May 14, 1968 J. J. OWENS 3,382,996

CLOSURE CONSTRUCTION

Original Filed Dec. 14, 1964

Fig. 1

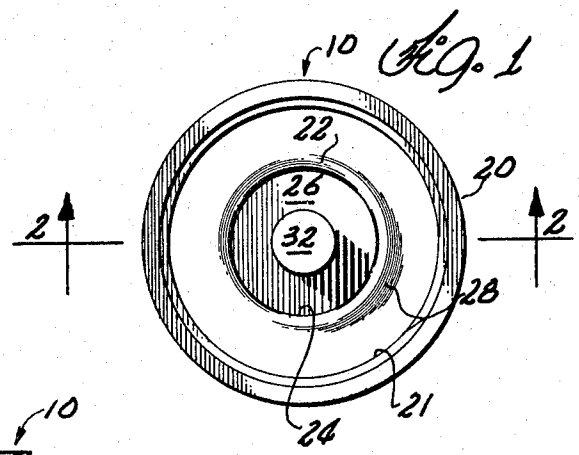


Fig. 2

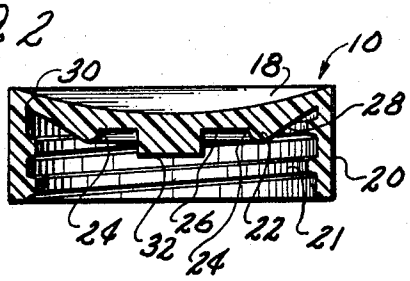


Fig. 3

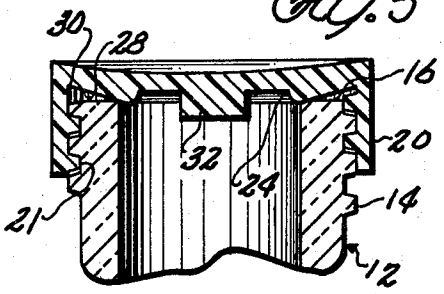
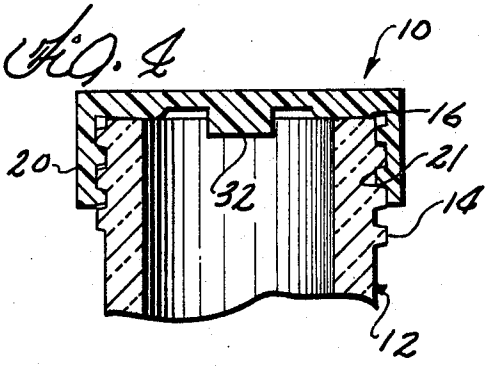


Fig. 4



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CLOSURE CONSTRUCTION

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Continuation of application Ser. No. 418,098, Dec. 14, 1964. This application June 20, 1967, Ser. No. 647,570
2 Claims. (Cl. 215—40)

ABSTRACT OF THE DISCLOSURE

A deformable closure having a circular top which is normally exteriorly concave as provided. Formed integrally with the top is a cylindrical, internally threaded skirt. A central reinforcing projection is formed on the top undersurface, and a sloping ring concentric with such projection is also formed on the underside. Upon being threaded into engagement with a container neck the top flexes toward a horizontal disposition.

This application is a continuation of application Ser. No. 418,098, filed Dec. 14, 1964, and now abandoned.

This invention relates to a deformable plastic closure for containers and more particularly pertains to a unitary closure which effects a fluid seal with a container neck.

Closures for liquid containers having the well-known externally threaded neck with an annular discharge terminus are in widespread use. Many of such closures having a top from which an internally threaded skirt depends, employ a separate deformable cork or plastic liner on the undersurface of the closure. Consequently, when the closure is screwed into sealing engagement with the threaded container neck, the terminal neck portion normally disposed in a single plane will engage and compress the liner and effect a liquid-tight seal therewith.

Deformable liners, such as cork or soft plastic, have been used extensively in the soft drink industry which employs metal closures crimped into sealing engagement with a container neck terminal portion with such liners interposed therebetween.

It is apparent that for those liquids whch are repeatedly used over an extended period of time by the consumer, the closure must be capable of continuously effecting a seal after each use, and consequently threaded closures are most commonly employed for such products.

