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[56]		References Cited	
		UNITED STATES PATENTS	
387,454	8/1888	Siegenthaler	128/221X
2,512,569	6/1950	Saffir	128/221
2,828,744	4/1958	Hirsch et al.	128/221
3,094,122	6/1963	Gauthier et al.	128/221
3,119,391	1/1964	Harrison	128/221
3,313,299	4/1967	Spademan	128/214.4
3,352,306	11/1967	Hirsch	128/214.4

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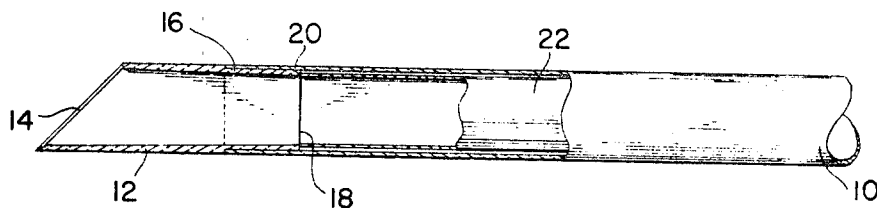
[54] **FLEXIBLE INTRAVENOUS CATHETER**
PROVIDED WITH CUTTING TIP MEANS
2 Claims, 7 Drawing Figs.

[52] U.S. Cl. **128/214.4,**
128/221

[51] Int. Cl. **A61m 5/00**

[50] Field of Search. **128/214.4,**
221, DIG.16

ABSTRACT: A catheter for intravenous injections and the like is disclosed, comprising a flexible cannula having a hardened ferrule on the distal end thereof and adapted to cut through tissue to enter a vein. A rigid stylet is concentric within the cannula and removable after the cannula is properly placed. The ferrule and cannula are of identical outside diameter. The stylet has a blunt distal end which bears directly on the ferrule to transmit force thereto during initial placement of the catheter.



