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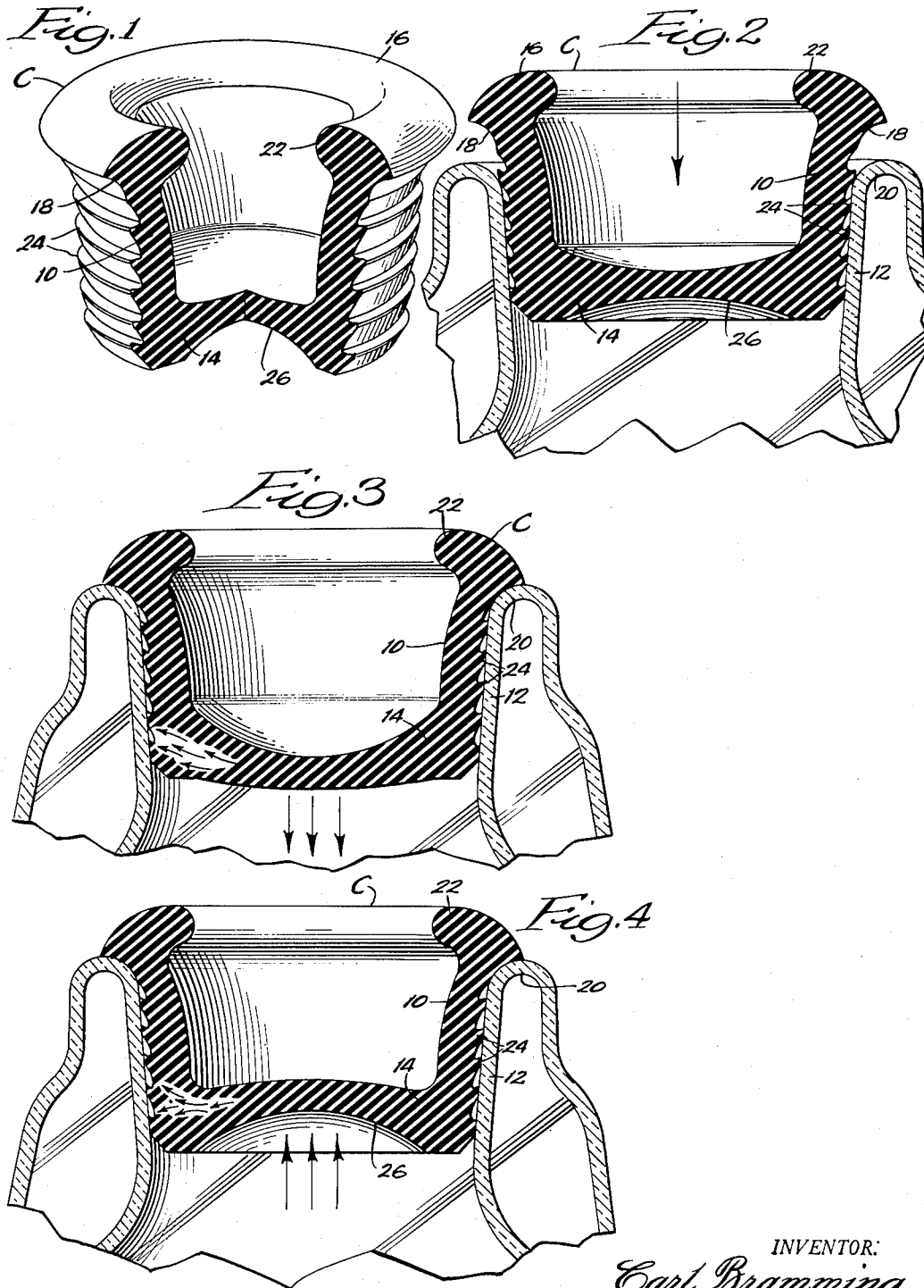
C. BRAMMING

