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(54) METHOD OF PRODUCING A VALVE CUP FOR A PRESSURISED AEROSOL DISPENSER

(71) We, THE RISDON MANUFACTURING COMPANY, a corporation organized and existing under the laws of the State of Connecticut, United States of America, of Risdon Way, Naugatuck, Connecticut, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:–

The present invention relates to a method of producing a valve cup which is mountable on the container body of an aerosol container.

Aerosol containers are commonly used to store fluid consumer products for later use in the home. When use is desired, the product is forced from the container through a dispenser valve by a compressed propellant such as compressed nitrogen, air, or Freon. "Freon" is a Registered Trade Mark.

If chemically inert with respect to the product and if not harmful to the environment or to people who might be exposed to it, the propellant may be directly introduced into a conventional container construction with the product. However, aerosol container constructions generally known as "barrier" or "piston" packages have been developed which separate the propellant from the product and prevent escape of the propellant into the atmosphere.

The method of the present invention may be adapted equally well to either the conventional or barrier or piston aerosol container constructions. Accordingly, as used in this specification and claims, the term "aerosol container" is intended to mean any container or package which stores a fluid product and which utilizes, a propellant, compressed in the container, to dispense the product from it.

Many different designs for aerosol containers are presently known. Most commonly available commercial designs include a metal container body, capable of withstanding high pressures, that defines a product receiving chamber and has an open container mouth. A metal valve ferrule or cup, which houses a dispenser valve, is installed in the container mouth by crimping a lip of the ferrule to the margin of the mouth to form an upstanding annular rim. The ferrule then closes the container body to enclose the produce receiving chamber and is a convenient means by which the dispenser valve can be mounted on the container.

This container assembly process utilizes relatively complex multichuck crimping machinery that must be able to crimp the ferrule to the container body tightly enough to withstand high aerosol propellant pressures, with a substantial margin of safety. Ordinarily, a heavy rubber sealant is required to prevent leakage. If an unsatisfactory seal is made, the container must be rejected.

Other aerosol container constructions include container bodies and valve cups which are moulded from plastics materials. Plastics components may be moulded in relatively complex shapes not easily made with metal by cold or hot metal working techniques. Therefore, plastics containers may be more economically produced with fewer, more easily assembled components than similar metal containers.

Still other aerosol container constructions utilize both metal and plastics parts. For example, U.S. Patent No. 3 746 218 (Risdon et al.) discloses a conventional metal container body having a mouth formed with an annular bead about its periphery. A mating lock ring is

installed on this bead and has a tapered annular surface that mates with a similar tapered annular surface on a valve-housing plug. The taper of the plug surface is less than the taper of the lock ring surface so that the lower portion of the plug surface can bear tightly against the lower portion of the lock ring surface to, in turn, force the lock ring tightly against the bead.

The aerosol container construction disclosed in U.S. Patent No. 3 746 218 obviously includes an added component, namely the lock ring. Therefore, production costs are greater than those for simpler container constructions.

U.S. Patent No. 3 270 924 (Kitabayashi) also discloses a container having metal and plastics parts. The container body has a conventional mouth rimmed by an annular bead. A plastics disc having a depending annular wall is inserted in this mouth with the annular wall in sealing engagement with the bead. Internal pressure forces the wall against the bead.

Plastics aerosol container components, used in either all plastics or metal and plastics aerosol containers such as those described above, are usually produced in conventional moulding apparatus having opposing die members that define a mould cavity configured to the shape of the component. The die members are separable along a parting plane located so that the component can be easily stripped from the cavity. However, components made with such apparatus often have parting line protrusions that form when plastics component forming material enters small cracks which remain between the mated die members at the parting plane. If formed on a component sealing surface, the parting line protrusions often prevent formation of a product or propellant-tight seal and, therefore, can result in undesirable leakage of either the product or aerosol propellant.

Moulded container components may be machined or otherwise finished to remove parting line protrusions and improve their sealing characteristics, but an extra step and its associated cost are undesirably added to the container producing process.

