Dec. 23, 1969 I. H. NEWTON 3,485,404

CLOSURE MEMBERS FOR VACUUM TYPE CONTAINERS AND THE LIKE

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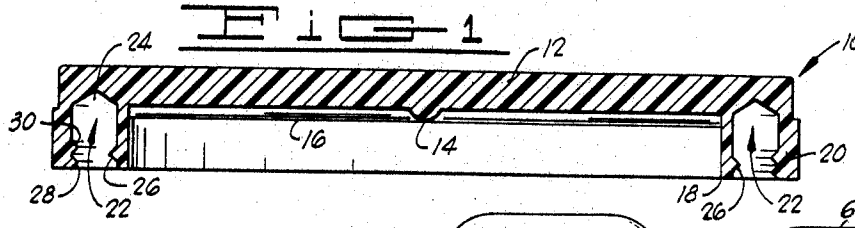
Fig. 1



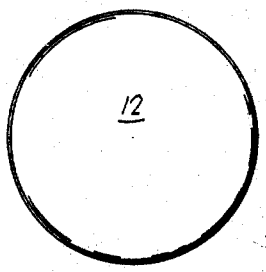
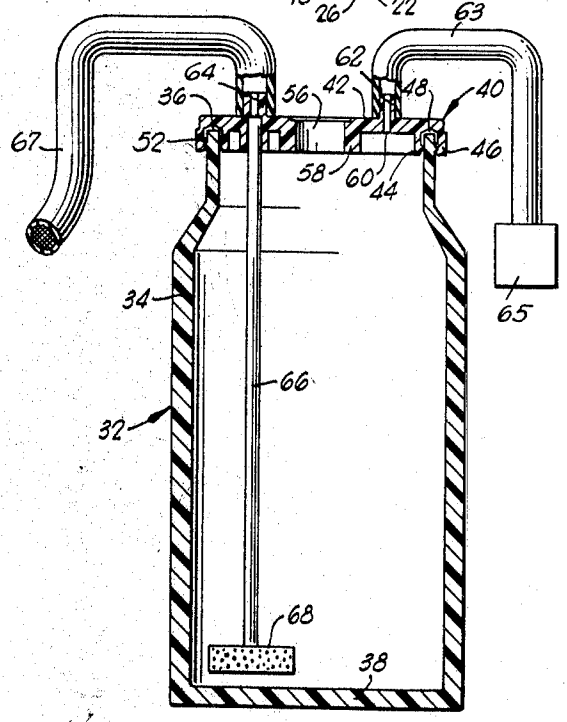


Fig. 2



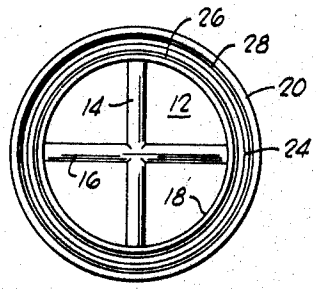
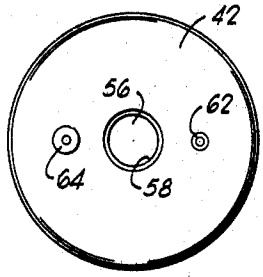


Fig. 3

Fig. 4



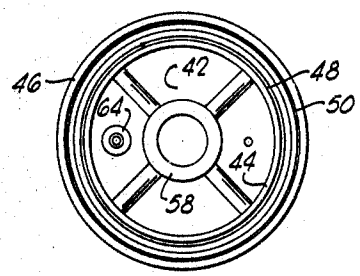


Fig. 5

Fig. 6

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CLOSURE MEMBERS FOR VACUUM TYPE CONTAINERS AND THE LIKE

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ABSTRACT OF THE DISCLOSURE

A closure member which increases in sealing efficiency as the pressure within a container upon which the closure member is used is decreased. The closure member includes a substantially planar central portion adapted to span across the open top of a container, and having at its outer peripheral edge a pair of spaced, downwardly depending flanges which define a groove into which the upper edge of the container projects when the closure member is in place. The groove is of V-shaped cross-sectional configuration at its deepest portion so that as the closure member is forced down on the top of the container, the engaged upper edge portion of the side of the container is placed in compression by a wedging action of the V-shaped portion of the closure member groove. Near the lower edge of the innermost of the downwardly projecting flanges, a rib or bead is provided which sealingly engages the inner surface of the side wall of the container. Directly opposite the bead, and located on the outermost of the downwardly projecting flanges are a pair of adjacent protuberances which conjunctively form a thread which can engage an externally threaded continer, or which can form a sealing structure bearing against the outer surface of the side of the container.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to closure devices for containers. More specifically, but not by way of limitation, the present invention relates to closure members which are preferably made of a resilient material, and adapted for extending across and closing the open upper end of containers which are evacuated when in use.

