

[54] MIXING DISPENSER WITH A SELECTIVELY RETRACTABLE SEAL TO PERMIT INTERMIXING OF THE INGREDIENTS

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FOREIGN PATENTS OR APPLICATIONS

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[51] Int. Cl. B67d 5/60

[58] Field of Search 222/94, 129, 145, 132, 222/309, 386, 386.5; 259/12, 29, 72, 48; 206/47 A; 128/218 M, 272, 218 P

[56] References Cited

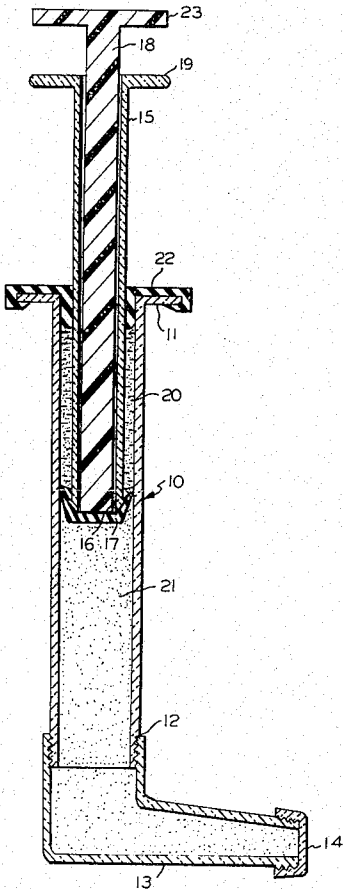
UNITED STATES PATENTS

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[57] ABSTRACT

A disposable mixing syringe for storing two materials in isolated relationship; permitting mixing of said materials; and permitting the ejection of said mixed ingredients. The syringe is of the single barrel variety and includes a movable plunger incorporating an independently movable actuator that enables a seal to be selectively radially retracted away from or reexpanded toward the walls of the barrel.

