This invention relates to hypodermic syringes, or the like, of the type employed by dentists and physicians for injecting drugs, and other fluids into body tissues. More particularly, the present invention relates to an improved syringe of the type employing disposable carpules as used in the dental profession to inject a local anesthetic.

The hypodermic syringes that are presently used to effect subcutaneous injections are characterized by a plunger operated device that carries a slender tubular needle through which liquid is passed into body tissue. The tubular needle being exposed to view is subject to accidental damage and contamination during sterilization or while being carried from place to place and causes apprehension in the patient on seeing the needle.

Accordingly, it is an object of the present invention to provide a syringe with an automatically retractable needle whereby the needle is protected when not in use thus saving expensive replacement of damaged needles and providing freedom from contamination and improved psychological disposition of the patient by removing the anticipation, apprehension and excitement caused by sight of an exposed needle.

Another object of the invention is the provision of an improved dental syringe of the type employing disposable carpules, which is of simple, inexpensive and practical construction and which is easily kept in good operating and aseptic condition.

Still another object is the provision of a new and improved hypodermic needle syringe which is inexpensive for dental use and which allows concealment and protection of the needle portion of the syringe until immediately before insertion into the tissue of the patient whereby the needle is extended out of the sight of the patient.

Yet another object of the invention is to provide a new and improved syringe of the foregoing character that is highly effective, extremely serviceable and yet easily manufactured at low cost.

Other objects and many of the attendant advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 is a fragmentary elevation view of a typical preferred form of my improved hypodermic syringe;

FIG. 2 is a fragmentary vertical sectional view through the syringe of FIG. 1 with the needle shown in a retracted position;

FIG. 3 is a fragmentary vertical sectional view similar to FIG. 2 but with the needle shown in a projected position.

FIG. 4 is an enlarged transverse vertical sectional view taken on the line 4-4 of FIG. 3 and

FIG. 5 is a fragmentary vertical sectional view of a modified form of the hypodermic syringe.

Referring now to the drawings that are shown; in FIG. 1 the hypodermic syringe 6 of the typical simple cylinder and piston type device and as illustrated is chargeable with a carpule or fluid carrying unit 8 and having a plunger 10 adapted to operate against the carpule to eject fluid therefrom through needle 12.

The body portion of barrel 14 is usually of cylindrical shape and is formed with longitudinal openings or slots 16 on opposite sides thereof allowing view and manipulation of the carpule. A thumb rest 18 is mounted on the back end of the plunger 10 and finger rest 20 are mounted on and are adapted to revolve around head portion 22. The opposite end of the plunger has stop means 24 which, on extensions of the plunger, also act as compressing means for the carpule.

There are various head portions available on different types of syringes that provide means for supporting the plunger and allow access to the barrel for insertion of carpules. But the type preferred for the purposes of the present invention comprise a hollow head portion 22 having a central bore 26 to receive plunger positioning means comprising a tapered cylinder 28 having material cylindrical bore 30 for receiving the plunger and being tapered so as to fit a short distance into the back end of the barrel and also adapted to be disposed into the recess 26 of hollow head portion 22 when compressed against spring 34 by withdrawing the plunger. Said head portion has arms 36 rotatably secured to barrel 14 by means of screws 38.

The assembly of this section of the inventive device is accomplished by inserting the cylinder over the plunger, the narrow end of the cylinder toward the stop on the plunger. The spring is then slid over the plunger and the plunger inserted into the head and the thumb rest screwed on the other end of the plunger. The spring is compressed and the holes in the arms of the head aligned with holes provided in the barrel and the screws inserted. The back part of the syringe is then ready to receive a carpule.

A standard carpule comprises a tubular transparent body 40 containing fluid 42 having a front end comprising a first plug 44 constructed of plant type material and adapted to be pierced by the rearward pointed end 46 of needle 12 and a back and comprising a piston type of plug 48. The plugs are preferably of soft plant material such as rubber so that the first plug is penetrable by needle in a sealing engagement and the back plug is compressible to have a sliding and sealing engagement with the interior of the carpule wall.