Description of the prior art

Many types of synthetic resin closure members or caps are used in modern packaging. As is well known in the art, a problem frequently arises in vacuum packaging in attaining a good seal between the closure member and the container to which it is secured. It is much more difficult to provide a seal of high integrity in the case of containers which are vacuum packed than where containers are at atmospheric or higher internal pressures. Moreover, the problem of establishing a reliable seal is often more pronounced in the case of closure members or caps which are made of relatively rigid or non-resilient material, than is the case of closure members constructed of synthetic resins having a significant degree of elasticity. Frequently, however, even in the case of such plastic closure members, forces of compression relied upon to seal the vacuum packed container are operative up to a predetermined pressure differential across the closure member, but with further reduction of the pressure within the container, the seal fails and air is admitted to the interior of the container, with the result that the contents become spoiled or deleteriously effected.

Brief description of the present invention

The present invention provides a synthetic resin closure member which can be used to effectively seal containers of various types with a tenacious, high integrity seal which is maintained despite changes in the internal pressure of the container under high vacuum. Broadly described, the closure member of the invention comprises a substantially planar central portion having a pair of spaced flanges extending around the outer periphery thereof, and at substantially right angles thereto. The flanges define a slot or groove adapted for receiving the upper portion of the side wall of a container, and including a generally V-shaped bottom portion. The flange which is the innermost of the two flanges with respect to the central portion of the closure member carries an integrally formed sealing bead spaced from the V-shaped bottom portion of the groove and facing toward the outermost flange. The sealing bead is preferably of V-shaped or triangular cross-sectional configuration. The outermost flange carries a pair of adjacent ribs or beads which are opposite, and face toward, the sealing bead on the innermost flange. The adjacent ribs on the outermost flange form a thread engageable with a thread portion adjacent the upper edge of a side wall of a container with which the closure member is engaged for sealing purposes.

The invention is also directed to, and includes, a novel humidifying assembly which incorporates the closure member of the present invention. The humidifier assembly includes a container having a free upper edge dimensioned for engagement with the slot or groove in the closure member and preferably having an external thread adjacent the upper edge configured to threadedly engage the adjacent ribs on the outermost flange of the closure member.

The closure member utilized in the humidifier assembly is of modified construction in that a filling aperture or opening is provided through the planar central portion of the closure member to permit water or other liquid to be introduced to the interior of the container. Also, the closure member carrier a tubular air intake nipple which communicates with an elongated tubular member inside the container and extending nearly to the bottom of the container. Finally, a tubular vacuum line spout is provided on the closure member to permit the interior thereof to be evacuated.

The described humidifier assembly may be usefully employed in conjunction with the carbuetor of an internal combustion engine for optimizing the moisture content of the air and fuel mixture. For such use, the vacuum line spout is connected through a suitable conduit or tubing to the carburetor, and a tubing is connected from the air intake nipple to a source of clean, atmospheric air. A sufficient amount of water is placed in the container to cover the lower end of the elongated tubular member and the filling aperture is closed. Then as the engine is operated, the pressure in the container is reduced by the suction developed by the carburetor and air is drawn into the container, through the water and into the carburetor. Efficient humidification of the thus circulated air is assured by the vacuum-tight seal afforded by the novel closure member of the invention.

A major object of the invention is to provide an improved closure member which is especially well adapted for use in sealing a container having a subatmospheric internal pressure.

Another object of the invention is to provide a closure member which can be easily molded from a synthetic resin material and which is characterized in having a long and trouble-free operating life.

An additional object of the invention is to provide a closure member which increases in sealing efficiency as

the pressure is decreased within the container upon which the closure member is used.

A further object of the invention is to provide an improved humidifier assembly which is vacuum operated to impart a high moisture content to a moving air stream.