15 Claims, 7 Drawing Figures



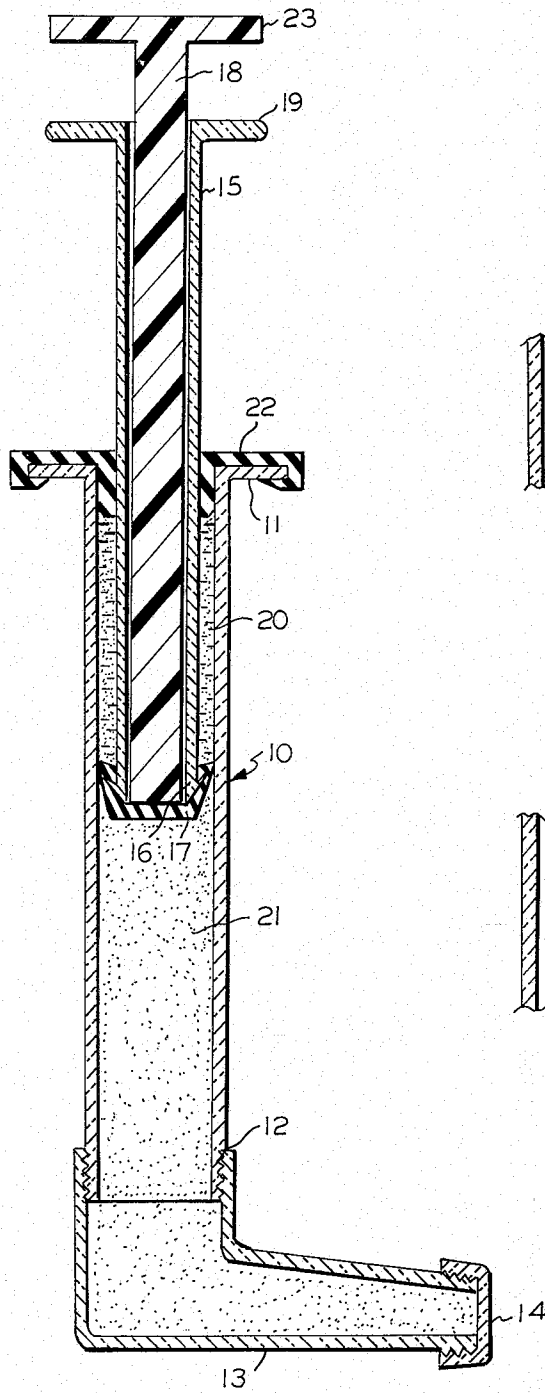


FIG. 1

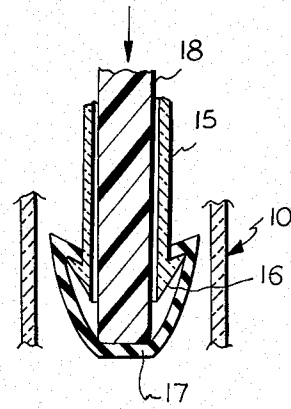


FIG. 1A

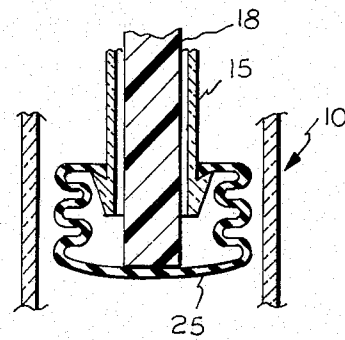


FIG. 2

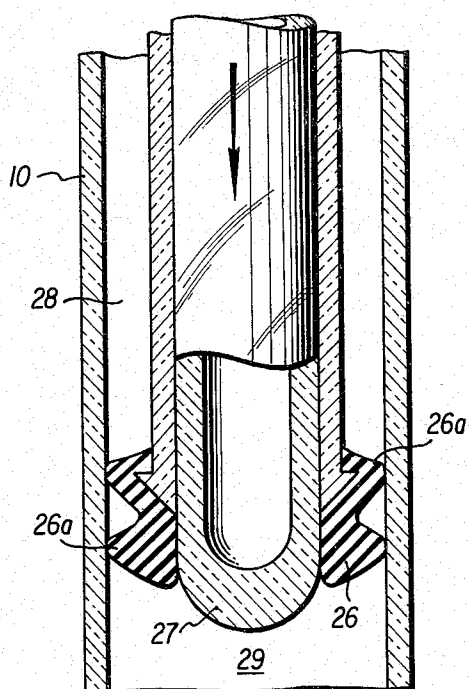


FIG. 3A

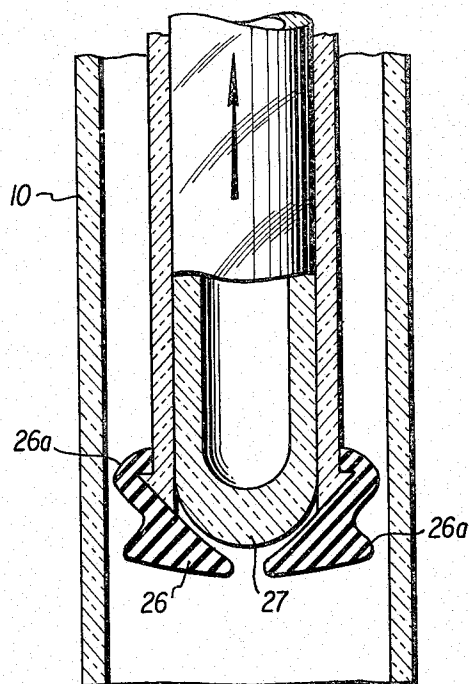


FIG. 3B

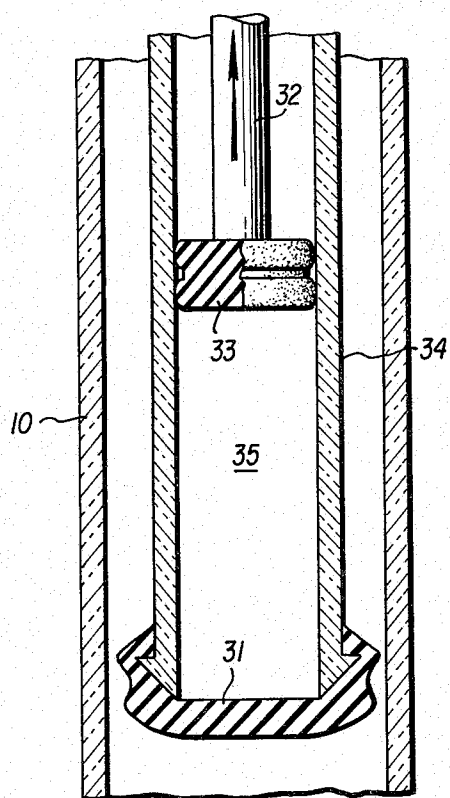


FIG. 4A

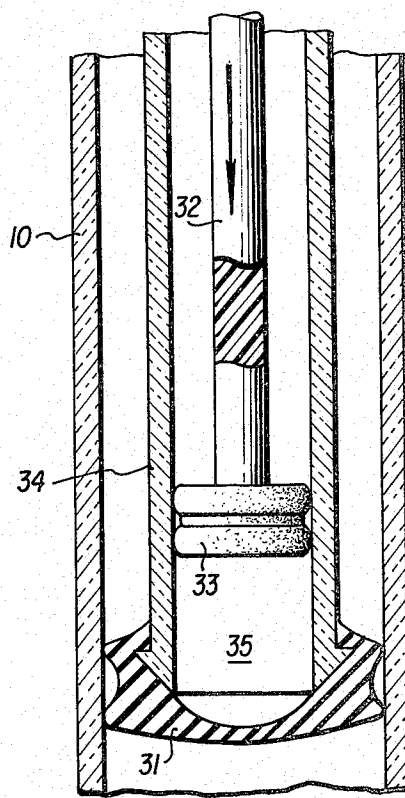


FIG. 4B

MIXING DISPENSER WITH A SELECTIVELY RETRACTABLE SEAL TO PERMIT INTERMIXING OF THE INGREDIENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to mixing dispensers or syringes that are adapted to store ingredients in separated compartments, and permit mixing and dispensing of the mixed ingredients when desired.

2. Description of the Prior Art

Many mixing dispensers are of the telescoping double barrel type, wherein the ingredients are separately retained by inner and outer barrels that are isolated from one another by a valve mechanism, a breakable membrane or other separator. Other dispensers use a single barrel construction with the ingredients stored in different portions of the barrel and isolated from one another by a displaceable or breakable seal or plug.

In general, the double barrel types of dispensers are not entirely satisfactory in that many are too complex and expensive for mass use as a disposable dispenser; having too many parts and requiring costly assembly. The single barrel types, on the other hand, although being intrinsically simpler and less complex in nature do not always provide the desired degree of isolation between the ingredients. Many also require a specially constructed interior of the single barrel to accommodate a displaceable seal or membrane and such a barrel may be expensive and difficult to manufacture.

SUMMARY OF THE INVENTION

The present invention seeks to overcome these disadvantages and provide a considerably less complex and less expensive mixing dispenser of the single barrel variety that is capable of storing unmixed ingredients for relatively long periods of time without contamination and permitting a thorough mixing and dispensing of such ingredients when desired.

