March 3, 1964 G. DE WAYNE MILES 3,123,260

VALVES AND METHOD FOR MASS PRODUCING THEM

Filed Nov. 14, 1958

FIG. 2.

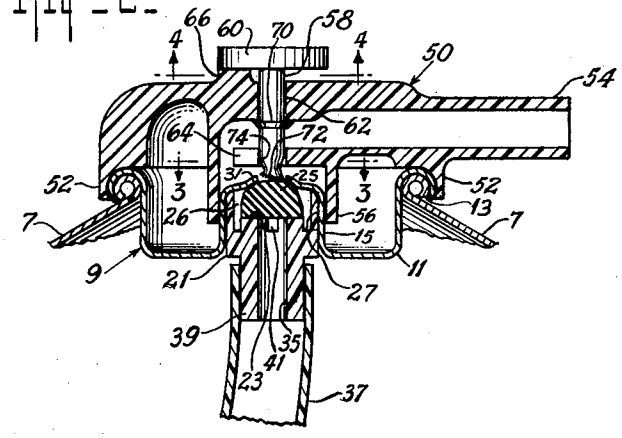


FIG. 4.

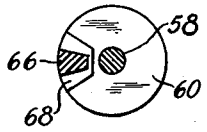


FIG. 3.

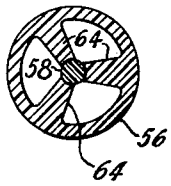


FIG. 7.

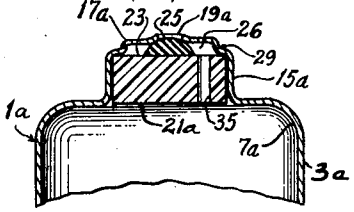


FIG. 1.

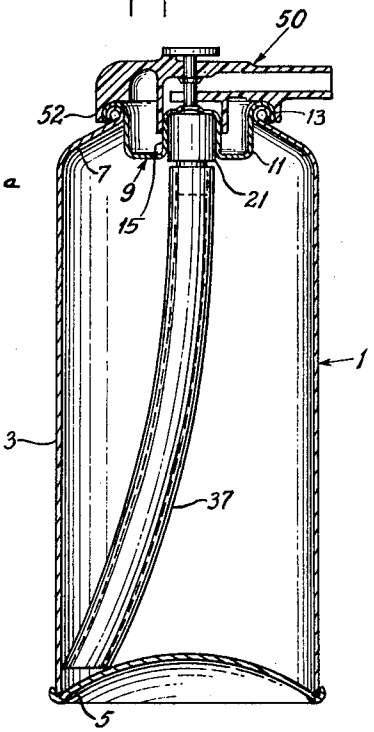


FIG. 5.

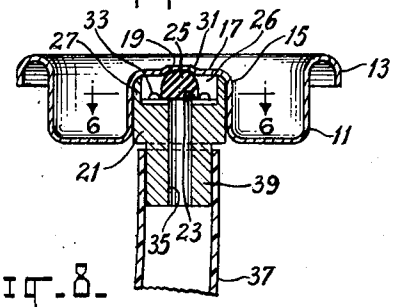


FIG. 8.

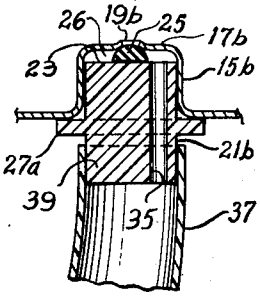
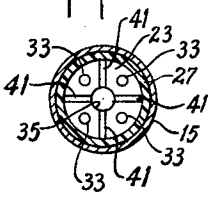


FIG. 6.



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VALVES AND METHOD FOR MASS PRODUCING THEM

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6 Claims. (Cl. 222—394)

The present invention relates to valves for dispensing fluid contents from a container and to a method for mass producing them, and, more particularly, to valves adapted for dispensing materials such as toothpaste, shaving cream and the like, from a container which also is provided with a propellant to force the contents out through the valve.

