Nov. 24, 1964 S. MYERSON ETAL 3,158,155

HYPODERMIC SYRINGE AND CARTRIDGE

Filed June 14, 1961

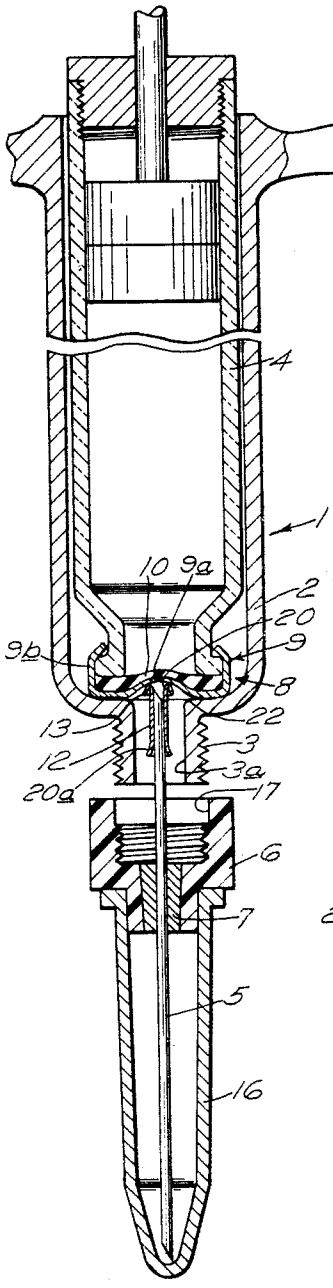

FIG. 1

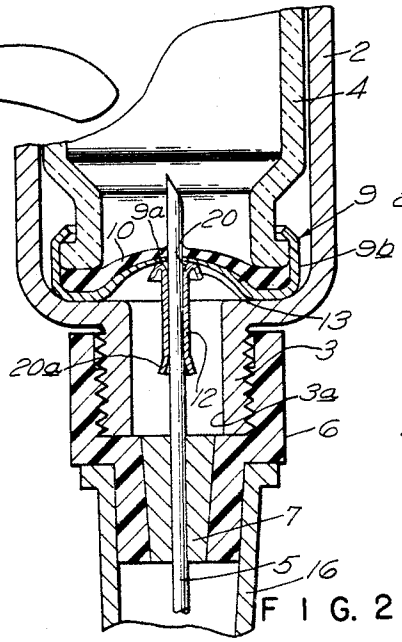

FIG. 2

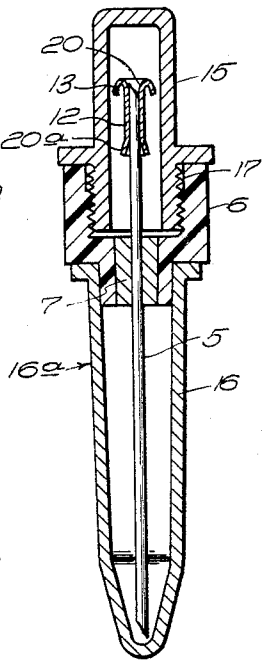

FIG. 3

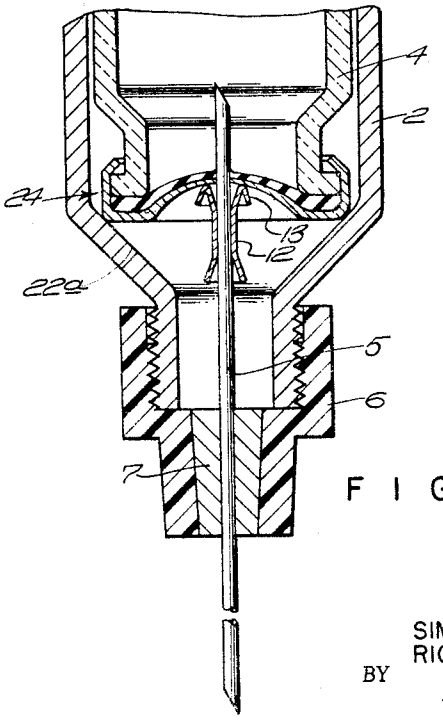

FIG. 4

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United States Patent Office 3,158,155 Patented Nov. 24, 1964

