July 3, 1956 A. M. HERZIG 2,753,091

CLOSURE FOR COLLAPSIBLE TUBES

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Fig. 1.

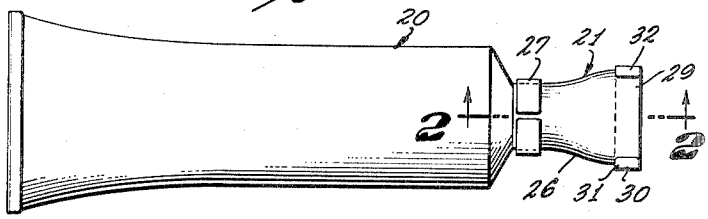


Fig. 2.

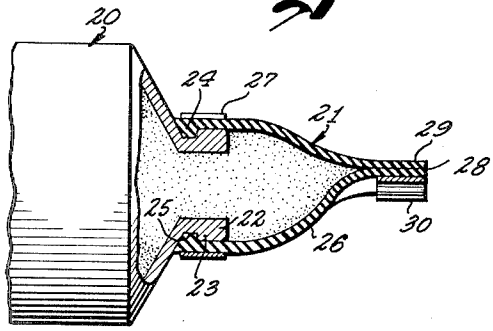


Fig. 3.

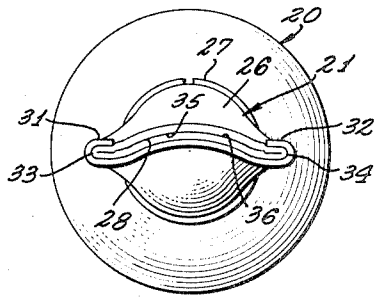


Fig. 4.

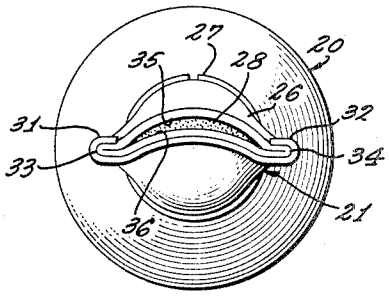


Fig. 5.

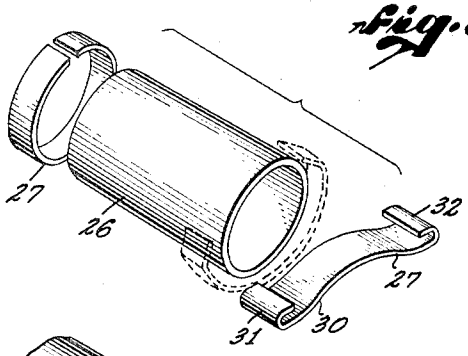
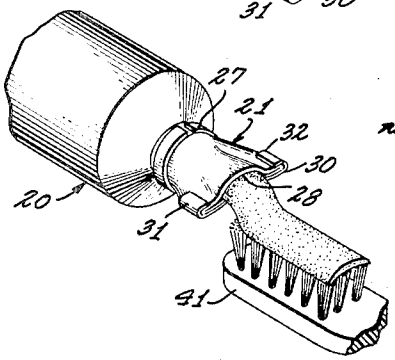


Fig. 6.



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Fig. 7.

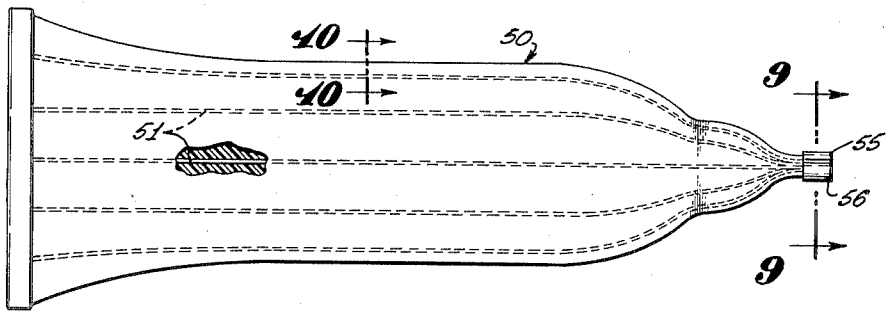


Fig. 8.

