March 31, 1970 G. I. PIERATT 3,503,386

BLOOD COLLECTING DEVICE

Filed April 10, 1967 2 Sheets-Sheet 1

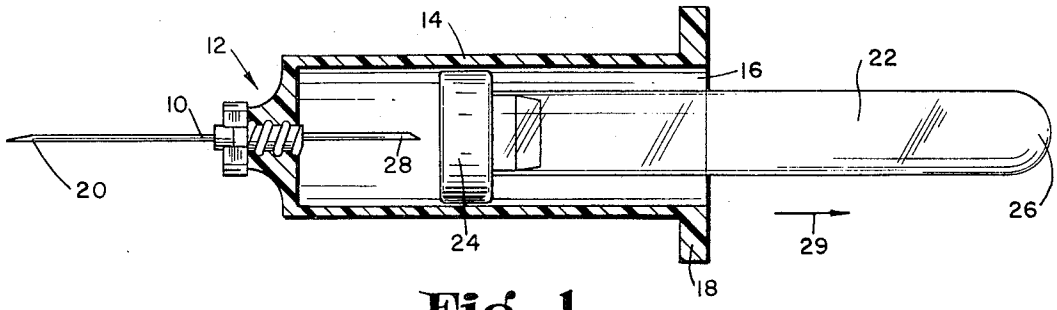


Fig. 1

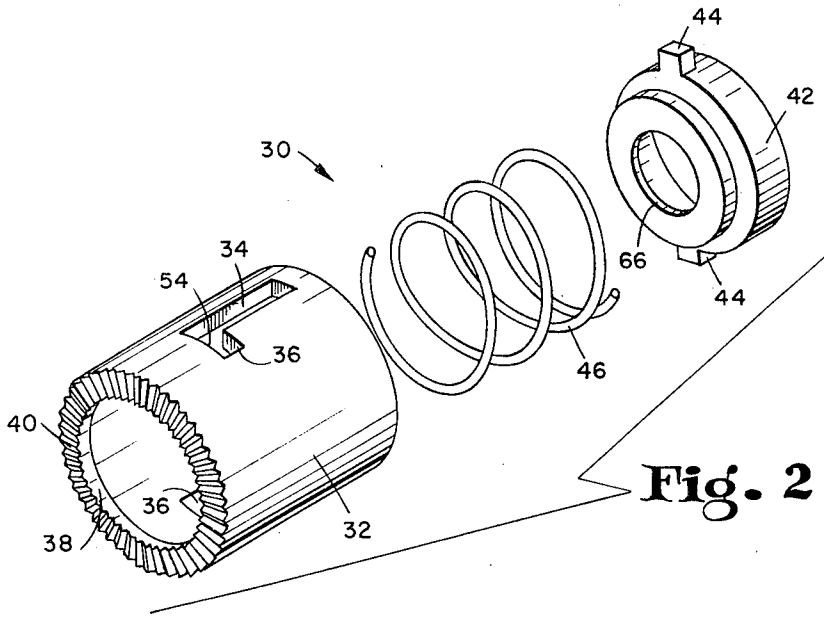


Fig. 2

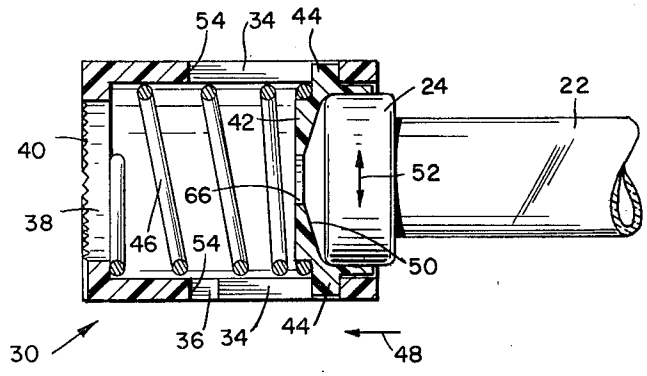


Fig. 3

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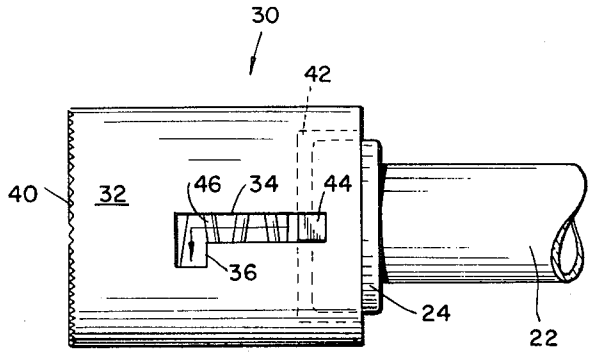


Fig. 4

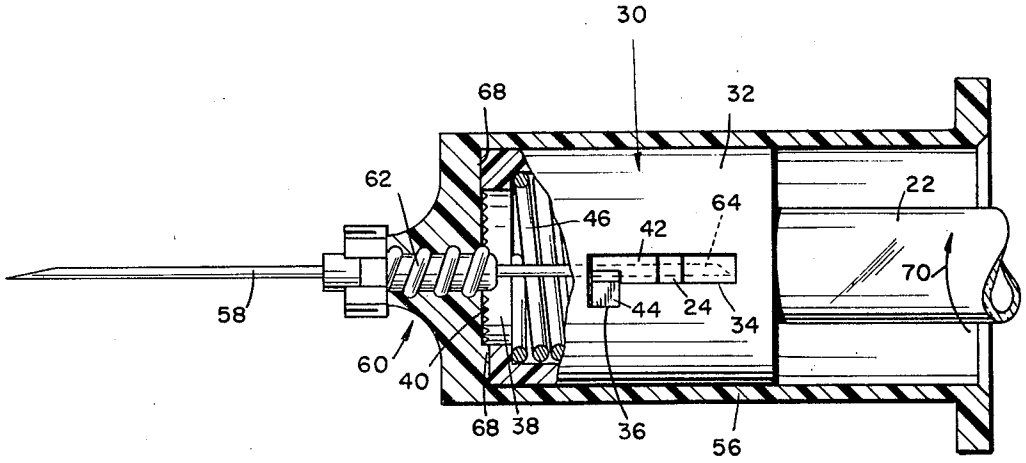


Fig. 5

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United States Patent Office 3,503,386 Patented Mar. 31, 1970

3,503,386

BLOOD COLLECTING DEVICE

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Filed Apr. 10, 1967, Ser. No. 629,470
Int. Cl. A61b 5/14; A61m 1/00
U.S. Cl. 128—2 9 Claims

ABSTRACT OF THE DISCLOSURE

A blood collecting device comprising a holder carrying a double-ended, hollow bored needle, an evacuated tube including a stopper at the forward end of the tube, the tube being engageable with the holder so that the stopper is penetrated by the rear end of the needle. Means are provided for removing the stopper from the needle, the removing means comprising energy storage means and latch means effective, when engaged, to store energy in the energy storage means and, when disengaged, to release the stored energy. The tube and latch means are arranged so that, when the stored energy is released, the stopper is removed from the needle.

The present invention relates generally to blood collecting devices, and more particularly to blood collecting devices of the type which utilize a double-ended, hollow bored needle and several evacuated tubes, each of which has a stopper at its forward end which is penetrated by the rear end of the needle while the forward end of the needle is penetrating one of a person's veins.

It is common practice to take several blood samples from a person by sticking the forward end of such a hollow needle into one of the person's veins and then at least partially filling a plurality of evacuated tubes with blood by penetrating the stopper which seals the tube with the rear end of the needle. In some cases, as many as ten tubes are at least partially filled with blood without removing the forward end of the needle from the vein. Needless to say, an inexperienced or careless technician may cause undue pain or tissue damage in penetrating the stopper with the rear end of the needle and then removing the stopper from the rear end of the needle. To date, such blood collecting devices have been arranged so that the stopper is removed from the rear end of the needle by pulling longitudinally on the evacuated tube after is it filled with the desired amount of blood. The problem with such an arrangement is that a rubber-like stopper which will provide the necessary seal for the tube is not so easily removed from the rear end of the needle. In fact, in some cases, this stopper will frictionally engage the needle so that it is extremely difficult to pull the stopper off the needle without disturbing the position of the needle in the vein.