Other moulding techniques are disclosed in U.S. Patents Nos. 3 325 576 (Kessler) and 3 006 030 (Paull). However, neither of these patents disclose a technique for producing aerosol containers or container components.

The present invention provides a method of producing a valve cup which is mountable on the container body of an aerosol container, the container body defining a product receiving chamber having an open container mouth and being formed with a conical sealing surface about the mouth inclined upwardly and outwardly of the product receiving chamber and catch means associated with the mouth, the valve cup being formed with a skirt having a conical sealing surface shaped and sized to mate with the conical container body sealing surface and latch means for engaging the catch means, the said method comprising:

A . . providing a one-piece mould member which defines a single mould cavity configured at least to the external shape of the mating conical sealing valve cup surface,

B . . providing a mandrel member which co-operates with the mould member and is configured to define the internal shape of the valve cup,

C . . introducing valve cup forming material between the co-operating mould and mandrel members,

D . . curing the valve cup forming material,

E . . removing the mandrel member from the valve cup, and

F . . stripping the cured valve cup from the mould member by pushing it axially out of the mould member.

In a preferred embodiment, to be described below in detail, an aerosol container includes a container body and a plastics valve cup, mounted in the container body, which is produced without parting line protrusions on any of its sealing surfaces. Therefore, machining or other sealing surface finishing steps are not required to produce a container body-valve cup assembly seal which is product and propellant-tight.

The container body, which may be made from metal or plastics, defines a product receiving chamber having an open mouth. Further, the container body is formed with a conical sealing surface about the mouth inclined upwardly and outwardly from the product receiving chamber, and a catch surface associated with the mouth.

The plastics valve cup, which is mounted directly in the container body mouth, houses a dispensing valve and is formed with a dispenser valve mounting portion and a skirt which depends from the valve mounting portion. The skirt is moulded with a conical sealing surface shaped and sized to mate with the conical container body sealing surface. A latch surface is associated with the skirt and engages the catch surface when the valve cup and container body are assembled to mate the respective sealing surfaces together. In this way, the valve cup is retained in the container body mouth against the pressure of the compressed propellant.

The valve cup is produced without parting line protrusions on the sealing surface, in a one-piece mould member which defines a single mould cavity configured to the external shape, and primarily the conical sealing surface, of the cup. The internal shape of the cup is defined by a mandrel or core member which co-operates with the mould member.

Moreover, the valve cup is shaped to be axially pushed from the cavity and stripped from the mould member after it has been cured. In particular, the natural elasticity and resilience of the plastics material from which the valve

cup is made permits the skirt to be slightly radially collapsed to release the cup by a camming action between the mould cavity walls and the conical sealing surface.

The shape of the mating component sealing surfaces also facilitates assembly of the aerosol contained by pressing the valve cup directly into the container body mount until the latch and catch surfaces snap together.

Accordingly, there may be obtained an economically manufactured and easily assembled aerosol container which has a substantially leak-proof seal between its container body and valve cup. Further, there may be produced such aerosol containers having valve cups moulded without parting line protrusions that, therefore, do not require sealing surface finishing subsequent to the cup formation process, or sealants. However, an easily applied thin sealant could be used.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view of one embodiment of an aerosol container, a valve cup-dispenser valve assembly being shown prior to being directly mounted in the container body;

Figure 2 is an enlarged vertical cross-sectional view of the upper portion of the assembled aerosol container

Figure 3 is an enlarged vertical cross-sectional view of the upper portion of the aerosol container illustrating the valve cup being installed in the container body mouth;

Figure 4 is an enlarged vertical cross-sectional view of the dispenser valve shown in its open position;

Figure 5 is a vertical cross-sectional view of suitable moulding apparatus for producing the valve cup;

Figure 6 is a vertical cross-sectional view of the apparatus of Figure 5 and showing the moulded valve cup being stripped from the one-piece mould;

Figure 7 is an enlarged vertical cross-sectional view of the upper portion of a second embodiment of an aerosol container; and

Figure 8 is an enlarged vertical cross-sectional view of the upper portion of a third embodiment of an aerosol container.