The structure, operation and advantages of valves of the present invention will be apparent from the following description, taken in conjunction with the drawings in which:

FIG. 1 is a vertical sectional view of a container having a valve of the present invention secured thereto;

FIG. 2 is a fragmentary vertical sectional elevation through the valve;

FIG. 3 is a horizontal sectional view through the dispensing cap associated with the valve on the line 3—3 of FIG. 2;

FIG. 4 is a sectional view through the dispensing cap on the line 4—4 of FIG. 2;

FIG. 5 is a vertical sectional elevation through a different embodiment of valve of the present invention;

FIG. 6 is a horizontal sectional view on the line 6—6 of FIG. 5;

FIG. 7 is a fragmentary vertical sectional view through a different type of container provided with a further embodiment of valve of the present invention; and

FIG. 8 is a fragmentary vertical sectional view through a still further embodiment of valve of the present invention.

Referring now to FIG. 1 of the drawing, a container 1, suitable for holding fluid products such as shaving cream, toothpaste, and the like, and a propellant such as any of the conventionally used lower hydrocarbons, halogenated lower hydrocarbons, nitrogen, compressed air, and the like, comprises a cylindrical wall 3, a domed bottom 5 crimped to the lower edge thereof and a necked in top wall 7 terminating in a circular bead to which a valve assembly 9 is secured. This structure is well known to those skilled in the art and forms no part of the present invention except as one of many possible types of containers with which valves of the present invention may be used in fabricating a finished package.

The valve assembly 9 illustrated in FIGS. 1, 2 and 5 comprises a valve cup 11 having a rim 13 crimped, or adapted to be crimped, to the bead surrounding the opening in the top wall 7 of the container 1.

Instead of mounting the valve parts in a mounting cup to provide a valve assembly as a separate unit to be crimped or otherwise secured to a separately formed container, they may be mounted in the container itself as illustrated in FIG. 7 in which the container 1*a* is of a type formed by impact extrusion with the parts corresponding to the valve cup 11 formed integral with the cylindrical wall 3*a* and top wall 7*a*. In this modified form of container, a bottom wall (not shown) may be secured thereto, after the valve parts are in place, in any satisfactory way, e.g., any of the ways conventionally used for fastening bottom walls to such containers.

In either case an upwardly extending tube 15, 15*a* or 15*b* is formed in the top closure for the container, as shown in FIGS. 1, 2, 5, 7 and 8, whether this top closure is a separate valve cup or the integral top wall of the container. This tube preferably is formed as an integral part

of the sheet metal of the valve cup as it is deep drawn in suitable dies or as an integral part of the corresponding sheet metal of the top wall of the container as it is formed in a suitable die in the impact extrusion of the container 1*a*, but it may be a separately formed sheet metal tube which is soldered, brazed, welded or otherwise connected in fluid-tight relationship with the valve cup or container top. While it is not essential, it is preferred that this tube be cylindrical in cross-section. This upwardly extending tube has an open bottom and a top wall 17, 17*a* or 17*b* provided with a dispensing opening 19, 19*a* or 19*b*. The wall surrounding the opening constitutes a valve seat.

A valve body 21, 21*a* or 21*b* is provided in the lower part of the tube 15, 15*a* or 15*b* to form a supporting surface 23 for a deformable rubber-like body 25 which serves by its own resiliency or elasticity to close the dispensing opening in the top wall of the tube.

The valve body may be made of any suitable material but it is preferred to die-mold it of plastic, such as nylon and the like, which has the property of deforming slightly under high stress and also, by reason of its inherent resiliency, of conforming to the shape of the body exerting compressive stress upon it. This is of considerable importance in the modifications shown in FIGS. 1, 2, 5 and 8 in which a dip tube is employed since the joint between the interior surface of the tube and the valve body should be gas-tight. By properly correlating the interior diameter of the tube and the exterior diameter of the valve body, the latter may be given a press fit within the former by automatic machinery to provide a very satisfactory gas-tight joint which permanently holds the valve body by friction with the tube.

