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RESILIENT DISPENSING TUBE

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This invention relates to blown resilient tubes of the collapsible type and particularly to blown resilient tubes of the collapsible type having a closing mechanism permitting expulsion of the contents of the tube container without the necessity of removing the closure from the tube.

Hundreds of products are packaged and sold in collapsible tubes. These products include such diverse materials as toothpaste; shaving cream; hair dressings; shampoos; suntan creams; various adhesives; medicants; food spreads such as jams, jellies, frostings, sandwich spreads, etc.; inks; greases; paints; and many more. The result is that many million collapsible tubes are produced and sold annually. Heretofore such collapsible tubes have been composed principally of soft metals such as lead, tin, zinc, aluminum or alloys thereof. In recent years, collapsible tubes composed of synthetic resinous materials have come into use.

Whether constructed of metal or of a synthetic plastic material, most of these previous collapsible containers have had one principal drawback in common. That is the necessity for a separable closure. Such separable closures usually are in the form of a hard plastic screw cap. Because they are usually small, they are easily misplaced, dropped and lost. Some metallic collapsible tubes and many of the synthetic resinous tubes have a simple pin as a closure. Such closures are equally or more susceptible to loss or misplacement.

It has been proposed to form resilient tubes of the collapsible type from flexible synthetic resinous materials in the usual form, except that the threaded neck which forms the normal outlet from the tube (instead of being open on the end) is formed with a closed end having one or more longitudinal slits. Such an outlet is normally maintained closed due to the resiliency of the plastic material but may be forced opened due to the pressure exerted by material being expelled from the resilient container.

To avoid accidental leakage from such a tube and to prevent possible failure of the outlet to close by itself (as, for example, might be the case if the material packaged in the tube were in the form of a relatively stiff paste or the like) there is provided a screw-on cap in the form of a tube open at both ends. This open-ended screw-on cap, when screwed tightly in place, effectively seals the end of the resilient tube. The contents of the resilient tube may be expelled, however, without the necessity of removing the screw-on closure simply by opening the closure a turn or two to relieve the pressure of the closure cap against the slit closed outlet member of the resilient tube. Then, when the collapsible tube is compressed, the contents are expelled out through the slit outlet and out through the open end of the closure cap.

Heretofore, resinous plastic resilient tubes of the collapsible type have been formed by a two-step combination of casting and extruding or blow molding techniques. The shoulders and necks of the tubes have been relatively thicker, stiff and rigid and have been formed by injection molding or casting techniques. The thinner bodies of the tubes have been formed by extrusion or blow molding techniques. One result of the relatively thicker and stiffer neck portion is increased difficulty in expelling the contents of the tube. The use of two diverse molding or

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forming techniques in the production of a relatively simple article as a resilient tube of the collapsible type makes the operation both complicated and costly.

It is the principal object of this invention to provide a resilient tube of the collapsible type of synthetic resinous material formed fully by blow molding techniques having a slit and threaded top outlet and a screw cap having an end opening adapted to seal the outlet and to permit expulsion of the contents of the resilient tube without the necessity of removing the cap.

It is a further object of this invention to provide a method for forming resilient tubes of the collapsible type of synthetic resinous material by blow molding techniques.

Other objects of the invention will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated by the drawings in which the same numerals refer to corresponding parts and in which:

FIGURE 1 is a longitudinal sectional view through a resilient tube of the collapsible type formed according to this invention;

FIGURE 2 is an end view taken on the line 2-2 of FIGURE 1 and in the direction of the arrows;

FIGURE 3 is a longitudinal sectional view similar to FIGURE 1 but showing a screw cap closure in place on the neck of the tube in sealing position;

FIGURE 4 is a longitudinal sectional view similar to FIGURE 3 but showing the screw cap closure in open position for permitting dispensing of the contents of the tube; and

FIGURE 5 is a sectional view through apparatus for forming the blown resilient tube of this invention the device being shown in open form for better understanding of the construction of the apparatus.