The inside front portion of barrel 14 is threaded to receive externally threaded hub 50. The hub comprises a front tapered portion 52 terminating in a rounded point 54 having an exit port. The hollow, externally threaded back portion is adapted to receive needle retracting spring 56 and a bore is provided through the front hub portion to allow extension of the needle. The needle 12 is of the usual doubly sharpened type and has a piston disc 58 secured thereto at a suitable midpoint allowing travel of said needle from an extended to a retracted position in its housing in the barrel. The forward travel of said disc and needle is restrained by abutment of the disc on the end of hub 50 and rearward from said hub is provided an enlarged bore section 60 which acts as a cylinder for said piston and needle and terminates at stops 62 which is the start of narrower section 64 of the barrel, which extends along the length of the carpule 8.

The assembly of the front section of the barrel is accomplished by inserting the needle and piston into the front end of the barrel, placing the spring over the needle and screwing the hub onto the barrel. Insertion of a carpule is accomplished by completely withdrawing the plunger from the barrel so as to compress the head spring and draw the cylinder into the recess provided in the head of the barrel. The entire head is then rotated on the arms pivoted at the screws secured to the barrel thus exposing the back end of the barrel. The carpule is now inserted into the barrel and the head rotated back to a closed position. The front plug of the carpule may be
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pierced by the back point of the needle in one of two ways. The carpule may be grasped through the slots in the barrel and moved forward in the barrel until the plug is pierced and seated against the back side of the piston disc of the needle. The same effect may be accomplished by exerting pressure on the carpule by means of the thumb rest and plunger thus driving the carpule forward until it is seated on the needle. The latter method is preferred since the needle may be cleared of air at the same time by expelling a small amount of fluid. In either case, release of pressure results in the automatic retraction of the needle and return of the carpule by the bias of the expanding forwardly disposed spring. To inject the fluid, slight pressure on the thumb rest completely extends the needle out of the hub and by additional pressure, the rear piston type stopper of the carpule will be moved forward relative to the walls of the carpule by means of the plunger and the fluid contained therein will be expelled from the needle. Removal of the needle from the injection site and release of pressure on the thumb rest results in automatic retraction of the needle into the hub. The head is again broken open and by finger pressure through the slots in the barrel, the carpule is removed and the syringe is now ready for sterilization.

The modified embodiment of the invention shown in FIG. 5 has most of the advantages of the first described structure except the ability to retract the needle once the carpule has been inserted. This device has the said forward and back sections and is operated and used in the same manner. However, the barrel is shortened by an amount equivalent to the cylindrical bore provided for the axial movement of the needle piston. Therefore, on insertion of the carpule, the needle remains permanently extended but is automatically retracted during sterilization and handling so as to protect the needle from accidental breakage or damage. Specifically, this modified embodiment comprises a shortened barrel 66 having an internally threaded front end and externally threaded hub 50 secured thereto and an axially moveable doubly pointed needle 12 with piston means 58 disposed in enlarged cylindrical bore 60 in the barrel terminating in stop 62. A carpule retaining narrowed back portion 64 of the barrel terminates in rotatable head section 22 carrying plunger 10 and stop member 24, tapered cylinder 25 and head spring 34.

The following is illustrative of a specific embodiment of the invention, it being understood that the relative dimensions are given by way of illustration only and can be altered to suit particular requirements:

Barrel—Length 3¾", O.D. ½", I.D. of enlarged bore ⅝", I.D. of carpule retaining section ⅞" for 2¼"

Hub—Length ⅞", O.D. ¾" from back portion tapering to rounded point

Needle Bias Spring—Length, approx. ⅝" extended, O.D. ⅜", 27" gauge wire compressible with about 3–7 ounces of pressure

Needle—Length 2¾", approx. 27" gauge; piston disc O.D. ⅞" fixed at a point ⅝" from front point of needle

Head—I.D. of bore approx. ⅛", arms separated by ⅜"

Plunger—Length 9", O.D. ⅜", O.D. of stop member ⅝"

Tapered Cylinder—Bore ⅝", O.D. tapered so as to fit into back end of barrel to a depth of about ¼"

Head—Length 5¾", I.D. about ⅛" to fit around plunger, approx. 25 gauge wire compressible with about 2 lbs. pressure

Thumb Rest—Approx. ¾" D.

