Sept. 25, 1962 D. H. BALLARD 3,055,361

INTRAVENOUS CATHETERS

Filed April 22, 1960 3 Sheets-Sheet 1

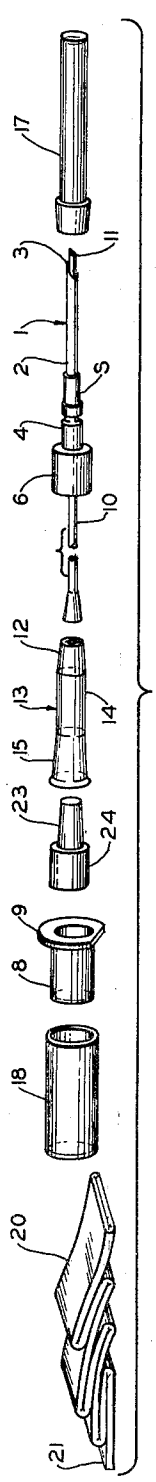

FIG. 1

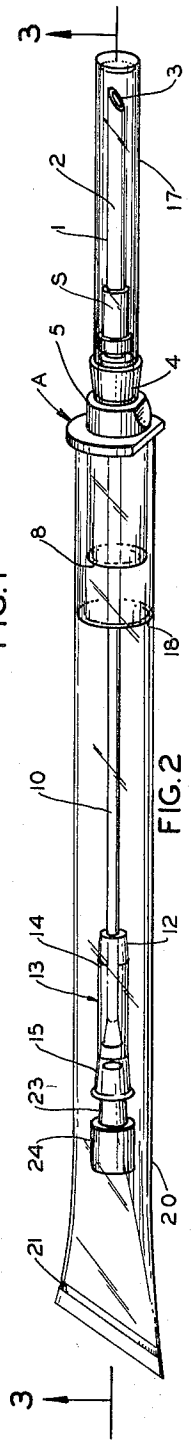

FIG. 2

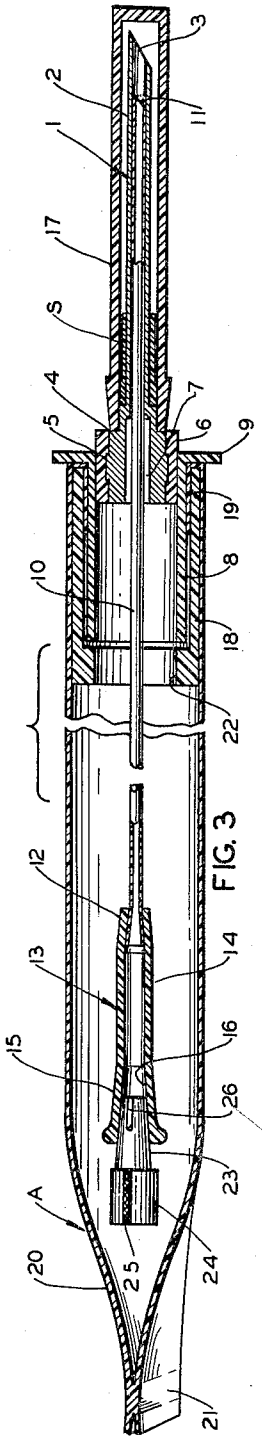

FIG. 3

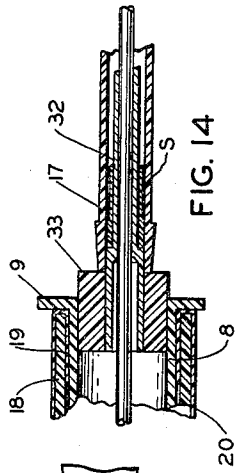

FIG. 14

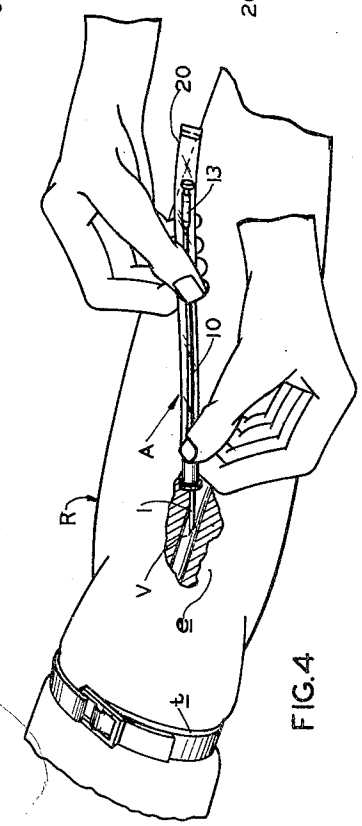

FIG. 4

INVENTOR.
DALE H. BALLARD
BY
Alfred W. Peterson
ATTORNEY

Sept. 25, 1962 D. H. BALLARD 3,055,361

INTRAVENOUS CATHETERS

Filed April 22, 1960 3 Sheets-Sheet 2

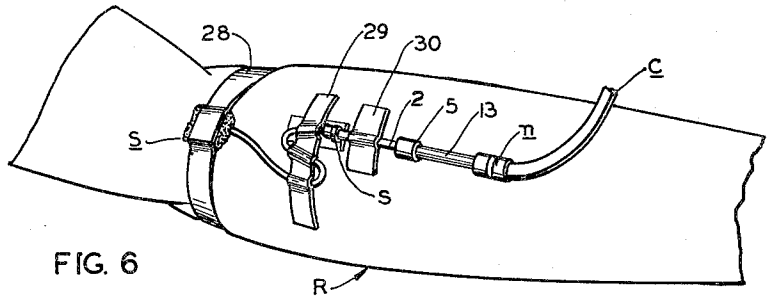

FIG. 6

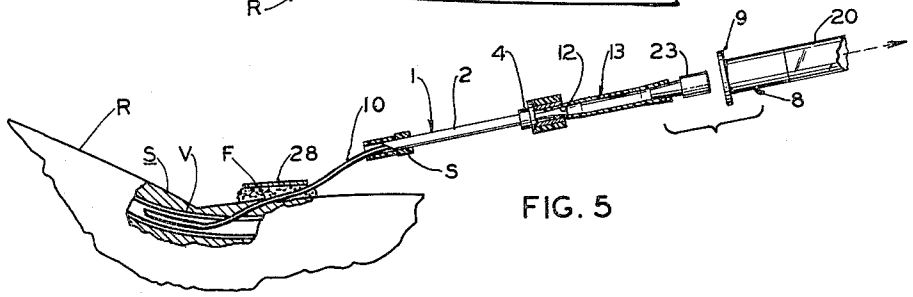

FIG. 5

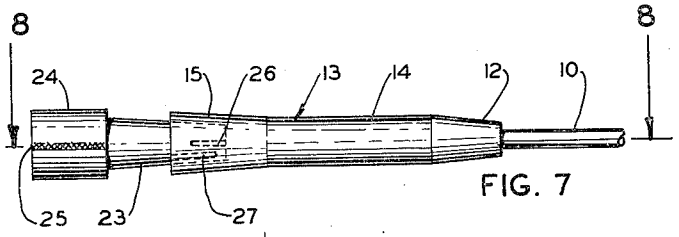

FIG. 7

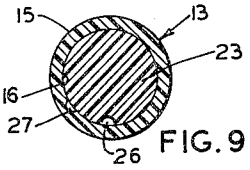

FIG. 9

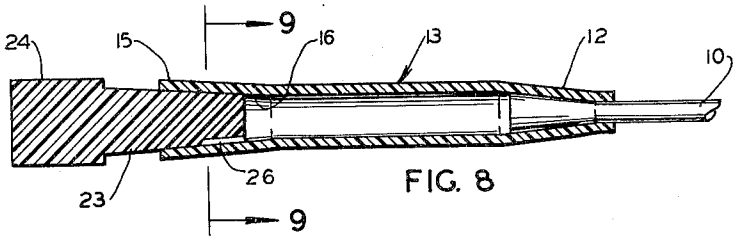

FIG. 8

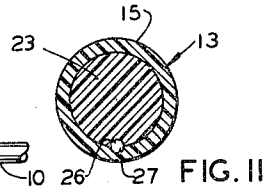

FIG. 11

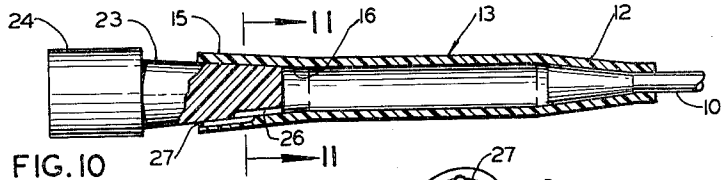

FIG. 10

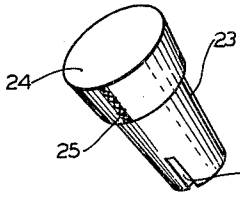

FIG. 12

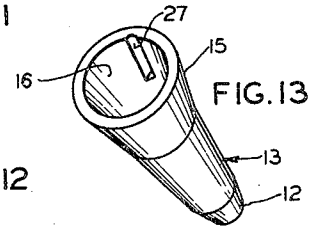

FIG. 13

INVENTOR.
DALE H. BALLARD
BY
Alfred W. Leitchaft
ATTORNEY

