

[54] **BLOOD TAKING DEVICE**

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[51] Int. Cl. **A61b 5/14; A61m 5/32**

[58] Field of Search **128/2 F, DIG. 5, 214.4, 128/221, 218 R, 218 N, 218 D, 218 NV, 215, 216, 276, 2 B, 274**

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[57]

ABSTRACT

An improved blood-taking device of the type wherein a hypodermic needle is inserted into a blood vessel and one or more evacuated containers in succession are connected to the needle for collecting blood samples has two valves therein. The first valve closes the proximal end of the needle section when a container is not connected thereto, and the second valve makes it possible to control the difference of pressure utilized for drawing blood from a subject. The second valve can be closed rapidly in the event it is discovered that the needle lies in tissue exterior to a blood vessel rather than in a blood vessel itself, thereby preventing extravasation and hematoma.

13 Claims, 6 Drawing Figures

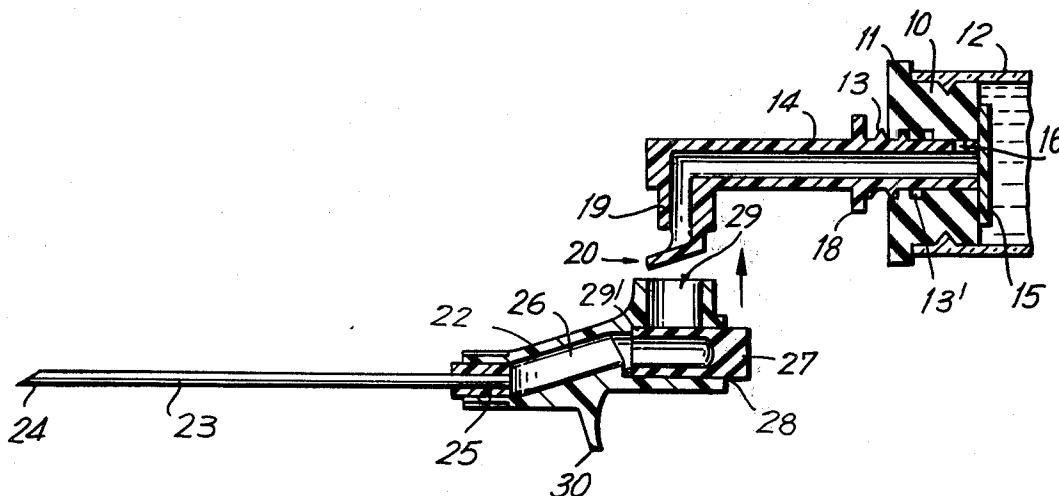


FIG. 1

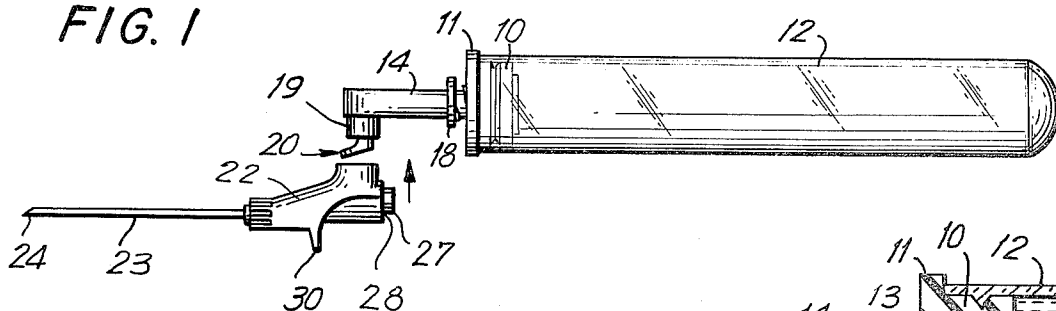


FIG. 2

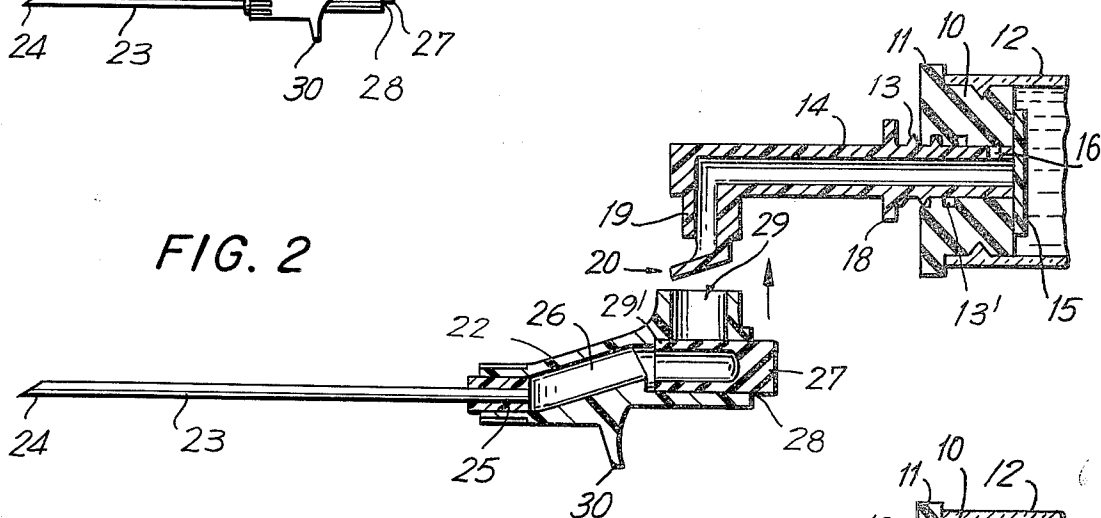


FIG. 3

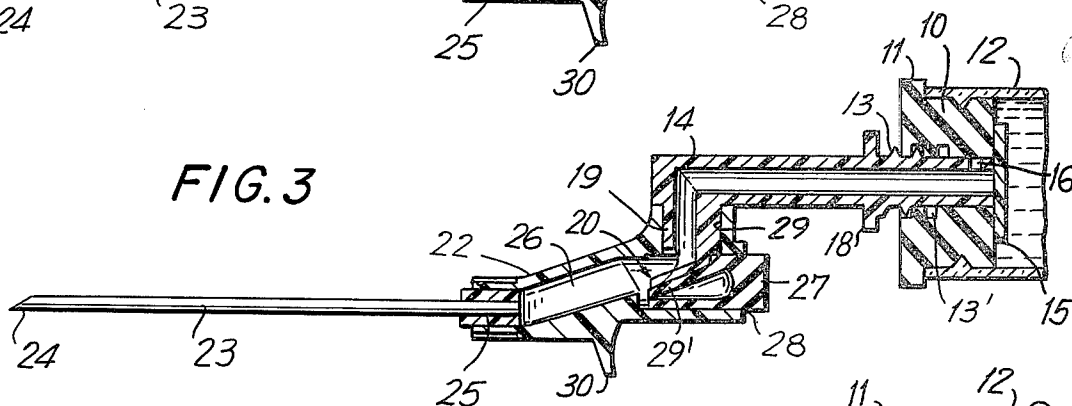


FIG. 4

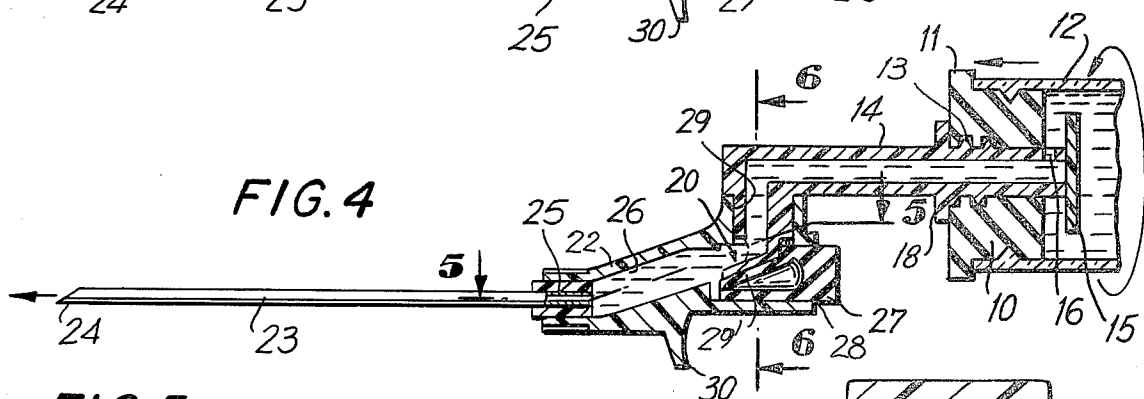


FIG. 5

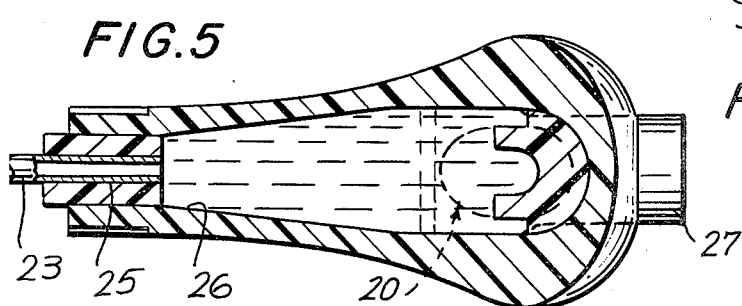
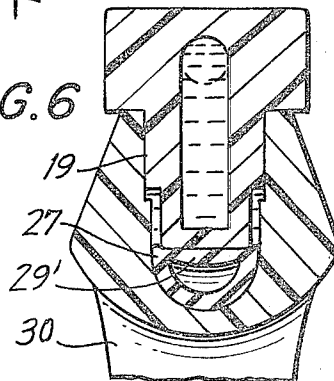


FIG. 6



BLOOD TAKING DEVICE

BACKGROUND OF THE INVENTION

It is routine practice in modern hospitals to take blood samples from patients by means of one or more evacuated test tubes placed in succession inside a holder having a two-pointed cannula; one pointed end of the cannula pierces the vein of the patient and the other pointed end pierces the stopper of the evacuated test tube thus providing a flow of blood from the vein to the evacuated tube.

