Feb. 3, 1970 G. BALLIN 3,493,147

COLLAPSIBLE TUBE AND FOLLOWER

Filed Feb. 5, 1968

FIG. 1

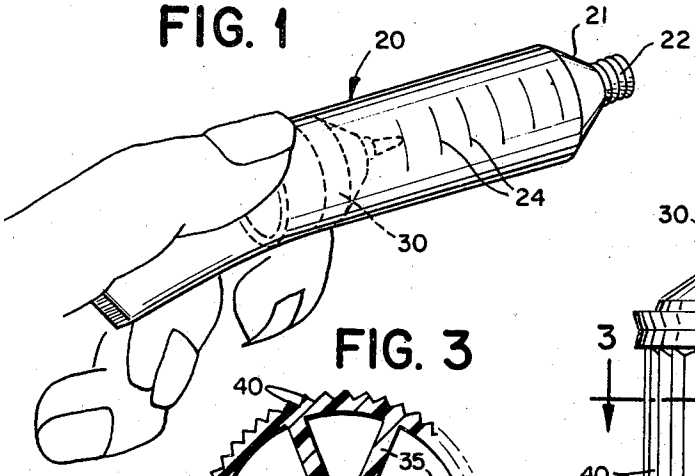


FIG. 2

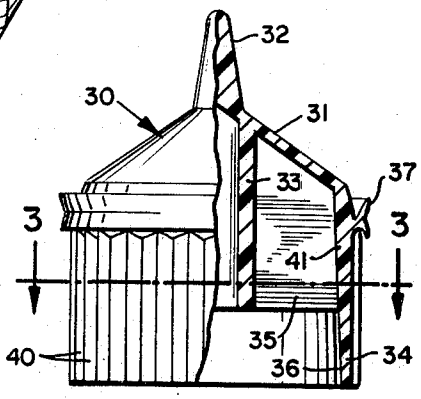


FIG. 3

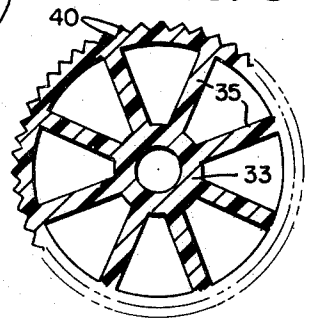


FIG. 4

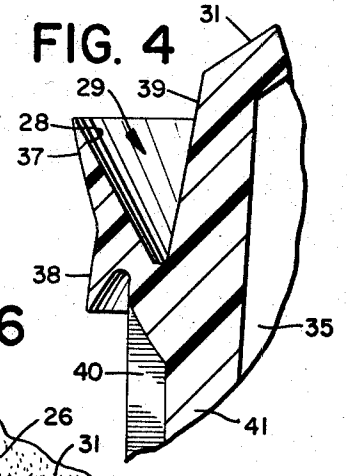


FIG. 5

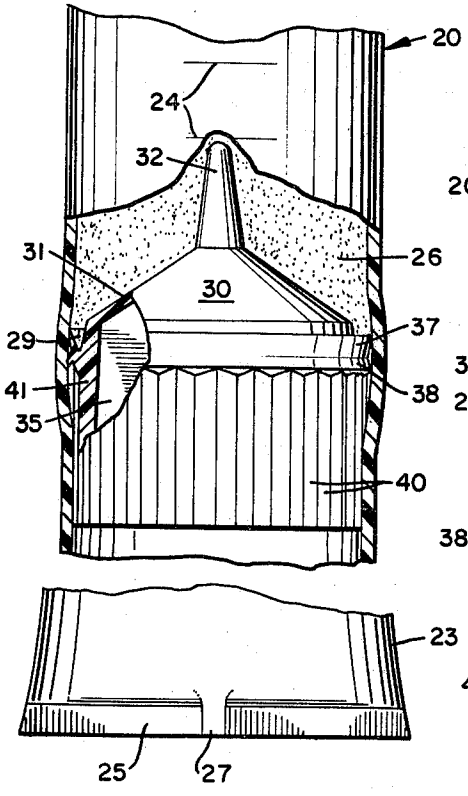
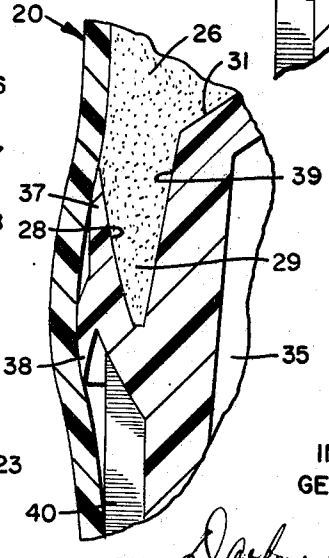


