

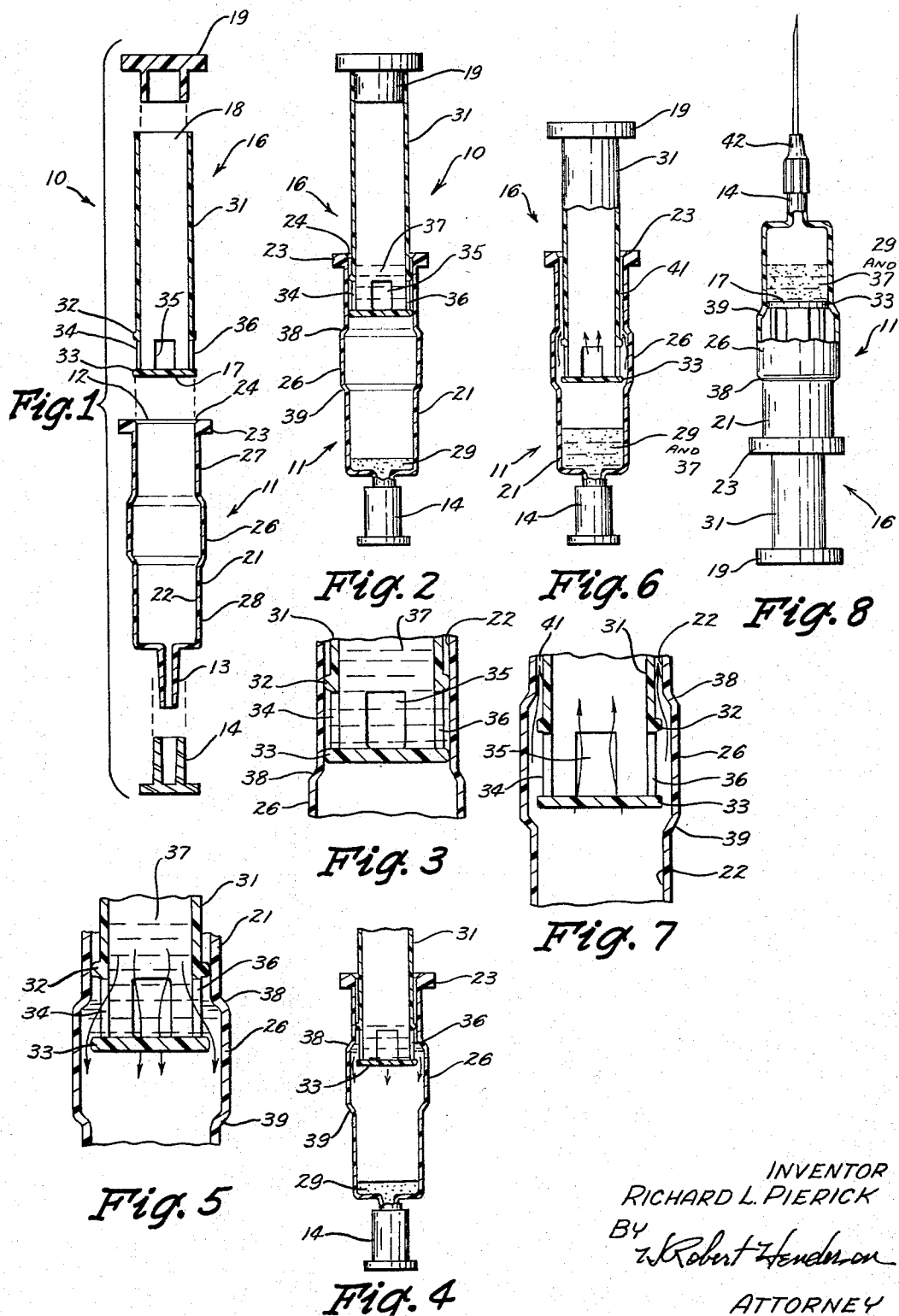
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R. L. PIERICK

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SYRINGE

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INVENTOR
RICHARD L. PIERICK
BY *Robert Henderson*
ATTORNEY

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SYRINGE

Richard L. Pierick, 2800 Tiffin, Des Moines, Iowa
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This invention relates to a syringe, and more particularly to a syringe wherein one part of the charge to be injected thereby is initially contained in one element of the syringe and another part of the charge is initially contained in another, separate element of the syringe. The elements of the syringe are manipulable to accomplish admixture of the components into the one charge, and then are operable as a piston and cylinder means to expel the resulting charge in the hypodermic administration thereof.

