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F. W. PODHORA

3,500,828

INTRAVENOUS CATHETER APPARATUS

Filed Aug. 31, 1966

FIG. 1

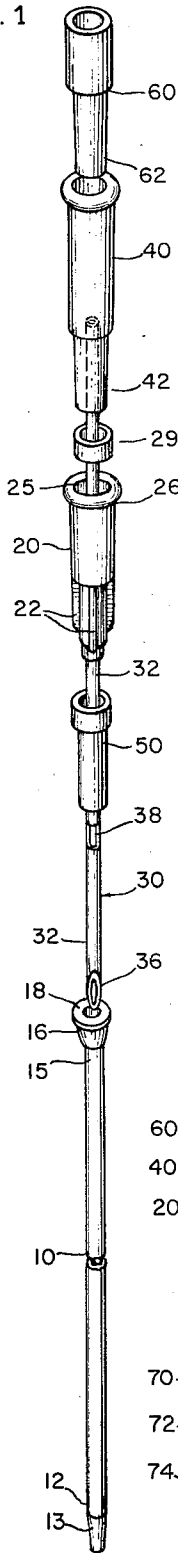


FIG. 2

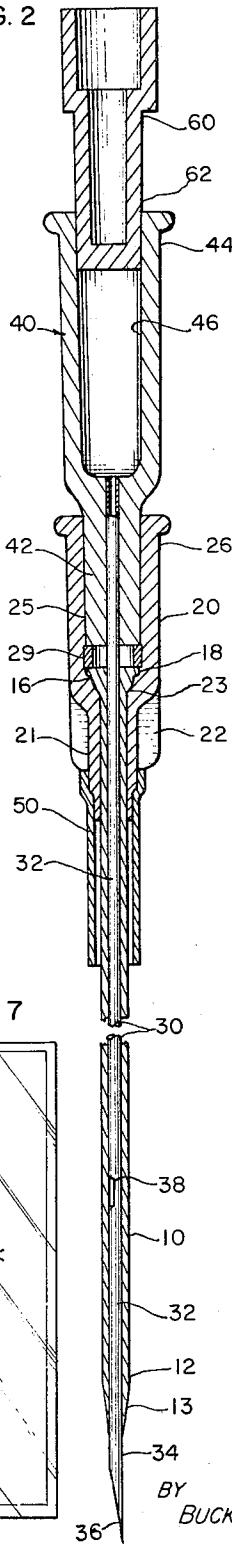


FIG. 3

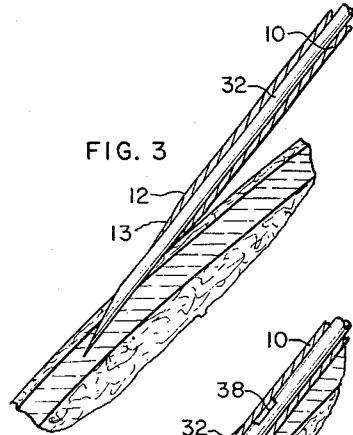


FIG. 4

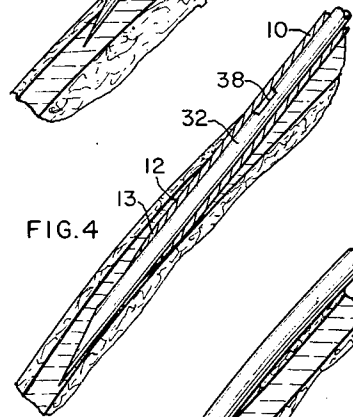


FIG. 5

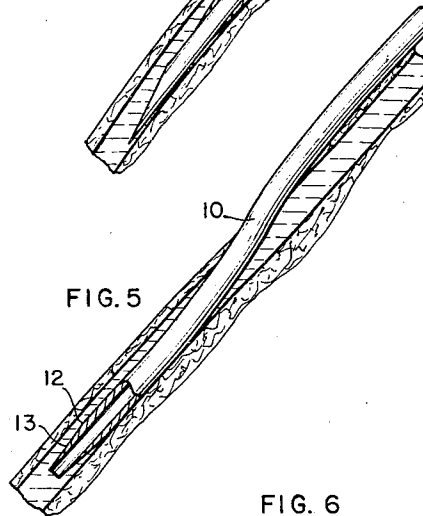


FIG. 6

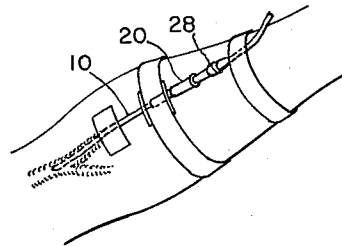
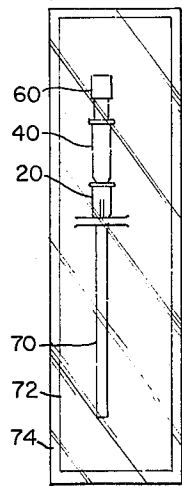


FIG. 7



BY

BUCKHORN, BLORE, KLARQUIST & SPARKMAN  
ATTORNEYS

FRED W. PODHORA  
INVENTOR

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3,500,828  
**INTRAVENOUS CATHETER APPARATUS**

Fred W. Podhora, 7429 SW. 59th Ave.,  
 Portland, Oreg. 97219

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4 Claims

**ABSTRACT OF THE DISCLOSURE**

An intravenous catheter apparatus having a thin-walled hollow catheter of substantially uniform normal inner and outer diameter made of translucent flexible plastic and a surgical needle removably disposed within the catheter, the needle having an elongated hollow stem, also of uniform inner and outer diameter, and having a sharpened edge at one end to make a venipuncture. The outer diameter of the needle is equal to the normal inner diameter of the catheter. One end of the needle is removably adapted to protrude from the distal end of the catheter, and the end of the catheter is externally tapered to facilitate its introduction into the vein. The inner diameter of the catheter is reduced in the region of its distal end below that of its normal inner diameter thus snugly to grip the needle and facilitate entry of the catheter into the venipuncture following the end of the needle. A slot is formed in the wall of the needle intermediate its ends at a position within the catheter remote from the region of reduced inner diameter, whereby blood may flow between the catheter and the needle in the region of the slot, thus to be visible when the venipuncture is successfully completed.

This invention relates to apparatus for use in the intravenous introduction of a fluid into a patient's body and, more particularly, to such apparatus in which a catheter of inert material is introduced into the patient's vein to remain there during the intravenous infusion.