Sept. 25, 1962 D. H. BALLARD 3,055,361

INTRAVENOUS CATHETERS

Filed April 22, 1960 3 Sheets-Sheet 3

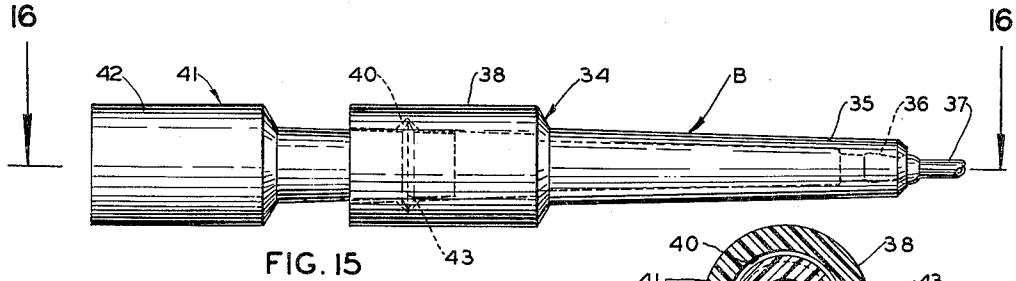

FIG. 15

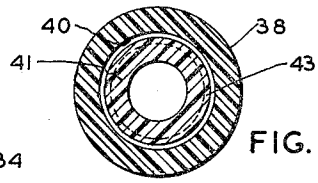

FIG. 17

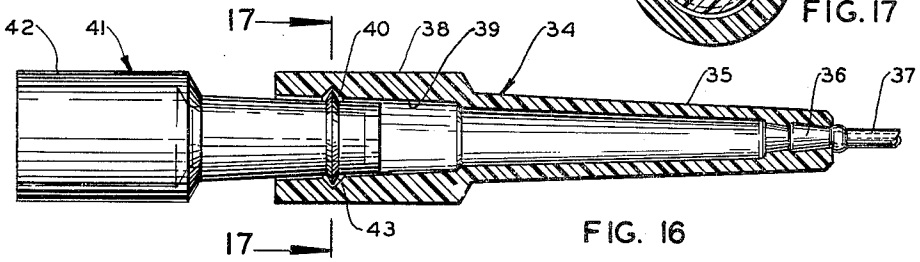

FIG. 16

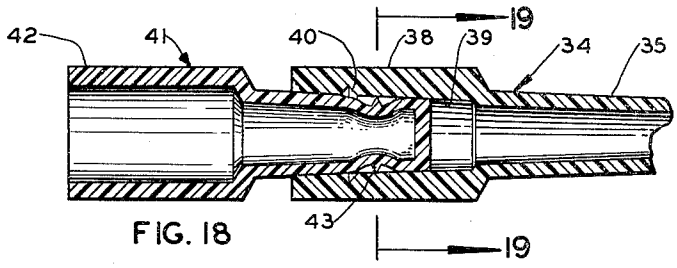

FIG. 18

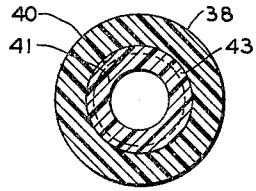

FIG. 19

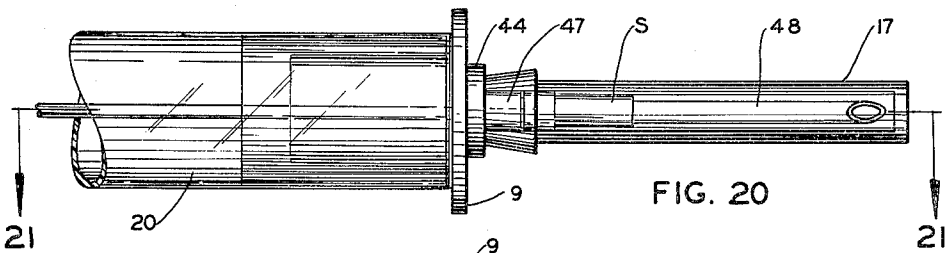

FIG. 20

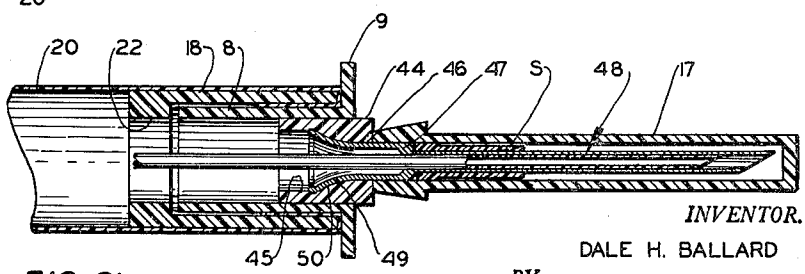

FIG. 21

INVENTOR.

DALE H. BALLARD

BY

Alfred W. Peschke Jr.

ATTORNEY

United States Patent Office 3,055,361 Patented Sept. 25, 1962

3,055,361

INTRAVENOUS CATHETERS

Dale H. Ballard, Salt Lake City, Utah, assignor to Deseret Pharmaceutical Company, Inc., Salt Lake City, Utah, a corporation of Utah

Filed Apr. 22, 1960, Ser. No. 24,153
7 Claims. (Cl. 128—214)

This invention relates in general to certain new and useful improvements in surgical devices and, more particularly, to intravenous catheters.

