May 14, 1963 S. D. GOLDBERG 3,089,490

DISPOSABLE CARTRIDGE TYPE HYPODERMIC SYRINGES

Filed March 14, 1960

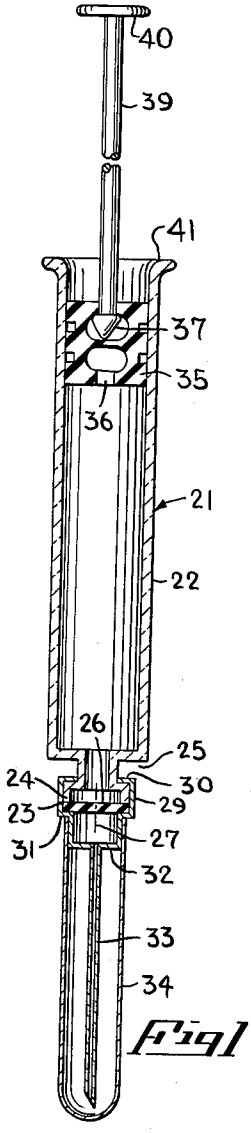

Fig1

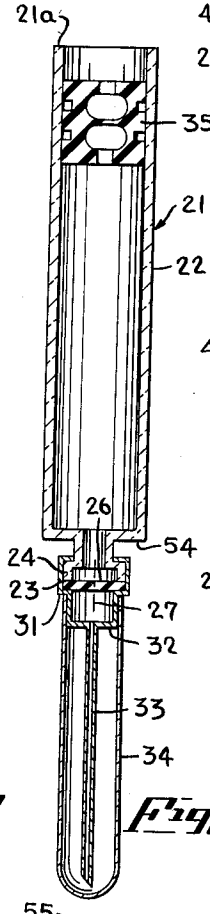

Fig2

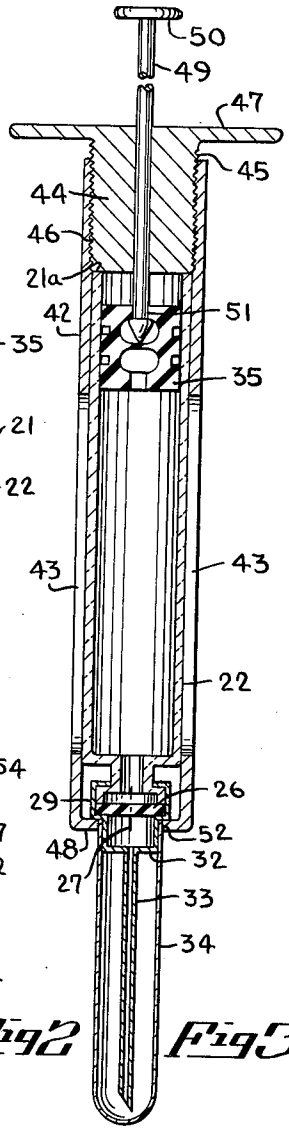

Fig3

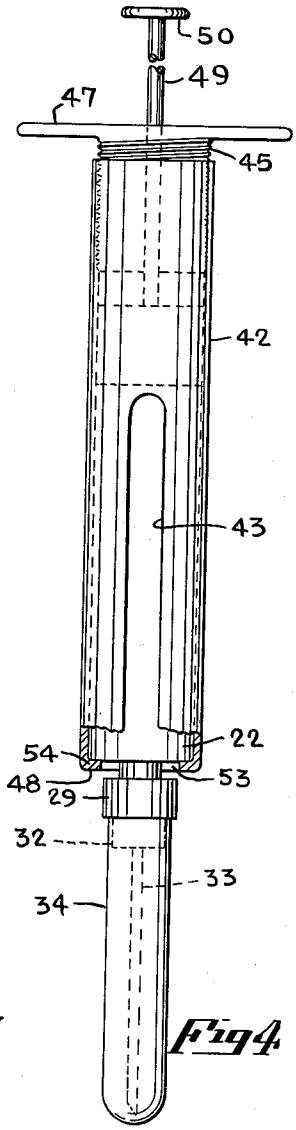

Fig4

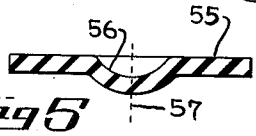

Fig5

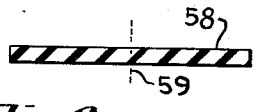

Fig6

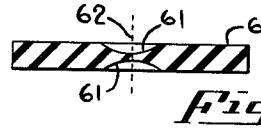

Fig7

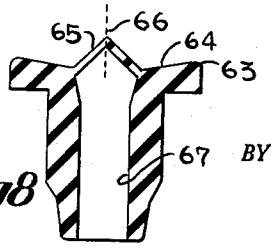

Fig8

INVENTOR.
SAMUEL D. GOLDBERG
BY
To Michaelis
Atty

United States Patent Office 3,089,490 Patented May 14, 1963

3,089,490 DISPOSABLE CARTRIDGE TYPE HYPODERMIC SYRINGES

Samuel D. Goldberg, West Hempstead, N.Y., assignor to Graham Chemical Corporation, Jamaica, N.Y.

Filed Mar. 14, 1960, Ser. No. 14,663
11 Claims. (Cl. 128—218)

The present invention relates to hypodermic syringes of the type used in parenteral administration of medicaments and the like agents in the diagnosis, therapy and prophylaxis of diseases of the human or animal organism.

More particularly, the invention is concerned with hypodermic syringes of the type comprising disposable, single dose cartridges or ampules containing the liquid to be parenterally administered, closed at one end by a temporary closure sealing the ampule to prevent premature discharge of the contents thereof, through the needle, and closed at the other end by a plunger or piston that seals the ampule permanently and is adapted to move axially within the ampule to expel the liquid contained therein.

Heretofore, disposable, single dose cartridges for use in hypodermic syringes, generally, were of two principal types.

One of these categories involved devices where the needle was firmly mounted on the cartridge and the captive end of the cannula, laterally supported in a perforated diaphragm, stopper, or similar partial closure of the cartridge, extended into the cartridge where it terminated in direct contact with the medicament or similar solution contained in the cartridge. Usually, the free end of the needle was closed by a closure which could be removed prior to the discharge of the contents of the cartridge.

