July 8, 1969 A. J. LANGDON 3,454,006

INTRAVENOUS CATHETER-NEEDLE ASSEMBLY PROVIDED WITH NEEDLE BUSHING GUIDE

Filed Jan. 28, 1966

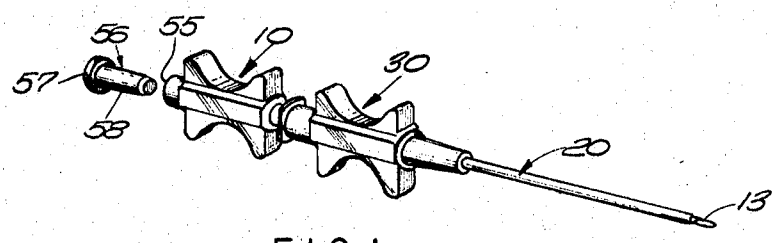

FIG. 1

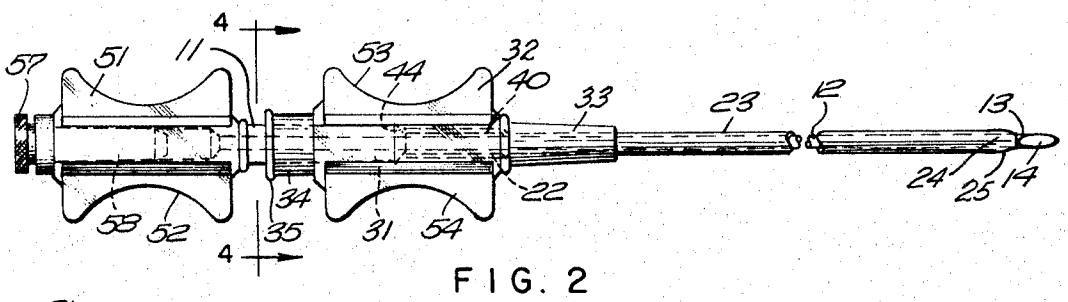

FIG. 2

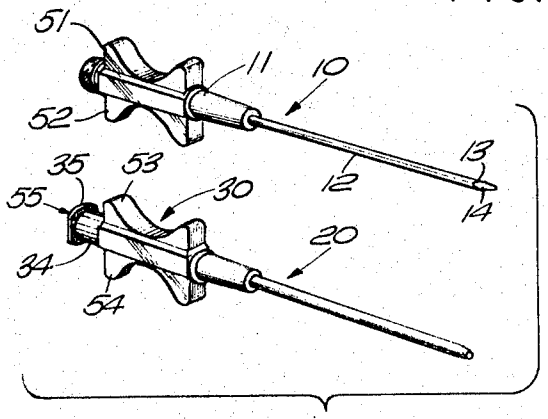

FIG. 3

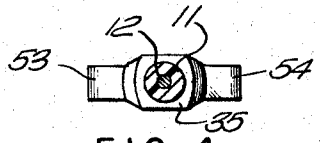

FIG. 4

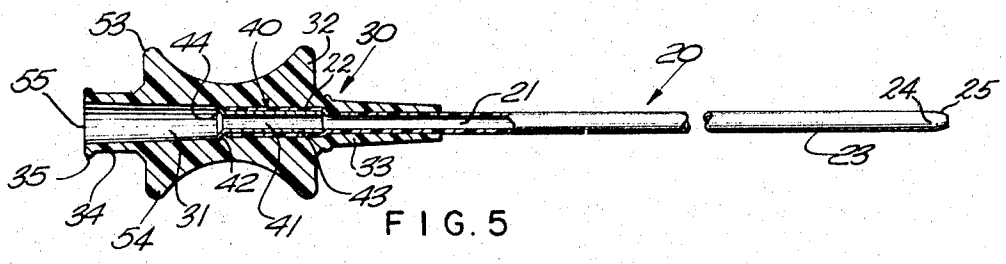

FIG. 5

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United States Patent Office 3,454,006
Patented July 8, 1969

3,454,006

INTRAVENOUS CATHETER-NEEDLE ASSEMBLY PROVIDED WITH NEEDLE BUSHING GUIDE

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Filed Jan. 28, 1966, Ser. No. 523,677
Int. Cl. A61m 5/32
U.S. Cl. 128—214.4 9 Claims

ABSTRACT OF THE DISCLOSURE

An intravenous needle assembly having a solid rigid needle removably inserted within a tightly fitting flexible cannula for insertion of both the needle and cannula into a blood vessel. The cannula is secured in a hub by a bushing having a tapered end adapted to center the needle as it is inserted into the cannula.

