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2,771,218

CLOSURE ASSEMBLY

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Fig. 1

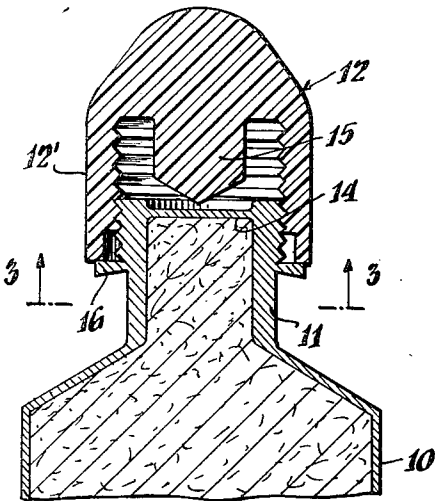


Fig. 2

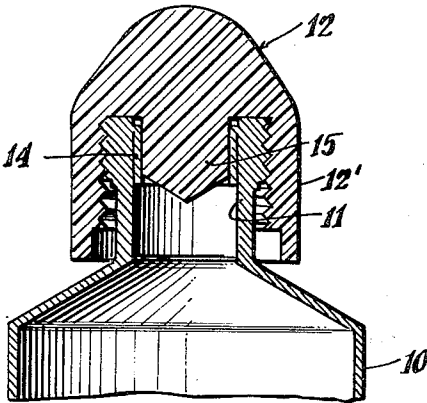


Fig. 3

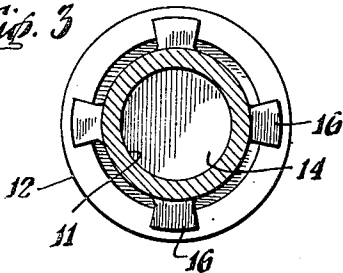


Fig. 4

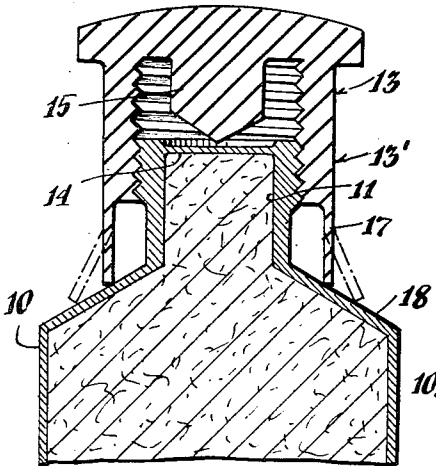


Fig. 5

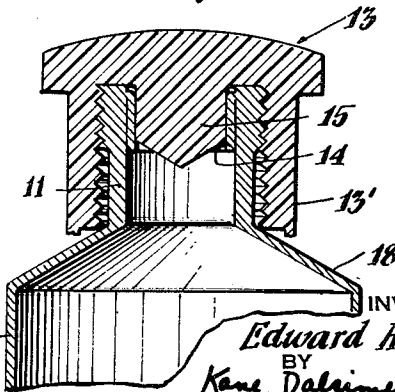
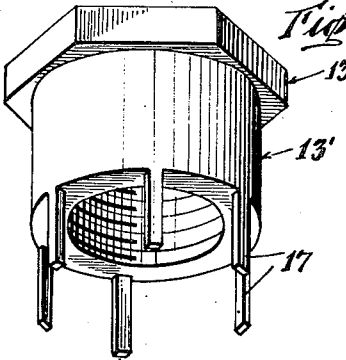


Fig. 6



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7 Claims. (Cl. 222—83)

This invention relates to an improved closure assembly for containers and particularly to a closure assembly of the type suitable for use with collapsible tubes.

Pharmaceutical, medicinal and biological preparations are frequently packaged in containers from which they are dispensed when it is desired to use them. While the packages are being shipped or stored, prior to use, it is desirable that the contents be preserved in sterile condition and protected from contamination or exposure to the atmosphere and loss through evaporation or leakage.

It is an object of the present invention to provide an improved closure assembly for a container which is initially sealed in an effective manner so as to preserve the contents of the container in sterile condition and to protect the contents from contamination, exposure to the atmosphere and loss by evaporation or leakage.

A further object is the provision of an improved closure assembly of the above type provided with a removable cap which may be conveniently used for breaking the seal so that the contents can be dispensed from the container and will thereafter serve as a removable closure to protect the contents until they have been completely consumed.

In carrying out my invention I provide a container with a dispensing aperture initially closed and sealed by means of a fixed diaphragm made of a relatively soft pierceable material. I also provide the dispensing aperture with a removable closure having a piercing point for piercing the diaphragm. The piercing point is initially held out of engagement with the diaphragm by frangible stop members which may be broken by applying an excessive torque force to the closure thereby permitting the piercing point to pierce and open the diaphragm. The removable closure may thereafter be removed or applied to expose or cover the dispensing aperture.

