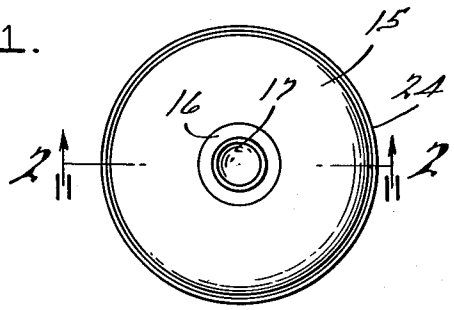
Aug. 6, 1963 W. F. VIA, JR 3,100,045

MIXING CONTAINERS

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Fig. 1.



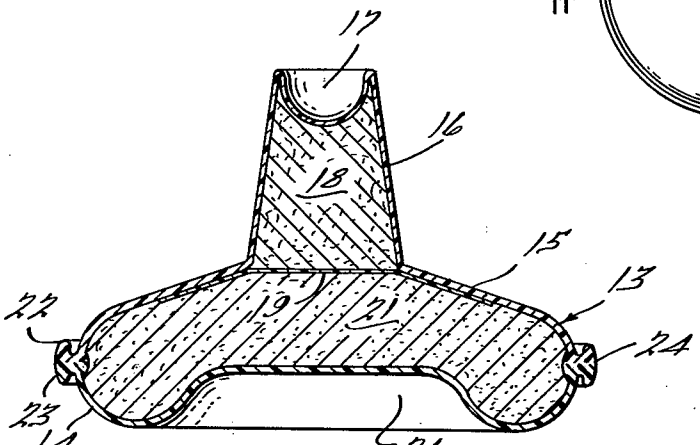
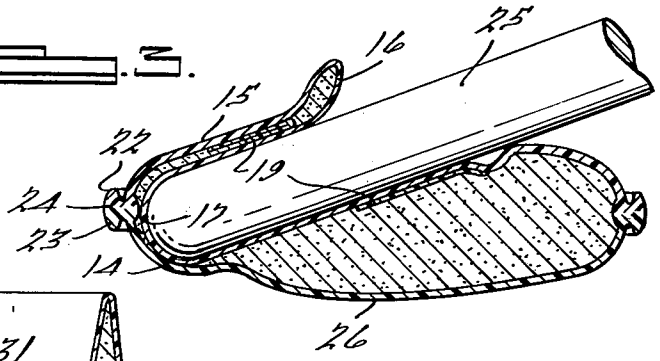


Fig. 2.

Fig. 3.



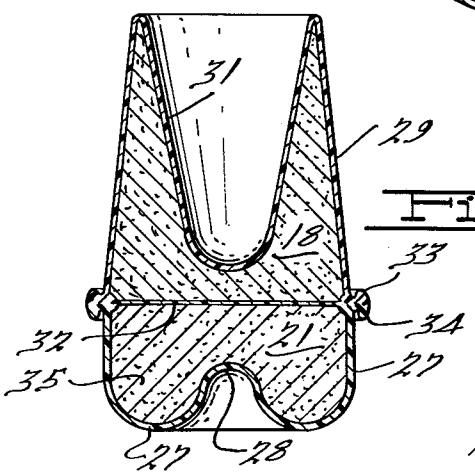


Fig. 4.