FIG. 6



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COLLAPSIBLE TUBE AND FOLLOWER

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U.S. Cl. 222—158 22 Claims

ABSTRACT OF THE DISCLOSURE

A dispensing tube for a fluid or semi-fluid composition having a follower located in the tube. The forward half of the follower is reinforced while the rear half of the follower is flexible. The follower also includes a pair of outwardly extending sealing flanges one of which projects forwardly while the other extends rearwardly to prevent passage of the dispensed material and air around the follower. The tube in which the follower is used has a sealed end opposite the dispensing end provided with an orifice which allows air into the tube but restricts outward flow.

This invention relates to improvements in flexible collapsible tubes for dispensing fluid or semi-fluid compositions when the tubes are squeezed and more particularly relates to means for increasing the efficiency of such collapsible dispensing tubes.

Flexible collapsible tubes are commonly used for dispensing a variety of fluid and semi-fluid compositions such as toothpaste, shaving cream, jellies, ointments, greases, oil colors and the like. Such dispensers are made of metallic foils, plastic compositions and combinations thereof of light gauge, so that the wall of the tubes will deform, flex or bend when squeezed between the fingers and extrude a portion of the contents of the tube. Generally, the extrusion of the complete contents of the tube has been found to be extremely difficult. Additionally, purely metal tubes wrinkle during use and tear easily so that pressure exerted on the tube expels the contents of the tube through the tear instead of through the mouth of the tube, thereby preventing resealing of the contents and creating a problem with each use thereafter. Further, the dispensing of measured quantities of material has been extremely difficult.

Attempts have been made heretofore to solve the above problems. One such dispensing apparatus is shown in my prior patent No. 3,297,207 issued Jan. 10, 1967.

In my prior Patent 3,297,207 a dispenser is disclosed wherein a tube follower is positioned within a flexible plastic tube. The tube followers disclosed therein while having improved characteristics over the prior dispensers have problems which prevent their application to certain types of collapsible tubes where extreme accuracy is required in the amount of the contents dispensed or where the presence of air affects the contents. When used with certain types of tubes, the tube collapses forward of the follower during use causing a restriction to form, thus increasing the force necessary to dispense the desired material. In addition the prior configurations permits air to pass into the material to be dispensed from behind the follower thereby preventing accurate dispensing of the contents and permitting deterioration of the contents from the air.

According to the present invention, a tube follower is provided in combination with a collapsible tube which can be assembled after filling of the tube with the material to be dispensed or pre-assembled and the tube filled through the orifice. The tube follower has a body portion having a diameter slightly smaller than the interior diameter of the tube. Approximately half of the body portion is reinforced at the end nearest the dispensing end

of the collapsible tube while the rear half of the follower is made flexible. An outwardly extending flange is located near the end of the body portion toward the dispensing end of the tube and acts as a squeegee to force material at the side of the tube forward and prevent its passing around the sides of the follower to the base of the tube. A second flange extends rearwardly from the aforementioned flange to prevent the passage of air from behind the follower into the contents of the tube. Both of the flanges have a diameter in excess of the diameter of the tube. The end of the follower which faces the dispensing end of the tube desirably includes a tip which extends through the orifice when the contents are completely exhausted to indicate such condition.

