June 10, 1958 E. B. FREED 2,838,207

COLLAPSIBLE TUBE

Filed July 5, 1955

FIG. 1.

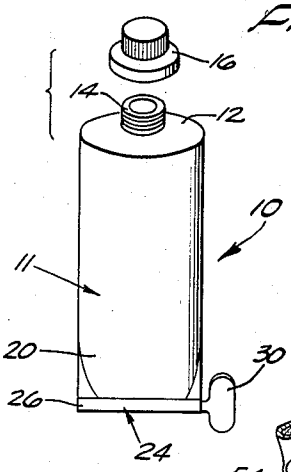
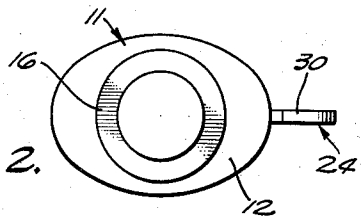


FIG. 2.



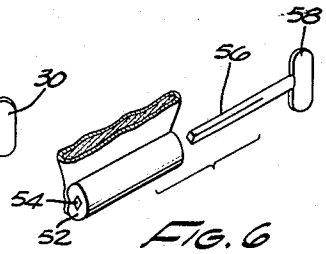


FIG. 6

FIG. 7.

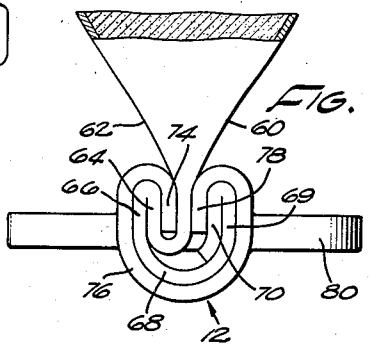
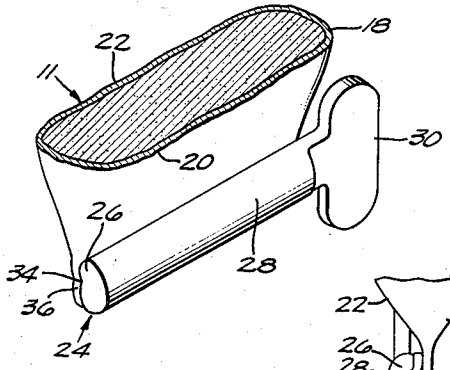


FIG. 3.



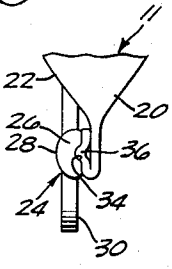


FIG. 4.

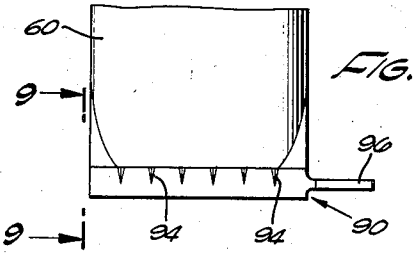


FIG. 8.

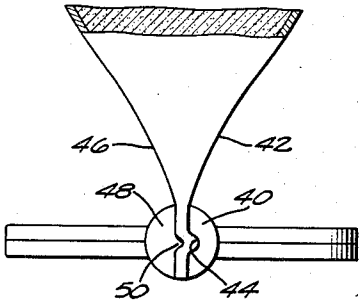


FIG. 5.

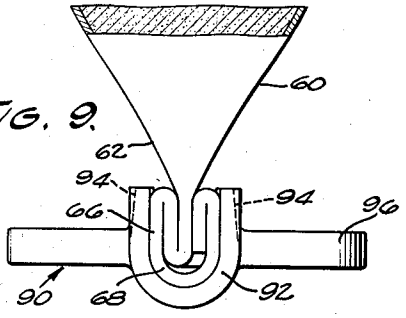


FIG. 9.

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COLLAPSIBLE TUBE

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Application July 5, 1955, Serial No. 519,740

4 Claims. (Cl. 222—99)

This invention relates to a tube for holding various materials such as fluids and more particularly to a collapsible tube having features for obtaining the use of an optimum percentage of the contents in the tube.

Deformable tubes are presently used for a number of different purposes. For example, tubes of this nature are used to hold toothpaste and shaving cream for use in the home and other fluids such as lubricating oils and paint compounds in industry. These tubes are provided with a hollow elongated configuration and are closed at their bottom end to retain fluid. The tubes are adapted to be opened at their top end to obtain an extrusion of the contents from the tube upon the exertion of pressure against the tube.

