April 30, 1957 R. L. LAWRENCE 2,790,576

CLOSURE ARRANGEMENT FOR THIN WALLED RIGID PLASTIC VIAL

Filed March 22, 1954

Fig. 1

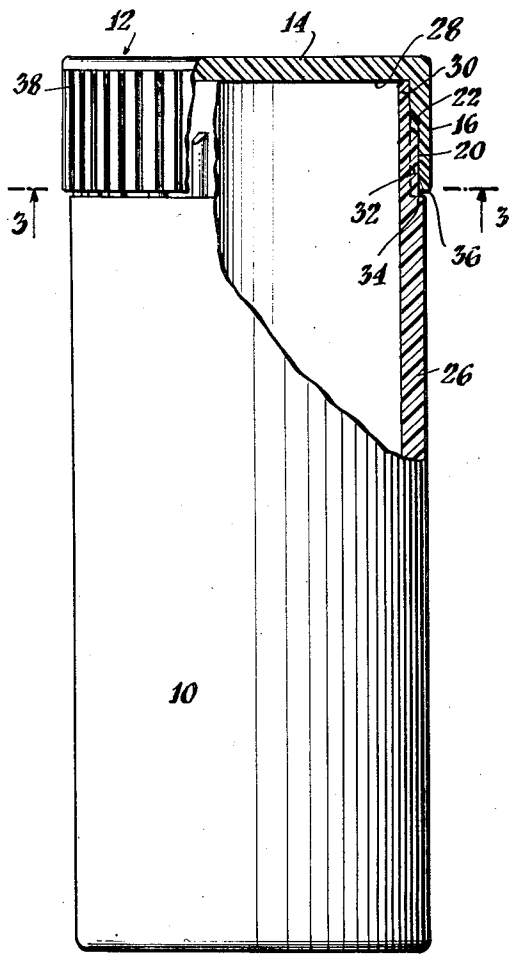


Fig. 2

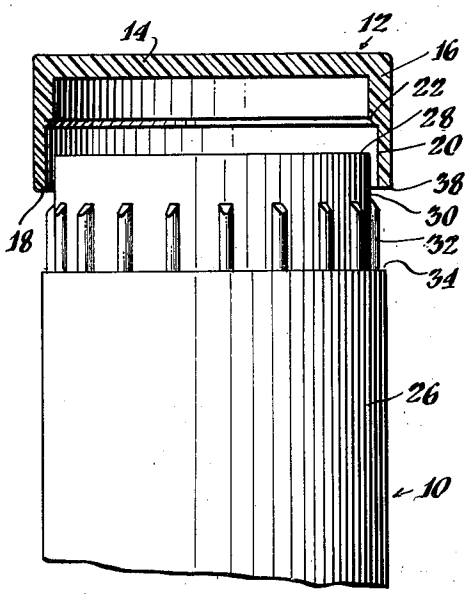
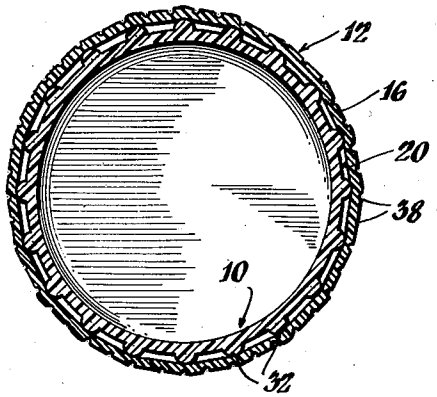


Fig. 3



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CLOSURE ARRANGEMENT FOR THIN WALLED RIGID PLASTIC VIAL

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7 Claims. (Cl. 220—42)

This invention relates to plastic containers and in particular to a plastic vial and cap having a closure arrangement which is especially adapted for use in automatic capping machines.

In accordance with my invention I provide a plastic vial with a cap of plastic material which fits over the mouth and down around the outside of the vial to form a highly efficient frictional seal with the vial wall. The closure arrangement for the cap and vial includes lead-in portions which provide enough clearance between the members initially so that orientation of the cap on the mouth of the vial may be carried out in a uniform and positive manner by automatic capping machinery. The lead-in portions also assist in guiding the cap down around the vial wall and when the cap is about half way home the lead-in portions frictionally engage mating surfaces which take up the initial clearance between the members and seal the vial. By bringing each lead-in portion into frictional contact with a mating surface in this way sealing action may be made to extend throughout the full length of the side wall of the cap to give a highly efficient closure for the vial.