The present invention relates to an intravenous needle assembly for insertion into the blood vessel of a patient to permit the administration of fluids thereto and the removal of blood specimens therefrom.

The combination of a flexible outer cannula and a rigid inner hypodermic needle for use as an intravenous needle assembly is old in the surgical art, and the history of its development is well recorded in U.S. 3,094,122 (patented June 18, 1963). Even so, the intravenous needle assemblies presently in use are still subject to a number of defects which assume a critical, and possibly fatal, magnitude of importance when considered in the appropriate environments of an operating room or hospital bed.

Perhaps the most important defect of current assemblies from the viewpoint of peril to the patient's life is the possibility of detachment of the cannula from its hub. In the operating room where several gloved hands may simultaneously be active in a single area, and even in the unattended hospital bed of a restless patient being fed intravenously by a feeder line connected to the hub, the fallibility of the conventional frictional connection between the cannula and hub, wherein the cannula is merely stretched over a roughened exterior hub surface, assumes a major importance. The accidental touch of the swiftly moving surgeon's hand or the catching of bedsheets on a protruding segment of the hub may lead to an accidental separation of the hub and cannula, resulting in a possibly fatal migration of the cannula within the venous system of the patient. In the assembly of the present invention a bushing is used to securely and permanently lock the cannula within the hub in such a manner as to avoid this danger.

An analogous defect, likely to manifest itself under similar conditions, is the possibility of an actual removal of the cannula from the vein, thereby abruptly interrupting the continuous administration of necessary fluids.

The possibility of such cannula-hub and cannula-patient separations are actually enhanced by the design of the hubs currently in use. Usually at some point along the length of a conventional hub, the hub section enlarges to a bulky square shape in order to provide a large opposing surface against which a surgeon can push to insert the assembly, at an acute angle to the skin level, into the blood vessel. As a result, the current hubs stand away from the skin and thus are more likely to be jostled or caught on something. On the other hand, the hub design of the present invention provides a satisfactory shaped gripping surface to the surgeon, thereby to facilitate insertion of the assembly into the tissue at the preferred acute angle to the skin level, while still permitting the assembly to lie relatively flatly against the tissues of the patient, thereby

to minimize the possibility of cannula-hub or cannula-patient separation.

Present assemblies involving the use of hollow hypodermic needles present several difficulties. One difficulty arises from the standard procedure for inserting such an assembly into the patient with a slight rotation or rocking of the assembly by the surgeon to facilitate its entry into the blood vessel. During such rocking, the sharp edges of the hollow needle tip, pressed against the wall of the blood vessel, tends to slice the vessel wall and cut a plug therefrom. Such plug cutting not only complicates the surgeon's task, but constitutes an addiitonal hazard to the patient. Another difficulty results from the fact that the assembly must be used in conjunction with a syringe. After the "blind" insertion of the assembly into the skin of the patient, the surgeon must test for the desired penetration of the cannula into the lumen of a blood vessel by withdrawing the plunger of a syringe attached to the hollow needle, the indication of a successful penetration being the emergence of blood into the syringe. From the standpoint of economics, the disadvantage is that a syringe must be sterilized and set apart for this purpose alone or a disposable syringe discarded; from the standpoint of operating procedure, the disadvantages are that one more instrument, and a bulky one at that, must be crowded into the limited operating area available and that precious time must be wasted while the blood travels the entire length of the cannula and hub into the syringe. All of these disadvantages are eliminated, however, in the present invention by use of a solid needle and a translucent hub. In particular, the need for a syringe is obviated as retreat of the solid needle within the close fitting cannula shank causes an aspiration of blood from the lumen of the blood vessel into the translucent hub where the blood becomes visible just immediately above the level of the patient's tissue. Use of the solid needle furthermore avoids the aforementioned possibility of cutting a plug from the vessel wall, as the solid needle pierces or punctures the vessel wall rather than slicing it.