As shown in Figure 1, an aerosol container, generally indicated at 10, includes a container body 12, a valve cup 14 adapted to be mounted in the container body, and a dispenser valve 16 mounted in the valve cup. Dispenser valve 16 may be of the tilt type, as shown in the drawings, that is used to dispense products such as shaving cream or whipped cream. However, it may be equipped with any other type of valve to dispense a wide variety of fluid products, such as window or all purpose cleaners, glue, caulking compounds in a spray, a stream or in other desired manners.

The container body 12 has a generally right cylindrical central portion 18, a flat or concave bottom (not shown) and a frustoconical top 20. If the body 12 is made of metal, it can be formed and assembled in any conventional manner. If it is made of plastics, the top 20 and central portion 18 may be injection or blow moulded and the bottom may be attached by, for example, ultrasonic or heat welding. In the case of either metal or plastics construction, the container must be capable of withstanding high pressures of the compressed propellant which may exceed 100 psi.

The container body 12 further defines a product receiving chamber 22 which holds the stored product as well as compressed aerosol propellant. A container mouth 24 opens at the top of the frustoconical container top 20 from the product receiving chamber.

A frustoconical sealing surface 26 is formed about the mouth 24 and is inclined upwardly and outwardly from product receiving chamber 22. It has been found that an angle of inclination between 10° and 20° with the vertical axis A of the container is preferable. As will be described in greater detail below, the sealing surface 26 is the primary area of contact between the container body 12 and valve cup 14 when the two are assembled. Accordingly, it is highly desirable to make a reliable product and propellant-tight seal between these surfaces in an economical and easily achieved manner.

As shown in Figure 2, the container body 12 also has a planar, annular catch surface in the form of a shoulder 28 which is generally perpendicular to the container axis A. This catch surface 28 co-operates with a mating latch surface, described in greater detail below, formed on the valve cup 14 to lock the cup and container body firmly together against the outwardly directed pressure of the compressed propellant.

Valve cup 14 has a frustoconical dispenser valve mounting portion 30 and a generally cylindrical skirt 32 which depends therefrom. The valve mounting portion may have another shape if desired to accommodate various types of valves. The outer side wall of the skirt 32 is moulded with a frustoconical sealing surface 34 which is upwardly and outwardly inclined from the product receiving chamber to firmly mate with the conical container body surface 26. In particular, it is desirable that the conical container body and valve cup sealing surfaces have substantially equal vertex angles, and that the valve cup sealing surface has a slightly larger diameter than does the container body sealing surface. These dimensional characteristics ensure that a product and propellant-tight seal is formed between the cup 14 and body 12.

Valve cup skirt 32 is also formed with an annular rabbet 36 on its outer cylindrical wall at the lower margin of the sealing surface 34. Rabbet 36 defines a planar, radially outwardly directed latch surface 38 which is generally

perpendicular to the axis A of the valve cup 14 and engages the container body catch surface 28 when the valve cup 14 is installed in the container body mouth 24. The mating latch and catch surfaces retain the valve cup in the container body against the pressure of the compressed propellant, indicated by arrows P. Moreover, this internal pressure serves to augment the seal formed between the respective conical sealing surfaces by forcing the valve cup skirt 32 outwardly against the container mouth 24.

Further, both the valve cup and container body sealing surfaces have small mating cylindrical portions 43 and 45 which lend added strength to the interconnection of the cup and body by decreasing any shear weakness which might be present at the rabbet vertex.

A cam surface 40 is formed at the lower margin of the skirt 32 and facilitates assembly of the valve cup 14 and container body 12.

Referring to Figure 3, the container is assembled by pressing the valve cup downwardly into the container body mouth 24, camming the cam surface 40 inwardly against the container body sealing surface 26 and further collapsing the valve cup skirt 32 radially inwardly as indicated by arrows B. An inverted V-shaped groove 41 may be formed in the container body 14 underlying the sealing surface 26 to aid outward flexing of the body. When the valve cup 14 has been completely inserted into the container body 12 as permitted by the mating conical surfaces, the latch surface 38 overtravels the catch surface 28 and the skirt snaps radially outward to engage the latch and catch surfaces 28 and 38 and tightly mate the respective conical sealing surfaces 26 and 34. Therefore, assembly may be completed without specialized metal crimping or forming tools.