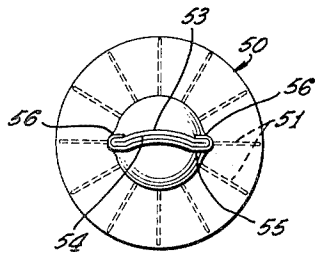


Fig. 9.

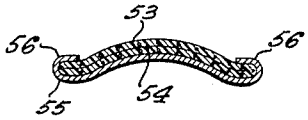


Fig. 11.

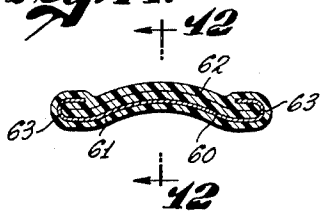


Fig. 12.

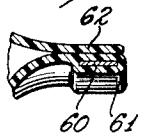
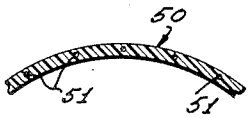


Fig. 10.



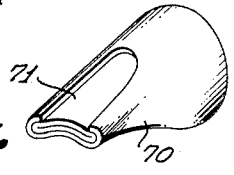


Fig. 13.

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United States Patent Office

2,753,091

Patented July 3, 1956

2,753,091

CLOSURE FOR COLLAPSIBLE TUBES

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Application January 9, 1953, Serial No. 330,379

8 Claims. (Cl. 222—491)

This invention relates to closure devices for collapsible tubes. More particularly it relates to such a closure adapted to open automatically when the tube is squeezed, and to similarly close and seal when pressure on the tube is released.

Many devices intended to accomplish a similar purpose are known to the prior art but such prior mechanisms are in general composed of many or sliding parts. Some do not affect an adequate seal, or, if they do seal, require excessive opening pressures especially for use by women and children. The prior art devices also provide openings in inappropriate places and thus do not lend themselves to desired sanitation. They also lack convenience of use and accuracy of material placement and distribution. None of them therefore have been made commercially acceptable or achieved any measure of commercial success.

In view of the above and other considerations, this invention has among its objectives the improvement of prior art devices heretofore intended for similar purposes. Another object of this invention is to provide an easily manufactured and simple structure which accomplishes a satisfactory seal and which utilizes an inherent elasticity and resiliency of the material of which the closure is made both to provide any desired degree of sealing action, to facilitate and control the intended unsealing action thereof in use, and to provide essentially a nozzle-like desired shape and fineness, thereby keeping the tube dimensions and surface areas at the opening to a minimum to provide a clean and sanitary surface.

Another object of this invention is the provision of an elastic type of closure for collapsible tubes or other containers for fluid under intermittent pressure which affords a small preferably tapered or flattened nozzle-type orifice portion of a desired, preferably approximately crescent-shaped appearance as seen end-on whereby a curved flattened ribbon of the tube-contained material is extruded with a minimum of manual pressure on the tube.

Another object of the invention is the provision of a discharge outlet for collapsible tubes or the like containing e. g. toothpaste, shave cream or other fluid or semi-fluid material, of such a shape that the outlet can be easily and neatly positioned on or astride a brush or other place of deposit of the material to deposit said material in a suitably shaped layer directly thereon.

Another further object of this invention is the provision of a discharge outlet of the character described so as to combine any desired degree of positive sealing action with the elimination of undesirable adjacent surfaces upon which the extruded materials may accumulate or to which they may adhere.

Yet another object of this invention is the optional provision in the device in question of inherent means for adjusting the degree of closing action of the sealing means.

Other objects will appear and be more fully apparent from the accompanying description considered in the light of the appended claims and the drawings.

