Dec. 6, 1932. C. V. HICKMAN ET AL 1,890,441

CLOSURES FOR COLLAPSIBLE TUBES

Filed June 15, 1931

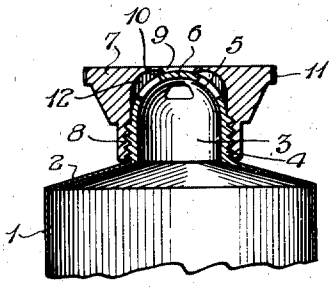


Fig. 1.

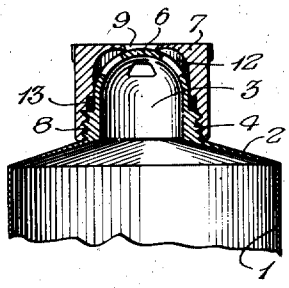


Fig. 3.

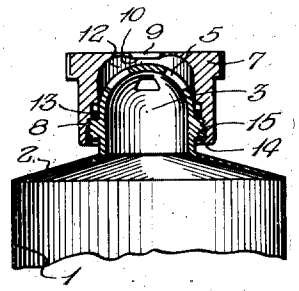


Fig. 4.

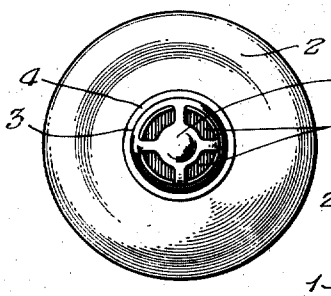


Fig. 2.

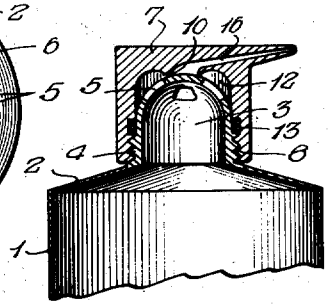


Fig. 5.

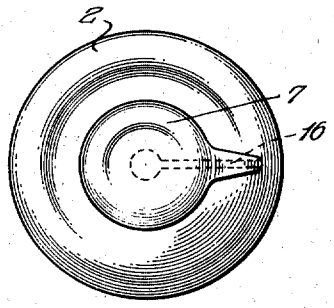


Fig. 6.

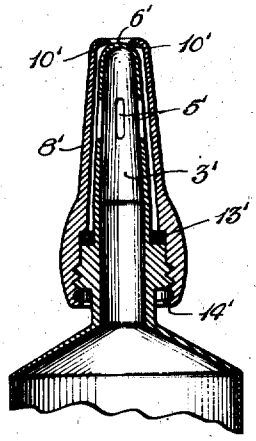


Fig. 7.

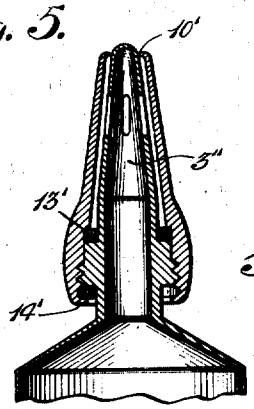


Fig. 8.

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Patented Dec. 6, 1932 1,890,441

UNITED STATES PATENT OFFICE

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CLOSURES FOR COLLAPSIBLE TUBES

Application filed June 15, 1931. Serial No. 544,626.

This invention relates to closures for collapsible tubes and the like and more particularly to a novel form of closure particularly adapted for holding liquids or materials which are not completely retained by the form of closures heretofore employed. Our invention is particularly adapted for the class of tube closures in which the contents of the tube or container may be dispensed or extruded without removal of the cap.

An important object of our invention is to provide a closure which is particularly adapted to hold refractory or difficult-to-control liquids, such as glycerine, which are not completely or satisfactorily retained by the type of closures heretofore provided.

The forms of collapsible tube closures heretofore employed are not adapted to hold highly volatile liquids, such as perfumes, in which a highly volatile essential oil or aromatic material is held in solution or under pressure in a solute or liquid vehicle; nor are they adapted to hold certain viscous materials having "creeping" characteristics, or in other words, a high capillary attraction. Such liquids, as glycerine, for example, appear to creep through all ordinary joints or seals and cannot be held in any form of collapsible tube closure heretofore devised. The closure of our invention, as hereinafter fully explained, serves to completely hold such refractory liquids without loss of material either through leakage or volatilization.