Holders for vacuum tubes are however relatively expensive and therefore non-disposable as well as bulky devices subject to contamination (see U.S. Pat. No. 3,520,292). Also, when double pointed cannulas are not a built-in feature of holders they have to be joined to them by an operator; this process of handling double pointed cannulas is hazardous since the operator may pierce his fingers or contaminate the cannula. Moreover, double pointed cannulas do not easily allow for injection of soluble drugs into the vein, whereas in medical practice it is sometimes desirable to inject drugs by the cannula into the vein after having drawn blood, in this way avoiding the attendant pain of piercing a new vein. Another drawback when using double pointed cannulas is that sometimes blood flushes back from the vein through the cannula to its inner end when withdrawing the tube thus spilling blood over the surroundings. Most important, when using vacuum tubes with a double-ended cannula, if the outer tip lodges within tissues rather than a vein, extravasation of blood from the adjacent vein and hematoma may result when the evacuated tube is pierced by the outer tip of the cannula. It is then necessary for the operator to withdraw the cannula as quickly as possible. Even then, the operator may not recognize the situation quickly enough because the full difference in pressure is applied to the outer tip of the cannula as the stopper of the evacuated tube is pierced.

Further, the conventional device has a holder member surrounding the proximal end of the double ended cannula for reception of the stoppered end of the evacuated tube. The diameter of the member is large enough so that the cannula enters the skin at a relatively sharp angle increasing the danger of passing through the further wall of the blood vessel so that the tip of the cannula is within the tissue rather than within the blood vessel. Also, when an evacuated container is not in position over the proximal end of the cannula, clotting at the tip may occur thus interfering with the operation of the device when the taking of an additional specimen is desired.

SUMMARY OF THE INVENTION

