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VESSEL WITH STERILE CLOSURE FOR SEPARATE STORAGE
OF AT LEAST TWO SUBSTANCES
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Fig. 1

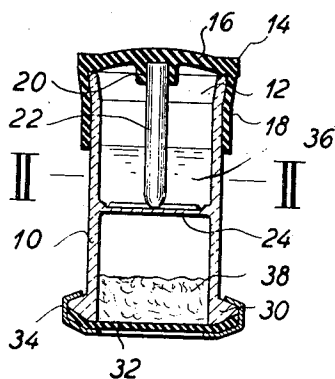


Fig. 3

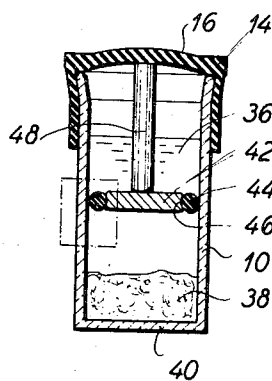


Fig. 2

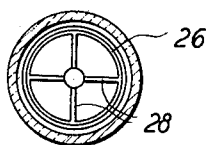


Fig. 7

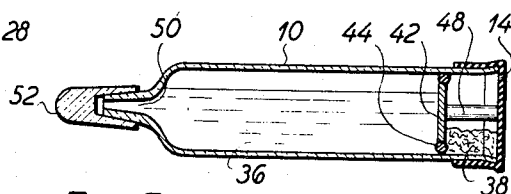
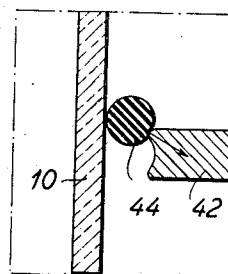
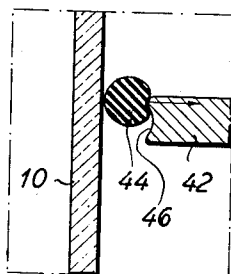
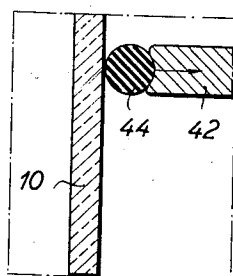


Fig. 4

Fig. 5

Fig. 6



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VESSEL WITH STERILE CLOSURE FOR SEPARATE STORAGE OF AT LEAST TWO SUBSTANCES

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4 Claims. (Cl. 206—47)

The invention relates to a vessel with sterile closure for separate storage of at least two substances, which can be brought together before use without breaking the sterile closure. Such vessels are used e. g. as ampuls for medicaments to be injected in the form of solutions or suspensions, which do not remain stable for a prolonged period and therefore must be produced immediately before injection.

Vessels of this kind generally consist of a housing which at one of its ends is closed by means of a diaphragm, and wherein there is provided a partition to divide the housing in compartments for the reception of the substances.

It has been known to manufacture the partition between the compartments of resilient material and to pierce it with a needle, e. g. the needle of a hypodermic syringe, which is used for the subsequent injection. By this means, however, only a small aperture is provided in the partition, thereby rendering the mixing of the substances difficult, even though the syringe can be utilized for this purpose. It has also been proposed to manufacture the partition of thin glass plate having a local weakening and a cast-in ferro-magnetic member, which can be influenced by a magnet from the exterior side of the vessel to break the partition. Such a device, however, is difficult to manufacture and complicated in operation. Other known devices for the said purpose suffer from similar drawbacks.

The main object of the invention is to avoid these drawbacks.

Another object is to provide a vessel of the kind in question in which the substances contained therein will be retained in sterile condition even during a long storage.

A further object is to indicate an arrangement by which the partition in the vessel can be broken by an outward pressure on the diaphragm, e. g. by means of a finger.

Finally, a still further object is to provide a vessel for the purpose described of a cheap and reliable construction and easy to handle in use.

