United States Patent [19]

Allet-Coche

[11] **3,809,225**

[45] **May 7, 1974**

[54] **CONTAINERS**

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[21] Appl. No.: **33,780**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 703,422, Feb. 6, 1968, abandoned.

[30] **Foreign Application Priority Data**

May 2, 1969 France 69.14008

[52] **U.S. Cl.** **206/220,** 128/272, 206/63.5, 215/6

[51] **Int. Cl.** **B65d 81/32,** A61b 19/02

[58] **Field of Search** ..... 206/47 A, 63.5; 215/6; 128/272, 218

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[57] **ABSTRACT**

Small reusable containers with two compartments for storing, transporting and intermixing pre-proportioned substances such as a metallic powder and mercury used in making a dental amalgam, provided with a displaceable disk-shaped partition between the compartments to prevent intermingling of the substances during storage and transportation but which, when displaced by way of a pusher, and with the intermingling of the substances, acts as a pestle in aiding trituration of the substances into the dental amalgam.

16 Claims, 9 Drawing Figures

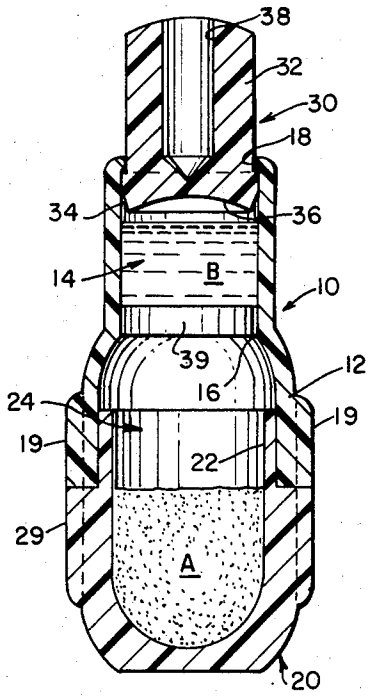


FIG. 1

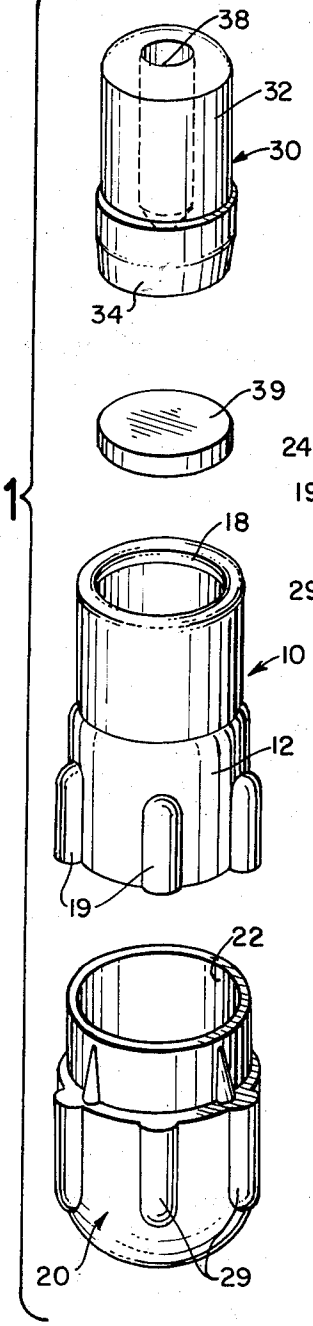


FIG. 2

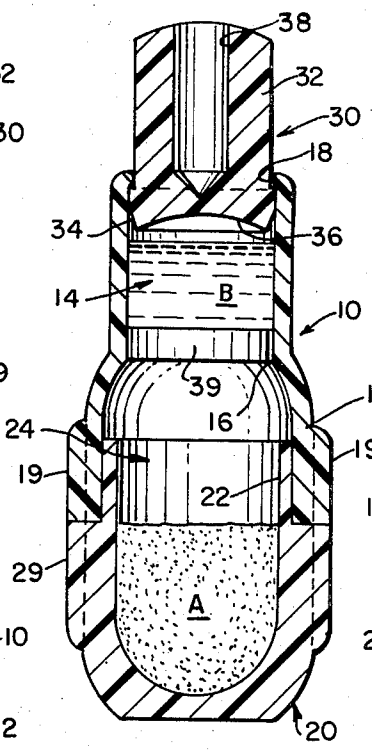


FIG. 3

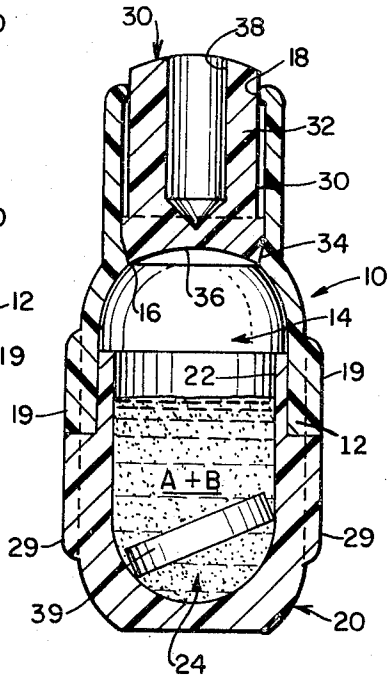


FIG. 4a

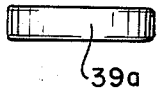


FIG. 4b

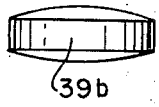


FIG. 4c

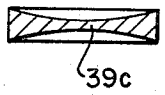


FIG. 4d

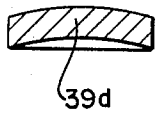


FIG. 4e

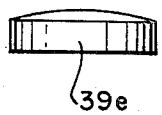
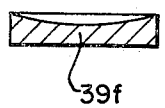


FIG. 4f



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CONTAINERS

This application is a continuation-in-part of the copending application Ser. No. 703,422, filed Feb. 6, 1968, entitled "Containers", now abandoned.

The invention relates to small containers with multiple compartments, preferably for storing, transporting and eventually triturating or intermixing the substances separately contained in the compartments.

Containers are known which provide separate compartments or spaces for the conditioning of preproportioned substances stored therein. One of the compartments may, for example, hold a metallic powder while the other may hold mercury in readiness to be stored or mixed with the powder to produce a dental amalgam. The filled compartments are separated by a partition or valve adapted to be operated from outside for the eventual mixing of the substances.