The other principal type of disposable, single dose cartridge for use in hypodermic syringes, involved a separation of the needle from the solution or similar contents of the cartridge until the hypodermic syringe was to be readied for immediate use. Usually, this separation of the cannula from the liquid in the ampule was accomplished by the interposition, between the captive terminal portion of the needle and the solution, of a partition, frequently in the nature of some sort of diaphragm made of a material and with a wall thickness such that it was susceptible of being ruptured or pierced on application of a force tending to either move the cartridge on to the needle, or else compel the needle to move toward the solution contained in the cartridge. In either instance, the relative displacement of the liquid containing portion of the ampule and the captive terminal portion of the cannula resulted first in contact of the diaphragm or other partition with the pointed end of the needle and on continuation of the relative displacement, in the penetration and rupture of the partition by the needle which now extended into the solution or other liquid contained in the ampule.

The afore-noted types of disposable, single dose cartridges for use in hypodermic syringes met with serious objections.

The first of the above-mentioned types of disposable cartridges, wherein the needle is in permanent contact with the solution, has been found objectionable for the reason that many medicaments, such as adrenalin, for example, and anaesthetics in particular, are adversely influenced by any extended exposure to metal, either because of the perishable aspects of the chemical agents which are promoted by contact with the metallic cannula, or because of corrosive action of the chemicals on the metal resulting in contamination of the medicament or similar solution, or for the reason that the contact of the medicament with the metallic needle may result in a discoloration of the solution which is objected to by the medical practitioner as it impedes the distinction between well preserved and contaminated contents of the ampules.

