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CLOSURE MEMBER

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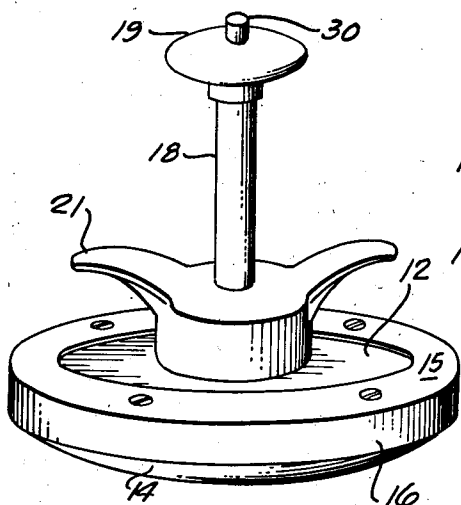


Fig. 1

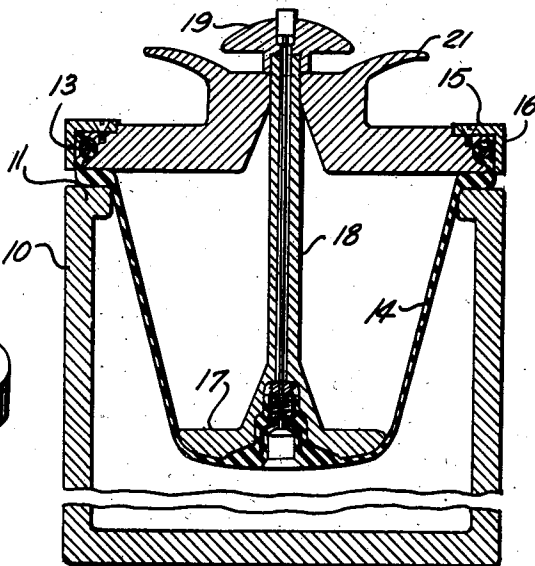


Fig. 2

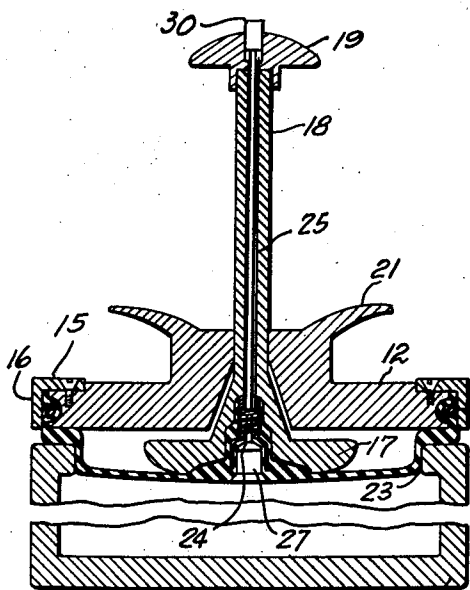


Fig. 3

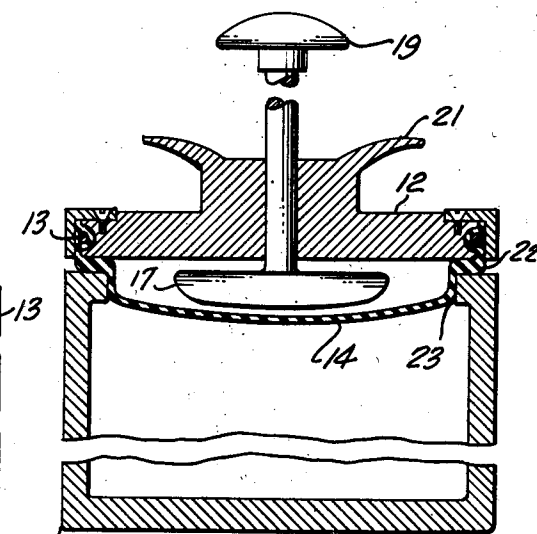


Fig. 4

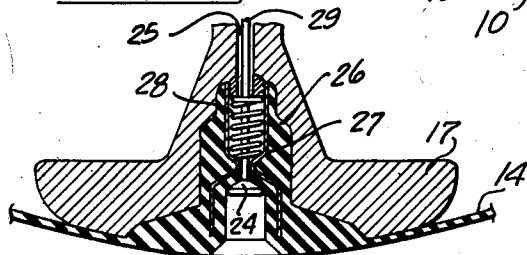


Fig. 5

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CLOSURE MEMBER

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12 Claims. (Cl. 220—24)

