

Oct. 2, 1956

H. P. BARASCH ET AL

2,764,983

DUAL COMPARTMENT MIXING VIAL

Filed March 20, 1953

2 Sheets-Sheet 1

Fig. 1

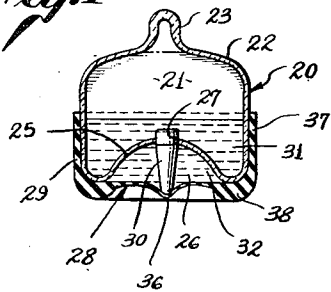


Fig. 2

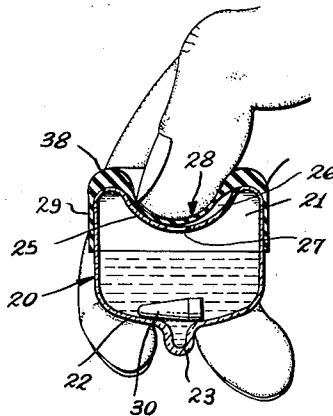


Fig. 3

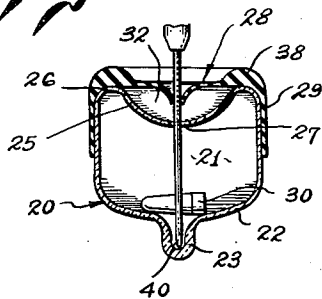


Fig. 4

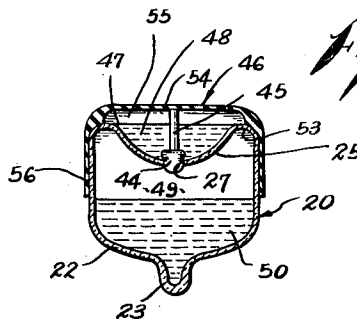


Fig. 6

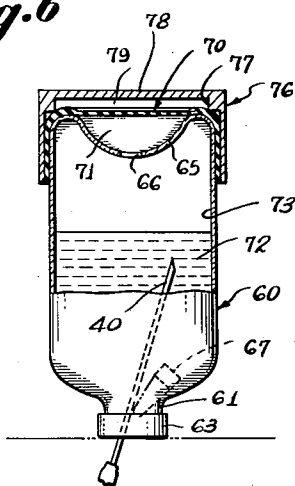
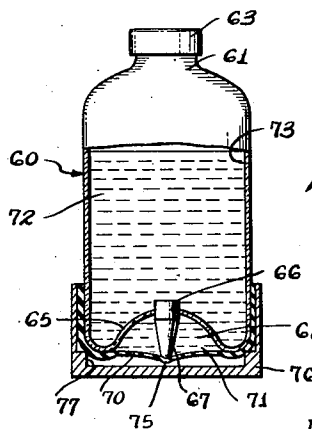


Fig. 5



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2 Sheets-Sheet 2

Fig. 7

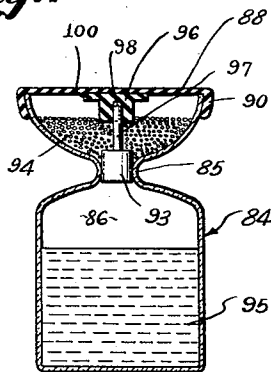


Fig. 8

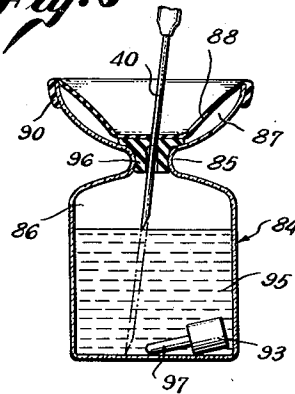


Fig. 9

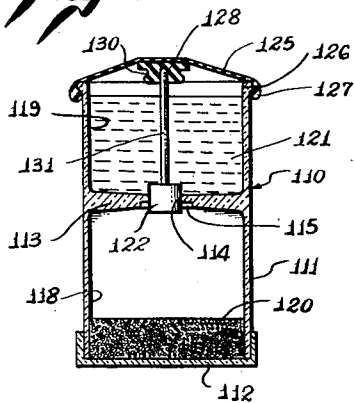


Fig. 10

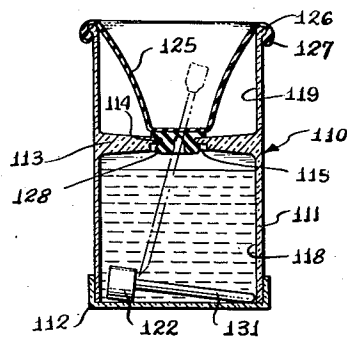


Fig. 11

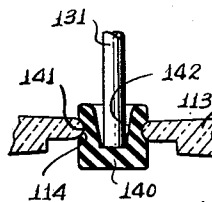
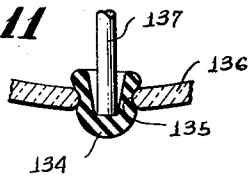


