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VALVED CLOSURE

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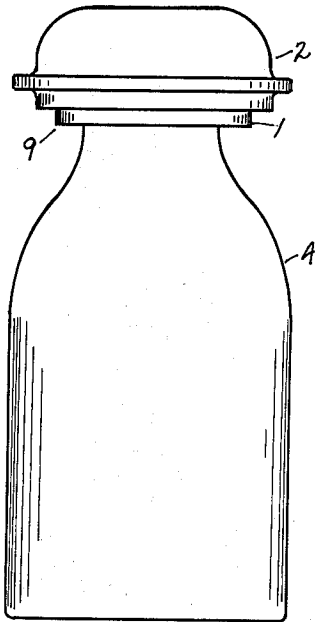


Fig. 1

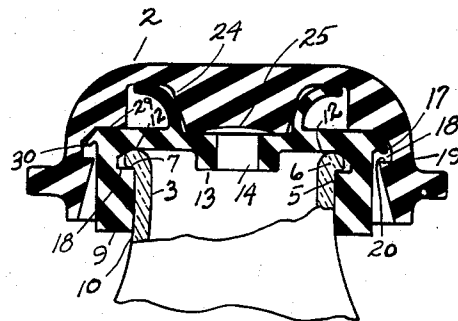
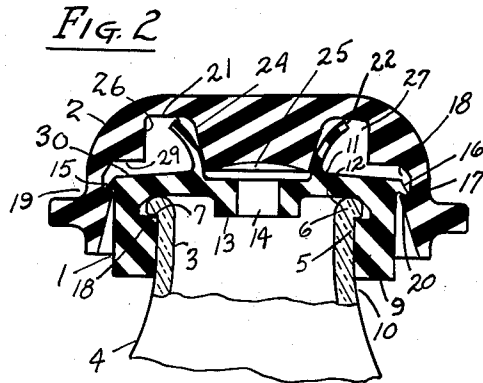


Fig. 3

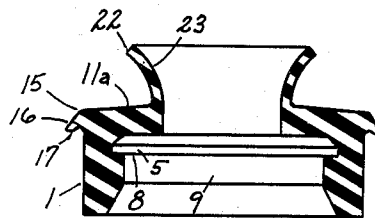


Fig. 5

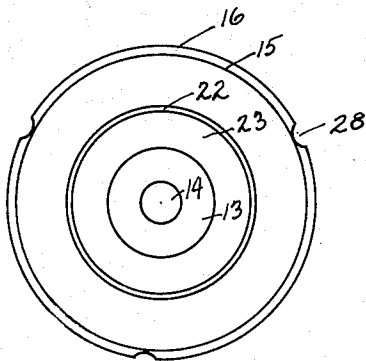


Fig. 4

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VALVED CLOSURE

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9 Claims. (Cl. 215-74)

In the preparation of sterile liquid or solutions for hospital use the flasks cannot be tightly stoppered during sterilization, but must be vented to allow the escape of air. The venting must be continued while the flasks are being cooled from the sterilizing temperature down to a temperature corresponding to atmospheric pressure during which time a small portion of the solutions vaporize and carry out any residual air. However while the flow of air and vapor out of the bottle should not be impeded, it is imperative that no air flow back into the bottle and contaminate the solutions.

This invention is intended to provide a closure which freely vents the flask to permit the outflow of air and vapor during sterilizing and cooling, but which positively seals and prevents any back flow of air into the flask at the end of the cooling cycle. As a further advantage, the cap is securely held so it cannot be blown off by bubbling of the solution during that part of the cooling cycle when the temperature within the flask corresponds to a higher pressure than atmospheric. Further objects and advantages appear in the specification and claims.

In the drawing, Fig. 1 is a side elevation of a flask, Fig. 2 is a section showing the closure in the venting position, Fig. 3 is a section showing the closure in the sealing position, Fig. 4 is a top view of the rubber sleeve fitting on the neck of the flask, and Fig. 5 is a section through a modification used with solutions which are to be poured from the flask.

The closure comprises two pieces, a sleeve 1 of a resilient elastomer such as natural or synthetic rubber and a cap 2 of suitable rigid material such as one of the heat resistant plastics. Both the sleeve and cap are readily removable for washing.

The sleeve 1 is suitably mounted on the mouth 3 of a flask 4, for example by a groove 5 in the sleeve which snaps over a bead 6 on the flask. The bead preferably has a square under shoulder 7 cooperating with a corresponding surface 8 on the groove so as to offer greater resistance to accidental removal of the sleeve, but the sleeve can be used with flasks having rounded beads. A skirt 9 on the sleeve depends around and grips the neck 10 of the flask.