In the form of the invention illustrated in FIG. 7, a gas-tight fit between the valve body 21*a* and the tube 15*a* is not essential and instead of using the friction of a press fit to hold it in place, any other suitable means for holding the valve body 21*a* in place within the tube, such as crimping of the wall of the tube into the body 21*a*, and the like, may be satisfactorily employed.

The rubber-like body 25 may be made of any suitable material including natural rubber, synthetic rubbers such as chloroprene polymers (e.g., neoprene) and copolymers of butadiene and acrylonitrile (e.g., buna N), elastomeric vinyl compounds, and the like. It is preferably circular in cross-section and of generally diminishing diameter from the bottom to the top. The upper end should be rounded to form a gas-tight fit with the rim of the dispensing opening 19, 19*a* or 19*b*. The body 25 may have a short cylindrical section at the bottom then a conical section and then a hemispheric top surface as illustrated in FIG. 2. A somewhat different form is illustrated in FIG. 5 in which the body 25 is conical with a rounded upper end. Similarly, a hemispherical or lesser segment of a sphere may be satisfactorily employed as illustrated in FIGS. 7 and 8.

A rubber-like body having a generally diminishing diameter in cross-section from bottom to top, of the types illustrated in FIGS. 2, 5, 7 and 8, has the advantage that it can be molded in a cavity having no seams or sprues to leave a flash or sprue at any place thereon where it would interfere with the formation of a gas-tight contact against the valve seat surrounding the dispensing opening 19, 19*a* or 19*b*. This advantage cannot be had with a body of spherical shape.

Any valve which can be successfully employed in widespread commercial use must lend itself to mass production on automatic machinery. The valve cup 11, the container 1*a*, the valve bodies 21, 21*a* and 21*b*, and the rubber-like bodies 25 of the present invention all lend themselves admirably for mass production. In this mass production,

the parts are formed in succession in dies and/or molds so that they have uniformity of dimension within very close tolerances. In assemblying the parts, however, it is essential that the height of the chamber 26 between the top wall and the supporting surface 23 be uniform from valve to valve, i.e., that there be a fixed distance from the under surface of the top wall 17, 17*a*, or 17*b* to the supporting surface 23 from valve to valve. Where this distance is uniform from valve to valve, the rubber-like bodies 25, each of which has a normal height greater than the height of the chamber 26, will be deformed a uniform amount from valve to valve so as to resiliently close dispensing opening 19, 19*a* or 19*b* with no, or substantially no, leakers and yet without being under such great stress as to make opening difficult.

In accordance with the present invention, means are provided to assure a uniform height of the chamber 26 under the conditions met in mass production.

In the forms of the invention illustrated in FIGS. 2 and 5, the valve body 21 is provided with an upstanding flange 27 at the periphery surrounding the surface 23. When the valve body with a deformable rubber-like body properly positioned thereon is forced into place by the automatic machinery which forms the press fit between the valve body and the tube 15 or 15*a*, the upper edge of the flange 27 engages the underside of the top wall 17 and thereby assures uniform height in the chamber 26 or, in other words, a uniform distance from the rim of the dispensing opening to the supporting surface 23.

In the embodiment of the invention illustrated in FIG. 7, a shoulder 29 is formed during the impact extrusion operation on the cylinder 15*a* which provides a stop means for the valve body 21*a* as it is forced into the tube 15*a* which likewise assures uniformity of distance between the rim of the dispensing opening 19*a* and the supporting surface 23.

In the embodiment shown in FIG. 8, which may be employed either with a drawn valve cup or an impact extruded container, the valve body 21*b* has a lateral projection 27*a* which, when the body is forced into place in the tube 15*b*, engages the lower end of the tube, thereby assuring uniform height of the chamber 26 and proper compression of the rubber-like body 25 to close the dispensing opening 19*b*.

In order to facilitate mass production, means should be provided to center the rubber-like body 25 with reference to the outlet 19, 19*a* or 19*b*. One means for accomplishing this objective is to form the rim of the outlet somewhat funnel-shaped by bending up the wall around the dispensing opening as shown at 31 in FIGS. 2 and 5. Another means for accomplishing the same objective is to provide centering projections 33 on the surface 23 as illustrated in FIGS. 5 and 6. These expedients may be used either singly or in combination.