The second of the categories of disposable cartridges heretofore disclosed and employed, wherein the needle is separated from the medicament or similar solution by a diaphragm or other partition which prior to the use of the hypodermic syringe, is required to be ruptured by a relative displacement of the cartridge and the needle, also is objectionable for a number of reasons. In the first place, although the art is replete with attempts at improving this type of disposable, single dose cartridge, none of the devices proposed thus far have given complete satisfaction from a mechanical point of view, and mechanical failures of one kind or another have been excessive, particularly considering the delicate nature of this field where nothing short of a thoroughly positive, safe and reliable performance of the instruments can be tolerated. In the second place, devices of this kind suffered from the inherent deficiency that in requiring rupture of a diaphragm or similar partition by the sharp edges of a hollow, tubular metallic needle which cut into the material of the diaphragm like a knife, at least some of the material thus cut out was bound to be forced into the open mouth of the needle, under the impact of the solution advancing into the needle under a very material pressure, with the result that clogging of the needle could occur, but far more often, particles of the material were passed along with the solution to enter into the organism of the patient. The entry of such foreign matter as the particles of a ruptured diaphragm, of course, tends to defeat the primary objectives of this class of instruments where the preservation of sterility, purity, and effective exclusion of all extraneous matter is of the most vital importance.

It is a major object of the present invention to eliminate the drawbacks of the disposable single dose cartridges of the prior art, and to provide a device having thoroughly improved characteristics.

More particularly, it is an object of this invention to provide a disposable, single dose cartridge wherein the medicament or other ampule content is prevented from coming in contact with the needle except during the use of the cartridge for purposes of parenteral administration.

It is another object of the present invention to provide a disposable cartridge wherein the needle is effectively separated from the liquid contents of the ampule until the cartridge is used for purposes of injection, yet the removal of such separation, and the establishment of contact between the medicament and the needle, is effected without any relative displacement of the cartridge and the needle whereby to eliminate the mechanical failures frequently attendant on such displacement.

It is another, important object of this invention to provide a disposable single dose hypodermic syringe incorporating a self-contained cartridge and needle unit.

It is a still further object of this invention to provide a disposable, single dose cartridge involving effective separation of the liquid contents of the ampule from the

needle up to the time of actual injection, but requiring no rupture of any wall or other separating element tending to introduce foreign particles into the needle, into the medicament, and ultimately, into the organism.

Among ancillary objects of this invention are enhanced simplicity, and consequently, an improved economy of manufacture of disposable cartridges, obtained along with the elimination of the prior art drawbacks enumerated above.

Other objects, and the manner in which the same are attained, will become apparent as this specification proceeds.

Regarded in certain of its broader aspects, the invention comprises a disposable cartridge incorporating a diaphragm and an expansion chamber therefor, interposed below the liquid contents of the ampule and a needle mounted in fixed position at the bottom of said expansion chamber with its captive terminal portion adequately spaced from the diaphragm even when the latter expands into said expansion chamber, to avoid any mutual contact of the needle and the diaphragm, the diaphragm being made of an elastomer, such as rubber and the like, the diaphragm incorporating a perforation or center bore made in the course of manufacture of the diaphragm, in a manner such that due to the elastic nature of the material, the opening is of a self-sealing character and thus, will present the effective properties of a complete partition or separating element, until, under the influence of the varying material pressure exerted on the liquid contents of the ampule by the actuation of the piston normally depressed for injection purposes, the diaphragm is caused to expand into the free space inside the expansion chamber, whereupon the pre-perforated, self-sealed opening is re-opened so as to serve as a passage for the solution in the ampule on its way to the needle and hence into the organism. Manifestly, reopening of the self-sealing pre-perforated passage involves none of the risks of clogging and contamination encountered on rupture of a diaphragm by the needle, nor any danger of mechanical failure because of the absence of any relative displacement of the cartridge and the needle. Yet, complete separation is maintained between the liquid in the ampule and the needle, so that the drawbacks resulting from the absence of such separation and consequent contamination and dissolution of the medicament are also eliminated by the present invention.

Suitable materials for use in making disposable cartridge diaphragms according to this invention include soft natural and synthetic elastomers, of which rubber chiefly is preferred. The diaphragm may be provided in the form of a disk with a very fine perforation in the center which is self-sealing except under material pressure when it opens to serve as passage for the liquid; it may be a disk with a depression in the center resulting in a particularly favorable force distribution; it may be a disk with a thinned out center portion, or it may be provided in the form of a mushroom-shaped structure wherein a pre-perforated center portion extends downward into a tubular guide portion which directs the stream of liquid issuing from the bore, when it is reopened under pressure, onto the open mouth of the needle mounted underneath.