Devices used heretofore in this field did not give satisfaction because they did not provide all the practical requisites for such containers, with respect particularly to the conditions of filling, the seal integrity between the compartments, and the desired simplicity of the operational steps to be performed by the user, especially when preparing amalgams used for dental purposes.

During the operational phase of triturating the substances, it is essential that such devices be adapted to allow the use of a pestle-like member within the mass of the intermingled substances. The action of the pestle, in cooperation with, for example, a simple shaking movement of the containers, is intended to assure an intimate mixing such that a good consistency or homogeneity of the derivative substances is imparted to the finished amalgam.

Pestles heretofore used in containers of the type described above had cylindrical, rod or ball forms, and the time sufficient to intermix the amalgam by means of a vibrator with these kinds of pestles has ranged in the order of from 8 to 12 seconds, depending on the pestle weight.

It is also desirable that the operational phase toward finishing the amalgam product be performed quickly and efficiently, the time element being particularly significant in dental or prosthetic uses and techniques. In this respect, the pestle action and hence the character of the pestle itself is a factor of importance.

An object of the present invention is to provide an improved container with more effective pestle action during the shaking period, such that the finished amalgam product will exhibit a high degree of consistency or homogeneity of its derivative substances.

Another object of the invention is to provide an improved container having a pestle of greater mobility then heretofore obtained to effectively reduce the intermix times relatively to quantities of substances used.

A further object is to provide an improved container with a partition closure member which will assure a tight seal between the compartments when separate substances are contained in the latter during storing and transportation.

To these ends, the present invention provides, according to one of its important features, an improved container having a pestle or partition of the character described in the novel form of a flat planar disk, although such disk may display variations in profile including, for example, biconvex, biconcave or concavo-convex specimens.