In the accompanying drawing—

Fig. 1 is a longitudinal sectional view of the upper end of a container having a closure assembly embodying my invention and showing the parts in their initial position with the sealing diaphragm intact and the piercing point held in spaced relation with respect thereto by the frangible stop members;

Fig. 2 is a similar view showing the removable closure fully applied so that the piercing point has pierced the sealing diaphragm;

Fig. 3 is a cross sectional view in the direction of the arrows on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view of the upper end of a container somewhat similar to Fig. 1 but showing a closure assembly with modified stop members and with the sealing diaphragm intact;

Fig. 5 is a similar sectional view showing the removable closure of Fig. 6 in fully applied position and the sealing diaphragm pierced by the sealing point; and

Fig. 6 is a perspective view of the modified type of closure shown in Figs. 4 and 5.

My invention is applicable to various types of containers but it is particularly applicable to collapsible tubes

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of the type used in packaging and dispensing various types of pharmaceutical, medicinal and biological products. Thus, in the accompanying drawing I have shown a collapsible tube having a container body 10 made of a soft metal such as lead, tin or antimony or alloys thereof, or a suitable plastic material.

The one end of the container is provided with a tubular dispensing nozzle 11 through which the contents of the tube may be dispensed when it is collapsed. The dispensing nozzle is externally threaded in the usual manner so as to receive the removable closure cap 12 shown in Figs. 1 to 3 or the closure cap 13 shown in Figs. 4, 5 and 6.

Initially, when the container is first filled and sold a pierceable sealing diaphragm is provided across the dispensing aperture in the nozzle a short distance beneath the outer end of the nozzle. The diaphragm is a fixed member which is preferably formed integrally with the nozzle and container body. Under any circumstances, it is made of a pierceable material which will not shatter or split so as to prevent particles of the diaphragm from contaminating the contents of the container when it is pierced. For this purpose, I have found that the diaphragm may be made of a soft metal such as lead, tin, antimony or alloys thereof, or of a suitable plastic material such as a polyvinyl resin, cellulose acetate, polyethylene or the like. The diaphragm is impermeable to the atmosphere, to the contents of the container, and to contaminants and is not adversely affected thereby so that it provides a satisfactory seal for the dispensing aperture.

The closure caps 12 and 13 are provided with an inwardly projecting piercing point 15 so that when the cap is fully applied, the piercing point will pierce the sealing diaphragm and will fold it backwardly against the inner surfaces of the dispensing nozzle as shown in Figs. 2 and 5. In this connection the piercing point has a cylindrical portion and a tapered portion. The cylindrical portion should be of a diameter substantially equal to the diameter of the dispensing aperture when the diaphragm is folded inwardly against the inner surface thereof as shown in Figs. 2 and 5. Also, it should be substantially as long as the radius of the diaphragm so as to cause the entire length of the pierced diaphragm to fold backwardly into contact with the inner surface of the dispensing nozzle. This prevents the pierced diaphragm from interfering with the dispensing operation and provides a dispensing aperture of maximum area without any pockets or recesses in which the contents of the container will lodge when dispensed.

When the container and closure assembly are in their initial position, the closure is only partially applied to the container with the piercing point held spaced from the diaphragm. For this purpose, I provide frangible stop members which serve to hold the closure in this partially applied position under normal conditions. The frangible stop members are disposed between the closure and the container and are preferably connected to one or the other. When a sufficient torque force is applied to the closure to tighten the cap, the stop members are broken or bent so as to permit the cap to be fully applied with the result that the piercing point will pierce the diaphragm pushing it back against the inner surface of the dispensing nozzle as shown in Figs. 2 and 5. In order to accomplish this result the internally threaded apron portion of the cap shown at 12' in Figs. 1 and 2, and of 13' in Figs. 4 and 5 must be sufficiently long so that the threads are adequately engaged when the closure is in its initial position and will also serve to feed the closure all the way down to fully closed position.

The frangible stops may be secured to either the cap or the container. In the form shown in Figs. 1 to 3, I

provide radial projections 16 integrally connected to the outer surface of the dispensing nozzle immediately beneath the threaded portion thereof and projecting outwardly so as to be engageable with the lower end of the apron portion of the cap. The number and arrangement of stop members may vary and in Fig. 3, I have illustrated four equally spaced radial stop members. I have found that it is preferable to form the lower end of the apron portion of the cap with a flange spaced outwardly from the threaded exterior surface of the dispensing nozzle. The flange engages the ends of the stop members and when sufficient torque is applied to the cap the stop members are initially bent downwardly and are accommodated by the space inside the flange. As the cap is further rotated, the stop members may break off completely or may be bent to conform to the inner surface of the cap.