As is well known, many compounds, mixtures, or solutions deteriorate with time or under varying conditions of temperature, light or other changing surroundings. The attempted mixing of such compounds, mixtures, or solutions at the point of use can be extremely difficult if not impossible relative to accurate measurement and sanitary requirements.

Attempts have been made, nevertheless, to solve these problems by compartmentizing the ingredients and components in a single syringe unit, with the compartments separated by a wall, diaphragm, or the like which is broken or pierced immediately prior to use of the syringe. These structures, whereas providing an advance in this field, have not been completely satisfactory.

It is an object, therefore, of this invention to provide an improved syringe of multi-compartment type.

It is another object of this invention to provide a two part syringe wherein one part contains one component of a charge the other part contains another component of the charge, and the parts are manipulable together to effect an admixture, then to effect an injection of same.

Yet another object of this invention is to provide a simple, two part syringe of plastic or the like which obviates the need for rubber or like members or membranes useable therewith, which obviates in fact the presence of any material foreign to the plastic or like basic material, and which obviates the need for piercing, breaking or in any way displacing a wall or the like.

Still another object of this invention is to provide a syringe of a two part, two compartment, telescopically arranged structure, wherein absolutely perfect sanitation is provided, no contamination of one component of a charge with another component being possible.

It is an other object of this invention to provide a two part, two compartment type syringe where the arrangement is such that upon one part telescopically entering the other part, air within the first part is discharged rearwardly past the axially forwardly moving second part, thus effecting an easier relative axial movement together of the two parts.

It is still another object of this invention to provide a syringe of a two compartment, two part type carrying at least a pair of components of a charge, which is manipulable to effect a mixing immediately prior to use of the components, said mixing being accomplished entirely by gravity.

Yet another object of this invention is the provision of a syringe employing only a casing for containing one component of a charge to be injected by the syringe, and a plunger slidable into the casing, and with the plunger containing another component of the charge, and wherein the casing and the plunger are operable in one position to effect a transportation condition with the components sealed off, operable in another position to provide a mixing condition where the components are mixed together by gravity within the casing, and where the components are

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operable in a third position to have the casing assuming the function of a cylinder with the plunger assuming the function of a piston to eject the mixed charge from the casing.

5 It is an other object of this invention to provide a syringe which is economical to manufacture, simple and rugged of construction, and effective in use, and further wherein after use, the syringe can be reused with the proper sanitary precautions being taken.

10 These objects and other features and advantages of this invention will be readily apparent according to the following description when taken in conjunction with the accompanying drawings, wherein:

15 FIG. 1 is an exploded, sectional view of the elements of this invention taken along the longitudinal axis of the syringe;

FIG. 2 is a longitudinal, sectional view of the syringe, showing the parts thereof in a transportation position, with a pair of components to make up an injection charge shown in separated compartments;

20 FIG. 3 is an enlarged, fragmentary detail view of a certain area of FIG. 2;

FIG. 4 is a fragmentary, sectional view similar to FIG. 2, and wherein the plunger part of the syringe is shown in a second position permitting thereby the components to be mixed;

25 FIG. 5 is an enlarged, fragmentary detail view of a certain area of FIG. 4;

FIG. 6 is a view similar to FIG. 2, and showing the parts in a third position to permit the escape of air from the casing part rearwardly past the plunger;

30 FIG. 7 is a fragmentary detail view of a certain area of FIG. 6; and

FIG. 8 is a view similar to FIG. 2, wherein the syringe has been rotated to a position immediately prior to use, with the plunger in a fourth position and with a hypodermic needle unit attached to the exposed end of the casing.

Referring now to the drawings, a preferred embodiment of the syringe of this invention is indicated generally at 10 in FIGS. 1 and 2. The syringe 10 comprises basically a casing 11 having an open rear end 12, and the nozzle-type front end 13 of which is normally closed by a cap 14. A plunger 16 is provided for axial, reciprocable insertion into the casing 11, having a closed front end 17 and an open rear end 18 normally closed by a flanged knob 19. All of the elements of the syringe 10, except the casing 11, are preferably manufactured of an inexpensive transparent plastic. The casing 11 should be manufactured of clear glass.

