 0.020 inch deep. Each recess is shaped to have its lower wall formed as an arc of a circle of 0.055 inch radius. A rounded protuberance 84 in the form of a portion of a sphere having a radius 0.060 inch, protrudes at most 0.008 to 0.010 inch from the base surface of each recess, and is coaxial with the arc defining the lower wall of each recess. Elongated grooves 86, 88, 90 have a maximum depth and width of 0.010 inch, 0.014 inch and 0.018 inch, respectively, and a curved lower wall lying on the circumference of a circle of radius 0.010 inch, 0.013 inch, and 0.018 inch, respectively.

The axially-elongated recesses 50, 52 and 54 are all located on the circumference of a circle which the three grooves 86, 88 and 90 define radii, and each of the recesses is on a common diameter with one of the channels. Thus, the recess 50 opposite the L position is on a common diameter with the narrow west flow channel 86, the recess 52 opposite the M position is on a common diameter with the medium sized flow channel 88, and the recess 54 opposite the H position is on a common diameter with the largest flow channel 90.

Actuator button 44 has a depending wall 92, the inner surfaces 94 of which has a diameter of 0.385 inch at its closed end and tapers outwardly (at a 3° angle) to a diameter of 0.403 inch at its open end. An outlet orifice 96 extends through the forward side of wall 92 into recess 98 and has a diameter of 0.020 inch, is 0.025 inch long, and is oriented at an upward 10° angle.

Stem 100 is coaxial with wall surface 94, and extends to upper wall 102. When button 44 is assembled with collar 30, wall 102 is parallel to and forms a fluid tight seal against the top wall 60 of crown 42, sealing the grooves 86, 88, 90 along their lengths to define fluid flow channels of different cross-sectional area.

Stem 100 has an outer diameter of 0.121 inch, an inner diameter of 0.052 inch, and a 0.030 inch wide and 0.295 inch long radial aperture or slot 104 opposite discharge orifice 98. The rear wall 106 of stem 100 in inwardly tapered, and a counterbore 108 in button 44 is located in communication with stem 100. Annular rib 110 is 0.036 inch high, about 0.023 inch wide at its widest point, and has its lower edge located 0.310 inch (measured parallel to the axis of stem 100) down from the forward upper corner of wall 92.

Indicator tab 112 has two tapered side walls 116 (tapering from 0.150 inch down to 0.090 inch separation), and a 0.025 inch wide linking portion between the tapered side walls of tab 112 and the annular wall 92. A locking detent 118 is located on the inside wall 120 of tab 112, wall 120 being a total of 0.310 inch from the center axis of actuator button 44 (of stem 100). Locking detent 118 is rounded, having a cross-section, perpendicular to the axis of stem 100, forming one-half of a circle of 0.025 inch radius.

To assemble the actuator assembly, stem 100 of cap 44 is inserted into bore 64. The axially extending slot 104 allows rib 110 to be compressed and slide within bore 64 until it is engaged by latch surface 68. In this position the surface 102 of cap 44 is biased against surface 60 of base 30 in sealing relation and the upper end of slot 104 is sealed by the wall of bore 64 except when that slot is aligned with one of the dispensing grooves 86, 88, 90. The assembly is then positioned on the package by inserting bore 76 of collar stem 74 over valve stem 20 and sliding it along the stem until the upper end of stem 20 abuts shoulder 70. There is a friction fit between bore 76 of collar stem 74 and the outer surface of stem 20 and a similar interference fit between the valve mounting cup 14 and the skirt 32, both interference fits tending to retard rotation of the actuator base relative to the container 12.

In operation, with indicator tab 112 latched in a dispensing position (locking detent 118 engaged with a latching recess 50, 52 or 54), the user, by downward pressure on actuator cap 44 moves that cap, and the valve stem 20 downwardly opening the valve and allowing the material in the container to be discharged up through valve opening 22 into the bore of stem 100. The material flows upwardly against the inclined surface 106 and the mixing chamber above surface 102 and then radially through the upper end of slot 104 and the aligned dispensing passage to a second mixing chamber defined between the outer cylindrical wall 94 of the cap and the corresponding recess 78, 80 or 82. As the rounded protuberance 84 in that recess as closely adjacent outlet orifice 98, a swirling flow pattern is produced which results in further breakup and mixing of the material which is then discharged through the discharge orifice 98 in a dispensing action.

