

March 15, 1960

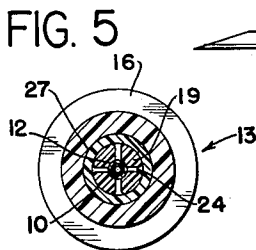
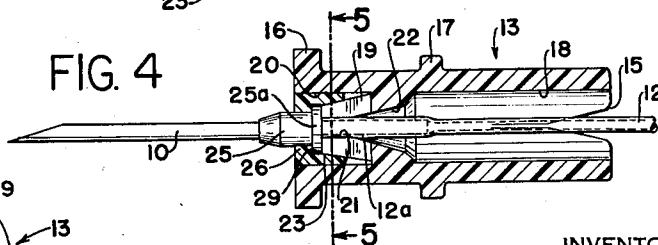
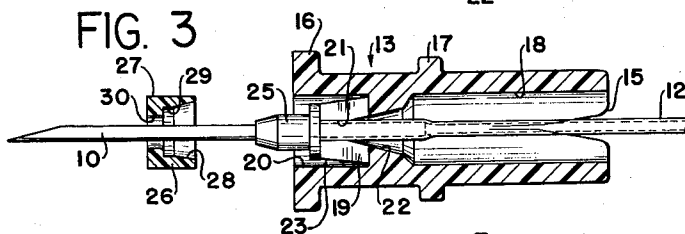
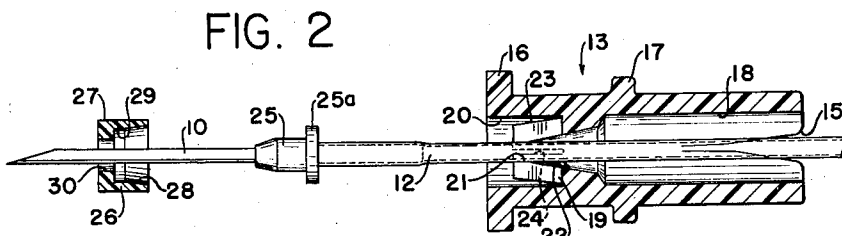
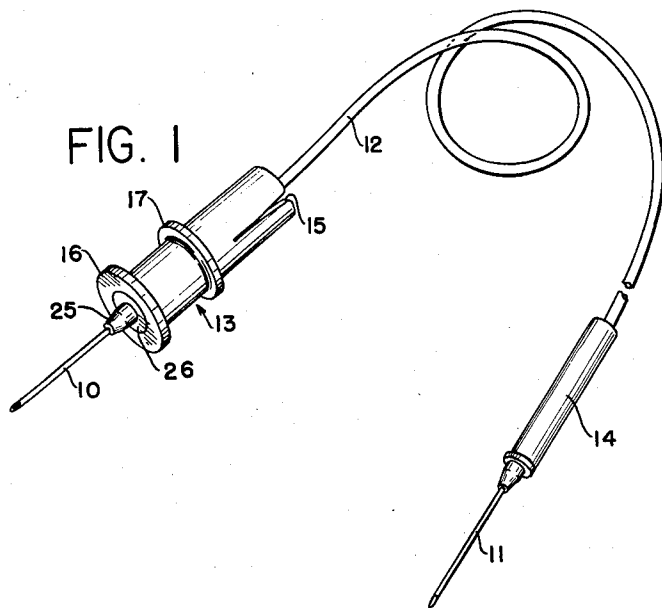
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2,928,392