1

This invention relates to closure members for containers and more particularly to a closure member carrying a vacuum producing means for partially evacuating the container to effect a seal thereby.

It has been heretofore proposed to seal sundry containers by atmospheric pressure, that is, by creating a partial vacuum within the container so that atmospheric pressure acting against the closure member of the container would hold the same in sealing engagement with a lip or the like formed about the mouth or opening of the container. Various means have been used to create the partial vacuum within the container and although a number of these previously used means have been successful they have been either complicated and costly to produce or where relatively simple in structure have been not entirely reliable and could not be re-used.

The means of the present invention for producing or creating the vacuum within the container is simple but yet efficient and is carried by the closure member itself. As this means is carried by the closure member itself it cannot be lost or misplaced. Furthermore, the closure member and the vacuum creating means carried thereby are not expendable and can be used indefinitely.

In the broadest aspects of the present invention the vacuum-producing means comprises an extensible member for displacing a substantial volume of the air within the container. Thus when the extensible member contracts or returns to its normal position after the closure member is seated on the lip or defining edge of the mouth or opening of the container atmospheric pressure alone holds the closure member in sealing engagement with the lip.

The extensible member comprises a thin, pliant sheet of resilient, impervious material such as rubber. The periphery of the sheet is secured to the periphery of the closure member so as to enclose the lower or bottom face of the closure member and at least a part of the edge face of the latter. A plunger slidably carried by the closure member is normally held by the resilient sheet in an elevated position relative to the closure member but is movable downwardly against the action of the resilient sheet to extend the latter and displace a volume of air from the container.

In the use of the closure member of the present invention the plunger is depressed to extend the sheet, that is, to force it away from the lower face of the closure member. With the sheet

2

in this position relative to the closure member the latter is now seated on the lip of the opening of the container and the plunger released. The resilient sheet will now urge the plunger upwardly to its normal position and as the extended sheet displaces a relatively large volume of air the resulting vacuum created by the return of the sheet is sufficient to effect a seal between the lip of the container and the closure member because of the differential between internal and external pressures.

To break the seal it is only necessary to again force the plunger downwardly to extend the sheet a distance sufficient to compress the air remaining in the container so as to equate the pressure of the air within the container and the pressure of the ambient atmosphere. As soon as the container differential pressure is zero the closure may be merely lifted from the container.

As the differential pressure produced by the partial vacuum within the container may be relatively large and thus render the compression of the air remaining within the container somewhat tedious, the present invention includes means for communicating the interior of the container to the atmosphere when it is desired to break the seal. This means may comprise a controllable vent or the like on the container but in the now preferred form of the invention this means comprises a spring-pressed valve normally closing a passage formed within the plunger and interconnecting the interior of the container and the atmosphere.

To facilitate operation of the valve, an actuator is carried by the plunger and is formed so as to be accessible to a user. The actuator preferably extends normally beyond the upper end of the plunger and is operated by a user merely placing a finger on the extending end and forcing it downwardly against the spring of the valve to open the latter. Thus, to gain access to the contents of the container after the seal has been effected, the valve actuator is merely depressed to destroy the vacuum within the container and the closure member removed from the same.

Another feature of the present invention lies in the fact that the air between the inner face of the sheet and the lower face of the closure member is at atmospheric pressure and this pressure urges the annular portion of the sheet adjacent the portion of the same serving as a gasket radially and outwardly against the inner wall of the container to further augment the seal.

