

- [54] **HYPODERMIC SYRINGE AND NEEDLE CONSTRUCTION**
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[58] Field of Search **128/218 NV, 218 D, 128/218 DA, 218 M; 401/134**

[56] **References Cited**

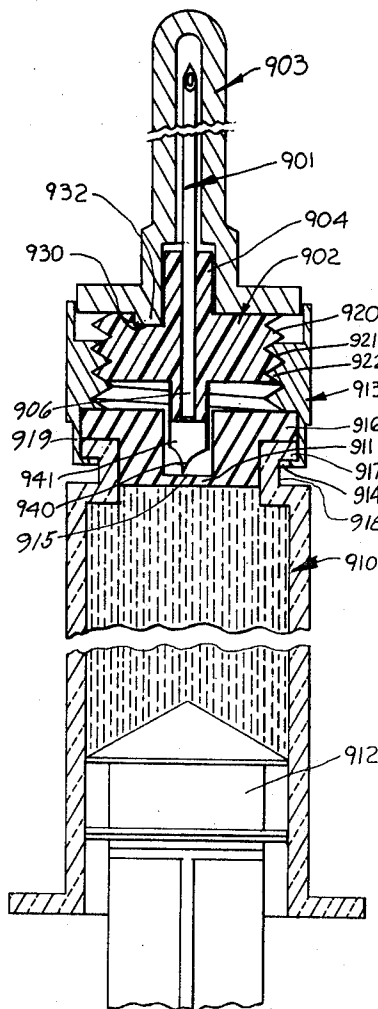
UNITED STATES PATENTS			
2,483,825	10/1949	Goldberg	128/218
1,180,665	4/1916	McElroy	128/218
3,187,749	6/1965	Sarnoff	128/218
1,767,304	6/1930	Morton	128/218
1,143,855	6/1915	Park	128/218
2,922,419	1/1960	Bednarz	128/218
3,158,155	11/1964	Myerson et al.	128/218

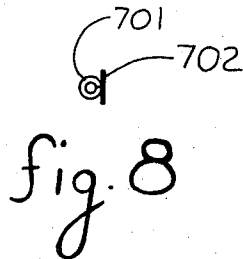
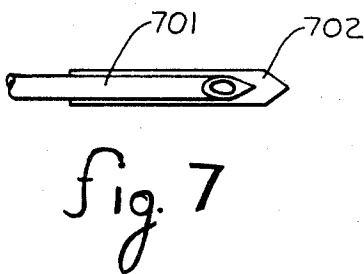
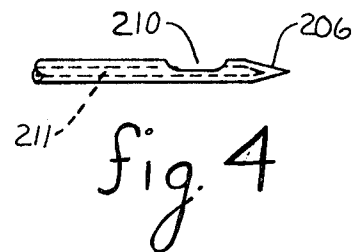
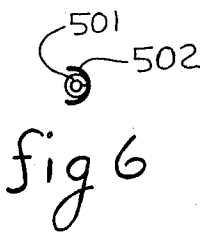
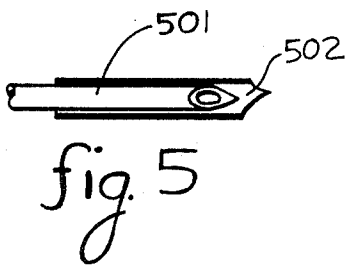
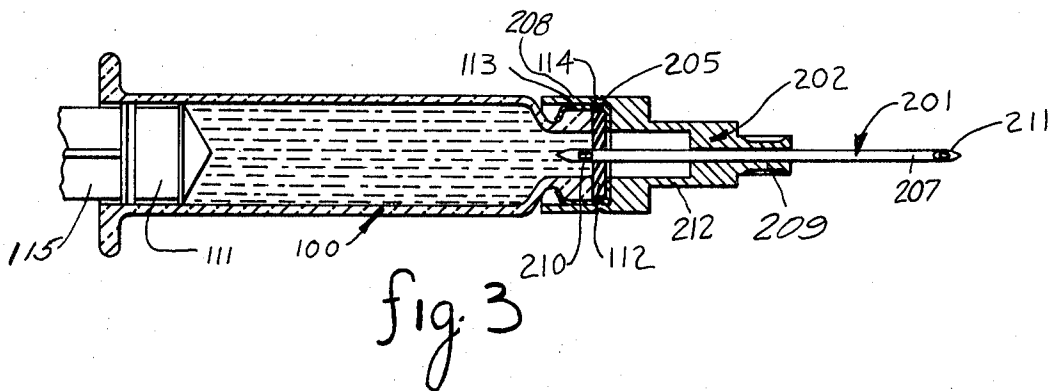
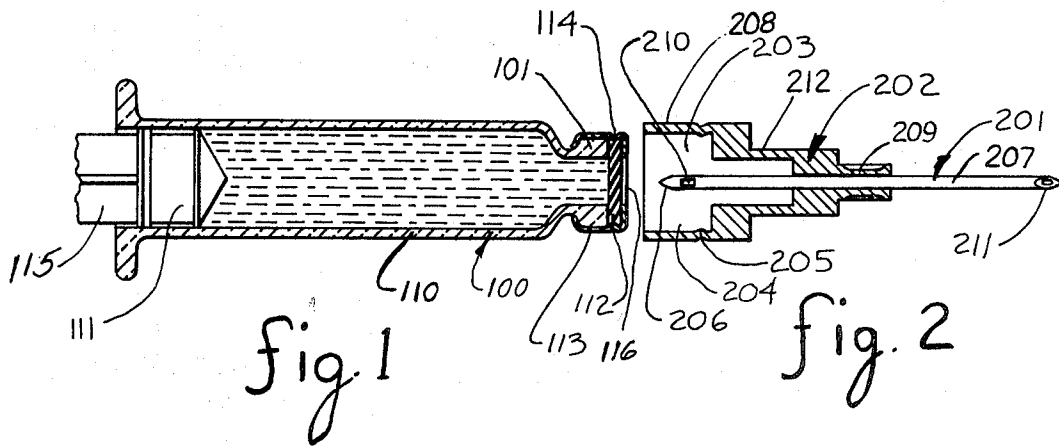
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[57] **ABSTRACT**

