

[54] TWO COMPARTMENT LOCKING SAMPLING SYRINGE 1,053,143 3/1959 Germany..... 128/218 R

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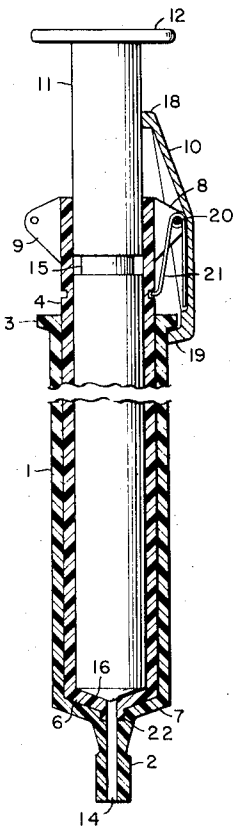
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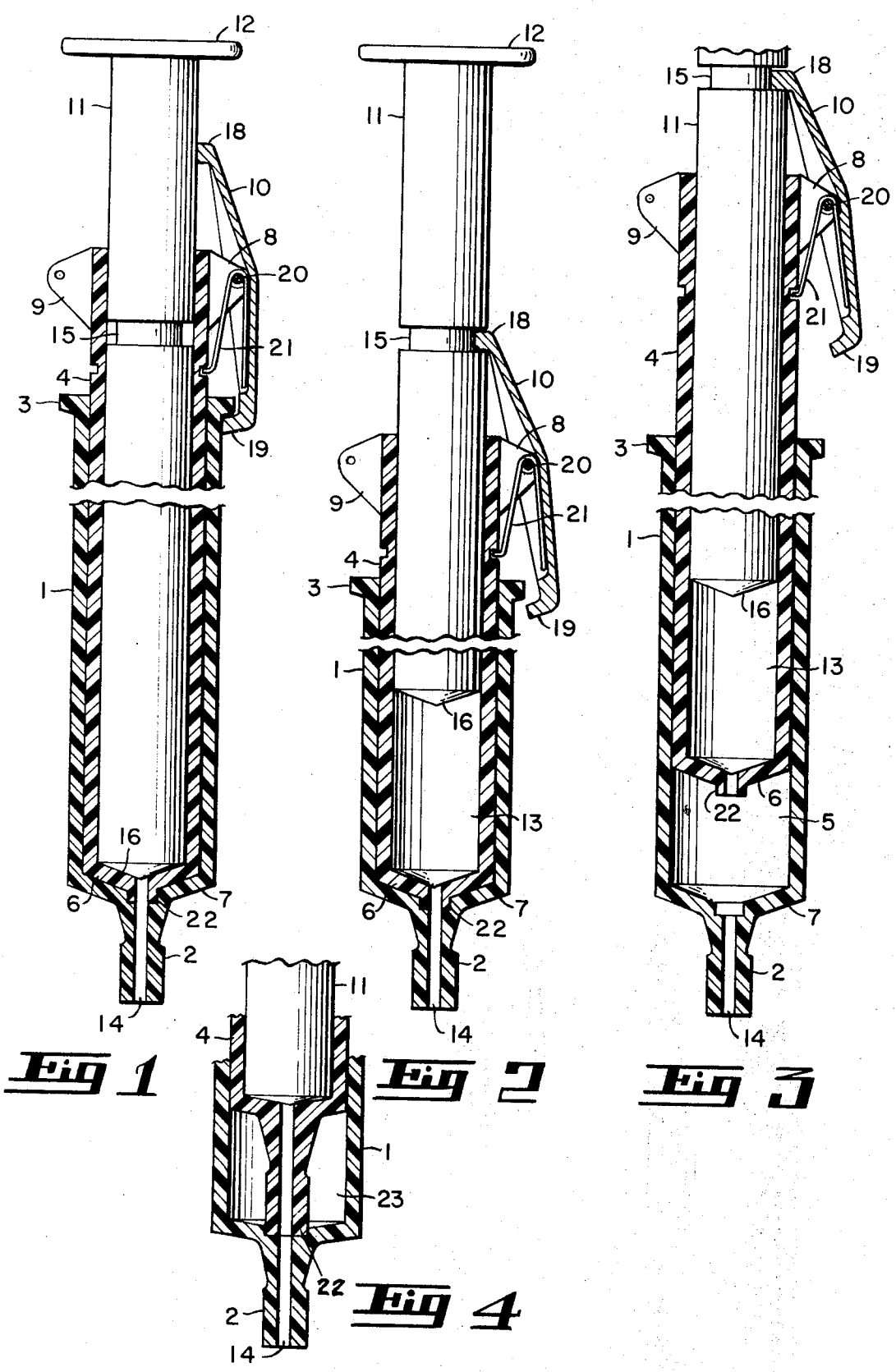
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[57] ABSTRACT