Since the tubes are deformable, they can be coiled upwardly into a spiral configuration as the contents are extruded from the tube. In this way, all of the contents are maintained at the top of the tube so that the contents can flow from the tube with a minimum amount of pressure. Winding the tube at the bottom to obtain a compact relationship is also desirable since it tends to insure that a substantial amount of the contents in the tube will ultimately be made available.

The use of as much of the contents as possible is important in the household for such items as toothpaste and shaving cream since these are items which are used every day. Using as much of the contents as possible in industry is important because of the high cost involved in the purchase and storage of at least some of the contents. Various attempts have been made to obtain an optimum use of the contents in deformable tubes. Furthermore, the attempts have been made over a large number of years. However, the attempts have not been entirely successful.

This invention provides a tube for obtaining the use of an optimum amount of contents in the tube. The tube has an elliptical shape in a direction substantially perpendicular to its elongated dimension. This elliptical shape is important in providing for optimum efficiency because it is the shape that the tube naturally adopts after a certain amount of the fluid has been used. A key is also provided at the bottom of the tube to facilitate a manual gripping of the tube for coiling the tube into its compact form. The key may be integral with the bottom of the tube or it may be formed from a separate piece fixedly held at the bottom of the tube. The key may be provided with a particular shape such as a curved external shape to insure that a maximum amount of unused fluid in the bottom of the tube is pressed upwardly as the bottom of the tube is coiled. The key may also be formed in other embodiments as will be described in detail subsequently.

An object of this invention is to provide a collapsible tube in which almost all of the contents in the tube can be used.

Another object is to provide a collapsible tube in which the tube can be easily wound upwardly into a spiral configuration to maintain the contents at the top of the tube for optimum use of the contents.

A further object is to provide a collapsible tube having a key portion at the bottom of the tube to obtain a firm and easy grip for rolling successive layers upwardly upon one another.

Still another object is to provide a collapsible tube having an elongated configuration and having a substantially elliptical shape in a direction perpendicular to the elongated dimension to facilitate the use of almost all of the contends in the tube.

Other objects and advantages will be apparent from a detailed description of the invention and from the appended drawings and claims.

In the drawings:

Figure 1 is an exploded perspective view of a collapsible tube constituting one embodiment of this invention;

Figure 2 is an enlarged top plan view of the tube shown in Figure 1;

Figure 3 is an enlarged, fragmentary perspective view of the bottom portion of the tube shown in Figure 1 as seen from a position in front of and to the left of the tube and shows the tube in an intermediate state of formation;

Figure 4 is an enlarged, fragmentary side elevational view of the collapsible tube shown in the previous figures in its final state of formation;

Figure 5 is an enlarged, fragmentary side elevational view of a tube constituting a second embodiment of the invention, the tube being shown in an intermediate state of formation similar to that shown in Figure 3;

Figure 6 is an enlarged, fragmentary, exploded perspective view of a third embodiment of the invention;

Figure 7 is an enlarged, fragmentary side elevational view of a fourth embodiment of the invention as seen from the left side of the tube;

Figure 8 is an enlarged, fragmentary front elevational view of a collapsible tube forming a fifth embodiment of the invention; and

Figure 9 is an enlarged, fragmentary side elevational view of the embodiment shown in Figure 8 as seen from a position defined by a section line 9—9 in Figure 8.

One embodiment of an invention for a collapsible tube generally indicated at **10** is shown in Figures 1 to 4, inclusive. This embodiment includes a hollow body portion **11** made from a suitable material such as a metal or a plastic having properties of deformation. For example, the body portion **11** may be made from a suitable material such as tin. The body portion **11** has an elongated configuration in one direction. In a direction substantially perpendicular to this first direction, the body portion **11** has a substantially elliptical configuration. This is best shown in Figure 2.

A support portion **12** extends from the top of the body portion **10**. The support portion **12** has a frusto-conical shape which tapers inwardly as it extends upwardly. A nozzle **14** extends upwardly from the top of the support portion **12**. The nozzle **14** is preferably tapped so as to receive a cap **16** which screws on the nozzle. When the cap **16** has been screwed on the nozzle **14**, it prevents the flow of the contents such as fluid through the nozzle. It should be appreciated that the tube may be provided with other openings than are obtained by the nozzle **14** and the cap **16**. For example, the top of the tube may be opened by ripping a seam. It should also be appreciated that the tube is adapted to hold different material. For example, the tube is adapted to hold such material as liquids, semi-liquids, semi-solids, fungible solids and powdered solids.

