United States Patent

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[54] **BLOOD TRANSFER DEVICE**
1 Claim, 6 Drawing Figs.

[52] **U.S. Cl.** **128/2, 128/276**
[51] **Int. Cl.** **A61m 1/00**
[50] **Field of Search** ..... 128/2, 214, 215, 221, 218, 216, 214.4, DIG. 5

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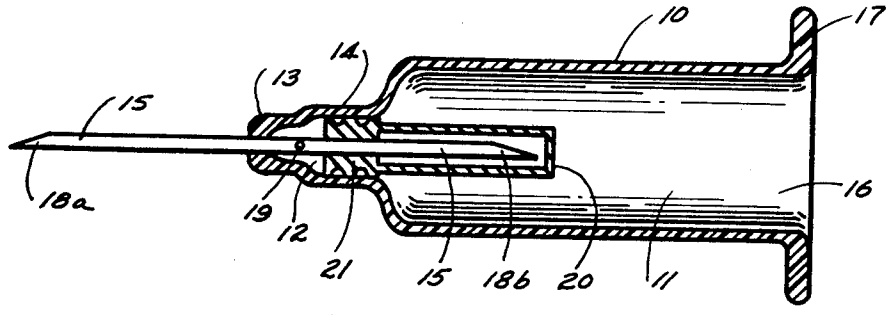
ABSTRACT: A blood transfer device for veni-puncture and the like is provided having a double-pointed cannula, a main chamber for loading and reloading cartridges, and a pilot chamber separated from the main chamber by a resilient collapsible cannula sheath. When the device is used and the cannula is correctly positioned as for veni-puncture, the blood enters the cannula and flows into the pilot chamber through certain aperture means between the cannula and the pilot chamber enabling the operator to confirm visually by the presence of a substantial sample that the placement is correct. One injection serves for the loading and filling of several cartridges, as desired, without spilling of blood between loadings and with minimum risk of exposure to contamination, etc.