In the drawings:

Fig. 1 is a side view of a collapsible tube incorporating a closure embodying a first preferred form of this invention.

Fig. 2 is an enlarged fragmentary sectional view of the tube and closure.

Fig. 3 is an end view of the outlet in a closed condition.

Fig. 4 is a fragmentary end-on view similar to Fig. 3 but with the outlet in an open condition.

Fig. 5 is an exploded perspective view of said first preferred closure device.

Fig. 6 is a perspective view of the tube and closure of the preceding figures as used, showing the contents of a toothpaste tube being extruded onto a toothbrush.

Fig. 7 is a side view of a second preferred form of collapsible tube embodying this invention.

Fig. 8 is a front end view thereof.

Fig. 9 is a sectional view taken as on a line **9—9** of Fig. 7.

Fig. 10 is a fragmentary sectional view as on a line **10—10** of Fig. 7.

Fig. 11 is a fragmental sectional view of the front end of a collapsible tube similar to Fig. 9, embodying a third preferred form of this invention.

Fig. 12 is a fragmentary sectional view thereof as on a line **12—12** of Fig. 11.

Fig. 13 is a perspective view of a fourth preferred form of this invention.

Referring more particularly to the drawings, there is shown by way of example but not of limitation a collapsible tube **20** as for toothpaste or like substance, having an automatic closure **21** thereon embodying this invention.

The tube **20** may be of any conventional type or material such as metal, e. g. aluminum or the like, such as are commercially available for toothpaste, shave cream, ointments, cold cream, lotions, and other cosmetics. It can also be of plastic or plastic and wire, as will appear.

While the neck **22** of the tube can be threaded as customary, I find it advantageous to provide merely an annular radial shoulder **23** thereon over which the base portion **24** of the closure can be snapped and into the resulting annular recess **25** of which said base **24** may nest in any pleasing and ornamental manner, such as that shown.

The main body of the closure **21** is, generally speaking, an elastic tube **26**, the base **24** of which can be optionally thickened, threaded, provided with a metal or other threaded insert, or otherwise suitably secured either releasably or permanently to the tube neck **22**. If the tube and closure are of the same material these parts can be made integral. In the preferred form under discussion said base may if desired be more securely or permanently affixed to the tube neck by means of a spring clip or ring **27** of metal or plastic. Such a snap band **27** will also serve to hold the closure on a conventionally threaded tube neck if desired as by doubling or rolling the rubber tube thereat even without the thickening of the base of the tube.

The elastic tube **26** is of any desired length, preferably sufficient to provide an adequate clearance of the tube body **20**.

In any event an outlet **28** is formed by the outer end **29** of the elastic tube when said end **29** is laterally tensioned, preferably stretched to some extent by applying a stiffening member or rib **30** across one end of the flattened tube. Such tensioning or stretching is accomplished in the preferred embodiment under discussion by means of the doubled-back ends **31** and **32** which pinch, clamp or otherwise hold the opposite edges **33** and **34**, respectively, of the elastic tube and secure the member **30** to the sleeve at opposite stations whereupon the sleeve and mem-

ber are reversely curved as shown to effect lateral spreading and tensioning of the tube.

Both upper and lower side edges **35** and **36** of the outlet or lip-forming portion of the elastic **26** are preferably tensioned against the convexity of the rib **30** by virtue of the stretching of said lip portion between said clamp ends **32** and **31**.

It is of greatest importance that the upper lip **35** be under tension at all times to insure a positive resilient sealing closure of the outlet. Such positive sealing closure is best obtained when the upper lip **35** is actually held in a normal stretched relationship over the nether lip **36** and similarly forcing said nether lip downwardly and into a corresponding compressed engagement with said rib **30**.

The shape and degree of curvature of the rib **30** determines the ultimate shape of the outlet in end-on view and also determines at what point or points between the lips the outlet will open in use. Thus a uniform curvature of the rib and outlet will give a smooth ribbon of extruded material of crescent shape tapering to feather edges at **33** and **34**.

