Oct. 25, 1955 A. NICHOLS 2,721,595

RIBBED PLUG TYPE CAP FOR PLASTIC EXTRUSION TUBE CONTAINER

Filed Nov. 19, 1953

Fig. 1

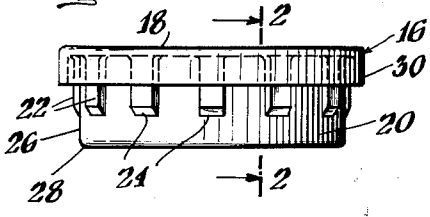


Fig. 2

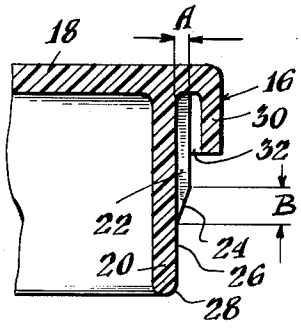


Fig. 3

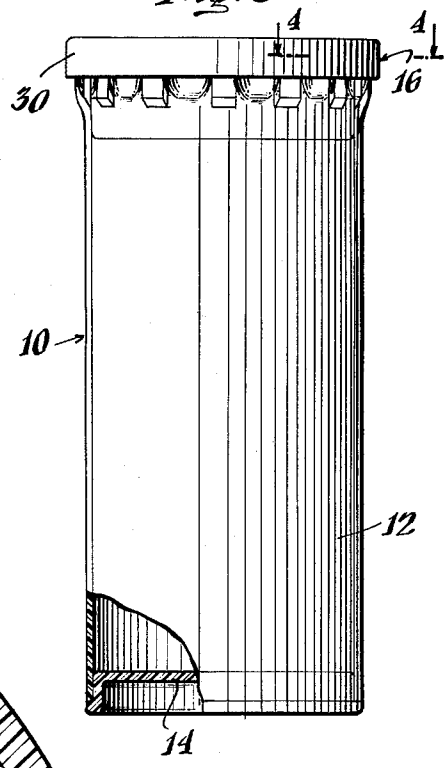


Fig. 4A

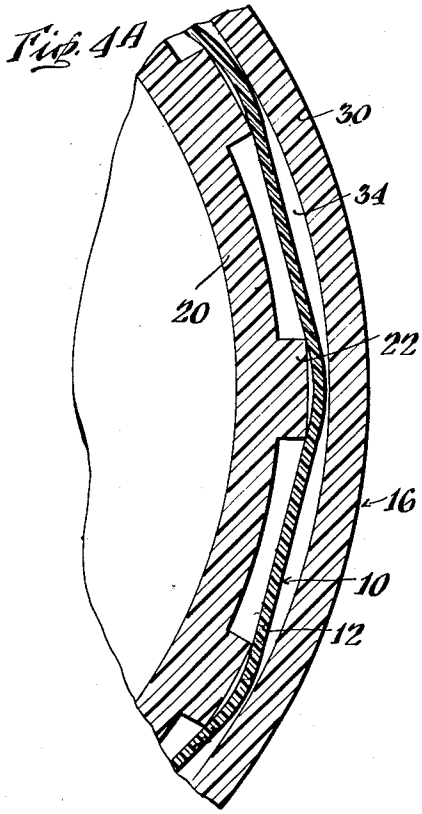
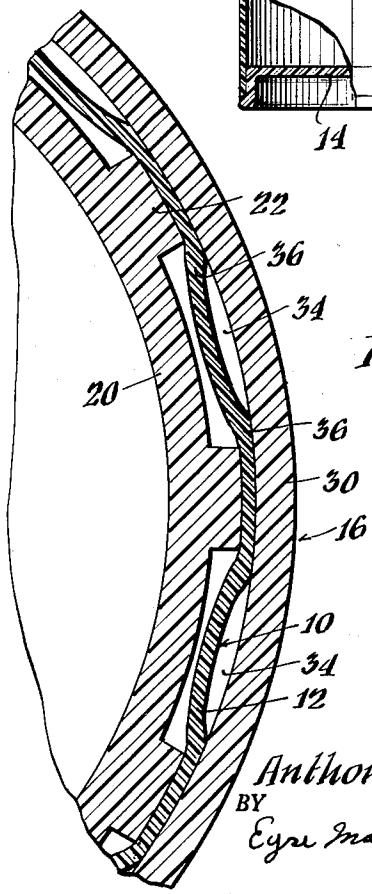


Fig. 4B



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RIBBED PLUG TYPE CAP FOR PLASTIC EXTRUSION TUBE CONTAINER

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Application November 19, 1953, Serial No. 393,179

5 Claims. (Cl. 150—.5)

This invention relates to an improved type of cap for plastic extrusion tube containers.

The type of cap to which this invention relates is described in my copending application entitled "Cap for Plastic Extrusion Tube Container," Serial No. 369,912, filed July 23, 1953. As set forth in that application, in order to achieve a cap which gives a satisfactory seal with plastic extrusion tube containers, the cap must be adapted to seal different size tubes because with present-day equipment it is virtually impossible to produce an extrusion tube with predetermined diameter and wall thickness. In my first application I solve this problem and compensate for variations in wall thickness and tube diameter by providing the extrusion tube container with a plug type cap adapted to stretch the mouth of the tube a limited amount. Excessive stretching of the mouth of the tube is prevented by means of an annular flange positioned around the plug and as a result my cap gives a satisfactory seal regardless of variations in the dimensions of the tube.