In addition to the foregoing described objects and advantages of the invention, additional objects and advantages will become apparent from the following detailed description of the invention when it is considered in conjunction with the accompanying drawings which illustrate the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a transverse sectional view through a closure member constructed in accordance with the present invention.

FIGURE 2 is a top plan view of the closure member depicted in FIGURE 1.

FIGURE 3 is a bottom plan view of the closure member depicted in FIGURE 1.

FIGURE 4 is a vertical sectional view through a humidifying device incorporating a modified embodiment of the closure member of the present invention, and showing the humidifying device connected to an air intake conduit and to a carburetor for operation.

FIGURE 5 is a top plan view of the closure member depicted in the humidifying device shown in FIGURE 4, the humidifying device being shown disconnected from the air intake conduit and vacuum conduit leading to the carburetor.

FIGURE 6 is a bottom plan view of the closure member depicted in FIGURE 5.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

A closure member constructed in accordance with the invention is depicted in section in FIGURE 1, and is designated generally by the reference numeral **10**. The closure member **10** is constructed of a resilient material, such as a synthetic resin, and includes a substantially monoplanar central portion **12**. The central portion **12** carries on its under side, a pair of reinforcing ribs **14** and **16** which extend substantially normal to each other as best depicted in FIGURE 3. At the outer periphery of the monoplanar central portion **12**, the closure member **10** carries a pair of spaced, annular flanges **18** and **20** which extend substantially normal to the planar central portion **12** and parallel to each other as best depicted in FIGURE 1. Although the particular embodiment of the closure member **10** depicted in FIGURE 1 is circular in configuration so that the flanges **18** and **20** are annular, the principles of the invention also extend to closure members which are of other configurations than circular, and which therefore have multilateral flanges rather than the annular flanges under description. The flanges **18** and **20** adjacent the outer periphery of the planar central portion **12** of the closure member **10** define between them a slot or groove designated generally by reference numeral **22**. The slot **22** is transversely dimensioned to engage the upper edge of the side wall of a container to which the closure member **10** is to be engaged. The groove **22** includes a generally V-shaped bottom or deepest portion **24** into which the upper edge of the container will project when the closure member is secured in closing position on the container.

The innermost flange **18** of the two flanges **18** and **20** carries at a point relatively close to its free lower edge, and spaced from the V-shaped groove **24**, a protuberant sealing bead or rib **26**. The sealing bead **26** projects toward the outermost flange **20** and is preferably of a generally triangular cross-sectional configuration as best shown in FIGURE 1. On the outermost flange **20**, a pair of adjacent beads or ribs **28** and **30** are formed at a position on the flange where the apex or crest of the sealing bead **26** is aligned with a trough or repression formed between the two adjacent ribs. Like the sealing bead **26**, the ribs **28** and **30** are preferably of generally triangular cross-sectional configuration. Each of the beads or ribs **26**, **28** and **30** is of annular configuration in the embodiment of the closure member **10** under discussion. In a preferred embodiment of the invention, the ribs **28** and **30** may be inclined so as to form a thread which is suitable for engagement with a single thread adjacent the upper edge of the side wall of the container to which the closure member **10** is to be engaged.

In the use of the closure member **10** depicted in FIGURES 1–3, the closure member is placed over and pressed down upon the free upper edge of the side wall of a container which is of a diametric configuration such that its side wall matches the diametric dimension of the closure member. The upper edge of the side wall of the container thus moves upwardly in the closure member **10** until it is seated at the entrance to the V-shaped portion **24** of the groove **22**. In this position the sealing bead **26**, as well as the ribs **28** and **30**, bear against the inner and outer surfaces, respectively, of the side wall of the container. Since the transverse dimension of the groove **22** is substantially the same as the thickness of the side wall of the container, the flanges **18** and **20** are necessarily distended slightly in plastic deformation to permit the side wall of the container to pass the sealing bead **26** and the ribs **28** and **30**. The resilient characteristc of the flanges **18** and **20** constantly forces the sealing bead **26** and the ribs **28** and **30** into sealing engagement with the surfaces of the side wall of the container to provide a good seal therewith.