When the user wishes to change the spray rate, he simply rotates the actuator cap 44 relative to the actuator base in the desired direction. Since the actuator cap is formed of a relatively resilient material, the indicator tab 112 deforms to allow the locking detent 118 to release from its engaged latch recess 50, 52 or 54. This relative rotation is facilitated by the serrations 34 on the skirt of the actuator base which may be gripped by the user, and by the tight fit of both the skirt 32 with respect to the valve mounting cup and the fit of depending collar 74 on valve stem 20. When detent 118 of the adjusting tab 112 snaps into the desired latch recess 50, 52 or 54, orifice 98 is aligned with a dispensing groove and similarly the upper end of slot 104 is aligned with that dispensing groove. The dispensing flow rate is determined by the cross-sectional area of the selected dispensing groove, thus enabling ready selection of a series of different flow rates.

Thus it will be seen that the invention provides a simple, compact and easy to use dispensing package having a range of dispensing rates which may be readily selected by the user. While a particular embodiment of the invention has been shown and described, various modifications thereof will be apparent to those skilled in the art. Therefore, it is not intended that the invention be limited to the disclosed embodiment or to details thereof and departures may be made therefrom within the spirit and scope of the invention as defined in the claims.

What is claimed is:
1. In a pressurized dispensing package comprising a container and a tubular valve assembly including a
valve opening for dispensing ingredient from said container, a variable spray rate actuator comprising a first actuator member comprising first indicator means, stem structure having an axial discharge passage disposed for fluid communication at one axial end thereof with said valve opening, and a radial discharge aperture for passing fluid radially out through said stem structure from said axial discharge passage, and outer wall structure surrounding and radially spaced from said stem structure, and having an orifice substantially aligned with said radial aperture, and a second actuator member, secured to said dispensing package for rotation relative to said first actuator member, said second actuator member comprising second indicator means, spray rate selector structure disposed within said first actuator member between said stem structure and said outer wall structure, said selector structure having an inner surface slidably and rotatably engaging portions of said stem structure adjacent said radial aperture, an outer surface adjacent said outer wall structure, and a plurality of discrete fluid flow channels, between said inner surface and said outer surface, each said channel constructed to have a different fluid flow rate therethrough, said channels extending radially outwardly from said stem, being disposed for communication with said radial aperture, and being circumferentially spaced from one another such that only a selected one of said channels is aligned for fluid communication with said radial aperture at any one time, said first and second indicator means being cooperatively constructed and arranged to indicate the one of said channels so selected.

2. The dispensing package of claim 1 wherein said second actuator member is friction-fit to said container against rotation relative thereto, and has a coupling structure formed as an integral coaxial extension of said selector structure secured to said tubular valve assembly in a fluid-tight seal.

3. The dispensing package of claim 2 wherein said second actuator member has an axial passage through said selector structure and said coupling structure, said tubular valve assembly is located in one end of said axial passage and said stem structure is located in the other end of said axial passage secured against axial movement in said passage, with said axial discharge passage in said stem structure aligned with the valve opening of said tubular valve assembly for fluid flow therebetween.

4. The dispensing package of claim 2 wherein said stem structure has an annular rib along the exterior surface thereof and said axial passage has a shoulder located to abut said protuberance to retain said stem structure in said axial passage.

5. The dispensing package of claim 1 wherein said first actuator member has a first planar surface arranged transverse to the axis of said stem structure, and closing the axial end of the stem opposite to the end in fluid communication with said valve opening, the radial aperture of the stem structure being at this closed end, said second valve member has a second generally planar surface, parallel to and disposed adjacent said interior planar surface, said parallel surfaces being biased together to form a slidable fluid-tight seal therebetween, and said fluid flow channels are defined by grooves to different cross-sectional area formed in said first surface and sealed along their length by said second surface.

6. The dispensing package of claim 1 wherein said outer wall structure of said first actuator member is of annular cross-sectional area, said flow selector structure has an outer cylindrical surface sized and located to rotatably and slidably engage said outer wall structure, and said second actuator member has, on said outer cylindrical surface, a recess in the region of each said flow channel to define a mixing chamber between said flow selector structure and said outer wall structure through which ingredient passes between said flow channel and said outlet orifice.

7. The dispensing package of claim 6 wherein said recess is shaped to define a more restricted flow path in the region of said outlet orifice than in the region of said flow channel.

8. The dispensing package of claim 7 wherein said flow channel opens into said mixing chamber at a location axially spaced from said outlet orifice and each said recess has a rounded protuberance located opposite said outlet orifice when the flow channel exiting to said recess is radially aligned with said outlet orifice.

9. The dispensing package of claim 1 wherein said first actuator member has exposed indicator tab structure defining said first indicator means, and said second actuator member has exposed dial structure defining said second indicator means located so that said tab structure passes along said dial structure as said first actuator member and said second actuator member are rotated relatively to one another, said dial structure having a plurality of spaced indicia identifying said plurality of flow channels through said selector structure located along said dial such that for any selected flow channel said tab is adjacent the one of said indicia corresponding to said selected flow channel.