In order to facilitate a more complete understanding of these and other facets of the present invention, reference is made to the accompanying drawing wherein several embodiments of the invention are illustrated, by way of example rather than with any limitative intent.

In the drawings:

FIG. 1 is a sectional view of a disposable hypodermic syringe assembly including a cartridge comprising a self-sealing diaphragm and expansion chamber therefor, according to the present invention;

FIG. 2 is a sectional view of essential parts of a modification, showing a disposable cartridge, needle and interposed diaphragm and expansion chamber assembly particularly adapted for insertion in a hypodermic syringe.

FIG. 3 is a sectional view of a hypodermic syringe accommodating the disposable cartridge, needle and interposed diaphragm and expansion chamber assembly shown in FIG. 2.

FIG. 4 is a similar view of a modification of the hypodermic syringe shown in FIG. 3.

FIG. 5 is a diagrammatic sectional showing of a diaphragm forming part of a disposable cartridge according to the invention, the diaphragm having a central depression;

FIG. 6 is a similar showing of a simplified, disk-shaped diaphragm;

FIG. 7 is a similar view of a diaphragm including a thinned out center portion, and

FIG. 8 is a similar sectional view of a diaphragm according to the invention provided with a tubular extension in the region of the self-sealing center portion.

Referring now to the drawings, wherein like elements are indicated by identical reference numerals, and first to FIG. 1, this illustrates a preferred embodiment of the invention involving a complete cartridge, self-sealing diaphragm and hypodermic needle assembly. The medicament-carrying cartridge **21** is seen to comprise an essentially straight, tubular body portion **22** of substantially uniform bore, open at one end and terminating at its opposite end **23**, in a partially constricted tubular portion **24**, having a diameter considerably smaller than that of the tubular body portion **22** and provided, on its outer surface, with an annular groove **25**. A disk **26** is positioned against the end portion **24**, substantially as shown. This disk **26** is formed of a resilient, liquid impervious, elastomer material such as natural or synthetic rubber, synthetic rubber-like material, or composite laminated material comprising the foregoing, capable of being sterilized and substantially inert toward and insoluble in liquids, solvents and medicaments normally parenterally administered by injection, and having a configuration and wall thickness so selected as to positively react to pre-perforation, in the course of its manufacture, by a narrow bore **27**, with a self-sealing effect which closes again the opening unless and until reopening thereof is forced by the material pressure brought to bear on the liquid by the descent of the piston **35** in the tubular body portion **22** of the cartridge **21**.

A substantially tubular closure collar element **29**, turned in at its ends, is disposed around the end portion **23** of the cartridge and has a top part **30** turned in so as to be sealed in and engaged with the annular groove **25**, while a bottom part **31** is similarly turned in at its ends to support, in its central region, a substantially tubular expansion chamber **32** at the bottom of which the hypodermic needle **33** is mounted, in any well known manner. Manifestly, these parts are held together firmly and permanently providing a liquid-tight closure across the mouth of the cartridge unless and until the application of compressive forces expands the diaphragm and in so doing, reopens the self-sealed opening **27**. An elongated needle cover or sheath **34** made of rubber, plastic, or similar material is slipped over the expansion chamber and needle mount member **32** to provide an airtight seal for the sterile needle until it is used.

In order to bring the compressive forces into play, an essentially cylindrical piston **35** is provided which on its circumference, is provided with a plurality of annular grooves formed at spaced intervals and serving to facilitate fluid-tight sealing of the ampule. While this piston, on principle, could be of any conventional type, it may be provided, advantageously, of the improved type disclosed and claimed in my copending application for U.S. Letters Patent, Serial No. 776,014, filed November 24, 1958, now Patent No. 3,045,674, which is distinguished by the disposition of identical top and bottom openings **36** either one of which is susceptible of being engaged by the head **37** mounted on the syringe plunger rod **39**. Piston actuating means **40** are mounted on the plunger rod **39**

and will serve in the depression of the piston 35 when the syringe is used in the parenteral administration of a medicament or similar agent contained therein. A finger grip 41 provided in the form of a flared end portion integral with said body, serves to further assist in a firm hold on, and safe operation of, the syringe.