The tube constituting this invention is able to hold and make available for use material that previous tubes have not been able to hold and make available for use.

This is especially true of the semi-solids and the fungible and powdered solids. The tube is able to make additional material available for use for reasons which will be described in detail subsequently.

As indicated at **18** in Figure 3, the body portion **11** tapers inwardly at its bottom end. As the body portion **11** tapers inwardly, the curved walls defining the body portion become gradually flattened so that at the bottom a pair of substantially parallel walls **20** and **22** are formed. These walls are either in contact with each other or are separated from each other by a relatively short distance so as to provide at least a partial seal against the leakage of the contents through the bottom of the body portion **10**.

The seal against the leakage of the contents is completed by the inclusion of features constituting one embodiment of this invention. As shown in Figures 1 to 4, inclusive, a key portion generally indicated at **24** and having a lobe **26** is provided in one of the walls such as the wall **20**. The lobe **26** is provided by increasing the thickness of the wall **20**. The lobe **26** may be formed during the process of forming the tube as by molding such that the lobe is integral with the wall **20**. The lobe **26** is preferably provided with a curved external configuration such as that indicated at **28**. In this configuration, the thickness of the lobe **26** gradually increases with progressive movements downwardly along the wall **20**, and then the thickness of the lobe gradually decreases with further downward movements.

The lobe **26** extends longitudinally across the tube in the direction in which the walls **20** and **22** remain substantially parallel to each other. At one extremity, a handle **30** extends from the lobe. The handle **30** is shown in Figures 3 and 4 as extending in a vertical direction and as being provided with two extensions, one on each side of the lobe. However, it should be appreciated that the handle **30** can extend in any other direction than the vertical and can have a different configuration than that shown in Figures 3 and 4.

At the position of maximum thickness of the lobe **26**, the interior surface of the wall **20** is indented to form a groove **34**. This groove retains a tongue portion **36** of the wall **22**. The tongue portion **36** is formed during the molding operation. The tongue portion **36** cooperates with the groove **34** to provide a further seal against the leakage of the contents such as fluid from the bottom of the tube upon the exertion of pressure against the tube.

As a final step in the formation of the tube shown in Figures 1 to 4, inclusive, the bottom of the tube **11** is folded back upon itself. The tube is folded in a direction so that the curved surface still appears in an exterior position. For example, the bottom of the tube is folded in a clockwise direction so that it will have the configuration shown in Figure 4. By folding the bottom of the tube back upon itself, further assurance is obtained that no contents will leak from the bottom of the tube. The purpose of folding the bottom of the tube to retain the curved surface **28** in an exterior position will be described in detail hereafter.

Fluids such as toothpaste or shaving cream can be stored in the collapsible tube shown in Figures 1 to 4, inclusive, and described fully above. These fluids are normally used in the household. Other fluids such as lubricating oils for use in industry can also be retained within the collapsible tube. Other contents such as semi-solids and certain solids can also be stored in the tube for subsequent use. As may be seen, at least some of the contents which are held within the tube are quite expensive. Because of this, it is important that as much of the contents within the tube as possible be used. This is even true of such household items as toothpaste since it is used every day by the whole family and can mount to a considerable expense over the course of a year, especially to a budget-minded housewife.

The contents in the collapsible tube shown in Figures 1 to 4, inclusive, can be used to a high degree. The contents are withdrawn from the tube by removing the cap **16** from the nozzle **14** and exerting pressure against the walls of the body portion **11**. This compresses the walls because of the deformable nature of the walls and forces the contents out through the nozzle. Materials such as semi-solids and certain solids can also be withdrawn from the tube described above since a full amount of force is available to extrude the contents from the tube when the tube is compressed. This results at least in part from the movement of the contents into the top of the tube upon the coiling of the bottom portion and from the fullness of the top portion of the tube.

As the contents are used, the tube starts to become empty. In order to maintain the contents at the top of the tube for easy extrusion through the nozzle **14**, the contents are moved upwardly by pressing against the bottom of the tube. The longitudinal dimension of the tube is then correspondingly diminished by winding the bottom of the tube upwardly into a spiral. This is accomplished by manually grasping the handle **30** of the key portion **24** in Figures 3 and 4 and rotating the key portion in a clockwise direction in Figure 4. By including the key portion **24**, the bottom of the tube can be wound into a tight spiral. This tends to insure that any contents in the portion of the tubing being wound will be forced upwardly in the tube so as to be still available for use. It also tends to insure that the quantity withdrawn from the tube can be controlled with certainty at any time. The key portion **24** is also advantageous in that it can be easily gripped to obtain an even coiling of the tube. By including the key portion **24**, any possibilities of obtaining broken fingernails and bad tempers during the winding operation are minimized.