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MIXING CONTAINERS

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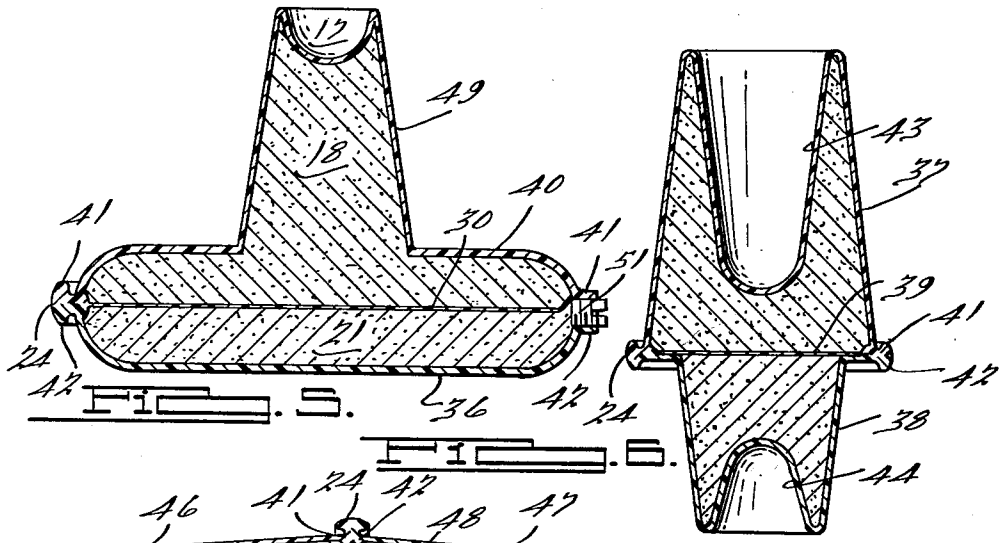


FIG. 5.

FIG. 6.

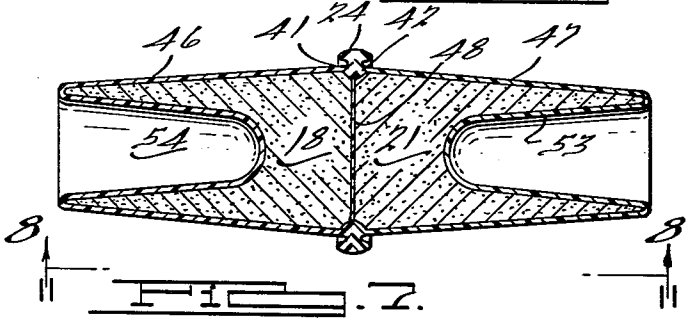


FIG. 7.

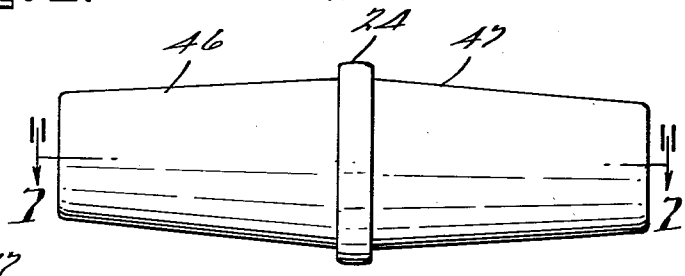


FIG. 8.

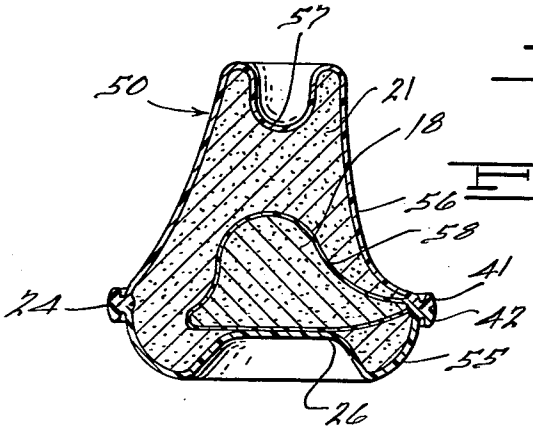


FIG. 9.

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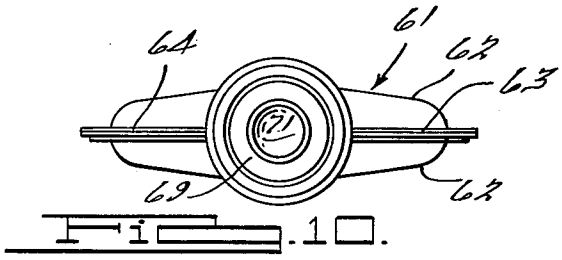


FIG. 10.