I have now discovered that it is possible to materially improve the seal of the cap of my first application by providing the plug with a series of longitudinal ribs for stretching and distorting the mouth of the tube. The ribs are positioned around the top portion of the plug and each rib has a cam surface at its lower end which tapers down to the surface of the plug. The portion of the plug below the ribs serves as a lead-in portion which is made small enough to start the plug into the mouth of the tube regardless of variations in tube diameter. When the cap is pushed home in the container the cam surface on the ribs cams and stretches the mouth of the tube up around the ribs which fit tightly into the tube and give exceptionally good sealing action. As in my first application, the cap has an annular flange which cooperates with the ribs to prevent excessive stretching of the mouth of the tube to a point where it would give a loose fit.

My invention can be readily understood by reference to the accompanying drawing, in which—

Fig. 1 is a front elevational view of my cap for a plastic extrusion tube container;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 shows the cap of Fig. 1 in position in the mouth of a plastic extrusion tube container which is cut away in part to show construction of the tube;

Fig. 4A is an enlarged sectional view taken on line 4—4 of Fig. 3; and

Fig. 4B is similar to Fig. 4A but in this view the mouth of the tube is made larger than the plug of the cap.

The plastic extrusion tube container **10** shown in Fig. 3 is made up of an ordinary plastic extrusion tube **12** having a bottom **14** which may be fixed in the tube in any convenient way, as for example, by means of an adhesive. The tube may be made of any suitable plastic material capable of extrusion molding such as the cellulose esters, cellulose ethers or highly plasticized vinyl derivatives and the like. I prefer to use cellulose acetate or cellulose acetate butyrate for the tube. The manufacture of these tubes is well known in the art and, as is known, it is virtually impossible to keep wall thickness and diameter of the tube constant. For example, with a tube one inch in diameter the thickness of the tube wall may vary about one thousandth of an inch or from approximately .013 to .012 inch. The outside diameter of the tube may vary about ten thousandths of an inch, or from approximately 1.060 to 1.070 inches. With a tube of such variable dimensions, the ordinary type of unthreaded cap which is made to fit a container of set dimensions does not give a satisfactory seal.

Referring to Fig. 1, cap **16** includes a top member **18** and a hollow thin-walled plug **20** having a series of longitudinal ribs **22** which protrude out from the surface of plug **20** and extend downwardly from top member **18** to a line at approximately the middle of the plug. At the lower end of each rib is a cam surface **24** which tapers down to the surface of the plug. Preferably the slope of cam surface **24** is abrupt and its length should not exceed approximately 2½ times the resulting increase in the diameter of the plug. That is, A should not exceed approximately 2½ B (see Fig. 2). In the drawings ribs **22** are shown with sharp edges for the purpose of clarity of illustration but these are not necessary and the edges of the ribs may be rounded off as may the surface of the ribs. The portion of plug **26** below ribs **22** serves as a lead-in portion which orients and guides the plug into the mouth of tube **12**. If desired, the rim of plug **20** may be beveled as at **28** to assist in orienting the plug in the mouth of the tube.

The diameter of lead-in portion **26** is made slightly smaller than the minimum inside diameter of tube **12** and the effective outside diameter of the plug as measured across a circle touching the outermost surfaces of ribs **22** is made slightly larger than the minimum inside diameter of tube **12**. For example, if the extrusion tube has the dimensions described above I achieve a highly effective seal by making the diameter of lead-in portion **26** approximately 1.025 inches and the effective diameter of the plug as measured across a circle touching the outermost surfaces of ribs **22** (Fig. 4A) approximately 1.054 inches. With this construction the lead-in portion **26** readily fits into the mouth of tube **12** and when the cap is pushed home camming surfaces **24** stretch the mouth of the tube and guide it up on ribs **22**. Excessive stretching of the mouth of tube **12** to a point where it would fit loosely on ribs **22** is prevented by an annular flange **30** which forms a slot **32** at the top of cap **16**. For best results, I make slot **32** approximately .031 inch deep so that a seal is achieved between surface areas of ribs **22** and tube **12** and not just with the rim of the tube. By making the width of slot **32** between ribs **22** and flange **30** approximately .001 inch greater than the thickness of the walls of extrusion tube **12** the slot readily receives tube **12** and guides the open mouth of the tube along the surface of ribs **22**. In the preferred form of my invention, however, I make the width of slot **32** at ribs **22** approximately equal to the thickness of the wall of tube **12** or slightly smaller than the thickness of the wall. When this is done, ribs **22** and flange **30** grip on the inside and outside surfaces of the mouth of tube **12** to materially increase sealing action of the cap. If the space between ribs **22** and flange **30** in slot **32** is smaller than the thickness of the wall of tube **12**, cold flow of the plastic material in the wall of tube **12** takes place as the cap is pushed home into the mouth of tube **12**.