The valve mounting portion 30 of the valve cup 14 terminates in a valve mounting aperture 42 which receives the dispenser valve 16 that, as noted, may be of the tilt type. This valve includes a flexible, outer sleeve 44 which has a flared gasket flange 46 formed to sealingly mate with the inner surface of the valve cup 14. An annular retaining rib 48 co-operates with the gasket flange 46 to tightly hold the sleeve 44 in the valve cup 14 and has an upwardly and inwardly tapered surface 50 which permits the sleeve 44 to be pressed upwardly into the valve cup 14 to complete their assembly. This sealing configuration may be modified to accommodate other valve constructions.

A valve member 52, having a mushroom shaped foot, and an A-shaped head 56, is mounted in the sleeve 44 and is movable between a closed position (Figure 2) and a tilted, open position (Figure 4). When open, fluid may pass through at least one of a plurality of radially directed outlet conduits 58 into an axial outlet passage 60 in the valve member 52 to be dispensed from the container in a conventional manner.

The valve cup sealing surface 34 is formed without parting lines or other protrusions which might otherwise result in leakage because of the high propellant pressures contained in the container. The inner surface of the valve cup valve mounting portion, which mates with the valve sleeve flange 46, is also formed without parting lines. Moreover, these smooth, protrusionless sealing surfaces are made without any special machining steps.

A one-piece mould is configured to the external shape of the valve cup sealing surface using a technique made possible by this external shape which permits the cup to be stripped from a mould that is not separable along an axial plane. Figure 5 illustrates such an apparatus which includes a main one-piece mould member 70 and a knock-out insert 71 that define a single mould cavity 72 configured to the external shape of the valve cup 14. The main mould member defines the entire conical valve cup sealing surface 34. A central one-piece mandrel or core member 74 is formed to co-operate with the main mould member 70 and is configured to define the internal shape of the valve cup 14. A plastic moulding material injection passage 76 is provided in the mould member 70. Accordingly, when the mandrel and mould members are mated together as shown in Figure 5, a valve cup may be produced by injecting plastics moulding material through the passage 76 to fill the cavity 72. Venting is provided by the sliding fit of the core member and knock-out insert. The cup is then cured in the moulding apparatus.

As shown in Figure 6, after the plastics moulding material has cured, the core member 74 is axially withdrawn downwardly from the mould member 70 as shown by arrow C. The finished valve cup 14 is then pushed axially downward from the mould member 70 by the knock-out insert 71, as shown by arrows D, to strip it from the mould cavity. Since the plastics moulding material is resilient and deformable, and since the sealing surface is slightly frustoconical making an angle of 10° to 20° with the vertical cup axis as noted above, the valve cup skirt 56 is cammed radially inwardly as shown by arrows E permitting the finished cup to be released from the mould member 70. Further, since the conical sealing surface 34 is formed in the one-piece mould member, the sealing surface has no parting line protrusions and requires no subsequent machining to produce a smooth sealing surface. The shape of the injection passage 76 eliminates all gate or flash so that the finished cup is ready for use.

Alternative embodiments of the aerosol container of the present invention are illustrated in Figures 7 and 8. Referring first to Figure 7, a valve cup skirt 132 may be formed with an annular, V-shaped groove 82, which underlies a valve cup sealing surface 134. Groove 82

facilitates removal of the valve cup 14 from a mould member 70 since the skirt 132 can collapse more easily to cam out of a mould cavity 72.

Figure 8 illustrates an embodiment of the present invention particularly well adapted to barrier or piston type aerosol container constructions. This aerosol container 210 includes a container body 212 formed with an upper portion 220 which, instead of being frustoconical in shape, is slightly indented to form a dome-shaped inner surface 84. The container mouth 224, frustoconical sealing surface 226, and catch surface 228 are formed on a generally cylindrical section 86 which extends upwardly from the dome-shaped surface 84. This particular construction permits a piston 88 to travel farther toward the dispenser valve and thus to exhaust more of the container's contents. Moreover, modifications such as these can be made to the container to co-operate with a piston of any similar design to dispense as much of the product as possible.