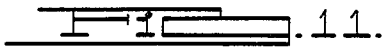
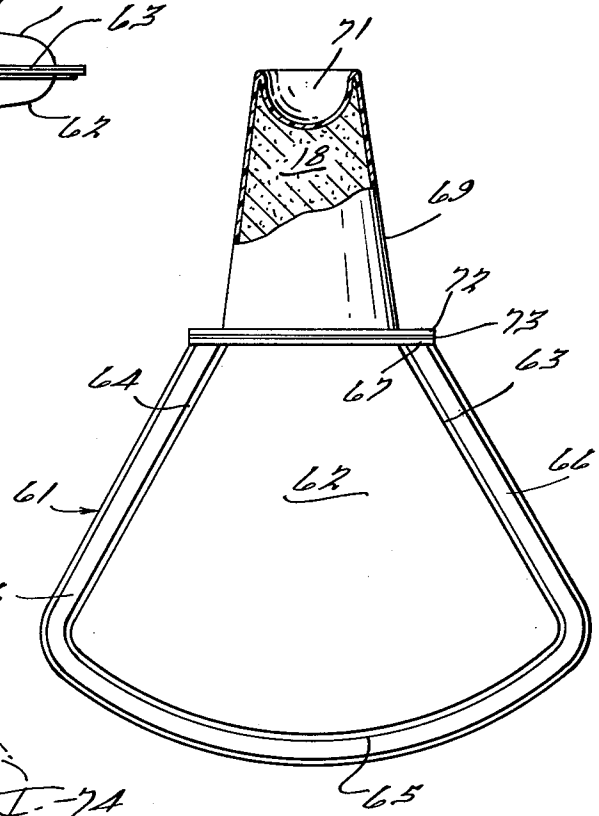


FIG. 11.



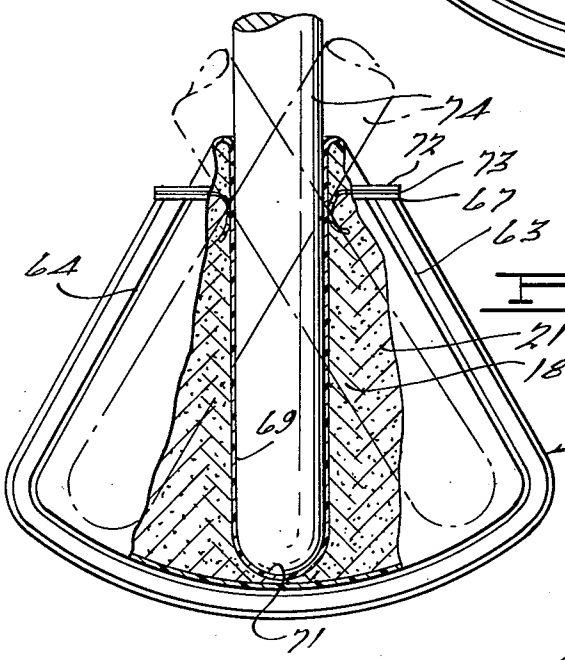


FIG. 12.

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MIXING CONTAINERS

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Filed June 12, 1961, Ser. No. 116,333
18 Claims. (Cl. 206—47)

This invention relates to containers for materials, and particularly to a container for separating two materials until mixed therewithin while the container is maintained sealed.