Another disadvantage of the conventional assembly is that, prior to insertion of the assembly into the patient's tissue, the surgeon must carefully inspect the needle end to insure that the bevel of the needle end will be in the proper position for insertion into the patient at the proper angle. Even so, during insertion of the assembly, the surgeon has no way of assuring himself that the bevel position has not been altered by an accidental rotation of the needle. In the assembly of the present invention, however, a pair of diametrically opposed finger-receiving lugs extend radially from both the cannula hub head and needle head, the bevel of the needle end being in a predetermined relationship with respect to the lugs on the needle head. With the needle lugs substantially parallel to the skin of the patient, the bevel is either in the correct position or in a position rotated exactly 180° from the correct position, and therefore easily correctable. When the lug pairs of both needle and hub are put in a common plane by the surgeon prior to insertion of the assembly, accidental rotation of the needle (and bevel) with respect to the hub manifests itself as an easily detectable non-alignment of the two lug pairs.

Common to the currently available assemblies is a defect which, although minor in nature, can create a serious interruption of the smooth, rapid practices of an operating room. This defect is simply the difficulty involved in assembling the two major components of the assembly: the needle and the cannula subassembly which is necessarily designed to tightly embrace the needle shank. Those who have had any experience in attempting to rapidly insert a needle into a cannula sub-assembly will testify to the difficulty involved in centering the

needle within the hub so as to permit its easy insertion through the hub into the cannula itself as well as to the possibility of a misaligned needle end puncturing the cannula. The assembly of the present invention is designed through an arrangement of tapered components to faciiltate such assembly and furthermore afford significant protection to the portion of cannula most susceptible to an accidental puncture by the needle end.

Accordingly, it is an object of the present invention to provide an intravenous needle assembly, utilizing a solid needle and a translucent hub, which is easily and safely assembled, which cannot cut plugs from the blood vessel walls, which facilitates the determination of the correct bevel angle, which affords the surgeon a desirable grasping surface during assembly and yet permits the cannula to lie relatively flatly against the skin of the patient, which permits the surgeon to rapidly ascertain whether he has appropriately placed the cannula within the blood vessel without requiring the use of other instruments, and which minimizes the possibility of cannula-hub separation and cannula-patient separation.

Briefly, the assembly of the present invention utilizes a rigid metallic bushing placed within a plastic cannula to secure the cannula to a hollow plastic translucent hub by squeezing the cylindrical wall of the top of the cannula against the interior wall of the hub. The lumen of the hub and the rear face of the bushing are each forwardly tapered to facilitate assembly by centering the solid needle end as it passes through the lumens of the hub, bushing and cannula.

Further objects and advantages of the present invention will become readily apparent from an inspection of the following detailed description of the construction and operation of the assembly in conjunction with the accompanying drawing in which:

FIG. 1 is a perspective view of the assembly;

FIG. 2 is a front elevational view of the assembly with portions being shown in section;

FIG. 3 is a perspective view of the needle of the assembly and a similar view of the cannula and cannula hub of the assembly;

FIG. 4 is a cross-section of the assembly taken along line 4—4 of FIG. 2; and

FIG. 5 is a front elevational view of the cannula with a portion thereof being shown in section.

Referring now in particular to FIGS. 1, 2 and 3, the present invention comprises the combination of a needle **10** and a cannula sub-assembly having a cannula **20**, a cannula hub **30** and a bushing **40**, each of which elements will now be described separately in detail.