3,158,155

HYPODERMIC SYRINGE AND CARTRIDGE

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Filed June 14, 1961, Ser. No. 117,655
9 Claims. (Cl. 128—215)

The present invention relates to an improvement in hypodermic syringes and cartridges which, when said syringes and cartridges are used together with sterilized needles of the construction described in co-pending application Serial No. 835,802, now Patent No. 3,055,364, filed by Simon Myerson and Richard L. Myerson, provide protection against infection due to contamination of the sterilized needle even though the syringe with which the sterilized cartridge and needle are used is not completely sterile.

In recent years much progress has been made towards eliminating the hazards of infection from hypodermic injections by the increasing use of presterilized and sterile packaged disposable needles. However, with the usual construction, these disposable needles do not provide protection against failure to completely sterilize a syringe or contamination of the syringe after sterilization and prior to its use.

The needle described in said co-pending application is provided with a sleeve attached slidably but snugly over the cartridge entrant end. This sleeve guides the needle through needle receiving passage in the tip of the syringe to the center of the puncturable end cap of the sterilized cartridge which contains a medicant that is to be injected. The sterilized sleeve is inserted with the cartridge entrant end of the sterilized needle through the needle receiving passage of the syringe to the puncturable cap of the sterilized cartridge and consequently protects such entrant end against any contact with the syringe. The needle is preferably sterile packaged with the sleeve thereon.

Contact of the end of the sleeve with the puncturable cap of the sterilized cartridge (1) during insertion of the sterilized needle and sleeve into the loaded syringe (loaded with the cartridge) or (2) during insertion (loading) of the sterilized cartridge in the syringe after the needle with the sleeve over the entrant end thereof has been inserted through the needle receiving passage in the syringe tip to its ultimate position in the unloaded syringe, forces the sleeve to slide back on the needle and the sharp entrant end of the sterilized needle to puncture the central portion of the cap. Thus, the entrant end of the sterilized needle, which enters the sterilized cartridge and is exposed to its sterilized contents, does not contact the syringe at any time. It contacts only the central portion of the sterilized puncturable end cap of the cartridge and consequently it is not contaminated even if the syringe is not completely sterile provided that the central portion of the cap is not contaminated.

There are two widely used types of syringes, the breech type and the window type. The puncturable central area of the cartridge may become contaminated in the breech type of syringe which is loaded through the upper end of the barrel thereof, by contact with the rim of the barrel and also, it may be contaminated when seated at its ultimate position at the bottom of the barrel. This is particularly true if the bottom of the barrel is of the usual construction and the closure cap is also of the usual construction described hereinafter. Contamination is almost certain if some globules of moisture are present at the bottom of the barrel at the time of the insertion of the cartridge and the floor is contaminated. In the window type of syringe which has a window along its length permitting the insertion and positioning of the

cartridge through the window, since such windows are usually arched at the bottom, the risk of contamination is less when the cartridge is being introduced in the window than when the cartridge is being inserted in the breech type of syringe. However, the risk of contamination by the floor is the same.

An object of this invention is to eliminate or to greatly reduce the hazard of contamination of the critical area of the cartridge cap when it is being inserted into the barrel. This objective can be accomplished by certain changes in the cartridge alone. Even greater protection can be provided by certain changes in the syringe. A combination of these changes in the syringe and in the cartridge is believed to offer maximum protection.

The usual closure cap is convex and comprises a metal outer shell with an end wall having a hole in its center. A very thin disc of aluminum is placed over the hole and a rubber sealing element is placed on top of the aluminum disc, then the closure cap is clamped onto the cartridge end. Some closure caps omit this disc and the sealing rubber or other medium is exposed. The needle passes through the hole and punctures the disc and the sealing element in the former case or through the hole and the seal in the latter case.