The embodiment shown in Figures 1 to 4, inclusive, is also advantageous because of the action of the curved surface **28**. This surface contacts the portion of the tube being wound and gradually increases the pressure against the tube as another loop is being coiled. By gradually increasing the pressure on the tube, the contents in the tube portion being wound are forced upwardly into the portion of the tube still being used. The curved surface **28** has a further advantage in that it causes even the first turns of the wound tube to have a curved configuration. This is important in insuring an even and tight winding of the successive turns.

The tube disclosed above is also advantageous because of its shape. By providing the tube with an elliptical shape in a cross-sectional direction perpendicular to its longitudinal dimension, the tube initially has the shape which it would ordinarily tend to assume after some of the contents have been removed from the tube. However, because of the elliptical configuration normally imparted to it, the tube does not have any pockets created in it by changes in the shape of the tube. In this way, an increase is obtained in the amount of the contents such as fluid which can be withdrawn from the tube.

The tube described above is also advantageous because of the tight coils in which it becomes wound as the contents are removed. This tends to eliminate air pockets and prevents deterioration of items which are sensitive to the air. By winding the tube in tight coils, the space occupied by the tube is also minimized. This is important in the household because of the limited space in the medicine cabinet and because of its tendency to keep the bathroom neat and clean. It is also important in industry, where only a limited space is available for the storage of various materials. When the contents of the tube have been completely consumed, the space occupied by the tube in its coiled relationship is also minimized. This has advantages, especially in industry, both from the standpoint of the space required for storage of discarded containers and from the standpoint of shipping accommodations required for used containers.

The embodiment shown in Figures 1 to 4, inclusive, is

advantageous for other reasons. It requires only a minimum amount of additional material and no extra parts as such. This is important, for example, when the tube is mass produced for household use. The tube can also be produced in a minimum number of steps. For example, it is possible to produce the tube in a single step.

The embodiment shown in Figure 5 is somewhat similar to the embodiment shown in Figures 1 to 4, inclusive. As in the first embodiment, a lobe indicated at **40** is provided on a wall **42** corresponding to the wall **20** in Figures 1 to 4, inclusive. The wall **42** is provided with a groove **44** on its inner surface in a manner similar to the wall **20** in the previous embodiment. However, a second wall **46** corresponding to the wall **22** in Figures 1 to 4, inclusive, is also provided with a lobe **48** which may have an outer configuration corresponding to the lobe **40**.

At its inner surface, the wall **46** may be provided with a tongue **50** positioned and shaped to fit in the groove **44**. The groove **44** and the tongue **50** cooperate to provide at least a partial seal against the leakage of the contents through the bottom of the tube. The embodiment shown in Figure 5 is also advantageous in that the walls **40** and **46** may be bent backwardly upon themselves in either direction as a final step in forming the tube. The walls **40** and **46** may be bent backwardly in either direction since the curved surface on one of the lobes will face outwardly.

The embodiment shown in Figure 6 also includes a lobe **52** preferably having a curved outer configuration corresponding to that indicated at **28** in Figures 3 and 4. The lobe **52** is provided at one end with a socket **54** having a particular shape such as that of a polygon in vertical cross-section. The socket **54** is adapted to hold a key portion **56** having a shape in cross-section corresponding to that of the socket **54**. The key portion **56** may be provided with a handle **58**.

The seal against the leakage of fluid is also obtained in other ways as by folding walls **60** and **62** in a sinuous path. For example, the walls **60** and **62** are first shown as being bent upwardly and to the left in Figure 7. This is indicated at **64** in Figure 7. As shown in Figure 7, the upwardly extending portions **64** of the walls **60** and **62** are somewhat separated from the downwardly extending portion of the wall. The walls **60** and **62** are then shown as being bent downwardly, as indicated at **66** in Figure 7. The walls **60** and **62** are subsequently bent towards the right as they extend downwardly, as indicated at **68** in Figure 7.

The walls **60** and **62** eventually extend upwardly as they extend towards the right. This is indicated at **69** in Figure 7. As a final portion, the walls **60** and **62** are looped backwardly on themselves to extend downwardly, this final portion being indicated at **70** in Figure 7. The portion **70** is separated from the wall **60** by a moderate distance. It should be appreciated that the portions **64**, **66**, **68**, **69** and **70** are merely illustrative and that other arrangements may also be used. However, the walls **60** and **62** should be looped back upon themselves in some fashion to obtain a complete seal of the bottom of the tube.