The needle **10** has an enlarged rear head **11** provided with a forward taper, a smooth and relatively inflexible solid shank **12** and a solid forward end **13** provided with a bevel **14** adapted to facilitate entry of the needle end **13** into the blood vessel of a patient. Referring now in particular to FIGS. 2 and 5, the cannula **20**, defining a lumen **21**, has a rear head **22** of enlarged diameter, a smooth shank **23** having a greater flexibility than the needle shank **12**, and a forward end **24** provided with a feather edge **25**. The hub **30**, defiining a lumne **31**, has an enlarged rear head **32** and a forward end **33** terminating along the cannula shank **22**. The rigid metallic bushing **40**, defining a lumne **41**, has a rear head **42** and a forward end **43**. The bushing head **42** is secured within the hub head **32**, as by a wedge fit, and has on its rear face **44** a sharp internal forward taper. The bushing end **43** is seated within the cannula head **22** and is axially aligned therewith and with the hub **30** to permit communication between their lumens **21**, **31** and **41**.

The bushing end **43** may be positioned within the cannula heead **22** by forming the cannula head **22** about the bushing end **43**, by stretching a pre-formed cannula head **22** and then inserting therein the bushing end **43**, or by other means obvious to those skilled in the art. Once assembled, the cannula **20** and bushing **40** are then dropped as a unit, cannula end **24** first, into the hub head **32** so that the cannula shank **23** extends through and beyond the hub lumen **31** while the bushing **40** is caught within the hub **30** by the gradual forward taper of the hub lumen **31**, that is, the gradual internal forward taper of the hub **30**. The bushing **40** is then permanently secured within the hub **30** by pressing the bushing head **42** into the hub lumen **31** and flaring its edges, or by other conventional means. The bushing head **42** may be provided originally with the sharp internal forward taper on its rear face **44**, or it may be of other shape originally and then flared to provide such a taper during the homing of the bushing **40**. Although it is preferred that a portion of the bushing head **42** extend rearwardly beyond and over the cannula head **22** so as to make direct physical contact with the interior wall of the hub **30**, it is also possible to have the entire length of the bushing **40** covered by the cannula head **22** so that the cannula head **22** is always intermediate between the bushing **40** and the interior walls of the hub **30**. In either case, the cannula head **22** is firmly secured between the periphery of the bushing **40** and the internal taper of the hub **30** to prevent displacement of the cannula head **22** from the cannula hub **30**.

The needle end **13**, during assembly of needle and cannula, is guided by the gradual internal forward taper of the hub **30** into the sharp forward taper of the rear bushing face **44** which centers the needle end **13** for the bushing lumen **41**. After the needle end **13** passes through the bushing lumen **41**, it emerges into the cannula shank **23** with the alignment of the needle **10** and cannula **20** being such that the possibility of a puncture of the unflexed cannula shank **23** by the needle end **13** is unlikely. In the finished assembly, the needle end **13** is disposed closely adjacent to and forwardly of the feather edge **25** of the cannula end **24**, while the needle shank **12** is tightly embraced in the rear by the bushing lumen **41** and in front by the lumen **21** of the cannula shank **23**.

Preferably the rear face **34** of the hub head **32** is possessed of a very low resilient elasticity or formed to such exact specifications so that it may not only receive but removably engage the mating forward taper of the needle head **11** and yet be detachable therefrom upon application of a separating pressure. The rear face **34** of the hub head **32** may also be provided with a marginal rim **35** designed to mate with Luer-Lok type connections of the type commonly used in the surgical instrumentation.

The needle head **11** and the hub head **32** are preferably each provided with a respective pair of diametrically opposed and radially extending lugs **51**, **52** and **53**, **54** which may be formed integrally on the otherwise substantially conical or cylindrical heads. Each lug is relatively flat in depth, about the depth of the corresponding head, and scooped out to confortably receive finger tip. Accordingly, each head may be grasped by two opposed fingers and moved axially during insertion or withdrawal of the assembly. The pair of lugs **51**, **52** on the needle head **11** are disposed along a diameter of the needle head **11** bearing a fixed predetermined relationship to the needle end **13** and, more particularly, to the bevel **14** thereon. As shown in the drawing, the bevel **14** is aligned with the plane formed by the needle head lugs **51**, **52** in such a manner that, for proper insertion of the needle end **13** into a patient, the lugs **51**, **52** should be substantially parallel to the skin of the patient. The surgeon desiring to insert the assembly thus need only glance at the needle end **13** to see whether the angle of the bevel **14** is exactly as desired or not; if not, the needle is merely reversed and a 180° rotation of the neede head **13** will correct the angle. During insertion of the assembly an accidental rotation of the needle **10** which throws off the angle of the bevel **14** will be reflected in two ways: the loss of parallelism of the needle lugs **51**, **52** with respect to the tissue of the patient and the creation of an angle