These novel disks may preferably be made of a substantially rigid material, such as metal, or alternatively of a less rigid or even resiliently plastic material; they may have a thickness of several millimeters and their edges can also be rounded.

Containers as disclosed in the afore-mentioned copending application and patent are characterized by certain features and provisions which, taken either separately or in combination, may be adapted to the present exemplary embodiment of an improved container which uses the disk-shaped partition or pestle.

As so adapted or modified, the major pre-disclosed features and provisions are:

1. The containers comprise two compartments separated by a movable partition caught elastically between adjoining walls, and being adapted to be expelled by itself into one of the compartments, by the action of a pusher which is slidable in the end of the container opposite to the other compartment.

2. One of the compartments may receive the partition, acting in fact as a pestle, for intimately mixing the two substances contained in the compartments.

3. The compartment into which is expelled the partition can be separated in two portions, fitting one on the other, either by sliding action or by conventional thread engagement.

4. The pusher is preferably constituted by the stem of a piston which traverses the wall of the compartment in which it slides, by way of an opening having a diameter sufficiently close to that of said compartment so that the pusher can be inserted in place, owing to the elasticity of its material or the wall surrounding it, by simple pressure.

As has been mentioned before, the improved containers according to the present invention have disk-shaped partitions or pestles, in conjunction with the just described features of the earlier invention.

According to certain other important features as earlier disclosed, the improved containers are constituted by two separable and interconnectable sections, each defining therein a compartment adapted to receive a particular substance. The disk-shaped partition in said sections between an initial or closing position, when in releasable frictional engagement with the upper container section, and a final or mixing position, when loosely contained within the lower container section.

According to further important features, a passage is provided in the upper section, leading from the upper compartment to the outside, and a pusher member insertable in said passage and sealingly slidable therein toward the partition so as to unseat the same by pressure exerted by the intermediary of the upper compartment and the substance therein.

When said partition is moved from its closing position to the mixing position, upon actuation of the pusher member, the substances are placed in communication, allowing intimate intermixing thereof in the lower compartment alone, by shaking the container, the partition or disk assisting the intermixing on account of its special shape.

The upper container section may have one or more locking portions, in the form of annular grooves, ribs or spurs, adapted frictionally to hold the partition or disk in its closing position.

While, as stated, the disk is made preferably of a rigid material, the container sections are made of a relatively resilient and elastic material, such as plastic. The plastic container sections may have portions adapted for threaded or sliding interengagement therebetween. At least one of the sections may be provided with preferably outer reinforcing portions for preventing collapsing and crushing of at least the lower compartment, particularly during transportation.

According to further features of the inventive improved containers, the pusher means may be provided with a head portion adapted to obturate the mouth of the lower compartment when the pusher is forced or pushed into the upper container section. The head portion may have a concave lower face, e.g., for complementary engagement with the outer surface of the disk constituting the partition.

Yet another feature relates to the expedient that the upper compartment is narrower than the lower compartment and has a smaller inner volume. The metallic powder used for making the dental amalgams has a smaller volume than the mercury with which it is intermixed in the larger lower compartment. The latter consequently has to be adapted to receive the volume of both initially introduced substances.

The inner diameter of the upper compartment is preferably the same or similar to the outer diameter of the pusher member and/or disk serving as a partition and pestle.

Other objects, features and many of the attendant advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description, when considered with the accompanying drawing, wherein

FIG. **1** is an exploded perspective view of a preferred embodiment of the inventive improved containers;

FIG. **2** is a vertical, axial sectional view of the container of FIG. **1**, after both substances have been filled in;

FIG. **3** is a view similar to that of FIG. **2** but after mixing of the substances once the pusher has been pushed in and the disk dropped into the lower compartment; and

FIGS. *4a* through *4f* are side elevations, some sectional, of various disk-shaped partitions that can be used in the improved containers, illustrating a range of variations or profiles thereof.