A multi-barrel syringe for drawing blood from a vein which is characterized by having a plunger member, an intermediate plunger-barrel member, an outer barrel member and releasable locking mechanism to fix the intermediate plunger-barrel to the outer barrel and to release the two members from their fixed relationship on predetermined movement of the plunger member while at the same time fixing the said intermediate plunger-barrel to said plunger whereby the intermediate member acts as a plunger and causes formation of a chamber for receiving blood between said outer barrel and said intermediate plunger-barrel member as the plunger member is withdrawn.

3 Claims, 4 Drawing Figures





TWO COMPARTMENT LOCKING SAMPLING SYRINGE

BACKGROUND OF INVENTION

Numerous factors must be taken into consideration when collecting blood for coagulation studies. One of the most important of these, with which the present invention is concerned, involves the extrinsic mechanism of blood coagulation. When tissue is damaged as by puncture of a vein by a needle, a procoagulant, thromboplastin, is released from the damaged tissue into the blood. To avoid the presence of tissue thromboplastin in freshly drawn blood samples, a two-syringe technique is employed.

In the two-syringe technique, the first one or two milliliters of drawn blood are discarded because in this initial volume, tissue thromboplastin is present as a result of the vein puncture. Actually, the first milliliter or two of blood withdrawn washes the needle free of thromboplastin so that subsequent blood may be withdrawn through the same needle free of the coagulating substance and the blood is more truly representative of that of the subject being studied. However, a number of disadvantages exist in the conventional two-syringe technique.

Changing syringes while the needle is in the punctured vein is cumbersome, time consuming, and messy and may result in the needle being dislodged from the vein or new injury to the tissue may be caused which may result in further release of tissue thromboplastin. The present invention provides a syringe which makes it possible to withdraw two samples of blood from a vein with a simple pull on an inner plunger member of the syringe. The first sample of blood is segregated and kept apart from the subsequently withdrawn analytical sample, and contamination of the analytical sample with tissue thromboplastin is avoided. The syringe of the present invention increases the efficiency of blood collection and improves the consistency of the blood sample. It makes practically nonexistent chance of contamination of blood samples by tissue thromboplastin caused by poor technique in blood collection.

SUMMARY OF THE INVENTION

The present invention is a multi-barrel syringe which is so constructed that it can draw a small amount of blood from a punctured vein into one compartment of the syringe, and then draw a larger amount of blood into a separate compartment without disturbing the position of the needle in the initial puncture or changing syringes as in the two-syringe technique. These results are obtained by providing locking means which may fix the outer barrel of the syringe to an intermediate plunger-barrel allowing an innermost plunger to be withdrawn to form a first compartment for receiving the first drawn blood sample between the said plunger and the intermediate barrel member. At a predetermined position of the plunger the intermediate barrel member is released from the outer barrel and fixed to the plunger so that continued withdrawal of the plunger draws out the intermediate barrel which then acts as a plunger and forms a second compartment for receiving blood between the outer barrel and the said intermediate plunger-barrel member.

THE PRIOR ART

Multi-barrel two-compartment syringes for injecting

drugs are known but insofar as the inventors are aware there has not been described a multi-barrel two-compartment syringe which automatically permits blood to be drawn into one compartment and then have subsequent amounts drawn into a distinct compartment from which it may be removed for testing without becoming mixed with the first drawn portion of blood.

THE DRAWINGS

In order that the nature of the invention may be more clearly understood, reference is made to the accompanying drawings in which:

FIG. 1 is an elevation partly in cross section of a preferred embodiment of the syringe of the present invention.