The tube used in the combination may be provided with a flared filling end to permit easy filling of the tube and insertion of the follower. In addition an orifice is provided in the seal at the filling end to permit air to enter the tube after dispensing to restore the undistored shape of the tube. The orifice is formed between the two flat surfaces of the seal so that increased air pressure to the rear of the follower caused by an inadvertent rearward movement of the follower, will close the orifice impeding the undesired movement of the follower.

The invention will be described in greater detail below and in the drawings in which:

FIGURE 1 is a perspective view of the invention showing the follower in use in a collapsible tube;

FIGURE 2 is a side elevational view, partially cut away of a follower in accordance with the present invention for use in association with a collapsible tube;

FIGURE 3 is a cross-sectional view along line 3—3 of FIG. 2;

FIGURE 4 is an enlarged view of the follower showing the flanges;

FIGURE 5 is a partial sectional view of a tube with the follower in place;

FIGURE 6 is an enlarged view of the flanges as shown in FIG. 5.

A collapsible container **20** shown in FIG. 1 is tubular in shape and is preferably fabricated from any conventional plastic material or combination of flexible material of suitable gauge. A collapsible container which is flexible, resilient and fatigue-resistant in peculiarly adapted to the extrusion of an exact or measured amount of the contents **26** of tube **20**.

Tube **20**, as illustrated, has a conical neck portion **21** formed at its top, ending in a conventional male threaded hollow extrusion nipple **22** to receive a female threaded screw cap (not shown). Tube **20** may be provided with a visible scale **24** along its longitudinal surface graduated to indicate any system of measure of capacity expressed in fluid ounces, cubic centimeters, etc. Any fluid or semi-fluid composition **26** may be extruded through nipple **22**.

Collapsible tube **20** is made slightly longer than a conventional collapsible tube of the same capacity, in order to accommodate a follower **30**. A funnel-like flange **23** may be provided in the base of the tube to permit easy insertion of the follower **30**. After follower **30** has been inserted inside tube **20**, the filling end thereof may be either closed as by heat or ultarsonic sealing at **25** (FIGURE 1) in the conventional way or may be left open.

In the preferred embodiment as shown in FIG. 5, a small opening **27** is left in seal **25** of tube **20**. The opening is sized so as to permit leakage of air into the tube after use, eliminating the vacuum caused by the forward movement of the insert. The tube thereby gradually returns to its original shape. Additionally, when the tube is accidentally squeezed forward of the follower the smallness of the opening **27** at the seal permits little, if any, air to exit from the tube behind the follower, thereby acting to

prevent or retard undesired rearward motion of the follower. The one-way action of the opening **27** is created by the fact that it is bounded by two flat surfaces which tend to close with each other when subjected to a sudden rush of air and increased pressure in the tube. When air flow is slower, in the case of the air entering the base of the tube after dispensing, the air can flow between the two surfaces without substantial hindrance.

Follower **30** is sized to telescopically fit within the dispensing tube **20** with a sliding fit so that when the nipple **22** is uncapped, the follower may be advanced in the tube **20** to extrude a measured quantity of contents **26** of the dispenser through nipple **22**.

As shown in FIGURES 2, 3 and 4 follower **30** includes a conical neck portion **31** shaped in size to nest inside substantially conical neck **21** of the collapsible tube **20**, and a protruding indicator **32** sized to extend through nipple **22** when the contents of the tube are totally evacuated. The indicator **32** will indicate to the user that complete dispensing has been achieved. Although the indicator **32** is shown in the preferred embodiment, any desired nose may be used, for example, a nose complementary to the nipple. The side wall **34** of the follower has a slightly smaller diameter than the interior of the tube and is provided with serrations **40** to reduce friction and permit easy movement of the follower in the tube.

A portion **41** of side wall **34** which merges with neck **31** is reinforced. A narrow hollow cylindrical core **33** is located on the interior of the follower and extends approximately half the length of the follower side wall **34**. Core **33** is molded to the interior of the follower at the forward end. Extending radially outwardly from the core is a series of reinforcing ribs **35** which are integrally molded with the core **33** and side wall **34**. The ribs are of sufficient strength to make the section of wall **34** to which they are joined, substantially rigid. Although ribs **35** are illustrated, any reinforcing method may be used alternatively, for example, an annular ring may be incorporated in the follower.