Another object of the invention is to provide a closure which is particularly adapted for holding substantially any form of divisible material, such as comminuted solids, dry or wet powders, pastes, or other materials containing granular or powdered particles. In the form of closures heretofore employed such materials clog the closure and prevent complete closing of the cap or closure means, or leave an amount of the material adhering to the closure means so as to form a slug, which in the case of paste, for example, dries out and frequently prevents further operation of the closure.

Another object of the invention is to provide a novel form of closure in which the parts of the closure means become automatically adjusted when the closure is put into the closed position. In accordance with this object, one feature of the preferred form of our invention comprises a spherical surface upon the neck portion of the closure which cooperates with a cap having a circular knife edge adapted to contact with the spherical surface and to completely seal off the contents of the container. It will be apparent that geometrically the circle of the knife edge contacts with only a corresponding circle on the spherical surface, irrespective of the angle of approach of the circular knife edge, and thereby serves automatically to adjust its position to form a completely sealed closure. A very distinct advantage of this feature of the invention is that in continued use of the closure the contacting surfaces become in effect case hardened or burnished so that there is no deterioration with use.

Another object of the invention is to provide a novel form of closure in which solid or granular particles tending to clog the exit of the closure will be displaced in the movement of the parts in advancing to the closed position and thereby prevent leakage or clogging of the closure.

In accordance with this object, we provide a cap having a knife edge portion so positioned so that it has a rotary forward movement when advancing to the closed position in engagement with the tapered or spherical surface, this rotary movement causing the knife edge to bite through or displace any particles in its way, thus permitting perfect seating of the knife edge and completely sealing off the material in the tube or container, therein being an improvement over a surface-to-surface closure.

Another object of the invention is to provide a novel form of closure in which the extrusion or dispensing from the tube may be accurately and positively regulated, thereby conserving material, such as expensive perfumes, and permitting extrusion of predetermined amounts of materials, such as medicines which would be harmful in excess amounts or corrosive if permitted to contact

with surfaces or parts for which they are not intended.

A further object of the invention is to provide a form of collapsible tube closure which, in a slightly modified form, may be employed as a combined medicine container and dropper which cannot become clogged, and in which there are only metal parts, so that no change occurs in the container or closure with age or continued use.

Other objects of the invention are to provide a form of closure which may be manufactured at low cost, which will not deteriorate in use, which will have greater efficiency than closures heretofore made and which may be employed with substantially any physical form of material adapted to be held in a collapsible tube or like container.

With these and other objects in view, the invention comprises various features hereinafter more fully described and particularly defined in the claims.

In the drawing, illustrating several embodiments of the invention, and in which similar reference characters indicate similar parts,

Fig. 1 is a sectional view in elevation showing one form of the invention in the closed position;

Fig. 2 is a top view of Fig. 1, without the cap;

Fig. 3 shows another form of the invention in elevation;

Fig. 4 is a sectional view in elevation illustrating another form of the invention with the provision of a non-removable cap;

Fig. 5 shows a slightly modified form of the invention;

Fig. 6 is a top view of the modification shown in Fig. 5;

Fig. 7 illustrates a further form of our invention; and

Fig. 8 shows a still further modification of the invention shown in Fig. 7.

In Fig. 1, the numeral 1 represents the side walls of an ordinary collapsible tube made of thin flexible metal. This collapsible tube is provided with the usual upper part 2, at the end of which, and integral therewith, is a dispensing neck 3. This dispensing neck 3 is provided at its lower end with threads 4 and is also provided with a discharge aperture, or a plurality of discharge apertures 5, located between the threads and the top of the dispensing neck, preferably near the top thereof. The upper end of the neck is provided with a curved portion 6 which is preferably spherically curved. This curved or tapered portion acts as a part of a valve for effecting a closure which will be described hereinafter.

Cooperating with this dispensing neck 3 is a cap generally designated 7, which may be made of ductile metal, bakelite, vulcanite, ebonite etc. This cap cooperates with the dispensing neck by means of threads 8 for effecting relative axial movement between the dispensing neck and the cap.