Other features and advantages of the present invention will be apparent from the following de-

scription taken in connection with the accompanying drawing in which:

Figure 1 is a perspective view of the closure member of the present invention;

Figure 2 is a sectional view of one form of the closure member of the present invention showing the same closing the mouth of a container with the diaphragm extended, and the thickened portion thereof somewhat exaggerated to more clearly illustrate the same;

Figure 3 is a view similar to Figure 2 but showing the position of the diaphragm and plunger after the seal has been effected;

Figure 4 is a fragmentary, enlarged view of the valve assembly showing a portion of the plunger; and

Figure 5 is a view similar to Figure 3 but showing a modified form of the closure member.

The closure member of the present invention may be used with any container desired as long as the same is formed of a material, or so fabricated, as to permit the container to be hermetically sealed. To illustrate the present invention a container 10 is shown as formed with a suitable opening having a lip 11 circumscribing and defining the same.

The closure member of the present invention comprises, in the form of the invention shown in Figures 1 through 4, a disc-like member 12 of some rigid material. The member 12 should have a diameter, where the opening of the container is circular, greater than the diameter of the opening. The reason for the relative dimensions of the member 12 and the opening of the container will be hereinafter made apparent.

The peripheral or edge face of the member 12 is formed with a groove for receiving a split ring 13 of some resilient material securing the peripheral portion of a thin, pliant and resilient sheet 14, here shown as somewhat dome-shaped in appearance, to the edge face of the member 12. The resilient sheet 14 completely encloses the lower face of the member 12 and the peripheral edge portion extends around the edge face of the member 12 as clearly shown in Figures 2, 3, and 4. To hold the ring 13 in the groove, as well as to conceal the ring, an escutcheon or shield 15 having a depending annular flange 16 is secured to the top face of the member 12.

The sheet 14 is formed of some resilient material impervious to air, such as rubber. The sheet forms an elastically deformable diaphragm extensible through actuation of a plunger 17 fixed to the lower end of a rod 18, slidably carried centrally of the member 12. The rod carries at its upper end a knob 19 which may be forced downwardly by the thumb of one hand of a user as the fingers of the hand are engaging a finger grip 21 preferably formed integral with the member 12.

To seal the container, the closure member is grasped by the thumb and fingers and the diaphragm 14 is extended by forcing the knob 19 toward the closure member. The amount the diaphragm 14 is extended will depend in most part on the amount of the contents of the container. The closure member, with the diaphragm still extended, is now placed on the lip 11 of the container, after which the pressure exerted on the knob 19 is released. The resiliency of the material of the diaphragm will tend to return the diaphragm to its normal position and urge the plunger and its actuating rod toward their respective positions in which they are normally held by the diaphragm.

The expanded diaphragm obviously displaces a volume of air within the container so that the contraction of the diaphragm creates or produces a partial vacuum within the container. As the air remaining in the container after contraction of the diaphragm is under a pressure considerably less than ambient pressure, the closure member will be tightly held against the seat formed by the lip 11 by atmospheric pressure. No other means need be used to hold the closure member in position and the closure member will be held in position until the container differential pressure becomes zero.

Although the pressure differential across the member 12 is zero, it should be noted that an annular portion of the diaphragm is, due to the pressure acting against the upper side of the diaphragm, clamped between the lower face of the member 12 and the seat formed by the lip 11. This portion of the diaphragm thus acts as a gasket or packing and insures a good seal between the closure member and the container. The diaphragm preferably is thickened as at 22 to provide a more efficient gasket, although it has been found that where the facing surfaces of the container and closure member are substantially coplanar and free of irregularities it is not necessary to thicken the diaphragm.

The seal is further augmented by the atmospheric pressure of the air between the member 12 and the diaphragm urging the latter radially and outwardly against the inner surface 23 of the container adjacent the lip 11. This feature is clearly illustrated in Figures 3 and 5 of the drawing.