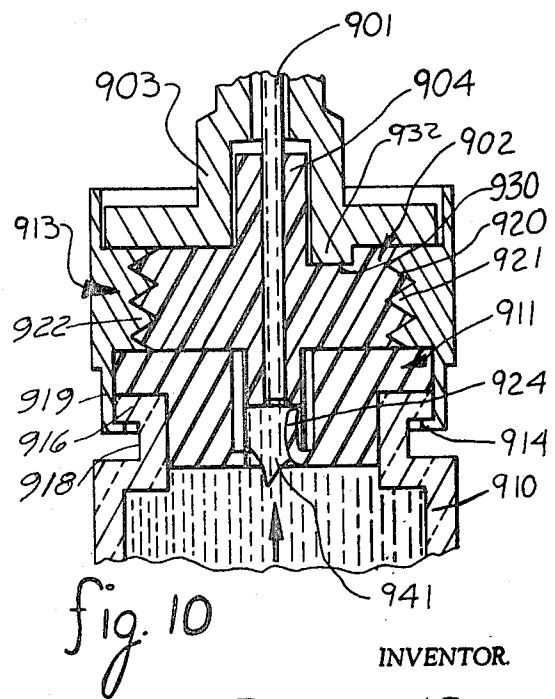
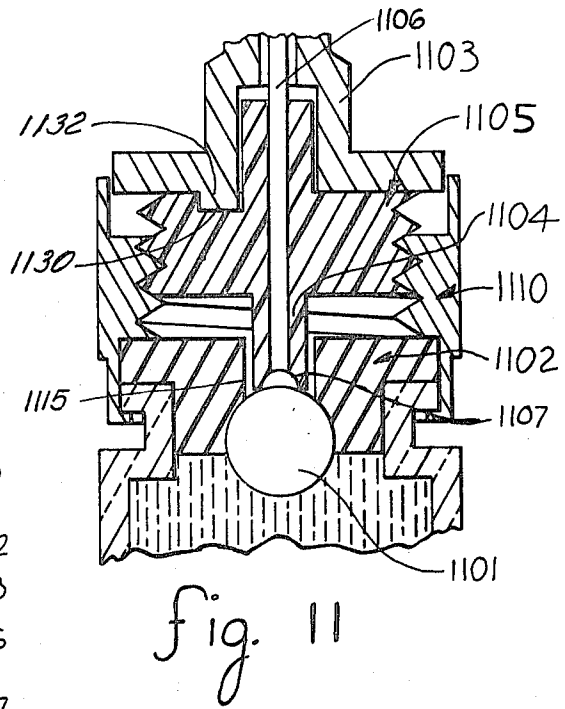
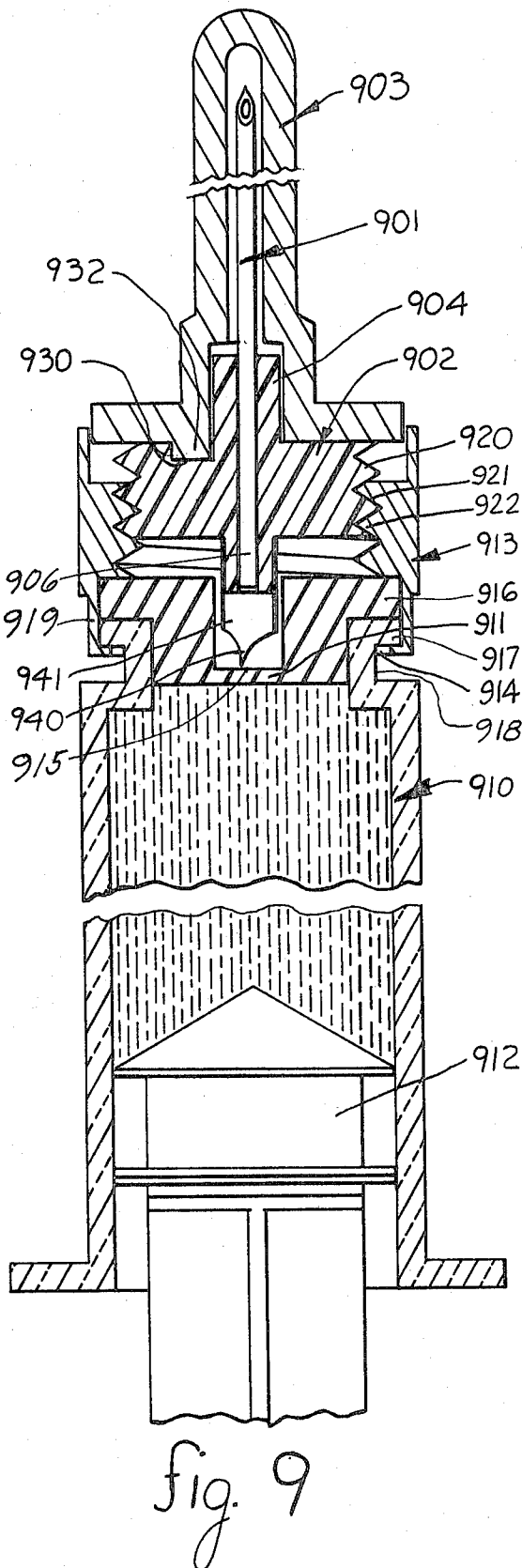
A hypodermic syringe and needle construction comprising threaded actuating means mounted on the end of a syringe ampule and adapted to provide a mechanical advantage for piercing a needle and needle holder unit through a piercable end closure. In another facet of the invention, a ball-type closure is provided in a disposable ampule unit, the unit including threaded actuating means on the distal end of the ampule for moving the needle holder to dislodge the ball in the closure and permit fluid communication between the contents of the ampule and the lumen of the needle. A non-coring, discrete needle and holder construction, adapted to be stored as a separate unit from a syringe or ampule, has a hypodermic needle provided with solid piercing means extending beyond the lumen of the needle for initially piercing the end closure of an ampule without producing a coring action, facilitating passage of the lumen of the needle through the pierced closure without creating a core, the needle holder being adapted to substantially rigidly, sealingly engage the discharge end of a syringe or ampule.

