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PLURAL-COMPARTMENT ADMIXING VIAL FOR SEGREGATED STORAGE OF INGREDIENTS OF SOLUTIONS AND LIQUID MIXTURES

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Fig. 1.

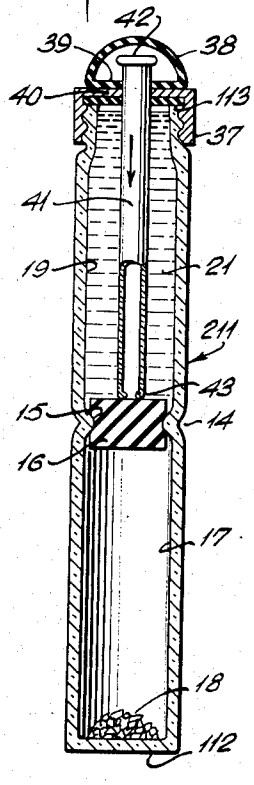


Fig. 2.

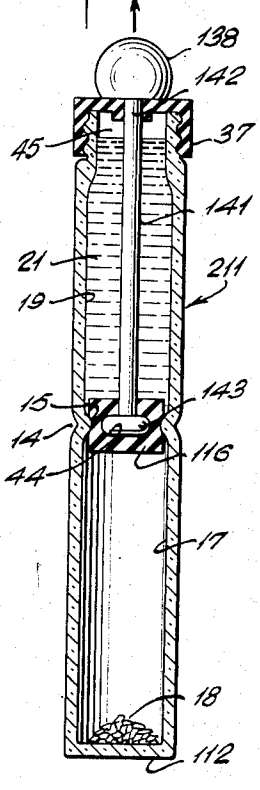
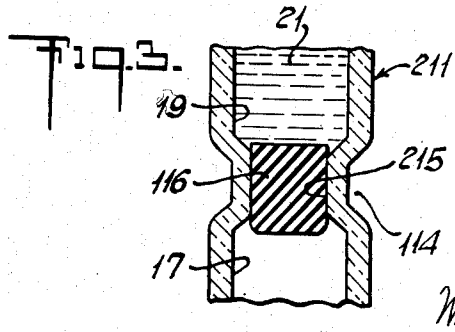


Fig. 3.



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PLURAL-COMPARTMENT ADMIXING VIAL FOR SEGREGATED STORAGE OF INGREDIENTS OF SOLUTIONS AND LIQUID MIXTURES

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7 Claims. (Cl. 128—233)

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The present invention relates to vials for segregated storage therein of different ingredients of solutions and liquid mixtures so constructed as to permit at will admixing of the ingredients without necessitating opening of the vials and, more particularly, to such structures desirably adapted to preservative storage of segregated liquids, medicaments and liquid vehicles or solutes and solvents to be admixed for production of medicinal solutions and therapeutic preparations or the like; and the present application is a continuation-in-part of my application Ser. No. 160,988, filed May 9, 1950, now Patent No. 2,610,628 of September 16, 1952.

A general object of the present invention is to provide such a vial structure, the parts of which are of simple construction, readily produced economically on a mass basis and easily assembled together to form such a plural-compartment vial assembly with chambers thereof charged or loaded with the different ingredients in a manner which assures sterility if desirable; the stucture featuring a tubular body having a constriction in its mid-section to provide a throated seat for a resilient gate plug of a diameter intermediate the diameters of the seat and the body, and with stem means being provided in one chamber to apply to that plug mechanical force sufficient to unseat it by manipulation external of the chambers without opening the same so as to avoid any undesirable interference with sterile conditions which may exist.

A more specific object of the present invention is to provide such vial structure in which is featured a gated intercommunicating passage formed by a waist constriction in a tube with a removable resilient gate plug seated therein to define one chamber from another for segregation of different materials in the latter, the gate plug being axially movable into one of the chambers from its seat by application of pressure applied physically by non-piercing stem means to push or pull it out of its seat.

Another object of the present invention is to provide such vial structure at one end with closing cap means equipped with dropper structure, the hollow dropper tube of which serves as the pushing or pulling stem means for effective displacement of the gate plug from its seat.

A still further object of the present invention is to provide structural embodiments of the apparatus which are readily and economically constructed and permit efficient use and operation thereof, as will be more fully apparent from the following descriptions of said embodiments shown by way of example in the accompanying drawing.

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Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a longitudinal or axial section, to an enlarged scale, of a loaded embodiment of the present invention, featuring a gate plug-removing stem means in the form of a dropper tube;

Fig. 2 is a sectional view similar to Fig. 1, showing a modified form of the invention; and

Fig. 3 is an enlarged axial section, with parts broken away, of a modified partition.