NEEDLE MANIPULATOR ASSEMBLY FOR DONOR SETS

Filed June 5, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 6

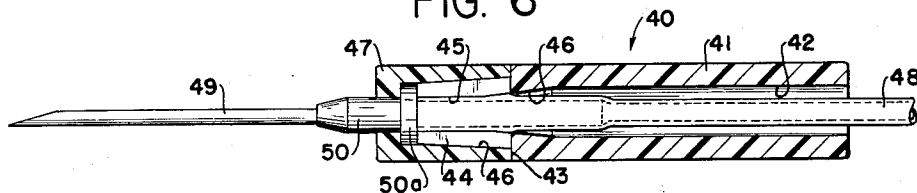


FIG. 7

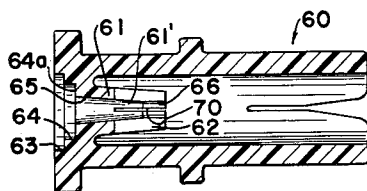


FIG. 8

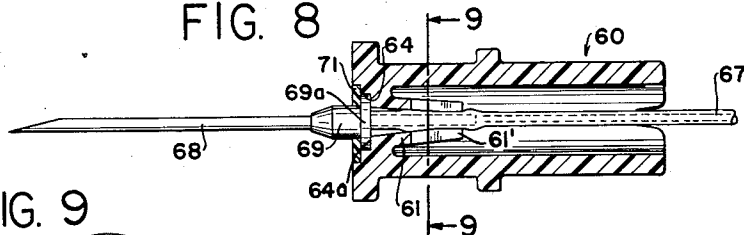


FIG. 9

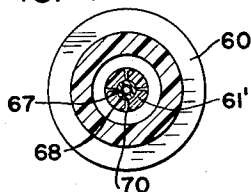


FIG. 10

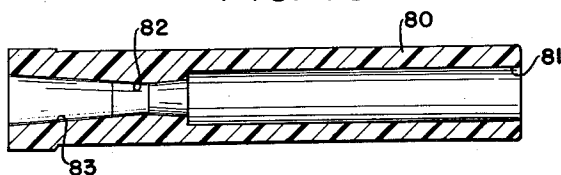


FIG. 11

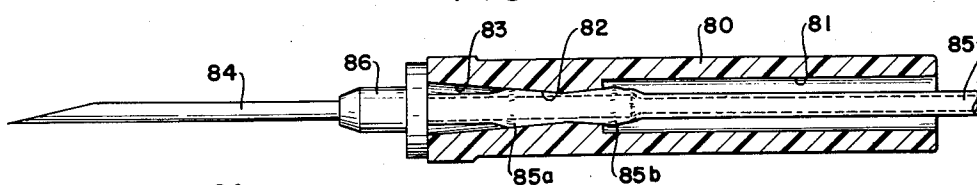
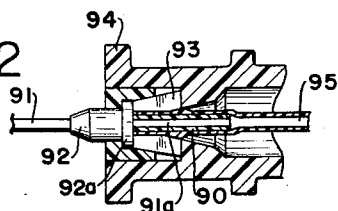


FIG. 12



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NEEDLE MANIPULATOR ASSEMBLY FOR DONOR SETS

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5 Claims. (Cl. 128—214)

The present invention relates to improvements in donor sets of the type used in the transferring of blood from a donor into an evacuated container, and more particularly to novel and improved needle manipulator assemblies for incorporation in such donor sets.

Present donor sets include a pair of needles connected together by a length of transparent flexible plastic tubing. In normal use, one of the needles is inserted into the vein of a donor, while the other needle is inserted through the stopper of an evacuated bottle. Blood is thereby caused to flow through the needles and tube into the evacuated container. The needles used for this purpose are of relatively small size. Accordingly, it is desirable to mount the needles in suitable manipulator fittings to facilitate gripping and handling of the needles, as well as to facilitate insertion of the needles into the container or donor, as the case may be.

Generally, the flexible tubing connecting the needles is formed of polyethylene or polyvinyl chloride or other suitable plastic material and is connected at the butt end of the needles, in open communication therewith. Heretofore, the effective attachment of the tubing ends to the needles has presented a considerable problem. A common method of connecting the tubing to the needles involves the use of small metal ferrules or collars which are slipped over the needles and tubing and then crimped to squeeze the plastic tubing into tight engagement with the needle. This is not altogether satisfactory, however, since the crimping of the ferrules is quite critical. That is, if insufficient crimping pressure is applied, the seal will not be airtight, nor will the connection be secure, while if excessive crimping pressure is used, the plastic tubing may be severed.