2,746,632

FLEXIBLE BOTTLE CLOSURE

Filed Nov. 27, 1953

2 Sheets-Sheet 1



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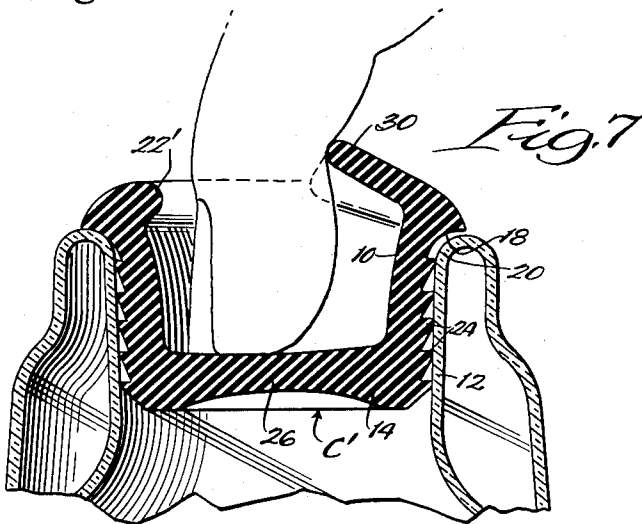
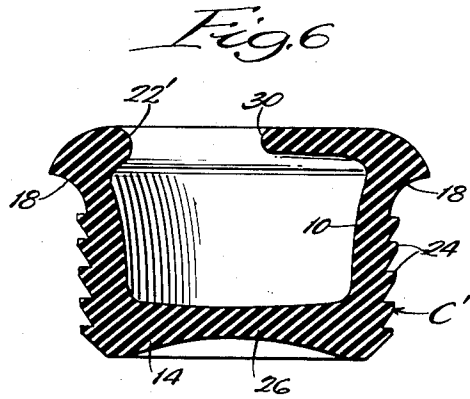
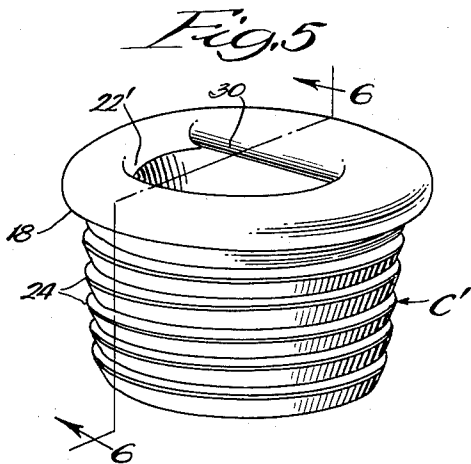
C. BRAMMING

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FLEXIBLE BOTTLE CLOSURE

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2 Sheets-Sheet 2



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2,746,632

FLEXIBLE BOTTLE CLOSURE

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Application November 27, 1953, Serial No. 394,611

4 Claims. (Cl. 215—52)

This invention relates to certain new and useful improvements in closures for bottles and more particularly to flexible closures to be used in vacuum bottles.

This application is a continuation-in-part of my co-pending application, Serial No. 319,521, filed November 8, 1952, now abandoned.

One of the recent innovations in the vacuum bottle art is the provision of flexible closures to be used as stoppers in the necks of vacuum bottles. They have been constructed in many different forms and their advantages over conventional cork stoppers have been fully described and are well known. However, there are some problems which have not been overcome by the present day commercial flexible closure.

The principal unsolved problem of today's construction of flexible closures is that they oftentimes leak; that is, a sufficient seal between the neck of the bottle and the flexible closure to prevent seepage of contents from within the bottle cannot be maintained at all times. Generally this is because the friction between the bottle closure and the neck of the bottle is such that the closure and the bottle cannot be held in close and constant contact at all times. Another problem presented in present day construction of closures is that the closures are, in most cases, difficult to remove from the neck of the bottle. The embodiment of my new form and type of closure solves these problems.

One of the primary objects of my invention, therefore, is the provision of a flexible closure for vacuum bottles which is so constructed as to provide a positive seal against leakage.

Another object of my invention is to provide a flexible closure for vacuum bottles having a side wall which is forced into continuous pressure contact with the neck of the vacuum bottle after the closure has been inserted therein.

A further object of my invention is to provide means for readily removing my closure from the neck of a vacuum bottle.

With the above and other objects in view which will become apparent as the nature of the invention is better understood, my invention consists in the novel form, combination and arrangement of parts hereinafter more fully described, the preferred forms of which are shown in the accompanying drawings wherein:

Figure 1 is a perspective view of a new closure with a portion dissected therefrom;

Figure 2 is a side elevational view in cross-section showing the new closure of Figure 1 after it has been inserted in the neck of a vacuum bottle and before pressure has acted upon it;

Figure 3 is a side elevational view in cross-section showing the new closure of Figure 1 after a hot liquid has been placed into the vacuum bottle;

Figure 4 is a side elevational view of the new closure after a cold liquid has been placed into the vacuum bottle;

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Figure 5 is a perspective view of a modified vacuum bottle closure embodying the present invention.