Many types of materials must be maintained separated until time for use when they are mixed together. Such materials may be epoxy resins, dental impression materials and the like which are difficult to proportion and mix satisfactorily. In dental impression materials, as an example, the two materials to be mixed are stored in separate compartments of a container and are mixed therein without rupturing the container wall so that the mixing is accomplished in the absence of air. There are several types of dental impression materials, among which are a rubber base material, a silicon base material, and a material embodying zinc oxide and eugenol. Such materials are in heavy paste form and embody a base material and an accelerator which must be mixed together just prior to use. This is also true of epoxy resins wherein the two materials are maintained separated until the time of use, when they are mixed together in exact proportion within the container. Such materials are presently furnished in collapsible tubes in cans, jars and like containers. With dental impression and other materials, it is necessary to measure out the correct proportion of the accelerator and base materials onto a glass slab, a paper pad or the like, and combine the two materials by the use of a spatula or other implement. Because the materials are heavy paste, it is difficult to determine the correct proportion and even more diffcult to mix them properly to be assured that a complete mixture is obtained. Such materials are usually malodorous, extremely sticky, difficult to remove from the skin, the glass slab and the mixing tool, and are in general very messy to mix, handle and use.

The present invention embodies a single container having separate compartments for the accelerator and the base materials. The container is so constructed as to permit the materials to be mixed together therein at the time needed, with no residue left on any object or person which would require cleaning, as the container is disposable.

The container takes various forms, all of which embody separate compartments which are joined together, with a rupturable diaphragm therebetween which separates the two materials. At least one of the compartments has a flexible, invertible wall which permits a rod to be inserted thereinto to break the diaphragm and then to mix the materials in the enclosed area without rupturing the outer wall of the container. The odors of the materials are confined within the container and the air is prevented from contaminating the materials until the two materials have been completely mixed. Thereafter, a portion of the material of the container may be severed or a plug removed so that the mixture may be ejected from the container directly into the area to which it is to be applied, into a syringe, or othewise disposed of without touching a surface or the skin of a person which would require cleaning.

Accordingly, the main objects of the invention are: to provide a container having separate compartments for materials which are to be mixed together at the time of use, one of the compartments having a flexible wall which permits a rod to be manipulated within the container to mix the materials; to provide a thin wall between two

compartments of a container which is ruptured by a rod that is manipulated within the container through an inverted flexible wall for mixing the material while the container remains sealed, and, in general, to provide a container for mixing two materials together which is simple in construction and economical of manufacture.

Other objects and features of novelty of the invention will be specifically pointed out or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a plan view of a container embodying features of the present invention;

FIG. 2 is an enlarged sectional view of the structure illustrated in FIG. 1, taken on the line 2—2 thereof;

FIG. 3 is a view of the structure illustrated in FIG. 2, with a rod in position for mixing two contained materials together;

FIG. 4 is a view of structure, similar to that illustrated in FIG. 2, showing a further form of the invention;

FIG. 5 is a view of structure, similar to that illustrated in FIG. 4, showing another form which the invention may assume;

FIG. 6 is a view of structure, similar to that illustrated in FIG. 4, showing still another form of the invention;

FIG. 7 is a sectional view of the structure illustrated in FIG. 8, taken on the line 7—7 thereof;

FIG. 8 is a view in elevation of the structure illustrated in FIG. 7, taken from the line 8—8 thereof;

FIG. 9 is a view of structure, similar to that illustrated in FIG. 5, showing a further form of the invention;

FIG. 10 is a plan view of structure, similar to that illustrated in FIG. 1, showing a still further form of the invention;

FIG. 11 is an enlarged broken view in elevation of the structure illustrated in FIG. 10, and

FIG. 12 is a broken sectional view of the structure illustrated in FIG. 11, showing the manipulation of a rod for mixing the material within the container.