In accordance with the present invention, the donor set is provided with improved manipulator fittings which serve not only to mount the respective needles, but also to secure the plastic tubing properly and effectively to the butt ends of the needles. Each manipulator fitting of this invention includes a chuck or gripping portion which surrounds the butt end of the needle and is adapted to firmly press the walls of the plastic tubing against the outer walls of the needle to secure the needle and tubing together and maintain an airtight seal therebetween.

One of the important features of the invention resides in the provision of a needle manipulator assembly, including a flanged needle and a manipulator which is ensleeved over a portion of the needle and is operative to grip the needle and a section of tubing in the absence of permanent deformation of the material forming the gripping portions of the manipulator. The manipulator contacts with the flange on the needle to provide rigid, mechanical support for the needle, while the gripping portion of the manipulator functions to retain the needle and tubing in assembled, sealed relation.

Another improved feature of the invention resides in the provision of improved manipulator assemblies for donor sets having the various advantages above men-

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tioned, and being further characterized by the ease and efficiency with which the manipulators may be assembled with the needles and tubing. The arrangement is such that the sets may be assembled in a practical minimum of time, without special skills or complicated machinery.

For a better understanding of the invention, references should be made to the following description and accompanying drawings, in which:

Fig. 1 is a perspective view of a donor set incorporating the improved features of the invention;

Fig. 2 is an enlarged longitudinal cross-sectional view of a manipulator fitting used in the set of Fig. 1, before assembly of the tube and needle therewith;

Fig. 3 is a cross-sectional view similar to Fig. 2, with the needle and tubing gripped in the manipulator;

Fig. 4 is a cross-sectional view similar to Fig. 3, showing the completed manipulator assembly;

Fig. 5 is a transverse cross-sectional view taken along line 5—5 of Fig. 4;

Fig. 6 is an enlarged longitudinal cross-sectional view of a second manipulator fitting assembly incorporated in the donor set of Fig. 1;

Fig. 7 is an enlarged longitudinal cross-sectional view of a modified manipulator fitting, prior to the assembly of the tube and needle therein;

Fig. 8 is a longitudinal, cross-sectional view similar to Fig. 7, showing the completed manipulator assembly;

Fig. 9 is a transverse cross-sectional view taken along line 9—9 of Fig. 8;

Fig. 10 is an enlarged longitudinal cross-sectional view of another modified form of the manipulator fitting, prior to assembly of the tube and needle therein;

Fig. 11 is a cross-sectional view similar to Fig. 10, showing the complete manipulator fitting assembly; and

Fig. 12 is an enlarged fragmentary cross-sectional view of a modified form of the assembly of Fig. 4 incorporating an adaptor element to accommodate needles of small size.

Referring initially to Figs. 1-5, the numerals 10 and 11 designate generally a pair of hollow, pointed needles which are connected together, in communication with each other, by means of an elongated flexible tube 12 formed of polyethylene, polyvinyl chloride or other suitable plastic material. At one end of the set, there is a relatively large manipulator fitting 13 which surrounds and mounts the needle 10 and facilitates handling thereof. At the other end of the set, is a smaller needle manipulating fitting 14 which surrounds and mounts the needle 11. In accordance with usual practice, the needle 10, mounted in the large manipulator 13, is inserted through the self-sealing stopper of a suitable evacuated container, not shown, while the needle 11, mounted in the small manipulator 14, is inserted into the donor. The pressure differential between the needles 10 and 11 causes a flow of blood through the tube 12 and into the evacuated container. To control the rate of flow of blood through the tube 12 a suitable clamp is provided for the tube. For example, one or more conventional V-shaped slots may be provided in the fitting 13, into which the tube 12 may be forced to constrict the passage through the tube. Other equivalent clamping devices, not integral with the manipulator, can also be used.

The improved manipulator shown in Figs. 2-5 corresponds to the large manipulator 13 of Fig. 1, and is generally of cylindrical shape, having an outside diameter in the order of one-half inch. A flange 16 is provided at one end of the manipulator 13, and a similar flange 17 is provided between the ends of the manipulator in spaced relation to the end flange 16. Together, the flanges 16, 17 facilitate gripping and handling of the manipulator.