Extending rearwardly from the reinforced portion **41** of the follower is a skirt **36** which constitutes an extension of the reinforced forward wall section **41** and is made of a flexible material which is equal in approximate length to the reinforced section. Skirt **36** yields under pressure applied to it and urges the follower forward and serves to keep the follower axially parallel to the axis of the tube.

Located at the forward end of the follower **30** as shown in FIG. 4, and extending outwardly and forwardly is a resilient squeegee shaped flange **37** which is molded integrally with wall **34**. The flange **37** has a diameter larger than the interior diameter of the tube so that material in the tube is prevented from passing backwardly past the squeegee. Flange **37** is of approximately the same length as wall **39** located adjacent to it on the follower body, so that when the follower is at the dispensing end of the tube, flange **37** will be forced closely adjacent wall **39** thereby permitting all of the material in the tube to be evacuated.

Extending rearwardly and outwardly from the forward flange **37** and integrally formed with it is a second resilient flange **38**. Flange **38** prevents air from passing from the rear of the follower into the material ahead of the follower. Presence of such air will create a problem in dispensing the materials **26** since air bubbles will make it impossible to accurately measure the material based upon the calibration **24** of the tube. Also such air could affect the contents if they are susceptible to air deterioration. The two flanges **37** and **38**, in combination, prevent passage around the follower of material or air in either direction. Although flange **38** is shown as an integral portion of flange **37**, it may be attached separately to the body of the follower to the rear of flange **37**.

By squeezing or pinching uncapped tube **20** between the thumb and forefinger at the skirt **36** of follower **30**, substantially as shown in FIGURE 1, the wall of tube **20** is compressed, which applies pressure to skirt **36** of the follower **30**, thus urging the follower **30** forward toward neck **21** of tube **20** to exert pressure on the column of material **26** within tube **20** and extrude a desired portion thereof through nipple **22**. It has been found that a follower which does not have reinforcing means such as ribs **35** will under the above action of squeezing cause a deformation of the tube which will impede the forward travel of the follower and the dispensing of the contents of the tube. When the tube is squeezed and the follower lacks a reinforced cylindrical portion, inward bending of the tube will occur forward of the follower in a direction perpendicular to the axis at which the tube is squeezed. Such inward deformation of the tube blocks the forward travel of the follower preventing a smooth forward travel and resulting in considerably increased effort to achieve dispensing of the contents. By providing a reinforced section as shown in FIG. 2 any distortion that is created in the tube by the application of discharging pressure will occur in the area of the reinforced section and will be flattened by the reinforced follower thereby preventing a disruption in the tube configuration forward of the follower. The pressure therefore required for extrusion of a quantity of a semi-fluid material will be much less than that required if the follower lack the reinforcing. In addition, the movement of the follower will be smoother, permitting accurate dispensing that would not be possible with a hesitating and jerking movement.

The upstanding peripheral flange **37**, as shown in FIG. 6, engages the interior surfaces of the wall of the tube **20** with a feathering action to wipe off composition **26** from the surface into V-shaped channel **29** formed between the face of the inwardly and rearwardly inclined wall **28** of flange **37** and rearwardly and outwardly inclined face **39** of the conical neck **31**. The second flange **38** extends rearwardly and outwardly from the first flange and firmly engages the interior surface of the tube wall preventing any air located behind the follower from passing around the follower into the dispensed material.

Scale **24** may be calibrated in any preferred system of measure such as fluid ounces and fractions thereof. To measure out any desired amount of composition **26**, the scale reading should be initially noted and then composition **26** should be extruded in the manner described above, while observing changes in the scale reading until the new scale reading indicates the exact amount desired has been dispensed through the nipple **22**.

Tube **20** may be made of any conventional type of pliable, flexible, collapsible, resilient material which is compressibly responsive to finger pressure such as polyethylene, polyvinyl acetate or polyvinyl chloride or combinations of flexible materials. Followers of this invention may be fabricated from plastic material suitable for use with the product to be dispensed. Followers made of polyethylene give good results.