In FIGS. 1 to 3, inclusive, a container 13 is illustrated made from a plastic material, such as polyethylene, polypropylene, or other readily sealable resins known in the art to be suitable. The container has a dish-shaped bottom portion 14 and an inverted dish-shaped top portion 15. The top portion 15 has an extended truncated conical portion 16 of thin wall construction to provide flexibility thereto, with the rounded end 17 inverted as illustrated in the figure. After the material 18 has been placed within the truncated conical portion 16, a thin rupturable diaphragm 19 is heat sealed or otherwise secured to the inner side of the top portion 15 to seal the material 18 within the truncated conical portion. Material 21 is placed within the dish-shaped portions 14 and 15 and the outwardly extended flanges 22 and 23 thereof are sealed together. If a heat seal is employed, the material of the flanges is pressed together inwardly of the projecting rib 24 to thoroughly intermingle the material thereof. It is within the purview of the invention to heat seal a greater portion of the flanges together and leave approximately one-third open for the passage of the material 21 into the dish-shaped portions, after which the unsealed flange portions are sealed together.

When it is desired to mix the materials 18 and 21 at the time they are to be used, a rod or similar implement 25 is engaged with the inverted end portions 17 and forced downwardly into the flexible conical portion 16 until the diaphragm 19 is engaged and ruptured, as illustrated in FIG. 3. Thereafter, the rod and inverted conical portion 16 are forced within the dish-shaped portions 14 and 15 adjacent to the sealed flanges 22 and 23 thereof. Relative rotation is provided therebetween, either

through the movement of the rod **25** when disposed in angular position within the compartment formed by the dish-shaped elements **14** and **15**, or the latter may be rotated when the rod is retained stationary. The dish-shaped element **14** has the bottom **26** inverted to extend within the compartment to reduce the volume thereof. When the rod **25** is inserted in the conical portion and the compartment, the inverted portion **26** bulges outwardly, as illustrated in FIG. 3, to permit all of the material and the rod to occupy the entire area thereof. The two materials **18** and **21** are thoroughly mixed together in the absence of air and without the emission of objectionable odors when kneaded between the container walls by the rod. When the two materials are thoroughly mixed, the rod **25** is withdrawn and pressure is applied to the dish-shaped element **14** to force the flexible conical portion **16** outwardly to asume the position illustrated in FIG. 2. Thereafter, the end **17** is severed and the material forced from the container in condition to be immediately used. In such arrangement, the mixed material does not contact the rod **25** or any other surface, and the difficult cleaning job which accompanies the mixing of some materials is thereby eliminated.

In FIG. 4, a somewhat similar structure is illustrated, that wherein the dish-shaped bottom element **27** has a central inwardly projecting dome portion **28** and the flexible conical element **29** has the end portion **31** inverted therein to be disposed closely adjacent to a rupturable diaphragm **32**. The diaphragm separates the conical portion from the dish portion when secured between the two flange portions **33** and **34** by heat sealing or other means. In this arrangement, when the rod **25** is inserted in the inverted end portion **31**, a downward movement will cause the diaphragm **32** to be broken, and by the revolution of the end of the rod in the doughnut-shaped recess **35** about the inverted dome portion **28** within the dish-shaped element **27**, the materials are thoroughly mixed. Thereafter, pressure on the dish-shaped element **27** will cause the inverted portion **31** to be moved to the position illustrated in FIG. 4 or to a fully extended position so that the end may be severed and the material expressed from the container. The materials **18** and **21** within the two compartments are mixed without the presence of air or the emission of odors.

In FIG. 5, a container is illustrated formed of oppositely facing dish-shaped elements **36** and **40** which are joined together by the flanges **41** and **42** which are heat sealed or otherwise secured together and to a rupturable diaphragm **30** after the material **18** and **21** has been placed therein. A flexible conical portion **49** extends from the center of the element **40**, having an inverted end portion **17**. The sealed flanges **41** and **42** have a plug **51** removably disposed within a cylindrical aperture of the flange material disposed about the plug. The plug may have a thread thereon which prevents it from being forced from the container when the material is being mixed under pressure therein. A slot or other means may be provided on the exposed end of the plug for aiding in its removal. The mixed material is forced from the aperture when the plug is removed by pressure applied to the walls of the container. The bottom element **36** may have an inverted portion, such as portion **26** of FIG. 2, which bulges outwardly during the mixing operation.