The closure cap of the present invention comprises a shell made of a suitable metal, e.g. aluminum, and having a smooth puncturable end wall which is concaved inwardly in its central area, which does not have a central hole and which has a relatively thin, puncturable central area which tapers to a thicker peripheral area. Positioned within the shell over and behind this end wall is a rubber disc which may also be concave in its central area to correspond in contour with the puncturable end wall of the aluminum shell. Such a construction provides a cleaner, safer and very simple closure.

Other objects and advantages of the present invention will become apparent from the following description of certain embodiments of the invention with reference to the accompanying drawings in which

FIG. 1 is a section in elevation of a conventional cartridge type syringe loaded with a cartridge having an improved closure cap which embodies the present invention and showing a sterile hub-type disposable needle in position to be attached to the syringe. The entrant end of the needle has a slidably fitted sleeve mounted thereon of the type referred to in the above-mentioned co-pending patent application.

FIG. 2 is an enlarged section of the lower end of the syringe of FIG. 1 after the needle has been attached to the syringe in operating position. The needle has penetrated the closure cap and the sleeve has been pushed back on the needle. The concavity of the end wall of the closure cap of the cartridge is preferably deep enough and wide enough to accommodate the flange at the leading end of the sleeve to thereby prevent jamming of the flange against the floor of the syringe barrel when it is pushed back along the needle by insertion of the cartridge.

FIG. 3 shows the packaged needle before it is inserted in the syringe.

FIG. 4 is like FIG. 2 but shows a modification of the syringe to prevent the sleeve from being caught in the syringe so that it cannot be withdrawn from the syringe with the needle. This is achieved by the strongly tapered floor of the barrel which also permits quick removal of any droplets of moisture by shaking or by an air blast and creates substantial space between said floor and the center of the closure cap.

In all the drawings, the numeral **1** designates a conventional cartridge type syringe, **2** the barrel thereof, **3** the externally threaded needle receiving tip thereof having a needle receiving passage **3***a* and **4** sterilized cartridge containing the medication and adapted to be removably inserted (loaded) in the syringe barrel.

The numeral **8** represents an improved puncturable closure cap embodying the present invention and attached to the lower end of the cartridge. It comprises (1) the metal shell **9** having a puncturable, smoothly contoured, inwardly concave end wall **9***a*, which is thin at the puncturable center area (in the order of about two thousandths of an inch thick) and gradually tapers to a thicker peripheral area (in the order of about eight thousandths of an inch thick), and side wall **9***b* which is clamped to the lower end of the cartridge by rolling the end thereof over the lower lip of the cartridge, as shown, and (2) a puncturable rubber sealing disc **10** which is located behind end wall **9***a*, which is also inwardly concave to conform to the end wall **9***a*, which may also be thin at its central puncturable area opposite the thin central area of end wall **9***a* and taper into a thicker peripheral area opposite the thicker peripheral area of end wall **9***a*, and the periphery of which is wedged tightly between the periphery of end wall **9***a* and the lower end of the cartridge as shown.

The numeral **5** represents the hypodermic needle sharpened at both ends and **6** the plastic hub which is preferably internally threaded and firmly secured to the needle in a conventional manner by the metal attaching means **7** and which is adapted to be threaded over the tip **3** to secure the needle to the syringe, as shown in FIG. 2. Plastic hubs are sometimes attached directly to the needle without the metal intermediate **7**. However, a firmer attachment may be secured by the use of an intermediate metal piece **7**. Also, hubs made completely of metal are often used.

It is preferred that the upper end of the hub **6** at **17** be unthreaded and correspond in inside diameter to the outside diameter of the tip **3** of a standard syringe with which the needle is to be used so that it slidably fits over such tip. This makes for easier, faster and more accurate attachment of the hub to the syringe. We have found that plastic hubs do not always get started perfectly and the plastic thread is easily damaged, therefore, we prefer to provide a short, unthreaded lead **17**.

