June 4, 1935. D. E. BAXTER 2,004,027

CLOSURE FOR CONTAINERS

Filed Oct. 27, 1933

Fig. 1.

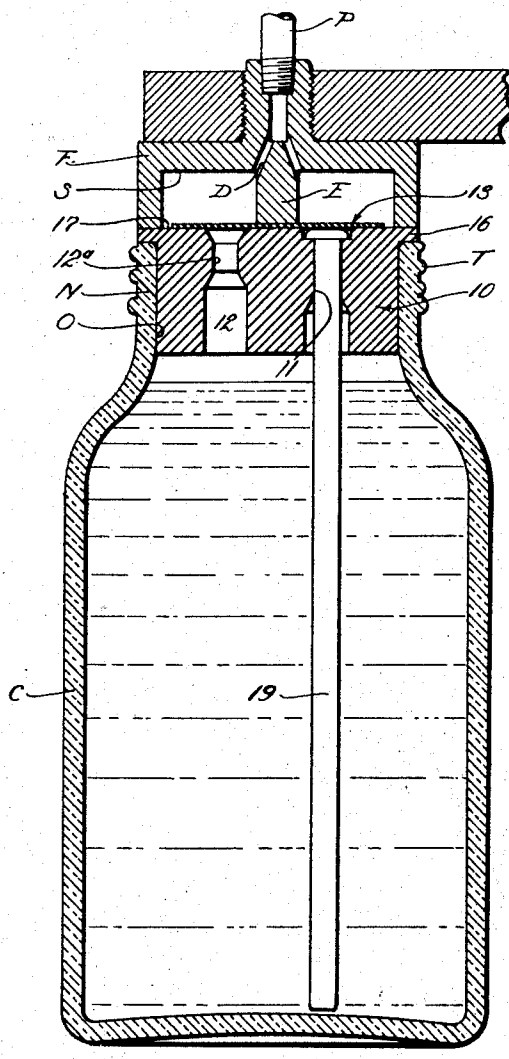


Fig. 3.

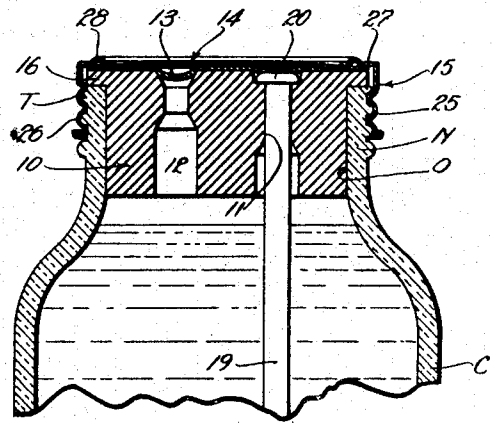


Fig. 4.

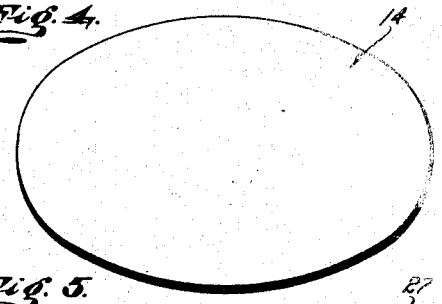


Fig. 5.

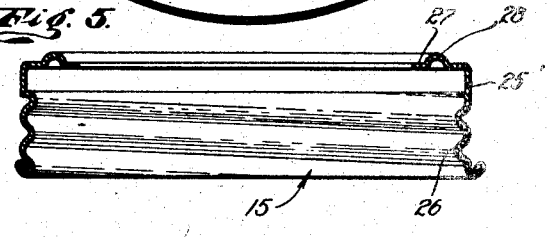
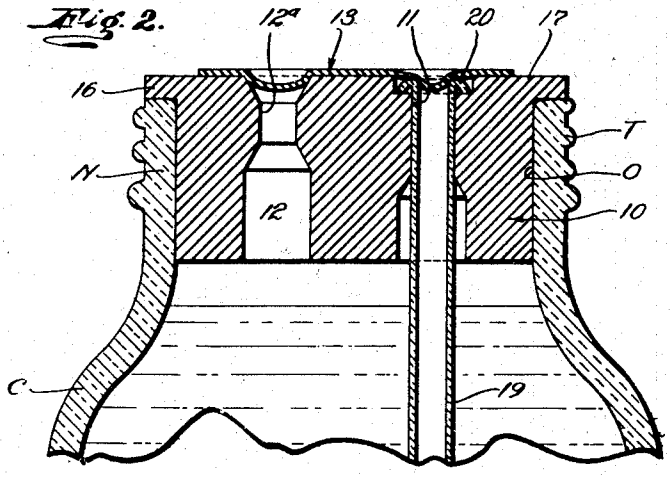