As atmospheric pressure will also be acting downwardly against the upper surface of the diaphragm and tending to resist contraction of the diaphragm the resiliency of the material forming the diaphragm will obviously have to be such as to overcome this force. Care should be taken however to insure that the material can be readily extended as otherwise it will be difficult to force the plunger downwardly during the sealing operation.

When it is desired to remove the closure member from the container to gain access to the contents thereof, the plunger can be again depressed to force the diaphragm downwardly to compress the air remaining in the container. It should now be understood that the seal will be broken when the container differential pressure is reduced to zero, that is, the seal will be broken when the air remaining in the container is compressed to atmospheric pressure. When the differential pressure becomes zero the closure member may then be merely lifted from the container by using the finger grip 21 as a handle or lifting knob.

To facilitate removal of the closure member, means are provided in the preferred form of the present invention for breaking the seal effected by atmospheric pressure. This means may comprise a controllable vent formed in the wall of the container, but in the now preferred embodiment of the invention this means comprises a valve 24 controlling the flow of air through a passageway 25 formed axially of the plunger rod 18. The passageway 25 leads from the knob 19 to a valve casing 26 housing the valve 24. The casing is preferably integral with the diaphragm and comprises essentially a substantially conical shaped mass of rubber having a passageway 27 leading to the end of the passageway 25. The passageway 27 is restricted intermediate the ends thereof and the valve 24 is normally held by a

5

spring 28 against the seat formed by the restricted portion of the passageway 27. The valve 24 may be displaced from the seat through an elongate actuating member 29 longitudinally extending upwardly through the passageway 25 to a point adjacent the top surface of the knob 19. The upper end of the member is preferably formed with an enlargement 30 forming an operating button.

It should now be seen that when it is desired to remove the closure member from the container it is only necessary for the user to depress the elongate actuating member downwardly to force the valve off its seat. The unseating of the valve opens the interior of the container to the atmosphere and air will be forced into the container through the passageway 25 until the container differential pressure becomes zero. The closure member, as will now be understood, can be merely lifted from the container.

As previously mentioned, however, the seal may be broken by merely forcing the plunger and diaphragm downwardly into the container to compress the air remaining in the container to atmospheric pressure. The cost of the closure member can be greatly reduced by eliminating the valve 24 and its associated elements. This more economical form of the present invention is shown in Figure 5 wherein elements to be found in the form of the invention earlier described are identified by like reference characters.

In this embodiment of the invention the plunger 17 is not fixed to the diaphragm and may as shown in Figure 5 be separated from the diaphragm in use after the seal has been effected. This is not true of the form of the invention shown in Figures 1 to 4 inclusive. This feature of the form of the invention shown in Figure 5 eliminates production and assembly steps necessary to form the first described form of the closure member of the present invention and results in lower production costs.

The closure member of the present invention in either embodiment thereof forms a simple, efficient, easy to operate means for partially evacuating a container to produce a container differential pressure sufficient to maintain the closure member in good sealing engagement with the lip or edge defining the opening of the container.

Although the now preferred embodiments of the present invention have been illustrated and described herein, it is to be understood that the invention is not to be limited thereto, for the same is susceptible to changes in form and detail within the scope of the appended claims.

I claim:

1. A closure member for hermetically sealing an opening in a container, including: a body member; elastically deformable, pliant means of substantially the same size and shape as said body member; means for securing the peripheral edge of said pliant means to the peripheral edge of said body member whereby said means depends therefrom into contact with the air in the main body of the container; means mounted intermediate said body member and said pliant means and movable relative to said body member; means for moving said last named means to deform said pliant means to effect displacement of air from said container sufficiently to create a partial vacuum within said container upon contraction of said pliant means whereby atmospheric pressure acting against said pliant means causes the peripheral portion of the same to her-

6

metically conform to the rim of said container and concurrently hold said body member against the defining edge of said opening; said pliant means having a passage therethrough; valve means normally closing said passage; and means carried by said moving means for actuating said valve to open said passage to lead ambient air into said container when it is desired to remove said closure member to gain access to the interior of said container.