The preferred embodiment of the invention according to FIG. 1 thus will be understood to be in the nature of a self-contained disposable single dosage syringe which incorporates a perfectly fluid-tight seal effective from the time of manufacture and introduction of the medicament, through the periods of shipment and storage, to the very instant of actual administration when the exertion of pressure on the piston, and the consequent exertion of pressure, transmitted by the liquid in the cartridge, on the self-sealed diaphragm closure, will re-open the pre-perforated but again sealed passage therein, so the liquid will pass through this passage and enter the needle disposed underneath the same, for injection into the organism, all dangers of mechanical failure, clogging, contamination or discoloration being effectively eliminated by the absence of mechanically displaced parts (other than the piston), and the avoidance of direct contact of the medicament with the needle prior to the injection, and of a rupture of the diaphragm tending to introduce foreign particles into the cannula and the medicament.

Referring now to FIG. 2, this illustrates a disposable, single dosage cartridge according to the invention which is designed for introduction and use in hypodermic syringes as shown in FIGS. 3 and 4, rather than as a self-contained unit assembly as illustrated in FIG. 1.

The disposable cartridge of FIG. 2 distinguishes from the self-contained unit of FIG. 1 by the elimination of the plunger rod 39, the piston actuating means 40, and the finger grip 41, the functions of these elements being taken over by corresponding members associated with the hypodermic syringes of FIG. 3 or 4.

Referring now to FIGS. 3 and 4, these illustrate cartridge type hypodermic syringes corresponding to a certain extent, to the devices covered by my United States Patent 2,753,867, distinguishing, however, therefrom, as well as from one another, in such respects as will be fully outlined below. These syringes essentially comprise three associated and coacting elements: a barrel, a plug engaging the barrel end, and a plunger assembly mounted in said plug. The barrel 42 is substantially tubular and provided with one or more longitudinally extending inspection openings or slots 43. The plug 44 is comprised of a relatively elongate, essentially cylindrical body having an opening extending axially therethrough, provided with external threading 45 extending along substantially its entire length, engaging with mating threading 46, in the interior end portion of the barrel 42 when the plug is positioned therein substantially as shown. It will be observed that the plug 44 is provided with a pair of integrally formed, oppositely radially extended lugs 47, together constituting the finger grip of the syringe, and serving also to facilitate rotating the plug relative to the syringe barrel, whereby the plug may be advanced toward or retracted from the bottom 48 of the barrel 42.

The syringe plunger assembly serving as the piston actuating means, comprises a shaft 49, freely slideably received in the axially extending opening formed in the plug 44, terminating at one end in a head 50, shaped to fit the syringe user's hand and to constitute the hand grip of the syringe, and, at the opposite end, terminating in a head 51 which may correspond to the head 37 shown in FIG. 1, and thus may be adapted to firmly engage an opening 36 in the piston 35, forming part of a cartridge according to FIG. 1 or 2.

In FIG. 3, the bottom 48 comprises a circular, centrically disposed opening 52 of a diameter substantially smaller than that of the portion 24, at the bottom of the tubular body 22 of the cartridge shown in FIG. 1. If a cartridge according to FIG. 2 is inserted in the barrel 42 of the hypodermic syringe of FIG. 3, it will be understood that the expansion chamber and needle mount member 32, the needle 33, and the cover or sheath 34 engaging member 32 so as to protect said needle, will pass through the opening 52 in the barrel bottom 48, but that the remainder of the cartridge will remain disposed inside the barrel as the bottom 48 will abut against the collar portion 31 and restrain the cartridge from passing through the aperture 52.

In the modified embodiment shown in FIG. 4, the bottom 48 of the barrel 42 comprises a circular, centrically disposed opening 53 of a diameter substantially larger than that of the portion 24 and all the elements associated therewith, at the bottom of the tubular body 22 of the cartridge shown in FIG. 2, this diameter, however, being also substantially smaller than that of the tubular portion 22 with the result that on insertion of the cartridge 21 into the barrel 42 of FIG. 4, the portion 24 covered by the collar 29, the expansion chamber and needle mount member 32 and the needle 33 and sheath 34, will pass through the aperture 53, while the remainder of the cartridge will remain disposed inside the barrel as the bottom 48 will abut against the shoulder portion 54 above the grooved and constricted portion 24 of the cartridge 21.