In FIG. 6, a container is illustrated having portions **37** and **38** of truncated conical shape separated by a diaphragm **39** which is disposed between the flanges **41** and **42** and sealed therewith during the sealing and deforming operations on the flanges. The diameter of the container **38** is less than that of the container **37**, the latter having an inverted conical portion **43** and the former an inverted conical portion **44**. A mixing rod may be employed in one or the other of the inverted conical portions **43** and **44** or may be employed in both to break the diaphragm **39** and mix the material by having the two rods orbit about each other without breaking the wall of the

container, in the absence of air and without any odors from the materials during the mixing operation. One of the conical elements **37** or **38** may have pressure applied thereto, causing one or the other inverted portions **43** and **44** to be extended so that the end may be severed and the material ejected therefrom.

In FIG. 7 a similar structure is illustrated wherein like conical elements **46** and **47** have the material **18** and **21** thereof separated by a diaphragm **48** which is heat sealed between flanges **41** and **42** while the material of the flange is deformed to form the rib **24**. The conical elements **46** and **47** have the end portions inverted at **53** and **54** respectively. The inverted portions receive aligned stationary rods over which the container is reciprocated to first break the diaphragm **48** and thereafter to thoroughly mix the materials **18** and **21** within the container which is maintained sealed during the mixing operation. A machine may be employed to retain the rods or container stationary while the other is reciprocated to produce the mixing operation. One of the inverted ends **53** or **54** is extended and severed to expose the mixed material for use.

A still further form of the invention is illustrated in FIG. 9 wherein a container **50** has a dish-shaped element **55** mated with a truncated conical element **56** having inverted end portion **57**. A separate flexible element **58** has the material **18** therein and is surrounded by the material **21** in the chamber formed by the elements **55** and **56**. The open end of the element **58** is disposed between the flanges **41** and **42** and sealed thereto when the flanges are heat sealed or otherwise secured together. The element **55** has an inverted bottom portion **26** which bulges outwardly when the rod **25** is forced into the material **21** within the container **50**. The rod is inserted in the inverted end portion **57** of the truncated conical element **56** to rupture the element **58** and to mix the two materials through the interfacial rubbing of the material on the walls of the container in the absence of air and without the emanation of odors as pointed out hereinabove. After the materials are thoroughly mixed, pressure on the dish-shaped element **55** returns the conical element **56** to the position illustrated in the figure. Thereafter, the end portion **57** is severed and the material forced from the container by applying pressure thereto.

In FIG. 10, a still further form of the invention is illustrated, that wherein a compartment **61** is formed of two dish-shaped elements **62** having converging sides **63** and **64** and an arcuate bottom portion **65**. These two elements are sealed together by flanges **66** in the manner pointed out hereinabove, and an annular flange **67** is provided at the top of the assembled elements **62**. A conical-shaped flexible element **69** has an inverted end portion **71** and a flange **72** of the same diameter as the flange **67**. A diaphragm **73** separates the compartment **61** from that of the conical-shaped element **69** and is sealed between the two flanges **67** and **72** when the flanges are sealed together in the manner as pointed out hereinabove. The materials **18** and **21** within the compartments are separated by the diaphragm **73**. A rod **74** is inserted in the inverted portions **71** and forced down therein to rupture the diaphragm **73**. Through the oscillation of the rod within the compartment **61** from one side **64** to the other side **63**, and vice versa, along the arc of the bottom portion **65**, the material is thoroughly mixed. Thereafter, the end **71** of the element **69** is forced out into the position illustrated in FIG. 11 and severed to permit the mixed material to be expressed therefrom when the sides of the elements **63** are pressed together. It will be noted that the flanges **66** have been distorted when heated to have the material flow together so that a perfect joint will be obtained. This is also true of the flanges **72** and **67**, the offsetting of the material during the heat sealing operation causing the intermingling of the material of the two flanges and the diaphragm **73**.