My invention can be readily understood by reference to the accompanying drawings in which

Fig. 1 is a front elevational view of my cap and vial partially cut away to show the closure arrangement;

Fig. 2 is a front elevational view of the cap and vial of Fig. 1 in which the cap is separated from the vial in order to show the construction of the mouth of the vial and the cap is shown in section to illustrate its construction; and

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1.

In the drawings the numeral **10** represents the plastic vial and **12** the cap having a top section **14** and a side wall in the form of an annular flange **16**. Flange **16** is adapted to fit over the mouth of the vial and down around the outside to form a frictional seal with the vial. The side wall of the cap adjacent its mouth **18** is partially cut away on the inside to form a lead-in portion **20** which is offset from the surface of the wall of the cap by means of a connecting shoulder **22**. As a result, the interior of the cap is divided into two separate cylindrical sections of different diameter separated by means of connecting shoulder **22**. Similarly, the side wall **26** of the vial is partially cut away on the outside adjacent mouth **28** to form a lead-in portion **30** which terminates in a series of ribs **32** positioned around the lower part of the lead-in portion of the vial. Lead-in portion **30** is connected with the wall of the vial by means of a shoulder **34** and as shown in the drawings, ribs **32** do not project out beoynd the exterior surface of the wall of the vial.

As best shown in Fig. 2, when cap **12** is placed over the mouth of vial **10**, lead in portions **20** and **30** provide enough clearance between the members so that the cap may be readily fitted over the mouth of the vial and pushed down around the vial wall in a uniform and positive manner by automatic capping machinery.

As a result of the initial clearance the cap may be made to fit squarely over the mouth of the vial and as it is pushed home on the vial lead in portion **30** at the mouth of the vial is brought into frictional engagement with the interior side wall of the cap and lead in portion **20** of the cap is brought into frictional engagement with ribs **32** as illustrated in Fig. 1. By bringing the lead in portions of the cap and vial into contact with mating surfaces in this way I achieve a highly efficient frictional seal which extends over the full length of the side wall of the cap. Ribs **32** on lead in portion **30** are of particular advantage for automatic capping in that they provide an escapement for the air which tends to be trapped and compressed in the vial during capping and this substantially eliminates objectionable popping-off of caps after assembly. For best results I prefer to make the height of lead in portion **20** of the cap approximately equal to the height of ribs **32** and the height of lead in portion **30** of the vial approximately equal to the height of the surface of the interior wall of the cap above the lead in portion **20**.

In the preferred form of my invention shown, both vial **10** and cap **12** are made of plastic materials and may be formed by any of the well-known methods of molding, such as injection molding. Any of the known plastic materials capable of being molded, may be used such as the phenolics, urea, cellulose acetate, cellulose acetate butyrate, vinyls, polystyrene, alkyd, melamine, polyester, acrylic, polyethylene, polyamide, protein, phenolic furfural, furan and vinylidene chloride plastic materials. For best results I prefer to make the cap of a plastic material which has greater flexibility than the material in the vial. This may be conveniently done by selecting materials in which the difference in hardness and resistance to distortion is approximately equal to the difference in hardness between polystyrene and polyethylene plastic materials. When this is done I can make the walls of the vial quite thin without danger of splitting them during automatic capping operations. Flexibility in the material of the cap is also of advantage in that the material tends to conform to the shape of the vial and if desired the cap can even be stretched around the mouth of the vial to give an exceptionally tight frictional seal without danger of cracking the vial walls. If the cap is to be stretched around the mouth of the vial then I prefer to bevel shoulder **22** and the leading edge of ribs **32** so that the lead-in portion and interior side wall of the cap above the lead-in portion will be cammed up around ribs **32** and lead-in portion **30** respectively.