Fig. 12

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2,764,983

DUAL COMPARTMENT MIXING VIAL

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18 Claims. (Cl. 128—272)

This invention relates to dual compartment containers to hold two separate materials isolated from each other for intermixture under sealed conditions whenever desired for final use. While the invention is widely applicable for its basic purpose, it is being initially embodied in dual compartment vials to produce mixtures for use in medical syringes. For the purpose of disclosure and to illustrate the principles involved, these embodiments will be described herein and will provide adequate guidance for those skilled in the art who may have occasion to apply the basic principles to other specific purposes.

In the field of medicine, there are many useful combinations of ingredients which deteriorate or otherwise change in character over a relatively short time and therefore must be freshly prepared for use. Vitamin solutions and solutions of various antibiotics are examples. The general object of the present embodiments of the invention in this field is to provide such a container for medical use whereby a liquid material sealed in one compartment and a second material, either in liquid or dry state, sealed in a second compartment may be intermixed when desired under sealed conditions, the container being especially adapted to permit the fresh mixture to be transferred aseptically to a medical syringe. Thus the invention avoids any possibility of contamination of the medication, eliminates error in the selection and proportioning of the components of the mixture, provides a mixing procedure that physicians and nurses may delegate to assisting personnel, and finally saves the cost of manufacturing and shipping a second container.

Broadly described this general object is attained by a container in which two compartments are separated by a wall with an aperture therein normally closed by a stopper, and in which one of the two compartments has an outer wall in the form of a diaphragm operatively associated with the stopper. For intermixture of the contents of the two compartments it is merely necessary to press inward on the diaphragm to dislodge the stopper and thus put the two compartments in communication with each other without exposure to external contamination.

A number of specific objects of the invention relate to various problems that arise in the construction and use of such a device. A feature of the invention is that all of these problems are met by a simple inexpensive construction.

One of the problems is to connect the diaphragm with the stopper across a liquid-containing compartment in such manner that force may be transferred from the diaphragm to the stopper for dislodgment of the stopper without creating undue initial hydraulic pressure in the compartment. Any excessive initial rise in pressure will, of course, tend to force separation of an edge of the diaphragm from the container with consequent leakage of the liquid content.

In one practice of the invention a cushion of air or other gas is provided to avoid an excessively steep initial momentary pressure rise. In another practice of the in-

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vention, the problem is met by an arrangement which, as will be explained, causes the effective volume of the compartment to increase instead of decrease in response to inward flexure of the diaphragm.

5 A second problem is to provide for complete transfer of material from the diaphragm compartment to the second or mixing compartment. The invention meets this problem by shaping the diaphragm compartment for ready gravitation of its content to and through the aperture leading to the mixing compartment.

10 Some practices of the invention go further by providing for substantially complete collapse of the diaphragm compartment for positive displacement of its content into the mixing compartment. In this regard, a feature of some embodiments of the invention is the concept of providing a diaphragm compartment in the form of a bowl shaped in accord with the curvature of a user's finger whereby finger pressure may be used to flex the diaphragm into such intimate contact with the bowl wall as to reduce the effective volume of the diaphragm compartment to zero for positive displacement of the entire liquid content of the diaphragm compartment into the mixing compartment.

15 A third problem is to provide safeguards against unintentional dislodgment of the stopper from its normal seat in the aperture in the wall between the diaphragm compartment and the mixing compartment. Accidental dislodgment may be caused by endwise pressure against the container while it is in storage or in transit and also may be caused by inadvertent pressure against the diaphragm in the course of handling the container. In some practices of the invention, this problem is met by providing a protective rim around the end of the container with the rim projecting outward beyond the plane of the diaphragm. In other practices, the problem is met by providing a removable protective end cap. A feature of both of these solutions is that the container may stand on the diaphragm end without subjecting the diaphragm to pressure.

20 A fourth problem is to provide for adequate agitation in those instances in which it is difficult to mix or dissolve one of the materials in the other. Obviously the need for agitation can not be met by the use of conventional stirring devices because the interior of the container must remain sealed during the mixing operation. The problem is met by using the dislodged stopper as a stirring means. The stopper or the stopper and associated means for dislodging the stopper may be of such weight and shape as to favor this function.