When the sleeve is in place on the mouth of the flask it grips the bead 6 and neck 10 of the flask and an inwardly extending flange 11 overlies the top edge 12 of the mouth of the flask. In the form illustrated in Figs. 2 and 3, the flange 11 terminates in a hub 13 at its center having a bore 14 frictionally receiving the usual draw off tubing. In the form illustrated in Fig. 5, where the contents of the flask are to be poured, the flange 11a terminates close to the inner surface of the mouth so as to permit free pouring.

Projecting outwardly from the top of the sleeve is a collar 15 having a downwardly beveled upper surface 16 and a square under surface 17. The collar 15 is loosely received in an internal groove 18 in the depending side walls 19 of the cap 2. The width of the groove 18 is substantially greater than the thickness of the collar 15 and the

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diameter of the groove 18 is greater than the diameter of the collar.

The square under surface 17 of the collar cooperates with a corresponding surface 20 on the groove to yieldably hold the cap on the sleeve. The beveled upper surface 5 offers less resistance, as the cap is placed on the sleeve.

When the cap 2 is in place as shown in Fig. 2 it can be freely turned and also can be moved up and down to the extent permitted by the clearance provided by the difference between the width of the groove and the thickness of the collar. The side walls 19 of the cap flare away from and do not contact the external surface of the sleeve so that movement of the cap is not impeded. 15 The cap can be removed by exerting a force sufficient to overcome the restraint offered by the collar. In the Fig. 2 position, the top wall 21 of the cap lightly rests on the rim 22 of a flexible lip 23 flaring upwardly and outwardly from the flange 11. The lip makes light sealing engagement with the top wall of the cap, for example, sufficient to prevent out flow from the flask until the pressure within the flask is slightly greater (e. g. 1 lb./sq. inch or less) than the pressure outside the flask. While the lip offers very little resistance to outflow from 25 the flask, it offers great resistance to back flow into the flask. Back flow tends to take place only when the pressure within the flask is less than outside and under these conditions the higher outside pressure presses the rim 22 of the flexible lip 23 into sealing engagement with the top wall of the cap acting in much the same manner as a pump leather. The higher outside pressure also tends to collapse the flexible lip against the similarly shaped side walls 24 of a frusto conical projection 25 depending from the top wall of the cap. The sealing effect obtained by 35 the collapsing of the lip against the side walls 24 is sufficient to maintain a vacuum within the flask during the entire storage period. The projection 25 has the additional function of preliminarily centering the lip 23 with reference to the top wall 21 of the cap so that no matter how the cap is placed on the sleeve, the rim 22 of the lip 23 will always be in proper relation to serve as a check valve seal. While with ordinary care, the projection 25 is not necessary it is helpful to an inexperienced or careless user. To further assist in centering the lip with respect to the cap, the top wall of the cap has a depending cylindrical wall 26 of somewhat larger diameter than the lip. As the cap is placed upon the sleeve, the rim of the lip accordingly is loosely received in an annular socket 27 and is guided into sealing position. This makes 45 it substantially impossible to buckle the rim so as to interfere with the sealing action.

The check valve sealing action of the flexible lip 23 requires venting of the cap to the atmosphere. This is conveniently done by notches 28 which can, for example, be located in the outer periphery of the collar 15. These notches occupy such a small portion of the periphery of the collar that the hold down action of the collar is not materially decreased. The notches 28 have sufficient area to permit the free outflow air or vapor from the flask without building up excessive pressure, which might 50 blow the cap off the sleeve.

Above the top edge 12 of the mouth of the flask is a sealing surface 29 on the cap which in the position shown in Fig. 2 is spaced above an upwardly presented sealing surface 30 on the flange 11. So long as the pressure within the flask is not less than the pressure outside the flask, the sealing surface 29 remains in this position. As soon as the pressure within the flask becomes less than the outside pressure, the vacuum sucks the cap downward bringing the surface 29 into sealing engagement with the surface 30 on the flange 11. Because the surface 30 on the flange 11 is supported by the top edge 12 of 65

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the mouth of the flask and by the skirt 9, a vacuum tight seal can be obtained. The clearance between the collar 15 and the groove 18 permits the downward movement of the cap necessary to effect the sealing engagement of the surfaces 29 and 30.