between the plane of the needle head lugs **51**, **52** and the plane of the hub lugs **53**, **54**, assuming the hub lugs **53**, **54** are maintained parallel to the tissue of the patient. Furthermore, once the assembly has been inserted in the patient and the needle removed, the hub head may be taped relatively flatly against the skin of the patient with the lugs lying substantially parallel to the skin so as to minimize the possibility of the hub or lugs being caught on passing objects.

Once the surgeon believes the assembly has entered the lumen of the blood vessel, a withdrawal of the needle end will draw with it by aspiration the blood of the patient, which blood will become visible through the translucent wall of the hub just above the level of the bushing. In this manner the accuracy of the placement of the assembly may be readily checked without the use of a syringe or other equipment outside of the assembly.

As shown in particular in FIGS. 1, 2 and 5, the needle head **11** and hub head **32** may each be provided with a forwardly tapering interior bore **55** accessible from the rear of the heads **11**, **32** and adapted to receive and be blocked by a non-toxic plug **56**, having an enlarged knurled rear head **57** and a resilient forward end **58** with a forward taper. In this manner the plug end **58** may be conveniently and accessibly kept sterile within the needle head **11** as part of the assembly and, when needed, removed from the needle head **11** and inserted in the hub head **32**, after removal of the needle therefrom, to block the hub lumen **31**, and in effect, close off the cannula lumene **21**.

The bushing and the shank and end of the needle may be formed of stainless steel or any other slightly flexible, non-toxic material suitable for use in a hypodermic needle. The cannula may be formed of polytetrafluoroethylene or any other non-toxic, highly flexible material. Preferably, the material of the hub is translucent in order to permit the surgeon to determine rapidly, and without use of a syringe, whether blood is being drawn through the cannula when the needle is withdrawn and to provide an observation area to observe fluid flow either to or from the patient. The same translucency further facilitates assembly of the needle and cannula by permitting the surgeon to view the position of the needle end within the cannula hub. The needle head and the cannula may be formed of any strong, relatively rigid material. Naturally, all parts of the assembly must be sufficiently heat resistant to withstand sterilization of the entire assembly without deleterious effects.

Now that one embodiment of the present invention has been described, modifications thereon and other embodiments may readily become apparent to those skilled in the art. For example, while the cannula shank has been described as being translucent, obviously a transparent cannula hub is also satisfactory for the purposes of observing fluid flow to and from the patient and facilitating assembly of needle and cannula; accordingly, the term "transparent" is intended to be comprehended by the term "translucent." Similarly, the needle head and hub may be manufactured in the same mold so that the rear of the needle head has a Luer-Lok connection to which a syringe may be attached to assist in insertion of the assembly into the patient and, furthermore, to substantially reduce production equipment costs. In such an embodiment, the needle shank might be secured within the needle head by a bushing device. It is therefore understood that the spirit and scope of the present invention is limited only by the scope of the appended claims.