More specifically, the casing 11 comprises an elongated, cylindrical body 21 the inner wall surface 22 of which has a substantially constant diameter. An annular end flange 23 is provided at the rear end of the casing body 21, and the internal peripheral edge 24 of which is beveled to aid the insertion therein of the plunger 16.

A blister 26 is formed within the wall 22 by an enlarged waist portion intermediate the front and rear ends 13 and 12, respectively, of the casing. The blister 26 has an annular shape, and the internal radius or diameter of which is greater than the internal diameter of the wall 22. The length of the blister 26, which length extends parallel to the longitudinal axis of the casing body 21, is of a predetermined length, and with the blister 26 being spaced adjacent to and intermediate a rear body portion 27 and a front body portion 28 of the body 21.

With the cap 14 (FIG. 2) closing the front end 13 of the casing 11, prior to shipment thereof a component 29 of a charge to be injected by the syringe 10 is placed within the body 21. Although this component can be either a liquid or a solid, it is shown herein as a solid.

More particularly as to the plunger 16, it comprises also a cylindrical body 31, the outer diameter of which is substantially constant and which is less than the inner diameter of the casing wall 22. A pair of longitudinally spaced, annular seals 32 and 33 are formed at the front end of the body 31. These seals 32 and 33 each have an outer diameter greater than the outer diameter of the body 31, but which is substantially the same as the inner diameter of the wall 22. This provides that the plunger 16 slides tightly within the casing 11, with the seals 32 and 33 effecting a seal with the interior surface of the wall 22 at any time either one or both engage the wall 22.

The seals 32 and 33 are spaced longitudinally apart a length the distance of which is less than the length of the blister 26. This is clearly illustrated by referring to FIG. 7 where it is seen that the length of the blister 26, as measured between a pair of shoulders 38 and 39 formed in the body 21, is greater than the longitudinal length of the plunger body 31 between the seals 32 and 33.

The plunger 16 is completed by a quartet of arcuately and equally spaced apertures (only three showing) 34, 35, and 36. Prior to shipment, with the knob 19 removed and with the plunger 16 inserted into the casing 11 in the position shown in FIGS. 2 and 3, the other component 37 of the charge to be injected by the syringe 10 is placed within the plunger body 31. This component is shown as a liquid.

The position of the syringe 10 in FIG. 2 is its transportation position. The two components 29 and 37 are separated, one in the casing 11 and the other in the plunger 16, by the sealed nature of the seals 32 and 33, particularly the front seal 33 (FIG. 3), with the wall 22 surface of the casing body 21. Furthermore, although the component 37 is movable within the plunger body 31, it can not escape therefrom through the apertures 34-36 except as to be contained between the seals 32 and 33, due to the sealing nature of these two seals.

The frictional engagement of both seals 32 and 33 with the casing body 21 sufficiently is tight such that ordinary transportation jarring of the syringe 10 in the FIG. 2 condition would not cause relative movement of the casing 11 and the plunger 16. Further, the shipping container itself could be molded to fit the parts of the syringe in their FIG. 2 positions to aid in preventing relative movement.

At the point of use, the syringe 10 is grasped in the normal manner with the fingers below the flange 23 of the casing 11, and with the thumb against the plunger knob 19. The plunger 16 is then moved into the casing 11, effecting actually a relative movement of both parts.

When the plunger 16 is moved axially into the casing 11 so that the front seal 33 has moved past the rear shoulder 38 (FIGS. 4 and 5), thus transversely aligning the plunger apertures 34-36 with the blister 26, the air trapped within the plunger 16 and also within the casing 11 is equalized, and then the medicant component 37 within the plunger is free to flow by gravity downwardly into the casing body 21. This flow is indicated by the arrows in FIGS. 4 and 5. Continued axial movement of the plunger 16 into the casing 11 brings the parts to their third relative position best illustrated in FIGS. 6 and 7.

It is well known that air is present in the casing body 21, along with the charge component 29 contained therein, in the position of the parts of FIG. 2. Also, the cap 14 for the casing body 21 can not be removed until the charge components are completely mixed. Thus, as the plunger 16 continues to move as a piston into the casing 11, which now functions as a cylinder for the piston, a build-up of air pressure occurs between the face or front end 17 of the plunger 16 and the closed front end 13 of the casing. In many contemporary plungers of the two compartment, two part type, no provision is made for relief of this air pressure build-up, therefore the continued axial movement of the plunger is made considerably more difficult, sometimes to the extent of impairing the effi-

ciency of the hypodermic needle insertion and ejection of the charge.