In the drawing like numerals identify similar parts throughout and, as shown in Fig. 1, one embodiment of the present invention may comprise a substantially cylindrical tube 211 of suitable material, preferably transparent to permit inspection and observation of contents and internal actions, such as glass, a suitable plastic or the like. Preferably tube 211 is closed at one end 112 with an integral wall which may be of any suitable shape, such as hemispherical or flat as shown. Before assembly of the parts, tube 211 has its other end 113 open to provide a mouth. At waist 14 tube 211 is circumferentially constricted to provide a circular internal seat 15 of a diameter substantially less than the internal diameter of the remainder of the tube.

A substantially cylindrical, elongated gate plug 16, formed of suitable resilient or elastic material, such as synthetic or natural rubber (for example, pure gum) is of a diameter which is of a dimension intermediate the diameter of the seat 15 and the diameter of the tube 211 to either side thereof; and it may be easily inserted through the open mouth at 113 and forced into seat 15 there to form a film fluid-tight partitioning seal. Integral end wall 112 and gate plug 16 define therebetween a chamber 17 in which may be loaded a quantity or mass 18 of suitable medicament, which, by way of example, may be a quantity of penicillin powder.

After loading of the mass 18 in chamber 17 and the closing of the gated intercommunicating passage at seat 15 by the gate plug 16, another ingredient of the mixture may be loaded into the remaining portion of the tube between the gate

plug and the end 113. That portion constitutes a chamber 19 which is closed off at the tube mouth by means of an internally-threaded cap 37, removably received on the tube end 113 which is externally threaded for that purpose, after that chamber has been substantially filled with a body 21 of liquid, which, by way of example, may be a solvent of distilled water in which the medicament solute 18 is to be dissolved to form the liquid solution.

Cap 37, serving as a movable end closure for closing off tube end 113, constitutes a part of a common type of aspirating dropper carrying an aspirating flexible bulb 38 located above and preferably having its underside 39 resting upon end wall 40 of the cap. The interior of the bulb 38 communicates with the bore of a hollow dropper stem 41 which has its upper or outer end 42 extended up through a hole in the bulb lower side 39 which serves as the neck thereof. Dropper stem 41 extends down through an axial hole in cap end wall 40 with its upper end 42 projecting up into the bulb an appreciable distance when its lower or inner open end 43 is rested upon the outer end of gate plug 16, as shown. Hollow stem 41 is thus slidably mounted through the neck 39 of bulb 38 and the hole in the end 40 of cap 37, with the upper or inner end 42 providing an extension against which physical or mechanical pressure may be applied with depression of the bulb down thereon. As a result, hollow dropper stem 41 acts as a stiff thrust stem which may be employed to push gate plug 16 into chamber 17. It is to be understood that a liquid ingredient may be housed in the lower compartment 17, provided, of course, there is a sufficient head of gas, such as air, above the body of liquid in the lower chamber to permit gate plug 16 to be pushed into the lower chamber. The solution may be withdrawn in doses of a certain number of drops from the Fig. 1 vial after admixture of ingredients by the dropper comprising bulb 38 and hollow stem 41 in a well-known manner.

A variation of the Fig. 1 embodiment is shown in Fig. 2 wherein a stem 141, in the form of a hollow dropper tube, is substituted for the dropper stem 41. Upper or outer end 142 of stem 141 may carry an aspirating bulb 138, and lower or inner end 143 may be shaped with an enlargement as shown to be removably engaged within a socket 44 in gate plug 116. Bulb 138 may be in the form of an aspirating bulb similar to 38 in the Fig. 1 embodiment. Gate plug 116 is to be removed from its seat 15 by pull on stem 141 rather than by push with bulb 138 or cap 37 being manually engageable to apply such pull to the stem. Accordingly, the quantity of liquid 21 should be such as to fall short of filling chamber 19 enough to leave at the top a gaseous head 45 sufficient to permit gate plug 116 to be pulled into chamber 19 to effect the desired intercommunication between that chamber and chamber 17 for admixture of liquid 21 with medicament solids 18. Thereafter, cap 37 may be removed from vial 211 and gate plug 116 completely withdrawn by stem 141. The gate plug 116 may then be snapped off of stem enlargement 143. Solution contents of vial 211 may be removed therefrom in predetermined dosages comprised of a certain number of drops with stem 141 formed as and acting in the nature of the hollow stem of an aspirating dropper.

Embodiments of the present invention have been illustrated in the drawing as adapted for segregated housing of liquid and solid ingredients of liquid solutions, and it is above indicated that those embodiments of the device are particularly adapted for the packaging and handling of medicinal solutions or therapeutic preparations. However, it is to be understood that the usefulness thereof is not confined to those fields of use, since obviously various embodiments of the device may be employed to house other segregated materials, such as two different liquids, whether they are liquid ingredients of medicinal solutions or of other mixtures. Of course, if both chambers are to contain liquid, the chamber which is to receive the unseated partition gate plug should have a gaseous head therein to permit the gate plug to be popped into that chamber.