Generally in a preferred embodiment, the dispenser includes but a single hollow tubular barrel having a uniform circular cross section, together with a piston or plunger slidable inside the uniform barrel. The ingredients are separately stored in the barrel in upper and lower regions or chambers that are isolated from one another only by a resilient seal means provided on the piston. For mixing of the ingredients, the seal means is radially retractable away from the walls of the barrel by the operation of a simple manually operated retracting mechanism, bringing the isolated regions into communication with one another. For dispensing of the mixed ingredients, the seal means is then permitted to return to its radially expanded position against the barrel, enabling movement of the entire plunger to eject the mixed ingredients from the barrel under pressure.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an enlarged cross sectional side view illustrating details of a preferred mixing dispenser.

FIG. 1A is a partial sectional side view showing the seal in retracted position, and

FIG. 2 is a partial sectional view similar to FIG. 1A and showing a modified bellows type resilient seal.

FIG. 3A and 3B are enlarged cross sectional side views illustrating a different embodiment of the invention with the seals expanded and contracted, and

FIG. 4A and 4B are views similar to FIGS. 3A and 3B, showing a still further embodiment.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT AND VARIATIONS

Referring to the drawing, the hollow tubular barrel 10 may be of glass or suitable plastic depending upon the nature of the materials to be stored and dispensed and upon the intended use or application of the dispenser. For a one-time disposable use, plastic barrels are generally less expensive and less easily broken. However many of the less expensive plastics may contaminate or otherwise chemically react with certain ingredients, particularly where the ingredients may be stored for long time periods in the dispenser before use.

The upper end of the barrel 10 is formed with a finger engaging flange portion 11 and its lower end is threaded at 12 to attach with a suitably shaped nozzle 13 or other outlet for directing the mixture from the syringe or dispenser. The terminating end of nozzle 13 is closed and sealed by a closure cap 14 that may be threaded onto this ejecting end or may be press fitted or otherwise fastened to retain and store the material contents filling the lower barrel and nozzle.

The plunger mechanism is comprised of three easily constructed parts; including an open ended hollow tube 15, a resilient cap seal 17 of rubber or the like covering the end 16 of tube 17, and a telescoping expander shaft 18 positioned inside the plunger tube 15.