Figure 6 is an elevational sectional view of the modified closure taken along a line 6—6 in Figure 5.

Figure 7 is an elevational sectional view showing the method of removing the modified closure from the neck of a vacuum bottle.

Figures 1—4 of the drawings illustrate a new type of closure in the form of a soft resilient hollow open-topped generally cup-shaped closure member C and having an annular side wall 10 which is slightly tapered to fit the neck of a vacuum bottle 12. A bottom wall 14 is connected to the lower end of the side wall 10. The closure C may be constructed of any preferred material so long as the material is flexible and, to that end, I prefer my closure to be made out of rubber. Moreover, when made of rubber, the closure can economically and efficiently be molded as a single unit.

Surmounting the top of the side wall 10 of my closure C is an enlarged flange 16. The exterior surface 18 of the flange 16 extends outwardly in an arch shape in order to approximate the shape of the lip 20 of the neck of the vacuum bottle 12 to insure a constant bearing surface between these parts after the closure has been inserted into the vacuum bottle 12. The opposite side of the flange 16 extends inwardly to form an enlarged rim 22 which provides a grasping area to permit the closure to be more easily removed from the vacuum bottle after it has been inserted therein. Because the side wall 10 is exerted into close and direct pressure contact with the neck of the vacuum bottle 12, it is necessary to provide the enlarged rim 22 to permit removal of the closure from the vacuum bottle. Without the enlarged rim 22 it would be most difficult to remove my closure from the vacuum bottle.

The outer side of the side wall 10 is provided with a plurality of ribs 24 which prevent any liquid which might be in the vacuum bottle from working its way out. The ribs 24 are preferably inclined upwardly in the direction of the top of the closure and when the ribs are so inclined, I have found that not only is a better seal obtained but the inclined ribs largely prevent the closure from working its way out of the neck of the vacuum bottle. In this way, a difficulty experienced with most flexible closures is substantially eliminated.

The bottom wall 14 of the closure C is relatively thinner than the side walls 10. The exterior side of the bottom wall 14 tapers inwardly toward the center and the interior side of the bottom wall 14 tapers downwardly towards the center resulting in a diaphragm wall 26 in the central portion of the bottom wall 14. The thickness of the bottom wall 14 must be such as to permit the wall 14 to respond, in the form of up and down movement, to physical phenomena which are explained hereinafter.

It has been found that after hot or cold liquids are placed into a vacuum bottle and sealed, certain physical phenomena take place. For example, after a hot liquid has been placed into a vacuum bottle and sealed, the subsequent decrease in temperature of the liquid reduces the pressure in the vacuum bottle resulting in the collapse and downward movement of the thin membrane bottom wall as shown in Figure 3. After a cold liquid has been placed into a vacuum bottle and sealed, the subsequent increase in the temperature of the liquid produces a pressure against the thin membrane bottom wall to force the wall upward as shown in Figure 4. The movement, whether up or down, by the thin membrane wall forces the periphery of the wall outwardly to compress the ribs on the side wall into pressure contact with the neck of the vacuum bottle. Briefly, the side wall of the closure is forced outwardly by the bottom wall because of the double concave construction of the bottom wall. Thus, the diaphragm 26 of the bottom wall has a curve on both sides

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of an even radius so that when the diaphragm is forced up or down the curve is changed to a chord. As is known, while the curve in the diaphragm is changing to a chord its linear dimension tends to increase but is prevented from doing so by the neck of the bottle. Since the closure comprising my invention is flexible, it will necessarily exert pressure against the side of the bottle neck as is shown by the arrows in Figures 3 and 4 of the drawings.

I have utilized this physical action in the construction and form of my closure. Thus, I have made the bottom wall 14 of my closure quite thin in order that it may react to these physical phenomena.

When a cold liquid or substance has been placed into a vacuum bottle and the closure comprising my invention has been inserted therein, the subsequent increase in the temperature of the liquid produces a pressure beneath the bottom wall 14 of the closure C and forces the bottom wall 14 upward substantially as shown in Figure 4. When the bottom wall 14 is forced upward, the bottom wall, as is readily seen because of its size and construction, is forced outwardly. This results in compressing the ribs 24 on the side wall 10 against the neck of the vacuum bottle 12. Thus, a pressurized positive seal is had which can only be broken by forcibly removing the closure from the vacuum bottle.