In its most common form, the large manipulator 13

has a length of approximately one and one-half inches, and has an enlarged cylindrical recess 18 extending from its inner or right-hand end throughout a substantial portion of the length of the manipulator. The V-shaped slot or slots 15 are formed in the cylindrical wall of the manipulator 13 at the inner end thereof, with the slot diverging toward and opening at the inner end of the manipulator.

Intermediate the ends of the manipulator 13 and forming an integral part thereof, is a chuck or gripping portion 19. The chuck 19 projects toward the outer end of the manipulator 13, within an outwardly opening recess 20 therein, and terminates inwardly of the outer end of the manipulator. The outer portion of the chuck 19 has a cylindrical opening 21 disposed concentrically with respect to the manipulator 13 and merging at its inner end with a tapered opening 22. In accordance with the invention, the outer walls 23 of the chuck 19 taper inwardly toward the outer end of the manipulator, substantially in the manner indicated in Fig. 2. In addition, the plurality of outwardly opening slots 24 are provided in the walls of the chuck 19, dividing the outer end of the chuck into a plurality of segments.

In the form of the invention shown in Figs. 2-5, the cylindrical opening 21 in the chuck 19 may have a diameter of approximately 0.095 of an inch, sufficient to freely accommodate the tubing 12 having a diameter of approximately 0.082 of an inch. In the assembly of the donor set, one end of the tube 12 is inserted into the manipulator 13, from the inner end thereof, and passed through the chuck 19. The hollow needle 10, having an outside diameter of approximately 0.060 of an inch, is then inserted within the tube 12, having an inside diameter of approximately 0.050 of an inch, until the end of the tube abuts against the flange 25a of a collar 25 secured to the shank of the needle intermediate its ends. In this respect, it will be noted that the inside diameter of the tube 12 is sufficiently less than the outside diameter of the needle 10 to cause the end of the tube to be deformed and expanded slightly when the end of the needle is inserted therein.

When the tube 12 and needle 10 are thus assembled, the butt end of the needle 10 is pushed into the cylindrical opening 21 in the chuck 19, until the flange 25a abuts against the outer end of the chuck, substantially as shown in Fig. 3. The inwardly projecting portion of the needle 10, being of somewhat greater length than the opening 21 in the chuck 19, projects into the tapered opening 22. The assembled needle and tube have a total outside diameter of approximately 0.089 of an inch, and will therefore be freely accommodated in the chuck 19 having an opening of 0.095 inch.

To complete the manipulator assembly, and firmly seal and grip the assembled tube and needle, an end or wedge cap 26 is inserted within the cylindrical recess 20. In accordance with the invention, the cap 26 has inwardly projecting walls, the inner surface 28 of which diverges outwardly and is generally complementary to the tapered outer walls of the chuck 19. The cap also has a large diameter cylindrical recess 29 adapted to be closely received about the flange 25a of the collar 25, and a smaller diameter cylindrical opening 30 adapted to be received about the neck of the collar 25.

As shown in Fig. 4, after the assembled needle and tube are inserted within the chuck 19, the inwardly projecting walls of the wedge cap enter the tapered annular area between the chuck 19 and recess 20. Pressure is then applied to the cap 26 to urge it into the recess 20, causing the tapered wall surface 28 of the cap to press upon the outer walls 23 of the chuck, urging the segments of the chuck inwardly, closing the opening therethrough to approximately 0.081 of an inch, and pressing the segments into tight engagement with the outer walls of the plastic tube 12. The side walls of the tube 12 are thereby compressed about 0.007 of an inch,

and the tube 12 is firmly pressed against the outer wall of the needle 10 to form a good seal therewith. In addition, a slight deformation of the tubing is caused to cold flow of the plastic material, as indicated at 12a, so that the tube 12 is both frictionally gripped and locked in place within the chuck 19. The chuck segments press against the walls of the tubing over a length of approximately one-eighth to one-fourth inch, so that a substantial gripping area is afforded.