A key portion generally indicated at **72** extends along the walls **60** and **62** in the direction in which the walls are parallel to each other. One end of the key portion **72** is disposed for support within the space between the portion of the walls **60** and **62** extending initially downwardly and the upwardly extending portion **64** of the walls. This portion is indicated at **74** in Figure 7. The key portion is then looped around and under the portions **66** and **68** as indicated at **76**, and its opposite end is supported between the wall portions **60** and **70**, as indicated at **78** in Figure 7. The key portion **72** has a handle **80** which extends laterally outwardly from the key portion to facilitate manual gripping. As shown in Figure 7, the handle **80** may have a substantially planar configuration to further enhance the ease with which the key portion **72** can be gripped.

The embodiment of the invention shown in Figures 8 and 9 also includes a tube having a body portion, a support portion, a nozzle and a cap similar to that shown in Figures 1 to 4, inclusive, and described fully above. A key portion generally indicated at **90** also forms a part of the embodiment shown in Figures 8 and 9.

The key portion **90** has a substantially U-shaped configuration which extends around and under the portions **66** and **68**, as indicated at **92** in Figure 9. To retain the key portion in this position, the key portion may be crimped at spaced intervals in the longitudinal direction. This is indicated at **94** in Figure 8. The key portion extends laterally outwardly to a position beyond the walls **60** and **62** of the tube to form a handle **96** similar to the handle **80** in Figure 7.

Although this invention has been disclosed and illustrated wtih reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

What is claimed is:

1. In combination, an elongated hollow tube having a closed bottom to retain contents such as a fluid within the tube and having a top portion for obtaining an outward flow of the contents of the tube, the tube being made from a deformable material to facilitate the flow of the contents through the top portion upon the exertion of pressure against the tube and to facilitate the folding of the tube from the bottom into a plurality of sinuous layers in accordance with the removal of the contents from the tube, and a key portion integral with the tube at the bottom of the tube to facilitate a manual grip for winding the tube from the bottom into the plurality of sinuous layers, the key portion having a curved external surface of convex configuration to produce a gradual increase in pressure on the tube as the tube is rotated for an optimum removal of the contents from the tube as the key portion is rotated, the key portion having a grooved configuration at its interior and the tube having a tongue portion for fitting into the groove to facilitate a seal of the bottom end of the tube.

2. In combination, a collapsible hollow tube having a closable top portion for holding contents such as a fluid and for obtaining a flow of the contents through the opening of the top portion and upon an exertion of pressure against the tube, the tube having an elongated configuration in the direction of the flow of the contents and a substantially elliptical shape in a direction perpendicular to the direction of the flow of the contents, the tube being defined at its bottom end by a pair of walls separated from each other by a relatively short distance, and at least one lobe extending across at least one of the walls in integral relationship with the wall, the lobe being provided with a curved external configuration initially extending gradually away from the tube and then extending gradually toward the tube and being recessed at its inner surface to receive a tongue in the other wall for a partial sealing action, the walls being folded back upon themselves at a position above the lobe to provide a seal against the leakage of the contents through the bottom of the tube, the fold being made in a direction to retain the curved surface of the lobe in an external position.

3. In combination, an elongated hollow tube having a top portion with a closable nozzle for obtaining an outward flow of the contents such as fluid through the nozzle upon the opening of the nozzzle, the tube being made from a deformable material to facilitate the flow of the contents through the nozzle upon the exertion of pressure against the tube and to facilitate the folding of the tube from the bottom into a plurality of sinuous layers in accordance with the removal of the contents from the tube, the tube having at the bottom a pair of walls ex-

tending in a substantially parallel configuration and with a slight separation between them, and a lobe on each wall extending along the wall in the parallel direction of the walls, the lobes having configurations of arcuate convexity for producing a gradual increase in pressure against the walls of the tube upon a coiling of the walls, one of the walls having a tongue at its inner periphery and the other having a groove at a corresponding position on its inner periphery to receive the tongue for the provision of at least a partial seal against the leakage of the contents from the tube, the walls being folded back upon themselves at a position above the lobes to provide a further seal against the leakage of the contents from the bottom of the tube.

4. A collapsible tube as set forth in claim 2 in which a socket is provided in the lobe and in which a key portion is adapted to fit in the socket to facilitate the winding of the tube into a plurality of coils upon the removal of contents from the tube.

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