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Brennan et al.

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[54] CLOSURE FOR CONTAINERS

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[52] **U.S. Cl.** ..... **215/38 R**

[51] **Int. Cl.** **B65b 41/02**

[58] **Field of Search** .215/37 R, 38 R, 41, 43 A, 43 R, 215/97

[56] **References Cited**

UNITED STATES PATENTS

3,499,568	3/1970	Riera	215/37 R
1,985,703	12/1934	Wheaton	215/43 R

FOREIGN PATENTS OR APPLICATIONS

1,077,767	11/1954	France	215/43 R
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[57] **ABSTRACT**

The invention relates to a cap assembly for a biological culture container, preferably a container for the cultivation of microorganisms from blood samples, where the cap assembly includes a cap with a central aperture. A rubber grommet is situated in the aperture. The grommet is symmetrical, is dimensioned to perform reliably under high vacuum or high pressure within the container. It may also be provided with a recess to facilitate penetration by a hypodermic needle or syringe.

3 Claims, 3 Drawing Figures

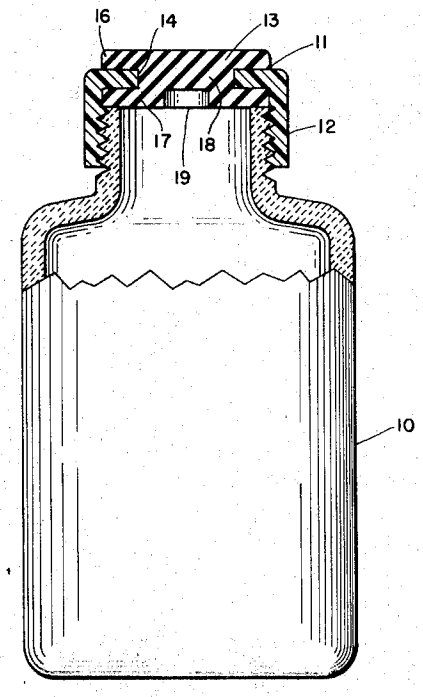
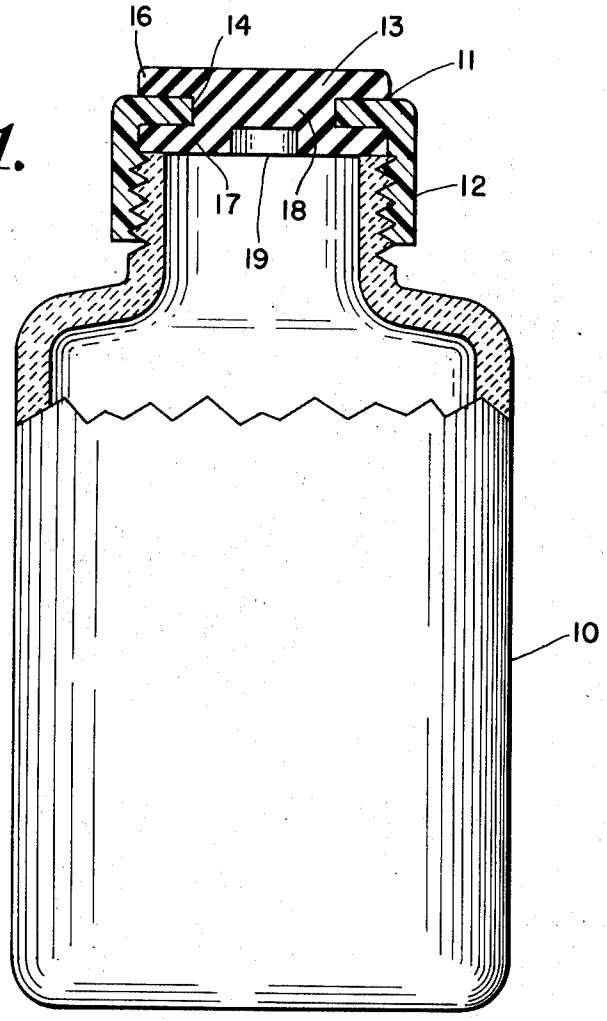


Fig. 1.