It is a primary object of the present invention, therefore, to provide such a blood-collecting device comprising means for removing the stopper from the needle without disturbing the position of the needle in the vein.

Another object of the present invention is to provide such a blood collecting device comprising an energy storage means and latch means effective, when engaged, to store energy in the energy storage means, and, when disengaged, to release the stored energy, the tube and the latch means being arranged so that, when the stored energy is released, the stopper is removed from the needle.

The above-mentioned energy storage means and latch means are part of an adapter which is arranged receivably to engage the end of the tube carrying the stopper. Thus, adapters can be placed on several tubes and preloaded to store energy in the energy storage means of each adapter before the blood collecting operation begins.

Other objects and features of the present invention will become apparent as this description progresses.

To the accomplishment of the above and related objects, the present invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is a partially sectioned, elevation view of a conventional blood-collecting device showing the double-ended needle and an evacuated tube;

FIG. 2 is an exploded perspective view of the adapter of the present invention showing a spring and a means for storing energy in the spring;

FIG. 3 is a sectioned, elevation view of the adapter of FIG. 2 showing the forward end of the evacuated tube receivably engaged by the adapter;

FIG. 4 is an elevation view of the adapter of FIG. 2 showing the means whereby energy is stored in the spring; and

FIG. 5 is a partially sectioned view showing the adapter of FIG. 2 received in a holder which carries a double-ended, hollow bored needle.

Referring now to FIG. 1, a conventional blood-collecting device will be described. The blood-collecting device of FIG. 1 comprises a double-ended, hollow bored needle **10** carried at the forward end **12** of a cup-shaped holder **14** having an open rear end **16** and conventional flanges **18** disposed adjacent the rear end **16**. The forward end **20** of the needle **10** is inserted into a vein and then an evacuated tube **22** having a seal-providing stopper **24** is inserted into the holder **14** as shown. The nurse or technician will press on the rear end **26** of the tube **22** with her thumb and pull on the flanges **18** with her fingers until the rear end **28** of the needle **10** penetrates through the stopper **24**, thereby permitting blood to flow into the tube **22**. Of course, blood flows from the vein into the tube **22** because the tube is evacuated.

After the desired amount of blood is collected in the tube **22**, the tube is conventionally pulled in the direction of the arrow **29** relative to the holder **14** and the rear end **28** of the needle **10** to remove the stopper **24** from the rear end of the needle. As stated previously, this is not always easily accomplished. The present invention provides means for removing such a stopper **24** from the rear end **28** without disturbing the position of the needle **10** in the vein.

The present invention comprises an adapter, indicated generally by the reference number **30**, which receivably engages the end of the tube **22** containing the stopper **24** and which is receivably engaged by a holder **56** (FIG. 5), similar to the holder **14**.

The adapter **30** comprises a hollow cylinder **32** having a pair of axially extending slots **34** in the wall thereof, each of the slots **34** opening into a short, circumferentially extending slot **36**. The forward end of the cylinder **32** is provided with a centrally located aperture **38** and generally radially disposed serrations **40**, the purpose of which will be discussed in conjunction with FIG. 5. A generally cylindrically-shaped slide element **42** having radially outwardly extending lugs **44** is arranged for axial reciprocation in the cylinder **32**, each of the lugs **44** being slidably received in one of the axially extending slots **34** and circumferentially extending slots **36**. A spring **46** is disposed between the front end of the cylinder **32** and the slide element **42** as shown in FIG. 3, the spring being

arranged to oppose movement of the slide element **42** in the direction of the arrow **48**.