25 A fifth problem is to provide such a device that may be used for transfer of its content to a medical syringe in an aseptic manner. A thin-walled diaphragm may be punctured once by the needle of a syringe without contamination of the confined mixture, but only a self-sealing member can be repeatedly punctured by a syringe needle without risk of contamination of the confined mixture. A feature of the invention is the concept of meeting this problem by an auxiliary stopper of self-sealing construction carried by the diaphragm. After the stopper that normally seals the two compartments from each other is dislodged by manual pressure against the diaphragm and the material in the diaphragm compartment has been transferred to the mixing compartment, the auxiliary stopper is carried by the inward movement of the diaphragm into a position replacing the first stopper in the aperture between the two compartments.

30 A sixth problem encountered in the construction of a device of this character, especially in relatively small containers of single-dosage size, is to provide for complete transfer of the mixed content to a syringe. To this end, the invention provides a drop-size drainage well in the

bottom of the mixing compartment within range of the syringe needle and, preferably, further provides for the walls of the container and of the well to be shaped to guide the needle to the bottom of the well.

The various objects and advantages of the invention will be apparent from the following detailed description considered with the accompanying drawings. In the drawings, which are to be regarded as merely illustrative:

Fig. 1 is a sectional view of a first embodiment of the invention showing the container in normal position for storage and transit;

Fig. 2 is a similar sectional view illustrating the manual operation of dislodging the stopper and transferring the content of the diaphragm compartment into the mixing compartment for intermixture of the two materials;

Fig. 3 is a sectional view illustrating how the needle of a medical syringe may be inserted to withdraw the last drop of the intermixed material;

Fig. 4 is a sectional view of a second embodiment of the invention;

Fig. 5 is a view partly in side elevation and partly in section, showing a third embodiment of the invention prior to intermixture of the two materials;

Fig. 6 is a similar view of the third embodiment of the invention showing the needle of a syringe inserted for the purpose of withdrawing the completed mixture;

Figs. 7 and 8 are sectional views illustrating a fourth embodiment of the invention;

Figs. 9 and 10 are sectional views illustrating a fifth embodiment of the invention; and

Figs. 11 and 12 are fragmentary sections showing the construction of stoppers that may be used in various practices of the invention.

The first embodiment of the invention shown in Figs. 1 to 3 includes a container 20 shown in upside down position in Fig. 1 and in upright position in Figs. 2 and 3. The container 20 may be made of any suitable material, including plastics, but preferably is made of glass. The interior of the container 20 is a mixing compartment 21 which normally contains one of the two materials that are to be mixed together for the final product. The glass container is of circular cross-sectional configuration and the mixing compartment 21 has a curved bottom wall 22 which drains into a central well 23. The well 23 may aptly be referred to as "drop-size" and serves the purpose of permitting a syringe needle to withdraw the last drop of liquid in the container.

The container 20 is formed with a re-entrant top wall 25 which is of outwardly concave configuration to form an upper or outer receptacle 26, the top wall 25 having a central aperture 27 for communication with the mixing compartment 21. The receptacle 26 is closed by a suitable diaphragm 28 to serve as a second compartment for storing in isolated state the second material of the final mixture. The diaphragm may be mounted on the container in any suitable manner. In this construction the diaphragm is formed with a thickened cylindrical skirt 29 that elastically telescopes over the end of the container. The second compartment 26 will be referred to as the diaphragm compartment.

In accord with the invention, the aperture 27 is normally closed by a suitable stopper 30 that cuts off communication between the two compartments and normally isolates the contents of the two compartments 21 and 26 from each other in a sealed manner. The two compartments may be employed to confine various materials in various states, but usually at least one of the materials will be liquid. In this instance, the mixing compartment 21 contains a body 31 of one liquid and the diaphragm compartment 26 contains a body 32 of a second liquid.

As heretofore indicated, it is contemplated that the diaphragm 28 will be operatively associated with the stopper 30 in such manner that inward pressure against the diaphragm may be used to dislodge the stopper and thereby place the two compartments in communication

with each other to permit intermixture of the two materials. A feature of this particular embodiment of the invention is that the stopper and the means for operatively associating the diaphragm with the stopper are united in one integral body; and a further feature is that the body is formed with an end portion for contact with the diaphragm 28, which end portion is substantially smaller in cross section than the aperture 27 in which the stopper seats. In this instance, the stopper is of conical tapered configuration as shown with one end of relatively large diameter to seal the aperture 27 and the other end tapered to a cross sectional dimension substantially smaller than the aperture 27.