It would obviously be a boon to distributors, as for instance of liquor, liquid bleaches, bottled cooking oils, etc., if a unitary closure having no separate liner could be successfully employed for effecting liquid-tight seals. Liners which are susceptible to disengagement from the closure undersurface obviously are oftentimes a nuisance and obviously contribute to the expense of closure manufacture. Although each liner has a negligible cost, when employed in quantities totaling in the millions, the cost thereof obviously becomes significant.

It is an object of this invention therefore to provide a deformable plastic closure for liquid products sold in bottles and cans which is unitary in construction and highly efficient in providing a liquid seal.

It is another object of this invention to provide a deformable threaded plastic closure which may effect varying degrees of liquid sealing in accordance with the applied torque in the course of threadedly applying the same to a container neck.

It is a further object of this invention to provide a deformable plastic closure which visually informs a viewer of the nature of the seal, if any, effected between the container discharge opening and the closure undersurface.

It is a further object of this invention to provide a

deformable closure which, while effecting a liquid seal with a container neck terminus, concomitantly effects a locking engagement with the container, thereby preventing accidental disengagement between the container and closure.

The above and other objects of this invention will become more apparent from the following detailed description when read in the light of the accompanying drawing and appended claims.

In one embodiment of this invention, a plastic closure having an exteriorly concave top from which an internally-threaded, cylindrical skirt depends is provided. The top is flexible relative to the skirt portion and the material of composition for said closure is preferably polypropylene or other plastic which may be flexed indefinitely without evidencing strain or cracking.

Centrally disposed on the closure top undersurface is a projecting ring which extends abruptly on its inner periphery from the closure surface with which it is integrally formed. The outer periphery of the ring smoothly merges into the surrounding closure undersurface by means of a fillet-like annular surface portion located so as to normally engage the terminus of a container neck. As the threaded skirt is screwed onto the external neck threads of the container, the concave top is engaged and the neck terminus forces the fillet surface and encompassed flexible cap portion into a substantially horizontal plane. The seal effected between the container neck terminus and the closure undersurface becomes increasingly efficient as the threaded engagement continues, as will hereinafter be explained in greater detail.

For a more complete understanding of this invention, reference will now be made to the drawing wherein:

FIGURE 1 is an enlarged bottom plan view of a deformable closure member made in accordance with the teaching of this invention;

FIG. 2 is an enlarged fragmentary sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary view illustrating the deformable closure of FIG. 2 partially deformed as a result of the engagement with the upper annular terminus of a container neck portion; and

FIG. 4 is a view similar to FIG. 3 illustrating the deformable closure of FIG. 1 in a fully-seated condition on the upper annular terminus of a container neck and in which the initially-concave upper surface is horizontal.

Referring now more particularly to FIGS. 1 and 2, a deformable closure **10** is illustrated which is adapted to form a liquid-tight seal with a threaded neck portion of a container, such as illustrated neck portion **12** fragmentarily illustrated in FIGS. 3 and 4, having external threads **14** formed on the upper end portion thereof. It will be noted from FIGS. 3 and 4 that the upper terminus of the container neck has a flat annular surface **16** which normally engages the undersurface of a cooperating closure member, such as closure **10**, for purposes of effecting a liquid seal therewith.

Closure **10** in the normal unstressed condition, that is, when not forming a liquid seal with a container neck portion, has the configuration illustrated in FIGS. 1 and 2. It will be noted that the closure **10** has a normally, exteriorly-concave top portion **18** from which a depending skirt portion **20**, having female threads **21**, depends. Centrally positioned on the lower, generally-convex surface of the deformable closure top portion **18** is a projecting ring **22**. It will be most clearly seen from FIG. 2 that projecting ring **22** at its inner periphery defines an abrupt juncture at **24** with an encompassed, annular undersurface portion **26** of the top **18** of the closure most clearly seen in FIG. 1.

Projecting ring **22** at its outer periphery is gradually

merged with the outer undersurface portion of the closure top by means of a fillet-like band 28. Band 28 comprises the area of the closure undersurface which is adapted to engage the upper terminal end of a container neck, such as annular end 16 of the container fragment 12 illustrated in FIGS. 2 through 4, in liquid-sealing engagement.