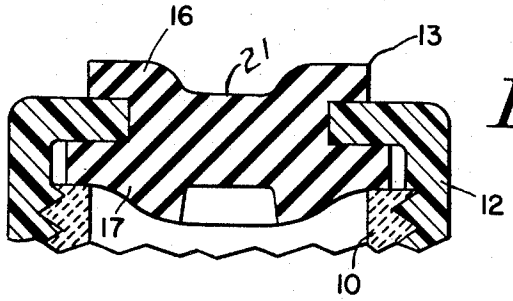


Fig. 2.

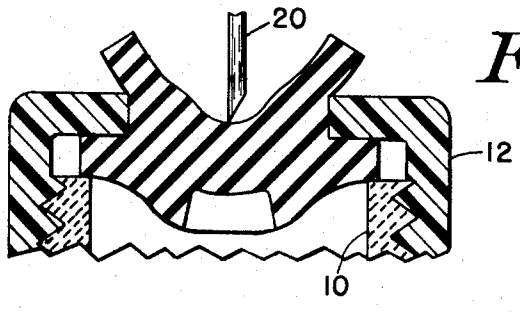


Fig. 3.

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CLOSURE FOR CONTAINERS

Culture mediums are typically used to encourage the growth of micro-organisms that may be present in samples of blood, spinal fluid, pleural exudates or other body fluids. Cultures are also used for the growth of body tissue cells.

Classically, two types of closures are used for culture containers. The first type uses a rubber or elastomeric stopper force fitted into the neck of a bottle.

The second prior art closure uses a flat rubber or elastomeric diaphragm held in place on the top of a bottle by a screw cap having a central opening.

These prior art closures are difficult to use in the preparation of the culture containers and in their use.

Bottles with a stopper often explode or blow the stopper and boil over when autoclaved as the culture medium boils. In either case the container is rejected for use.

Removal of the stopper to remove samples for examination risks aerosol generation of micro-organisms when the stopper is pulled. Additionally, once removed the stopper is difficult to replace and can introduce extraneous micro-organism contamination. These limitations preclude the use of a sterile loop or pipette to remove a sample.

Considering the diaphragm construction and steam autoclaving, the diaphragm has a tendency to be pulled into the bottle when a partial vacuum forms when the bottle cools.

Additionally, the problem is aggrevated by the unreliability of the prior art devices. The failures occur somewhat randomly. They occur during autoclaving, immediately after cooling, during storage in the plant, prior to use or at the time of use. A sealed bottle at room temperature will, at times, fail when the temperature drops, increasing the vacuum. Failure may also occur after the blood sample is inserted. The diaphragm has a tendency to depress when a hypodermic needle is penetrating the diaphragm to introduce a sample, thus adding to the problem.

Additionally, there is also a tendency for extraneous micro-organisms (contamination) to lodge between the diaphragm and cap.

It is, therefore, an object of the invention to provide a cap assembly for biological containers which avoids the limitations and disadvantages of prior art systems.

It is another object of the invention to provide a symmetrical grommet which simplifies assembling the cap assembly.

It is still another object of the invention to provide a reliable cap assembly.

It is yet another object of the invention to provide a cap assembly which eliminates the danger of a grommet implosion where the containers contain a vacuum.

It is still another object of the invention to provide means in the grommet of a cap assembly, in the form of a depression for facilitating the entry of a needle into and through the grommet.

It is still another object of the invention to provide a cap assembly which eliminates the danger of the cap blowing during autoclaving.

The novel features that are considered characteristic of the invention are set forth in the appended claims; the the invention itself, however, both as to its organization and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a section of a closure and container;

FIG. 2 is a section of the closure; and

FIG. 3 is a section of the closure.

Referring to FIG. 1 there is shown a biological container **10** with a cap assembly embodying the principles of the invention. The cap assembly includes a cap **12** and a rubber, or other resilient material, grommet **13**.

The cap **12** is made from a plastic or a metal stamping. It is a screw-on cap having threads complementing the threads of the container **10**.