A further feature of this first embodiment of the invention is that the tapered outer end of the plug 30 forms an outward bulge 36 in the diaphragm 28 with the cross sectional area of the outward bulge substantially less than the cross sectional area of the aperture 27 in which the stopper is seated. The significance of this arrangement is that when finger pressure is applied to the outer surface of the outward bulge 36 to shift the stopper 30 inward, the resulting reduction in the volume of the diaphragm compartment caused by inward movement of the diaphragm at the outward bulge is more than offset by increase of the effective volume of the compartment caused by inward shift of the larger end of the stopper 30. Thus the net effect of pressing the bulge 36 in the diaphragm 28 slightly inward to shift the plug 30 slightly inward, is increase of the effective volume of the diaphragm compartment 26 instead of reduction. Consequently, the application of manual pressure to the outer surface of the diaphragm 28 for dislodgment of the stopper 30 does not result in rise in liquid pressure in the diaphragm compartment.

The diaphragm 28 may be of any suitable construction and may be mounted on the container 20 in any suitable manner. Preferably, the diaphragm is made of a suitable rubber-like material or elastomer and is cup-shaped with a cylindrical skirt portion 37 elastically embracing the periphery of the container 20 under tension. A suitable bonding agent may be employed to unite the cylindrical portion 37 of the diaphragm to the outer surface of the container 20, but a feature of the invention is that the elastic embracement of the container by the diaphragm forms an effective mechanical seal that may be depended upon to prevent contamination of the liquid body 32 in the diaphragm compartment.

A further feature of the embodiment of the invention shown in Fig. 1 is that the diaphragm 28 is thickened to form an annular rim 38 that extends outward beyond the plane of the central portion of the diaphragm and beyond the outward bulge 36 in the diaphragm. As may be seen in Fig. 1, the thickened rim 38 permits the device to stand on end on a flat surface without causing pressure against the central portion of the diaphragm and thus affords a measure of protection against inadvertent dislodgment of the stopper 30.

The utility of this first embodiment of the invention may be readily understood from the foregoing description. With the initially empty container in position with the reentrant top wall 25 uppermost, it is a simple matter to introduce the body of liquid 31 into the mixing compartment 21 through the aperture 27 and to seat the stopper 30 in the aperture to seal off the mixing compartment. The second body of liquid 32 may then be poured into the receptacle formed by the re-entrant top wall 25 and then the diaphragm 28 may be slipped over the end of the container to complete the assembly.

To intermix the two bodies of liquid 31 and 32 in preparation for administration of the mixture, it is merely necessary to turn the device upright and to press inward on the diaphragm 28 in the manner shown in Fig. 2 to force the stopper 30 into the mixing compartment 21. With continued inward thumb pressure on the diaphragm, the diaphragm is brought into intimate contact with the

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re-entrant wall 25, the curvature of the re-entrant wall and the construction of the diaphragm being such as to permit complete collapse of the diaphragm compartment in a positive manner to accelerate the gravitational displacement of all of the liquid body 32 into the mixing compartment 21.

When the liquid content of the diaphragm compartment has been transferred to the mixing compartment in this manner, the container may be shaken or vibrated manually for agitation to cause complete intermixture of the two bodies of liquid. If desired, the depression of the diaphragm may be maintained during the mixing operation to keep the liquid out of the diaphragm compartment, but continued inward flexure of the diaphragm is not necessary since any liquid that is thrown into the diaphragm compartment during the mixing operation will readily drain back into the mixing compartment. A feature of the device is that the stopper dislodged from its seat, as shown in Fig. 2, serves as agitating means when the container is shaken and thereby facilitates the task of agitating the liquid content.

After the final mixture of the two materials has been prepared in the manner described, the needle 40 of a medical syringe may be inserted, as shown in Fig. 3, with the needle puncturing the diaphragm 28 and extending into the bottom of the well 23. The device shown in the drawings is a single dosage container, the content of which is intended to be withdrawn by one inspiration of the syringe. The curvature of the bottom wall 22 in the region of the well 23 guides and locates the inserted needle into the well and to the bottom of the well, so that the inspiration by the syringe will withdraw the last drop of the mixture.

The second embodiment of the invention shown in Fig. 4, employs the same container 20 having the re-entrant top wall 25 with the central aperture 27 therein. In this instance, however, a stopper 44 of relatively short length is seated in the aperture 27 and is operatively connected by a short pin 45 with a diaphragm 46 that extends across the diaphragm compartment 47. The diaphragm compartment 47 confines a liquid body 48 and the lower mixing compartment 49 confines a second liquid body 50.