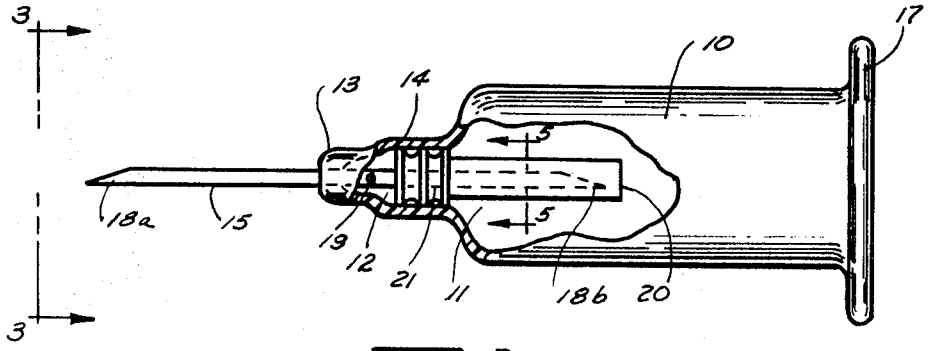


Fig. 1

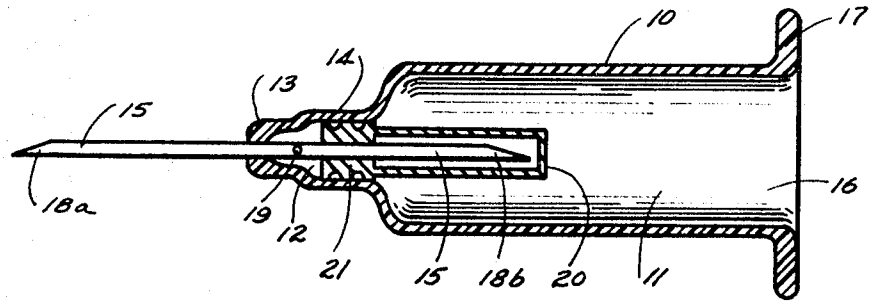


Fig. 2

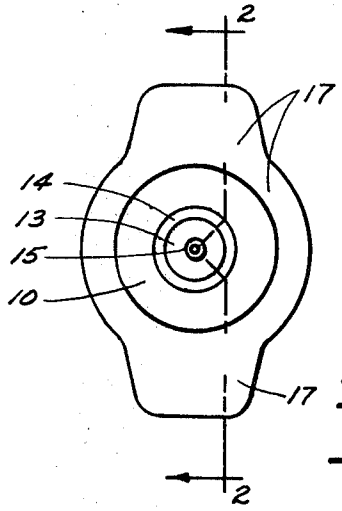


Fig. 3

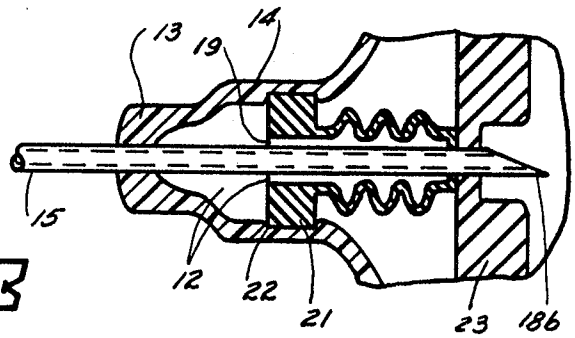


Fig. 4

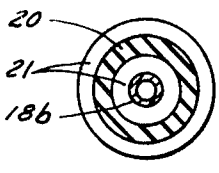


Fig. 5

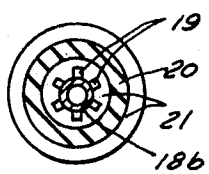


Fig. 6

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BLOOD TRANSFER DEVICE

SUMMARY AND DETAILED DESCRIPTION

This invention relates to blood transfer devices and more particularly to blood transfer devices for veni-puncture and the like assuring the correct placement of the cannula within the vein.

Heretofore the devices commonly used for veni-puncture, blood withdrawal, parenteral administration, etc. have generally suffered from the disadvantage that means were lacking for determining readily whether or not the cannula end was correctly placed in the vein. For blood withdrawal purposes, for example, where the cannula is incorrectly placed, an insufficient blood sample is obtained or the site of injection becomes traumatized through misplacement, misadventure, etc. On the other hand, in devices which incorporate features for the detection of venous blood prior to the main sample, the construction has been unduly complicated or difficult to manipulate or the volume of fluid transferred with each injection has been unduly restricted.

It is therefore an object of the present invention to provide simple, inexpensive means for detecting the correct placement of blood transfer devices for intravenous injection. It is also an object of the invention to provide blood transfer devices having a main chamber and a separate pilot chamber—the latter chamber being useful for initial collection of the blood sample to determine visually whether or not the device is correctly oriented for access to the vein.

It is a further object of the invention to provide blood transfer devices which can be used either for the withdrawal of blood samples or for the administration of drugs, medicaments and the like, or for both in a single injection and in any desired volume.

Other objects, features and advantages will be apparent from the specification which follows, in conjunction with the accompanying drawing in which:

FIG. **1** is a side view of a preferred blood transfer device of the invention, partly cut away to show details in the construction of the cannula and associated sheath means;

FIG. **2** is a cross section of the preferred device shown in FIG. **1** taken on a line **2–2** designated in FIG. **3**;

FIG. **3** is an end view taken on line **3–3** of FIG. **1** of a blood transfer device of the invention;

FIG. **4** is an enlarged partial section of another preferred embodiment of the invention showing the cannula piercing the sheath means and cartridge stopper and also illustrating the collapsed position of the sheath means;

FIG. **5** is a sectional view of the cannula and sheath means taken on line **5–5** of FIG. **1**, and FIG. **6** is a similar view showing channels **19** between the cannula and collar **21**.

Referring to FIGS. **1** and **2** of the drawing, the blood transfer device includes a holder **10** defining a main chamber **11** and a pilot chamber **12**. The pilot chamber is defined by a hub **13** and the neck portion **14**. The hub **13** serves as a mounting for a cannula **15**. The opposite end of the holder has an open end **16** for receiving cartridges containing drugs, vaccines or the like for administration under pressure or cartridges evacuated for blood collection purposes. The cartridge **23** (partly shown in FIG. **4**) can take any of a number of various forms known in the art. Surrounding the opening are the flanges **17** providing means for conveniently gripping the holder **10**.

The cannula **15** has an outer end **18***a* for injection and an inner end **18***b*. It also includes aperture means **19** located generally midway between the ends of the cannula in communication with the pilot chamber **12**. Surrounding the inner end **18***b* of the cannula **15** is sheath means **20** at the base of which is a supporting collar **21**.

The sheath means **20** with its collar **21** serves as a fluid-impervious seal between the pilot chamber **12** and the main chamber **11**. It is resilient and flexible, particularly in the sheath portion; it is also resealable or self-sealing when punctured. The term "sheath means" is sometimes used herein in a general sense to include both elements **20** and **21** and will be so understood. The sheath means operates according to the invention in two positions: In one position, it extends into the unloaded main chamber **11** as shown in FIGS. **1** and **2** where it surrounds the cannula end **18***b* and walls off the main chamber from the pilot chamber **12**. In the other position, the sheath means, when contacted in an axial direction by a cartridge **23** (e.g., a cartridge of the type illustrated in U.S. Pat. No. 3,366,103) being loaded into the chamber, is forced against and pierced by the pointed inner end **18***b* of the cannula, and is collapsed as illustrated in FIG. **4** with the result that the lumen of the cannula is in open communication with the interior of the cartridge. In turn, when the cartridge is withdrawn, the sheath spontaneously reseals itself and flexes back to its original position.

As shown in FIG. **3**, the holder in a preferred form is generally cylindrical with the cannula **15**, hub **13** and neck **14** in axial alignment along the central axis of the holder.