The numeral **12** represents a sleeve fitted snugly but slidably over the cartridge entrant end of the needle. The sleeve is of the type described in said co-pending application and has a rearwardly and outwardly extending flange **13** at the leading end thereof. The sleeve extends slightly beyond the end of the needle, as shown. The leading end of the bore of the sleeve tapers outwardly slightly at **20** before it is bent back to form the rearwardly and outwardly extending flange **13**. The flange may be notched as described in said co-pending application. The flange spaces the open leading end of the sleeve and hence the end of the needle away from the wall of the needle receiving passage **3***a* in the syringe tip when the needle with the sleeve attached thereto, as shown in FIG. 1, is inserted in and through such passage to the position shown in FIG. 1 to insure against contamination. The slight outward flare **20** spaces the leading end edge of the sleeve radially outwardly with respect to the end of the needle to further protect it in the event such edge is accidentally contacted. The rear end of the sleeve is tapered slightly outwardly at **20***a*.

The numerals **15** and **16** represent the cap and hood, respectively, of the package **15***a* for the sterilized needle and its sleeve. The package is assembled with the needle and sleeve therein, as shown, by screwing the cap **15** to the hub **6** and mounting the hood **16** on hub **6** by a friction fit. Both **15** and **16** are sealed to hub **6** at their margins after being affixed to **6**.

As aforesaid, generally, the sterilized cartridge is inserted into the barrel of the syringe through the top as in the breech type of syringe or through a long opening in the side of the syringe. Both types are in common use in the dental profession. In either type the central area of the cap at the lower end of the sterilized cartridge, which is punctured by the needle may be contaminated during insertion of the cartridge by contact with the

syringe in the syringe has not been completely sterilized or has become contaminated before use. Since the cartridge entrant end of the needle comes in contact with this area of the closure cap, freedom from contamination is essential. The concavity in the cap shown in the drawings prevents contact of the area of the cap to be punctured with any part of the barrel of the syringe by bridging such area to thereby insure against contamination.

The depth of the concavity in the end wall **9***a* is preferably greater than (at least as great as) the height of the flange **13**, i.e. the vertical distance between the leading end of the sleeve and the trailing end of the flange, and the width of the concavity is preferably wider than (at least as wide as) the widest portion of the flange (the trailing end) so that the entire flange is contained within the concavity, as shown in FIG. 2 to insure against the flange being jammed against the bottom **22** of the barrel when the cartridge is inserted into the syringe and forces the sleeve to slide backwardly along the needle. Thus, the concavity forms a chamber or housing for the flange when the needle is attached to the syringe in its operative position.

The concavity not only protects the central punctured area of the end wall **9***a* against contamination and prevents jamming of the flange against the bottom of the barrel but it also serves to guide the forward end of the needle and sleeve to the thin center of such end wall.

The cartridge entrant end of the needle is protected from contact with the wall of the needle receiving passage **3***a* in the tip of the syringe by the sleeve **12** which, as aforesaid, is slidably affixed thereto and extends beyond the end of the needle. The attachment of the sleeve to the needle is snug enough to resist accidental displacement during insertion of the needle with the sleeve attached thereto through the needle receiving passage of the syringe tip, but permits displacement backwardly along the needle by engagement of the leading end of the sleeve with the puncturable end wall **9***a* of the closure cap (1) when the puncturable end wall **9***a* is forced over the point of the needle during insertion of the cartridge into the syringe to the position shown in FIG. 2 after the needle with the sleeve thereon has been inserted to its ultimate position (FIG. 2) in the syringe, as usually practiced, or (2) when the needle is pushed through such end wall of the pre-positioned cartridge from the position shown in FIG. 1 to the position shown in FIG. 2.

