

April 10, 1962

H. PRATER, JR
HYPODERMIC SYRINGE
Filed July 2, 1959

3,028,862

FIG. 1

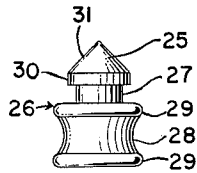
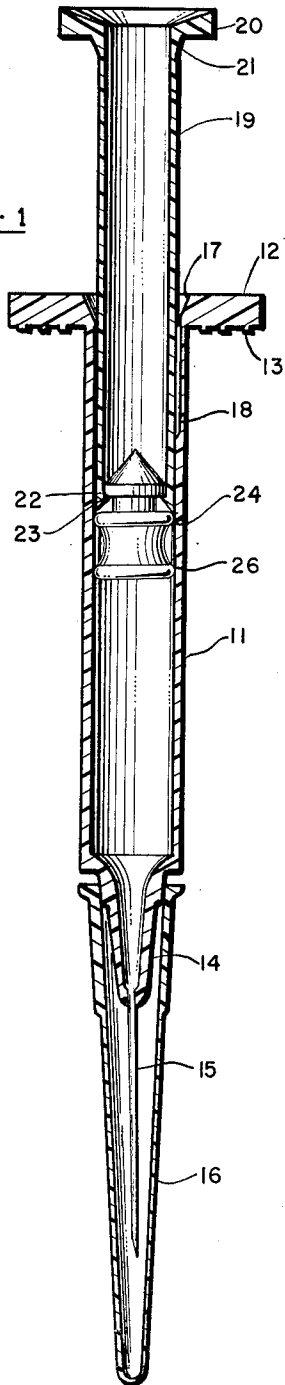


FIG. 3

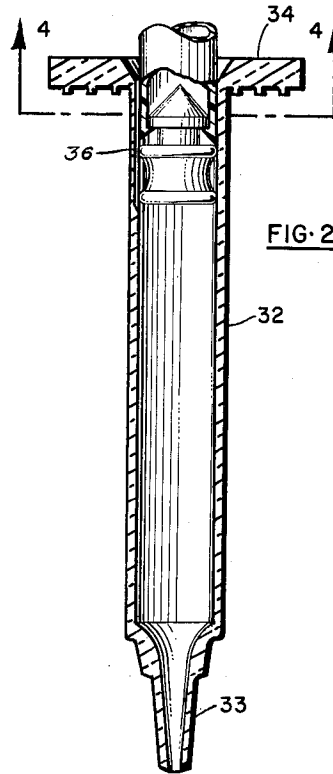


FIG. 2

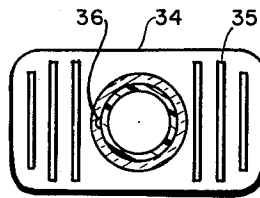


FIG. 4

HARLAN PRATER JR.
INVENTOR.

BY
Samuel Branch Walker
ATTORNEY

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3,028,862

HYPODERMIC SYRINGE

Harlan Prafer, Jr., Greenwich, Conn., assignor to American Cyanamid Company, New York, N.Y., a corporation of Maine

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4 Claims. (Cl. 128-218)

This invention relates to a hypodermic syringe and more particularly to a hypodermic syringe having an elastic piston at the front of a plastic plunger, which piston is retained in position by a piston retaining stud integral with the piston passing through a stud retaining aperture in the front end of the plunger.

The cost of labor in hospitals and physicians' offices is rising. The cost of cleaning and sterilizing and insuring absolute sterility of hypodermic syringes is increasing. Thus, it is desirable to be able to obtain hypodermic syringes at a sufficiently low price that the syringes may be supplied in a sterile state, used once, and then discarded. Such a disposable syringe has the advantage that it need not be cleaned and there is no chance of cross infection or contamination.

A hypodermic syringe, even though designed for a single use, and hence, very low in cost, must meet certain standards to be useful. The plunger must have an effective seal throughout its working stroke and the plunger must have sufficient smoothness of operation that the action may be regarded as smooth by the user.

The cost of plastic syringes and particularly plastic plungers is less than that of glass and by using an elastic piston the necessity for precision in the syringe barrel is reduced. An effective syringe and plunger therefor of low cost and high effectivity which meets these and other requirements is the object of this invention.

Referring to the attached drawings, which are a part of this application:

FIGURE 1 is a longitudinal section through a hypodermic syringe having an integral needle,

FIGURE 2 is a longitudinal section through a hypodermic syringe having a glass barrel and a Luer tip,

FIGURE 3 is a view of the elastic piston of the present invention,

FIGURE 4, is a section along 44 of FIGURE 2 showing the cross section of the plunger and the syringe barrel including particularly a sterilizing gas port.