In order to insert a cartridge according to FIG. 2 in the devices of FIG. 3 or 4, the plunger and plug assembly is removed from the breech end of the syringe barrel. In the device of FIG. 3, the sheath-protected needle passes through the bottom aperture in the barrel, but the remainder of the cartridge remains disposed inside the barrel. In the device of FIG. 4, the sheath-protected needle, as well as the constricted bottom portion 24 pass through the bottom opening in the barrel while the other parts of the cartridge remain disposed inside the barrel.

The threaded portion of the plug 44 is then engaged with the internal threading of the syringe barrel breech portion, and, by relative rotation of the plug and barrel, the plug is advanced axially with the barrel until the end portion of the plug 44 abuts against the end portion 21*a* of the cartridge 21.

By suitable manipulation and rotation of the plunger shaft 49 and the hand grip 50, the shaft is advanced axially within the barrel until the head 51 engages an opening 36 in the piston 35 of the cartridge. It will be appreciated that in this manner, the disposable cartridge inserted in the barrel is firmly secured therein, and this applies to cartridges according to FIG. 2, of varying length. It will be understood further that regardless of the particular type or size of cartridge employed, the disposable cartridge-needle units, when inserted in the devices of FIGS. 3 and 4, will operate on the same principle as the complete disposable syringe assembly of FIG. 1, by relying on the self-sealing closure of the pre-perforated disk 27, for maintaining a perfect seal for the cartridge content until by pressure applied to the hand grip 50, the piston is caused to descend so as to expand the diaphragm into the free space of the expansion chamber, and in so doing, reopen the perforation and allow the liquid to pass through the disk and into the needle, without incurring any of the drawbacks of contamination, discoloration, or mechanical failure so frequently observed with prior art devices.

Referring now to FIGS. 5, 6, 7, and 8, it will be understood that these figures illustrate various forms of self-sealing diaphragms which can be used to advantage in disposable, single dose cartridges or syringes according to the invention.

FIG. 5 shows a diaphragm of generally disk-like configuration which may be molded from rubber or some similar elastomer and which comprises a flat outer portion 55, and a depressed center portion 56, the center of the latter being pre-perforated in the course of its manufacture by a self-sealing, very narrow bore 57.

FIG. 6 shows a simple disk-shaped diaphragm of the type incorporated in FIGS. 1 and 2, which consists of the

disk **58** of rubber or the like, and the normally re-sealed bore **59** which will re-open when the piston in the cartridge is forced down to expel the medicament.

FIG. 7 illustrates a diaphragm of generally disk-like configuration which comprises an outer portion **60** of a certain substantial thickness, and a center portion including top and bottom depressions or recesses **61** whereby the effective wall thickness of the diaphragm is reduced in the very center where the pre-perforated and then self-sealed aperture **62** is disposed, in a manner and for a purpose set forth above.

FIG. 8 illustrates a more composite diaphragm structure comprising an outer portion **63**, a slightly depressed intermediate portion **64**, and a cone-shaped center portion **65**, the center of which accommodates the bore **66**, normally closed by the self-sealing characteristics of rubber or a similar elastomer of which the diaphragm is made. A substantially tubular guide portion **67** which, preferably, is provided integral with the disk-shaped portion of the diaphragm, extends downward from the bottom of the center portion **65**, and serves to guide the liquid issuing from the passage **66**, once this has been re-opened by actuation of the piston and corresponding pressure exerted on the medicament in the cartridge, into proximity of the mouth of the hypodermic needle mounted underneath, e.g. in the manner shown in FIGS. 1 and 2.

I wish it to be understood that I do not desire to be limited to the construction, design, and operation of devices according to the invention as shown and described, as modifications within the scope of the following claims and involving no departure from the spirit of the invention nor any sacrifice of the advantages thereof, may occur to workers in this field.