In the complete manipulator assembly, as shown in Fig. 4, the wedge cap 26 is tightly secured in the fitting 13 by the frictional engagement between the projecting walls of the cap and the walls of the recess 20 and chuck 19. The needle 10 is provided with rigid mechanical support, restraining axial movement of the needle by the end of the chuck 19 and the end cap 26, which confine and support the flanged collar 25; and the tube 12 is firmly secured to the butt end of the needle as well as sealed therewith by the inward pressure of the chuck segments 19. In actual practice, the tube 12 is secured so tightly to the needle 10 that the plastic material of the tube will rupture before the tube will release from the chuck 19, while at the same time the possibility of rupturing the tube by applying excessive clamping pressure is wholly obviated.

The form of the invention shown in Fig. 6 is similar to that shown in Figs. 2-5, except that the features of the manipulator of Fig. 6 are such as to make it of small overall size, similar to the small manipulator 14 in Fig. 1. Thus, the manipulator 40 of Fig. 6 comprises an elongated body portion 41 of relatively small diameter having a recess 42 therein opening at the inner or right-hand end of the manipulator and extending throughout a substantial portion of its length. At its outer end, the body portion 41 has a shoulder 43 and a plurality of forwardly projecting chuck segments 44, forming an integral part of the body portion 41. A cylindrical opening 45 extends through the chuck segments 44, and joins with a diverging opening 46 merging at its inner end with the recess 42.

In accordance with the invention, the outer surfaces of the chuck segments 44 are tapered, and are adapted to closely interfit with the diverging inner surface 46 of a wedge cap 47. Preferably, the wedge cap 47 has the same outside diameter as the body portion 41.

The manipulator 40 is assembled by inserting the end of a plastic tube 48 into the recess 42 and through the cylindrical opening 45 defined by the chuck segments 44. The end of the tubing is then placed over the butt end of a needle 49 having a flanged collar 50 in its mid-portion. The cylindrical opening 45 defined by the chuck segments 44 is initially about 0.095 of an inch in diameter, and is adapted to freely receive the assembled tube and needle, with the flange 50a of the collar 50 engaging an abutment surface formed by the forward ends of the chuck segments 44.

After the assembled needle and tube are fully inserted in the chuck, the wedge cap 47 is applied over the end of the needle and pressed onto the chuck segments 44 until the end of the cap engages the shoulder 43 on the body portion 41. When the cap 47 is thus applied, the diverging surfaces 46 thereof press inwardly upon the tapered outer surfaces of the chuck segments 44, causing the segments to be pressed inwardly and urged into tight engagement with the walls of the tube 48. The final diameter of the opening through the chuck segments 44 is about 0.081 of an inch, so that the side walls of the tube are compressed to about one-half their original thickness. The tube and needle are thus sealed together and firmly secured in the manipulator 40, in the manner desired. The needle 49 is also mechanically supported by reason of the confinement of the flange 50a between the outer end of the chuck segments 44 and the wedge cap 47.

Where desired, the wedge cap 47 may be provided

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with an axial groove or recess adapted to engage with parts of the needle hub or collar 50 to properly orient the needle 49 in the manipulator.

In the form of the invention shown in Figs. 7-9, a large manipulator 60 has a chuck 61 forming an integral part of the manipulator and comprising a plurality of chuck segments 62 which project inwardly of the manipulator, from a point near the outer end thereof. At the outer end of the manipulator 60 is a large diameter cylindrical recess 63 of short axial length joining a second cylindrical recess 64 of smaller diameter. The recess 64 connects with a tapered opening 65, concentric with the chuck 61, which extends from the chuck to the outer end of the fitting and increases in diameter toward the outer end. The tapered opening 65 terminates short of the inner end of the chuck 61 and joins with a cylindrical opening 66 extending through the inner end portion of the chuck.