In the embodiment of the invention shown in FIGURE 1, a plastic hypodermic syringe barrel 11 is provided with a finger flange 12 at the rear end. The flange has anti-slip ridges 13 integral therewith. At the forward end of the barrel and serving as the cylinder head is a needle holding tip 14. In the construction shown in FIGURE 1, a hypodermic needle 15 is fixed in the needle holding tip and is used but once. Slidably emplaced over the hypodermic needle is a needle guard 16, which is a plastic, preferably a resilient plastic such as polyethylene. It is slidably retained on the base of the needle holding tip to both protect the hypodermic needle from damage and protect the user from accidental injury from the hypodermic needle.

For convenience in assembling, the rear end of the barrel is provided with a tapered entrance 17 which is the frustum of a cone to aid in the rapid and simple insertion of the plunger. At the rear end of the barrel is a sterilizing gas port 18. This port is a narrow groove in the barrel extending a short proportion of the barrel length. When assembling, the plunger, described below, is inserted into the rear end only of the syringe barrel so that the sterilizing gas port bypasses the sealing rings of the plunger. This permits a hypodermic syringe to be assembled complete including the needle guard, with the entire interior portion in communication with the

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outside so that a sterilizing gas, such as a mixture of ethylene oxide and carbon dioxide, may come in contact with all portions of the assembly. Without such port the space between the piston sealing rings and the portion of the barrel ahead of the piston, when the needle guard is in place, may be sealed off from and not as easily sterilized by exposure to the sterilizing gas. When the piston is shoved slightly forward, the gas retaining port is sealed off and good control of the syringe contents is obtained.

The syringe barrel may be of a plastic such as styrene or methyl styrene; if of styrene, the melting point is so low that the syringe cannot be sterilized by heat alone, and is thus guaranteed against any efforts of a user to thus resterilize. If the user is unable to use heat sterilization, it reduces the chance that the user will attempt to resterilize the syringe but do so ineffectively, thus permitting contamination.

In manufacturing such a molded plastic syringe barrel, it is difficult to withdraw the member of the mold which forms the interior of the barrel unless such member has a slight taper or draft. Conveniently, in the present invention the interior of the barrel has a draft of from about 0.002 to 0.004 inch per inch. Such a taper greatly simplifies molding problems. The plunger of the present invention is sufficiently resilient to give effective sealing with a barrel having such taper.

The plunger itself is conveniently of plastic such as polystyrene or polymethylstyrene, etc. and has a plunger stem 19 which comprises the main length of the plunger. The rear of the plunger has a thumb piece 20 which is preferably slightly concavely rounded for contact with the thumb of the user. To avoid stress concentration and molding problems, a thumb piece fillet 21 rounds the otherwise sharp corner between the plunger stem and the thumb piece.

The forward end of the plunger stem on the inside has a stud retaining aperture 22, adjacent to which is a flat rear shoulder 23. Adjacent the shoulder of the stud retaining aperture is a cone shaped transition section 24 which extends rearwardly inwardly, towards the aperture, thus forming a conical entrance to the aperture. Preferably the angle of the cone elements with the syringe axis is from between 30° and 60°, an angle of 45° gives very good results. By having this cone shape entrance, the entrance of the piston retaining stud 25 during assembling is simplified and additionally, there is a smaller area of contact between the front of the plunger stem and the piston 26, which area of contact is a circle. If the piston is resilient, during assembling the entire piston can be slipped into this one piece transition section by simple pressure on the piston. The flexure of the piston causes the piston retaining stud to enter further into the stud retaining aperture so that the piston stem 27, in its unstretched state, can be slightly shorter than the distance between the end of the plunger stem and the flat rear shoulder, thus causing the piston stem to be under slight tension when the piston itself is assembled to the plunger stem.

The piston itself is preferably of an elastic material such as natural or synthetic rubber. A fairly soft grade of rubber is preferred. The piston head is preferably formed with two annular sealing rings 29 with rounded edges. The diameter of these rings is slightly greater than the maximum diameter of the hypodermic syringe barrel so that two areas of contact are established between the piston and the hypodermic syringe barrel, one near each end of the piston head. These areas of contact may vary from a fairly narrow line near the back end of the barrel to a somewhat broader line when the piston is near the front end of the barrel, as the barrel is slightly tapered

as above-mentioned. Sufficient resilience exists that smooth action and sealing is obtained throughout the stroke. The front face of the piston head is flat, and has a sharp edge at the intersection with the front sealing ring. This gives a sharp contact at the barrel piston seal line, which gives a wiping or squeegee action to prevent syringe contents from squeezing between the piston and the barrel. The piston may be coated with a silicone oil lubricant. From the rear face of the piston head 28 a piston stem 27 extends to a piston retaining stud 25. The piston retaining stud preferably has a conical rear end extending outward forwardly, and is somewhat larger than the piston stem. There may be a short cylindrical section 30 between the conical section 31 and piston stem 27. The piston retaining stud has such a size that it substantially fills the interior of the plunger stem. The stud has a flat shoulder portion which rests against the flat shoulder of the plunger stem, thus giving a good retaining contact.