Fig. 2.



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CLOSURE FOR CONTAINERS

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5 Claims. (Cl. 215—74)

This invention relates to closures and relates more particularly to closures for containers holding sterile fluids such as intravenous solutions, etc.

It is a general object of the invention to provide a simple, practical and effective closure means for a container that is operable to positively prevent the entrance of air or foreign material into the container.

Another object of the invention is to provide a closure for a container that involves a novel and effective sealing means that provides a perfectly air-tight seal for the container whereby its contents may be preserverd indefinitely.

Another object of the invention is to provide a closure for a container that includes a sealing means that allows the air to be exhausted from the container to insure the preservation of its contents.

Another object of the invention is to provide a closure for a container that facilitates the sterilization of the contents of the container and that may be easily opened to allow the contents to be drained from the container.

It is another object of the invention to provide a closure for a container that visibly indicates that the container is sealed against the entrance of air and foreign matter.

It is a further object of the invention to provide a closure means for a container that includes a valve member or sealing member operable to open under a reduced pressure or vacuum to allow the air to be exhausted from the container and that automatically closes to effectively seal the container when again subjected to external or atmospheric pressure, said sealing member thereafter visibly indicating that a reduced pressure or vacuum is maintained in the container.

It is a further object of the invention to provide a closure means of the character mentioned that is simple and inexpensive of manufacture and that is easy to apply and use.

Other objects and features of the invention will be better and fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawing, in which:

Fig. 1 is a vertical detailed sectional view illustrating a typical embodiment of the invention employed on a container and showing the manner of exhausting the air from the container. Fig. 2 is an enlarged vertical detailed sectional view of the closure means and the upper portion of the container illustrating the sealing member in the position it assumes after the air has been exhausted from the container. Fig. 3 is a vertical detailed sectional view of the closure means and the upper portion of the container with the outer disc and cap in position. Fig. 4 is an enlarged perspective view of the outer disc, and Fig. 5 is an enlarged vertical detailed sectional view of the threaded cap included in the closure means.

The improved closure means provided by the present invention may be embodied in forms for use in connection with containers of various types and for use on containers holding fluids of different characters. Throughout the following detailed disclosure, I will describe a typical form of the invention used on a simple bottle or container, it being understood that the invention is not to be construed as limited or restricted to the specific form and application about to be described, but is to be taken as including any features or modifications that may fall within the scope of the claims.

The typical container C illustrated in the drawing is in the nature of a glass flask or bottle of more or less conventional shape. The container C has cylindrical side walls reduced in diameter at the upper portion of the container to provide a substantially cylindrical neck N. The exterior surface of the neck N is cylindrically curved and is provided with a continuous thread T. The wall of the opening O in the neck N is smooth and is cylindrically curved. The upper end of the neck N is flat and normal to the longitudinal axis of the container C.

The closure means of the present invention includes generally, a body or plug 10 for arrangement in the opening O of the container neck N and having an air inlet opening 11 and a fluid discharge opening 12, a removable valve member or sealing member 13 for closing the upper ends of the openings 11 and 12, an outer protective and sealing disc 14, and a cap 15 for clamping the disc 14 in position.