As seen in FIG. 3, the rear end of the slide element **42** is provided with a cut-out **50** which receives the stopper **24**. Since the stopper **24** is preferably fabricated from a rubber-like material, the stopper is frictionally held in the cut-out **50** so that, when the stopper is rotated in the direction of the arrow **52** about its axis, the slide element **42** is thereby rotated. Also, this stopper **24** is preferably frictionally held in the cut-out **50** so that, when the tube **22** is pulled in a direction opposite to the arrow **48**, the slide element **42** and, consequently, the cylinder **32** are pulled in the same direction.

It will be seen, therefore, that when the tube **22** is pushed in the direction of the arrow **48** relative to the cylinder **32**, energy will be stored in the spring **46**. Thus, when each lug **44** is against the forward end **54** of the slot **34** in which the lug is slidably received, the element **42** may be rotated by rotating the tube **22** until each lug **44** is received in its circumferentially extending slot **36**, thereby storing energy in the spring **46**. This feature is clearly illustrated in FIG. 4, which shows a lug **44** at the rear end of one of the axially extending slots **34** and the spring **46** expanded, and in FIG. 5, which shows the lug **44** in the circumferentially extending slot **36** and the spring **46** compressed. Thus, to release the energy still in the spring **46**, it is necessary to rotate the lugs **44** out of their respective circumferentially extending slots **36** so that the lugs are free to move in the axially extending slots **34**.

The adapter **30** is arranged to be received in a holder **56**, which is similar to the holder **14** except as will be discussed, as shown in FIG. 5. A double-ended, hollow bored needle **58** is arranged to extend through the forward end of the holder **56** as indicated generally by the reference number **60**. Conventional threaded adapter means **62** is provided for securing the needle **58** against movement relative to the holder **56**. The rear end **64** of the needle **58** extends axially back through the holder **56** to penetrate through the stopper **24** when the adapter **30** and tube **22** are pushed into the holder **56**. That is, the rear end **64** of the needle **58** extends through the cylinder **32**, spring **46**, an aperture **66** in the slide element **42** and the stopper **24**. The cylinder **32** is free to move longitudinally in the holder **46**. However, the inside surface of the forward end wall of the holder **56** is preferably provided with serrations **68** which engage the serrations **40** on the cylinder **32** to prevent rotation of the cylinder **32** in the holder **56**. Thus, after the desired amount of blood is drawn into the tube **22**, the tube may be rotated in the direction of the arrow **70** (FIG. 5) to move the lugs **44** out of their respective slots **36** so that the spring **46** may urge the slide element **42** against the stopper **24** to remove the stopper from the rear end **64** of the needle **58**.

It has been found that the sudden release of energy stored in a spring, such as the spring **46**, is effective to remove the stopper **24** from the rear end **64** of the needle **58**. Each lug **44**, when engaged in its circumferentially extending slot **36**, acts as a latch means effective to store energy in the spring **46**. Of course, moving each lug **44** out of its circumferentially extending slot **36** releases the energy stored in the spring **46**. In practice, an adapter **30** could be placed on each of several tubes **22** and the springs **46** could be preloaded before the blood collecting operation is started. Thus, a technician would find it relatively easy to pick up one of the tubes **22** having an adapter **30** mounted thereon and insert it into and remove it from the holder **56** as described above.

What is claimed is:

1. A blood sampling device comprising a holder, a double-ended, hollow bored needle carried by said holder, an evacuated tube including a stopper at the forward end of said tube, and a removable adapter arranged receivably to engage the forward end of said tube and to be operably engaged between said holder and said tube, said adapter

comprising energy storage means and latch means effective, when engaged, to store energy in said energy storage means and, when disengaged, to release the stored energy, said adapter being arranged so that, when said tube is received in said adapter and said adapter is engaged with said holder, said stopper is penetrated by the rear end of said needle, and said tube being receivably engaged by said adapter so that, when said stored energy is released, said stopper is removed from said needle.

2. A blood sampling device as in claim **1** wherein said latch means comprises an element which is moved in opposition to said energy storage means to build up energy therein when said tube is inserted into said adapter and means for releasably holding said element in a position which will store energy in said energy storage means.