In use, the sterilized cartridge **4** may be loaded in the syringe. The cap **15** of the sterilized package containing the sterilized needle and sleeve attached thereto, is removed from the hub **6** and by grasping the hub **6** with the fingers, the exposed end portion of the needle with the sleeve attached thereto is inserted in the needle receiving passage **3***a* until it reaches the position shown in FIG. 1 in which the leading end of the sleeve engages the puncturable end wall **9***a*, whereafter further insertion of the needle causes the sleeve to be pushed backwardly along the needle and the needle to puncture the central thin, recessed area of the end wall and move to the position shown in FIG. 2 at which the hub **6** is screwed tightly on the tip **3** of the syringe. Thereafter, the hood **16** is pulled off the hub **6** and the syringe is ready for use. Usually however, the needle with the sleeve thereon is attached to the syringe in its ultimate position shown in FIG. 2 before the cartridge is placed in the syringe in which case insertion of the cartridge in the syringe will force the sleeve back along the needle and will cause the exposed end of the needle to puncture the thin central recessed area of the end wall **9***a*.

In FIG. 4 the floor **22***a* of the syringe barrel is sloped inwardly and downwardly for greater protection against contamination and other advantages as explained above.

It is usual practice to keep cartridges in alcohol just before use. It is good practice to shake the cartridge and then quickly "flame" the closure end before inserting it into the barrel of the syringe. For this reason, it is

preferable that the aluminum shell 9, which functions as a clamping member, cover the rubber seal and that it be one piece so as to provide a smooth continuous surface. Furthermore, the continuous smooth contour of the external surface of the metal cap of the present invention eliminates crevices and corners in which bacteria or other harmful organisms can accumulate. We have referred to the aluminum clamping member or shell as being made of aluminum merely because it is the most commonly used material and is quite suitable for the purpose. However, other materials may be used.

Furthermore, where we have described the use of our invention for sealed cartridges containing measured doses of medicants, it may, of course, be used to aspirate into an empty cartridge.

Although the closure cap shown in the drawings has an end wall comprised of two layers, we do not limit our invention to any particular number.

Although we illustrate and we prefer to thread the needle hub to the syringe tip other conventional means may be used, for example, the Luer lock or a tight tapering fit.

It is not intended that the invention be limited to the exact structures described and shown, such structures being for illustrative purposes only.

This application is a continuation-in-part of said copending application Serial No. 835,802, now Patent No. 3,055,364.

We claim:

1. In combination, a cartridge and syringe having a barrel, said cartridge being removably placed in said barrel and having a needle puncturable closure cap at one end, a hypodermic needle extending through a needle receiving passage in said syringe to said closure cap of said cartridge and having a slidable sleeve normally mounted with a slidable friction fit around the cartridge entrant end of said needle, said cartridge entrant end of said needle being adapted to be inserted with said sleeve therearound into said needle receiving passage in said syringe to said closure cap, said cap comprising a seal and a clamping member having a needle puncturable wall overlying said seal, the circumferential surface area of said clamping member protruding below its central needle puncturable area to provide a centrally recessed area to prevent contact of said needle puncturable area with the syringe , said sleeve being slidable back on said needle by engagement with said recessed area to expose said cartridge entrant end of said needle, said needle puncturable area being pierced by said exposed entrant end of said needle with said sleeve slid back on said needle to a position intermediate the ends of said needle and outside said closure cap, said recessed area being concave inwardly, said slidable sleeve having a flange at its leading end, said concave recess being deep enough and wide enough to receive said flange.

2. In combination, a cartridge and a syringe having a barrel in which said cartridge is received for use with a hypodermic needle having a slidable sleeve located over its cartridge entrant end, said cartridge having a centrally puncturable closure cap at one end adjacent the floor of said barrel, said closure cap comprising a seal and a clamping member having a centrally needle puncturable wall overlying said seal, said wall being recessed inwardly, the floor of said barrel sloping downwardly to form with said recess a housing, said syringe including a needle receiving passage leading to said barrel, said combination also including a hypodermic needle having a cartridge entrant end and a patient entry end and having a slidable sleeve normally mounted with a slidable friction fit around said cartridge entrant end of said needle, said cartridge entrant end of said needle being adapted to be inserted with said sleeve therearound into said needle receiving passage, said sleeve being slidable back on said needle by engagement with said recessed portion of said clamping member, said needle being located in said needle receiving passage with said needle puncturable area being pierced by said exposed entrant end of said needle and said sleeve being slid back on said needle and located in said housing.