The body or plug 10 of the closure is shaped and proportioned to tightly fit in the opening O of the container. The plug 10 is preferably made of a good grade of gum rubber to have substantially resiliency so as to bear outwardly against the wall of the opening O with considerable pressure. The tight fit of the plug 10 in the opening O and the inherent resiliency of the plug insures the effective sealing engagement of the exterior of the plug with the wall of the opening. The plug 10 is long or of considerable depth to have extensive sealing contact with the wall of the opening O. An annular radial lip or flange 16 is

provided on the plug 10 to bear and seal against the upper end of the neck N. In the particular structure illustrated, the flange 16 is of the same external diameter as the neck of the container. The upper end 17 of the plug 10 is preferably flat and smooth.

In accordance with the invention, the air inlet opening 11 and the discharge opening 12 extend longitudinally through the plug 10 to have their inner ends in communication with the interior of the container C and to have their outer ends opening at the upper surface 17 of the plug. The openings 11 and 12 are spaced a suitable distance apart and are preferably located at diametrically opposite sides of the longitudinal axis of the plug 10. The fluid discharge opening 12 which is provided to permit the discharge of the contents from the container C may have a restricted or reduced portion 12^a adjacent its upper end to tightly receive and grip the end portion of a discharge tube (not shown) that may be inserted in the opening to facilitate draining of the contents from the container. The opposite end portions of the restricted part 12^a of the discharge opening may be flared as illustrated throughout the drawing. An air inlet tube 19 is provided to admit air or atmospheric pressure into the container C when the container is opened and inverted to discharge its contents. The tube 19 has its outer portion carried in the opening 11 and extends to a point adjacent the bottom of the container C. The opening 11 may be proportioned so that the tube 19 is tightly or securely held in position. A bead or rim 20 is provided on the outer end of the tube 19 and is counter-sunk or received in a recess at the outer end of the opening 11. The lower or inner portion of the opening 11 may be enlarged in diameter.

The valve member or sealing member 13 is normally arranged on the outer end 17 of the plug 10 to seal or close the upper ends of the openings 11 and 12 to exclude air or foreign material from the container C. The sealing member 13 is an important feature of the present invention as it permits air to be exhausted from the container C and automatically closes immediately after the air exhausting operation to seal off the outer ends of the openings 11 and 12 thereby maintaining the vacuum in the container. The valve member and sealing member 13 is in the nature of a sheet of rubber or similar material and seals against the outer end 17 of the plug 10. It has been found practical to form the sealing member 13 of rather flexible rubber or rubber composition and to make it comparatively thin. The sealing member 13 is preferably disc shaped and is proportioned to completely cover the outer ends of both the openings 11 and 12 and to have sealing contact with a substantial part of the outer end 17 of the plug. In the preferred construction, the sealing member 13 is somewhat smaller in diameter than the outer end 17 of the plug 10 so that there is an exposed annular portion of the end 17 surrounding the sealing member 13. The opposite surfaces of the sealing member 13 are parallel and are smooth and flat.

When it is desired to provide a reduced pressure or vacuum in the container C and to seal the container to preserve its contents, the plug 10 is positioned in the opening O so that its flange 16 seats against the upper end of the neck and the sealing member 13 is laid in a central or concentric position on the outer end of the plug. A bell or fitting F having a socket S in its under side or end is then placed on the plug so that its annular end surfaces seats on and seals with the exposed peripheral portion of the end 17 of the plug. The fitting F is connected with a vacuum line or reduced pressure pipe P by ports D. A central stop or stem E projects from the bottom or upper end of the socket S and is adapted to contact or engage the sealing member 13 at a point spaced between the plug openings 11 and 12. Upon the vacuum being drawn on the pipe P, the air is first exhausted from the socket S and the atmospheric pressure within the container C lifts or raises the sealing member 13 from the upper ends of the openings 11 and 12 so that air is admitted to the socket S and exhausted through the pipe P. When a predetermined or suitable amount of air has been exhausted from the container C, the sealing member 13 of course returns to its normal position where it engages the upper end 17 of the plug around the upper ends of the openings 11 and 12. Upon the fitting F being removed, the external pressure or atmospheric pressure tightly holds the sealing member 13 on the upper end 17 of the plug and forces the sealing member 13 into the upper end portions of the openings 11 and 12 so that it is cupped or depressed at these points as illustrated in Figs. 2 and 3 of the drawing. This depressing or indenting of the flexible sealing member 13 on the upper ends of the openings 11 and 12 through the action of the atmospheric pressure, insures the tight effective sealing engagement of the member 13 with the plug at these points so that a perfectly airtight seal is provided around the outer ends of the openings in the plug. In actual practice, the atmospheric pressure may cause the sealing member 13 to bear downwardly against and seal with the bead 20 on the upper end of the tube 19. The flaring outer end part of the opening 12 permits the cupped or inwardly distended portion of the sealing member 13 to effectively seal against this portion of the plug. It will be apparent that the presence of the depressions or recesses in the sealing member 13 caused by the atmospheric pressure acting upon the unsupported parts of the member at the ends of the openings 11 and 12 visibly indicates the preservation of the vacuum in the container C and therefore indicates the perfect air-tight sealing of the container. From the above it will be seen that the sealing member 13 operates as a valve during the exhaustion or the air from the container C and thereafter forms an effective seal for the container and indicates the perfect preservation of the contents of the container.