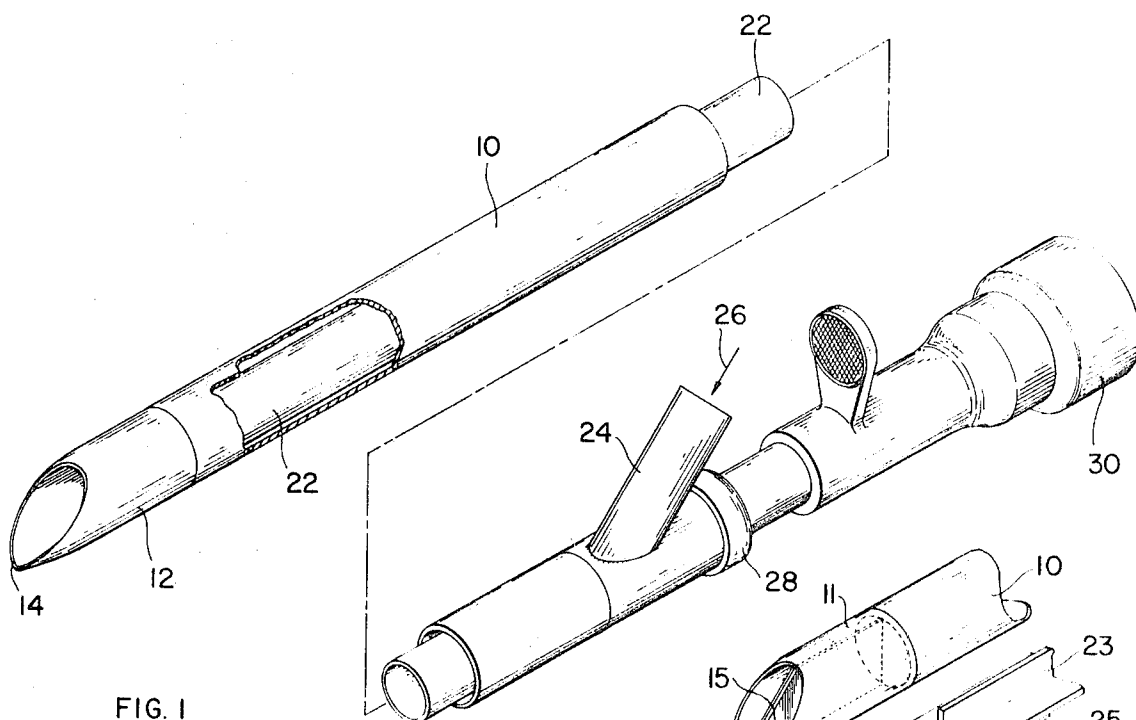


FIG. 1

FIG. 1a

FIG. 1b

FIG. 1c

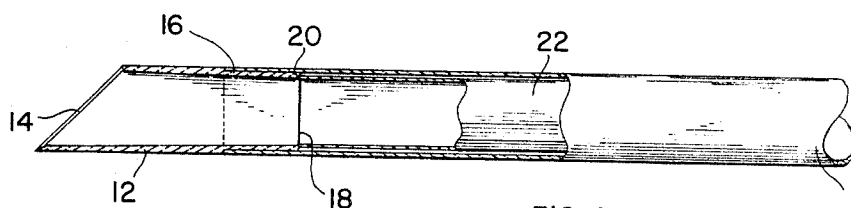


FIG. 2

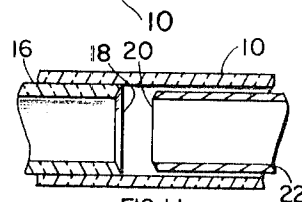


FIG. 1d

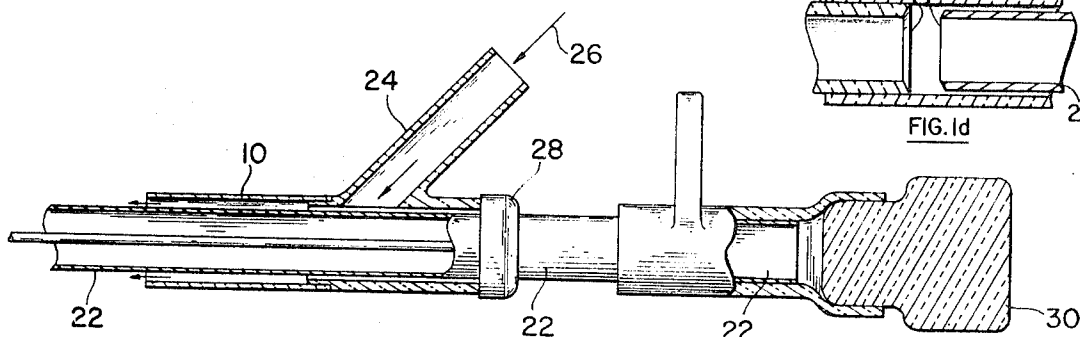


FIG. 3

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FLEXIBLE INTRAVENOUS CATHETER PROVIDED WITH CUTTING TIP MEANS

This application is a continuation of previous application Ser. No. 576,281 filed Aug. 3, 1966, since abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a catheter or the like for obtaining blood samples or injecting materials intravenously.

In the medical arts several types of devices are used for penetration of and entrance into veins for various purposes, wherein the vein is first pierced and a hollow conduit or tubular element is fitted or canalized within the vein. Such devices typically include two principal components, one for cutting through tissue to reach the vein and the other comprising a slender tube adapted to remain inside the vein for introducing the fluid. In two of the commonest forms of devices thus used, the cutting element is a large bore hollow needle fitted within a surrounding flexible plastic tube or catheter sleeve which remains after the needle is withdrawn completely from the vein, while the other is a large bore needle having a slender plastic tube axially aligned therewithin.

In the first-mentioned type, the needle acts as the cutting element and makes a smaller incision through the skin and the wall of the vein than the cross-sectional size of the surrounding catheter sleeve, whereby the sleeve must be forced into the aperture formed by the needle, causing aggravated pain and occasional tearing of tissue. In addition, leakage of blood through the needle while trying to force the catheter into place is frequently excessive and obscures the area. Moreover, perforation of the vein is a frequent mishap in this type catheter because the added force required to push the catheter through a hole of insufficient size to accommodate it causes both needle and catheter to pass completely through the vein instead of canalizing therewithin. This type of mishap is extremely difficult to remedy, since a vein thus punctured cannot be used for intravenous procedures until completely healed, with possibly grave consequences.

In the second-mentioned form wherein a large bore needle is the cutting element and contains a slender tube therewithin, the needle makes an excessively large hole which is not fully occupied by the tube after the needle is removed. This results in continuous bleeding for hours or even days around the periphery of the tube while contained in the patient's arm. The repeated changes of dressing around the intravenous tube on a patient's arm involves repeated risk of mishap due to movement of the tubing or the cutting element within the vein.

Accordingly, it is a principal object of the invention in this case to provide catheter means whereby the incision necessary for penetrating a vein or the like is essentially self-sealing with respect to the catheter tube whereby leakage thereabout is minimized.

It is a further object in this case to provide catheter means including cannula means whereby risk of puncture of a vein during prolonged canalization of the cannula therewithin will be minimized.