5 Claims, 11 Drawing Figures





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HYPODERMIC SYRINGE AND NEEDLE CONSTRUCTION

THE FIELD OF THE INVENTION

This invention relates to disposable hypodermic syringes and ampules which are used in the administration of medicaments or injectable fluids to humans or animals. Particularly, the invention is directed to a syringe or ampule construction, and a needle and needle holder construction, which are designed to produce an optimum mechanical advantage for introducing the needle into the syringe or ampule through a resealable closure without creating any sudden release of fluid under pressure at the moment of insertion of the needle through the end closure. The disposable hypodermic syringes which exist are of two types. The first type is pre-sterilized empty disposable syringe, in which the person administering the medicament or injectable fluid transfers the required amount of that liquid from a bulk container to the syringe prior to injection, after which injection the entire syringe assembly is discarded. The second type of disposable syringe is that in which the medicament or injectable fluid is pre-filled in the syringe under production filling conditions. Another type of syringe is a reusable syringe, which is loaded with a disposable ampule which has been pre-filled with medicament or injectable fluid, and which also utilizes a disposable needle. The two latter types of syringe have many advantages over the former, such as printing the identification of the medicament or fluid and dosage thereof in clear, identifiable language on the syringe or ampule, and the limiting of contamination of the contents of the syringe or ampule under production filling and handling techniques. These contrast with the increased likelihood of contamination which occurs when the person administering the liquid fills the syringe.