In many surgical and hospital procedures, such as intravenous feeding and the like, it is conventional practice to insert a tubular needle such as a hypodermic needle into the vein, artery, or spine, and then connect some suitable fluid conduit to the external end thereof. However, such techniques require immobilization of the patient's arm on an arm board or similar structure. Furthermore, these techniques of intravenous therapy require the services of a physician, interne, or surgical nurse and it is necessary that such person thoroughly scrub his hands and wear sterile rubber gloves in order to avoid contamination of the equipment.

Recently a new technique has been developed which involves the making of a venipuncture with a needle and then threading a sterile plastic catheter in the vein. This catheter is light in weight, flexible and can be taped to the patient's arm to remain in place as long as desired without causing the patient any appreciable discomfort. But in such procedure the external end of the installed catheter creates a problem since it cannot readily be kept sterile and, moreover, must be clamped or otherwise closed when not being used for induction of fluids or removal of blood. In addition to this, the external portion of the catheter may contain a quantity of air which must be removed in some way before fluid is induced through the catheter, otherwise a dangerous air embolism could ensue. At present, the entrained air is purged from the catheter by permitting blood to flow outwardly therethrough, but this is difficult to control and uncontrolled or difficultly controlled blood flow is always repugnant to the surgeon even though it does not reach dangerous proportions.

Hence, it is the primary object of the present invention to provide an improved type of intravenous catheter which can be installed in the patient's arm, or other area, very simply and quickly without violating sterile discipline.

It is also an object of the present invention to provide means of the type stated which eliminates the need for immobilizing the patient's arm or other appendage and, at the same time, eliminates unnecessary loss of the patient's blood.