The embodiment shown in collapsed form in FIG. **4** is a preferred construction where instead of aperture means intermediate the outer and inner ends of the cannula there is provided an annular open zone **19** within the body of the sheath means **20** surrounding the cannula whereby blood entering the cannula is in open communication with the pilot chamber **12** and is free to move and distribute itself within the confines of the pilot chamber. Prior to collapsing, the sheath means of FIG. **4** assumes the position free of end **18***b*, as in the unflexed position shown in FIG. **2**. In the embodiments of FIGS. **1**, **2** and **4** the wall portions of the hub **13**, neck **14** and/or sheath means **20** are conveniently made of transparent or translucent material so that blood contained in the pilot chamber can be readily observed. By this means the device can be used for veni-puncture and the like by inserting the outer end **18***a* into the vein so that the blood enters and passes through the cannula into the pilot chamber **12** by way of the aperture means **19** as seen in FIGS. **1** and **2** or the aperture means **19** within the sheath means **20**, as seen in FIG. **4**. In this case if the cannula **15** is correctly positioned within the vein the venous pressure serves to pump the blood free into the pilot chamber substantially filling the same so that a distinct and sharp visual red coloration may be readily observed. On the other hand, where the placement of the cannula **15** is incorrect the supply of venous blood, if any, reaching the pilot chamber is only slight thereby giving direct visual indication of an improper placement of the cannula. The sheath means **20** in any case serves to prevent the entry of blood into the main chamber **11**. Thus, when it is desired for purposes of the invention to take a blood sample, the injection is made to provide visual indication in the pilot chamber **12** of the correct placement of the cannula. A vacuum cartridge is then inserted into the main chamber **11** through the open end **16** until its stopper contacts sheath means **20** and collapses the same upon the inner end **18***b* of the cannula **15**, causing the sheath means to be pierced so that the inner end **18***b* of the cannula reaches the evacuated zone. The resulting high-pressure differential causes blood to flow from the vein through the cannula **15** into the cartridge. The procedure is continued until the cartridge is sufficiently full for sampling purposes. The cartridge is then withdrawn from the chamber **11**. As a consequence of withdrawal and because the sheath means **20** is resilient, flexible and resealable, the sheath means flexes back into the position illustrated so that the cannula **15** is sealed off against further blood flow into the main chamber **11**. At this point, the cannula can be withdrawn from the vein or, if desired, fresh cartridges can in turn be loaded and filled without interruption and without the need for making a new injection for the filling of each tube. Substantially the same procedure using pressure cartridges instead of vacuum cartridges can be followed. Thus, when the correct placement of the cannula **15** is obtained as indicated by the ample supply of venous blood in the pilot chamber **12** the medicament cartridge can then be loaded into the chamber **11**, whereupon the positive pressure present in the cartridge

serves to cause the medicament contents to move through the cannula into the vein until the pressure is equalized.

The aperture means **19** can take any of various forms including an opening between the ends of the cannula (FIG. **1**), an annular open zone of uniform section separating the collar and sheath from the cannula (FIG. **4**), and channels **19** (FIG. **6**) at the interface between the collar and cannula. Other equivalent forms will be suitable.

The makeup of the various components employed in the blood transfer devices of the invention can be of any conventional material. Thus, the cannula will ordinarily be of high grade surgical stainless steel. The holder **10** can be made of glass, plastic or other suitable inert material, preferably transparent and readily sterilizable. The sheath means **20** and collar **21**, suitably made of gum rubber, elastomeric plastic or the like, should be impervious to fluids and resilient so as to provide the required seal between the pilot chamber **12** and main chamber **11**. In particular, the sheath means **20** should be sufficiently resilient to be pierced and collapsed by the insertion of a cartridge in chamber **11** and yet to flex back and reseal in its original position covering the inner end of the cannula **18***b* when the cartridge is withdrawn from the chamber. As an optional feature shown in FIG. **4**, the collar **21** can be made of a somewhat more rigid material and can be anchored into the neck **14** in seating relationship within the channel **22**, secured if necessary by adhesive or other suitable means.

While the invention has been described in detail in the foregoing specification, it will be realized by those skilled in the art that considerable variation can be made in such detail without departing from the spirit of the invention.

I claim:

1. A blood transfer device comprising: a holder including a hub, a neck and an axially extending main chamber adapted to receive a cartridge;

a cannula having piercing outer and inner ends;

means for mounting the inner end of the cannula in axial alignment within the holder for piercing contact with a cartridge inserted in the holder;

pierceable sheath means adapted in a first position to enclose the inner end of the cannula and sealingly prevent blood in the cannula from entering the main chamber and further adapted in a second position with a cartridge inserted in said piercing contact in the holder to be pierced by the inner end of the cannula and to expose the same for fluid transfer with respect to the cartridge, the sheath means being fixedly mounted by collar means within the neck and being resilient such that upon withdrawal of a cartridge from the main chamber the sheath means flexes back to said first position and reseals;

a pilot chamber defined by the hub, neck and collar means, the pilot chamber being separate from the main chamber and including light-transmissive wall means for viewing the presence of blood collected in the pilot chamber; and

aperture means including an opening in the cannula wall between the ends of the cannula, the opening being in direct communication with the pilot chamber whereby, prior to insertion of a cartridge, blood under tension entering the outer end of the cannula has direct access for distribution to the pilot chamber for visual observation.