The diaphragm 46 is formed with an inner annular shoulder 53 that engages the top rim of the container 20 and causes the central portion 54 of the diaphragm 46 to lie in a plane spaced outward from the rim of the container. By virtue of this construction, when the liquid body 48 fills the diaphragm compartment up to the level of the rim of the container, the diaphragm 46 forms an air pocket 55 above the liquid level. The advantage of this construction is that when initial inward pressure on the central portion 54 of the diaphragm 46 causes appreciable contraction of the effective volume of the diaphragm compartment, the body of air serves as an elastic cushion to minimize the rise in pressure in the diaphragm compartment. It is contemplated that the stopper 27 will be dislodged by inward pressure against the diaphragm 46 without such rise in pressure as would cause the extrusion of air or liquid to the exterior of the container. It is intended to avoid such leakage because the effect is to create a vacuum in the container. It will be noted, however, that the diaphragm 46 has a cylindrical portion 56 that elastically embraces the container 20 in such manner that any extrusion will be a matter of one-way flow without return contamination flow and any such loss will be largely air rather than liquid.

The device shown in Fig. 4 is utilized in the manner heretofore described. A feature of this construction is that the pin 45 may simply seat in a recess (not shown) in the end of the stopper 27 and be separable from the stopper so that the pin and the stopper will eventually comprise two separate agitating means for facilitating intermixture of the two liquids in the mixing compartment 49.

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The third embodiment of the invention shown in Figs. 5 and 6 is characterized by the use of a glass container, generally designated 60, that has the general configuration of a conventional vial for use in dispensing liquids by means of a medical syringe. The vial is formed with the usual neck 61 of reduced diameter and top end of the vial has the usual self-sealing closure adapted to be punctured by a syringe needle. The self-sealing closure includes the usual elastomer plug or stopper (not shown) embraced and retained by the usual metal ferrule 63.

The glass container 60 differs from the conventional vial of this type in having a re-entrant bottom wall 65 of outwardly concave configuration with a central aperture 66 therein. With the glass container 60 turned upside down, and with a stopper 67 seated in the aperture 66, a body of solid or liquid 68 may be placed in the receptacle formed by the re-entrant bottom 65. Then a suitable diaphragm 70 of the character heretofore described may be telescoped over the bottom end of the container to cooperate with the re-entrant bottom wall to form a diaphragm compartment 71 confining the body of liquid 68. The diaphragm 70 may be depressed to dislodge the stopper 67 in the manner heretofore described to cause the body of liquid 68 to mix with a second larger body of liquid 72 in the mixing compartment 73 provided by the interior of the container.

The stopper 67 may be of the tapered configuration heretofore described and may form an outward bulge 75 in the diaphragm 70 for the purpose heretofore explained. The diaphragm 70 is normally protected by a bottom cap 76 of suitable rigid material, preferably a nonbreakable plastic. The bottom cap 76 may be formed with an inner annular shoulder 77 to engage the rim portion of the diaphragm and thereby space the bottom wall 78 of the cap from the central portion 79 of the diaphragm 70. Since the bottom cap 76 protects the diaphragm 70 and provides a protective support base for the container as may be seen in Fig. 5, it is apparent that the device will withstand the ordinary hazards of handling and shipping in the same manner as a conventional vial of this general type.

To cause the intermixture of the two bodies of liquid, the device is turned upside down, as shown in Fig. 6, and then the bottom cap 76 is temporarily removed to permit the stopper 67 to be dislodged by external manual pressure against the diaphragm 70, as heretofore described. After the two bodies of liquid have been adequately intermixed, the container may be used in the well known manner as shown in Fig. 6 by inserting the needle 40 of a medical syringe through the self-sealing stopper in the ferrule 63 for withdrawal of a portion of the liquid mixture. It is apparent that the container 60 may be of relatively large size to hold a quantity of the mixture sufficient to fill the syringe several times.

The fourth embodiment of the invention shown in Figs. 7 and 8, includes a thin-walled container 84 which may be made of glass and has the general configuration of an hour glass. Thus the container is formed with an intermediate neck 85 dividing the container into a bottom mixing compartment 86 and an upper bowl-shaped diaphragm compartment 87 closed by a suitable diaphragm 88. The diaphragm 88 is formed with a marginal skirt portion 90 adapted to embrace the rim of the container in a sealing manner as shown. As suitable stopper or plug 93 may be seated in the neck 85 to isolate a mass of dry material 94 in the diaphragm compartment 87 from a body of liquid 95 in the mixing compartment 86. Instead of dry material, the compartment 86 may contain highly viscous material.

What may be termed an auxiliary stopper 96 is bonded to the inner face of the diaphragm 88 and is dimensioned to replace the first stopper 93 in the neck 85. The diaphragm 88 is operatively connected with the first stopper 93 by suitable means such as a pin 97 that extends from the first stopper 93 into a socket 98 in the auxiliary stop-

per 96. Preferably the auxiliary stopper 96 is formed with a top flange 100.