A rib of smaller radius of curvature between said edges **33** and **34** will give a ribbon of correspondingly different shape except that there will be an increased tendency of the outlet to open only in its central portion and to remain closed towards the edges **33** and **34**.

A rib having a greater radius of curvature, all other things being equal, will permit the outlet to open under less pressure on the tube **20** and will in general provide a heavier flow. But the tendency of the lips to seal and pinch off the extruded material will then be diminished. It will thus be apparent that the radius of curvature, the wall thickness and character of the elastic, the degree of elasticity, the over-all width of the outlet and the front to back width of the rib will each have a bearing on the ease of opening and closing of the outlet. So too, the relative viscosity and nature of the material **40** to be extruded through the outlet will be a factor in selecting a suitable set of outlet conditions for optimum use. These will be varied therefore to suit conditions within the skill of those familiar with the art to which this invention relates. These principles will be applicable to a fluid material like water or gas, or to a material more resistant to flow.

The most favorable set of operating factors is that which tends to the easiest opening of the outlet consistent with full sealing closure upon release of pressure. Thin-walled easily stretchable lips, a large radius of curvature, a wide outlet opening, and greater fluidity of the contents encourage easy opening.

The rib **30** may be of any desired width from a wire shape and thickness of, e. g. $\frac{1}{64}$ of an inch to a ribbon of, e. g. ½ inch. It may be formed with bent clamping ends as shown or it can be moulded or imbedded integrally into the lower lip **36** of the outlet. It can also be cemented or otherwise adhered to the inside or outside of such lower lip. Both lips **35** and **36** are preferably convex and parallel along their lines of contact in the closed position; otherwise the outlet will not properly seal nor will the outlet taper to a narrow tip as desired. A less desirable construction embodies an essentially rigid outlet quill having a convex edge over which an elastic sheet of material is stretched. Such a structure does not lend itself to the most desired neat and tapered outlet shape of the instant construction. If a longitudinally rigid type of outlet is desired it is preferable that an outer rigid shell be employed comprising substantially a rearward and upward extension of the rib portion **30** to cover the rubber sleeve **26** except, for example, above the upper elastic lip **35**. Such a modification is shown in Fig. 13.

The rib should be sufficiently rigid to hold its form in use and can therefore be of unyielding shape, as iron. It may be slightly resilient if desired, however, and it can also advantageously be formed of a bendable substance such as lead, aluminum, tin plate, or any such metal or alloy of a thinness that can be shaped or re-shaped by hand or with simple tools. The shape and mode of action of the outlet can in such event be altered to suit individual desires or requirements.

It has been found that a rubber commercially available as "Hycar" is suitable for use in the presence of soaps, greases and the like, which might cause other forms of rubber to deteriorate. Vinyl plastics or other elastomers or rubber-like products which are sufficiently elastic in a particular contemplated use are also suitable and are usually unaffected by cosmetic products of any kind.

It is among the features of this invention to provide a broad curved outlet normally held closed under resilient tension of its lips by means of a convexly curved body associated with one of its said lips and pressing the other lip thereagainst. The stretched upper or outer lip "bellies" out to extrude a fluid forced between the lips. Any caking or drying of material which may occur between or at the lips is readily broken (and the caked material forced out) by the progressive forward stretching and spreading ("bellying" or "blistering") action of the fresh body of the material within the closure and back of the sealing lips.

When the elastic in at least the upper lip **35** of the closure is normally stretched to some extent (but not to its elastic limit) the tendency is also for such lip to stretch further and open before the main body of the closure stretches. This phenomenon is well known from experience in blowing new elongate rubber toy balloons wherein the first puff is the hardest until stretching has begun, whereupon when the elastic limit is obtained in a first area it easily progresses to the other areas.