It has been found that in prolonged storage of partitioned vials of the type illustrated in the above-identified parent application and herein, where constricted seats have almost line or narrow zone contact with the cylindrical walls of the partition plugs, certain stored materials may evidence a tendency for transfer of an objectable amount of liquid from its storage chamber to the other chamber where another ingredient (a particulate hygroscopic solid, for example) is stored. This tendency of moisture transfer can be appreciably minimized, and in cases entirely eliminated, by modifying the partition plug and seat in a manner proposed in Fig. 3. The tubular wall of the vial 211 may be constricted at its waist 114 with formation therein of a relatively wide, circumferentially-extending groove, to provide a relatively wide internal seat 215. Elongated cylindrical elastic partition plug 116 thus has a wide zone of its cylindrical external side surface seated securely against or in a wide cylindrical constricted seat surface provided at 215, cooperatively to minimize or eliminate moisture transfer from chamber 19 to chamber 17 during prolonged storage.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A vial for storage of a liquid and another material segregated in separate chambers having a gated intercommunicating passage to permit admixture comprising, in combination, an elongated tube provided in its mid-section with a constricted circular internal seat of a diameter substantially less than the diameter of said tube on either side thereof to define at opposite ends a liquid chamber and a second chamber for the other material, means closing off one end of said tube, a resilient gate plug of a diameter intermediate the internal diameter of said seat and the diameters of said chambers removably fitted in said seat temporarily isolating said chambers from each other, and a movable end closure closing off the other end of said tube including an aspirating dropper having a longitudinally-mov-

able hollow stem with its inner end reaching to engagement of said gate plug mechanically to displace it from its seat for permitting admixing of the liquid and the other material.

2. The vial structure as defined in claim 1 characterized by the provision of said movable closing means as a closing cap with said hollow stem comprising a hollow dropper tube slidably mounted through said cap with the outer end of said tube connected with an external aspirating bulb.

3. The vial structure as defined in claim 1 characterized by the provision of said hollow stem as an aspirating dropper tube which extends to said gate plug to serve as a thrust member for pushing the latter out of said seat into the far end of said vial.

4. The vial structure as defined in claim 1 characterized by said hollow dropper stem extending and being removably connected to said gate plug to pull the latter outward off of its seat.

5. A vial for storage of a liquid and another material segregated in separate chambers having a gated intercommunicating passage to permit admixture comprising, in combination, a substantially tubular body closed at one end by an integral wall and constricted in its mid-section to provide a circular internal seat of a diameter substantially less than the diameters of said body on either side thereof, the other end of said tubular body having a mouth with the end of said body on the mouth side of said seat constituting a storage chamber for one material, and the other end on the closed side of said seat constituting a second chamber for the other material, a substantially cylindrical resilient gate plug of a diameter intermediate the diameter of said seat and the diameters of said chambers removably fitted in said seat temporarily isolating said chambers from each other, a removable cap closing the mouth of said vial, an aspirating dropper tube slidably mounted through an axial hole in said cap with its inner end located in the vicinity of the outer end of said gate plug to push it into said second chamber to permit admixing of the liquid and the other material, said dropper tube having its outer end extending beyond said cap an appreciable distance to permit it to be pushed forward for unseating said gate plug, and an aspirating bulb mounted on the outer end of said dropper tube.

6. The vial structure as defined in claim 5 characterized by the location of the underside of said aspirating bulb adjacent the outer end of said cap with the outer end of said dropper tube slidably mounted in a fluid-tight manner through a hole in that bulb underside and extending inside the bulb to the vicinity of the far topside of said bulb, so that by pressing down on the bulb topside said dropper tube may be slid forward a distance through said cap to push said gate plug out of its seat.

7. A vial for storage of a liquid and another material segregated in separate chambers having a gated intercommunicating passage to permit admixture comprising, in combination, an elongated tube constricted in its mid-section to provide a circular internal seat of a diameter substantially less than the diameter of said tube on either side thereof to define at opposite ends a liquid chamber and a second chamber for the other material, means closing off one end of said tube, a resilient gate plug of a diameter intermediate the internal diameter of said seat and the diameters of said chambers removably fitted in said seat temporarily isolating said chambers from each other, a movable end closure in the form of a removable cap constituting closing means for the other end of said tube, and an aspirating dropper device carried by said cap and including a hollow stem reaching to engagement of said gate plug and connected thereto mechanically to pull said plug out of said seat for permitting admixing the liquid and the other material.

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