Conversely, after a hot liquid or substance has been placed into a vacuum bottle and the closure comprising my invention has been inserted into the neck of the vacuum bottle, the temperature of the hot liquid or substance decreases which reduces the pressure in the vacuum bottle resulting in the downward movement of the bottom wall 14 of the closure C substantially as shown in Figure 4. Because of the form and construction of the bottom wall 14, the bottom wall is forced outwardly. This results in compressing the ribs 24 of the side wall 10 into close and direct contact with the neck of the vacuum bottle 12 which gives a pressurized seal which can only be broken by removing the closure from the vacuum bottle.

It is obvious that I have provided a new type of closure for vacuum bottles which is constructed so that it is possible to take advantage of various physical phenomena which occur when hot or cold liquids are placed into a vacuum bottle. The advantages of this construction, which thus utilizes these forces, presents, for the first time, a closure which positively seals a vacuum bottle and prevents any leakage of the contents of the vacuum bottle. In this way, the closure eliminates a difficulty experienced with the usual types of flexible closures.

The sealing action arising from the provision of the double concave bottom wall is so effective that it has been found desirable to make added provision for removing the closure from the vacuum bottle. To illustrate this aspect of the invention, a modified embodiment C' is shown in Figures 5-7. In the modified embodiment, the side and bottom walls of the closure are constructed in the same manner as in the embodiment of Figures 1-4. Accordingly, the same reference characters have been applied to these elements and the other elements of the modified embodiment which correspond exactly to those provided in the first embodiment.

To facilitate the removal of the modified closure C' from the vacuum bottle, the annular side wall 10 is formed at one side of its upper edge with an inwardly extending generally semi-circular lip 30 extending part way across the top of the closure. The remainder of the closure top is open except for an annular lip portion 22' which is somewhat less pronounced than the lip 22 of the first embodiment. Thus, a person desiring to open the vacuum bottle may readily insert one finger underneath the lip 30 through the open top of the closure C'. Be-

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cause of its convenient shape and ample size, the lip 30 may be firmly grasped so that the closure C' may be removed despite the highly effective holding action resulting from the provision of the flexible bottom wall 14. Even when a considerable pressure differential exists between opposite sides of the bottom wall 14, under which circumstances the maximum sealing effect is obtained, the lip 30 of the closure may be grasped firmly enough to provide for easy removal of the closure from the vacuum bottle. In this respect, the second embodiment is considered to be preferable over the first embodiment.

While there are herein shown and described the preferred embodiments of the present invention, it is nevertheless to be understood that changes may be made therein without departing from the spirit and scope of the invention as claimed.

I claim:

1. A flexible closure for vacuum bottles, said closure comprising a soft resilient hollow open-topped generally cup-shaped member having an annular side wall, a bottom wall of double concave shape connected to said side wall adjacent its lower edge so that pressure or vacuum in the vacuum bottle will result in upward and downward flexing of the bottom wall and thereby will effect outward expansion of said side wall, an outwardly projecting annular flange connected to said side wall adjacent its upper edge for engaging the top of a vacuum bottle, and an inwardly projecting generally semi-circular lip connected to said side wall adjacent its upper edge and adapted to be grasped in removing said closure from the vacuum bottle, said lip extending generally half way across the top of said member, said member having an open top to afford access to the underside of said lip.

2. A flexible closure for vacuum bottles, said closure comprising a soft resilient open-topped member, an annular side wall and a bottom wall connected to said side wall, said bottom wall being of double concave shape so that upward or downward fluid pressure thereon will effect corresponding flexure thereof and in both cases will expand said side wall outwardly to effect a positive seal.

3. A flexible closure for vacuum bottles, said closure comprising a soft resilient hollow open-topped cup-shaped member having an annular side wall with external ribs and a bottom wall of double concave shape connected to said side wall, said bottom wall being thinner at its central portion than at its edge portion so that upward or downward fluid pressure thereon will effect corresponding flexure thereof and, in both cases, will expand said side wall outwardly.

4. A flexible closure for vacuum bottles, said closure comprising a soft resilient hollow open-topped generally cup-shaped member having an annular side wall, a bottom wall of double concave shape connected to said side wall adjacent its lower edge so that pressure or vacuum in the vacuum bottle will result in upward and downward flexing of the bottom wall and thereby will effect outward expansion of said side wall, and an inwardly projecting element connected to said side wall adjacent its upper edge and adapted to be grasped in removing said closure from the vacuum bottle, said member having an open top to afford access to the underside of said element.

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