Referring to the drawings, the resilient tube of the collapsible type indicated generally at 10 includes a hollow cylindrical tube body 11, a narrowing shoulder 12, and a hollow neck 13. The tube neck 13 is provided with a plurality of threads 14 around its base adjacent to the shoulder 12. It will be noted that the tube body, shoulder and neck are all of about substantially uniform thickness, including even the threaded portion of the neck so that the impression of the threads are apparent from the inside of the neck. Even though relatively thin the corrugations of the threads impart considerable rigidity to the neck portion of the tube. The outer end 15 of the neck 13 tapers slightly inwardly from the threaded portion 14 and terminates in a projecting tip portion or crown 16 at the end of the neck. The tapering portion 15 of the neck is provided with one or more off-center longitudinal cuts or slits 17 across the neck extending from the crown to the threads. The slits 17 are spaced outwardly slightly from the base of the crown 16 to leave a small shoulder 18 at the base of the crown.

The closure cap indicated generally at 20 is provided with internal threads 21 which cooperate with the threads 14 of the tube neck. The inner surface 22 of the cap 20 conforms generally to the outer shape of the neck 13. In the center of the end of the cap is an opening 23 which is of a size adapted to receive the crown 16 at the end of the tube neck 13. When the cap 20 is in closed position, the periphery of opening 23 is adapted to seat upon the shoulder 18 at the base of the projecting crown adjacent to the slits 17. In this manner, the cap 20

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insures a tight sealing of the tube even though accidental compression of the tube body might tend to force the slits 17 open.

In FIGURE 4, the tube is shown with the cap 20 in normal open position for expulsion of the contents of the resilient tube upon compression of the tube body. For clarity, the tube is illustrated without contents but the slits 17 are shown as they are forced open under pressure of the tube contents to push the tapering side wall portions of the upper neck against the inner side wall of the cap. The cap 20 is shown unscrewed several turns but still firmly held by several turns of threads to the neck of the tube.

As the contents of the resilient tube are compressed in the tube body and forced out through the neck and open slits 17, the chamber or space in the end of the cap 20 is first filled and the contents are then forced out through the end opening 23. When the cap is screwed back into sealing position, any material in the space 24 is forced out through the opening 23 and the slits 17 are forced closed.

The small amount of the contents of the tube which might remain on the end of the projecting crown portion extending through the opening 23 at the end of the cap after use is easily removed. In the case of face and hand creams, hair dressings, shaving creams, shampoos and the like, which in normal use are expelled into the hand of the user, the projecting tip of the neck is simply wiped off on the hand. In the case of toothpaste, metal polishes, paste waxes and the like, which are normally expelled onto an applicator of some type, the projecting tip may simply be wiped off on the applicator. In the instance of glues and similar adhesives, it may simply be wiped upon the surface to which the adhesive is being applied.

The resilient tube of the collapsible type according to this invention is formed from a relatively soft and flexible but strong thermoplastic synthetic resinous film forming material capable of being extruded and blown out as a relatively thin shell. Numerous materials are commercially available which have the requisite properties which adapt them to use in the formation of the resilient dispensing tubes according to this invention. Among these might be mentioned polyethylene, polyvinyl resins, nylon and the like. Polyethylene is a preferred material, both from a standpoint of cost, ease of forming and strength and durability of the molded tube.

The closure cap 20 is relatively thicker and more rigid than the tube body and may be formed from a variety of synthetic thermoplastic and thermosetting resinous material such as for example, polystyrene, phenolics, melamines, urea-formaldehyde and the like, as well as more rigid forms of the same materials from which the tube body may be made. The cap may be formed by any conventional molding techniques such as casting, injection molding, etc.