THE PRIOR ART

It is necessary, in order to preserve the sterility of the contents of pre-filled syringes and ampules, and to preserve the sterility of the interior of non-pre-filled syringes, that the syringe or ampule be sealed in such a manner as to avoid any contact with the atmosphere. This is best accomplished by maintaining the needle as a separate unit from the syringe unit prior to use. This separation is also necessary because of the desirability of using various sizes of needles with different fluids, as a result of which it is more economical to separately produce and sell the syringes or ampules and the needle units. Furthermore, many injectable liquids have a corrosive reaction with the metal of which hypodermic needles are typically made, so that it is desirable to maintain the needle out of contact with the liquid for any prolonged period of time prior to administration of a medicament or other injectable.

It has long been recognized as being desirable to provide a hypodermic needle which will pierce a piercable end closure of a syringe or ampule, to provide convenient assembly of the needle onto a hypodermic syringe unit. Many prior art devices are known for achieving this result. For example, U.S. Pat. No. 3,380,449 discloses one such type of unit, in which the needle is manufactured as an integral portion of the ampule and closure assembly, and a conventional, double-pointed needle is used to pierce the necked-down section of an ampule stopper. U. S. Pat. No. 2,688,966 shows a simi-

lar construction as part of a reusable syringe which uses disposable ampules, and in which the double-pointed needle is screwed on the syringe and has one end which penetrates the ampule stopper. Other types of devices, one example of which is shown in U.S. Pat. No. 3,115,136, entail the incorporation, as an integral part of the ampule unit, of a needle holder assembly which is designed to dislodge a ball which is mounted in the ampule closure, which closure is sometimes piercable. The former two types of constructions have the disadvantage of causing coring of the syringe or ampule closure, by the sharp, pointed end of the syringe, cutting a core from the closure as it passes therethrough. This core may obstruct the lumen of the needle, and therefore prevent administration of the medicament or injectable fluid, or alternatively, under the pressures of administration, might be forced through the needle into the patient with the attendant possibility of contamination, or of injury to the patient, such as by creating a venal or arterial obstruction. One disadvantage of the latter type of needle construction, involving the dislodging of a ball, is the possibility of pre-ejection of liquid at the moment that the ball seal is released, under the considerable forces necessary to dislodge the ball. This latter, ball-type construction is also much more expensive to manufacture than the other types constructions, because of the expense of the elements of the unit and of the assembly thereof. The ball-type units are also more subject to contamination than is a unit incorporating a one-piece end closure. In those constructions of prior art pre-filled syringes of the former type, there is also a possibility of pre-ejection of fluid at the moment of entry of the needle into liquid communication with the ampule interior.

BRIEF SUMMARY OF THE INVENTION AND ADVANTAGES OVER THE PRIOR ART

The hypodermic needle and syringe construction of this invention overcome the disadvantages of the prior art of possible contamination, expensive construction, coring, and pre-ejection of liquid, by providing a needle construction which is inexpensive, which will not core, which is not susceptible to contamination during manufacture, which need not be stored as an integral part of the syringe assembly, and which, in one embodiment of the invention, is provided with a substantial mechanical advantage such that communication between the needle lumen and ampule or syringe interior can be gradually achieved to avoid an abrupt, high-pressure communication and possible pre-ejection of liquid.

In one aspect of the invention, an ampule or a syringe is provided with a piercable end closure, and the ampule or syringe and needle may be pre-assembled as a single unit. The distal end of the ampule or syringe is provided with a sealing cap, having a threaded inner surface, which engages a mating threaded inner surface of the needle holder. The proximal end of the needle extends below the main surface of the needle holder, and the needle may be constructed to provide a non-coring, piercing penetration of the end closure, or, alternatively, to dislodge a sealing ball mounted in the end closure. The needle unit may be pre-packaged as an integral part of the syringe or ampule unit, or may be screwed into the sealing cap immediately prior to its use. Communication between the needle lumen and syringe or ampule contents is achieved by rotating the needle unit until communication is obtained. The mechanical advantage provided by the mating threaded

members facilitates gradual communication between the needle and the syringe or ampule contents, thereby avoiding the likelihood of pre-ejection of liquid therefrom. In one embodiment of the invention, the needle is provided with non-coring entry means at its proximal end for piercing the syringe or ampule piercable end closure, to provide an easy communication between the syringe or ampule interior and the needle, without coring, and without pre-ejection of liquid. In this embodiment, the needle holder and needle cap may be lockingly constructed, so that rotation of the cap will rotate the holder, for insertion of the needle into the ampule or syringe without contaminating the needle.