A blood-taking device is made in two joinable portions, the first portion including a cannula and a support section, and a second portion including an evacuated container closed by a stopper through which passes an axially and rotatably movable tube. The cannula-containing first portion and the container portion can be firmly joined together to establish a continuous passage for the flow of blood through the cannula, the support section and the tube into the container. The support section has a first valve therein which is ordinarily closed so that when the tube and container portion are not connected to the cannula-containing portion, blood in the support section is closed off from contact with the air and possible contamination is

avoided. The container portion has a second valve therein which makes it possible to control the difference of pressure applied at the distal tip of the cannula and to cut off the application of vacuum in the event that the cannula is not properly placed in a blood vessel from which blood is to be drawn, thereby avoiding the danger of hematoma. The second valve is operated by rotation of the container around the tube. The distal end of the tube can be seated in the proximal end of the support section to make a continuous passage. The distal end of the tube is fitted with a projecting lip which opens the first valve when the container portion and the cannula-containing portion are connected.

Accordingly, an object of the present invention is to provide an improved blood-taking device having valve means for quickly cutting off the vacuum applied to the tip of a cannula in the event that the cannula is not properly situated in a blood vessel.

Another object of the present invention is to provide an improved blood-taking device with which a plurality of blood specimens can be drawn with a single insertion of a cannula into a blood vessel without incurring the danger of blood clotting in the hiatus between the taking of successive specimens.

An important object of the present invention is to provide an improved blood-taking device in which the angle at which the cannula enters the subject's skin is controlled by said device.

A main object of this invention is to provide a novel stopper for a vacuum container and a novel hypodermic applicator to eliminate the need for a holder as well as double pointed cannulas.