A number of apparatuses have recently been developed wherein a catheter of plastic or similar inert material is inserted into a vein or other vessel into which an infusion is to be made. These have not been fully successful, however. The plastic catheters have in some instances become disassociated from the apparatus and in extreme instances have become lost in the patient's vein. Other apparatuses have made it difficult for the medical technician immediately to see if a venipuncture is successful. These prior apparatuses have also been characterized by their complexity and relatively large number of parts.

Accordingly, it is the primary object of the present invention to provide a new and improved intravenous catheter which will be simple and easy to use.

It is a further object of the present invention to provide an apparatus in which an intravenous catheter made of an inert plastic material can be readily introduced into a patient's vein, thereby eliminating the need for repeated venipunctures.

It is a still further object of the present invention to provide such an apparatus which will enable the medical technician immediately to see if the venipuncture is successful.

It is a still further object of the present invention to provide such an apparatus which although simple and easy to use, will make it impossible for the catheter to become disassociated from the apparatus and possibly lost in the vein.

It is a still further object of the present invention to provide such an apparatus wherein the surgical needle associated with the plastic catheter may be re-inserted in the vein after initially being withdrawn, if further medical treatment makes this desirable.

These and other objects and advantages are achieved by the present invention which provides an apparatus comprising a thin-walled hollow catheter of substantially uniform inner and outer diameter formed of an inert flexible translucent material and a surgical needle removably disposed within the catheter. The needle has an elongated hollow stem also of uniform inner and outer diameter and it is formed at one end to provide a sharpened edge for making a venipuncture. The sharpened edge of the needle is adapted removably to protrude from the distal end of the catheter to make the venipuncture in the patient. The distal end of the catheter is tapered and has a reduced inner diameter less than the outer diameter of the needle snugly to grip the needle near the sharpened end, thereby to permit the catheter easily to enter the venipuncture following the introduction of the needle.