Satisfactory examples of the instant device for use, e. g. with tubes of shaving soap or toothpaste, have been made from the severed necks of toy balloons which serve as closure bodies. The severed portion of the neck provides satisfactory outlet lips. The bendable tip of the well known and commercially available "Stascco" fastener for paper provides an excellent bendable rib which can be shaped to any desired curvature to facilitate neat application of the extruded material, as to a toothbrush **42**. (Cf. Fig. 6.)

As a variation of the above described invention the tube body **50** can be formed of vinyl plastic or the like as shown in Figs. 7–10. Bendable wire ribs **51** (see Fig. 7) are molded integrally therein to permit rolling of the tube to overcome in use the undesirable tendency of the rubber or plastic tube body to unroll after squeezing. Said latter ribs preferably are continuous through the integral suitably shaped neck for the tube and terminate at the outlet lips.

The end of the tube at **53** defines elastic lips forming a normally closed outlet at **54**. A rib **55** comprising for example a strip of metal determines the shape of said opening by the convexity of its central body portion between the clamping ends **56** which retain at least the upper of the lips of the opening stretched between them. By running the wires **51** longitudinally of the tube **50** the same can be rolled up or deformed during normal use to facilitate removal of the contents. But the elastomeric body in which the wires are imbedded will stretch laterally between the wires to permit the outlet to open and close automatically as heretofore described.

Figures 11 and 12 show a further modification wherein a metal rib **60** is imbedded wholly within the lower lip **61** to retain the desired curvature thereof so that the upper lip **62** is normally held in closed, stretched relationship thereover. The ends **63** of the rib **60** are preferably rounded or otherwise thickened as by doubling to prevent them from cutting into the elastic material of the outlet body. If desired they can be curved in the side edges of the outlet and imbedded also in the side edges of the upper lip **62** for such latter purpose in the manner shown. And while the outlet is shown as flattened at the outer ends **56**, the rib **60** can define an even, un-

broken curve from end to end, and can terminate wholly in or in the plane of the curved lower lip in any of the forms shown or described. In such case the rib will not be curved upwardly and inwardly at each end as now shown most clearly in Fig. 11.

As hereinabove already mentioned, the outlet can be made externally rigid by extending the external rib **70** in the embodiment of Figs. 1–10 to cover the elastic body of the closure except at the operative upper lip portion at **71**. In such event the elastic body is a continuous liner for the rib except at the portion **71**. Such a modification is shown in Fig. 13.

The lower lip **61** (e. g. in Figs. 11 and 12) is shown as thickened to accommodate the rib **60**, but said lower lip including said rib can also have a thickness no greater than the upper lip **62**. Likewise the longitudinal wires **51** can extend into or even to the front edges of the lips **61** and **62**.

Any of the above embodiments can be used interchangeably or modified with respect to one another. Thus a vinyl plastic closure with longitudinally imbedded wires can be used on an all-metal tube of conventional construction. The external or imbedded type of rib can also be used interchangeably, except in the version of Fig. 13.

In the fabrication of the above closures, the rib is preferably of a length somewhat greater than the diameter of the elastic sleeve body. The ends of the ribs or stiffening member are preferably first clamped (or imbedded) in place as desired at opposite stations on the sleeve. The body then having a reversed curvature, when the rib is bent back into the curvature shown in Figs. 5 and 9 in dotted outline, the sleeve is doubled upon itself and the clamped stations and ends of the rib or stiffening member are thus spread apart to tension the tube and form the desired outlet. The length of the rib is such that when so bent back as to be rendered effectively convex, it tightens and stretches the sleeve lips over the convex side of the rib to close the outlet. The dotted outline position of the ribs **30** and **55** in Figs. 5 and 9 respectively show how they are bent prior to affixation to the elastic sleeve body. They may, of course, be similarly reversely bent prior to being molded integral with the lower lip **61** of Fig. 11, for example.