Another aspect of this invention resides in a needle construction which is adapted to be used with a disposable hypodermic syringe or ampule, which needle is of a design such that no coring is produced upon entry of the needle through the syringe or ampule end closure, and which, in one embodiment, allows the needle and needle holder to be constructed as a separate unit from the syringe or ampule which can readily be produced and stored in a variety of needle sizes, with a single size of holder which can be rigidly, sealingly secured to any suitable syringe or ampule. The needle unit of this invention is provided with a lumen which terminates inboard the proximal end of the needle unit, such that the needle unit has a solid end member which initially pierces the end closure of a syringe or ampule, to form a suitable aperture for passage of the needle, whereby no core is or can be produced during entry. In one embodiment of the invention, the needle has a closed proximal end, which may be formed by collapsing the normally open proximal end of a conventional needle and then sharpening the same to produce a piercing point. The fluid inlet near the proximal end of the needle is spaced from that point at the proximal end, and is formed by grinding an aperture through the side wall of the needle to the lumen. In another embodiment of the invention, a conventional needle having a lumen which extends from one end to the other, and having one or two pointed ends, is provided with a pointed piercing member formed integrally therewith, and extending about one-half inch beyond the proximal end of the needle. The piercing member is preferably of such size that it produces a slit, slightly wider than the outside diameter of the needle, which is large enough to permit convenient passage of the needle through the end closure, while maintaining an adequate tight seal around the needle to avoid leakage. The needle holder is of such design that, upon entry of the needle through the syringe or ampule end closure, the needle holder is tightly secured to the distal end of the syringe or ampule, to provide a firm unitary combination of the two at the time that the syringe or ampule is to be used for fluid administration.

Therefore, it is an object of this invention to provide a hypodermic needle construction which will not produce coring.

Another object of this invention is to provide a non-coring hypodermic needle and needle holder construction which may be manufactured and stored as separate units from the ampules or syringes with which they may subsequently be used, and which will, when assembled, provide a rigid, sealed assembly.

Yet another object of this invention is to provide a needle holder and syringe or ampule combination construction, which is provided with a considerable me-

chanical advantage, to facilitate gradual communication between a hypodermic needle lumen and a sealed ampule or syringe interior, to avoid pre-ejection of the contents of the ampule or syringe.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a pre-filled hypodermic syringe adapted for use with the needle and holder in this invention;

FIG. 2 is a cross-sectional view of a preferred embodiment of the non-coring needle and needle holder of this invention, adapted to be used with the syringe of FIG. 1;

FIG. 3 is a cross-sectional view, showing the needle holder of FIG. 2 seated on the end of the syringe of FIG. 1, with the needle inserted in fluid communication with the syringe interior;

FIG. 4 is a fragmentary side view of the proximal end of the non-coring needle of FIG. 1;

FIG. 5 is a fragmentary top plan view of the proximal end of a modified embodiment of non-coring needle, which may be used with the needle holder construction of FIG. 2;

FIG. 6 is an end view of the non-coring needle embodiment of FIG. 5;

FIG. 7 is a fragmentary top plan view of the proximal end of another embodiment of non-coring needle of this invention;

FIG. 8 is an end view of the non-coring needle embodiment of FIG. 7;

FIG. 9 is a fragmentary cross-sectional view of a preferred embodiment of a combined syringe and needle construction in accordance with this invention, showing the position of the needle prior to piercing the syringe end closure;

FIG. 10 is a fragmentary view, of the unit of FIG. 9, showing the needle in fluid communication with the contents of the syringe; and

FIG. 11 is a fragmentary cross-sectional view of another embodiment of the invention shown in FIG. 8, showing the position prior to displacing the ball out of the end closure.