The needle is further characterized by having a slot disposed intermediate its ends at a position within the catheter remote from the catheter region of reduced inner diameter, whereby blood may be observed inside the catheter through the slot when the venipuncture is successful. An adapter is mounted on the proximal end of the catheter and means are provided to prevent movement of the catheter with respect to the adapter. A tubular needle holder is attached to the proximal end of the needle, and the distal end of the needle holder is adapted removably to fit within the proximal end of the adapter, the proximal end of the needle holder being adapted to receive the male fitting of an infusion set. Thus, when the needle holder is withdrawn from the adapter, the needle is likewise withdrawn from within the catheter, thereby to permit the latter to remain within the venipuncture. Inasmuch as the proximal end of the adapter is likewise adapted to receive the male fitting of the infusion set, such can quickly be connected thereto immediately to commence the infusion process.

For a more detailed description of the invention, reference is made to the following drawings wherein:

FIG. 1 is an exploded view of the intravenous catheter apparatus of the present invention, the thin-walled catheter, however, being illustrated below the assembly and not in conjunction with the adapter which is normally mounted on the proximal end thereof;

FIG. 2 is a longitudinal view, partly in section through the assembled apparatus of the present invention;

FIG. 3 is a view showing the apparatus of the present invention at the start of a venipuncture;

FIG. 4 is a view showing the surgical needle together with the catheter inserted into the vein;

FIG. 5 is a view showing the catheter within the vein, the surgical needle having been removed therefrom;

FIG. 6 is a view showing the catheter in position in the vein during the infusion, the surgical needle having been withdrawn and the fitting of the infusion set connected to the proximal end of the adapter; and

FIG. 7 is a view of the apparatus of the present invention packaged and ready for sterilizing in an autoclave.

Referring to the drawings and in particular to FIGS. 1 and 2, the apparatus of the present invention consists of a thin-walled hollow plastic catheter **10** of substantially uniform inner and outer diameter throughout its length. Preferably it is made of polypropylene, although it could be made of any similarly inert, flexible, translucent plastic material. The distal end **12** of the catheter **10**, that is, the end adapted to be inserted into the vein, is provided with an external taper **13** for easy introduction into the vein. Furthermore, the inner diameter of the catheter **10** in the region of the distal end **12** is slightly reduced below the normal diameter which exists throughout the rest of its length for a purpose to be described.

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hereinafter. I have found that a reduction of 0.003 inch below that of the normal inner diameter of the catheter is desirable. Tapering the distal end of the catheter and reducing its inner diameter is accomplished by inserting the end of a catheter into a heated conical die so that the heat softened plastic can conform to the die convergence. The proximal end 15 of the catheter 10 has a flared portion 16 terminating in a bead 18, also for a purpose to be hereinafter described.

A tubular adapter 20 preferably made of nylon is, as best shown in FIG. 2, mounted on the proximal end 15 of the catheter 10 and attached thereto by an epoxy cement. The adapter 20 is generally cylindrical in shape, the distal end 21 being of reduced diameter and provided with a plurality of ribs 22 for strength. The inner diameter of the distal end 21 of the adapter is substantially equal to the outer diameter of the catheter 10, the inner surface 23 of the adapter then flaring outwardly to accommodate the flared portion 16 of the catheter 10. The inner surface 23 merges into a 5° tapered frustoconical surface 25 at the proximal end 26 of the adapter to receive the standard male fitting 28 of an infusion set (see FIG. 6), as will be more fully described hereinafter.

The flared portion 16 of the catheter 10 seats itself on the corresponding inner surface 23 of the tubular adapter 20 and, together with the bead 18, prevents the catheter 10 from being pulled forwardly and out of the adapter 20, irrespective of the presence or absence of the epoxy cement therebetween. This form of construction positively inhibits disassociation of the catheter 10 from the tubular adapter 20, thereby to make it impossible to lose a catheter in the vein of a patient. An annular snap ring 29 preferably made of polyvinylchloride and having an outer diameter preferably 0.001 inch larger than the inner diameter of the tubular adapter 20, is disposed within the adapter rearwardly of the flared portion 16 on the catheter and adjacent the bead 18 thereof. The bead 18 serves as an abutment for the ring 29 to prevent the catheter 10 from being pushed out rearwardly of the adapter. Notwithstanding the interference fit above described, the ring 29 may also be secured to the inner surface 25 of the adapter 20 by an epoxy cement.

