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H. W. GERARDE
DISPOSABLE SYRINGE
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2,907,326

Fig. 1.

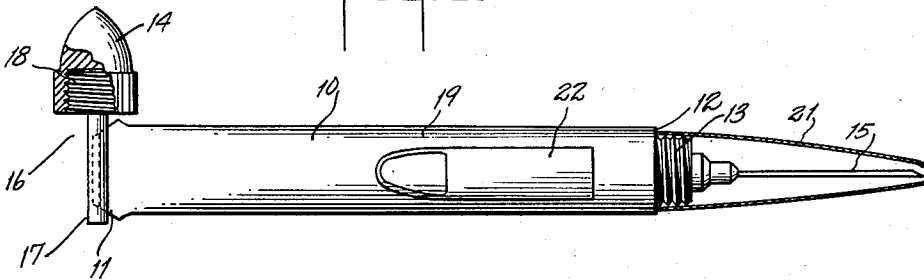


Fig. 2.

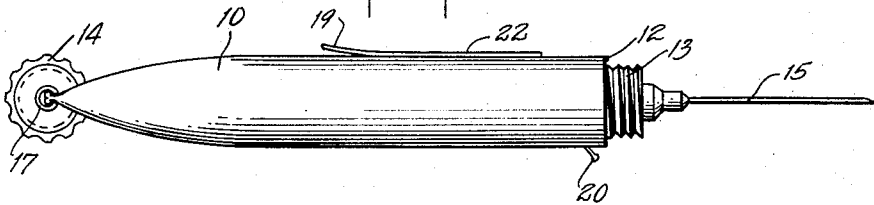


Fig. 3.

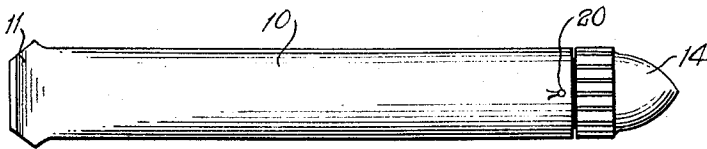
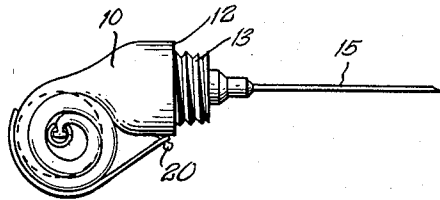


Fig. 4.

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DISPOSABLE SYRINGE

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8 Claims. (Cl. 128—216)

This invention relates to syringes, and more particularly to a disposable plastic plungerless syringe which accurately withdraws and collects blood samples for analysis and study.

Syringes presently in use in laboratories, hospitals, clinics and doctors offices for withdrawing and collecting blood samples are generally made of glass. Conventional glass syringes are generally elongated tubes sealed at one end with provision for attaching a hypodermic needle to the other end. A plunger is movable axially in the tube which expels air from the tube on the forward stroke. The blood to be analyzed is drawn into the tube by placing the hypodermic needle in the patient's arm and withdrawing the plunger to create a vacuum which draws the blood into the tube. These glass syringes are generally individually calibrated and the blood is carefully drawn up to the required indicia marking.

After the blood sample has been collected in conventional syringes it must be transferred to other containers such as test tubes or bottles for biochemical analysis, bacteriological and serological study, cross-matching etc. This transfer of the blood sample from the syringe to other containers is time consuming, requires additional clean and often sterile equipment, and is one of the causes of hemolysis or rupture of the red blood cells, which imparts a pink color to the plasma or serum. When the red blood cells are ruptured during this transfer it often interferes with subsequent tests to which the fluid portion of the blood is subjected.

Due to the relatively high initial cost of conventional glass syringes they must be used over and over again and meticulous care must therefore be exercised in the cleaning and sterilization of each syringe after it has once been used. This is particularly true in bacteriological and serological work where glass syringes may become contaminated with blood from individuals with blood-borne diseases, and they are therefore cleaned by successively rinsing them with water, alcohol and ether, and then finally air dried by sucking air through them.

In view of the foregoing it is the primary object of the present invention to provide a plungerless syringe which will permit the rapid withdrawal of an accurate controlled volume of blood.

Another object of the present invention is to provide a syringe in which the blood sample can be centrifuged without transfer to another container and the supernatant plasma or serum separated from the packed cells.

A further object of this invention is to provide a syringe which is so inexpensive to manufacture that it may be used once and then discarded.

For a better understanding of the present invention as well as further objects and features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawings in which:

Figure 1 is a top elevation view of the syringe of the present invention, portions of the view being shown in cross-section in order to illustrate structural details.

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Figure 2 is a front elevation of the syringe illustrated in Figure 1.

Figure 3 is a view similar to Figure 2 after the syringe has been spirally wound or coiled.

Figure 4 is a view similar to Figure 2 after the syringe has unwound and been filled with blood, the syringe being shown in a sealed condition.