In the normal course of use, closure 10 threadedly engages the threaded upper end portion of the neck 12, as illustrated. As the closure 10 is screwed downwardly, upper annular surface 16 of the container neck 12 initially engages the fillet band 28 of the closure undersurface at its innermost portion in the manner illustrated in FIG. 3. As the threaded engagement continues, a greater and greater surface portion of the annular end limit 16 of the container neck comes into sealing engagement with a greater and greater area of the fillet surface portion 28 of the closure top 18. Simultaneously, the closure top is deformed gradually into a horizontal position.

FIG. 4 illustrates closure 10 after it has been fully deformed whereby the top portion 18 has the upper surface thereof deformed from the concave condition of FIG. 2 to the substantially horizontal condition of FIG. 4.

It will be further noted from FIG. 4 that in the fully deformed condition, substantially the entire annular surface 16 of the neck 12 of the container is in engagement with the now-deformed annular fillet portion 28 of the closure undersurface. It is apparent in FIGS. 2 through 4 that the relative thinness of the annular closure portion superposed over annular surface 26 of the closure, as well as the relative thinness of the annular juncture 30 between skirt portion 20 of the closure and the closure top portion 18, permits the closure top portion 18 to readily flex relative to the closure skirt portion 20.

Central projection 32 of the closure extending from the closure undersurface serves as a reinforcement for that portion of the closure inwardly disposed from the annular juncture 30. Projection 32 and projecting rib 22 serve to reinforce the closure so that the entire top 18 uniformly moves as a unit into the horizontal position of FIG. 4 as it flexes about annular juncture 30. The central annular thin portion superposed above surface 26 facilitates the upward flexing of the central portion of the closure undersurface while obviating any problems of cracking which might result from any strain imparted to the plastic.

It has been found that polypropylene comprises an excellent material of composition for forming a closure, such as illustrated closure 10. Other plastics, such as regular polyethylene and linear polyethylene and other resilient materials having good flex characteristics may be employed. Closure 10 may be readily formed as by injection molding, vacuum forming, compression molding and other processes which suggest themselves to those skilled in the art.

It is apparent that when the closure 10 is in the fully seated and sealing condition, such as is illustrated in FIG. 4, the upper surface of the closure will be substantially horizontal thereby visually indicating that the closure has been properly seated. It is believed obvious that varying degrees of sealing may be desirable for containing liquids of varying specific gravities and viscosities. Accordingly, the upper surface of the closure 10 will immediately tell the packager if the desired threaded engagement between the closure and the container neck has been effected. If the fully seated condition of FIG. 4 is not necessary or desirable, an intermediate seal may be effected which will result in a specific concavity in the upper surface of the closure. The specific concavity, therefore, will indicate to the packager whether or not the desired seal has been effected.

Because of the deforming of the closure top portion relative to the skirt portion and because of the excellent flex characteristics and resiliency of plastics such as polypropylene, the deformed closure will retain the tendency to resume its initial configuration, such as is illustrated in FIG. 2. Accordingly, a constant pressure exists between the upper annular surface 16 of the container neck and the inclined annular sealing surface 28 of the closure. The resilient engagement and urging of the closure top against the neck terminal end limit serves to lock the closure in place by virtue of such tight, frictional engagement, thereby tending to oppose any minor forces which may be exerted by jostling or the like, tending to unscrew the closure from the container neck.

It is seen, therefore, that a novel deformable closure has been provided which is simple in construction, unitary in construction, gives visual evidence of the degree of seal which it effects with the container member, and automatically functions to lock itself to a container when fully seated. The tolerances employed in manufacturing such closures need be no greater than those employed in manufacturing ordinary threaded closures of this type. The industry standard is plus or minus .012 inch.

Without further elaboration, the foregoing will so fully explain the character of my invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, while retaining certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. A deformable closure comprising a circular top which is normally exteriorly concave, a cylindrical skirt depending from the periphery of said top and which is internally threaded, the central portion of said top having a cylindrical projection formed in the center of the top undersurface and defining the area of maximum thickness of said closure, a projecting, outwardly tapering ring concentric with said projection and extending abruptly from the top undersurface at its inner periphery, said inner periphery comprising the location of maximum ring thickness; said ring tapering outwardly to a juncture with said closure skirt, a circular top portion of reduced thickness interposed between said top central portion and said ring, said closure top exterior surface flexing toward a horizontal disposition upon exertion of an axial force against said ring on said top undersurface.

2. The closure of claim 1 in which said closure is formed of plastic having good flex characteristics and good resistance to cracking.

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