The apparatus of the present invention also includes a surgical needle 30 preferably made of stainless steel and having an elongated hollow stem 32 of uniform inner and outer diameter, the outer diameter being identically equal to that of the inner diameter of the plastic catheter 10. The distal end 34 of the needle 30 is diagonally cut to provide a sharpened edge 36. As shown in FIGS. 1 and 2, the surgical needle 30 is adapted to slide into the catheter 10 and when inserted fully, the distal end 34 thereof protrudes beyond the distal end 12 of the catheter 10, thereby to be able to make a venipuncture in the patient. When the needle 30 is fully inserted into the catheter 10, the reduced normal inner diameter of the distal end 12 of the catheter 10 causes such end snugly to grip the needle 30 directly above the sharpened edge 36, whereby the tapered end 13 of the catheter presents no obstructions and the catheter may smoothly and easily follow the needle into the venipuncture with no wrinkling or sliding back of the catheter on the needle as might otherwise occur were this grip not provided.

The stem 32 of the needle 30 is also provided with a vent or slot 38 disposed approximately one inch from the sharpened end 36, whereby blood may be observed through the light transparent catheter wall as it flows from inside the needle 30 through the slot 38 when the venipuncture is successful. Blood will flow between the catheter and the needle in the region of the slot 38 to make a large bloody patch. Thus, the medical technician immediately can see if the venipuncture is successful. I have found that a  $\frac{1}{16}$  inch long slot is adequate for this purpose and will not unduly weaken the stem 32 of the needle.

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A tubular needle holder 40 preferably made of nylon is fixedly attached to the proximal end of the needle 30 as by an epoxy cement. The distal end 42 of the needle holder 40 is of reduced diameter and has a complementary 5° taper to enable it to be inserted in the proximal end 26 of the tubular adapter 20. The inner diameter of the distal end 42 of the needle holder 40 is of substantially the same diameter as the outer diameter of the needle 30. The proximal end 44 of the needle holder is hollow and is also provided with a 5° tapered frustoconical inner surface 46 to receive the male fitting 28 of the infusion set.

A colored plastic sheath 50 is provided and is adapted to be slipped over the distal end 21 of the tubular adapter 20 to distinguish catheters of varying diameters.

A plug 60 for flow control is also provided and it has a distal end 62 of reduced diameter having a complementary 5° taper to enable it to be inserted in the proximal ends of the adapter 20 or the needle holder 40.

A clear plastic protector tube 70 is provided to slip over the assembled catheter and needle to provide protection and the entire apparatus can then be packaged as shown in FIG. 7 and sterilized in an autoclave.

The apparatus of the present invention is assembled as follows:

The needle 30 with the tubular needle holder 40 attached to the proximal end thereof inserted into the proximal end 26 of the tubular adapter 20 and thence into the catheter 10 so that the distal end 34 of the needle protrudes from the distal end 12 of the catheter, as shown in FIG. 2. Since the inner diameter of the distal end of the catheter 10 is slightly reduced below its normal inner diameter, which is equal to the outer diameter of the needle 30, the distal end of the catheter is adapted snugly to grip the needle 30 near its sharpened end. Thus, as the needle is inserted into the catheter to protrude therefrom, a slight constriction is encountered, but this is not severe enough to prevent the needle from being pushed through the catheter, thereby to protrude therefrom as shown, nor to prevent the needle from being withdrawn later. The plug 60 for flow control is inserted into the proximal end 44 of the needle holder 40 to complete the assembly of the apparatus. The distal end of the catheter and the needle are then slid into the protector tube 70 which is attached to a card 72 and placed in a package 74 for sterilization in an autoclave.

In making a venipuncture with the apparatus of the present invention, the apparatus is first assembled as described above, with the plug 60 for flow control inserted in the proximal end of the needle holder 40. The sharpened edge of the needle 30 is then inserted into the vein in the usual manner, as shown in FIG. 3. If the venipuncture is successful, blood may be observed inside the catheter 10 through the slot 38 in the needle. The plug 60 serve to stem the flow of blood through the needle.