A syringe constructed in accordance with the present invention comprises an elongated tube constituted by a resilient material. The tube is sealed at one end and has provision at the other end for the attachment of a hypodermic needle. A winder is provided for winding or coiling the tube into a tight spiral and for maintaining the tube in this coiled position. After the hypodermic needle has been inserted in the patient's vein the tube is permitted to uncoil creating a vacuum which draws the blood into the tube. When the tube has uncoiled the needle is removed and the tube sealed with a cap. The volume of blood collected is controlled by varying the length and diameter of the tube.

Referring now to the figures, the syringe of the present invention is denoted by the numeral 10 and consists of an elongated tubular body sealed at one end 11, such for example as by heat sealing. The material from which the syringe 10 is fabricated may consist of any suitable plastic such for example as polyvinyl chloride, polyethylene, etc. The only restriction on the material used is that it be non-reactive with the blood collected in the syringe, and that it be flexible or compressible so that it can be tightly coiled for a purpose to be presently described.

The open end 12 of the syringe 10 is externally threaded such as at 13 with threads that are complementary to the internal threading on a cap 14. The bore within the open end 12 of the syringe 10 is adapted to receive the hypodermic needle 15 in any conventional manner, such for example as by internal threading in the bore complementary to external threads on the hypodermic needle, or by frictional engagement between the walls of the bore and the outer circumference of the needle. The only requirement on the manner of attaching the needle 15 to the syringe 10 is that the needle be removable from the syringe and that axial movement of the needle be prevented in order to facilitate entry of the needle 15 into the patient's vein.

The syringe 10 is spirally wound or coiled by means of a winder denoted generally by the numeral 16 and consisting of a stem 17 and a head or flanged portion 18. The stem 17 is slotted longitudinally to slip over and engage a portion of the sealed end 11 of the syringe 10. When the syringe 10 is engaged by the winder 16 in this manner the syringe is spirally wound or coiled by rotating the winder 16. The head or flanged portion 18 of the winder 16 is externally threaded with threads complementary to the internal threads on the cap or knob 14. This provides a convenient method for storing the cap or knob 14 until it is used to seal the syringe 10.

When the syringe 10 has been spirally wound or coiled it is held in this position by the retaining loop 19 which is engaged by the pin 20. The retaining loop is secured to or formed integrally with the surface of the syringe 10 and positioned in such a manner that when the syringe has been wound sufficiently to expel the air from the interior of the syringe the retaining loop 19 is positioned to be engaged by the pin 20.

The syringe of the present invention may be supplied with a hypodermic needle 15 attached thereto, or without a needle in the event ultimate users of the syringe prefer to use their own needles. If the syringe of the present invention is provided with a needle 15 attached thereto the needle 15 should be enclosed by a cover 21 of suitable material in order to maintain the needle in a sterile condition ready for use upon removal of the

cover 21. When the syringe 10 is provided without a needle 15 the open end 12 of the syringe 10 should be enclosed by a cap (not shown) or other means to maintain the interior of the syringe 10 in a sterile condition.

When it is desired to use the syringe of the present invention the syringe 10 is spirally wound or coiled by rotating the winder 16 in a clockwise direction. It is to be noted that the retaining loop 19 is positioned on the surface of the syringe 10 in such a manner that when the syringe is in a coiled position the retaining loop is positioned to be engaged by the pin 20. The winder is rotated in a clockwise direction since rotation of the winder 16 by means of the cap 14 in a counterclockwise direction would disengage the cap 14 from the winder 16. It is to be understood, however, that the cap 14, winder 16, retaining loop 19 and pin 20 may be so positioned in relation to each other as to permit the syringe 10 to be spirally wound or coiled in either a clockwise or counterclockwise direction.

The purpose of spirally winding or coiling the syringe 10 is to force or expel the air from the interior of the syringe to be replaced by blood when the syringe unwinds. In order to permit the air to escape during coiling of the syringe 10 the cover 15 should first be removed, or if a cap has been used to seal the open end 12 of the syringe this should be loosened.

After the syringe has been coiled as illustrated in Figure 3 with the needle 15 in place, the needle is inserted into the patient's vein in a conventional manner. The retaining loop 19 is then disengaged from the pin 20 and the syringe is permitted to slowly uncoil and expand to its original shape and length. As the syringe 10 uncoils and expands a vacuum is created in the interior of the syringe which draws blood into the tube. The flow of blood ceases when the syringe has fully expanded. It has been found that the time required for the syringe to fully expand varies from 20 to 30 seconds to collect 10 ml. of blood. The volume of blood collected in the syringe 10 can be accurately controlled by varying the length and diameter of the syringe 10.