Yet another object of the invention is to provide a hypodermic applicator that allows either to inject soluble drugs into a blood vessel or to draw out blood without spilling due to flush-back.

A significant object of the present invention is to provide an improved blood-taking device in which the operation of said device is free from the danger of causing hematoma.

Yet another object of the present invention is an improved blood-taking device in which the operation of joining the cannula-containing portion to the container portion automatically opens the valve in the support section to provide a continuous and unimpeded channel from the cannula tip to the proximal end of the tube leading into the container.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises an article of manufacture possessing the features, properties, and the relation of elements which will be exemplified in the article hereinafter described and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 is a side view of a device in accordance with the present invention with the cannula-containing portion and the container portion separated;

FIG. 2 is a side view of the device in accordance with the present invention with the two portions thereof about to be joined;

FIG. 3 is a side view in section showing the two portions of the device connected together, and with the valve in the container portion closed;

FIG. 4 is a side view similar to that of FIG. 3 but with the valve in the container portion open;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4.

FIG. 6 is a sectional view along line 6—6 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The improved blood-taking device of the present invention consists of two joinable portions, a cannula-containing portion and a container portion shown separated from each other in FIG. 1. Cannula 23 has a sharp tip 24 for insertion into a blood vessel through the skin of a subject. Proximal end 25 (FIG. 2) of cannula 23 is tightly held in support section 22 having a passage 26 therethrough. Plug 27 having flexible walls is seated in passage end 28. The flexible wall of plug 27 lies across opening 29 so that plug 27 seals opening 29 and passage end 28 simultaneously. Support section 22 has a projection 30 which serves to hold said support section away from the skin of the subject by a predetermined distance, thereby establishing the angle at which cannula 23 penetrates the skin, and facilitating handling of the support section and cannula.

Container 12 is closed by stopper 10 having a flange 11 which seats on the open end of container 12. Stopper 10 has an axial passage therethrough traversed by tube 14 which fits within stopper 10 sufficiently tightly to prevent the entry of air between tube 14 and the axial passage in stopper 10, but not so tightly as to prevent axial or rotational movement of tube 14 in stopper 10.

Tube 14 is closed at its proximal end, preferably by a disc cemented or otherwise joined to the end of tube 14 subsequent to placing tube 14 in stopper 10. Disc 15 performs the double function of sealing the end of tube 14 and simultaneously limiting the axial excursion of tube 14 in a direction away from container 12. Tube 14 also has a stop 18 firmly joined thereto at a position such as to limit the excursion of tube 14 in an axial direction toward container 12.

Tube 14 has a lateral opening therein located a short distance away from the sealed end of tube 14. As shown in FIG. 1, opening 16 lies within the passage through stopper 10, thus effectively sealing container 12 against the entry of air when container 12 is evacuated. In a preferred form, the axial passage through stopper 10 is threaded from the exterior portion thereof inwardly to a distance short of that at which opening 16 will seat when disc 15 is brought into contact with stopper 10. As is obvious, tube 14 must be correspondingly threaded.

FIG. 2 shows the container portion of the device about to be joined to the cannula-containing portion. The join is effected by seating distal tip 19 of tube 14 in socket 29; the tip and socket are shaped so that they mate closely preventing leakage of air therebetween. Tip 19 has joined thereto a lip 20 which makes contact with the flexible wall 29' of plug 27 when the two portions are joined. As tip 19 is inserted into socket 29, lip 20 displaces the upper portion of plug 27, thereby establishing a continuous passage between the tip of cannula 23 and the interior of tube 14. This is shown in FIG. 3 in which the upper wall of flexible plug 27 is de-

pressed by lip 20. The appearance of the cannula-containing portion of the device after insertion of tip 19 into socket 29 is shown in section in FIGS. 5 and 6.

When it is desired to take a blood sample, container 12 is carefully rotated in the direction shown by the arrow in FIG. 4 until opening 16 just clears the proximal end of the stopper 10. Axial movement of the container 10 toward stop 18 results from the fact that tube 14 has threads 13 thereon which mate with threaded cannula 13' of stopper 10. It is to be noted that stopper 10 has an unthreaded portion at its proximal end, thereby ensuring a tight seal when opening 16 is within stopper 10.

If blood does not flow virtually immediately through opening 16 into container 12, container 12 is rotated in the opposite direction to bring opening 16 within stopper 10, thereby avoiding the application of the full difference in pressure to the tissue in which the cannula must be imbedded. In this way extravasation of blood and consequent hematoma are avoided. The cannula can then be withdrawn and properly reinserted so that the tip lies within a blood vessel. The container 12 is then rotated again as shown in FIG. 4 for starting the flow of blood. Assuming that blood flows through opening 16, rotation of container 12 is continued until stopper 10 hits stop 18. It is kept in this position until the required amount of blood is drawn or until the container is filled.