2. A device for closing and sealing an opening in a container comprising a body member adapted to be supported by the rim of said opening; a thin, pliant, relatively flat diaphragm of resilient material impervious to air secured about its periphery to said body member and enclosing at least the lower face thereof; and a plunger slidably carried by said body member for urging said diaphragm away from said body member to displace a relatively large volume of air from said container equal to the volume of air between said extended diaphragm and said body member, the contraction of said diaphragm when said plunger is released creating a partial vacuum within said container so that said diaphragm is held in sealing engagement with the rim of the opening in said container, the portion of said diaphragm pressurally urged against said defining edge being thicker than the body of the diaphragm and serving as a gasket to augment the seal.

3. A closure member for hermetically sealing an opening in a container comprising a body member adapted to be supported by the rim of said opening; a pliant diaphragm of resilient material impervious to air substantially flat, means for securing the peripheral edge of said diaphragm to the peripheral edge portion of said body member; a plunger slidably carried by said body member for deforming said diaphragm to effect displacement of air from said container sufficient to create a partial vacuum within said container upon contraction of said diaphragm whereby atmospheric pressure acting against said diaphragm causes the peripheral portion of the same to hermetically conform to the rim of said opening and concurrently hold said body member against said rim; said diaphragm having a passage therethrough coaxially aligned with a passage extending longitudinally of said plunger; a valve; resilient means for normally urging said valve to a position closing the passage through said diaphragm; and means carried within the passage of said plunger including means extending therefrom for actuating said valve to open the passage closed thereby.

4. A closure member for hermetically sealing an opening in a container comprising a body member adapted to be supported by the rim of said opening; a pliant diaphragm of resilient material impervious to air depending from said body member; a plunger slidably carried by said body member for deforming said diaphragm to effect displacement of air from said container when said body member is closing the opening of the latter sufficient to create upon contraction of said diaphragm a partial vacuum within said container whereby atmospheric pressure acting against said diaphragm causes the peripheral portion of the same to hermetically conform to the surface of the wall of said container adjacent the opening therein and hold said closure member across said opening; said diaphragm having a passage therethrough coaxially aligned with a passage extending longitudinally of said plunger;

a valve; resilient means for normally urging said valve to a position closing the passage through said diaphragm; an elongate rod coaxially carried within the passage of said plunger for reciprocating movement relative thereto for moving said valve to open the passage through said diaphragm, the end of said rod extending beyond said plunger to form an operating member for moving said rod against the action of said resilient means.

5. A device for closing and sealing an opening in a container comprising a rigid body member; a thin, substantially flat, pliant diaphragm of resilient material impervious to air; means for securing the peripheral edge of said diaphragm about the edge face of said body member and enclosing the lower face thereof; an annular portion of said diaphragm spaced inwardly from the peripheral edge thereof being substantially thicker than the remainder of said diaphragm; said thickened portion having a diameter substantially equal to the diameter of said opening; and a plunger slidably carried by said body member for urging said diaphragm away from said body member to displace a volume of air from said container when said closure member is positioned across said opening, the contraction of said diaphragm when said plunger is released creating a partial vacuum within said container whereby said thickened portion of the diaphragm is held by atmospheric pressure in sealing engagement with the defining edge of the opening in said container.

6. A closure member for hermetically sealing an opening in a container comprising: a rigid body member adapted to be supported by the rim of said opening; a relatively flat, elastically deformable pliant means of substantially the same size and shape as said body member; means for securing the peripheral edge of said pliant means around the peripheral edge of said body member; means movably interposed between said body member and said pliant means and normally held by the latter adjacent the lower face of said body member; and means for urging said last named means away from said body member to distend said pliant means into said container to displace a relative large volume of air therefrom to create a pressure differential across said pliant means, when said urging means is released and said pliant means contracts to return said movable means to its normal position, sufficient to hermetically conform the peripheral portion of said pliant means to the rim of said opening and thereby hold said closure member across the opening of said container.