The chamber 26 is connected to the interior of the container by a passageway 35. This passageway may communicate directly between them, as in FIG. 7, where the container is tipped upside down for dispensing, or it may communicate through a dip tube 37, as illustrated in FIGS. 1, 2, 5 and 8, where the can is used in generally upright or somewhat tilted position for dispensing the product. Where a dip tube is used, some means, e.g., a projection 39, is provided to secure the dip tube to the valve body.

The passageway 35 may communicate immediately with the chamber 26 at the side of the deformable rubber-like body 25 as illustrated in FIGS. 7 and 8 or, if it is more convenient to have the passageway more centrally located, the surface 23 may have one or more channels 41 formed therein leading from the passageway 35 to the chamber 26.

In carrying out the method of mass producing valves in accordance with the present invention there is formed a succession of die-shaped metal tubes, preferably mounting cups, each having an apertured top wall and a lateral wall extending outwardly from the lower end thereof. A succession of valve bodies adapted to fit in said tubes, preferably in the form of cylindrical valve bodies adapted to form a press fit in the tube or cylinder, is die-molded to have the structure described above. A succession of rubber-like bodies is molded in a seamless cavity of diminishing cross-section from the mouth to the bottom and of proper dimensions relative to the other parts as described above. The parts are then assembled into a succession of valve assemblies by assembling in each valve assembly in succession one of said rubber-like bodies on the supporting surface of one of the valve bodies, inserting the valve body into the tube or cylinder until the stop means are engaged, thereby limiting the inward movement of the valve body into the tube to space the supporting surface a substantially uniform distance from the top walls of the tubes or cylinders in each successive valve assembly and placing the rubber-like bodies under substantially uniform compression from valve to valve with the small end up and closing the aperture in the top wall, and securing the valve body in the tube, preferably by press fitting.

Any suitable means may be employed for deforming the rubber-like body 25 sufficiently to open a dispensing passageway between the chamber 26 and the atmosphere. One suitable means as illustrated in FIGS. 1 and 2 in the form of a molded elastomeric plastic dispensing cap 50 having a flange 52 engaging the rim 13 of the valve cup. Preferably the interior surface of the flange is slightly undercut so as to grip under the rim 13 and thereby assure the holding of the cap 50 in sufficiently tight relationship to the container for satisfactory operation. The cap 50 is provided with a dispensing spout 54 of any suitable length and shape. The spout 54 communicates with a delivery tube 56 which tightly surrounds the tube 15 and forms a fluid-tight joint therewith so that the product issuing from the dispensing opening 19 all flows out of the dispensing spout 54.

A push rod 58 having a head 60 is slidably mounted for axial movement in a push rod passage 62 in the upper surface of the dispensing cap 50. Guide projections 64 are formed in the delivery tube 56, as shown best in FIG. 3, loosely to engage the push rod 58 adjacent to its lower end and thereby guide it properly into the dispensing opening 19.

The elastomeric material from which the cap 50 is molded is preferably a polyethylene which yields sufficiently to permit the flange 52 with its slight undercut to be withdrawn from the mold to permit a push rod 58 provided with a stop shoulder 70 in the form of a truncated cone to be pushed through the push rod passage 62. The stop shoulder 70 thereafter limits outward motion of the push rod 58 at the proper place.

In order to prevent inward movement of the push rod 58 during shipping and handling of the filled containers, the dispensing cap 50 preferably is provided with a stop or projection 66 on the upper surface directly under the head 60. The projection 66 is of such height as just to engage the under surface of the head 60 when the stop shoulder 70 engages the under surface of the top of the cap surrounding the push rod passage 62 as illustrated in FIG. 2. The head 60 is provided with a sufficiently deep recess 68 on its under surface for a minor sector of its circumference, as illustrated in FIG. 4, so that when it is aligned with stop 66, the push rod may be moved inwardly far enough to open the valve to the desired discharge aperture. At any other position of the head 60 with respect to the projection 66, the push rod 58 is locked against inward movement to open the valve.