Referring to FIGURE 5, there shown in simple form, apparatus for making the plastic dispensing tube of this invention. The device includes a conventional extrusion means (not shown) for maintaining the plastic tube material viscous and fluid and extruding it through a nozzle under pressure. The nozzle 30 includes an annular opening 31 in which is disposed a tubular gas inlet pipe 32. The pipe 32 is of the same general configuration as opening 31, somewhat smaller in diameter and is centered in the nozzle opening to form an annular opening space of substantially uniform width between the pipe and the wall of the nozzle opening. The pipe 32 projects beyond the nozzle opening and into the die cavity as explained hereinafter. The opposite end of the pipe which extends into the extruder nozzle is connected to a source of compressed air or other gas inert to the molten plastic material under pressure.

The die, indicated generally at 34, is comprised of two symmetrical segments 34L and 34R adapted to be placed together along an interface 35L and 35R. Each of the

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die segments is provided with a cavity, 36L and 36R respectively, whose surface conforms to the desired shape and configuration of the exterior of the dispensing tube. Thus, the die cavities include a body portion, a shoulder portion, a threaded neck portion, and a tapering neck portion terminating in a projecting tip or crown, all corresponding to the similar portions of the tube. The die segments are provided with sprue or channel members 37L and 37R by which the molten plastic from the extrusion die is conveyed to the die cavity.

The nozzle opening, gas inlet pipe and die channel all have the same general cross-sectional shape. Preferably this shape is circular, but, it may, if desired, be oval, polygonal or the like. The shape of the openings is preferably the same as the desired shape of the tube body but this is not essential. For clarity, the die segments are shown spaced apart from each other and from the extrusion nozzle. It will be readily understood, however, by those skilled in the plastic molding arts that in normal use, the die segments will be held together along their interface and the channel will be in direct communication with the extrusion nozzle opening. Thus, the channel 37 has a diameter substantially the same as that of the extrusion nozzle opening 31 and the pipe 32 extends through the channel to define a thin tubular passageway from the extrusion nozzle to the die cavity between the inner walls of the channel and the outer wall of the gas inlet pipe.

As the molten synthetic resinous plastic material is forced from the extrusion nozzle, it is formed in the shape of a thin, hollow tube between the inner wall surface of the opening 31 and the outer wall surface of the pipe 32 and in this form is forced through the channel of the die into the die cavity. As the molten plastic leaves the confines of the channel passage, it is expanded under the pressure of the compressed gas from pipe 32. The expanded thin tube of semi-molten plastic material thus formed is forced in intimate contact against the walls of the die cavity and there hardens and sets in place to retain the desired form.

It will be understood that the molten plastic material and compressed gas are introduced into the mold cavity in regulated measured quantities so that only enough plastic material is introduced into the mold cavity to form a tube of the desired size and wall thickness. The molten plastic material is injected rapidly along with the compressed air so that the formation of the plastic tube is almost instantaneous.

After the plastic has set up the die is opened and the blown plastic tube is removed from the die cavity and from the extruder. The neck end of the collapsible tube is provided with one or more longitudinal slits 17 and the neck is fitted with a screw-on closure cap 20 formed by conventional molding technique. The open end of the resilient tube is cut to remove the sprue slug and to facilitate loading of the tube. After loading the tube is closed by pinching together the sides of the tube body adjacent the open end and securing them, preferably by means of heat sealing.

As a typical example of the tube forming process of this invention, polyethylene is maintained at a temperature of about 125° C. in the extrusion apparatus. In this instance, the diameter of the extrusion nozzle opening 31 was 6 mm. and the outside diameter of the air pipe 32 was 5 mm. leaving a circular space between the opening wall and the outside pipe wall of ½ mm. The channel of the die was of the same diameter as the nozzle opening so that a molten tube of polyethylene having a wall thickness of ½ mm. was injected into the die cavity. Within the die cavity, the tubular stream of molten plastic was expanded by compressed air to several times its original diameter with a corresponding decrease in wall thickness to form a tube as described against the inside walls of the die cavity.