It is a further object of the present invention to provide means of the type stated wherein a needle need be inserted into the vein only a short distance and thereafter removed, and used as an external connection means for a flexible tube or conduit through which the administered fluid can pass.

It is an additional object of the present invention to provide means of the type stated which permits precise control of blood which is permitted to flow out through the catheter for purposes of purging it to remove entrained air.

It is a further object of the present invention to provide an intravenous catheter in which the external end and, more particularly, the internal portions thereof, always maintains its sterile condition.

It is another object of the present invention to provide an intravenous catheter which can be readily manipulated and detached from its sterile outer container after it has been installed in the patient's vein.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (three sheets)—

FIG. 1 is an exploded perspective view of an intravenous catheter constructed in accordance with and embodying the present invention;

FIG. 2 is a perspective view of the intravenous catheter of the present invention in assembled relation;

FIG. 3 is a fragmentary sectional view taken along line 3—3 of FIG. 2;

FIGS. 4 and 5 are fragmentary perspective views showing successive steps in the installation of an intravenous catheter in accordance with the present invention;

FIG. 6 is a perspective view of the intravenous catheter after it has been inserted into the vein and showing the manner of using the apparatus for intravenous feeding;

FIG. 7 is a fragmentary elevational view of the distal end of the intravenous catheter;

FIG. 8 is a fragmentary sectional view taken along line 8—8 of FIG. 7 showing the plug in closed position;

FIG. 9 is a transverse sectional view taken along line 9—9 of FIG. 8;

FIG. 10 is a longitudinal sectional view similar to FIG. 8 except that the plug is in open position;

FIG. 11 is a transverse sectional view taken along line 11—11 of FIG. 10;

FIG. 12 is a perspective view of the plug forming a part of the present invention;

FIG. 13 is a perspective view of the coupling forming a part of the present invention;

FIG. 14 is a fragmentary sectional view of a modified form of needle element forming a part of the present invention;

FIG. 15 is a fragmentary elevational view of the distal end of a modified form of intravenous catheter constructed in accordance with and embodying the present invention;

FIG. 16 is a fragmentary sectional view taken along line 16—16 of FIG. 15 showing the plug in open position;

FIG. 17 is a transverse sectional view taken along line 17—17 of FIG. 16;

FIG. 18 is a longitudinal sectional view similar to FIG. 16 except that the plug is shown in closed position;

FIG. 19 is a transverse sectional view taken along line 19—19 of FIG. 18;

FIG. 20 is a fragmentary elevational view of a further modified form of intravenous catheter constructed in accordance with and embodying the present invention; and

FIG. 21 is a fragmentary sectional view taken along line 21—21 of FIG. 20.

Referring now in more detail and by reference characters to the drawings, which illustrate a practical embodiment of the present invention, A designates an intravenous catheter comprising a rigid tubular needle 1 having a hollow shank 2 terminating its forward end in a point 3, the latter being shaped for piercing the skin and vein. Slidably but snugly fitted upon the needle-shank 2 is a short length of tubing made of polyethylene or other similar flexible material forming a protective sleeve S for purposes presently more fully appearing. At its rear end, the needle 1 is formed with a diametrally enlarged hollow cylindrical hub 4 provided on its periphery with a diametrally enlarged annular band 5 which retentively engages a snug fitting sleeve 6 made of polythene or similar synthetic resin. The hub 4 is internally bored to form an axial socket or recess 7. Fitted around the sleeve 6 and gripped snugly thereby is a tubular ferrule 8 formed of heavy transparent or translucent synthetic material, such as lucite, polythene, polystyrene resin, or the like and having a diametrally enlarged annular flange 9.

Slidably disposed within the bore of the needle **1** and entending through the ferrule **8** is a flexible catheter **10** preferably formed of a polymerized synthetic resin, such as vinyl resin, polythene, or the like, and having a mitercut forward end **11** initially positioned adjacent to and slightly within the needle point **3**. The catheter **10** is loosely disposed within the ferrule **8** and at its rear end is flared out or enlarged and snugly seated within a complementarily shaped somewhat tapered tip-portion **12** of an elongated sleeve-like coupling **13** which also integrally includes a cylindrical body-portion **14** and, at its opposite or distal end, an outwardly flared terminal-portion **15** having a tapered interior surface **16**. Preferably, the needle **1** is covered with a tubular protector sleeve **17**, which is longer than the needle **1** and is suitably closed at its outer end.