In the form of my invention shown in Figs. 4 to 6 inclusive, the stops take the form of projections 17 depending downwardly from the lower end of the cap 13 and engageable with the sloping walls 18 at the upper end of the collapsible container adjacent the dispensing nozzle. The angular surface 18 performs a camming function when sufficient torque force is applied to the cap causing the projections 17 to first bend outwardly as shown in dotted lines in Fig. 4 and then to completely break off with the result that the cap may be fully applied to the position shown in Fig. 5.

When the cap is fully applied as shown in Figs. 2 and 5 the piercing point 15 serves as a plug. The top of the cap seats against the upper end of the dispensing nozzle and the piercing points seats inside of the pierced diaphragm of the dispensing nozzle.

In using a container having my improved closure assembly, the removable closure cap is initially only partially applied to the limit permitted by the frangible stops with the result that the sealing diaphragm serves to maintain the contents in sterile condition and protects them from contamination, contact with the atmosphere and loss by evaporation or leakage. The container may be shipped and stored while thus sealed. When it is desired to use a portion or all of the contents, sufficient torque force is applied to the closure to tighten it with the result that the frangible stops are bent or broken and the piercing plug pierces the diaphragm, forcing it back against the inner wall of the dispensing nozzle. The removable closure may then be removed to permit all or a portion of the contents to be dispensed and may then be re-applied to protect the contents until it is desired to use them again.

Modifications may, of course, be made in the illustrated and described embodiments of my invention without departing from the invention as set forth in the accompanying claims.

I claim:

1. A container closure assembly comprising: a container having an externally threaded tubular dispensing nozzle with a dispensing aperture extending therethrough; a diaphragm made from a non-shattering relatively soft fluid impervious material extending across the dispensing aperture in the nozzle to seal the same; an internally threaded removable closure cap engageable with the threaded nozzle to close the same, the said cap having a completely enclosed top portion serving as a sealed closure for said container and said closure cap having a piercing plug depending downwardly from the top of the cap and engageable with the diaphragm to pierce the same when the cap is fully applied but being spaced from the diaphragm when the cap is only partially applied; and frangible stop means between the cap and container and connected to one of said parts and being en-

gageable with the other part when the cap is only partially applied to limit the further application thereof, said stop means being frangible so as to break when sufficient torque force is applied to the cap in the direction of further application of the cap whereby the cap can be fully applied and the diaphragm pierced.

2. A container closure assembly as set forth in claim 1 in which the frangible stop means is in the form of a radial projection formed on the dispensing nozzle and engageable with the lower end of the cap when it is partially applied.

3. A container closure assembly as set forth in claim 1 in which the frangible stop means is in the form of a radial projection formed on the dispensing nozzle and the cap has a flange at its lower end spaced radially from the dispensing nozzle and engageable with the radial projection when the cap is only partially applied.

4. A container closure assembly as set forth in claim 1 in which the frangible stop means is in the form of a frangible projection at the lower end of the cap engageable with the container when the cap is only partially applied thereto.

5. A container closure assembly as set forth in claim 1 in which the frangible stop means is in the form of a frangible projection at the lower end of the cap and the container has an annularly disposed wall engageable with the stop means when the cap is only partially applied to the container, said wall serving as a cam surface to deflect and break the frangible projection when sufficient torque force is applied to the cap.

6. A container closure assembly as set forth in claim 1 in which the piercing point has a cylindrical portion with a tapered portion at its outer end terminating in a centrally positioned point the cylindrical portion being substantially equal in diameter to the diameter of the aperture in the dispensing nozzle when the diaphragm is disposed against the inner surface thereof and said cylindrical portion being approximately equal in length to the radius of the diaphragm.

7. A container closure assembly comprising: a container having an externally threaded tubular dispensing nozzle with a dispensing aperture extending therethrough; a diaphragm made from a non-shattering relatively soft fluid impervious material extending across the dispensing aperture in the nozzle to seal the same; an internally threaded removable closure cap engageable with the threaded nozzle to close the same, the said cap having a completely enclosed top portion serving as a sealed closure for said container and said closure cap having a piercing plug depending downwardly from the top of the cap and engageable with the diaphragm to pierce the same when the cap is fully applied but being spaced from the diaphragm when the cap is only partially applied; and frangible stop means between the cap and container and connected to one of said parts and being engageable with the other part when the cap is only partially applied to limit the further application thereof, said stop means being pliable so as to bend when sufficient torque force is applied to the cap in the direction of further application of the cap whereby the cap can be fully applied and the diaphragm pierced.

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