The cap 7 is provided at its top with a central orifice 9. This orifice is bounded by a thin, annular knife edge generally designated 10. Upon slight rotating movement of the cap 7 to close the same by gripping it at the shoulder 11, the knife edge 10 of the orifice 9 will seat upon the spherical or conical top of the neck 3. In effecting this, the knife edge has a rotary movement, which causes it to bite into or displace any material in its way, and so a very tight seal is effected. As will be obvious from the drawing, the knife edge preferably contacts the curved surface at an angle substantially normal to the latter, although it is to be understood that any angle which will give rise to a knife edge seal is within the contemplation of the invention. Any irregularities in the knife edge will be destroyed as it is forced to its seat. The shoulder 11 may be knurled to give a good gripping action.

In operation, slight movement of the cap 7 by gripping the surface 11 will open the closure. Upon pressure on the sides of the tube 1 the contents will be extruded through the discharge apertures 5 into the recess 12 formed between the dispensing neck and the cap, and thence out of the orifice 9. It is of course readily apparent that the cap need not be entirely removed from the neck. One turn is sufficient for ordinary use. To close, the cap is turned down to bring the knife edges 10 into rotating biting contact with the surface 6.

In the modification shown in Fig. 3, the closure is provided with a gasket 13 situated between the outside of the neck and inside of the cap. Such a gasket is not only preferable, but in most cases necessary, when liquids, particularly glycerine and other viscous materials, are dispensed. The provision of the gasket 13 prevents seepage of such liquid through and around the threads 4 and 8. The gasket is not necessary when granular materials, or semi-solids such as tooth paste and shaving cream are dispensed.

In the modification shown in Fig. 4 there is provided a cap which is not removable from the neck. This is made possible by the provision of turned-in lips 14 situated on the lower end of the cap 7. Thus when the cap is in open position it is effectively retained on the dispensing neck by means of the lips 14, and the shoulder 15 of the dispensing neck.

In this modification both the dispensing neck and the cap may be provided with a minimum number of threads, so that the threads of the cap after several turns, may become disengaged from the threads of the dispensing neck, so that continued rotation

of the cap will not destroy either the threads or the retaining lip 14.

Fig. 5 shows a modification of the invention particularly adapted for the dispensing of liquids in small drops, such as perfumes or medicines. In this form of the invention the cap, instead of being provided with a central orifice in the cap has a small channel 16 connecting with the recess 12 between the cap and dispensing neck.

In operation the knife edges 10 are lifted from the surface 6 by slight movement of the cap. Then upon pressure on the sides of the walls of tube 1 the material is extruded through the apertures 5 into the recess 12 and thence out the channel 16. This modification may have a gasket when the dispensing of liquids is contemplated.

The modification shown in Fig. 7 is particularly adapted for the dispensing of glue, paste and the like. The elements shown in this modification are much the same as those illustrated in Fig. 4, the cap and dispensing neck, however, being relatively long. The long neck 3′ terminates in a spherically curved top 6′, and is provided with discharge apertures 5′. The cap 8′ has an opening at the top defined by an annular knife edge 10′ which seals against the curved top 6′. A gasket 13′ and lip 14′ may be used, if desirable.

In operation, the long tapered cap is given a few turns to open the closure and the tip applied to paper or other material upon which the paste or glue is to be deposited and then this tip is drawn across the paper while pressure is being applied to the tube to dispense the contents.

It is evident that whether the edges 10 come down on the surface 6 perpendicularly or at an angle an air and liquid tight seal will always be obtained. Thus, should the threads of the neck or cap be slightly out of line and the orifice 9 thrown a little out of perpendicular with the neck 3, upon closing, the edges 10 will grip the spherical surface 6 at an angle, but will nevertheless, effect a tight closure in any position. The spherical surface is superior to the conical surface in this respect, although the conical surface is entirely satisfactory in certain cases.

It is also readily apparent that the gripping and biting action of the knife edges 10 into the surface 6 is a distinct advantage over the methods of closure wherein a surface to surface contact is used. In this latter type of closure, where, upon closing, the surface of the cap would merely rub against the surface of the neck, any hard granules between these two surfaces would of course prevent an air and liquid tight seal.

In the modification of Fig. 8, the neck 3″ is conical and the knife edge 10′ seats on the conical side, instead of on the spherical top, as in Fig. 7. In this form, the top end of the neck provides a place where a drop of liquid, as medicine, may form. It is obvious that the top end of the neck which protrudes above the knife edge 10′ serves also as a plug to minimize accumulation of excess material on the top of the cap. It is likewise obvious that this construction could be well applied to the other modifications of the invention, particularly as shown in Figs. 1, 3, 4 and 7.