Snugly fitted upon and extending concentrically around the ferrule **8** is a tubular sleeve **18** which, in effect, clampingly retains the turned-back end **19** of an elongated flexible transparent sac or tube **20**, the latter extending snugly back around the outer face of the sleeve **18** and being heat-sealed or otherwise closed at its distal end **21** to enclose the extended end of the catheter **10** and coupling **13** as shown in FIGS. 2 and 3. Preferably, the ferrule **8**, the turned-back end **19** and sleeve **18** are cemented or fused together to form an integral unit. Furthermore, the sleeve **18** is provided at its proximal end with an internal annular flange **22** which is in co-axial alignment with the end of the ferrule **8** so as to add to the structural integration of the two parts.

Provided for removable and rotatable disposition within the tapered terminal portion **15** of the coupling **13** is a tapered plug **23** having an enlarged head-portion **24** inscribed upon its outer periphery with an axial index line **25** which corresponds to, and indicates the position of, a vent-groove **26** formed in the tapered face of the plug **23** and extending from the inner end thereof to a point slightly more than half the plug's length. Similarly, the inner surface **16** of the coupling **13** is provided with a matching axial vent-groove **27** which opens upon the outer margin of the coupling **13** and extends inwardly to overlap the end of the vent-groove **26** whn vent-grooves **26**, **27**, are axially aligned as shown in FIG. 10. When the plug **23** is turned somewhat so that the grooves **26**, **27**, are out of alignment the plug **23** will be in so-called "closed" position and will completely seal the coupling **13**, as shown in FIGS. 7, 8, and 9. The entire assembly is then suitably enclosed and sealed within a conventional outer package, bag, or wrapping (not shown) and completely sterilized.

In use, the arm or other appendage R is externally cleaned in the area in which the penetration is to be made. The protector sleeve **17** is then removed from the needle **1** and the pointed end **3** of the needle is inserted through the skin *e* into the vein V, preferably utilizing a suitable tourniquet *t*, the latter being conventionally used to control the flow of blood through the vein V. After the needle **1** has been inserted into the vein V, the catheter **10** is manually propelled forwardly by applying force from the finger of the user through the flexible sac or tube **20** against the head-portion **24** of the plug **23**, as shown in FIG. 4, thereby inserting the catheter **10** through the needle **1** into the vein V. After the catheter **10** is in position within the vein V, the needle **1** is slowly withdrawn from the vein V and moved back along the catheter **10**, while, at the same time, digital pressure is applied to the skin *e* distal to the needle piercing point so as to hold the catheter **10** within the vein V. The needle **1** is withdrawn until the hub-recess **7** is engaged around the tapered tip-portion **12** of the coupling **13** and the head-portion **24** of the plug **23** is manually pressed forward so that the coupling **13** is firmly seated within the recess **7**. As this is done, the flange **9** of the ferrule **8** is grasped and held back with the result that the manual pressure against the plug **23** will "pop" it, the sleeve **6** and the hub **4**, as a unit, out of the ferrule **8** to effect removal of the sac **20** and its associated parts, as shown in FIG. 5. Meanwhile, the protective sleeve S is pushed along the needle-shank **2** while it projects slightly beyond the beveled point **3** of the needle **1** so as to prevent cutting of the catheter **10** as it is flexed from time to time during use.