It is another object of the invention in this case to provide conduit connection means for a cannula whereby removal of blood specimens or injection of materials into a vein may be independently accomplished with improved ease and without movement of the cannula within a vein.

SUMMARY OF THE INVENTION

This invention comprises an intravenous catheter having a flexible cannula 10 with a hardened end portion 12 secured thereto. A rigid stylet 22 fits telescopically within flexible tube 10 and bears against trocar 12 to transmit force directly thereto as required for trocar 12 to cut through the skin and tissue of a patient and enter a vein. All cutting is done by a sharpened edge on trocar 12, which has the same external diameter as that of cannula 10, whereby the puncture has precisely the same size as the cannula and is neither undersized nor oversized. After the cannula is properly located

within the lumen of the vein, the stylet is removed therefrom without risk of puncturing the cannula, since the stylet has a blunt distal end.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a general perspective view, with portions displaced, of an illustrative embodiment of the inventive concept,

FIG. 2 is a fragmented side elevational view, partly in cross section, of the structure shown in FIG. 1,

FIG. 3 is a side elevational view, partly in cross section, of a portion of the structure from FIG. 1,

FIG. 1a FIG. 1, and

FIGS. 1b and 1c are fragmented perspective views of two modifications of the force transmitting means shown in the structure of FIG. 1.

FIG. 1d is a fragmented side elevational view in cross section of the forward tip area of FIG. 1 in detail.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings described above, and particularly to FIG. 1, it may be seen that the invention in this case comprises a catheter having an outer flexible tubular portion 10 and a relatively more rigid or hardened tip or trocar 12 secured thereto at one end thereof. Portion 10 functions as a cannula as discussed more particularly below, and may be thin flexible plastic of suitable strength and chemical stability, or equivalent material. Tip 12 is of generally cylindrical shape and has tapered cutting edge 14 at one end thereof and a reduced diameter collar or bushing portion 16 at the other end thereof as best seen from FIG. 2. Tip 2 may be hard resinous material such as methyl methacrylate, or metal. Collar 16 is sized to fit forcibly and securely within the distal end of tube 10 and to remain united therewith permanently such as by means of permanent adhesive or the like. The end of collar 16 opposite from tip 14 is squarely cut to form an annular bearing surface 18 adapted to contact a similarly shaped surface 20 of a stylet or rigid member 22 adapted to fit slideably within tube 10. Stylet 22 may be hard plastic or resin of generally inflexible physical properties and functions to provide rigidity to flexible tube 10 while contained therewithin and also to act as a force transmitting means for applying force to tip 12 during the initial cutting action of the catheter, after which member 22 is normally completely withdrawn. Force transmitting member 22 may be tubular in shape as shown in FIGS. 1 and 2 or may take the form of a plus sign cross-sectional shape or simple blade as shown in FIGS. 1b and 1c, respectively. The distal end of the force-transmitting member being generally blunt in each case.

At the other end of tube 10 opposite from tip 12, an "L" or "T" connection 24 is permanently secured to tube 10 in the same manner as tip 12, and functions to provide an independent connection for a flow of fluid suggested by arrow 26 which is sought to be intravenously injected from a source not shown. A rubber or plastic flexible membrane 38 covers the end of "T" connection 24 and is self-sealing in its relationship to element 22 so that stylet 22 may be completely removed without any loss of blood occurring through the membrane. Solid plastic member 30 shown in FIGS. 1 and 3 is included in the end of tube 22 to function as a siphon when necessary to initiate a flow of blood from the vein through tube 10.

The modification shown in FIG. 1a includes provision of a cutting edge 13 on inner dividing partition 15 in order to facilitate the penetration of tip 12 through tissue and through the wall of a vein whereby greater control is maintained and less force is required during the incision action of the device. Partition 15 may be integrally formed on tip 12 or separately formed of the same material as tip 12 and permanently secured thereto. Moreover, fragmentation of any particles of tissue or the like resulting during incision will be achieved by the modification shown in FIG. 1a and the risk of blockage of the catheter or the vein due to lodgment of such particles

therein will be minimized due to the smaller size of such particles. Similarly, passage of cotton, cork, or other particles accidentally through the catheter into the vein will be prevented by partition 15.

