Nov. 11, 1952 J. L. LAY 2,617,553

SCREW THREADED ELASTIC CLOSURE CAP

Filed Sept. 1, 1948

Fig. 1

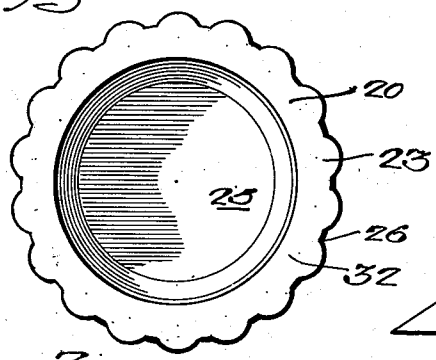


Fig. 4

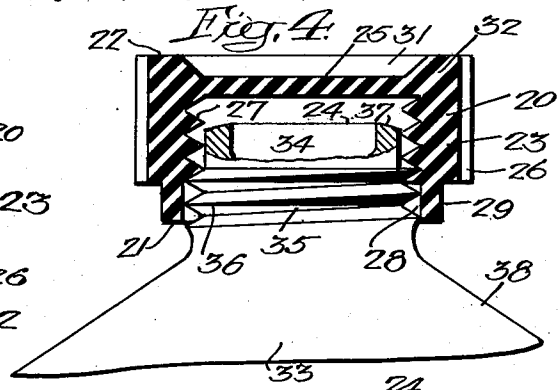


Fig. 2

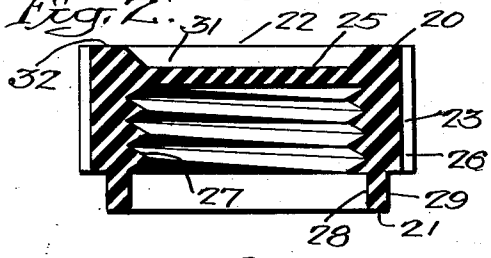


Fig. 5

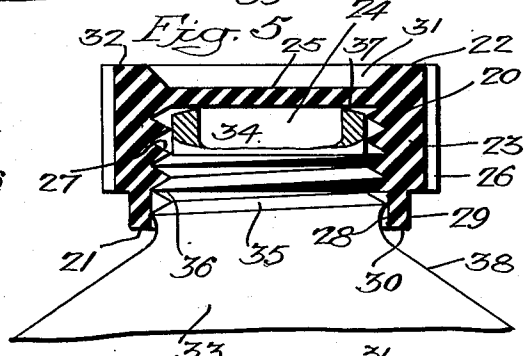


Fig. 3

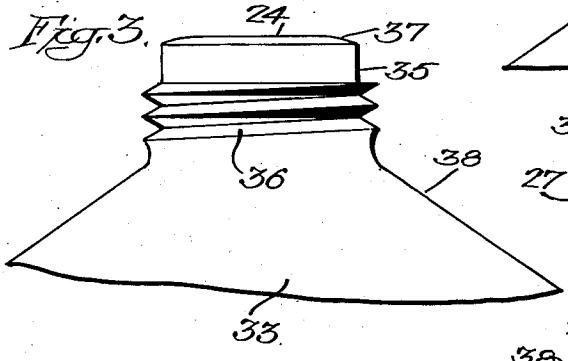
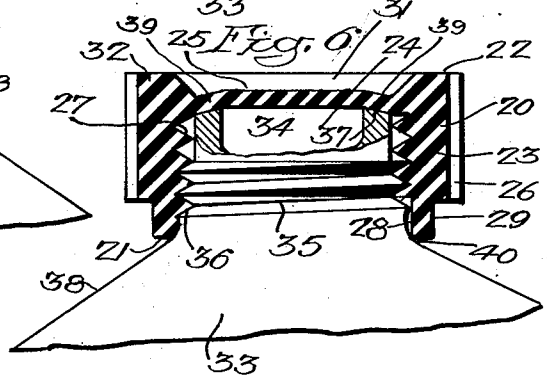


Fig. 6



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SCREW THREADED ELASTIC CLOSURE CAP

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3 Claims. (Cl. 220—39)

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The present invention relates to closure caps for collapsible tubes and other containers.

A purpose of the invention is to eliminate the necessity for the use of liners, washers or other cushioning or sealing material in closure caps for collapsible tubes and the like.

A further purpose is to obtain an improved seal in a collapsible tube cap, desirably by shaping the sealing end of the cap to fit the end of the container at the point of sealing by means of elastic deformation of the cap.