In certain aspects of the invention, and with particular substances, it is sufficient to make the top of the neck, in the several modifications, conical instead of spherical, and it is within the contemplation of the invention to have the knife edge seat against such conical surface, but the use of a spherically curved surface presents distinct advantages, as noted above.

The terms curved or curved in cross section as employed in the claims are intended to mean having an inclination or curve and are intended to include a spherical surface, a conical surface, a parabolic surface, or other regular surfaces as generated by a line or curve around a central axis.

While several embodiments of the invention have been described in some detail, it should be understood that the invention is not to be limited to these precise details but may be carried out in other ways.

We claim as our invention:—

1. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the collapsible tube, a top portion on said neck having a curved surface, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to engage said curved surface at such an angle as to provide a knife edge seal, said neck portion having an opening below said knife edge seal through which material is passed from the collapsible tube in the open position of said cap member, and means for effecting forcible engagement of said knife edge portion with said curved surface.

2. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the collapsible tube, a top portion on said neck curved in cross section, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to engage said top portion surface at such an angle as to provide a knife edge seal, said neck portion having an opening below said knife edge seal through which material is passed from the collapsible tube in the open position of said cap member, and threaded means interconnecting the neck and cap, whereby when the cap member is turned to closed position, the knife edge will bite

through the top portion and effect a knife edge seal.

3. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the container, a spherical top portion on said neck, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to adjustably engage said spherical surface at such an angle as to provide a knife edge seal, said neck portion having an opening therein below the knife edge seal permitting removal of material from the container in the open position of the cap member, and means for effecting forcible engagement of said knife edge portion with said spherical surface.

4. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a threaded neck portion on said container provided with a discharge opening, a spherically curved top portion on said neck portion, a cap member, a threaded portion on said cap member adapted to cooperate with the threads on the neck portion, the cap member being provided with an opening in the top thereof for exit of material from said container, said cap member having a projecting knife edge adapted to engage said spherically curved top portion above said discharge opening at an angle substantially normal to said curved top portion, whereby when the cap member is turned into closed position, the knife edge will bite through to the spherically curved top and a complete knife edge seal is obtained.

5. A closure for collapsible tubes and the like, comprising a dispensing neck the outer portion of which has a curved surface, the neck being provided with a discharge aperture, a closure cap taking over and cooperating with said head, the cap being provided with an orifice defined by an annular knife edge, the angle of said knife edge being substantially normal to the curved surface of the neck and means for effecting relative axial movement between the dispensing neck and the closure cap, whereby the annular knife edge engages the curved surface of the neck above said discharge aperture for effecting an annular, curvilinear seal, the interior of the cap, below said curvilinear seal, when in sealing position, being spaced away from the outer surface of the dispensing head.

6. A closure for collapsible tubes and the like, comprising a dispensing neck the top portion of which is spherically curved, the neck being provided with a discharge aperture, a closure cap takng over and cooperating with said head, the cap being provided with a central orifice defined by an annular knife edge, the angle of said knife edge being substantially normal to the spherically curved portion of the neck and means, including cooperating threaded members, for effecting a limited axial movement between the dispensing head and the closure cap, whereby the annular knife edge engages the spherically curved surface of the head above said discharge aperture with a rotary movement for effecting an annular curvilinear seal, the interior of the cap, below the curvilinear seal, when in sealing position, being spaced away from the interior of the cap.

7. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the collapsible tube, a conical top portion on said neck, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to engage said conical top portion at such an angle as to provide a knife edge seal, said neck portion having an opening below said knife edge seal through which material is passed from the collapsible tube in the open position of said cap member, and threaded means interconnecting the neck and cap, whereby when the cap member is turned to closed position, the knife edge will bite through to the conical top portion and effect a knife edge seal.

8. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a threaded neck portion on said container provided with a discharge opening, a conical top portion on said neck portion, a cap member, a threaded portion on said cap member adapted to cooperate with the threads on the neck portion, the cap member being provided with an opening in the top thereof for exit of material from said container, said cap member having a projecting knife edge adapted to engage said conical top portion above said discharge opening at an angle substantially normal to the conical top portion, whereby when the cap member is turned into closed position, the knife edge will bite through to the conical top portion and a complete knife edge seal is obtained.

9. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the collapsible tube, a top portion on said neck having a curved surface, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to engage said curved surface at such an angle as to provide a knife edge seal, said neck portion having an opening below said knife edge seal through which material is passed from the collapsible tube in the open position of said cap member, a gasket placed

between the outside lower part of the neck and the inside of the cap and means for effecting forcible engagement of said knife edge portion with said curved surface.

10. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a threaded neck portion on said container provided with a discharge opening, a spherically curved top portion on said neck portion, a cap member, a gasket placed between the outside lower part of the neck and the inside of the cap member, a threaded portion on said cap member adapted to cooperate with the threads on the neck portion, the cap member being provided with an opening in the top thereof for exit of material from said container, said cap member having a projecting knife edge disposed at an angle substantially normal to the spherical top portion and adapted to engage said spherically curved top portion above said discharge opening, whereby when the cap member is turned into closed position, the knife edge will bite through to the spherically curved top and a complete knife edge seal is obtained.

11. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a neck portion on the collapsible tube, a top portion on said neck having a curved surface, a cap member having an opening in the top portion thereof, a continuous knife edge portion on said cap member adapted to engage said curved surface at such an angle as to provide a knife edge seal, said neck portion having an opening below said knife edge seal through which material is passed from the collapsible tube in the open position of said cap member, means for effecting forcible engagement of said knife edge portion with said curved surface and means for preventing complete removal of the cap member.

12. A closure for collapsible tubes and the like of the type permitting removal of material without removing the cap member, which comprises a threaded neck portion on said container provided with a discharge opening, a spherically curved top portion on said neck portion, a cap member, a threaded portion on said cap member adapted to cooperate with the threads on the neck portion, the cap member being provided with an opening in the top thereof for exit of material from said container, and with an inturned lower lip for preventing complete removal of the cap, said cap member having a projecting knife edge adapted to engage said spherically curved top portion above said discharge opening at an angle substantially normal to the spherical top portion, whereby when the cap member is turned into closed position, the knife edge will bite through to the spherically curved top and a complete knife edge seal will be obtained.

13. A structure as specified in claim 1 in which the opening in the top portion of the cap member passes through a nose portion extending outwardly from the body of the said cap portion, whereby it is adapted for the dispensing of medicine or as a "dropper".

14. A structure as specified in claim 3 in which the said cap member is provided with an open nose portion, the opening through the said nose portion communicating with the said opening in the top portion of the cap member whereby the construction is particularly adapted as a dropper or dispensing closure for liquids or volatile materials not tending to cause clogging in the said open nose portion.

15. A closure for collapsible tubes, comprising in combination a neck portion having a discharge opening therein, a cap member engageable with said neck portion and provided with a discharge orifice, the cap member being provided with an annular knife edge adapted to be brought into forcible engagement with the top of the neck portion and to bite into it for effecting a knife-edge seal, the cap and neck portion being provided with engaging means for forcing the cap downwardly so that its knife edge goes into biting engagement with the neck portion upon relative movement of the cap member and neck portion.

16. A closure for collapsible tubes, comprising in combination a neck portion having a discharge opening, a cap member engageable with said neck portion and provided with a discharge orifice, the cap member being provided with an annular knife edge adapted to be brought into forcible biting engagement with the neck portion at a point substantially below the top thereof leaving a protuberance above the knife edge portion when in closed position, the cap and neck portion being provided with engaging means for forcing the cap downwardly so that its knife edge goes into biting engagement with the neck portion upon relative movement of the cap member and neck portion.

17. A closure for collapsible tubes, comprising in combination a neck portion having a discharge opening, said neck portion gradually decreasing in cross-section outwardly, a cap member engageable with said neck portion and provided with a discharge orifice, the cap member being provided with an annular knife edge adapted to be brought into forcible biting engagement with the neck portion at a point substantially below the top thereof leaving a protuberance above the knife edge portion when in closed position, the cap and neck portion being provided with threaded engaging means for forcing the cap downwardly so that its knife edge goes into biting engagement with the neck portion

upon relative rotary movement of the cap member and neck portion.

18. A closure for collapsible tubes comprising in combination a neck member having a discharge aperture therein, a cap member having a discharge aperture therein, one of said members being provided with a knife edge which is adapted to bear against an adjacent surface of the other member and to engage such surface and form a knife edge seal, the neck member and the cap member being provided with inter-engaging means for forcing the two members together for effecting said knife edge seal.

In testimony whereof we affix our signatures.

CHARLES V. HICKMAN.
RAYMOND L. JEFFERY.