To cause the mass of dry material 94 to drop through the neck 85 into the body of liquid 95, it is merely necessary to exert finger pressure on the outer face of the diaphragm 88 thereby to cause the stopper 93, together with the pin 97, to be forced into the lower mixing compartment 86. After making sure that all of the dry material has dropped through the neck, the user of the device may then exert further pressure against the outer face of the diaphragm 88 to force the auxiliary stopper 96 into the neck 85 as shown in Fig. 8. Preferably the marginal skirt portion 90 of the diaphragm yields in the manner of a one-way valve to release air when the diaphragm is depressed thereby to prevent an excessive pressure rise.

The container may then be shaken or vibrated to agitate the content for the purpose of causing the dry material 94 to dissolve into or mix with the liquid body 95. The needle 40 of a medical syringe may then be extended through both the diaphragm 88 and the auxiliary stopper 96 in the manner shown in Fig. 8, the auxiliary stopper being of self-sealing construction.

The diaphragm 88 is of elastic material to stretch sufficiently to permit seating of the auxiliary stopper 96. It is contemplated that the auxiliary plug 96 will seat in the neck 85 with sufficient tenacity to withstand both the tension of the diaphragm 88 and the rise in internal air pressure resulting from contraction of the effective volume of the container. It will be apparent, however, that no harm will result in the diaphragm withdrawing the auxiliary stopper after the needle 40 is withdrawn, since the auxiliary stopper makes the diaphragm self-sealing and the contents of the container will continue to be sealed against contamination.

The fifth embodiment of the invention shown in Figs. 9 and 10 has the same general interior configuration as the embodiment shown in Figs. 7 and 8, but has a substantially cylindrical exterior configuration. The container generally designated 110 which may be of large capacity has a cylindrical wall 111 and is closed at the bottom by a suitable cap 112 that is bonded thereto in a fluid-tight manner. Unitary with the cylindrical wall 111 is an intermediate transverse wall 113, formed with a central aperture 114. Preferably the transverse wall 113 is centrally recessed as indicated at 115, so that the wall is relatively thin around the rim of the aperture 114.

The transverse wall 113 divides the interior of the container into a lower mixing compartment 118 and an upper diaphragm compartment 119. The mixing compartment 118 may contain, for example, a mass of dry material 120 and the diaphragm compartment 119 may contain a body of liquid 121, the two materials being normally isolated from each other by a suitable stopper 122 in the aperture 114. The upper end of the diaphragm compartment 119 is closed by a suitable diaphragm 125, in the same general manner as heretofore described. The cylindrical wall 111 of the container may be formed with a bead 126 at its upper rim and the margin of the diaphragm 125 may be formed with an elastic bead 127 so that the two beads may interengage as shown to hold the diaphragm in place in a fluid-tight manner.

Bonded to the inner face of the diaphragm 125 is an auxiliary stopper 128 that is preferably formed with circumferential groove 130 for locking engagement with the thin rim of the aperture 114 in the transverse wall 113. A suitable pin 131 interconnects the stopper 122 and the auxiliary stopper 128 in the general manner heretofore described.

To drop the body of liquid 121 into the mixing compartment 118, it is merely necessary to exert finger pressure on the outer face of the diaphragm 125, thereby to cause the stopper 122 and the associated pin 131 to drop through the aperture 114. The container may then be shaken to cause thorough agitation of the content and complete solution of the material 120 in the liquid 121.

Intermixture and solution are facilitated by leaving the aperture 114 open and shaking the container in such manner as to cause the liquid to surge back and forth between the two compartments through the aperture 114.

When the content has been thoroughly prepared for administration in this manner, the diaphragm 125 may be pressed further inward to cause the auxiliary stopper 128 to seat and lock in the aperture 114 in the manner shown in Fig. 10. In this form of the invention it is contemplated that the diaphragm bead 127 will elastically embrace the container bead 126 in such manner as to serve as a one-way valve to release air when the diaphragm is depressed. No vacuum results because the diaphragm remains depressed. On the contrary a small desirable over pressure will result to assist in subsequent withdrawal of liquid from the container by a syringe. The elastic diaphragm 125 will be placed under appreciable tension but the interlocking engagement of the auxiliary stopper with the thin rim of the aperture, as may be seen in Fig. 10, will cause the auxiliary plug to maintain its seat in opposition to the diaphragm tension. The auxiliary stopper 128 is of self-sealing construction to permit the needle to be inserted therethrough repeatedly as shown in Fig. 10 for withdrawing increments of the liquid content.

Figs. 11 and 12 show forms of stoppers that may be used for normally sealing off the two compartments of such a device from each other. The stopper 134 shown seated in an aperture 135 in a transverse wall 136, in Fig. 7, comprises a soft rubber disc which is distorted into the form of a stopper when pushed into the aperture by a pin 137. The pin 137 will operatively connect the usual diaphragm with the stopper to permit the stopper to be forced through the aperture 135 in the usual manner by manual pressure against the outer face of the diaphragm.