A preferred shape for the lower end of the push rod 58 is illustrated in FIG. 2. It will be seen that the diameter of the dispensing opening is substantially the same as the diameter of the push rod 58. This is desirable since the operation of the valve is facilitated if the area of the push rod is a substantial fraction of the diameter of the body 25. It is advantageous to bevel the end of the push rod

as shown at 72 in FIG. 2 since the application of relatively light pressure on the head 60 deforms only a portion of the body 25 and opens a small dispensing passage at one side, whereas the application of greater pressure on the head 60 moves the push rod 58 inwardly further to deform the body 25 and open a relatively much larger dispensing passage around the entire periphery of the body 25. Just above the beveled end, the push rod 58 preferably has a neck 74 of reduced diameter to provide a sufficiently large dispensing passage between the push rod and the dispensing opening 19 to pass without substantial restriction all of the material flowing between the body 25 and the rim of the dispensing opening 19.

When pressure on the head 60 is released, the body 25 returns to the shape it possessed before the push rod 58 was depressed, thereby reclosing the dispensing opening and returning the push rod to its starting position. If desired, a spring (not shown) may be used to return, or assist in returning, push rod 58 to its starting position, e.g., a helical spring around rod 58 between head 60 and cap 50.

The term "sheet metal" is used herein to embrace metal which has been worked by one or more operations such as rolling, extrustion, drawing, and the like from pieces of relatively heavy section into pieces of relatively thin gauge such as used in conventional valve cups and extruded aerosol containers.

Although the invention has been described and illustrated by reference to certain specific embodiments of the invention representing the best mode contemplated for carrying out the invention, those skilled in the art will appreciate that modifications and variations in structure and materials of construction may be made without departing from the invention as defined in the claims hereof.

Having thus described the invention, what is claimed is:

1. A valve for affixation to a pressurized container for dispensing fluid contents when desired comprising an upwardly extending tubular member having an open bottom and a top with a wall provided with a dispensing opening, support means inserted into said tubular member through said open bottom and having an upper supporting surface, stop means to limit the inward movement of said support means to space the supporting surface thereof a desired fixed distance from said top wall during assembly of the valve independent of permanently sealing ths support means in place in the tube at said fixed distance from the interior of the top wall, means separate from said stop means permanently holding said support means fixed in said tube with said supporting surface spaced said fixed distance from said top wall to provide a chamber of predetermined fixed height, a passageway for connecting said chamber to the interior of the container, and a deformable resilient rubber-like body having a normal height greater than the height of said chamber, positioned in the chamber under compressive stress between the supporting surface of said support means and the top wall of the tubular member, so that it resiliently closes said dispensing opening, and controllably opens it in response to an external force directed through the dispensing opening and against the resilient rubber-like body.

2. A valve assembly for affixation to a pressurized container for dispensing fluid contents when desired comprising a sheet metal top closure for said container, an upwardly extending tubular member on said top closure having an open bottom and a top with a wall provided with a dispensing opening, a molded plastic valve body conforming substantially to the inner cross-sectional dimensions of said tubular member inserted therein through said open bottom and having an upper supporting surface, stop means to limit the inward movement of said valve body into said tubular member to space said upper supporting surface a fixed distance from the top wall of said tubular member during assembly of the valve independent of permanently sealing the support means in place in the tube at said fixed distance from the interior of the top wall, means separate from said stop means permanently holding said valve body fixed in said tubular member with said supporting surface spaced said fixed distance from said top wall to provide a chamber of predetermined fixed height, and a deformable resilient rubber-like body having a normal height greater than the height of said chamber, positioned in the chamber under compressive stress between the supporting surface of said valve body and the top wall of the tubular member, so that it resiliently closes said dispensing opening and controllably opens it in response to an external force directed through the dispensing opening and against the resilient rubber-like body.