As illustrated in Fig. 3 when the vial is made of a rigid material such as polystyrene and the cap of a flexible material such as polyethylene then the flexible material in the side wall of the cap tends to stretch out flat between the individual ribs **32** which in turn bite into the material of the cap to give an extremely effective frictional seal in this part of the closure. With these plastic materials I have been able to achieve this result without splitting the vial during automatic capping with an exceedingly thin walled vial in which the thickness of the vial wall was not over approximately .035 to .045 inch and in which the thickness of the lead-in portion of the vial was not over approximately .020 to .030 inch. In this connection, it will be noted that I prefer to make the outside diameter of the cap slightly greater than the outside diameter of the vial as indicated at **36** so that the cap may be stripped from the vial by sliding the thumb along the side of the vial and up against the projecting edge of the rim of the cap. If desired a series of grooves as indicated at **38** may be positioned in the outside surface of the wall of the cap to provide a grip for manual capping and uncapping of the vial in use.

It will be understood that it is intended to cover all changes and modifications of the example of my invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of my invention.

What I claim is:

1. An improved plastic container comprising the combination of an open mouth vial having the top portion of its side wall adjoining the open mouth cut away on the outside to reduce the thickness of the top of the side wall of the vial and provide a lead in portion around the open mouth of the vial, said lead in portion having a plurality of parallel ribs positioned around the exterior thereof that extend upwardly from the bottom of such lead in portion to approximately the middle of said lead in portion, each of said ribs being of uniform thickness and the thickness of the ribs being such that the distance from the outside surface of one rib to the outside surface of the second rib positioned diametrically across the vial from said first rib is no greater than the outside diameter of the vial wall so that the ribs do not project out beyond the surface of the vial wall, a cap for the vial having a top section and a side wall in the form of an annular flange, the length of said flange being approximately equal to the length of the lead in portion of the vial with the inside surface of said flange being divided up into two separate cylindrical sections of different diameter which are separated by means of a connecting shoulder, the bottom cylindrical section comprising a lead in portion positioned around the open end of the cap, said lead in portion having its length approximately equal to the length of the ribs of the vial and having its inside diameter approximately equal to the distance from the outside surface of one rib to the outside surface of a second rib positioned diametrically across the vial from said first rib so that the bottom cylindrical section of the cap will mate with and frictionally engage the exterior surface of the ribs of the vial and the top cylindrical section of the cap having its inside diameter approximately equal to the outside diameter of the lead in portion of the vial so that the top cylindrical section will mate with and frictionally engage the exterior surface of the lead in portion of the vial that is free of said ribs, whereby the lead in portions of the cap and vial provide initial clearance between the cap and vial and whereby the lead in portion of the cap mates with and frictionally engages the exterior surface of the ribs and the top cylindrical section of the cap mates with and frictionally engages the lead in portion of the vial that is free of the ribs to form a closure for the vial when the cap is pushed home over the mouth of the vial.

2. A structure as specified in claim 1 in which a portion of the exterior of the flange at the open end of the cap projects out beyond the outside of the vial.

3. A structure as specified in claim 1 in which the vial is made of polystyrene plastic material and the cap of polyethylene to provide a flexible cap and rigid thin walled vial in which the wall thickness of the vial is approximately .035 to .045 inch.

4. A structure as specified in claim 1 in which the hardness and resistance to distortion of the plastic material of the vial is greater than that of the plastic material of the cap and in which the difference in the hardness of the two plastic materials is approximately equivalent to the difference in hardness between polystyrene and polyethylene plastic materials.

5. A structure as specified in claim 1 in which the inside diameter of the top cylindrical section of the cap above its lead in portion is slightly less than the outside diameter of the lead in portion of the vial and in which the distance measured from the outside surface of one rib to the outside surface of a second rib positioned diametrically across the vial from said first rib is greater than the inside diameter of the lead in portion of the cap so that the annular flange of the cap is tightly stretched around the mouth of the vial when the cap is pushed all the way home over the mouth of the vial to provide a highly effective frictional seal.

6. A structure as specified in claim 1 in which the leading edge of each of the ribs is in the form of a beveled edge.

7. A structure as specified in claim 1 in which the connecting shoulder between the lead in portion of the cap and the top cylindrical section is in the form of a bevelled edge.

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