Referring to FIGS. **1** through **3**, the exemplary embodiment of the improved containers comprises an upper section **10**, a lower section **20** and a pusher member **30** insertable in the open top of the upper section **10**, as can be seen from the assembled view of FIGS. **2** and **3**. The two sections can be slidingly engaged, in a liquid-tight manner, by way of respective sleeve-like terminal portions **12** and **22** which allow a close fit of the sections **10** and **20**.

Upper compartment **14** is formed within section **10**, and lower compartment **24** in section **20**, as shown in FIG. **2**. Between the compartments, a disk-shaped partition or valve member **39** can be frictionally seated, for example in an annular groove **16** of the upper section **10**. Inwardly projecting spurs **18** or a continuous ridge serve for tightly surrounding the pusher member **30** in the free end of the upper section **10**.

Preferably, the sections **10, 20** may be provided with outer ribs or reinforcing portions as shown in FIG. **1** at **19** and **29** for lending rigidity to the container, particularly in the area of the lower compartment **24**.

The pusher member **30** has an upper portion **32** which is manually operable, and a lower portion **34** which may constitute an enlarged head, as shown. Preferably, but not necessarily, the lower face of the pusher **30** may be made concave, as shown at **36**, so as to complement the shape of the disk partition **39** and obturate the lower compartment **24** when completely pushed into the upper container section **10**, as shown in FIG. **3**. For manufacturing purposes, the pusher **30** may have an axial bore **38** in its top, primarily for saving material, although this expedient does not appreciably affect the operation of the container.

The filling of the device shown in FIGS. **1** to **3** can be accomplished as follows: one starts with the assembled container, that is sections **10, 20** which are interconnected with a sliding fit, as shown, or by a thread (not illustrated). The disk **39** and the pusher **30** are not yet in place so that the compartments **14, 24** directly communicate with the outside by way of the passage or opening of upper section **10** (below the ridge or spurs **18**). One pours into the lower compartment **24** that is, into the lower section **20**, the desired amount of the first substance which is identified by letter A. Hereafter one inserts in place the disk **39** by forcing it into the compartment **14**, for example by means of a mandrel, stem or similar conventional tool. Owing to the elasticity of the material (either of the disk or of the container section in question), the disk **39** will first pass the ridge at **18** and then take its place in the groove **16**. Thus, the disk constitutes a leak-tight partition which separates the two compartments **14** and **24**.

Subsequently one pours into the upper compartment **14**, which is still open from the top, the desired quantity of the second substance B. All that remains now is to insert the pusher **30** past the ridge **18**, which will then occupy the position shown in FIG. **2**. The container is now charged and is ready for transportation or storage. It should be noted that the operation was carried out without any disassemblage of the sections **10, 20**, simply by way of the passage or opening leading to the outside from the upper compartment **14**.

The filling can of course also be carried out by separating the sections **10, 20**, the disk **39** being then set in its place, as shown in FIG **2**, e.g., in its seat **16**. The substance A is now introduced into the lower section **20**, the sections **10, 20** are assembled, and the filling operation continues as has been explained before.

For discharging the substances, or their mixture, from the container, subsequent to transportation or storage, it is sufficient to exert a pressure sufficient for the pusher **30** to move the disk **39** by direct or indirect action, whereby the latter is made to fall into the lower compartment **24**. It will be clear from FIG. **3** that the pusher **30** remains in engagement with the upper part of section **10** while only the disk **39** falls into the lower compartment **24**. It will be understood that hydrostatic pressure plays a certain role in this pushing operation, by way of the substance A contained in the upper compartment **14**.

The partition which was previously constituted by the disk **39**, and which separated the two compartments, is thus abolished so that the substance B is allowed to drop and mingle with the substance A in the lower compartment **24**.

When one continues to move the pusher member **30** inward, it will take the position as shown in FIG. **3,** its base or lower face **36** abutting against the annular groove **16** so that the compartment **24** is now closed again in a hermetic manner.