Upon initial canalization of the cannula 10, it will be understood by those skilled in the art that force transmitting and stiffening stylet 22 is removed by application of force to the end thereof protruding from membrane 28 whereby highly flexible tube 10 with trocar tip 12 remains in the vein. Connection 24 is also of relatively more rigid material such as hardened plastic or metal and is secured to cannula 10 by appropriate means such as adhesive or the like. With tube 10 and tip 12 thus contained within a vein, it may be seen that occasional movement of a patient's arm will not result in application of direct or uniform force to tip 12 such as might produce further undesirable cutting action by the tip. Thus, force applications at the end of cannula 10 protruding from a patient's arm can have no effect on tip 12 since flexible tube 10 cannot transmit such forces, except a direct pulling force to remove items 10 and 12 from a patient's arm. Moreover, since the hole made by tip 12 is precisely the same size as tube 10, leakage around the skin or the vein during prolonged placement of the catheter in a vein will be minimized. The hub arrangement of portion 30 shown in FIGS. 1 and 3, for example, permits ease of connection between the catheter and the fluid source whereby intravenous flow may be commenced immediately when the catheter is properly placed. In addition, a syringe can be easily attached to this system by removing plastic plug 30 for purposes such as the administration of a drug, medication or the like.

In further connection with the structural details disclosed above, it will be understood that the outer diameter of tube 10 and tip 12 are substantially identical whereby a continuous surface results from the joint therebetween around collar 16 as shown particularly by FIG. 2. Moreover, the cross-sectional dimensions of elements 23 and 24 are sufficient to bear against edge 18 of collar 16 to transfer force thereto, whereby both stated elements are sized to produce the required contacting relationship as between edges 18 and 20, for example, shown in FIG. 1.

With specific regard to FIG. 1d, it may be seen therefrom that edges 18 and 20 on elements 16 and 22, respectively, may be oppositely contoured in matching conical shape so that their bearing surfaces are self-centering. Thus, conical surface 20 cannot apply force unevenly to surface 18, such as by contacting only one-half of the surface due to alignment of member 22 in nonaxial relationship within tube 10. In such case, the camming action of conical or beveled edges 18 and 20 shown in FIG. 1d will automatically center the end of member 22 in uniform force transmitting contact with collar 16 of ferrule 12.

It may also be seen from FIG. 3 that blade 25 shown in FIG. 1c may be incorporated with hollow tubular element 22 if added stiffness of tube 22 is required in special cases. Also, the addition of blade 25 in the foregoing manner will insure strong force-transmitting contact with ferrule 12 if the ferrule incorporates partition 15 shown in FIG. 1a, since elements 15 and 25 will of necessity contact each other in addition to the limited surface contact between surfaces 18 and 20 described

above. Elements 15 and 25, if used in the foregoing combination, will thus provide positive force transmitting means in the event that inaccurate sizing of elements 22 and 16 prevents contact of surfaces 18 and 20.

In all of the embodiments suggested herein for stylet 22 and elements 23, 25 shown in the drawings, it may be seen that these elements are characterized by a relatively blunt forward distal edge, incapable of cutting through flexible cannula 10.

I claim:

1. In a catheter for intravenous injections:

elongate conduit means comprising a flexible hollow tube having a smooth continuous outer surface,

elongate force-transmitting means comprising a relatively rigid member axially aligned within said tube and longitudinally slidable relative thereto,

cutting means comprising a hardened end portion on said hollow tube and of uniform continuous external diameter with said outer surface thereof, said end portion having a cutting edge thereon,

ridge means comprising a radially inward projecting ridge on the inner surface of said end portion,

blunt distal edge means formed on said rigid member, said edge means having a bearing surface adapted to bear against said ridge on said end portion in force transmitting relationship, and with substantially uniform circumferential distribution of said force over said bearing surfaces and said ridge, whereby force applied to said relatively rigid member in a direction toward said end portion is transmitted to said end portion through said bearing surface and said ridge means,

said hardened end portion consisting of a relatively rigid cylindrical ferrule secured to said flexible hollow tube, an inner dividing partition situated within said ferrule, and a forward cutting edge on said inner dividing partition for fragmenting particles cut by said cutting edge on said hardened end portion.

2. In a catheter for intravenous injections:

elongate conduit means comprising a flexible hollow tube having a smooth continuous outer surface,

elongate force-transmitting means comprising a relatively rigid hollow cylindrical member axially aligned within said tube and longitudinally slidable relative thereto,

cutting means comprising a hardened end portion on said hollow tube and of uniform continuous diameter with said outer surface thereof, said end portion consisting of a relatively rigid cylindrical ferrule secured to said flexible hollow tube and having a cutting edge on said ferrule,

ridge means comprising a radially inwardly projecting ridge having a conical bearing surface on the inner surface of said ferrule,

blunt distal edge means formed on said rigid member, said edge means having a conically contoured bearing surface for mating contact with said bearing surface on said inwardly projecting ridge in force-transmitting relationship, an inner dividing partition secured within said ferrule, and a forward cutting edge on said inner dividing partition for fragmenting particles cut by said cutting edge on said hardened end portion.