3. A blood collecting apparatus comprising a holder, a double-ended, hollow bored needle carried by said holder, an evacuated tube including a stopper at the forward end of said tube, said tube being engageable with said holder so that said stopper is penetrated by the rear end of said needle, and means for removing said stopper from said needle, said removing means comprising energy storage means, and latch means effective, when engaged, to store energy in said energy storage means and, when disengaged, to release the stored energy, said tube being engaged with said latch means so that, when said stored energy is released, said stopper is removed from said needle, said latch means comprising an adapter engageable between said holder and said tube, said adapter comprising cooperating guide and slide means, said energy storage means being disposed between said guide and slide means yieldably to oppose movement of said slide means in one direction relative to said guide means, and means for releasably holding said slide means in a position which will store energy in said energy storage means, and said slide means being engageable with the forward end of said tube so that movement of said tube in said one direction relative to said guide means will move said slide means to said energy storing position, whereby energy can be stored in said energy storage means before said adapter is engaged with said holder.

4. A blood collecting apparatus as in claim **3** wherein said guide means is a hollow cylinder having an axially extending slot in the wall thereof, said slot opening into a circumferentially extending slot, said slide means having a lug movably received in said axially extending slot and said circumferentially extending slot, said slide means being held in said energy storing position when said lug is received in said circumferentially extending slot, said slide means being frictionally engaged with said stopper so that, when said tube is turned in one direction about its axis, said lug is moved out of said circumferentially extending slot and is thereby freed to move in said axially extending slot.

5. A blood sampling device comprising a hollow, cylindrically-shaped holder having an open rear end and an apertured front end wall, a double-ended, hollow bored needle having each of its ends pointed, said needle extending axially through said aperture, means for holding said needle against movement relative to said holder, an evacuated, cylindrically-shaped tube, a stopper providing a seal at the forward end of said tube, a hollow, cylindrically-shaped adapter having an open rear end for receiving the forward end of said tube and an aperture in its front end for receiving the rear end of said needle, an element arranged for axial reciprocation in said adapter, spring means disposed in said adapter and resiliently resisting forward movement of said element toward said needle, and means for releasably latching said element in a position which will store energy in said spring means, said adapter being received through said rear end of said holder so that said stopper is penetrated by the rear end of said needle, said element being engaged with the forward end of said tube so that, when said stored energy is released, said stopper is removed from said needle.

6. A blood sampling device as in claim 5 wherein the inside surface of the front end wall of said holder is provided with serrations and wherein the outside surface of the front end of said adapter is provided with serrations which engage the first-mentioned serrations, thereby preventing rotation of said adapter relative to said holder.

7. A blood sampling device as in claim 5 wherein said stopper frictionally engages said element so that, when said tube is pulled toward the rear of said adapter, said adapter is pulled toward the rear end of said holder.

8. For use with a blood collecting device including a holder providing a chamber open at its rear end and rigidly carrying at its forward end a hypodermic needle having a sharpened end projecting forwardly beyond said holder and a sharpened rear end disposed in said chamber, the improvement being an adapter comprising an open-ended casing receivable in said chamber with the forward end of said casing disposed between the forward end of said chamber and the rear end of said needle, an apertured slide reciprocally retained in said casing, said slide being proportioned and designed at its rear end for retentively receiving the stopper of an evacuated tube, energy storage means in said casing resiliently resisting forward movement of said slide, and latch means for releasably retaining said slide in a position in which the rear end of said needle penetrates a stopper so received in said slide.

9. The invention of claim 8 in which the wall of said casing is provided with a part peripherally extending slot

and an axially extending slot opening into said peripherally extending slot and extending rearwardly therefrom, and in which said latch means includes a rigid lug extending outwardly from said slide to reciprocate in said axially extending slot and to be engageable in said part peripherally extending slot releasably to hold said slide in its said position, the retentive reception of the rear end of said slide with the forward end of said tube being such that said lug is movable out of engagement with said part peripheral slot and into said axial extending slot by rotating said tube.

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