The container may now be vigorously shaken to bring about and assure the intimate mixing of the substances A and B. As has been mentioned before, A may be a metallic powder while B may be mercury, the mixing action resulting in an amalgam, suitable e.g., for dental purposes. The special shape, including the planar or curved surfaces as well as the edges, of the disk **39** efficiently assists in the thorough intermixing or trituration of the substances.

When the shaking and mixing is terminated, the sections **10, 20** of the container may be separated so that the user can easily discharge the mixture or amalgam, which is now contained in the open lower compartment **24,** in section **20.** It will be clear from the preceding description that the inventive containers do not have any puncturable or breakable parts and thus can be used over and over again if this should be economically desirable.

FIGS. **4***a* through **4***f* illustrate various shapes and profiles of partition means, in the form of disks **39***a* to **39***f*, the illustration of FIG. **4***a* being substantially identical with that of FIGS. **1** through **3.** It will be seen that the disk-shaped partitions **39***a* to **39***f* may have one or two planar surfaces, and one or two concave and/or convex surfaces, found to be most efficient in the speedy and efficient trituration of the substances.

The disks **39***b*, **39***d* and **39***e* have the previously described convex surface which can cooperate with the concave lower surface **36** of the pusher **30** while the disks **39***c*, **39***d* and **39***f* display a concave surface which actually increases the inner volume of the upper compartment **14** without alteration of the physical dimensions of the container.

The various disks are of course interchangeable and selectively usable in the improved containers as long as their diameters are identical and correspond to the appropriate inner diameter of the seating surface in the upper section **10** (e.g., at the described annular groove **16**).

The arrangement might also be reversed so that the lower surface of the pusher **30** is made convex (not shown), to complement the upper surface of one of the disks **39***c*, **39***d* and **39***f* when properly inserted in the container.

It will be seen that, in the shaking and mixing described above, the disk **39** exerts a pestle force by actively aiding in the intermixing of the substances. It has been observed through experiments that the trituration or intermixing of substances with the use of a disk is more efficacious than intermixing conducted with prior-art pestles including the ball-shaped type described in the own afore-mentioned invention. Moreover, the consistency and quality of an amalgam produced through trituration with a disk-shaped pestle have been found to be very much improved.

The experiments tend to confirm that the superior mixing action afforded by disk-type pestles as compared to previous types derives from their flat shape and increased mobility during the shaking or vibrator phase. In this sense, it has been observed that vibrators upon which the containers are placed subject the latter to motions uniformly helocoidal in character. During this movement of the containers, the disk pestles' high mobility permits a double action of their own: first, a satellite helicoidal motion pattern of the disk within the mixing compartment of the container, and, secondly, an almost simultaneous larger rotary motion pattern in a more conventional sense. This double action of the disk results in a more thorough and intimate mixing of the substances than is possible with pestles of other shapes.

Disks, though of lighter weight than ball- or cylinder-type pestles of like material or composition, have nonetheless shown to require a much shorter trituration time in realizing a better quality amalgam. Thus, the critical factor in the intermixing process, where amalgam - completion times are evaluated, would seem to reside not in the weight of the pestle but in its mobility. This phenomenon, not explored to its fullest extent, may have to do with the alternating plane surfaces, edges and curved envelope portions of the disks, as compared to ball or cylinders which have predominantly smooth, uninterrupted spherical areas.

The following examples serve to illustrate the superiority of the disk pestle over the ball type.

EXAMPLE 1

This Example illustrates a comparison between the intermix times required by a ball and by a disk of the same weight and using the same quantities of amalgam substances. Results were obtained as follows: both the ball and the disk had a diameter of **8** millimeters, the former was of a plastic substance while the latter was made of a material commercially known under the trade name of "Teflon". The disk had a thickness of 3.5 mm. The respective weights were about the same, namely 0.37 grams for the ball and 0.38 grams for the disk.

Nevertheless, the intermix time with the ball was 13 seconds while the disk performed the same intermixing or triturating action within 10.5 seconds. It is thus established that, with pestles of equal weight, the intermix times for the disk type are clearly better than those of the ball type.

EXAMPLE 2

This Example repeated the just described Example 1 with the same pestles but using double the quantity of amalgam substances appportioned equally to the pestles. The physical characteristics were described in Example 1, while the intermix times proved to be **15** seconds for the ball and 11 seconds for the disk.