Plunger tube 15 may also be integrally molded or otherwise suitable formed of plastic or glass, and provided with a finger supporting integral flange 19 at its upper end and a generally barbed shaped shoulder area 16 at its lower end to retain the resilient seal cap 17. The cap 17 is made of rubber or other suitable resilient or elastic material and is initially stretched to be tightly fitted over the end of the tube 15, being interengaged with the barbed shoulder 16 as shown. The outside walls of the cap seal 17 normally tightly engage with the inside walls of the barrel 10 to form a liquid tight seal therewith and accordingly provide upper and lower isolated chambers within the barrel to separately store a first ingredient 20 above the rubber seal 17 and a second ingredient 21 below the seal 17. A suitable top seal 22 of rubber or the like is provided to seal or close off the top of the barrel in the region between the flange 11 of barrel 10 and the plunger 15, thereby completing the upper closed chamber above the seal 17 for storage of ingredient 20.

MIXING OPERATION

For mixing the ingredients, the seal 17 is radially retracted away from the inner walls of the barrel 10 bringing the upper and lower ingredients 20 and 21 into communication through the retracted seal. This is performed in the preferred embodiment by manually pushing downwardly on the expander shaft 18 while retaining the plunger tube 15 in place, by applying finger pressure between the enlarged end 23 of shaft 18 and the flange 19 of the plunger tube 15. The downward movement of shaft 18 bearing against the inside of cap seal 17 stretches and enlarges the rubber seal 17 downwardly, as best shown in FIG. 1A, to radially reduce its outer cross sectional diameter to less than the inside diameter of the barrel. This removes the divider separating the upper ingredient 20 and the lower ingredient 21

in the barrel and permits the two ingredients to be mixed together.

Where the two ingredients are viscous or otherwise not self mixable, the plunger tube 15 may be agitated while maintaining the seal 17 in the retracted position shown in FIG. 1A. This action provides vigorous mechanical mixing of the ingredients to the extent desired; using the plunger 15 as a reciprocating stirrer. Since the barrel 10 is of transparent material, the user may usually determine the extent of mixing action required.

After such mixing, and while the plunger seal 17 is still retracted, the plunger tube 15 is raised upwardly until its seal means 17 is disposed near the upper end of the barrel 10, and the resilient seal 17 is then permitted to radially reexpand outwardly against the inside walls of the barrel by releasing the finger pressure between the expander shaft 18 and the finger flange 19 of the plunger tube 15. This action positions the expanded seal 17 in proper location to eject the entire mixed contents from the syringe.

For ejecting the mixed contents, the end cap 14 is then removed and finger pressure is applied between the finger rest flange 23 on the expander shaft 18 and the finger engaging flange 11 on the barrel 10. By application of finger pressure, the entire plunger mechanism is moved downwardly while the plunger seal 17 engages the inner walls of the barrel. This forces the mixture out of the nozzle 13 of the syringe or dispenser under pressure.

It will be noted that downward pressure exerted between the expander tube 18 and flange 11 of barrel 10 also pushes downwardly on the seal 17. However in this case, the plunger tube 15 is free to also travel downwardly into the barrel 10 so that the plunger seal 17 remains in constant engagement with the barrel 10 to eject the mixed material contents of the barrel. To enable this action, the plunger seal 17 is formed of material that, although resilient as previously described, is sufficiently stiff with respect to the viscosity of the mixture to be ejected and the resisting friction provided by the sliding seals, to maintain itself in sealing engagement with the walls.

The cap seal 17 may be constructed in many different forms consistent with its purposes, and a modified seal construction is shown in FIG. 2. In this embodiment the walls of the cap seal 25 are formed in a bellows shape with folds providing a series of areas of sealing contact with the inner walls of the barrel 10. Downward pressure on the expander shaft 18, while holding the plunger tube 15 stationary as previously described, expands the bellows seal 25 in the longitudinal direction thereby radially contracting its diameter and bringing its outer surface out of contact with the inner walls of the barrel 10, in the same manner as shown in FIG. 1A.

It will be appreciated by those skilled in this art that the preferred inexpensive, disposable, mixing dispenser as described may be used for many different applications, such as the mixing and dispensing of two-part plastic cements and adhesives, the mixing and selective dispensing of temporary dental fillings for teeth, as well as many other household, medical, dental, and industrial uses.