The exposed portion of the catheter **10** is secured to the appendage R adjacent the needle-puncture F by strips of tape **28**, **29**, **30**, as shown in FIG. 6. During the venipuncture and installation of the catheter **10**, the plug **23** is turned to closed position in the coupling **13**, that is to say, in the position shown in FIGS. 7, 8, and 9. In this position, the entrained air will prevent bleeding from the vein V. However, as soon as the catheter **10** is installed and taped down to the arm, the plug **23** may be carefully rotated to the venting alignment shown in FIGS. 10 and 11, allowing the blood to run up the catheter **10** pushing entrained air out through the venting-grooves **26**, **27**, and thereby purging the catheter **10**. As soon as blood begins to run into the venting-grooves **26**, **27**, the plug **23** may be turned back to closed position. Then when a liquid is to be infused into the vein V, the plug **23** can be pulled bodily out of the coupling **13** and a flexible conduit *c* connected thereto by a nipple *n* which fits tightly into the terminal-portion **15** of the coupling **13**. When the infusion is completed and the conduit *c* removed, the plug **23**, which meanwhile has been kept in a sterile or antiseptic solution can be again inserted closurewise into the terminal-portion **15** of the coupling **13** until the next occasion to use the catheter **10**.

It will be apparent that the catheter **10** may be easily manipulated so as to install the catheter **10** in the vein V. The needle **1** is easily withdrawn along the catheter **10** and the coupling **13** can be ready manipulated to detach the sac **20** as well as thereafter serving as a fitting through which fluids can be intravenously administered without contaminating or destroying sterile conditions. As a result, fluid introduced through the catheter **10** can be introduced into the vein V without becoming unsterile or contaminated and the possibility of inadvertently introducing an air embolism into the vein V is effectively avoided. It will also be apparent that the doctor, nurse, or technician, in using the apparatus A, will not be required to scrub or use sterile gloves, as is ordinarily required in conventional venipuncture techniques heretofore in use. Moreover, the use of an arm board is eliminated since there is no necessity for a patient to have the appendage immobile except during installation or removal of the catheter **10**.

It is possible to provide a modified form of needle **31** as shown in FIG. 14 in which the steel capillary tube **32** forming the needle proper is fitted or molded directly into a hub **33** formed of polythene or other similar synthetic resin, thereby, eliminating the steel hub **4** and polythene sleeve **6** of the previously described needle **1**. The remaining structure is, otherwise, the same as heretofore described.

It is also possible to provide a modified form of intravenous catheter B as shown in FIGS. 15–19, inclusive, which is substantially similar to the previously described catheter A, except that it is provided with a sleeve-like coupling **34** having an internally tapered tip **35** into which the distal end **36** of a catheter **37** is tightly and retentively fitted. At its other or distal end the coupling **34** is provided with a diametrally enlarged terminal-portion **38** having a tapered interior socket **39** provided, about midway of its length, with an undercut annular groove **40**.

Provided for removable and axially shiftable disposition within the tapered socket **39** of the coupling **34** is a hollow tapered plug **41** formed of somewhat resilient material and having an enlarged head portion **42**. About midway of its length the plug **41** is integrally provided with a diametrally enlarged annular shoulder or sealing element **43** which fits loosely within the groove **40**. Thus, when the plug **41** is in the relative axial position within

the tapered socket 39, as shown in FIG. 16, air and even blood may leak past the shoulder or sealing element 43 and escape from the bore of the catheter 37. However, when the plug 41 is pushed axially inwardly to the position shown in FIG. 18 the body of the plug will deform slightly inwardly as shown, and the shoulder or sealing element 43 will seat snugly against the smaller diameter portion of the socket 39 and tightly seal the coupling 34.

It is possible to provide a modified form of needle-hub arrangement as shown in FIGS. 20 and 21, in which the usual lever-type hub is eliminated and, instead, a molded plastic hub 44 is employed, having a tubular socket 45 terminating in a flat bottom wall 46 through which the shank 47 of a tubular needle 48 is snugly inserted. The hub-engaging end 49 of the needle 48 is sharply flared and snap-fitted into a flared groove 50 formed on the interior of the socket 45 adjacent to the bottom wall 46 as best seen in FIG. 21.