It is established, upon evaluating the foregoing two Examples, that augmenting the mass to be intermixed has very little effect on the disk's intermix time: one-half second at most, whereas the intermix time performance of the ball was extended by two seconds.

EXAMPLE 3

This Example consists of a comparison between the intermix times required by two disks of differing weight, using the same quantity of amalgam substance. Two disks of 8 mm dia. and 3.5 mm thickness have been used, one being made of the afore-mentioned "Teflon" material, weighing 0.38 g, while the other was made of plexiglass, weighing 0.2 g. The intermix times were 10.5 and 11 seconds, respectively, for the "Teflon" and the plexiglass disks. This confirms that the

pestle weight is a relatively negligible factor in the intermixing of amalgams with the use of disks.

Of added significance is the discovery, in experiments such as the above, that disk intermixing of an amalgam reduces frictional heating of the amalgam to a minimum and thereby enhances the quality of the finished product.

It will not require further explanation that a ball within the mixture exhibits a rotating or rolling action, when the container is shaken or vibrated, involving substantial friction between the contacting surfaces (ball and substances), while a disk, when the container is shaken, actually performs a paddle-like action, involving only minimum friction but resulting in a thorough intermixing or trituration of the substances.

It is evident from the above Examples that disk-pestle intermixing of dental amalgams produces excellent results as much for promoting an improved consistency in the amalgam product as for obtaining quicker intermix performance times.

Additional experiments, having as their primary object the acceleration of the triturating process during the shaking or vibrator phase, have shown that with a disk pestle made of plastic and of a thickness of several millimeters it is possible to realize an excellent quality amalgam within time ranges of the order of 6 to 8 seconds.

With other types of pestles, such as cylindrical, rod or ball forms, the amalgam completion times are known to consume 8 to 12 seconds, depending on the pestle weight.

These experiments tend to prove, as may also be conconcluded from Example 3, supra, that the critical factor in the performance time of a trituration process is not in the weight of the pestle member but in its mobility. The superiority of the disk pestle, because of its high mobility, is thus apparent.

In its use as the partition or valve member during storing and/or transportation of the substances prior to mixing, the disk can be made to assure an even tighter and virtually leak-proof seal between the compartments as by locating the annular groove not in the upper section but more precisely at the level of the juncture of the two compartments, whereby the disk will be frictionally held more firmly.

The present invention as it relates to a method of trituration by agitation with the use of a disk pestle is not limited to amalgams but is applicable as well to the intermixing of all chemical products where an intimate mixture is desired.

In the illustrated embodiment, the pusher member has been shown to be substantially cylindrical. It will be understood that it could be given any other configuration, complementing the inner passage of the upper container section, as long as a sliding fit can be assured, with a leak-proof engagement when the pusher member is completely pushed in.

The container sections themselves need not be cylindrical, as shown, although this is the easiest manner of manufacturing them, particularly from a plastic material. A rectangular, octagonal or other cross section would work equally well for the inventive improved containers.

It should be understood, of course, that the foregoing disclosure relates only to a preferred, exemplary embodiment of the inventive improved containers, and that it is intended to cover all changes and modifications of the example described which do not constitute departures from the spirit and scope of the invention.

In particular, the above-mentioned earlier own application and patent describes certain modifications with reference to FIGS. 4 to 8 thereof, which are fully compatible and could be used with the disk-type pestle of the present invention.