As seen in FIG. 1, the syringe 100 comprises a plastic or glass cartridge 110 in which a liquid, which may be a medicament or other injectable fluid, is maintained in sealed condition. The proximal end of syringe 100 is sealed with a piston or plunger 111 which is made of rubber or a matching ground glass surface, and which is attached at the end of a syringe plunger rod 115. The other end of syringe 100 is formed with a reinforced, reduced diameter, neck section 101, over the end of which resealable rubber diaphragm 112 is sealingly held by a sealing ring 113. Sealing ring 113 has an aperture 116 which provides access to the central outer surface of the rubber diaphragm 112 for entry of a hypodermic needle. Sealing ring 113 is provided with an annular groove 114, which engages the edge of diaphragm 112, and the purpose of which will be more fully discussed hereinafter. The general construction of the disposable syringe, insofar as the syringe material, the piston and syringe plunger construction, and the manner of fastening the rubber diaphragm 112 about the neck 101 of the syringe with an annular sealing ring 113, are well known in the art, and do not form any part of this invention.

As seen in FIG. 2, hollow needle 201 is mounted in a needle holder 202, in such manner that a substantial

length 207 of the needle 201 projects in front of the needle holder 202, for insertion into a human or animal for administration of medicament or other injectable fluid. The needle holder 202, which is formed of moldable, slightly yieldable plastic material, such as is provided with a depending annular skirt 208 which extends slightly beyond the proximal, pointed end 206 of needle 201. The skirt 208 is provided, at its upper extremity, with an annular inwardly extending lip 205, which is designed to lockingly, sealingly seat in recessed portion 114 of annular ring 113. The interior diameter 204 of the annular skirt 208 is approximately the same as the outer diameter of annular ring 113, and the needle holder 202 is formed, as noted, of somewhat yieldable plastic material, such that the lip 205 will releasably, tightly seat in groove 114, and the skirt will snugly engage annular ring 113, when the needle holder is in the administering position shown in FIG. 3. Hypodermic needle 201 has a closed pointed end 206, and fluid communication with the fluid-receiving portion of the needle 201 is provided through side opening 210, which is preferably located at least one-quarter inch from the point on end 206, as best seen in FIG. 4.

One manner of forming needle 201 is by taking a conventional hypodermic needle which is pointed at both ends, or which has one flat end and collapsing the proximal end (the flat end in a needle having only one point) and grinding a point thereon, to provide a closed, pointed proximal end 206. An aperture 210 is then ground through the side wall of needle 201 to provide fluid communication between the needle exterior near the proximal end of the needle and the lumen 211 of the needle.

Prior to use, the needle and needle holder unit 201, 202 would preferably be stored in a sterilized package. Sterility of the needle 201 could be achieved by providing an end cap for the skirt portion 208 of the needle holder, and a needle cap which would sealingly seat around one of the annular surfaces 209 or 212 at the distal end of the needle holder. Needle caps and end closures of this sort are well known in the art, and form no part of this invention. Alternatively, sterility could be maintained by packaging sterilized needle and holder units 201, 202 in a pre-sterilized, sealed envelope in a manner which is well known in the art.

In use, the end cap and needle cover would be removed from the needle holder, and the exposed surface of syringe diaphragm 112 sterilized with alcohol. Alternatively, the diaphragm 112 could be provided with a suitable removable sealing cover, to protect the sterility of the outer diaphragm surface. The outer surface of the needle holder, such as surface 212, is grasped by the person assembling the unit, and the holder is slipped over the neck 101 of the syringe 100. As it thus slides over the neck 101, point 206 of the needle 201 pierces the rubber diaphragm 112 which closes the syringe. The needle holder skirt 208 is pushed down tightly over the syringe neck, a moderate amount of force being required to yield lip 205, so that it tightly engages annular groove 114, whereby a substantially rigid union is formed between the syringe and the needle holder.

Because of the closed, pointed construction of the proximal end 206 of needle 201, the needle presses through the rubber diaphragm 112, and cannot cut a core from the diaphragm, inasmuch as the lumen 211 of the needle 201 is closed at the pointed end 206.

Thus, the hypodermic needle construction of this invention readily avoids the coring problem so frequently associated with the prior art constructions. After pointed end 206 of needle 201 pierces diaphragm 112, the apertured portion of the needle enters the pierced diaphragm, to provide fluid communication between the needle lumen 211 and the interior of syringe 100. As a result of the tight fit between the needle holder skirt 208 and the annular ring 113 surrounding the rigid neck 101 of the syringe, when the needle, needle holder and syringe are in the position shown in FIG. 3, they form a substantially rigid unit for reliable utilization in the injection of medicaments and other injectable fluids into human beings and animals.