Attention is drawn to our copending application No. 49009/77, (Serial No. 1564996) which describes and claims an aerosol container for storing a product under pressure and having a dispenser valve for dispensing the product, and a method for producing such an aerosol container.

WHAT WE CLAIM IS:—

1. A method of producing a valve cup which is mountable on the container body of an aerosol container, the container body defining a product receiving chamber having an open container mouth and being formed with a conical sealing surface about the mouth inclined upwardly and outwardly of the product receiving chamber amd catch means associated with the mouth, the valve cup being formed with a skirt having a conical sealing surface shaped and sized to mate with the conical container body sealing surface and latch means for engaging the catch means, the said method comprising:

A . . providing a one-piece mould member which defines a single mould cavity configured at least to the external shape of the mating conical sealing valve cup surface,

B . . providing a mandrel member which cooperates with the mould member and is configured to define the internal shape of the valve cup,

C . . introducing valve cup forming material between the co-operating mould and mandrel members,

D . . curing the valve cup forming material,

E . . removing the mandrel member from the valve cup, and

F . . stripping the cured valve cup from the mould member by pushing it axially out of the mould member.

2. A method as claimed in Claim 1, wherein the said one-piece mould member mould cavity is configured to produce an annular groove that underlies the conical valve cup sealing surface, the annular groove facilitating the stripping step by facilitating flexing of the valve cup skirt.

3. A method as claimed in Claim 1, wherein the said one-piece mould member mould cavity and mandrel member are configured to produce a conical cam surface associated with the valve cup latch means, the conical cam surface facilitating mounting of the valve cup in the container body by producing a radial, inward camming action of the valve cup skirt when the valve cup is pushed into the container mouth.

4. A method as claimed in Claim 1, wherein the said one-piece mould member mould cavity is configured to produce an annular rabbet associated with the said valve cup skirt, the said annular rabbet defining a planar, radially outwardly directed latch surface formed to engage the said catch means.

5. A method of producing a valve cup substantially as herein described with reference to Figures 1 to 6, Figure 7 or Figure 8 of the accompanying drawings.

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Sheet 1

Fig. 1.

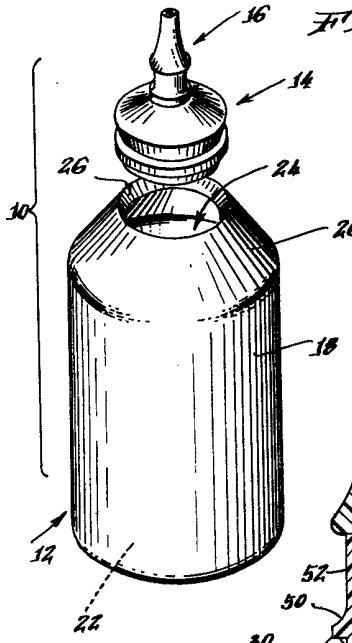

Fig. 2.

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Fig. 3.

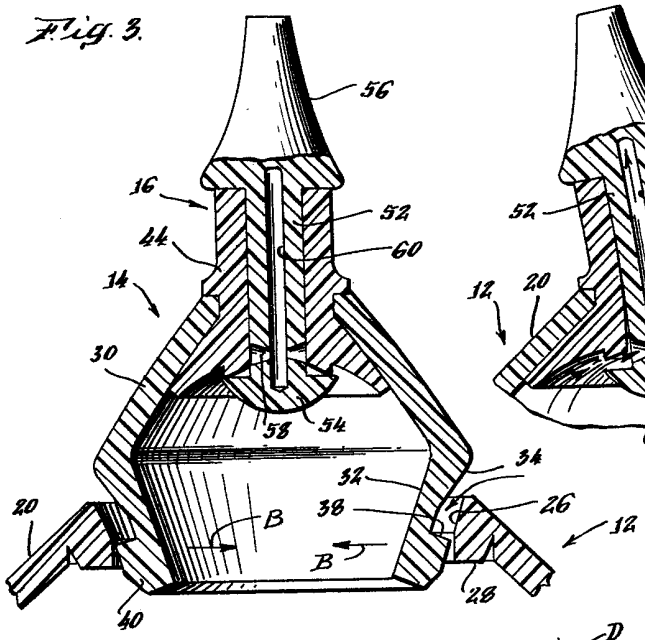
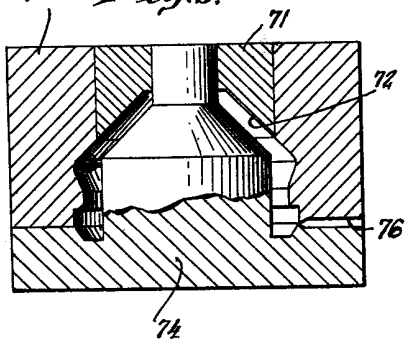