What I claim is:

1. A plural-chamber admixing container comprising a sectional container body forming a first chamber, one section having a reduced neck bore extending therefrom and open at the end thereof, a movable disk whose thickness is less than any other overall dimension thereof frictionally removably retained in and closing said neck bore at the entrance of the first chamber, said disk being smaller than and fully freely movable in tumbling mix-assisting fashion within said first chamber upon removal from said neck bore, a plug slidably mounted in said neck bore's open end and frictionally engaging the wall of said reduced neck bore in externally sealing relation, said plug being physically separate and spaced at all points from said disk forming a second chamber peripherally bounded by said reduced neck bore, the effective front surface of said plug and the effective rear surface of said disk, and manually manipulable means integral with said plug and protruding externally from said reduced neck bore for moving said plug along said reduced neck bore, a first admixable material disposed within said second chamber and forming an axial force transmission means between said plug and said disk, a second admixable material disposed within said first chamber for admixing with said material within said second chamber upon dislodgement of said disk into said first chamber, the inner face of said plug being movable substantially to the juncture zone between said neck bore and said first chamber during dislodgement of said disk to effectively form a single chamber bounded by the walls of said first chamber and the effective inner forward face of said plug for admixing of said materials after dislodgement of said disk into said first chamber, said disk assisting in the admixing on account of its mass and configuration.

2. The container as defined in claim **1**, wherein said one section includes a locking portion for said disk, formed by at least one annular groove in its inner wall, and one of said disk and said groove is of a resilient material yielding when in frictional engagement with the other.

3. The container as defined in claim **1**, wherein said disk is made of a substantially rigid material, at least said one section of said body being made of a resilient plastic material.

4. The container as defined in claim **1**, wherein said plug has a head portion adapted to obturate the mouth of said second chamber when said pusher means is pushed into said neck bore, and wherein the length of said plug substantially corresponds to that of the portion of said neck bore which forms said second chamber, preventing manual removal of said plug from said neck bore once it has been completely pushed in and said mouth of the first chamber is obturated.

5. The container as defined in claim **1**, wherein said plug has a head portion adapted to obturate the mouth of said first chamber when said plug is pushed into said neck bore, and wherein said head portion has a con-

cave lower face adapted to engage a substantially complementary convex upper face of said disk means.

6. The container as defined in claim **1,** wherein at least one of said sections of said body includes means for slidingly and frictionally interconnecting the same with the other section.

7. The container as defined in claim **6,** wherein said interconnecting means is provided in the area of said first compartment, in the form of sleeve portions constituted by the adjoining ends of said sections, and allowing introduction and removal of one of the substances into said first compartment irrespective of the provision of said disk and said pusher means in said upper section.

8. A container for storing, transporting and intermixing pre-proportioned substances comprising a body having a first portion including a closed end defining a part of a mixing chamber for holding a first admixable substance and a second portion having an inner wall substantially free from indentations or protuberances defining a material containing chamber for communicating with said mixing chamber for holding a second admixable substance, a disk partition means having a thickness smaller than any other overall dimension and a diameter smaller than the inner diameter of the mixing chamber held in a friction fit by the inner wall of one of said sections at the junction of said chambers and movable in said sections between an initial or closing position separating said chambers and a final or mixing position loosely contained within said mixing chamber, pusher means slidably positioned in said material containing chamber with the outer periphery of its inner end in sliding and sealing engagement with the wall thereof, said pusher means being movable from an initial position through the entire length of said material containing chamber to a final position with its inner end positioned substantially at said junction of said chambers for positively forcing said disk partition means and clearing the entire contents of said material containing chamber into said mixing chamber, the lower end of said pusher means when in said final position and subsequently sealing the upper end of said mixing chamber to allow intermixing in said mixing chamber of the admixable substances originally in said chambers by the shaking of said container with the disk partition means aiding in the mixing on account of its mass and configuration.

9. A container as in claim **8,** wherein said disk has substantially planar upper and lower surfaces.

10. A container as in claim **8,** wherein said disk has generally convex upper and lower faces.

11. A container as in claim **8,** wherein said disk has generally concave upper and lower faces.

12. A container as in claim **8,** wherein one face of the disk is generally concave and the other face is generally convex.

13. A container as in claim **8,** wherein one face of the disk is generally concave and the other face is generally flat.

14. A container as in claim **8,** wherein one face of the disk is generally convex and the other face is generally flat.

15. A container as in claim **8,** wherein the opposing faces of the first portion of said pusher means and said disk are generally complementary.

16. A container as in claim **15,** wherein said face of said pusher means is generally concave and said opposing face of said disk is generally convex.

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