In the use of the closure, the flask 4 is filled to the proper level with the solution and the sleeve 1 and cap 2 are mounted on the mouth 3 of the flask in the position shown in Fig. 2. The flask is then placed in a steam sterilizer and brought up to sterilizing temperature. As the flask comes up to temperature, the partial pressure of the air within the flask when added to the vapor pressure of the liquid causes the pressure within the flask to exceed the pressure outside the flask. The higher internal pressure is relieved by the outflow of air past the rim 22 on the check valve sealing lip 23. The higher internal pressure within the flask cannot be completely relieved because the engagement of the top wall of the cap with the rim 22 is sufficient to provide a seal against a slight differential in pressure, for example, up to 1 pound per square inch. At the end of the sterilizing cycle, the steam atmosphere in the sterilizer is slowly exhausted, for example, in a half hour. During this exhaust period, the temperature of the solution within the flask is at a higher temperature than the surrounding steam atmosphere in the sterilizer and there is accordingly a vaporization of the solution. This vaporization of the solution does not take place gradually, but in the form of burps or bubbles, which cause droplets to impinge against the inner surface of the cap. This is particularly noticeable in the case of the Fig. 5 construction where there is no baffling effect to restrict the flow of droplets toward the cap. However, because of the hold down effect provided by the engagement of the collar 15 with the groove 18, these droplets do not dislodge the cap. This is important because the cap must remain in the Fig. 2 position while the flask is cooling down. When the sterilizer is completely exhausted to atmospheric pressure, the temperature of the solution within the flask will still be slightly above that corresponding to atmospheric pressure and there will still be some outflow of vapor from the flask past the sealing lip 23. Upon further cooling of the solution within the flask, there is a condensation of the vapor within the flask which produces a vacuum. This vacuum forces the rim 22 of the lip 23 against the top wall 21 of the cap, collapses the lip 23 around the conforming surfaces 24 on the projection 25 on the cap and forces the cap downward bringing the sealing surface 29 into engagement with the sealing surface 30 on the flange 11. Either the seal against the lip 23 or the seal against the surface 29 is sufficient to maintain a vacuum during the storage of the flask, thereby protecting the contents from air borne contamination. The closure is self-sealing in that it requires no added operation to complete the seal.

What I claim as new is:

1. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably telescoped over the mouth of the flask and having a flange overlying the upper edge of the mouth of the flask and a projecting flexible collar, a cap removably mountable on the sleeve having a top wall extending over the mouth of the flask and side walls loosely depending around the collar and sleeve, the side walls of the cap having a groove therein loosely receiving the collar and having width greater than the thickness of the collar, the collar and groove cooperating to yieldably retain the cap on the sleeve and to permit movement of the cap toward the sleeve and removal of the cap from the sleeve, an annular lip of resilient material on and flaring outward and upward from the flange toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a should-

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der on the cap radially outside the lip and above and cooperating directly with the flange on the sleeve as the cap is moved downward by vacuum within the flask to make a vacuum-tight seal, said shoulder being supported spaced above and out of sealing engagement with the flange by the lip in the absence of vacuum in the flask, and vent means outside the lip for the outflow of air and vapor during steam sterilizing and the cooling off period following the sterilizing when the pressure within the flask is higher than the pressure outside the flask.

2. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably mounted on the mouth of the flask and having an upwardly presented annular substantially planar face, a cap loosely and removably mounted over the sleeve in an upper position and clearing the sleeve so the cap is freely movable downward to a lower sealing position by vacuum within the flask, said cap having side walls depending around and spaced out of contact with the sleeve, means releasably preventing upward movement of the cap off the sleeve when the cap is in its upper position, an upwardly presented annular sealing surface on said face, a downwardly presented sealing surface on the cap radially inward of the side walls and above the sealing surface on the sleeve and arranged to be pulled down directly against the sealing surface on the sleeve by vacuum within the flask, an annular lip of resilient material extending upwardly from said face on the sleeve radially inward of said sealing surface flaring outward and upward toward the top wall of the cap and having a rim engaging the top wall and yieldably supporting the cap with its sealing surface spaced above the sealing surface on the sleeve, said lip serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, and vent means outside the lip for the outflow of air and vapor during steam sterilizing and the cooling off period following the sterilizing when the pressure within the flask is higher than the pressure outside the flask.

3. A closure for a flask containing sterilized liquids comprising a cap removably telescoped over the mouth of the flask, with its side walls loosely depending therearound, means yieldably holding the cap on the flask, an annular lip of resilient material supported on the mouth of the flask and flaring outward and upward toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a cylindrical shoulder on the cap radially outside of and depending around the lip, and a projection on the cap depending within the lip against which the lip is collapsed by vacuum within the flask to provide a vacuum tight seal.

4. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably telescoped over the mouth of the flask and having a flange overlying the upper edge of the mouth of the flask and an external flexible collar projecting from the sleeve, an upwardly presented sealing surface on said flange, a cap removably mounted on the sleeve having a top wall extending over the mouth of the flask and side walls of the cap loosely depending around the sleeve and clearing the sleeve so the cap is freely movable downward by vacuum within the flask, the cap having portions extending under the collar and cooperating with the collar to yieldably hold the cap on the sleeve, an annular lip of resilient material flaring outward and upward from radially inward of said sealing surface on the flange toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, and a shoulder on the cap radially outside the lip, said shoulder being above and cooperating with the flange on the sleeve as the cap is moved downward by vacuum within the flask to make a vacuum-tight seal, said shoulder being supported spaced above and out of sealing engagement with the flange by the lip in the absence of vacuum in the flask.

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5. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably telescoped over the mouth of the flask and having a flange overlying the upper edge of the mouth of the flask and a flexible projecting collar, a hub in the flange having a bore for receiving draw off tubing, a cap removably mountable on the sleeve having a top wall extending over the mouth of the flask and side walls loosely depending around the collar, the side walls of the cap having a groove therein loosely receiving the collar and having width greater than the thickness of the collar, the collar and groove cooperating to yieldably retain the cap on the sleeve and to permit movement of the cap toward the sleeve, an annular lip of resilient material surrounding the hub and flaring outward and upward from the flange toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a shoulder on the cap spaced above the flange radially outside the lip and cooperating with the flange on the sleeve as the cap is moved downward by vacuum within the flask to make a vacuum tight seal, said shoulder being supported above and out of sealing engagement with the flange by the lip in the absence of vacuum in the flask, and vent means outside the lip for the outflow of air and vapor during steam sterilizing and the cooling off period following the sterilizing when the pressure within the flask is higher than the pressure outside the flask.

6. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably mounted on the mouth of the flask and having an upwardly presented annular sealing surface, a flange extending inward from the sleeve over the mouth of the flask and having a hub provided with a bore for receiving draw off tubing, a cap loosely mounted over the sleeve, a downwardly presented sealing surface on the cap spaced above the sealing surface on the sleeve and arranged to be pulled down against the sealing surface on the sleeve by vacuum within the flask, an annular lip of resilient material surrounding the hub radially inside said sealing surfaces, the lip flaring outward and upward toward the top wall of the cap and having a rim engaging the top wall and yieldably supporting the cap with its sealing surface above the sealing surface on the sleeve, said lip serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, and vent means outside the lip for the outflow of air and vapor during steam sterilizing and the cooling off period following the sterilizing when the pressure within the flask is higher than the pressure outside the flask.

7. A closure for a flask containing sterilized liquids comprising a cap removably mounted on the mouth of the flask, an annular lip of resilient material supported on the mouth of the flask flaring outward and upward

toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a flange extending inward within the lip and having a hub provided with a bore for receiving draw off tubing, and a projection on the top wall of the cap depending within the lip against which the lip is collapsed by vacuum within the flask to provide a vacuum tight seal.

8. A closure for a flask containing sterilized liquids comprising a cap removably telescoped over the mouth of the flask, with its side walls loosely depending therearound, means yieldably holding the cap on the flask, an annular lip of resilient material supported on the mouth of the flask and flaring outward and upward toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a flange extending inward within the lip and having a hub provided with a bore for receiving draw off tubing, a cylindrical shoulder on the cap radially outside of and depending around the lip, and a projection on the cap depending within the lip against which the lip is collapsed by vacuum within the flask to provide a vacuum tight seal.

9. A closure for a flask containing sterilized liquids comprising a sleeve of resilient material removably telescoped over the mouth of the flask and having a flange overlying the upper edge of the mouth of the flask and an external collar projecting from the sleeve, a cap removably mounted on the sleeve having a top wall extending over the mouth of the flask and side walls loosely depending around the collar, detent means on the side walls of the cap cooperating with the collar to yieldably hold the cap on the sleeve, an annular lip of resilient material on the flange flaring outward and upward toward the top wall of the cap and having a rim engaging the top wall and serving as a check valve permitting outflow of air and vapor from the flask but preventing back flow into the flask, a hub on the flange within the lip having a bore for frictionally receiving draw off tubing, and spaced sealing surfaces on the cap and sleeve radially outside the lip and normally out of contact with each other and brought into direct sealing engagement by downward movement of the cap on the sleeve to make a vacuum tight seal.

References Cited in the file of this patent

UNITED STATES PATENTS

1,694,851	Glass	Dec. 11, 1928
1,871,984	Horrman	Aug. 16, 1932
2,394,911	Griswold	Feb. 12, 1946
2,443,086	Turenne	June 8, 1948
2,622,762	Parsons	Dec. 23, 1952