In use, digital or other pressure on the main tube body causes stretching of the upper lip of the closure and the liquid or viscid contents are exuded in a neat crescent ribbon which may conform to the curvature of a brush to which it may be closely applied. Upon release of pressure the upper lip seals by its elasticity against the lower curved lip so as to pinch off the extruded ribbon of material and re-seal the outlet.

While I have herein shown, described and claimed a preferred form of my invention, I do not wish to be limited thereto, but to be entitled to modifications thereof within the ability of those familiar with this art so as to embrace all equivalent forms thereof within the spirit of the appended claims. In this connection, it may be noted, for example, that occasionally the fluid material of the tube, after long storage or disuse, hardens or causes the lips of the closure to adhere to one another. Similarly such disuse and prolonged contact of certain materials in the tube, such as oil, if the closure is of rubber, will affect the rubber and weaken the same in its main body back of the lips, so that when the tube is squeezed the lips may tend to stick. Excessive opening pressures required to clear the lips may then cause the body of the closure behind the lips to balloon out. For this reason it is sometimes desirable to thicken the closure walls preferably tapering the same to thicker dimensions rearwardly of the lips so that said lips are the thinnest part of the elastic closure body.

I claim:

1. In a closure comprising an elastic sleeve, the sleeve being substantially flattened at one end to form two sides and two opposite edges of a normally closed discharge outlet, means having a portion on one side of said outlet pressing said side against the opposite side of said outlet, said means engaging said sleeve at said opposite edges thereof and retaining said opposite side in a tensioned condition against said one side, said opposite side being free to flex away from said one side to open said outlet.

2. In a closure comprising an elastic sleeve, the sleeve being substantially flattened at one end to form two sides and two opposite edges of a normally closed discharge outlet, means having a portion on one side of said outlet pressing said side against the opposite side of said outlet, said means engaging said sleeve at said opposite edges thereof and retaining said opposite side in a tensioned condition against said one side, said means comprising a stiffening element secured to said edges and being bowed inwardly toward said opposite side, said opposite side being free to flex away from said one side to open said outlet.

3. In a closure comprising an elastic sleeve, the sleeve being substantially flattened at one end to form two sides and two opposite edges of a normally closed discharge outlet, means having a portion on one side of said outlet pressing said side against the opposite side of said outlet, said means engaging said sleeve at said opposite edges thereof and retaining said opposite side in a tensioned condition against said one side, said means being arranged to clamp said opposite edges in permanently tightly closed condition, said opposite side being free to flex away from said one side to open said outlet.

4. In a closure comprising an elastic sleeve, the sleeve being substantially flattened at one end to form two sides and two opposite edges of a normally closed discharge outlet, means having a portion on one side of said outlet pressing said side against the opposite side of said outlet, said means engaging said sleeve at said opposite edges thereof and retaining said opposite side in a tensioned condition against said one side, said means comprising a relatively rigid member having terminal portions clamping said opposite edges in closed condition and being bowed inwardly toward said opposite side between said terminal portions, said opposite side being free to flex away from said one side to open said outlet.

5. A device having a closure as defined in claim 4 wherein said sleeve is provided with at least one longitudinally extending malleable metal member secured thereto.

6. The method of making a tube closure comprising providing a sleeve, applying a stiffening member across one end thereof, securing said member at opposite stations to said sleeve, spreading said sleeve and member together to tension at least one side in contiguous relationship to the other side.

7. The method of making a tube closure comprising providing a sleeve, applying a stiffening member across only one side of one end thereof, securing said member at opposite stations to said sleeve, pressing a portion of said member, between said stations, inwardly, thereby spreading said sleeve and tensioning at least one side thereof in contiguous relationship to the other side.

8. The method of making a tube closure comprising, flattening an end of a tubular sleeve while applying a stiffening member across said end thereof adjacent one side, securing said member at opposite edges of said sleeve, bowing said member inwardly to tension the opposite side of said sleeve in contiguous relationship to said one side.

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