FIGS. 5 and 6 illustrate an alternative embodiment of the non-coring needle of this invention, which can be used as the proximal end construction for a non-coring needle mounted, for example, in the needle holder illustrated in FIGS. 2 and 3. The needle of FIGS. 5 and 6 constitutes a conventional hypodermic needle 501 which is pointed at both ends, and the lumen of which is in fluid communication with both pointed ends of the needle. A substantially semi-circular metal piercing member 502 has a pointed end extending about one-fourth inch beyond the proximal point of needle 501. Piercing member 502 is preferably formed of rigid metal or plastic and is rigidly joined to needle 501, as by a high-strength adhesive or by welding. It is noted that the diameter of semi-circular member 502 is slightly greater than the outer diameter of the needle, so that the semi-circular cut which is made in rubber diaphragm 112 when the needle passes through the rubber diaphragm into the syringe is adequate to permit convenient, substantially liquid-tight access of needle 501 into the syringe interior. In the embodiment of FIGS. 5 and 6, the proximal end of hypodermic needle 501 could be blunt, rather than pointed, if desired.

FIGS. 7 and 8 illustrate an alternative non-coring needle construction, similar to that shown in FIGS. 5 and 6, with the exception that the piercing member is a planar member 702, which is fastened along the side of needle 701. Planar member 702 extends approximately one-fourth inch or more beyond the point of the proximal end of needle 701, and provides a slit-type opening through the rubber diaphragm 112, to permit non-coring passage of the needle 701 through the diaphragm into fluid communication with the syringe contents. In this embodiment, the proximal end of the needle does not have to be pointed, and may be blunt, if desired.

It will be appreciated that the needle and holder construction illustrated may be modified for use with a variety of needle sizes, and that these various needle sizes can be provided in a holder, the proximal end dimensions of which may be consistent, so that a single basic holder construction may be used to provide non-coring, rigid, fluid-tight communication between a variety of sizes of hypodermic needles, and a single size of hypodermic syringe or ampule units.

It is also to be noted that, although a filled syringe is illustrated in the drawings, it is equally possible and useful to apply the article of this invention to use in an unfilled syringe construction, in which the medicament or injectable fluid to be administered is withdrawn from a bulk container.

Too, the principles of the invention may be used with ampules which are designed for insertion in reusable

metal hypodermic syringe constructions, in which a pre-filled ampule or cartridge is inserted in a reusable administration unit comprising an ampule receptacle and an actuating plunger.

In the embodiment of the invention illustrated in FIGS. 9, 10, and 11, a hypodermic syringe and needle construction is provided which has a substantial mechanical advantage to facilitate gradual, non-prejecting communication between a pre-filled syringe or ampule and a hypodermic needle. Viewing FIG. 9, hypodermic needle 901 is shown as being of a type similar to that illustrated in FIGS. 5 and 6, in that access through the syringe end closure is provided by the use of a rigid, pointed, semi-circular piercing member 941, having a point 940 for passing through the necked-down portion 915 of a sealing rubber end closure member 911. The needle 901 is mounted in a needle holder 902, which comprises a solid body having a narrow pendulous section to which the piercing member 941 is fastened, as by an adhesive, and which section 905 has an opening for fluid communication with the proximal end 906 of hypodermic needle 901. The outer surface of needle holder member 902 is provided with surface threads 920 which rotatably matingly engage surface threads 921 on the inner face of sealing cap 913, which cap 913 is tightly fitted on the lip 917 of disposable syringe 910.

Syringe 910 is of a generally well-known construction, in that it comprises a rigid, elongated, liquid-containing syringe body, one end of which is closed by piston 912, and the other end of which is closed by piercable rubber closure 911 having a central, necked-down piercing section 915. The closure 911 has an outwardly extending flange 916 which overlies lip 917 of the syringe.

The distal end of the syringe has an outwardly extending lip 917 which is connected to a narrow neck 918 between that flange and the syringe body, and which seats the body of closure 911.

The sealing cap 913 has a downwardly extending skirt portion 919 terminating in an annular lip 914 which is seated below the lip 917 of the syringe in the narrow neck section 918. The sealing cap 913 has an inwardly extending threaded portion 922 which overlies the rubber closure member 911, so that the rubber closure member 911 is tightly, sealingly held by the sealing cap 913 between the lip 914 and the inwardly extending portion 922. Cap section 922 terminates inwardly in internal threads 921 which matingly engage the threads 920 of needle holder 904. The sealing cap is fixed on the neck of the syringe, and is not rotatable thereon.