10. The dispensing package of claim 1 wherein said first actuator member has exposed tab structure, and said second actuator member has an exposed interlocking surface lying along the arcuate path traced by said tab structure when said first and second actuator members are rotated relative to one another, and said tab structure and said exposed interlocking surface are mutually constructed to removably interlock at arcuately spaced positions corresponding to the coincidence of one of said flow channels with said radial aperture, said positions being located on a circle of which said flow channels define radii, and each said position being on a common diameter with one of said channels.

11. The dispensing package of claim 10 wherein said exposed interlocking surface is in the form of a portion of a cylinder coaxial with said circle and has a plurality of axially elongated recesses at said positions, and said tab structure has an axially elongated detent sized to removably interlock with the one of said recesses located on a common diameter with the flow channel selected.
12. The dispensing package of claim 10 wherein said second actuator member has exposed indicator dial structure located adjacent and along said exposed interlocking surface, said dial structure including indicia opposite each said interlocking position identifying the flow channel corresponding thereto, and said tab structure includes indicating structure passing along said dial structure with relative rotation of said first and second actuator members and pointing to indicia thereof corresponding to the flow channel selected by said rotation.

13. The dispensing package of claim 1 wherein said stem includes an axially extending slot and said radial discharge aperture is at the upper end of said slot.

14. The dispensing package of claim 1 wherein said axial discharge passage of said stem structure is open at one axial end to said valve opening and closed at its other end, and said radial aperture is axially spaced from said closed end so that a mixing chamber is defined adjacent said closed end.

15. The dispensing package of claim 14 wherein the said cross-sectional area of axial passage opposite said flow channels is smaller than the cross-sectional area of said axial passage at its open end.

16. For use with a pressurized dispensing package comprising a container and a valve assembly including a valve opening for dispensing ingredient from said container, a variable spray rate actuator assembly comprising first and second relatively movable actuator members having interfitting portions, said members having, respectively, first and second engaging surfaces at the respective interfitting portion, said surfaces arranged in parallel with one another, and remaining slidingly engaged with one another along an interface as said members are moved relative to one another, one said actuator member having a fluid passage between said valve opening and a first region of said interface, said engaging surface of the other member being interrupted at spaced intervals by a plurality of grooves, each groove having a different cross-sectional area, said grooves extending from said fluid passage along said interface to the outer edge of said interface, said engaging surfaces defining, with said grooves, a plurality of fluid flow channels from said fluid passage to said outer edge of said interface, said one actuator member including structure defining a closure arranged to overlie said outer edge of said interface to seal the openings of said fluid flow channels at said outer edge, and an outlet orifice through said closure arranged to be aligned with a selected one of said flow channels with a correspondingly selective relative movement of said actuator members to provide fluid flow out of said flow channel to said outlet orifice.

17. The assembly of claim 16 wherein said one actuator member includes stem structure having a discharge passage adapted to be disposed for fluid communication with said valve opening, and a discharge aperture from said discharge passage at said interface, and said other actuator member includes coupling structure defining a passage extending between said interface and said tubular valve assembly, said passage being sized to receive said stem structure and said valve assembly through opposite ends of said passage to locate and secure said stem structure and said valve assembly for said fluid communication.

18. The assembly of claim 17 wherein said stem structure includes an axially extending slot open at one end and said discharge passage is at the closed end of said slot.

19. The assembly of claim 17 wherein said stem structure has a protuberance in its exterior surface and said coupling structure has a shoulder within said passage located to abut said protuberance to retain said stem structure within said coupling structure.

20. The assembly of claim 16 wherein said actuator members are constructed to provide a gap between said outlet orifice and the fluid flow channel aligned therewith thereby to define a mixing region for ingredient passing between said orifice and said channel.

21. The assembly as claimed in claim 16 wherein said other member includes a plurality of recesses, each said recess being disposed at the end of a corresponding groove, so that a mixing region is defined between said outlet orifice and the end of the groove aligned with said outlet orifice.

22. The assembly as claimed in claim 21 wherein said first and second actuator members are coaxially mounted for rotation relative to one another, said engaging surfaces extend generally radially outward from said axis, said grooves are radially oriented, said one actuator member has a cylindrical outer surface and said recesses are formed in said cylindrical outer surface, and said closure defining structure includes a cylindrical surface that mates with said cylindrical outer surface.

23. The assembly as claimed in claim 22 wherein said first and second actuator members further include cooperating releasable latch structure to secure said outlet orifice in alignment with any one of said grooves for selecting a desired spray rate, and indicator means for indicating the selected spray rate.

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