In accordance with the teachings of the invention, the diameter of the cylindrical opening 66 is about 0.082 of an inch, or just large enough to receive the end portion of a plastic tube 67. In assembling the manipulator, the tubing 67 is inserted through the chuck 61 from the inner or right-hand end of the manipulator and is projected beyond the outer end of the manipulator. The projecting end of the tubing 67 is then ensleeved over the butt end of a needle 68 having a flanged collar 69 intermediate its ends. When the tube and needle are assembled together, the portion of the tube surrounding the needle is about 0.089 of an inch in diameter, or slightly greater diameter than the normal diameter of the tube, and hence of greater diameter than the opening 66 in the chuck 61. Accordingly, when the assembled tube and needle are inserted through the tapered opening 65 into the chuck 61, the chuck will be urged to expand, and this is permitted by providing a plurality of slots 70 dividing the inner end portion of the chuck to a plurality of segments 61'.

Although the individual segments 61' of the chuck 61 will expand or spread apart upon insertion of the assembled needle and tube, the inherent resilience of the segments 61' will cause the segments to press tightly against the tube and needle to form a seal therebetween and to firmly secure the parts in the manipulator. The side walls of the tube will also be compressed, causing a cold flow of the plastic material and forming bulges at the ends of the chuck to lock the tube in place in the chuck.

When the needle 68 is fully inserted in the manipulator 60, the flange 69a of the collar 69 is received in the cylindrical recess 64 and abuts against a shoulder 64a at the inner end of the recess. An apertured disc 71 is then applied over the needle 68 and collar 69, and received within the recess 63. The disc 71 overlies the flange 69a and serves to confine the flange within the recess 64. The disc 71 is cemented or otherwise secured in the recess 63, thereby providing mechanical support for the needle 68.

In the form of the invention shown in Figs. 10 and 11, a manipulator 80 is formed of a single piece of plastic material. At its inner or right-hand end, the manipulator 80 has a generally cylindrical recess opening at the inner end of the manipulator and extending throughout a substantial portion of its length. Near the outer end of the manipulator 80 is an opening 82 of reduced (approximately 0.082 inch) diameter which, in the preferred form, has tapered side walls diverging slightly in either direction from the central portion of the opening. At its inner or left-hand end, the opening 82 communicates with the recess 81, and at its outer end, the opening 82 communicates with an opening 83 having tapered walls diverging toward the outer end of the manipulator. In accordance with the invention, the minimum diameter of the opening 82 is slightly greater than the outside diameter of the needle 84 (approx-

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mately 0.060 inch) to be received in the manipulator but slightly less than the diameter of the assembly comprising the needle 84 and the end portion of a tube 85 (approximately 0.089 inch).

To assemble the manipulator 80 with the needle and tube 84, 85, the tube 85 is first inserted through the manipulator from the inner end thereof. The butt end of the needle 84 is then ensleeved by the end of the tube, deforming the walls of the tube outwardly a slight amount. The assembled tube and needle are then inserted into the manipulator 80 through the tapered opening 83 at the outer end thereof, until the flanged collar 86 on the needle abuts against the outer end of the manipulator. When the needle is fully inserted into the manipulator, the inwardly projecting portion thereof extends through the small diameter opening of the chuck portion 82 and into the recess 81. The annular space between the inner portion of the needle and the walls of the chuck portion 82 is somewhat less than the normal wall thickness of the tubing 85, and consequently the tubing is deformed and partly extruded out of the small annular space. The tubing, being of polyethylene, polyvinyl chloride or similar material, flows slightly toward the ends of the opening 82 and forms bulges, as at 85a, 85b. This simultaneously seals the tubing with the needle 84, and firmly locks the assembled needle and tubing in place in the manipulator 80 in the manner desired.