FIGS. 2 and 3 are elevations partly in cross section showing the syringe in different positions of its operation.

FIG. 4 is an elevation partly in cross section of the lower part of an alternative structure.

Referring to FIG. 1 it will be seen that the novel syringe of the present invention comprises an outer barrel 1 provided with a conventional tip 2 to which a hollow needle (not shown) suited for intravenous puncture may be attached. The outer barrel is also provided with a lip 3 or equivalent engaging means.

An intermediate barrel member 4 fits snugly within the outer barrel member, loose enough to permit easy axial movement but tight enough to prevent air from leaking into chamber 5, FIG. 3, when the intermediate barrel is withdrawn. The lower end 6 of the intermediate plunger-barrel is formed to conform closely with the shape of the lower inside end 7 of the outer barrel. The structure should be such that first drawn blood cannot enter between the outer barrel member and the intermediate barrel member. This may be assured by forming a tip 22 on the intermediate barrel which fits into a pocket or recess in the outer barrel. When made of glass the joining surfaces may be ground. If of resilient plastic, accurately molded parts will provide a sufficient seal. Rubber O rings may also be used to provide a good seal.

The intermediate barrel member is provided with lugs 8, 9 or equivalent means of mounting a locking means 10 as will be explained hereafter.

An innermost plunger member 11 is provided with a tip 16 which fits snugly within the intermediate barrel member. Means 12 for grasping the plunger between the operator's fingers is provided.

The innermost plunger, the intermediate barrel and the outer barrel members are in telescopic relationship and slide smoothly along their mutual axis as do the plunger and barrel of a conventional syringe. Withdrawal of the plunger from the intermediate barrel forms a chamber 13 into which the first drawn blood can be introduced through channel 14 in the tip 2.

The innermost plunger is provided with a groove 15 or other means of engaging stud 18 on the locking means 10.

As noted above, the intermediate plunger-barrel member is provided with means to mount a locking mechanism. For purposes of clarity in the drawings only one such locking means is shown. This means may comprise a rocker arm pivoted 20 to lug 8. A similar rocker arm will be mounted on lug 9. Studs 18, 19 are provided on each end of the rocker arm. A spring 21 holds the stud 18 firmly against the innermost plunger

member as shown in FIG. 1. When the plunger is in the position shown in FIG. 2, the stud 18 slips into groove 15 as shown in FIG. 2, thus locking the plunger to the intermediate barrel and releases the outer barrel thus permitting the two innermost members to act as a single plunger and withdrawal thereof results in formation of the second chamber 5 as shown in FIG. 3. The suction created by formation of this second chamber draws blood into it.

It should be understood that the length of the lower section of the lever arm, that is the distance from the pivot point 20 to the locking stud 19 should be such that the lowermost part of the intermediate barrel fits tightly against the inside bottom of the outer barrel so that blood may not enter between the two members while the initial blood is being drawn.

It will also be understood that the location of a locking groove 15 on the inner plunger member will determine capacity of chamber 13 and the volume of blood that may be drawn into it before the locking mechanism releases the outer barrel and locks the intermediate barrel to the plunger. The lower the locking groove on the plunger the greater the volume of the chamber 13 that is formed. A capacity of 2 milliliters is usually sufficient.

An important variation in the structure of the syringe of the present invention is shown in FIG. 4. In this modification the tip 22 of the intermediate barrel is extended downwardly a distance sufficient to form a chamber 23 when the intermediate barrel is inserted into the outer barrel. This chamber may be filled with a diluent, an anti-coagulant, a sequestering agent, or some other solution with which it is desired to mix with the blood sample.

Although it is not a part of the present invention, it is pointed out that all surfaces which may come in contact with the drawn blood, particularly when of borosilicate glass, should be coated with a solution of silicone to avoid activation of the Hageman Factor of the blood.

The capacity of the second formed compartment of the syringe may vary by any desired amount from one-half milliliter to 100 milliliters. Usually the volume for blood coagulation studies will be between 5 and 30 milliliters. These volumes may be determined by varying the lengths of the outer and intermediate barrels or by increasing their diameters. Suitable calibration marks may, of course, be placed on a suitable location on the parts of the syringe.