When the syringe has fully uncoiled and expanded the hypodermic needle 15 is detached and the open end 12 of the syringe 10 is sealed with the cap 14, which is first removed from the winder 16. When the cap 14 is secured to the open end 12 of the syringe, the syringe is sealed at both ends and if ordinary aseptic techniques are used throughout the various operations, the blood will be received and retained in a sterile condition since the inner surface of the cap 14, as well as the other parts of the syringe assembly that come into contact with the blood are sterile.

After the cap 14 has been secured to the open end 12 of the syringe 10, the winder 16 may be removed from the closed end 11 and the blood sample subjected to various tests or procedures, depending upon the purpose for which the blood was collected. For example, the syringe 10 can be centrifuged in an ordinary clinical centrifuge in order to separate the plasma or serum from the formed elements of the blood. At the completion of the centrifuging operation the supernatant plasma or serum can be separated from the packed cells by sealing off the portion of the syringe 10 just above the junction of the fluid and packed cells. This can be accomplished by a pair of pinch or screw clamps (not shown) which are clamped on the syringe 10 in parallel relationship and effectively separate the syringe into two sealed tubes. The two sealed portions of the syringe 10 may be separated by cutting the syringe 10 between the clamps with scissors, scalpel, etc. One of the sealed portions contains the supernatant fluid phase and the other contains the packed cells, the contents of both portions being maintained in a sterile condition.

If desired the syringe of the present invention may be provided with an anticoagulant. The syringe may be discarded after use or sterilized with steam, chemically

or electronically, or be made self-sterilizing by incorporating a sterilizing chemical in the plastic material from which the syringe is fabricated. In order to identify the blood collected in the syringe, a tag 22 may be secured to each unit in any conventional manner.

What has been described is a syringe assembly which is inexpensive to manufacture and therefore may be disposed of after a single use, and which will permit the rapid withdrawal of an accurate controlled volume of blood. Throughout the specification it has been stated that the material from which the syringe is fabricated must be flexible and compressible. In the claims that follow the term resilient denotes a material which is capable of being tightly coiled and which will spring back to its original shape when allowed to uncoil.

I claim:

1. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, and winder means detachably engaged with the sealed end of said tube for coiling said tube spirally thereabout to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle.

2. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, winder means detachably engaged with the sealed end of said tube for coiling said tube spirally thereabout to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, and releasable means for retaining said tube in said coiled position.

3. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, a winder provided with a slotted stem and detachably engaged with the sealed end of said tube for coiling said tube spirally thereabout to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, and releasable means for retaining said tube in said coiled position.

4. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, a winder provided with a slotted stem and detachably engaged with the sealed end of said tube, a knob removably secured to said winder for rotation of said stem, said tube being coiled spirally about said stem upon rotation of said knob to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, and releasable means for retaining said tube in said coiled position.

5. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, winder means detachably engaged with the sealed end of said tube for coiling said tube spirally thereabout to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum

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suction action is provided to draw fluid into said tube through said needle, a pin secured to the end of said tube opposite said sealed end and extending therefrom, a loop secured to said tube intermediate said ends and engageable with said pin when said tube is coiled to releasably retain the tube in said coiled position.

6. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, a winder provided with a slotted stem and detachably engaged with the sealed end of said tube for coiling said tube spirally thereabout to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, and a pin secured to the end of said tube opposite said sealed end and extending therefrom, a loop secured to said tube intermediate said ends and engageable with said pin when said tube is coiled to releasably retain the tube in said coiled position.

7. A syringe assembly comprising an elongated collapsible tube formed of resilient material, a hypodermic needle detachably coupled to one end of said tube and extending axially therefrom, the other end of said tube being sealed, said needle communicating with the interior of said tube, a winder provided with a slotted stem and detachably engaged with the sealed end of said tube, a knob removably secured to said winder for rotation of said stem, said tube being coiled spirally about said stem upon rotation of said knob to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, a pin secured to the end of said tube opposite said sealed end and ex-

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tending therefrom, and a loop secured to said tube intermediate said ends and engageable with said pin when said tube is coiled to releasably retain the tube in said coiled position.

8. A syringe assembly comprising an elongated collapsible tube formed of resilient material, one end of said tube being sealed, the open end of said tube being externally threaded and having a hypodermic needle detachably coupled thereto and extending axially therefrom, said needle communicating with the interior of said tube, a winder provided with a slotted stem and detachably engaged with the sealed end of said tube, a cap threadably secured to said winder for rotation of said stem, said tube being coiled spirally about said stem upon rotation of said cap in one direction to expel air from said tube through said needle whereby when said tube is thereafter uncoiled a vacuum suction action is provided to draw fluid into said tube through said needle, said cap being removable from said winder upon rotation in the opposite direction and adapted to be threadably engaged with the threaded portion of said tube to seal said tube after removal of said needle, a pin secured to the end of said tube adjacent said threaded portion and extending therefrom, and a loop secured to said tube intermediate said ends and engageable with said pin when said tube is coiled to releasably maintain said tube in said coiled position.

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