Fig. 4.

Fig. 5.



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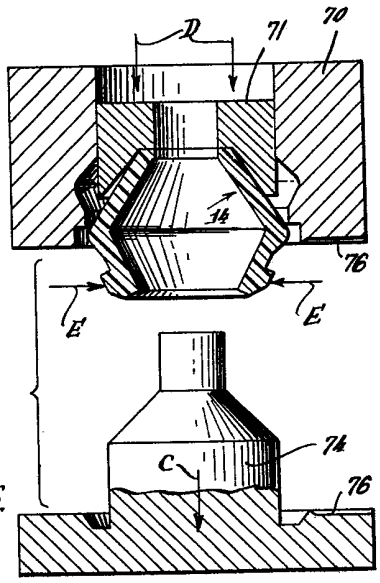

1564997 COMPLETE SPECIFICATION
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Sheet 3

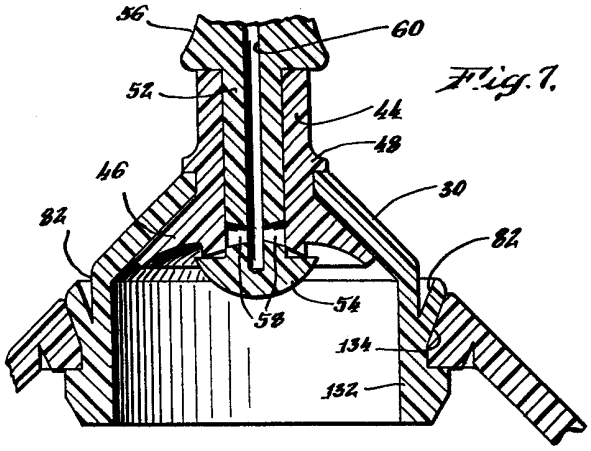

Fig. 7.

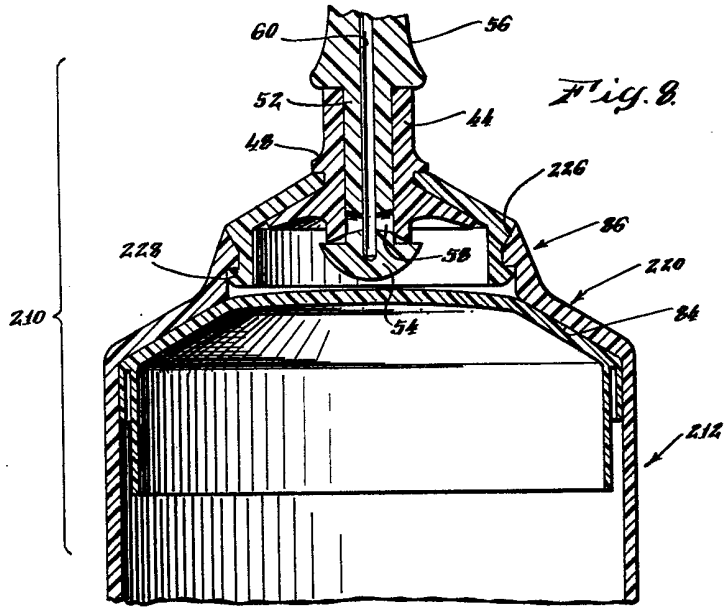

Fig. 8.