After the venipuncture has been made, as shown in FIG. 4, the catheter 10 is further inserted into the vein by sliding the adapter 20 and the catheter 10 along the needle 30 until the desired length of catheter has entered the vein. The needle holder 40 is then removed from the adapter 20 and the needle 30 withdrawn from within the catheter, while the catheter remains within the venipuncture, (see FIG. 5), the medical technician holding the adapter 20 in place manually. The male fitting 28 of the infusion set may then be directly connected to the proximal end 26 of the tubular adapter, thereby immediately to commence the infusion process. With the catheter 10 remaining in the vein, the catheter 10, adapter 20 and fitting 28 may then be taped to the patient's arm, as shown in FIG. 6. The apparatus will also permit the needle 30 to be reinserted through the catheter 10 and into the vein after having once been withdrawn, if this be desired for further medical processes.

I have thus provided an improved intravenous catheter which is simple and easy to use and which will enable the

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medical technician immediately to see if the venipuncture is successful and to start the infusion quickly and easily. Its construction is also such that it is impossible to lose a catheter in a patient's vein.

I claim:

1. Apparatus for use in intravenous introduction of a fluid, comprising
  - a thin-walled hollow catheter of substantially uniform inner and outer diameter formed of inert flexible plastic material, and
  - a surgical needle removably disposed within said catheter,
    - said needle having an elongated hollow stem of uniform inner and outer diameter and formed at one end to provide a sharpened edge,
    - said one end of said needle being adapted removably to protrude from one end of said catheter to make a venipuncture in a patient,
    - said one end of said catheter being externally tapered, said inner diameter of said catheter being reduced in the region of said one end to a value less than the outer diameter of the needle so as snugly to grip said needle near said one end, thereby facilitating entry of said catheter into a venipuncture following said one end of said needle,
    - said needle having a slot through the wall thereof disposed intermediate the ends of said needle at a position within said catheter remote from the catheter region of reduced inner diameter and adjacent a light transparent portion of said catheter, whereby blood may flow between said catheter and said needle in the region of said slot and flow within said catheter entirely around said needle thus to be visible when said venipuncture is successful.
2. Apparatus as in claim 1, in which said inner diameter of said proximal end of said catheter is approximately 0.003 inch less than said outer diameter of said needle.
3. Apparatus as in claim 1, in which said slot is approximately  $\frac{1}{16}$  inch long.
4. Apparatus for use in intravenous introduction of a fluid, comprising
  - a thin-walled hollow catheter of substantially uniform normal inner and outer diameter formed of inert flexible translucent plastic;
  - a surgical needle removably disposed with said catheter,
    - said needle having an elongated hollow stem of uniform inner and outer diameter and diagonally cut at one end to provide a sharpened edge, the outer diameter of said needle being equal to said normal inner diameter of said catheter,
    - said one end of said needle being adapted remov-

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- ably to protrude from one end of said catheter to make a venipuncture in a patient,
- said one end of said catheter being externally tapered and having an inner diameter in the region of said one end slightly less than said outer diameter of said stem of said needle, thus snugly to grip said needle near said sharpened one end, thereby to facilitate entry of said catheter into a venipuncture following said sharpened one end of said needle,
- said stem having a slot disposed therein intermediate its ends at a position within the catheter remote from the catheter region of reduced inner diameter and adjacent a light transparent portion of said catheter, whereby blood may flow between said catheter and said needle in the region of said slot and flow within the catheter entirely around said needle thus to be visible when said venipuncture is successful;
- a tubular adapter mounted on other end of said catheter, one end of said adapter having an inner diameter substantially equal to said outer diameter of said catheter, the other end of said adapter having a tapered inner surface adapted to receive the male fitting of an infusion set;
- a flared portion on said other end of said catheter to prevent said catheter being pulled forwardly of said adapter, the terminal end of said flared portion being formed into a bead;
- an annular ring disposed within said adapter rearwardly of said bead to prevent said catheter from being pushed out rearwardly of said adapter; and
- a tubular needle holder attached to the other end of said needle, one end of said needle holder being adapted removably to fit within said other end of said adapter, the other end of said needle holder being adapted also to receive the male fitting of said infusion set.

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DALTON L. TRULUCK, Primary Examiner

U.S. Cl. X.R.

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