The disc 14 is provided to protect the sealing member 13 and to seal with the sealing member and the plug 10 to provide a secondary or outer seal with the closure means. The disc 14 may be a simple sheet metal member of approximately the same diameter as the outer end of the plug 10. The disc 14 may be lacquered or treated to resist the action of the fluids with which it may come in contact and has flat smooth surfaces as illustrated in the drawing. After the sealing member 13 has been positioned on the plug 10 and the air has been exhausted from the container C, the disc 14 is laid on the sealing member 13 to cover the upper and the exposed peripheral portion of the end 17 of the plug.

The cap 15 is adapted to be removably screw-threaded on the neck N of the container to clamp the disc 14 against the sealing member 13 and the exposed part of the end of the container.

The cap 17 may be formed of sheet metal, or the like, and is a simple member adapted to be easily and quickly threaded on the neck N and removed from the neck N. The cap 15 has a tubular portion 25 provided with a thread 26 for cooperating with the thread T of the neck N. An inwardly projecting annular lip or flange 27 is provided on the upper end of the cap 15 to engage the outer surface of the disc 14. The flange 27 may be comparatively narrow to engage only the peripheral portion of the disc 14. In the particular construction illustrated in the drawing, the flange 27 is grooved or channeled at 28 to increase its strength and rigidity. When the cap 15 is threaded on the neck N, the inner edge of the flange 27 is spaced outwardly from the periphery of the sealing member 13 so that the flange engages the peripheral portion of the disc 14 with sufficient force to tightly compress the sealing member 14 against the outer side 17 of the plug and to bend or flex the peripheral portion of the disc 14 inwardly against the outer surface of the plug. In this manner the disc 14 is clamped downwardly to hold the sealing member 14 flat and in tight sealing engagement with the outer side of the plug and to engage the peripheral portion of the plug to provide a second or outer seal.

It is believed that the operation of the closure means provided by the invention will be readily understood from the foregoing detailed description. The plug 10 may be readily forced into the opening O of the container to have its flange 16 bearing and sealing against the outer end of the neck N. The plug 10 may carry the air inlet tube 19 when it is positioned in the opening O, or the tube 19 may be inserted after the arrangement of the plug in the opening. When the container C is to be closed or sealed, the sealing member 13 is laid in a substantially concentric position on the outer surface 17 of the plug so that it covers the outer end of the openings 11 and 12. When a reduced pressure or vacuum is to be provided in the container C the fitting F is arranged on the closure plug 10 so that its annular lower end seats on the exposed peripheral portion of the plug. The sealing member 13 automatically opens when the air is exhausted from the container and automatically tightly seals with the upper end 17 of the plug when again subjected to atmospheric pressure. The atmospheric pressure acting on the sealing member 13 causes it to be stretched or distended inwardly at the outer ends of the openings 11 and 12 to have recesses or depressions at these points. This cupping or distorting of the sealing member 13 at the outer ends of the openings 11 and 12 insures a more effective and perfect seal and visibly indicates that the vacuum is maintained in the container. The disc 14 may then be laid on the outer side of the sealing member 13 and the cap 15 threaded on the neck N to have its flange 27 clamp against the disc. When the cap 15 is tightly threaded down on the neck N, the peripheral portion of the disc 14 engaged by the flange 27 may be flexed or bent inwardly against the outer end 17 of the plug and the sealing member 13 is tightly clamped against the plug. The disc 14 further provides a secondary or outer seal, protects the inner sealing member 13, and holds the sealing member in tight engagement with the outer surface 17 of the plug 10. When the contents of the container C are to be preserved in a sterile state, the various parts of the closure are of course sterilized before use and are handled with the utmost care. The major portion of the outer surface of the disc 14 is exposed to view and may be suitably marked to indicate the contents of the container.