Although the manner of using the syringe of the present invention is believed to be obvious from the foregoing description, the method of using it will be recapitulated. The operator will, of course, attach a suitable needle to the tip of the assembled syringe which will be in the closed position shown in FIG. 1. All parts should be clean and sterile. The vein from which blood is to be drawn is punctured and the innermost plunger member 11 is slowly withdrawn to the position shown in FIG. 2. This draws blood into chamber 13. When groove 15 comes opposite stud 18 the lever arm 10 will be moved by spring 21 into the position shown in FIG. 2. As will be seen from the drawing, stud 19 is released from the lip 3 of the outer barrel.

As will be obvious from the drawings, continued withdrawal of the inner plunger 11 brings with it the intermediate barrel 4 which then acts as a plunger drawing blood into chamber 5 as the withdrawal movement

is continued. Withdrawal continues until the desired amount of blood, uncontaminated by tissue thromboplastin, is collected in chamber 5.

When using the alternative structure shown in FIG. 4 the drawn blood will be mixed with whatever solution is in chamber 23 at the start of the operation. Uncontaminated blood is forced out of the chamber by telescoping the intermediate plunger-barrel to force the blood out of chamber 5. As noted, the locking means prevents the inner plunger member from ejecting the blood from sample 13 until it is released by depressing lever arm 10.

Obviously other means by which the outer barrel may be fixed to the inner barrel while the plunger is allowed to move axially and then release the inner barrel from the outer barrel and fix the inner barrel member to the plunger so that the latter two may move axially as a unit with respect to the outer barrel will occur to those skilled in the art of syringe design.

We claim:

1. A multi-barrel two-compartment syringe for withdrawing blood from a vein whereby the first drawn blood is introduced into one compartment, and subsequently withdrawn blood is introduced into a second compartment without mixing the two samples which comprise:

- a. an innermost plunger member,
- b. an intermediate barrel member, and
- c. an outer barrel member, the said three members being in telescopic relationship and being independently movable along their mutual axis to form two separate compartments, a fitment on one end of the outer barrel for holding a hollow needle and having a channel for blood, a channel in one end of said intermediate barrel co-axially aligned with the channel in the fitment of the outer barrel member permitting blood to flow into said intermediate barrel member when the members having the two channels are in abutment, means on said intermediate barrel member for fixing the outer barrel member to the said intermediate barrel member to prevent axial movement with respect thereto, said means further comprising means releasing said outer barrel from said intermediate barrel member on predetermined axial movement of said plunger member and simultaneously fixing said plunger member to said intermediate barrel whereby said intermediate barrel is withdrawn from said outer barrel member and a compartment for holding blood is thus formed between the said outer barrel member and the intermediate member on continued withdrawal of the plunger.

2. A syringe in accordance with claim 1 in which the lowermost part of the intermediate barrel member has a downwardly extending tip with a channel, said tip fitting into a recess in the bottom of said outer barrel thus providing a compartment between the said outer and intermediate barrel members.

3. A multi-barrel two-compartment syringe for withdrawing blood from a vein whereby the first drawn blood is introduced into one compartment, and subsequently withdrawn blood is introduced into a second compartment without mixing the two samples which comprises:

- a. an innermost plunger member,
- b. an intermediate barrel member, and
- c. an outer barrel member,

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the said three members being in telescopic relationship and being independently movable along their mutual axis to form two separate compartments, a fitment on one end of the outer barrel for holding a hollow needle and having a channel for blood, a channel in one end of said intermediate barrel co-axially aligned with the channel in the fitment of the outer barrel member permitting blood to flow into said intermediate barrel member when the members having the two channels are in abutment, holding means on the intermediate barrel member to carry a locking means, locking means comprising a lever arm pivoted on said holding means

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with studs on each end, means on the outer barrel to engage a stud on the lower end of said lever arm and hold the intermediate barrel and outer barrel in fixed relationship, means on the innermost plunger for engaging a stud on the upper end of said lever arm, means tending to hold the stud on the upper end of the lever arm against the surface of the plunger and force the said stud into fixed engagement with engaging means on the innermost plunger when the relative position of the two members permits.

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