3. A valve assembly for affixation to a pressurized container for dispensing fluid contents when desired, comprising a sheet metal mounting cup, an upwardly extending sheet metal cylinder on said cup open at the bottom and closed at the top by a wall having a funnel shape around a dispensing opening therein, a molded plastic cylinder having an upper supporting surface, stop means on said cylinder cooperating to space said upper supporting surface a fixed distance from said top wall during assembly of the valve independent of permanently sealing the cylinder in place in said sheet metal cylinder at said fixed distance from the interior of the top wall to provide a chamber, said molded plastic cylinder being held in position by frictional engagement with said sheet metal cylinder, a dip tube, said dip tube connected to said molded plastic cylinder, a passageway in said plastic cylinder connecting said dip tube to said chamber and a deformable, resilient rubber-like body having a normal height greater than the height of said chamber, positioned in the chamber under compressive stress between the upper supporting surface of said molded plastic cylinder and the top wall of said sheet metal cylinder, so that it resiliently closes said dispensing opening and controllably opens it in response to an external force directed through the dispensing opening and against the resilient rubber-like body.

4. A valve for affixation to a pressurized dispensing container for dispensing fluid contents when desired, comprising a top closure, an upwardly extending die-formed tubular member on said top closure having an open bottom and a top wall provided with a dispensing opening, a molded plastic valve body inserted into the tubular member through said open bottom and having an upper supporting surface, a molded resilient rubber-like body having a hemispherical upper end free from flash and sprue positioned under compressive stress between said supporting surface and said top wall for resiliently closing said dispensing opening, stop means to limit the inward movement of said valve body into the tubular member for positively spacing said supporting surface a desired fixed distance from said top wall during assembly of the valve independent of permanently sealing the support means in place in the tube at said fixed distance from the interior of the top wall, means separate from said stop means permanently holding said valve body at said fixed distance in said tubular member, said distance being less than the normal height of said resilient rubber-like body, whereby said compressive stress is related to the said fixed distance and the normal molded height of said rubber-like body, so that it resiliently closes said dispensing opening and controllably opens it in response to an external force directed through a push rod having a tapered end and which is slidably mounted for axial movement in a molded plastic cap which is removably secured to said top closure, thereby deforming said rubber-like body by application of force upon the upper end of said push rod to provide a dispensing passage.

5. A valve for affixation to a pressurized dispensing container for dispensing fluid contents when desired, comprising a top closure having a funnel-shaped valve seat surrounding a dispensing opening, a supporting surface positioned a fixed distance below said valve seat during assembly of the valve independent of permanently seal-

ing the supporting surface in place said fixed distance below said valve seat, a resilient rubber-like body, said fixed distance being less than the normal height of said rubber-like body, whereby said rubber-like body is maintained under compressive stress between said surface and said valve seat for closing said opening, means including a push rod operating through said dispensing opening for deforming said body to open a dispensing passageway between the body and the seat in response to an external force directed through said dispensing opening and against the resilient rubber-like body, said push rod having a tapered end for engaging said body.

6. A method of mass producing valves comprising forming a succession of die-shaped metal tubes each having an apertured top wall and a lateral wall extending outwardly from the lower end thereof, die-molding a succession of valve bodies adapted to fit in said tubes, each of said valve bodies having an upper supporting surface and a passageway from said surface through said body, molding a succession of resilient rubber-like bodies in a seamless cavity of diminishing cross-section from the mouth to the bottom, assembling in succession one of said rubber-like bodies on the supporting surface of each of said valve bodies, inserting and securing in succession one of said valve bodies with the rubber-like body thereon into each of said tubes to a predetermined point beyond which movement of the valve body is positively prevented by means which space said supporting surface at a substantially uniform fixed distance from the top walls of said tubes during assembly independent of permanently sealing the valve body in place in said tubes at said fixed distance from the top walls so that the rubber-like bodies are compressed substantially uniformly therebetween when closing said apertures, said fixed distance being less than the normal height of each of said rubber-like bodies, whereby each said rubber-like body is maintained in compression between its associated apertured top wall and its supporting surface.

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