Standard 1.8 cc. carpule—Length about 2½", ⅜"

However, it is obvious that by substituting a longer barrel section and plunger, the syringe of the present invention can accommodate both the 1.8 cc. and 2.2 cc. variety of carpules. The main parts of the syringe can be stainless steel or chrome plated steel. The piston can be a machined disc or of the self lubricating variety of plastics capable of withstanding sterilization temperatures such as polytetrafluoroethylene, commercially known as "Teflon" or "Kel-F".

Obviously, many other modifications and variations of the present invention are possible in the light of the above teachings. It is therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

1. A hypodermic syringe, comprising: an elongated tubular body having a first bore portion in one end thereof for slidably receiving a tubular carpule, and a second bore portion at the other end thereof aligned with and adjacent to said first bore portion; manually operable plunger means carried by said one end of said tubular body, selectively engageable with said carpule to slide the same within said tubular body and to effect selective emptying thereof; a hub mounted on said other end of said tubular body, and having an axial bore therethrough aligned with said first and said second bore portions; a piston received within said second bore portion, and having a bore therethrough aligned with said axial hub bore; a hollow needle pointed at both ends thereof, said needle extending through and being secured within said piston bore, and being slidable within said piston towards said first bore portion and resilient means arranged to bias said said piston and said needle away from said hub and toward said first bore portion, to engage said piston with said abutment means.

2. A hypodermic syringe as recited in claim 1, wherein said second bore portion is enlarged relative to said first bore portion, and terminates at the inner end thereof in a shoulder, said shoulder defining said abutment means.

3. A hypodermic syringe as recited in claim 1, wherein said hub is detachably secured to said tubular body.

4. A hypodermic syringe as recited in claim 1, wherein said last mentioned means comprises a coil spring received within said second bore portion, and extending between said piston and said hub.

5. A hypodermic syringe as recited in claim 1, wherein said plunger means is arranged to be moveable from a first position in alignment with said first bore portion to a second position wherein the outer end of said first bore portion is open to receive said carpule.

6. A hypodermic syringe, comprising: an elongated tubular body having a first bore portion in one end thereof for slidably receiving a tubular carpule, and a second bore portion at the other end thereof aligned with and adjacent to said first bore portion, said second bore portion being enlarged relative to said first bore portion, and terminating at the inner end thereof in an abutment shoulder; manually operable plunger means carried by said one end of said tubular body, and engaged with said carpule to slide the same forwardly within said tubular body and to effect selective emptying of said carpule; a hub mounted on said other end of said tubular body, and having an axial bore therethrough aligned with said first and said second bore portions; a piston received within said second bore portion, and having a bore therethrough aligned with said axial hub bore, said piston being slidable within said second bore portion from a first position in engagement with said abutment shoulder, to a second position spaced from said abutment shoulder; a hollow needle pointed at both ends thereof, said needle extending through and being secured within said second bore portion, the inner end of said needle projecting for a substantial distance from the inner face of said piston and the outer end.
of said needle projecting from the outer face of said piston for a distance such that it will extend substantially beyond the outer end of said axial hub bore when said piston is in said second position, and that it will be completely received within the combined lengths of said axial hub bore and said second bore portion when said piston is in said first position; and resilient means arranged to bias said piston toward said first position thereof.

7. A syringe as recited in claim 6, wherein said plunger means is arranged to be moveable from a first position in alignment with said first bore portion, to a second position wherein the outer end of said first bore portion is open to receive said carpule.

8. A syringe as recited in claim 6, wherein said hub is detachably secured to said tubular body.

9. A syringe as recited in claim 6, wherein said resilient means comprises a coil spring received within said second bore portion, and arranged to extend between confronting surfaces on said hub and said piston.

10. A syringe as recited in claim 9, wherein said coil spring is compressible with from about 3 to about 7 ounces of pressure.

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DALTON L. TRULUCK, Primary Examiner