With the above and other objects in view the present invention consists in the combination and arrangement of parts, hereinafter more fully described, illustrated in the accompanying drawings and more specifically pointed out in the claims, it being understood that changes may be made in the form, size, proportions, and details of construction without departing from, or sacrificing any of the advantages of the invention.

In the drawings:

Fig. 1 is a longitudinal section of a vessel embodying the invention,

Fig. 2 is a transverse section thereof on the line II—II in Fig. 1,

Fig. 3 is a longitudinal section of another embodiment, Fig. 4 shows on a larger scale that part of Fig. 3 which is framed in dot-and-dash lines,

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Figs. 5 and 6 are illustrations of the same part with the members in other relative positions, and

Fig. 7 shows a variant of the embodiment according to Fig. 3.

The vessel shown in Figs. 1 and 2 consists of a tubular housing 10, which is suitably manufactured of transparent material, e. g. glass or plastic. At one end, the housing has an expanded mouth 12, which is closed by a resilient diaphragm in the form of a cap 14, manufactured e. g. of rubber, said cap comprising a slightly arched part 16 and a collar 18, which embraces the expanded end of the housing, fitting hermetically tight thereto.

At the internal side of the arched part 16 there is provided a projection 20 with a recess receiving one end of a rod 22, which may consist of the same material as the housing 10.

The lowermost end of said rod abuts against a partition 24, which in the embodiment described as cast integral with the housing 10. In one face of the partition 24 there are provided various weakening lines, which e. g. as shown in Fig. 2 may consist of a circular groove 26 and a number of radial grooves 28, the preferred section of which is V-shaped.

The lowermost end of the housing 10 is hermetically closed by means of a closure frequently used for ampuls and manufactured in the following manner. The open end of the housing is surrounded by a collar 30, the section of which is trapeziform. On the mouth of the housing there is placed an elastic disc 32, e. g. of rubber, which by means of a metal ring 34 pressed around said collar is maintained in tight abutment against the end face of the housing and the outermost cone-shaped face of the collar 30.

Before putting on the cap 14 there is supplied a e. g. fluid solvent 36 to the uppermost compartment of the housing 10 above the partition 24. In like manner there is placed a pulverulent medicament 38 in the lowermost compartment below the partition 24 before providing the closure 32, 34. The medicament and the solvent are kept completely separate by the partition 24, until the medicament is to be used.

When, immediately before use, the solvent has to be added to the medicament, pressure is exerted on the arched part 16 of the cap 14, whereby said part is bent inwardly like a diaphragm and carries with it the rod 22, the lowermost end of which thereby breaks through the partition 24, which will preferably break in the grooves 26 and 28, whereby the pieces thus broken off will fall to the bottom of the housing 10. The dissolution of the powder in the liquid may be accelerated by shaking the housing.

The dissolved medicament may be removed by means of an injection syringe, piercing the disc 32 with its needle.

In the embodiment shown in Fig. 3, the housing 10 is closed below a fixed bottom 40, which is cast integral with its tubular lateral wall. Above, the housing 10 is shaped and hermetically sealed as described in the foregoing, excepting only that the arched part 16 of the cap 14 is not provided with an internal projection. The construction and function, however, of the partition between the medicament 38 and the solvent 36 present considerable deviations.

In this case the partition is constituted by a rigid disc-shaped body 42, made e. g. of metal, and an elastic ring 44 surrounding said body, the cross-section of the ring being rounded, preferably circular. The ring 44 may consist of rubber, especially butyl rubber (GR-I) which is impervious to steam. The circumference of the disc-shaped body is suitably circular, so that a gap, having the same width everywhere, will be provided along the periphery, when the body is disposed co-axially in the

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housing 10, the section of which is circular. In said gap the ring 44 is so disposed that it is subject to a pressure sufficient to provide safe tightening between the body 42 and the wall of the housing. A groove 46 is preferably provided at the edge of the body 42, in which groove the ring 44 normally rests.