To open the container, it is merely necessary to unthread the cap 15 from the neck N and remove the disc 14 whereupon the sealing member 13 may be easily disengaged or pulled from the upper end 17 of the plug. To drain the contents from the container C it may be necessary or desirable to insert a drain tube in the opening 12 to carry the contents from the container when the container is inverted. As the bead 20 on the upper end of the air inlet tube 19 is visible after the removal of the sealing member 13, there is no possibility of the inadvertent insertion of a drain tube in the air inlet opening 11. When the container 14 is inverted and draining, the air inlet tube 19 admits atmospheric pressure into the container to provide for the free steady drainage of its contents. After use, the plug 10, cap 15, and if desired, the disc 14 may be sterilized for re-use. It is to be noted that the present invention provides a closure means that is particularly simple and inexpensive of manufacture and that is convenient to apply and use. The closure means, in providing a perfectly airtight seal for a container, is particularly adapted for use on containers for holding intravenous solutions, etc. Further, the closure means may be easily sterilized and maintained in a sterile condition, and the provision of the inner sealing member and the protective outer sealing disc 14 positively prevents the accidental breaking of the seal and contamination of the contents of the container.

The sealing member 13 may be viewed at any time by removing the cap 15 and disc 14 to determine the condition of the contents of the container. The indenting or depression of the sealing member 13 at the outer ends of the openings 11 and 12 visibly indicates that the vacuum is being maintained in the container. If these indentations or recesses are not present in the sealing member it may indicate that the seal has been broken and that the contents of the container C may be contaminated or unfit for use.

Having described only a typical form and application of my invention, I do not wish to be limited or restricted to the specific form and application herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. Closure means for the opening of a container including, a closure body closing the opening and having a discharge opening communicating with the interior of the container, a removable sealing member arranged on the outer end of the body and sealing the outer end of the discharge opening through the action of atmospheric pressure, a removable disc covering the sealing member, and means for clamping the disc against the sealing member.

2. Closure means for the opening of a container including, a closure body for closing the opening and having an opening in communication with the interior of the container, a removable sealing member engaging the outer end of the body and covering the end of the latter opening, the sealing member being flexible to be held in sealing engagement with the body around the end of the said latter opening by atmospheric pressure when a reduced pressure is present in the container, a removable part covering the sealing member and adapted to engage the end of the body around the

sealing member, and means for clamping the said part against the sealing member and body.

3. Closure means for the opening of a container including, a plug in the opening having two spaced openings in communication with the interior of the container, a comparatively thin sealing member removably arranged on the outer end of the plug over the ends of its openings, the member being flexible to be tightly forced against the plug to seal therewith by atmospheric pressure when a reduced pressure is present in the container, a removable disc covering the sealing member, and a cap threaded on the container and clamping the disc on the sealing member and outer end of the plug.

4. Closure means for the opening of a container including, a plug in the opening having two spaced openings in communication with the interior of the container, removable flexible disc of rubber on the outer end of the plug covering its openings, there being an annular portion of the end of the plug exposed around said disc, an air inlet tube having a portion carried in one of the openings and extending to a remote point in the container, an outer disc arranged against the rubber disc, and a member threaded on the container and clamping the outer disc against the rubber disc and the said exposed portion of the plug.

5. In combination with a container having an open end, a closure for said open end, said closure being provided with two opening therethrough, a thin elastic seal engaging the outer face of said closure and extending over said openings, said seal being sufficiently resilient to enter said openings to form depressions indicating pressure below atmospheric within the container, and means releasably engaging said container for exerting pressure upon said seal to lock it against said closure wall.

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