7. A closure member for hermetically sealing an opening in a container comprising: a rigid body member adapted to be supported by the rim of said opening; a relatively flat, pliant diaphragm of resilient material impervious to air; means for securing the peripheral edge of said diaphragm around the peripheral edge of said body member; a plunger slidably mounted on said body member for longitudinal movement and movable to distend said diaphragm into said container to displace a relatively large percentage of the air therefrom whereupon release of the plunger permits the diaphragm to contract and return to its normal position thereby creating a partial vacuum within said container, the resulting pressure differential across said diaphragm forcing the peripheral edge portion contiguous to said rim against and around the same to hermetically seal said container and hold the body member to the same:

8. A closure member for hermetically sealing an opening in a container comprising: a rigid body member of a diameter larger than the diameter of said opening; a relatively flat thin membrane of resilient material impervious to air peripherally secured to said body member and enclosing at least the lower face thereof; and a plunger slidably carried by said body member and normally held in an elevated position by said membrane; depression of said plunger distending said membrane into said container to displace a relatively large volume of air therefrom, the contraction of said membrane upon release of said plunger elevating the same and creating a partial vacuum within said container, whereby said membrane is urged by the higher atmospheric pressure against and around the lip of said opening to hermetically seal the same:

9. A closure member for sealing an opening in a container comprising: a rigid body member of a size larger than said opening and adapted to be supported upon the rim of said opening; a substantially flat sheet of resilient material of a size and shape substantially that of said body member; means for securing the peripheral edge of said sheet to the peripheral edge of said body member; and means, including means movably interposed between the body member and said sheet, for distending the latter displacingly into the air held by said container, whereby to create, upon return of said sheet to its normal position, a pressure differential across said sheet adequate to force and hold the peripheral portion of said sheet in sealing engagement with the rim of said opening:

10. A closure member for sealing an opening in a container comprising: a rigid body member of a size larger than said opening and adapted to be supported upon the rim of said opening; a substantially flat sheet of resilient material of a size and shape substantially that of said body member; means for securing the peripheral edge of said sheet to the peripheral edge of said body member whereby said sheet extends across the lower face of said member; means carried by said body member and movable into engagement with said sheet for distending the latter displacingly into the air held by said container, whereby to create, upon return of said sheet to its normal position adjacent the lower face of said body member, a partial vacuum within said container producing a pressure differential across said sheet adequate to force the periphery of said sheet into hermetic contact with the interior of the rim of said opening:

11. A closure member for closing and sealing an opening in a container comprising: a rigid body member of a size larger than said opening, adapted to be supported upon the rim of said opening; a thin, pliant, substantially flat diaphragm of resilient material impervious to air secured about its periphery to said rigid body member, and normally held by its own resiliency adjacent the lower face of said body member; and a plunger slidably carried by said body member for urging said diaphragm away from the lower face of said body member to displace a relatively large volume of air from said container when said body member is positioned across said opening, the contraction of said diaphragm when said plunger is released and the diaphragm returns to its normal position adjacent said lower face of the rigid body member creating a partial vacuum within said container whereby the peripheral edge portion of said diaphragm is held

by atmospheric pressure in sealing engagement with the defining edge of the opening in said container.

12. A closure member for closing and sealing an opening in a container comprising: a rigid body member of a size larger than said opening adapted to be supported upon the rim of said opening; a thin, pliant, substantially flat diaphragm of resilient material impervious to air secured about its periphery to said rigid body member, and normally held by its own resiliency adjacent the lower face of said body member; a plunger slidably carried by said body member and normally held in an elevated position relative to said body member by said diaphragm; and means carried by the upper face of said body member adapted to be engaged by the fingers of one hand of a user as the thumb of the hand depresses said plunger to urge said diaphragm away from the lower face of said body member to displace a relatively large

volume of air from said container, the contraction and return of said diaphragm to its normal position adjacent the lower face of said body member, when the thumb is removed from said plunger, creating a partial vacuum within said container whereby the peripheral edge portion of said diaphragm is held by the higher atmospheric pressure in sealing engagement with the defining edge of the opening in said container.

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