In any of the devices herein illustrated, a container is employed having a plurality of compartments for retain-

ing a predetermined amount of different materials which are to be mixed together. The elements of the container are mated to have at least two compartments, although a third or any number of compartments may be employed by the use of more of the diaphragms, maintaining the materials separated until the diaphragms are broken by the mixing rod. The rod is inserted through one or more flexible compartments to break the diaphragms therebetween so that any number of materials may be mixed together while the container is maintained sealed. The thin wall of the conical-shaped compartment permits the rod to be manipulated within the container to mix the material without breaking the container wall. The mixing occurs in the container through the manipulation of the rod therein or by maintaining the rod stationary and rotating or oscillating the container thereabout. The relative movement between the container and the rod may be effected by a simple machine which will maintain the rod or container stationary when the other is manipulated. When employing any of the containers, a plurality of materials are mixed together at the time of use without the material contacting the mixing tool or surface on which the mixing occurs. The mixed material is directly applied to the work or to a syringe without contacting any tool, device, surface or the skin of a person and no clean-up time is required. The relative amount of the materials is critical and the containers permit the accurate measurement of the materials and the permanent sealing thereof. Some materials change in character when exposed to the air which occurs each time a jar is opened or at the time the materials are mixed together in the open.

The containers are preferably made of parts having different characteristics as to thickness, hardness and flexibility. Different materials may be employed for the various elements of the container so long as they are compatible and can be secured together. In FIGS. 1 to 3 the container **13** is made of the same material with the element **14** of a wall thickness of approximately .04 inch so as to have a considerable amount of rigidity since the mixing occurs therein. The element **15** may be .03 inch in thickness to have less rigidity, and the element **16** may have a wall thickness of approximately .02 inch. The rupturable diaphragm can be made of a brittle material but preferably is made of a stretchable plastic material having a thickness of approximately .01 inch so as to readily tear when distorted by the rod. The sizes above mentioned are by way of example and were taken from a container of a diameter illustrated in FIG. 1. It is to be understood that different wall thicknesses will be employed for larger and smaller containers.

It was found that a liquid and a powder or paste could be mixed in the same manner without loss through vaporization, spillage, absorption or for other reasons. A methyl methacrylate monomer mixed with a methyl methacrylate polymer is an example of dissimilar materials to be mixed within a container. In any mixing of materials the size of the rod and container must be such as to force the material to intermingle and rub under pressure on the wall surfaces which confine the material in such a manner as to cause it to move as a mass.

What is claimed is:

1. A container having a pair of compartments for containing dissimilar materials separated by a rupturable diaphragm, said material requiring a kneading action when mixed together, one of said compartments having a flexible wall to permit the insertion of a rod for breaking the diaphragm and permitting relative movement between the rod and container to produce the complete kneading and mixing of the materials with the container remaining sealed.

2. A container formed from a pair of facing dish-shaped elements having peripheral flanges, means sealing said flanges together, a sealed rupturable diaphragm secured within the container for separating it into two compartments, and a conical-shaped flexible wall forming an extension of one of the elements.

3. In a container for a measured amount of two materials to be mixed together at the time of use, a pair of elements forming compartments, at least one of said elements having an outwardly extending flexible wall containing a recess for a rod which mixes the material, and a rupturable diaphragm separating the two compartments and the materials therewithin.

4. In a container for a measured amount of two materials to be mixed together at the time of use, a pair of elements forming compartments, at least one of said elements having an outwardly extending flexible wall, a rupturable diaphragm separating the two compartments and the materials therewithin, and a rod insertable into the interior of the container by inverting the flexible wall for breaking the diaphragm and mixing the two materials together.

5. In a container, a compartment having spaced faces, converging sides and an inwardly extending arcuate bottom portion, a second compartment formed from a thin walled truncated conical element, and a rupturable diaphragm disposed between the compartments and sealed at the edges thereof.