It will be further appreciated that many variations may be made in the structure of the parts of this dispenser without departing from the spirit and scope of the invention. For example, instead of using an expander shaft 18 for radially retracting the cap seal 17, the

seal 17 may instead be radially expanded and retracted by the use of springs and levers (not shown) that are located inside of the plunger tube 15. Similarly, the nozzle and its mode of connection to the barrel 10 as well as the closure cap 14 may also be changed in shape, size, dimensions, and manner of interconnection, all compatibly with the intended use of the mixer.

In the alternative embodiment shown in FIGS. 3 and 3A, the cap seal 26 is generally provided in the form of an annular ring of rubber having a central slit or other opening and with the expander shaft or tube 27 inserted through said opening as shown to force the peripheral surfaces 26a of the seal in expanded radially engaging relationship to the inside walls of barrel 10. This divides the interior of barrel 10 into upper and lower chambers 28 and 29, in the same manner as previously described to retain and store the two ingredients in isolated regions. For mixing of the two ingredients, the plunger or expander shaft is raised upwardly, as shown in FIG. 3B, withdrawing the shaft from the central slit or opening of the seal 26. The natural resilience of the seal thereupon provides radial retraction or closure of the seal, bringing its outer peripheral surfaces 26a away from the inside walls of the barrel 10 and accordingly bringing the formerly separated materials in the upper and lower chambers into communication with one another.

For agitation of the two materials, the entire plunger mechanism may be reciprocated while the seal is retracted; and for ejection of the mixed materials, the seal is reexpanded against the walls of the barrel 10 and the entire plunger mechanism is employed to force the mixed materials out of the syringe as previously described.

It will be noted that in this embodiment, the seal is retracted by upward movement of the expander shaft 27 rather than downward movement thereof as in FIG. 1, and the construction of the seal 26 also differs from that of FIG. 1, in having a central slit or other opening that is penetrated by the expander shaft or tube 27. In other respects, however, the entire plunger mechanism is similar, being comprised of only upper and lower seals, an expander shaft or tube 27, and an open ended hollow tube 30 of the same construction as previously described.

As also illustrated in FIG. 3, the inside expander element may be provided in either embodiment in the form of a closed end hollow tube 27 of glass or plastic instead of a solid shaft as is illustrated in FIG. 1.

FIGS. 4 and 4A illustrate a still further embodiment, employing compressed air as the operating medium to expand and retract a seal 31 against the inside walls of the barrel 10.

As shown in FIG. 4A, the inside expander member is, in this embodiment, provided as a central shaft 32 having a solid seal 33 of rubber or the like provided at its lower end in hermetic sealing engagement with the inside walls of the inner hollow tube 34, thereby to entrap a column of air 35 inside of the inner hollow tube 34 below the solid seal 33. When the central shaft 32 is located in a raised position, as shown in FIG. 4A, the column of air 35 is substantially in uncompressed condition and the cap seal 31 is deposed in radially retracted position away from the walls of the barrel 10. When the central shaft 32 is pushed downwardly into the inner hollow tube 34, the column of air 35 is then compressed, and the compressive force bearing against the cap seal 31 expands the seal 31 so that its outer periph-

eral surfaces engage the inside walls of the barrel 10 as shown in FIG. 4B.

Before use of the mixing syringe, the seal 31 is disposed in the expanded position of FIG. 4A to provide the isolated chambers inside the barrel for separately retaining the unmixed ingredients. The air column 35 is therefore compressed and the expander shaft 32 is suitably retained and locked in its lower position until it is desired to use the syringe. The locking means employed (not shown) need be no more than a tear off plastic strip or tape for retaining the shaft 32 in lower position with respect to the inner hollow tube 34.

At time of use, such locking means (not shown) may be easily removed and the compressed column of air 35 is permitted to expand, thereby raising the expander shaft 32 and permitting retraction of the cap seal away from the walls of the barrel to the position of FIG. 4A. Mixing of the ingredients is then made by reciprocating the entire plunger; and finally, ejection of the mixed material is enabled by raising the entire plunger unit, reexpanding the cap seal 31 and then lowering the entire plunger unit with the cap seal engaged with the walls of the barrel.

What is claimed is:

1. A combined mixer and pressure ejector for initially retaining two ingredients in separated relationship, permitting controlled mixing of said components, and controlled ejection of said mixed components comprising:

a hollow barrel,

a plunger reciprocally disposed partially inside said barrel,

a deformable seal means radially projecting from said plunger and engageable with the walls of said barrel to provide upper and lower separated chambers within said barrel,

said plunger incorporating manually operable means for enabling the retraction of said seal means away from the walls while the plunger is stationary within the barrel and said plunger and seal means being constructed and arranged to provide positive mixing of said components by the seal means by reciprocating said plunger with the seal means in retracted position,

said manually operated means permitting return of the said means to the walls for enabling the ejection of said mixture.