In the present embodiment, however, the structure is so arranged to provide sufficient relief of the air pressure to obviate any problems caused thereby. Referring to FIGS. 6 and 7, with both seals 32 and 33 of the plunger 16 positioned within the blister 26 and between the shoulders 38 and 39, rendering the seals ineffective thereby, any air pressure built up within the plunger body 31 and within the cylinder body 21 is relieved thereby. The relief is indicated by the arrows in FIGS. 6 and 7, wherein, due to the reduced outer diameter of the plunger body 31, relative to inner diameter of the casing wall 22, an annular space 41 (FIG. 7) is formed therebetween. As the space 41 is open to the rear end 12 of the casing 11, the air under pressure is free to escape.

It will be observed here that the exterior of the plunger body 31 could be somewhat varied from the present showing without impairing the function or the effectiveness of the syringe 10. For example, rather than having a pair of seals 32 and 33, one annular seal having the same outer diameter and the same longitudinal length of the two seals could be used. Furthermore, the remainder of the body 31 could have the same outer diameter as the one annular seal, but with one or more longitudinally extended grooves formed in the body to provide for the escape of air thereby. Additionally, the inner diameter of the casing front body portion 28 could be slightly greater than the inner diameter of the rear body portion 27 to aid the inward movement of the plunger 16.

Continued movement of the plunger 16 into the casing 11 brings the front seal 33 again into sealing engagement with the casing wall 22 (FIG. 8), the blister 26 having been passed. The combined components 29 and 37 now sealed within the remaining casing chamber can now be thoroughly shaken if this be necessary. The syringe 10 is then turned upside down, or turned to a position 180° from that of FIGS. 1-7, whereby the charge rests against the front end 17 of the plunger 16 (FIG. 8) by gravity.

In this position of the syringe 10, the cap 14 can be removed and a hypodermic needle unit 42 substituted therefor. The syringe 10 is now ready for use. The plunger 16 is then inserted further into the casing 11 to effect an egress of the charge contained therein through the needle unit 42.

Although a preferred embodiment of this invention has been described and disclosed hereinbefore, it is to be remembered that various modifications and alternate arrangements may be made without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. A syringe comprising in combination:

- an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof with a substantially constant internal diameter;
- a blister formed in said casing by a portion of said casing having a radius greater than the normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at the rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;
- said plunger exterior having a diameter less than said casing constant internal diameter and having a pair of longitudinally spaced seals formed on the exterior thereof, the outer diameter of said seals being identical, being greater than the outer diameter of the remainder of said plunger exterior, and being substantially equal to said constant internal diameter

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of said casing interior, whereby said plunger is tightly slidable within said casing, said seals having a certain length therebetween less than the length of said blister;

said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is moveable by gravity into said casing interior for mixing with said one component.

2. A syringe comprising in combination:

an elongated casing having an open rear end and having a cylindrical interior formed by a cylindrical wall, said casing adapted to contain one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof with a substantially constant internal diameter;

a blister formed in said wall by a portion of said wall having a radius greater than the radius of the said constant diameter remainder of said interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a diameter less than said casing constant internal diameter and having a pair of longitudinally spaced seals formed on the exterior thereof, the outer diameter of said seals being identical, being greater than the outer diameter of the remainder of said plunger exterior, and being substantially equal to said constant internal diameter of said casing interior, whereby said plunger is tightly slidable within said casing, said seals having a certain length therebetween less than the length of said blister;

said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is moveable by gravity into said casing interior for mixing with said one component.

3. A syringe comprising in combination:

an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a substantially constant internal diameter;

a blister formed in said casing by a portion of said casing having a radius greater than normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated, cylindrical plunger insertable into said casing rear end and axially reciprocable therein, said plunger closed at a front end and having a knob removably inserted into an open rear end thereof, said plunger having further a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a diameter less than said casing constant internal diameter and having a pair of longitudinally spaced seals formed on the exterior thereof, the outer diameter of said seals being identical, being greater than the outer diameter of the remainder of said plunger exterior, and being substantially equal to said constant internal diameter of said casing interior, whereby said plunger is tightly slidable within said casing, said seals having a certain length therebetween less than the length of said blister;

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said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is moveable by gravity into said casing interior for mixing with said one component.