The most important utility of the closure members of the present invention is in the use of these devices for sealing containers which are vacuum packed or, stated differently, in which the interior of the container is under subatmospheric pressure. The effectiveness of the sealing function of the closure member in this use arises in large part from the inclusion of the V-shaped portion **24** as a part of the groove or slot **22**. Thus, with the development of a substantial vacuum within the container to which the closure member **10** is applied, the closure member tends to be drawn tightly down upon the container so that the resilient synthetic resin side walls of the V-shaped portion **24** of the groove **22** are spread apart in plastic deformation, and more tenaciously grip or engage the upper edge of the side wall of the container. The greater the reduction in the pressure within the container the more tenacious becomes the seal since the upper edge of the side wall of the container tends to be forced further into the V-shaped portion **24** of the groove **22**.

In FIGURES 4, 5 and 6 of the drawings, a modified embodiment of the closure member of the invention is depicted as such modified embodiment is applied to a container to form a novel humidifying device adapted for use in the carburetion system of internal combustion engines. It is known in automotive engineering that it is frequently desirable to add a small amount of moisture to the air being introduced to the carburetor of an automobile engine to smooth and improve the efficiency of engine performance. The humidifier assembly depicted in FIGURE 4 and incorporating a closure member constructed in accordance with the present invention is well adapted for this purpose. As shown in FIGURE 4, a container which may be constructed of glass, or more preferably, plastic or synthetic resin, is designated generally by reference numeral **32** and includes a side wall **34** which terminates in an upper edge **36** of generally annular configuration. The container **32** also has a conventional, substantially monoplanar bottom **38** which is preferably formed integrally with the side wall **34**.

Secured across the top of the container **32** in engagement with the upper edge **36** of the side wall **34** is a synthetic resin closure member designated generally by reference numeral **40**. As in the case of the closure member **10** depicted in FIGURE 1, the closure member **40** includes

a substantially monoplanar central portion 42 which carries at its outer peripheral edge, a pair of spaced, downwardly projecting flanges 44 and 46. The spaced, downwardly projecting flanges 44 and 46 define between them a groove or slot which receives the upper portion of the side wall 34 of the container 32. The deepest or bottom portion of the slot defined by the flanges 44 and 46 is of V-shaped cross-sectional configuration and is designated by reference numeral 48.

The flanges 44 and 46 are provided with a sealing bead 49 and with a pair of annular ribs 50 and 52, respectively. The closure member 40 is modified from that depicted in FIGURE 1 to accommodate it to use in the humidifier assembly depicted in FIGURE 4. Thus, the monoplanar central portion 42 is provided with a relatively large central filling aperture 56 which communicates with the interior of the container 32 through an annular flange 58. A relatively small opening 60 is also provided through the central portion 42 of the closure member 40 in a radially outwardly spaced position relative to the filling aperture 56. The opening 60 passes through a small diameter tubular vacuum spout 62 which extends upwardly from the upper surface of the closure member 40 and is connected through a vacuum conduit 63 to a carburetor 65 of an internal combustion engine. The carburetor is schematically illustrated. An air intake nipple 64 is provided on the upper side of the closure member 40 and on the opposite side of the filling aperture 56 from the tubular vacuum spout 62 and is connected to an air intake conduit 67. A small bore is provided through the air intake nipple 64 and communicates with the bore of an elongated tubing 66 which is pressed into a receiving recess in the monoplanar central portion 42 of the closure member. At its lower end, the elongated tubing 66 carries a perforated distribution head 68 through which air passed through the tubing may emerge in a manner hereinafter described.

In the use of the humidifying device depicted in FIGURE 4, the closure member 40 is placed in the illustrated position in engagement with the top of the container 32, and flexible tubular connections are made to the air intake nipple 64 and the vacuum spout 62 leading, respectively, to a suitable atmospheric air intake position, and to an air intake fitting on the carburetor 65 of the automobile. Water is poured through the filling aperture 56 in the closure member 40 to fill the container 32 approximately one-half full. A cork or other suitable closure device is then placed in the opening 56 to seal it.