Needle cover 903 overlies the distal end of needle 901 and the needle holder section 904. The needle cap 903 is provided with a downwardly extending projection 932 which engages in a detent 930 in the needle holder body, such that rotation of the needle cap 903 rotates the needle holder 902 through the engagement of projection 932, thereby gradually lowering the needle holder toward the syringe. As lowering occurs, the piercing point 940 of piercing member 941 engages the thin neck portion 915 of the syringe closure 911 and, as it rotates therein, cuts a flap 924 therefrom. FIG. 10 illustrates the final seated position of the needle holder 902 against the upper surface of the syringe closure member 911, so that there is a tight, liquid seal between the needle holder and the end closure, whereby liquid

can flow through the aperture created by flap 924, and through the opening in the proximal end 906 of needle 901.

The embodiment of FIG. 11 differs from that shown in FIGS. 9 and 10 only in the use of a ball 1101, mounted in an aperture 1115 in rubber diaphragm 1102, to seal the aperture. The ball is made of stainless steel or of plastic, and may be desired in certain embodiments of the invention, to provide for thorough mixing of the contents of the syringe prior to injection. Needle holder 1105 is substantially the same as needle holder 902, with the exception that the dependent projection 1104 of the needle holder is somewhat longer in the embodiment of FIG. 11, than its counterpart 905 in FIGS. 9 and 10, as the projection is used to dislodge the ball 1101. Also, the lower end of projection 1104 is formed with a hemispherical recess 1107, to facilitate fluid communication between the contents of the syringe and the needle 1106 in needle holder 1105. In the use of this embodiment, needle cap 1103, which lockingly engages needle holder 1105 by the action of projection 1132 in recess 1130 is rotated to lower the needle holder assembly, dislodge ball 1101, and provide sealed fluid contact between the syringe and the needle, in the manner shown in FIG. 10.

It may be desired to seal the needle holder and cap assembly of the embodiment of FIGS. 9, 10 and 11, separately from the syringe or ampule and its end closure assembly, in order to permit a wide variety of needle sizes to be used with the syringe or ampule. In that case, a suitable closure is provided for sealing cap 913, to maintain the sterility of the upper surface of the syringe closure 911. Also, a suitable cap could be fabricated to cover the piercing point 941 of the needle holder assembly, to prevent its contamination. In that instance, a wide variety of needle sizes, fabricated with holders 904 and caps 903 as parts of the same unit, could be separately stored for use with a single size of syringe or ampule and sealing cap, depending upon the size of the needle needed for a particular purpose.

I claim:

1. A non-coring disposable hypodermic syringe comprising, a tubular body for holding fluids and having a first end and a second end, a movable plunger capable of being moved into said body and sealing said first end, a piercable end closure sealing said second end of said body, a needle holder with a non-coring hollow needle secured therein, said needle holder adapted to telescopically fit onto said second end of said body when the hypodermic syringe is assembled, said needle having an inner end adapted to protrude through said piercable end closure when the syringe is assembled and an outer end projecting outwardly of said needle holder, said hollow needle permitting fluid communication between the fluid within the tubular body and the outer end of the needle for administering injectable fluids to humans or animals, said needle further including a piercing element secured to said needle between said inner end and said needle holder, said piercing element projecting longitudinally beyond said inner end of said needle and adapted to prepierce said piercable end closure so as to prevent a core cut from the piercable end closure from obstructing the passage of fluid through said needle when said needle holder is fitted onto said second end of said tubular body.

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2. A non-coring disposable hypodermic syringe according to claim 1 wherein said piercing element is substantially planar.

3. A non-coring disposable hypodermic syringe according to claim 1 wherein said piercing element is substantially semi-circular.

4. A non-coring disposable hypodermic syringe according to claim 1 including a retainer cap to secure said piercable end closure to said body, a ring on said needle holder adaptable to said retainer cap wherein

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said piercing element is guided to pierce said piercable end closure on sliding said ring onto said retainer cap.

5. A non-coring disposable hypodermic syringe according to claim 1, including a retainer cap to secure said piercable end closure to said body, a threaded surface on said retainer cap, a matching threaded surface on said needle holder wherein rotation of said needle holder on said cap provides the rotational and axial movement to pierce said piercable end closure.

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