While the closed end of the tube illustrated is shown having a threaded nipple, a dispensing opening could be used in conjunction with any desired capping structure, all of which is well known in the art. From the above it is to be understood that the present invention provides positive ejection of the material contained within the tube of a precise measured amount with minimum distortion of the tube ahead of the follower and with provision for prevention of any air from leaking into the dispensed material thereby disrupting the accuracy of the dispensing operation or creating deterioration of the contents.

It will be understood that the invention has been described for the purposes of illustration and that changes and variations are possible without departing from the scope of the invention; all of such modifications and changes are intended to be included in the appended claims.

What is claimed is:

1. In combination, a resilient deformable dispensing tube having a discharge opening at one thereof and adapted to house material to be ejected through said opening, and a follower positioned within said tube for ejecting material housed therein through said discharge opening, said follower having a body portion slidably fitted to the interior wall of said tube and a forward end facing said discharge opening, an outwardly extending peripheral flange projecting forwardly from said follower to define a squeegee edge slidably fitted to the interior of said tube to remove material from the wall thereof as the follower is moved forwardly in the tube, said squeegee edge having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the tube contents from passing back of the follower when pressure is exerted on the resilient, deformable tube, said follower having means for preventing the formation of distortions in the tube when said follower is subjected to pressure from behind in its direction of travel, said distortion preventing means further comprising means for reinforcing said follower body portion a predetermined distance rearwardly from said follower forward end, and means for rendering the remainder of said body portion relatively yieldable.

2. The combination according to claim 1 wherein said dispensing tube is sealed at the end opposite said discharge opening, the combination further including means for allowing the entry of air into said tube between the sealed end and the follower to restore the original pressure to the tube after discharge of a portion of the contents of said tube, and means for limiting the evacuation of air from the space between the sealed end and said follower during rearward movement of the follower.

3. The combination according to claim 2 wherein said means for allowing the entry of air into said tube comprises an orifice having two closely spaced resilient surfaces joined at opposite sides, the space between said surfaces being in communication with the interior and exterior of said tube.

4. The follower of claim 1 wherein the reinforcing means include a relatively rigid core member extending rearwardly from the center of said follower forward end and a plurality of rib members extending radially between said core member and an interior wall of said body portion, said rib members being integral with said core and said body portion.

5. The combination according to claim 1 further including a second peripheral flange projecting rearwardly and outwardly from said first peripheral flange to define a second sealing edge slidably fitted to the interior of said tube, said second peripheral flange having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the passage of air from the rear of said follower to the front of said follower.

6. The combination of claim 5 wherein said tube is calibrated to measure quantities of materials ejectable therefrom by said follower, and has a scale legibly recorded upon the wall of said tube to indicate the position of said follower relative to the tube after ejection of each measured quantity of material.

7. The combination of claim 1 wherein said body rearwardly of said flange is formed with a plurality of longitudinal serrations on its exterior to reduce the sliding friction of the follower as it moves in the tube.

8. The combination defined by claim 1 wherein the end of said tube opposite said dispensing opening is flared outwardly.

9. The combination of claim 1 wherein said follower includes a projecting indicator extending forwardly from the forward end of said follower and of sufficient length and width to extend through the discharge opening of said tube when the contents of said tube are completely evacuated.

10. A follower for use in dispensing the contents of a flexible tube comprising a body portion, a nose section unitary with the forward end of said body portion, a peripheral flange projecting forwardly and outwardly from the forward end of said body portion to define a squeegee edge, said squeegee edge having a slightly larger exterior diameter than the exterior diameter of the body portion, reinforcing means interior of said body portion rendering approximately half of the body portion adjacent the nose rigid and means for rendering the remainder of said body portion relatively yieldable.

11. The follower of claim 10 further including a second peripheral flange projecting rearwardly and outwardly from said body of said follower to define a sealing edge, said second peripheral flange having a slightly larger diameter than the diameter of said body portion.

12. The follower of claim 10 further including a second peripheral flange projecting rearwardly and outwardly from said first peripheral flange to define a sealing edge, said second peripheral flange having a slightly larger diameter than the diameter of said body portion.