As above-mentioned, the cone shaped transition section at the forward end of the plunger stem permits the piston to be shoved into position firmly rearwardly into the plunger stem, thus causing the piston head to be drawn against the end of the plunger stem, so that in use there is a minimum of lost motion as the direction of the piston in the hypodermic syringe barrel is reversed.

In use, it is conventional to press the plunger first forward to remove air from the barrel, then pull the plunger rearward to fill the syringe, then forward to remove any trapped air, and then after insertion into the patient, the plunger is pulled backwards to check for blood to see the hypodermic needle has been inserted into a vein or artery, and then only are the syringe contents injected. Sometimes it is desirable that the needle be inserted in a blood vessel. Sometimes it is desirable that it not be inserted in a blood vessel. A rearward motion of the plunger is used to check the desired location of insertion. It thus can be seen that it is desirable that the piston head be held back against the plunger to eliminate lost motion. The cone shaped transition section permits a desired tension to be more easily obtained and permits more tolerance in molding both the piston and the plunger stem while holding the parts in such relationship that adequate tension in the plunger stem is obtained on assembling.

A slightly different modification is shown in FIGURE 2 in which the hypodermic syringe barrel 32 is of glass. In the construction shown in FIGURE 2, the syringe barrel has a needle retaining tip 33. Conveniently, the standard taper for a Luer needle hub is used. Obviously, non-standard configurations would be satisfactory, but for interchangeability this tip is designed to fit the standard needle hubs in use in the industry.

As shown in FIGURE 4, a finger flange 34 is molded of glass which has anti-slip ridges 35 integral in the glass. Also molded in the glass is a sterilizing gas port

36. The construction is the same as for the all plastic syringe.

Other advantages of the present syringe construction will be obvious to those skilled in the art.

5 The scope of this invention is illustrated by the drawings and the specification, and the scope is as more fully set forth in the appended claims.

I claim:

1. A hypodermic syringe plunger for use with a
10 hypodermic syringe barrel, which barrel may have a slight taper, comprising a hollow tubular stem portion which has a maximum diameter slightly smaller than the barrel in which the plunger is to operate, and the front end of which has a stud retaining aperture having a flat
15 rear shoulder and a rearwardly inwardly cone shape transition section adjacent the stud retaining aperture and forming the front entrance thereto, and an elastic piston having two annular sealing rings thereon to contact the barrel, each ring having a slightly rounded axial cross
20 section, and an integral piston retaining stud attached to the piston by a piston stem, the length of the piston stem being such as to pull the piston against the end of the plunger, so that the piston stem is under tension at all times, said stem passing through said aperture, with
25 said stud against said shoulder.

2. A hypodermic syringe comprising a syringe barrel of plastic having a slight taper inwardly toward the front and a sterilizing gas port in the bore of the barrel extending along the back end of the barrel only, and fitting
30 in said barrel, a hypodermic syringe plunger comprising a hollow tubular stem portion which has a maximum diameter slightly smaller than said barrel and the front end of which has a stud retaining aperture having a flat rear shoulder, and a rearwardly inwardly cone shaped
35 transition section adjacent the stud retaining aperture and forming the front entrance thereto, and an elastic piston having two annular sealing rings thereon in contact with the barrel, and an integral piston retaining stud attached to the piston by a piston stem, the length of
40 the piston stem being such as to pull the piston against the end of the plunger, so that the piston stem is under tension at all times, said stem passing through said aperture with said stud against said shoulder.

3. The hypodermic syringe of claim 2 having
45 a hypodermic needle attached to the barrel.

4. The hypodermic syringe of claim 2 having a tip to fit a needle hub at the forward end of the syringe.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,028,862

April 10, 1962

Harlan Prater, Jr.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 44, strike out "from"; line 45, for "shape" read -- shaped --; column 3, line 32, after "see" insert -- if --.

Signed and sealed this 21st day of August 1962.

(SEAL)

Attest:

ESTON G. JOHNSON

Attesting Officer

DAVID L. LADD

Commissioner of Patents