The cap **12** also includes a central aperture **14** in which the grommet **13** is positioned.

The grommet **13** has a pair of like-sized spaced disc portions **16** and **17** joined by a reduced diameter portion **18**. The disc portion **17** also includes a recess **19**. The grommet **13** is self-sealing when punctured by a needle.

Typically, as the cap is screwed on the container the disc portion **17** is compressed between the cap and the top of the container forming a seal. Also, typically, the container is sealed at high temperature. The vacuum created at cooling tends to suck the grommet in. This tendency is depicted by the central depression **21** in the grommet. See FIG. 2.

Note that the disc portion **17** tends to stretch and move that portion forming the seal toward the center of the container. This is a very common occurrence with rubber seals subjected to tension in a direction tending to destroy the seal.

Note too the tendency of the disc portion **16** to move into the central aperture **14**. If the diameter of disc portion **16** is about the diameter of the central aperture, as is true of prior art devices, the aforementioned annulus will not be able to hold the grommet in place and the grommet will be sucked in.

An important consideration, based on experimental data and observation, is that the disc diameter be at least 1.2 times the diameter of the aperture. A circular aperture is illustrated. For other shaped apertures, the dimensional ratio of at least 1.2 is measured across the aperture along a common axis, i.e., colinearly. For added reliability, the disc diameter should be 1.5 times the diameter of the aperture.

The added security of the 1.5 diameter comes into play when the grommet is punctured by a needle. See FIG. 3. The needle imparts an added force in the same direction as the suction force. Here, too, if the annulus is not wide enough, the grommet will be pushed into the container.

In the FIG. 1 illustration, the disc portions are the same size. This symmetry simplifies assembly as the grommet can be inserted with either disc in either position. Preferably, the recess is in the container, however.

The recess **19** reduces the amount of rubber a needle needs to penetrate to enter the container. This reduces the time needed necessary to pierce the grommet, thus further reducing the vulnerability of the grommet.

The invention is similar to that described in U.S. Pat. No. 3,499,568, though it is clear that the patented device is different in the following respect. It is, in fact, a stopper which fits into the bottle. The patented closure is assembled when the cap is tightened. The upper

part is only slightly larger than the central opening and very thin, and not capable of resisting being sucked in, in the absence of the stopper. The metal protective cap appears to be an essential function part of the system and the discussion centers about the use of Agar culture medium, which is typically prepared aseptically.

In summary, the cap assembly just described provides a reliable biological container and avoids some of the most serious problems associated with prior art concepts.

The various features and advantages of the invention are thought to be clear from the foregoing description. Various other features and advantages not specifically enumerated will undoubtedly occur to those versed in the art, as likewise will many variations and modifications of the preferred embodiment illustrated, all of which may be achieved without departing from the spirit and scope of the invention as defined by the following claims:

I claim:

1. A cap assembly for a biological culture container having an opening with a marginal edge and means for receiving a threaded cap comprising;

a threaded cap with flat interior and exterior surfaces through which an aperture is defined; and

a grommet made from a self sealing elastomer with spaced upper and lower disc portions joined by a portion configured to fit into the aperture, the upper disc being dimensioned to be at least 1.2 times the colinear dimensions of the aperture, the grommet is secured to the cap with the upper and lower disc portions in contact with the exterior and interior flat surfaces of the cap, respectively.

2. In a biological culture a container comprising a bottle, a cap assembly for said bottle and culture under a partial vacuum in said bottle, said improvement comprising a cap assembly comprising:

a threaded cap fitted to a complementary threaded opening in the bottle, said cap having flat interior and exterior surfaces through which an aperture is defined; and

a grommet made from a self sealing elastomer with spaced upper and lower disc portions joined by a portion configured to fit into the aperture, the upper disc being dimensioned to be at least 1.2 times the colinear dimensions of the aperture, the grommet is secured to the cap with the upper and lower disc portions in contact with the exterior and interior flat surfaces of the cap, respectively.

3. A cap assembly as defined in claim 2, wherein said disc portions are the same size.

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