13. The follower of claim 10 wherein the reinforcing means includes a relatively rigid core member extending rearwardly from the center of the nose section and a plurality of rib members extending radially between said core member and the interior wall of said body portion, said rib members being unitary with said core and said body portion.

14. The follower of claim 12 further including a projecting indicator centrally located on said follower and extending forwardly from the forward end of said follower.

15. In combination, a resilient deformable dispensing tube having a discharge opening at one end thereof and adapted to house material to be ejected through said opening, and a follower positioned within said tube for ejecting material housed therein through said discharge openings, said follower having a body portion slidably fitted to the interior wall of said tube and a forward end facing said discharge opening, a first outwardly extending peripheral flange projecting forwardly from said follower to define a squeegee edge slidably fitted to the interior of said tube to remove material from the wall thereof as the follower is moved forwardly in the tube, said squeegee edge having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the tube contents from passing back of the follower when pressure is exerted on the resilient, deformable tube, a second peripheral flange projecting rearwardly and outwardly from said follower body to define a sealing edge slidably fitted to the interior of said tube, said second peripheral flange having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the passage of air from the rear of said follower to the front of said follower, said follower having means for preventing the formation of distortions in the tube when said follower is subjected to pressure from behind in its direction of travel, said distortion preventing means further comprising means for reinforcing said follower body portion a predetermined distance rearwardly from said follower forward end, and means for rendering the remainder of said body portion relatively yieldable.

16. The combination of claim 15 wherein said tube is calibrated to measure quantities of material ejectable therefrom by said follower, and has a scale legibly recorded upon the wall of said tube to indicate the position of said follower relative to the tube after ejection of each measured quantity of material.

17. The combination of claim 15 wherein said tube is calibrated to measure quantities of material ejectable therefrom by said follower, and has a scale legible re-

corded upon the wall of said tube to indicate the position of said follower relative to the tube after ejection of each measured quantity of material.

18. The combination of claim 17 wherein said tube is calibrated to measure quantities of materials ejectable therefrom by said follower, and has a scale legibly recorded upon the wall of said tube to indicate the position of said follower relative to the tube after ejection of each measured quantity of material.

19. In combination, a resilient deformable dispensing tube having a discharge opening at one end thereof and adapted to house material to be ejected through said opening and a follower positioned within said tube for ejecting material housed therein through said discharge opening, said follower having a body portion slidably fitted to the interior wall of said tube and a forward end facing said discharge opening, a first outwardly extending peripheral flange projecting forwardly from said follower to define a squeegee edge slidably fitted to the interior of said tube to remove material from the wall thereof as the follower is moved forwardly in the tube, said squeegee edge having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the tube contents from passing back of the follower when pressure is exerted on the resilient, deformable tube, a second peripheral flange projecting rearwardly and outwardly from said follower first peripheral flange to define a sealing edge slidably fitted to the interior of said tube, said second peripheral flange having a shape complementary to the interior wall of the tube and being slightly larger than said interior wall to form a pressure seal to prevent the passage of air from the rear of said follower to the front of said follower, said follower having means for preventing the formation of distortions in the tube when said follower is subjected to pressure from behind in its direction of travel, said distortion preventing means further comprising means for reinforcing said follower body portion a predetermined distance rearwardly from said follower forward end, and

means for rendering the remainder of said body portion relatively yieldable.

20. A follower for use in dispensing the contents of a flexible tube comprising a body portion, a nose section unitary with the forward end of said body portion, a first peripheral flange projecting forwardly and outwardly from the forward end of said body portion to define a first sealing edge, said first sealing edge having a slightly larger exterior diameter than the exterior diameter of the body portion, a second peripheral flange projecting rearwardly and outwardly with respect to said follower to define a second sealing edge, said second peripheral flange having a slightly larger diameter than the diameter of said body portion, and means for rendering the remainder of said body portion relatively yieldable.

21. A follower according to claim 20, wherein said second peripheral flange extends from said follower body.

22. A follower according to claim 20, wherein said second peripheral flange extends from said first peripheral flange.

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