The tube of this invention is formed simply and eco-

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nomically wholly by blow molding. It is simply and easily loaded and sealed. The open ended closure cap permits use of the tube to dispense its contents without the necessity of removing the cap completely from the neck of the tube. It need merely be given a couple of turns to lift the open end of the cap from the tip of the neck of the tube. The possibility of dropping, misplacing or losing the cap is eliminated.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof. The specific embodiments described are given by way of example only and the invention is limited only by the terms of the appended claims.

We claim:

1. A unitary resilient non-rigid tube for containing and dispensing relatively thick viscous substances, said tube including a flexible hollow tubular body, a narrowing shoulder portion at one end of said body and a central hollow neck portion projecting outwardly from said shoulder, the base of said neck portion being threaded, the projecting end of said neck portion extending beyond said threads tapering inwardly and terminating in a projecting tip portion forming a closed end on said neck portion, and at least one off-center longitudinal slit across said tapering projecting neck end portion, said slit being normally closed but adapted to be spread open under pressure exerted by material being expelled from said tube body, said tube, body, shoulder and neck portions, including the threaded base of said neck portion, being thin walled, of substantially uniform wall thickness such that the impressions of the threads are apparent from the inside of the neck, and consisting essentially of a heat deformable, film forming synthetic resinous plastic material.

2. A tube according to claim 1 further characterized in that said neck portion is provided with a rigid screw-on closure cap the inner surfaces of which are threaded and conform generally to the outer surfaces of said tube neck portion, said closure cap being provided with an end opening opposite to the threaded end of said cap, said cap in its closed position maintaining said slit in normal closed position and adapted when partially unscrewed to permit said slit to be spread open under pressure exerted by material being expelled from said tube body.

3. A tube according to claim 2 further characterized in that said projecting neck tip portion and said closure cap end opening are generally circular in cross-section whereby said projecting tip is adapted to fit into said opening when said cap is screwed into closing position.

4. A tube according to claim 3 further characterized in that said longitudinal slit is spaced outwardly from said projecting tip to provide a narrow shoulder adjacent to the base of said tip whereby the inner periphery of said closure cap end opening seats upon said shoulder to seal the tube when the cap is screwed into closing position.

5. A tube according to claim 1 further characterized

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in that said tapering projecting end portion is provided with two parallel longitudinal slits, each of said slits being spaced outwardly from and on opposite sides of said projecting tip to form a narrow shoulder adjacent to the base of said tip.

6. A tube according to claim 1 further characterized in that said synthetic resinous plastic material is polyethylene.

7. A unitary resilient non-rigid tube for containing and dispensing relatively thick viscous substances without the necessity of removing the closure cap, said tube including a flexible hollow cylindrical tubular body, a narrowing generally circular shoulder portion at one end of said body and a central hollow neck portion projecting outwardly from said shoulder, the base of said neck portion being threaded, the projecting end of said neck portion extending beyond said threads tapering inwardly and terminating in a generally circular projecting tip portion forming a closed end on said neck portion; said tube body, shoulder and neck portions, including the threaded base of said neck portion, being thin walled, of substantially uniform wall thickness such that the impressions of the threads are apparent from the inside of the neck, and consisting essentially of polyethylene; a rigid screw-on closure cap on said neck portion, the inner surfaces of said cap including threads and conforming generally to the outer surfaces of the tube neck portion, said closure cap having generally circular end opening opposite to the threaded end of said cap and adapted to fit over said projecting tip; and a pair of parallel longitudinal slits across said tapering projecting neck end portion, each of said slits being spaced outwardly from and on opposite sides of said projecting tip to form a narrow shoulder adjacent to the base of said tip whereby the inner periphery of said closure cap end opening seats upon said shoulder to seal the tube when the cap is screwed into closing position, said slits being normally closed but adapted to be spread open under pressure exerted by material being expelled from said tube body, said cap in its closed position maintaining said slits in normal closed position and adapted when partially unscrewed to permit said slits to be forced open under pressure exerted by material being expelled from said tube body.

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