Having thus described the subject matter of this invention, what it is desired to secure by Letters Patent of the United States of America is:

1. A disposable, single dose cartridge for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

2. A self-contained, disposable hypodermic syringe for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, piston actuating means engageable with said piston disposed to enter the open end of said tubular body for producing controlled axial motion of the piston at will in either direction, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

3. A disposable, single dose cartridge for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; said diaphragm being provided in the form of a substantially flat disk, and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

4. A disposable, single dose cartridge for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to re-

open under the influence of pressure exerted on said piston; said diaphragm being provided in the form of a disk, a depressed portion being disposed in the center of said disk, said perforation being disposed in the center of said depressed center portion, and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the grove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

5. A disposable, single dose cartridge for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; said diaphragm being provided in the form of a disk, depressions in the top and bottom in the center of said disk, said perforation being disposed in the center of said center portion, and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion, adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

6. A disposable, single dose cartridge for use in parenteral administration of medicaments and the like, comprising an elongate tubular body of substantially uniform bore, open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; said diaphragm comprising a disk portion, a projection rising from the center of said disk portion, a tubular guide portion extending downward from the center of said disk portion, said perforation being disposed in the center of

said projection in axial alignment with the center of said tubular guide portion, and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm.

7. A disposable, single-dose cartridge according to claim 1, comprising a protective sheath adapted to provide an air-tight sterile seal for said needle, said sheath comprising an elongate tubular body closed at the bottom and open at the top, said open top being adapted to tightly fit over and engage said cup-shaped expansion chamber portion disposed underneath said diaphragm.

8. A self-contained, single-dose hypodermic syringe according to claim 2, comprising a protective sheath adapted to provide an air-tight sterile seal for said needle, said sheath comprising an elongate tubular body closed at the bottom and open at the top, said open top being adapted to tightly fit over and engage said cup-shaped expansion chamber portion disposed underneath said diaphragm.

9. In combination with a hypodermic syringe device including a barrel, a bottom opening in said barrel and a piston actuating means mounted on said barrel, a disposable, single-dose cartridge comprising an elongate tubular body of substantially uniform bore adapted to be disposed inside said barrel, said tubular body being open at one end, partially constricted and provided with an annular grooved formation on the outer surface near the other end thereof, a piston positioned within the open end of the tubular body and capable of movement axially therein, engaging the inner walls thereof to provide an essentially liquid-tight closure therewith, and a partial closure at the other end of said tubular body, said partial closure comprising a diaphragm extending across and lying against the bottom of said annular grooved formation, said diaphragm being self-sealing, a perforation in said diaphragm normally closed due to the self-sealing characteristics of the diaphragm, but adapted to reopen under the influence of pressure exerted on said piston; and provided as an integral unit, a combination needle mount, diaphragm expansion and needle member comprising a top collar portion adapted to engage said annular grooved formation, an annular re-entrant flange at the top of said collar portion engaging the groove of said annular formation, a re-entrant flange at the bottom of said collar portion abutting against the bottom of said diaphragm along the periphery thereof, a cup-shaped portion serving as an expansion chamber for said diaphragm extending downward from said re-entrant flange at the bottom of the collar portion, a bottom on said cup-shaped expansion chamber portion, and a needle mounted in said bottom and flush therewith, whereby to firmly mount the needle on said tubular body, seal the diaphragm at the bottom thereof, and avoid any contact of said needle with said diaphragm, means on said piston actuating means for engaging said piston, said bottom opening in the barrel being adapted to permit passage of said needle but to restrain at least the major portion of said tubular cartridge body within said barrel.

10. The combination of claim 9, wherein the bottom opening in the barrel is adapted to permit passage of the constricted bottom portion at the end of said tubular cartridge body.

11. The combination of claim 9, wherein the bottom opening in the barrel is adapted to permit passage of the needle but to restrain the entire tubular cartridge body including its constricted bottom portion, within the barrel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,288,174 Pittenger ---------- Dec. 17, 1918
1,712,069 Cressler ---------- May 7, 1929
1,840,788 Nevin ---------- Jan. 12, 1932
1,929,247 Hein ---------- Oct. 3, 1933
2,577,780 Lockhart ---------- Dec. 11, 1951
2,671,449 Dann ---------- Mar. 9, 1954

FOREIGN PATENTS

328,570 France ---------- May 6, 1903