The stopper 140, shown in Fig. 12, may be used instead of the plain cylindrical stopper 122 of Fig. 9 to close the aperture 114 in the transverse wall 113. The stopper 140 is of generally cylindrical configuration but is formed with a circumferential groove 141 for light engagement with the thin rim of the aperture 114. The stopper 140 is also formed with a socket 142 to receive the lower end of the previously described pin 131.

Our description in specific detail of selected embodiments of the invention for medical purposes will suggest to those skilled in the art various changes, substitutions and other departures from our disclosure that properly lie within the spirit and scope of the appended claims.

Having described our invention, we claim:

1. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an aperture in the bottom of the receptacle for communication with the compartment; a diaphragm closing the top of said receptacle to form therewith an upper compartment; a stopper in said aperture cutting off communication between the two compartments; and means extending from said stopper for contact with said diaphragm to permit said stopper to be forced out of said aperture into said lower compartment by manual pressure inward on the diaphragm thereby to permit mixture of the contents of the two compartments under sealed conditions, said lower compartment being formed with a small drainage well therein whereby a syringe needle may be inserted through said diaphragm and aperture into said well to withdraw a residual portion of the mixture.

2. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an aperture in the bottom of the receptacle for communication with the compartment; a diaphragm closing the top of said receptacle to form therewith an upper compartment; a stopper in said aperture cutting off communication between the two compartments; and means extending from

said stopper for contact with said diaphragm to permit said stopper to be forced out of said aperture into said lower compartment by manual pressure inward on the diaphragm thereby to permit mixture of the contents of the two compartments under sealed conditions, said receptacle being of curved internal configuration whereby said diaphragm may be depressed into intimate contact with the inner surface of the receptacle for positive displacement of the contents of the upper compartment into the lower compartment.

3. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an aperture in the bottom of the receptacle for communication with the compartment; a diaphragm closing the top of said receptacle to form therewith an upper compartment, said diaphragm elastically embracing the rim of said receptacle to seal off the content of said upper compartment; a stopper in said aperture cutting off communication between the two compartments; and means extending from said stopper for contact with said diaphragm to permit said stopper to be forced out of said aperture into said lower compartment by manual pressure inward on the diaphragm thereby to permit mixture of the contents of the two compartments under sealed conditions.

4. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an aperture in the bottom of the receptacle for communication with the compartment; a diaphragm closing the top of said receptacle to form therewith an upper compartment; a stopper in said aperture cutting off communication between the two compartments; means extending from said stopper for contact with said diaphragm to permit said stopper to be forced out of said aperture into said lower compartment by manual pressure inward on the diaphragm thereby to permit mixture of the contents of the two compartments under sealed conditions; and a cap removably mounted on said receptacle to protect said diaphragm.

5. In a device of the character described, the combination of a container having a re-entrant end wall forming an outer receptacle; a flexible diaphragm closing the top of said outer receptacle to form therewith an upper compartment, the interior of the container constituting a second lower compartment, said re-entrant wall having an aperture for communication between the two compartments; a stopper in said aperture cutting off communication between said two compartments; and means extending from said stopper into contact with said diaphragm to permit the stopper to be forced out of said aperture into said lower compartment by manual pressure inward on the diaphragm thereby to permit intermixture of the contents of the two compartments.

6. A device as set forth in claim 5 in which said re-entrant end wall is of curved configuration to permit said diaphragm to be manually depressed into intimate contact with the re-entrant wall for positive displacement of the content of said upper compartment into said lower compartment.

7. In a device of the character described, the combination of: a thin-walled container having the general configuration of an hour glass forming a lower compartment and an upper open-top receptacle with communication therebetween through the neck portion of the hour glass configuration; a flexible diaphragm closing the top of said receptacle to form therewith an upper compartment; a stopper in said neck portion cutting off communication between the two compartments; and means extending from said stopper into contact with said diaphragm to permit said stopper to be forced out of said neck portion into said lower compartment by manual pressure inward on the diaphragm thereby to permit intermixture of the contents of the two compartments.

8. In a device of the character described, the com-

5 bination of: a thin-walled container having substantially vertical outer wall surfaces and having inner wall surfaces of the general configuration of an hour glass providing a lower compartment and an upper open-top receptacle with communication therebetween through the neck portion of the hour glass configuration, a flexible diaphragm closing the top of said receptacle to form therewith an upper compartment; a stopper in said neck portion normally cutting off communication between the two compartments; and means extending from said stopper into contact with said diaphragm to permit said stopper to be forced out of said neck portion into said lower compartment by manual pressure inward on the diaphragm thereby to permit intermixtures of the contents of the two compartments.

9. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an opening in the bottom of the receptacle for communication with the compartment; a stopper in said opening cutting off the receptacle from the compartment; an elastic diaphragm extending across the open top of said receptacle to seal the receptacle; and means operatively connecting said diaphragm with said stopper to permit external manual pressure against the diaphragm to force said stopper out of said opening into said compartment, said connecting means distorting said diaphragm outward to form a bulge in the diaphragm to receive the manual pressure whereby initial inward pressure movement of the diaphragm acts upon the limited area of the bulge.

10. A device as set forth in claim 9 in which the cross-sectional area of said bulge is less than the cross-sectional area of said opening whereby initial inward pressure movement of the diaphragm at the bulge results in reduction of the enclosed volume of said receptacle.

11. In a device of the character described, the combination of: container walls forming a lower compartment and an upper open top receptacle with an opening in the bottom of the receptacle for communication with the compartment; an elastic diaphragm extending across the open top of said receptacle to seal the receptacle; and a stopper in said opening cutting off the receptacle from the compartment, said stopper having a portion abutting the inner surface of said diaphragm to permit external manual pressure against the diaphragm to force the stopper out of said opening into said compartment, said portion of the stopper distorting said diaphragm outward to form a bulge therein whereby initial pressure against said stopper through said diaphragm to move said stopper inward results in reduction of the bulge.

12. A device as set forth in claim 11 in which said portion of the stopper is substantially smaller in cross-sectional area than said opening to result in a corresponding diaphragm bulge smaller than the opening whereby initial inward movement of the diaphragm at the bulge results in reduction of the enclosed volume of the receptacle.

13. In a device of the character described, the combination of: a thin-walled cylindrical container having an outwardly concave wall across one end forming an outer receptacle, said wall having a central opening for communication with the interior of the container; an elastic diaphragm member embracing said end of the container and sealing off said receptacle; a stopper in said opening to cut off said receptacle from the interior of the container; and means extending from said stopper to said diaphragm centrally of the diaphragm to permit external pressure against the diaphragm to force said stopper out of said opening into the interior of the container, said diaphragm being thickened at the rim of the container to extend outward beyond the center of the diaphragm whereby said end of the container with said diaphragm thereon may rest on a flat surface with the central portion of the diaphragm out of contact with the flat surface.

14. In a device of the character described, the combination of: a thin-walled cylindrical container having an outwardly concave wall across one end forming an outer receptacle, said wall having a central opening for communication with the interior of the container; an elastic diaphragm member embracing said end of the container and sealing off said receptacle; a first stopper in said opening to cut off said receptacle from the interior of the container; a second stopper dimensioned to fit said opening and attached to the inner surface of said diaphragm opposite said first stopper; and means extending between said two stoppers to transmit force from said diaphragm to said first stopper whereby external manual pressure on the diaphragm will initially force said first stopper out of said opening into said compartment and subsequently force said second stopper into the opening.

15. A device as set forth in claim 14 in which said second stopper is made of resilient material with upper and lower enlarged portions for engagement with opposite sides of said wall to latch the stopper in said opening in opposition to the tension of the depressed diaphragm.

16. In a device of the character described, the combination of: a bottle having a reduced neck at one end and an outwardly concave wall forming an outer receptacle at the other end, said wall having a central opening for communication with the interior of the bottle; a first stopper in said neck and a second stopper in said opening co-operating with the first stopper to seal the interior of the bottle; a diaphragm extending across said other end of the bottle to cooperate with said second stopper to seal off said receptacle; and means extending from said second stopper into contact with said diaphragm to permit said second stopper to be forced out of said opening into the interior of the bottle by manual pressure inward on the diaphragm thereby to permit intermixture of material in

the bottle and material in the receptacle under sealed conditions.

17. A device as set forth in claim 16 which includes a cap member to removably embrace said other end of the bottle to protect said diaphragm and to provide a base for the bottle.

18. In a device of the character described, the combination of: a container having a re-entrant end wall forming an outer receptacle, said wall having an aperture for communication with the interior of the container; an elastic diaphragm member extending across said receptacle to seal the receptacle from the exterior of the container; a stopper in said aperture to cut off said receptacle from the interior of the container; and means extending from said stopper to said diaphragm centrally of the diaphragm to permit external pressure against the diaphragm to force said stopper out of said aperture into the interior of the container, said diaphragm having a marginal portion embracing the end of the container under circumferential tension to yield out of contact with container for the release of air when depression of the diaphragm reduces the enclosed volume of the container but to prevent the ingress of fluid into the container.

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