It should be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the intravenous catheters and in the steps of its production may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. Intravenous catheter means comprising a tubular needle being provided at one end with a sharp point capable of penetrating the flesh and puncturing a vein, said needle being provided at its other end with hollow cylindrical diametrically enlarged hub means, a ferrule removably connected to one end of said hub means, a flexible sac having means by which it is securely attached at one end to said ferrule, a flexible catheter enclosed within the sac and having one end shiftably disposed in the tubular needle, a sleeve snugly but slidably mounted externally upon the needle and being of sufficient axial length so that when said sleeve is slid down to the point of the needle, a substantial portion of its length will remain retentively engaged with the needle while a portion of its length will project protectively beyond the point of the needle and around the catheter whereby to prevent the point of the needle from cutting the catheter as the latter is flexed, tubular coupling means rigidly attached to the other end of said catheter, and a plug removably mounted in said coupling means, whereby said coupling means may be grasped for manipulating said chatheter through said tubular needle.

2. Intravenous catheter means comprising a tubular needle having a sharpened end capable of penetrating the flesh and puncturing a vein, a diametrically enlarged hollow cylindrical hub formed on the end of said tubular needle opposite to the sharpened end, an inner sleeve disposed around and snugly secured to said hub, a tubular ferrule fitted around said inner sleeve and gripped thereby, a flexible tubular sac closed at one end and having an outer tubular sleeve permanently attached at its other end, said sac and outer tubular sleeve being conjointly disposed in snug-fitting disposition upon the ferrule, a flexible catheter enclosed within the sac and having one end shiftably disposed in the tubular needle, tubular coupling means rigidly attached to the other end of said catheter, and a plug removably mounted in said coupling means, whereby said coupling means may be grasped for manipulating said catheter through said tubular needle.

3. Intravenous catheter means comprising a tubular needle having a sharpened end capable of penetrating the flesh and puncturing a vein, a diametrically enlarged hollow cylindrical hub formed on the end of said tubular needle opposite to the sharpened end, an inner sleeve disposed around and snugly secured to said hub, a tubular ferrule fitted around said inner sleeve and gripped thereby, a flexible tubular sac closed at one end and having an outer tubular sleeve permanently attached at its other end, said sac and outer tubular sleeve being conjointly disposed in snug-fitting disposition upon the ferrule, a flexible catherer enclosed within the sac and having one end shiftably disposed in the tubular needle, said catheter being provided with a flared-out portion at its distal end, a sleeve-like tubular coupling formed on said flared-out portion, and a tapered plug provided for removable and rotatable disposition within said coupling, whereby said coupling means may be grasped for manipulating said catheter through said tubular needle.

4. Intravenous catheter means comprising a tubular needle having a sharpened end capable of penetrating the flesh and puncturing a vein, a diametrically enlarged hollow cylindrical hub formed on the end of said tubular needle opposite to the sharpened end, an inner sleeve disposed around and snugly secured to said hub, a tubular ferrule fitted around said inner sleeve and gripped thereby, a flexible tubular sac closed at one end and having an outer tubular sleeve permanently attached at its other end, said sac and outer tubular sleeve being conjointly disposed in snug-fitting disposition upon the ferrule, a flexible catheter enclosed within the sac and having one end shiftably disposed in the tubular needle, said catheter being provided with a flared-out portion at its distal end, a sleeve-like tubular coupling formed on said flared-out portion having an internally presented vent groove therein, and, a tapered plug provided for removable and rotatable disposition within said coupling, and having a vent groove formed therein adapted for optional alignment with said vent groove in said coupling.

5. An intravenous catheter according to claim 4 further characterized in that the vent grooves in the plug and coupling extend in an axial direction.

6. An intravenous catheter according to claim 3 further characterized in that the coupling is internally provided with a circumferential groove and the plug is provided with a matching circumferential shoulder adapted for sealing engagement within the groove when the plug is in normal seating position within the coupling, said shoulder being adapted to become unseated with respect to the groove to provide air venting from the coupling when the plug and coupling are shifted axially with respect to each other.

7. An intravenous catheter according to claim 6 further characterized in that the plug is hollow and its side walls are resilient.

References Cited in the file of this patent

UNITED STATES PATENTS

2,915,063	Cutter	Dec. 1, 1959
2,937,643	Elliott	May 24, 1960
3,010,453	Doherty	Nov. 28, 1961

FOREIGN PATENTS

1,064,445	France	May 13, 1954

OTHER REFERENCES

Mitchell: An Introducer for Plastic Cannulae from the Lancet, vol. 1, No. 4755, Feb. 23, 1954, p. 435.