What is claimed is:

1. An intravenous needle assembly comprising:

(1) a needle having an enlarged head, a smooth substantially rigid shank and a pointed forward end; and

(2) a cannular sub-assembly comprising:

(a) a hub having a tapered rear lumen receiving and removably engaged with the forward end of said enlarged needle head, and a communicating tapered forward lumen;

(b) a flexible non-toxic cannula removably, coaxially receiving and tightly embracing said needle shank, said cannula having a head and a feather edged end, said feather edged end being disposed rearwardly and closely adjacent said pointed end of said needle; and

(c) a non-toxic metallic bushing having an inwardly tapered rear face, said bushing being mounted within and tightly embraced by said cannula head, said bushing and said cannula head being tightly secured to said hub within said tapered forward lumen, said tapered rear lumen of said hub and said tapered rear face of said bushing being adapted to center said pointed needle end upon insertion thereof into said cannula sub-assembly;

whereby said cannula is adapted to be inserted into a blood vessel together with said needle and to remain therein upon withdrawal therefrom of said needle.

2. The needle assembly of claim **1** wherein said intravenous needle end is solid and said hub is translucent.

3. An intravenous needle assembly for insertion into the blood vessel of a patient comprising

(1) a needle comprising
an enlarged rear head,
a smooth and relatively inflexible shank, and
a beveled forward end;

(2) a relatively flexible and non-toxic cannula tightly embracing and removably mounted on said needle shank and adapted to be inserted into a blood vessel with said needle and to remain in an inserted position in the blood vessel upon withdrawal of said needle, said cannula comprising
an enlarged rear head,
a smooth shank, and
a feather edged forward end removably disposed closely adjacent to and rearwardly of said needle end;

(3) a hollow non-toxic hub mounted on said cannula head, said hub comprising
an enlarged rear head with an internal forward taper tightly embracing and removably mounted on said needle head, and
a forward end terminating along said cannula shank; and

(4) a rigid metallic bushing defining a lumen for passage therethrough of said needle shank, said bushing comprising
a rear head secured within said hub and having on its rear face a sharp internal forward taper for guiding said needle end to said lumen during assembly of said needle and cannula, and
a forward end seated within said cannula head for guiding said needle end from said lumen into said cannula shank during assembly of said needle and cannula;

whereby said bushing facilitates a rapid and safe assembly of said needle and cannula by centering said needle end and minimizing the possibility of cannula puncture.

4. The intravenous needle assembly of claim **3** wherein said bushing head is in direct physical contact with and grippingly engaged by said hub head.

5. The intravenous needle assembly of claim **3** wherein the rear of said hollow hub head is formed with a transversely disposed outwardly extending margine rim adapted to receive and removably engage a Luer-Lok connection.

6. The intravenous needle assembly of claim **3** wherein said needle head and said hub head each have a pair of relatively flat finger-receiving lugs, the lugs of each of said pairs being diametrically opposed and ra-

dially extending, the lugs of said needle head have a predetermined angular relationship to the bevel of said needle end.

7. The intravenous needle assembly of claim 6 wherein the forward end of said needle head is tapered externally to removably and frictionally engage the internal forward taper in said hollow hub head with said flat lugs on both heads in a common plane, whereby said hub and needle heads are adapted to be easily grasped and inserted into a blood vessel as a unit at an acute angle to the skin of a patient and yet be easily separable.

8. The intravenous needle assembly of claim 3 further having a non-toxic plug; and wherein said needle head and said hub head each have an interior bore adapted to receive said plug; whereby when said needle is withdrawn from said hub head, said plug may be withdrawn from said needle bore and inserted in said hub bore.

9. The intravenous needle assembly of claim 3 wherein said needle end is solid and said hub is translucent, whereby after insertion of said assembly through the skin of and into the blood vessel of a patient and subsequent withdrawal of said solid needle end from said cannula to aspirate blood from said blood vessel into said hub, the desired puncture of the blood vessel is verifiable by the visible presence of blood in said hub.

References Cited

UNITED STATES PATENTS

2,828,744	4/1958	Hirsch et al.	128—221
3,094,122	6/1963	Gauthier et al.	128—221
3,225,762	12/1965	Guttman	128—214.4
3,352,306	11/1967	Hirsch	128—214.4
3,406,685	10/1968	May	128—214.4

FOREIGN PATENTS

1,175,889	11/1958	France.
1,278,961	1/1961	France.

DALTON L. TRULUCK, *Primary Examiner.*

U.S. Cl. X.R.

128—221