Once the container is filled, tip 19 of tube 14 is removed from socket 29 and flexible wall of plug 27 springs back into place to seal off passage 26 in support section 22. The process can be repeated as many times as desired using a fresh vessel each time for extracting a sample.

If desired a soluble drug can be injected without pain to the patient by filling with the drug a regular syringe assembled to a small caliber needle and a piercing stopper 27 through aperture 28 by means of the syringe's pointed needle. The drug is then injected inside chamber 26 and through this goes to cannula 23, aperture 24 and finally the patient's blood vessel given that aperture 29 remains sealed. A new container portion might be assembled to the in situ support section 22 to draw more blood or else, cannula 23 might be removed from the blood vessel and then discarded. The filled container portion is shipped to a suitable biochemical laboratory where valve 16 is first opened after which the stopper 10 can readily be removed, the tests performed, and the unit discarded.

Since socket 29 is closed off each time a vessel is removed, blood tends neither to continue to flow out through passage 26 nor to withdraw into the blood vessel.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above article without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. An improvement in a blood-taking device for taking blood from a blood vessel, wherein said improvement comprises a cannula-containing portion and a container portion, said cannula-containing portion comprising a cannula having a sharp distal end and a proximal end, a support section having a passage there-through, the distal end of said passage tightly receiving the proximal end of said cannula, first valve means seated in the proximal end of said passage for closing same, said support section having an aperture therein connecting with said passage, said first valve means normally closing the connection between said aperture and said passage, said container portion comprising an evacuable container having a mouth, a stopper in said mouth, tube means having a proximal end passing through said stopper and a distal end removably connected with said aperture in said support section to form a tight connection between said tube means and said support section at said aperture therein, and operating means on the distal end of said tube means for opening said first valve means and thereby connecting said aperture with said passage when said tube means is connected to said support section, said stopper being affixed to said container for movement therewith relative to said tube means and fitting sufficiently tightly to said mouth to prevent flow of air therebetween.

2. The improvement as defined in claim 1, wherein said first valve means comprises a flexible hollow plug seated in and closing said proximal passage end, said plug extending across and completely blocking said aperture when said tube means is not connected to said support section.

3. The improvement as defined in claim 2, wherein said operating means on said tube is a lip extending from the distal end of said tube and so disposed as to displace the portion of said hollow flexible plug blocking said aperture, thereby providing connection to said passage for the flow of blood through said support section into said tube.

4. The improvement as defined in claim 2, wherein the axis of said aperture is essentially perpendicular to the axis of said cannula.

5. The improvement as defined in claim 1, wherein said aperture is socket-formed and the distal end of said tube is adapted to fit tightly within said socket-shaped aperture.

6. The improvement as defined in claim 1, wherein said support section has thereon a projection which can

be placed proximate the surface into which said cannula is to be inserted, thereby establishing the angle at which said cannula is inserted into said surface and holding said support section away from said surface and making said support section readily graspable.

7. The improvement as defined in claim 1, wherein said stopper has an axial channel therethrough, and said tube means fits within said channel sufficiently tightly to prevent flow of fluid between said tube means and said channel, said tube means being sealed at the proximal end thereof and having an opening in the side wall thereof proximate the proximal end thereof, said container being axially movable relative to the proximal end of said tube means by an amount sufficient so that said opening in said tube means may be within said container thereby establishing connection between said tube and said vessel, or within said channel in said stopper thereby sealing said container against possible entry of air or liquid therein from said tube means.

8. The improvement as defined in claim 7, wherein the distal end of said channel in said stopper and the exterior of the proximal end of said tube means are correspondingly threaded so that gradual making and breaking of connection between said tube means and said container may be effected by rotation of said container about said tube.

9. The improvement as defined in claim 7, wherein said tube means has protrusions thereon on either side of said stopper, said protrusions serving as stops to limit the axial excursion of said container and stopper relative to said tube means.

10. The improvement as defined in claim 7, wherein said tube means has a right-angled elbow therein exterior to said stopper.

11. The improvement as defined in claim 7, wherein said tube means has at its distal end a projecting lip suitable for opening said valve means on insertion of said tube means into said aperture.

12. The improvement as defined in claim 7, wherein the distal end of said tube means is suitably shaped for fitting within a socket.

13. The improvement as defined in claim 1 wherein said first valve means is a hollow plug of a material through which a hypodermic needle may be passed for injecting fluid into a patient once a puncture in the surface of a patient has been made for withdrawing blood.

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