4. A syringe comprising in combination:

an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;

an annular blister formed in said casing by a waist portion thereof having a radius greater than the radius of the constant diameter remainder of said casing interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a diameter less than said casing constant internal diameter and having a pair of longitudinally spaced seals formed on the exterior thereof, the outer diameter of said seals being identical, being greater than the outer diameter of the remainder of said plunger exterior, and being substantially equal to said constant internal diameter of said casing interior, whereby said plunger is tightly slidable within said casing, said seals having a certain length therebetween less than the length of said blister;

said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is moveable by gravity into said casing interior for mixing with said one component.

5. A syringe comprising in combination:

an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;

a blister formed in said casing by a portion of said casing having a radius greater than the normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is frictionally slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;

said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is moveable by gravity into said casing interior for mixing with said one component.

6. A syringe comprising in combination:
 an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;
- a blister formed in said casing by a portion of said casing having a radius greater than the normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;
- said plunger exterior having a diameter less than said casing constant internal diameter and having a pair of longitudinally spaced seals formed on the exterior thereof, the outer diameter of said seals being identical, being greater than the outer diameter of the remainder of said plunger exterior, and being substantially equal to said constant internal diameter of said casing interior, whereby said plunger is tightly slidable within said casing, said seals having a certain length therebetween less than the length of said blister;
- said plunger having further a plurality of arcuately spaced openings in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said openings with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.
7. A syringe comprising in combination:
 an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;
- an annular blister formed in said casing by a waist portion thereof having a radius greater than the radius of the constant diameter remainder of said casing interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;
- said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is frictionally slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;
- said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.
8. A syringe comprising in combination:
 an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;

- an annular blister formed in said casing by a waist portion thereof having a radius greater than the radius of the constant diameter remainder of said casing interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;
- said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is frictionally slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;
- said plunger having further a plurality of arcuately spaced openings in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said openings with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.
9. A syringe comprising in combination:
 an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;
- a blister formed in said casing by a portion of said casing having a radius greater than the normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;
- said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is tightly slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;
- said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.
10. A syringe comprising in combination:
 an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;
- an annular blister formed in said casing by a waist portion thereof having a radius greater than the radius of the constant diameter remainder of said casing interior, said blister having a certain length parallel to the longitudinal axis of said casing; and
- an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably

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sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is tightly slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;

said plunger having further an opening in communication with said cavity formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.

11. A syringe comprising in combination:

an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;

an annular blister formed in said casing by a waist portion thereof having a radius greater than the radius of the constant diameter remainder of said casing interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having a substantially constant diameter, having a pair of longitudinally spaced, annular seals formed on the exterior surface thereof, the diameter of said seals being identical, being greater than the diameter of the remainder of the exterior surface of said plunger, and being substantially equal to said casing constant internal diameter, whereby said plunger is tightly slidable within said casing, said seals having a length therebetween longitudinally of said plunger less than the length of said blister;

said plunger having further a plurality of arcuately spaced openings in communication with said cavity

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formed therein between said seals, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said openings with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.

12. A syringe comprising in combination:

an elongated casing having an open rear end, and adapted to contain within the interior thereof one component of a charge to be injected by the syringe, said casing interior having at least a portion thereof a constant internal diameter;

a blister formed in said casing by a portion of said casing having a radius greater than the normal radius of said constant diameter interior, said blister having a certain length parallel to the longitudinal axis of said casing; and

an elongated plunger insertable into said casing rear end, said plunger closed at a front end, releasably sealed at a rear end, and having a cavity formed therein adapted to contain a second component of the charge to be ejected by the syringe;

said plunger exterior having an annular seal portion adjacent said front end, with the remainder of the exterior of said plunger having at least one relief groove formed therein extended from the seal portion to the rear end thereof, the outer diameter of said seal portion being substantially equal to said casing constant internal diameter, whereby within said casing the plunger seal portion is tightly engaged with the casing interior while said relief groove forms a fluid passage therewith, said seal portion having a longitudinally extended length less than the length of said blister;

said plunger having further an opening in communication with said cavity, said opening formed in said seal portion and having a length less than said length of said seal portion, said casing interior and said plunger cavity fluidly communicable upon transverse alignment of said opening with said blister, whereby said second component is movable by gravity into said casing interior for mixing with said one component.

No references cited.

ROBERT B. REEVES, *Primary Examiner.*

F. R. HANDREN, *Assistant Examiner.*