With these connections made, and the container enclosing the water, the device is ready for utilization for humidifying air to be mixed with fuel vapors in the carburetor. As a vacuum is developed by the engine acting through the carburetor, air is drawn through the intake nipple 64 and the elongated tubing 66 and is discharged beneath the water through the distribution head 68. The air then bubbles through the water, becomes laden with water vapor and passes out of the humidifying device through the vacuum spout 62 and the tubing or conduit 63 which connects the spout to the carburetor. The operation of the engine of the vehicle thus continuously develops subatmospheric pressure within the container 32. As a result, a tendency exists for air to pass between the flanges 44 and 46 and the upper edge 36 of the side wall 34 of the container 32 to the interior of the container. The development of a vacuum within the container, however, concurrently causes the closure member 40 to be forced down upon the upper edge 36 of the side wall 34 of the container 32 with a greater closing pressure, and the result is that the upper edge 36 of the container 32 is moved farther into the V-shaped portion 48 of the groove defined by the flanges 44 and 46. The sealing effect of the closure member 40 is thus enhanced by the reduction in pressure within the container 32, and little or no leakage can occur around the upper edge 36 of the side wall 34 of the container. The sealing efficiency of the closure member 40 is also, of course, enhanced by the engagement of the sealing bead 49 and the ribs 50 and 52 with the upper portion of the side wall 34 of the container 32. Preferably, the container 32 is provided with a single, protuberant thread on its external surface which is dimensioned for engagement with the groove or trough formed between the ribs 50 and 52.

From the foregoing description of the invention, it will have become apparent that the present invention provides an improved closure member which can be usefully employed on containers in which the interiors of the containers are to be retained at subatmospheric pressure. The closure member is relatively simple in construction, can be easily molded from a synthetic resin material, and is characterized in having a long and trouble free service life. The structure of the closure member is such that its sealing efficiency increases as the pressure within the container upon which it is used is reduced. Thus, little opportunity exists for leakage of atmospheric air to the interior of the container, even though the interior of the container is maintained under a high vacuum at all times.

Although certain preferred embodiments of the invention have been herein described in order to provide an example of its construction and utilization which can present a guide to the practice of the invention useful to those skilled in the art, it is to be understood that various changes and modifications can be made in the described and illustrated structure without departure from the basic principles of the invention. All changes and innovations of this type which continue to rely upon the basic principles of the invention are therefore deemed to be circumscribed by the spirit and scope of the invention.

What is claimed is:

1. A resilient closure member comprising:
a substantially monoplanar central portion;
a filling aperture through said central portion;
a tubular air intake nipple on said central portion for admitting air through said closure member;
a tubular vacuum line spout on said central portion;
a pair of spaced flanges formed integrally with, and extending normal to, said central portion and extending around the outer peripheral portion of said central portion, said flanges defining between them a groove, with said groove having a generally V-shaped bottom portion;
a container having an upper edge portion projecting into said groove and having an upper edge seated against the mouth of the V-shaped portion of said groove;
a sealing bead formed integrally with one of said flanges which is the innermost of the two flanges relative to said central portion, said sealing bead protruding from said one flange toward the other of said flanges and spaced from the V-shaped bottom portion of said groove;
a pair of adjacent ribs formed integrally with the outermost of said flanges and protruding toward said innermost flange, said adjacent ribs defining between them a groove which is opposite and faces the sealing bead on said innermost flange; and
an elongated tubular member connected to said tubular air intake nipple for receiving air therefrom and projecting downwardly into said container.

2. The combination defined in claim 1 wherein said adjacent ribs and said sealing bead are substantially triangular in transverse cross-section.

3. A resilient closure member comprising:
a substantially monoplanar central portion having a filling aperture therethrough;
means for admitting air through said closure member;
an opening through said closure member for permitting said closure member to be evacuated;
a pair of spaced flanges formed integrally with, and extending substantially normal to, said central portion and extending around the outer portion of said cen-

tral portion, said flanges defining between them a groove having a generally V-shaped bottom portion;

a container having an upper edge portion projecting into said groove into proximity to the V-shaped bottom portion thereof;

a tubular member connected to said means for admitting air through said closure member and projecting downwardly into said container;

a sealing bead formed integrally with one of the flanges on said central portion and protruding from said one flange toward the other of said flanges and spaced from the V-shaped bottom portion of said groove; and

a pair of ribs formed integrally with the other of said flanges and protruding therefrom toward said one flange, said ribs defining between them a groove which faces the sealing bead on said one flange.

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215—79; 261—122