2. In the mixer-ejector of claim 1, said plunger being hollow and said manually operated means being disposed partially inside the plunger for selectively retracting and releasing said seal means.

3. In the device of claim 2, said seal means comprising a closed resilient tube disposed over the outside of one end of said plunger and said manually operated means comprising a reciprocally disposed shaft located inside the plunger and having one end disposed against the tube to selectively stretch and release the resilient tube away from and toward the walls of the barrel.

4. A combined mixer and ejector for reactive components comprising:

a hollow barrel,

a hollow plunger, disposed partially inside said barrel,

a deformable seal covering the open end of said plunger and having portions projecting radially outside said plunger to engage the inside walls of the barrel,

a reciprocally moveable expander member disposed partially inside said plunger and being manually movable against said seal to selectively controllably retract said seal away from the walls for variable distances and permit automatic return of said seal thereagainst as effected by the resilience of the seal,

whereby separate containers are provided within said barrel above and below said seal whose contents may be mixed by agitation of said plunger when the seal is retracted and whereby the resulting mixture may be ejected by movement of the plunger with the seal engaging the walls of the barrel.

5. In the dispenser of claim 4 said expandable seal comprising a cap of resilient material disposed over the end of said plunger within said barrel and expander means within said barrel for stretching said cap to reduce its circumferential diameter to retract said seal away from the walls of said barrel.

6. A disposable dispenser for storing ingredients in isolated areas, enabling mixing of said ingredients before use, and dispensing of said mixed ingredients,

a hollow barrel member,

a plunger disposed for movement inside said barrel, an expandable seal carried by said plunger to selectively engage and disengage with the walls of the barrel and provide separated chambers in said barrel above and below said seal for storing ingredients,

and manually actuated means movable with respect to said plunger for radially contracting said seal away from the walls providing communication between said chambers for enabling mixing of said ingredients inside the barrel, said expandable seal being constructed and arranged to enable positive mixing of said ingredients by reciprocating the plunger with the seal disengaged from the walls of the barrel,

said manually actuated means permitting return of the seal against the walls for enabling the dispensing of the mixed ingredients.

7. In the dispenser of claim 6, said manually actuated means comprising an expander member disposed partially inside said plunger and engageable with said seal to enable selective radial expansion and contraction of said seal toward and away from engagement with said barrel.

8. In the dispenser of claim 6, said expander being manually positionable against said seal to stretch and expand said seal, thereby reducing its thickness and removing its outer surface out of sealing engagement with the barrel.

9. In the dispenser of claim 6, said seal having an opening therein and said expander being manually positionable to penetrate said opening, thereby expanding portions of said seal radially outwardly to engage with the walls of the barrel in sealing relationship.

10. In the dispenser of claim 6, said manually actuated means comprising a movable expander member disposed partially inside said plunger and having portions reciprocally movable to selectively produce and remove a column of compressed gas inside said plunger, thereby to selectively expand said seal to engage said walls and permit disengagement of the seal with said walls.

11. In the ejector of claim 1, said plunger including a manually positionable expander member for longitudinally

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dinally elongating said seal to retract the seal from the walls and selectively withdrawable to permit return of said seal into engagement with the walls.

12. In the ejector of claim 1, said seal having an aperture therein and said plunger including a manually positionable expander member to selectively penetrate said aperture and radially expand the seal against the walls of the barrel.

13. In the ejector of claim 1, said plunger including means for selectively producing a compressed gas inside said plunger to expand the seal against the walls of the barrel.

14. In the ejector of claim 13, said compressed gas producing means including a piston disposed inside said plunger and manually positionable by an expander shaft.

15. A syringe for storing plural materials in separated

relationship, permitting mixing of said materials, and controlled ejection of the mixed materials comprising:

a hollow barrel,

a hollow plunger reciprocally disposed inside of said barrel,

a deformable seal supported by the plunger and having portions radially projecting from the plunger to engage with the inside walls of the barrel,

an actuating member located partially inside of said hollow plunger and disposed for reciprocal movement with respect to said plunger, said member being in operative relationship to said seal to selectively enable retraction of the seal away from the walls of the barrel when said member is reciprocated with respect to the plunger, thereby enabling the mixing of said ingredients.

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