To the uppermost side of the body 42 there is attached a rod 48, the free end of which abuts against the arched part 16 of the cap 14.

When the partition is to be broken, the arched part 16 of the cap 14 is forced downwardly like a diaphragm. Thereby a pressure is transferred through the rod 48 to the disc-shaped body 42, and as a consequence thereof the ring 44 will be unrolled between the wall of the housing 10 and the edge of the body 42, as illustrated in Figs. 4-6. In Fig. 4 the parts assume the same relative positions as in Fig. 3. In Fig. 5 the ring 44 has left the groove 46, and the uppermost part of the edge of the body 42 has been pressed slightly into the ring 44, thereby increasing the stress of same. The body 42 will then be in a position of labile equilibrium, which is exceeded by its subsequent movement, see Fig. 6. The stress in the ring 44 will thereupon throw the body 42 downwardly towards the bottom 40 of the housing, which movement, however, is braked by the powder 38. Simultaneously, the liquid falls down into the powder, and the dissolution of same in the liquid is initiated and may thereupon be continued and completed by shaking the housing 10, the free body 42 serving as a stirring device. In Figs. 4-6 an arrow indicates the pressure exerted by the ring 44 on the body 42.

The construction described presents the special advantage that a large aperture is provided between the compartments of the vessel, when the partition is broken.

The dissolved medicament may be removed by means of an injection syringe, the needle piercing the arched part 16 of the cap 14.

In the process of filling the vessel 10, the cap 14 is removed and the medicament 38 is deposited. Thereupon the body 42 surrounded by the ring 44 is inserted, a downwardly pressure being exerted on said ring by means of the edge of a tube having the same diameter as the ring, so as to prevent the unrolling of the ring during the insertion. Finally, the solvent is supplied to the uppermost compartment, and the cap 14 is put on.

In the embodiment shown in Fig. 7, which differs slightly only from that shown in Fig. 3, the vessel is formed as a pipette, e. g. for dripping eyes. For this purpose the bottom of the housing 10 is provided with a neck 50, normally closed by a removable cap 52 forming a tight seal. When the fluid 36 and the

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medicament 38 have been mixed, as heretofore described, the cap 52 is removed, and after the vessel has been turned with the neck 50 downwards the contents can be discharged drop by drop by successively exerting slight pressures on the diaphragm 14.

The vessel in question may be manufactured with more than two compartments by incorporating additional partitions. The embodiment according to Fig. 3 may thus have several bodies 42 with appurtenant tightening rings 44 and actuating rods 48. The free end of the rod on a subsequent body will then have to abut against the preceding body. By pressing the arched part 16 of the cap 14 the pressure will be transferred from one body 42 to the next one, and all bodies will be released simultaneously.

Having thus fully described my invention I claim as new and desire to secure by Letters Patent:

1. A sterile closed vessel for separate storage of at least two substances which are adapted to be intermixed before use which comprises, means defining a housing having at least one open end, a transverse partition in said housing dividing it into adjacent compartments for the respective reception of said substances, a resilient diaphragm closing an open end of said housing, and a member extending between said diaphragm and said partition for displacing said partition inwardly of said housing upon inward movement of said diaphragm, said partition comprising a disc-shaped body and an elastic ring having a substantially circular cross-section frictionally disposed between the periphery of said body and the inner surface of the housing, said partition normally sealing the adjacent compartments from one another but inwardly-directed pressure applied to said diaphragm and transmitted through said member to said body causing said body to be displaced inwardly while said elastic ring rolls over the housing wall to provide free communication between said compartments.

2. A vessel as defined in claim 1, wherein said disc-shaped body is provided along its periphery with a continuous groove in which said elastic ring is seated.

3. A vessel as defined in claim 1, wherein said member comprises a rod secured to said body and having a free end abutting against said diaphragm.

4. A vessel as defined in claim 1, having a second open end in the form of a neck and a removable seal closing said open end.

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