In some cases it is possible that control of extrusion molding may be temporarily upset and this may result in a tube having an inside diameter slightly greater than the effective outside diameter of the plug. In such case

the cap tightly grips the mouth of the tube in the space between ribs **22** and flange **32** and the excess material in the mouth of the tube is held in channels **34** between ribs **22**. This situation is illustrated in Fig. 4B which also illustrates cold flow of plastic material in the tube wall caused by having a wall of greater thickness than the width of the space between ribs **22** and flange **30**. As shown in Fig. 4B cold flow of the material of the tube enlarges the tube wall on each side of ribs **22** as at **36**. Where standard tolerances are maintained, stretching and distortion of the mouth of tube **12** by the cap is as shown in Fig. 4A. As there shown the tube mouth is stretched flat across channels **34**. Fig. 4A also illustrates a cap in which the space between ribs **22** and flange **30** is made approximately .001 inch greater than the thickness of the tube wall.

Another advantage of using ribs **22** for stretching the mouth of tube **12** is that the cap always fits tightly into the tube and does not lose its sealing action during use. Upon initial closing of the container, each rib is impressed into the wall of the tube in a certain position and each time the container is closed thereafter the ribs occupy a slightly different position so that the mouth of the tube is stretched and distorted each time the container is closed. As a result, the cap always gives a tight fit with the tube.

For best results, the dimensions of cap **16** should be closely controlled. This may readily be done by forming cap **16** by means of any of the well-known methods of molding such as injection molding. Since the standard tolerance of such a molded piece is plus or minus .005, the maximum diameter of lead-in portion **26** for the example given above would be 1.030 inches which is .004 less than the minimum inside diameter (1.034 inches) of extrusion tube **12**. Similarly the effective minimum outside diameter of plug **20** as measured across a circle around the plug touching the outermost surfaces of ribs **22** would be 1.049 inches which is .003 more than the maximum outside diameter (1.046 inches) of tube **12**.

Since the cap stretches the mouth of tube **12** it must have a greater resistance to distortion than the material of the tube. For example, when the cap is made by injection molding, I may use polystyrene or one of the acetate materials or if the cap is made by compression molding I may use the phenolic or urea plastic materials. For best results I use a polystyrene cap for a tube of cellulose acetate and I prefer to keep the difference in hardness and resistance to distortion of the materials of the cap and tube equivalent to the difference in hardness between polystyrene and cellulose acetate.

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

What I claim is:

1. A cap adapted to seal the mouth of an extrusion tube container, said cap comprising a plug of plastic material adapted to fit into the open mouth of the container, said plug having ribs positioned on and around the exterior surface thereof, said ribs extending downwardly from the top of the plug and terminating in cam surfaces tapering down to the exterior surface of the plug, said plug and ribs having an effective outside diameter as measured across a circle around the plug touching the outermost surface of the ribs which is slightly greater than the minimum inside diameter of the container, whereby the mouth of the tube is stretched as it rides up over the cam surfaces of the ribs to form a frictional surface fit with the ribs when the cap is pushed home into the mouth of the container, and said plug having a top member which extends outwardly over the rim of the container.

2. A structure as specified in claim 1 in which the top member includes an annular flange spaced outwardly away from the plug to form a slot around the plug and ribs for receiving the mouth of the container.

3. A structure as specified in claim 1 in which the cam surfaces of the ribs terminate in the surface of the plug at a substantial distance above the bottom of the plug to provide a lead-in portion for guiding the container up on the ribs of the cap, said lead-in portion being of smaller outside diameter than the inside diameter of the container.

4. A cap for an extrusion tube container which comprises a plug of plastic material adapted to fit into the open mouth of the container, said plug having ribs positioned on and around the exterior surface thereof, said ribs extending downwardly from the top of the plug and terminating in cam surfaces tapering down to the exterior surface of the plug, said plug having a top member which extends outwardly over the rim of the container and an annular flange affixed to such top member spaced outwardly away from the ribs of the plug to form a slot between the exterior surface of the ribs and interior surface of the flange for receiving the mouth of the container, said slot being approximately equal to the thickness of the wall of said container at the mouth of the tube whereby the mouth of the tube is tightly gripped on both its inside and outside surfaces by the ribs and annular flange respectively when the container mouth is pushed home in the slot of the cap to seal the tube.

5. A cap for a plastic extrusion tube container which comprises a plug of plastic material having a series of ribs positioned around the top portion of the plug on the exterior surface thereof which extend downwardly along the exterior surface of the plug and terminate at their lower end in a cam surface tapering down to the exterior surface of the plug, a cover member positioned across the top of said plug which extends outwardly beyond the rim of the plug, an annular flange affixed to said cover member which extends downwardly from the cover member and which is spaced outwardly away from the surface of the top portion of the plug to form a slot between the exterior surface of the ribs and interior surface of the flange for receiving the mouth of the container, said slot being approximately equal to the thickness of the wall of said container at the mouth of the tube whereby the mouth of the tube is tightly gripped on both its inside and outside surfaces by the ribs and annular flange, respectively, when the container mouth is pushed home in the slot of the cap to seal the tube.

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