A further purpose is to provide a supplemental seal between the cap and the container at the shoulder of the container near the base of the threads.

A further purpose is to prevent stripping of the threads on an elastic plastic cap.

A further purpose is to limit the screwing down on an elastic plastic cap by contact between the forward end of the cap and the shoulder of the container.

A further purpose is to seal by an elastic sealing diaphragm at the top of the cap and also by a sealing ring at the open end of the cap.

A further purpose is to prevent closure caps from working loose during shipment.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the numerous embodiments in which my invention may appear, choosing the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a rear end elevation of the improved cap of the invention.

Figure 2 is a central longitudinal section of the cap of Figure 1.

Figure 3 is a fragmentary side elevation of a container upon which the cap is to be applied, suitably a collapsible tube.

Figures 4 to 6 inclusive are fragmentary side elevations, partly in central longitudinal sections, showing the steps in application of the cap to the container.

In the drawings like numerals refer to like parts throughout.

Describing in illustration but not in limitation and referring to the drawings:

Considerable difficulty has been encountered in producing a fully satisfactory closure for containers of the character of collapsible tubes, such as the common extruded tooth paste and shaving cream tubes of tin alloy, lead alloy, aluminum or the like. Common practice has been to employ

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rigid plastics for the caps such as phenol-formaldehyde and urea-formaldehyde, but in many cases it is necessary to use a liner or washer in the end of the cap to seal against the end of the neck of the container. Washers or liners are commonly made of metal foil, cork, paper or the like and combinations thereof.

With the prior art rigid plastic or metal caps, it is considered to be objectionable to have the cap engage the shoulder, as this prevents a good impression on the liner or washer at the bottom of the cap recess, and thus prevents firm sealing.

In some cases liners or washers are eliminated and reliance is had upon the firmness of contact between the cap and the container for adequate sealing. Usually when this is done, a valve neck and cap are necessary in order to obtain even an aproximation of tight sealing.

The present inventor has experimented with the possibility of obtaining a satisfactory seal by the use of an elastic plastic, of which polyethylene, sometimes known as polythene, is an outstanding example. Other elastic plastics are polyvinyl chloride, polyvinyl acetate and polyvinyl chloride acetate.

When caps have been made from such elastic plastics, using structural designs previously employed for rigid plastics, it has been found that the caps are comparatively unsatisfactory due to the fact that it is necessary to deform the top or closed end of the cap for adequate sealing, and the user in an effort to properly seat the cap, especially when the threaded neck of the container is coated with the contents, is likely to strip the threads and cause the cap to come off the container.

This tendency to strip and lose the tightness of hold by the cap on the threads of the container is especially aggravated by the lubricating properties possessed by the contents of the container when it is filled with shaving cream, tooth paste or the like.

It has been found by the present inventor that the difficulties previously encountered can be overcome and an improved seal obtained without danger of stripping of the threads and without the necessity for liners or washers, if the cap is made to engage the container at the normal sealing end of the container and also at the shoulder at the base of the neck on the container. By this procedure the firm engagement of the open end of the cap against the shoulder prevents the likelihood of the user applying sufficient force to strip the threads, while at the same time the user is not able to stretch the end wall

of the cap to such an extent as to distort the side walls of the ring portion of the cap into a position favoring stripping.

In accordance with the invention distortion of the end wall of the cap sufficient to secure tight sealing is obtained, thus avoiding the necessity for liners or washers, while on the other hand a supplemental seal is desirably provided at the shoulder.

In accordance with the invention, the cap 20 is manufactured by molding as a single piece from an elastic plastic such as polyethylene. The cap has an open end 21 and a top end 22. An annular side wall 23 surrounds an interior recess 24, which is to engage on the dispensing end of a container. A top sealing end wall 25 extends across the cap, closing the top end of the annular side wall. The exterior cylindrical surface of the annular side wall is desirably fluted at 26 over most of its length to aid in engagement by the fingers. The interior of the annular portion is provided with female threads 27, adapted to cooperate with male threads on the container. The female threads desirably do not extend to the forward end 21, leaving an interior surface 28 free from threads, and desirably the corresponding exterior surface 29 is free from flutings so as to make a sealing ring 30 at the open end of the cap. The sealing ring is desirably more elastic than the rest of the side wall due to the absence of threads and fluting.