6. In a container, a compartment having spaced faces, converging sides and an arcuate bottom portion, a second compartment formed from a thin walled conical element, a rupturable diaphragm disposed between the compartments and sealed at the edges thereof, the end of the conical element being inverted therewithin, and a rodlike element for forcing said end to break the diaphragm and mix the materials with the compartment retained sealed.

7. In a container, two conical-shaped portions having flanges at the open end forming compartments, and a rupturable diaphragm separating said compartments and sealed to the flanges when the flanges are sealed together, the material of the conical-shaped portions being flexible.

8. In a container, two conical-shaped portions having flanges at the open end forming compartments, and a rupturable diaphragm separating said compartments and sealed to the flanges when the flanges are sealed together, the material of the conical-shaped portions being flexible, the ends of said conical-shaped portions being inverted and extended into the larger end sections thereof.

9. In a container, two conical-shaped portions having flanges at the open end forming compartments, and a rupturable diaphragm separating said compartments and sealed to the flanges when the flanges are sealed together, the material of the conical-shaped portions being flexible, the ends of said conical-shaped portions being inverted and extended into the larger end sections thereof, the diameter of one of the conical-shaped portions at the flanged ends being larger than that of the other conical-shaped portion.

10. In a container for materials to be mixed together, a first dish-shaped element, a second dish-shaped element joined at the periphery to the first dish-shaped element, one of said dish-shaped elements having an inwardly extending central portion, the other of said dish-shaped elements having a conical extending portion made of thin flexible material, and a rupturable diaphragm separating the interior of the container into two compartments.

11. In a container for materials to be mixed together, a first dish-shaped element, a second dish-shaped element joined at the periphery to the first dish-shaped element, one of said dish-shaped elements having an inwardly extending central portion, the other of said dish-shaped elements having a conical extending portion made of thin flexible material, and a rupturable diaphragm separating the interior of the container into two compartments, the end of said conical extending portion being inverted to extend into the main body portion thereof.

12. In a container, a dish-shaped element having the central portion extending inwardly, a conical-shaped portion having a flexible wall joined to the dish-shaped portion at the periphery thereof, and a rupturable dia-

phragm separating the dish-shaped portion from the conical portion adjacent said junction therebetween.

13. In a container, a dish-shaped element having the central portion extending inwardly, a conical-shaped portion having a flexible wall joined to the dish-shaped portion at the periphery thereof, and a rupturable diaphragm separating the dish-shaped portion from the conical portion adjacent said junction therebetween, the outer section of said conical portion being inverted to extend into the larger end portion thereof.

14. In a container in which two dissimilar materials are to be mixed while retained sealed from the air, a dish-shaped element having a central inwardly directed portion, a flexible conical portion joined to the periphery of said dish-shaped portion, and a compartment of rupturable material within said joined portions sealed to the wall thereof.

15. In a container in which two dissimilar materials are to be mixed while retained sealed from the air, a dish-shaped element having a central inwardly directed portion, a flexible conical portion joined to the periphery of said dish-shaped portion, and a compartment of rupturable material within said joined portions sealed to the wall thereof, the outer end of said conical portion being inverted into the larger portion thereof.

16. The method of mixing two or more materials together by a kneading action which includes the steps of forcing the end of a flexible wall portion against a rupturable partition which separates the materials, and relatively revolving the container and wall portion to knead the material under a rubbing action on the wall portion without rupturing the container to thoroughly mix the materials together.

17. The method of mixing two materials together within a container in which the materials are separated by a rupturable partition, and of advancing a rod into a flexible wall of one portion of the container to rupture the partition and bulge another portion of the container when the container and rod are relatively revolved to mix the material under pressure without rupturing the wall of the container.

18. The method of mixing two dissimilar materials in compartments of a container without rupturing the wall thereof which includes the steps of relatively moving the container and a pair of rods at opposite ends of the container to rupture a wall separating the compartments, and further relatively moving the container and rods to produce the mixing of the materials within the container without rupturing the wall thereof.

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