3. A combination according to claim 2, the leading end of said sleeve having a flange extending outwardly and rearwardly therefrom, the depth and width of said housing being greater than the height and width, respectively, of said flange, said flange being located in said housing.

4. A combination according to claim 2, the central areas of said seal and overlying wall being concaved inwardly and being thinner than the peripheral areas thereof, the concave outer surface of said wall of said clamping member being smoothly contoured and continuous.

5. A cartridge for use with a hypodermic syringe, said cartridge having a needle puncturable closure cap over an opening at one end, the other end of said cartridge having a closure stopper fitted tightly but slidable therein, said stopper being adapted to be propelled longitudinally within said cartridge to expel the contents of said cartridge through said one end, said closure cap comprising a clamping member and a sealing member extending across said opening at said one end of said cartridge, the portion of said sealing member across said opening being displaced inwardly to form an inwardly curved concavity, said clamping member having a centrally puncturable wall extending across said opening and overlying said concave sealing member, the portion of said wall across said opening also being displaced inwardly to form an inwardly, smoothly and continuously curved concavity of relatively shallow curvature similar in contour to said sealing member and extending over an area corresponding to the area of said opening to provide across said opening a concave, centrally needle puncturable area which is protected from contact with said syringe, said clamping member being of one piece and the outer surface of said wall thereof being smoothly contoured and continuous thereacross.

6. A cartridge according to claim 5, said concave wall of said clamping member being thinner at its central area than at its peripheral area.

7. In combination, a cartridge according to claim 5, a syringe having a barrel, said cartridge being removably placed in said barrel, and a hypodermic needle having a cartridge entrant end and a slidable sleeve normally mounted with a slidable friction fit around said cartridge entrant end, said cartridge entrant end being adapted to be inserted with said sleeve therearound into a needle receiving passage in said syringe to said closure cap, said sleeve being slidable back on said needle by engagement with said concave centrally needle puncturable area to expose said cartridge entrant end of said needle, said centrally needle puncturable area being pierced by said exposed entrant end of said needle with said sleeve slid back on said needle to a position intermediate the ends of said needle and outside said closure cap.

8. A cartridge for use with a hypodermic syringe, said cartridge having a needle puncturable closure cap over an opening at one end, the other end of said cartridge having a closure stopper fitted tightly but slidable therein, said stopper being adapted to be propelled longitudinally within said cartridge to expel the contents of said cartridge through said one end, said closure cap comprising a clamping member and a sealing member extending across said opening at said one end of said cartridge, said clamping member having a centrally puncturable wall extending across said opening and overlying said sealing member, the portion of said wall across said opening being concave inwardly over an area corresponding to the area of said opening to provide across said opening a concave, centrally needle puncturable area which is protected from contact with said syringe, the outer surface of said concavity being smooth and uninterrupted throughout, the inner and outer surfaces of said concave portion of said wall converging towards each other from the periphery of said concavity to the center thereof to form a thin, easily puncturable center.

9. In combination, a cartridge and a syringe having a barrel in which said cartridge is received for use with a hypodermic needle having a slidable sleeve located over its cartridge entrant end, said cartridge having a puncturable closure cap over an opening at one end thereof adjacent the floor of said barrel, said closure cap comprising a sealing member extending across said opening and a clamping member having a centrally needle puncturable wall extending across said opening and overlying said sealing member, the portion of said wall across said opening being displaced inwardly to form an inwardly curved concavity of smooth and shallow curvature across said opening extending over an area corresponding to the area of said opening and being smoothly contoured and continuous thereacross, the floor of said barrel sloping downwardly to form with said concavity in said closure member a housing.

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