The sealing end wall of the cap is preferably made comparatively thin so as to form a diaphragm, and with this purpose in view the top end is preferably provided with a recess 31 extending inwardly from a diameter larger than the diameter of the container at the sealing end. For best results the diaphragm thickness should be of the order of $\frac{1}{32}$ to $\frac{1}{16}$ inch. The recess 31 thus desirably produces an annular rim 32 around the rear end of the cap, which to an extent guards against damage to the diaphragm and provides space into which the diaphragm can deform without causing curving of the top of the cap when viewed from the side.

The container will preferably be of the conventional collapsible tube type, consisting of a tube 33 having a dispensing opening 34 provided by a neck 35 externally threaded at 36 and having a sealing end 37 adapted to engage the sealing wall or diaphragm of the cap. As shown, the sealing end 37 is desirably crowned, having the higher portion toward the center to assure deformation of the diaphragm in sealing, and cause increase in area of contact with further deformation. At the base of the threads 36 a shoulder 38 extends outwardly preferably at an angle less than a right angle.

Thus it will be seen that when the cap is applied to the neck of the container, the threads of the cap are first screwed down on to the nipple as shown in Figure 4. Eventually as the cap advances it will reach the position shown in Figure 5, where the sealing diaphragm 25 just engages the inner portion of the sealing edge 37 at the end of the neck. In this position the forward edge 21 of the sealing ring 29 is just about to engage the shoulder. It will be understood that the exact relation between the position of the forward edge 21 and the position of the sealing diaphragm will not always be the same, since the tolerance in the length of the neck of the tube is never a close tolerance, usually being plus or minus $\frac{1}{64}$ of an inch. Thus in some tubes when the sealing diaphragm first contacts the end of the neck, the forward end of the sealing ring 21 may be touching the shoulder, while in other tubes it may not.

The flexibility of the elastic plastic used is such that notwithstanding such variations, the cap can be further advanced to the position of Figure 6. In this position, the sealing diaphragm or wall at the rear of the cap is flexed or distorted as indicated at 39, assuring very good contact with the sealing end of the neck, while at the same time the open edge of the cap is engaging the shoulder at the base of the thread at 40. Thus the firm seating of the open edge of the cap on the shoulder assures against screwing the cap further down and thereby stripping the threads, notwithstanding that the threads may be coated with contents of the tube. Furthermore, a very excellent and broad sealing contact is obtained between the outer end of the neck of the tube and the sealing diaphragm or end wall of the cap, due to the fact that the diaphragm conforms to the exact shape of the particular sealing end of the neck. Furthermore, a supplemental seal is obtained at 40 where the sealing ring 29 engages the shoulder. The sealing ring being thin in radial dimension conforms to the exact shape of the shoulder in the preferred embodiment and adapts itself to any variation in the tube in the best embodiment.

It is thus evident that an unusually fine seal is obtained without the need for sealing washers or liners, and unless the chemical or other content of the tube is such as to attack the plastic it is preferable in most cases to avoid entirely the use of liners or washers with the cap of the present invention.

The present invention finds wide application to replace the prior art closures for collapsible tubes and other containers, particularly when applied to substances having lubricating characteristics which are likely to encourage stripping of the threads on elastic plastic caps.

An important feature of the invention is the remarkable property possessed by the caps of the invention, particularly when made from polyethylene of avoiding loosening under vibration, for example due to shipment. Metal caps have this bad feature and with rigid plastics such as phenol-formaldehyde the condition is so objectionable that liners must almost always be used. On the other hand, polyethylene caps show no tendency to loosen in shipment and elastic plastics generally show very little tendency to loosen. This property is believed to be due to the damping capacity of the elastic plastics.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A unitary closure cap of elastic plastic comprising a comparatively thick tube internally threaded, a comparatively thin impervious elastic diaphragm extending across and closing the tube, an annular rim around the end of the top beyond the diaphragm with respect to the threads and a comparatively thin annular unthreaded

elastic extension forming a sealing edge at the end of the tube remote from the rim.

2. A closure cap according to claim 1 in which the elastic plastic is polyethylene.

3. A collapsible tube having a neck having a free edge defining a dispensing opening, having external threads on the neck around the dispensing opening and having an annular shoulder adjoining the base of the neck and a unitary cap of elastic plastic comprising a comparatively thick tube internally threaded on to the external threads on the neck, said cap having a comparatively thin elastic diaphragm extending across and contacting said free edge to close the tube and deform the diaphragm to seal the end of the neck around the dispensing opening, an annular rim around the end of the cap tube beyond the diaphragm and a comparatively thin unthreaded annular extension forming a sealing edge at the end of the cap remote from the rim and sealing against said annular shoulder of the collapsible tube with deformation of the sealing edge.

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