In the form of the invention shown in Fig. 12, an adaptor 90 is employed to accommodate a needle 91 of small size. As in the other forms of the invention, the small diameter needle 91 is provided with a flanged collar 92, the flange 92a of which engages an abutment surface formed at the forward end of a chuck 93 forming part of a manipulator 94. The shank or butt end 91a of the needle is, however, somewhat smaller than the opening in the chuck 93 and the passage in the tube 95. Accordingly, a sleeve-like adaptor 90, having an outside diameter approximately equal to the outside diameter of a standard needle, is received over the butt end 91a of the needle 91. The tubing 95 is then ensleeved over the adaptor 90, and the assembled needle, adaptor and tubing are inserted into the chuck 93, substantially as shown in Fig. 12. All of the advantages of the invention are retained when the adaptor 90 is employed, since the tube 95 is gripped and sealed in the same manner, and the flange 92a provides rigid mechanical support for the needle 91, to resist axial forces applied against the needle.

For purposes of illustration, the manipulator 94 indicated in Fig. 12 is equivalent to that shown in Figs. 2-5. However, it will be understood that the adaptor element may be incorporated in any of the modifications contemplated by the invention.

In all forms of the invention, the resilient nature of the plastic manipulator or tubing is utilized to effect the application of sealing and securing pressure on the walls of the tubing surrounding the inner end of the needle, such sealing and securing pressure being applied in the absence of permanent deformation of the material forming the gripping portions of the manipulator. At the same time, the needle is provided with rigid mechanical support by means of a flanged collar abutting against a portion of the manipulator. The arrangement is such that axial forces applied to the needle, while inserting the needle into a container or into the arm of a donor, are wholly isolated from the chuck portion of the manipulator, in which the tube and needle are gripped and sealed.

In all of its forms, the new manipulator is of inexpensive design, being adapted for manufacture by ordinary plastic molding techniques. In this respect, the new manipulator provides for substantial economies in the manufacture of donor sets. Moreover, the assembly of the donor sets is substantially simplified with the

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manipulator of the invention, resulting in substantial savings in labor costs, as will be readily understood.

Since the various forms of the invention herein specifically illustrated and described are intended to be representative only, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. A needle manipulator assembly for a blood donor set comprising in combination a hollow needle having a butt end and a pointed end, a section of deformable plastic tube of circular cross-section ensleeved over the butt end of said needle and extending along the side wall thereof, a manipulator ensleeved over the butt end of said needle and said tube, said manipulator having an inner end and an outer end and having an integral portion forming a chuck, said chuck having a plurality of resilient segments surrounding said tube and the butt end of said needle to compress said tube toward said needle to secure said tube and needle together, the chuck segments having tapered outer surfaces converging toward the outer end of said manipulator, and means to urge said segments toward the walls of said needle comprising a wedge cap received about said segments and having a tapered inner surface complementary to the tapered surfaces of said chuck segments.

2. The needle manipulator assembly of claim 1, further characterized by said manipulator having a cylindrical recess in its forward end, said chuck segments being projected into said recess and toward the outer end of said manipulator, and said wedge cap having cylindrical outer walls adapted to be received snugly in said recess to close off the outer end thereof.

3. The needle manipulator of claim 1, further characterized by said needle having means forming a flange between its butt and pointed ends, said chuck segments forming an abutment engaging said flange and providing rigid mechanical support for said needle, and said wedge cap being received over said needle and engaging said flange to retain said flange in engagement with said abutment.

4. A needle manipulator assembly for a blood donor set comprising in combination a hollow needle having a butt end and a pointed end, means forming a flange between the butt and pointed ends of said needle, a section of a deformable plastic tubing ensleeved over the butt end of said needle and extending along the

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side wall thereof, and a manipulator ensleeved about the butt end of said needle and having a chuck gripping said tubing and holding said tubing against the side wall of said needle, said manipulator having abutment means near its outer end engaging said flange and providing rigid mechanical support for said needle, said chuck surrounding said tubing and needle and gripping said tubing, and said chuck comprising a plurality of resilient chuck segments.

5. A needle manipulator assembly for a blood donor set comprising a hollow needle having a butt end and a pointed end, means forming a flange between the butt and pointed ends of said needle, a length of hollow flexible tubing of circular cross-section ensleeved over the butt end of said needle, and needle manipulator means for mounting said needle and for sealing and securing said needle and tubing together, said manipulator means comprising an elongated generally cylindrical member having inner and outer ends and having an opening extending longitudinally throughout, the inner end portion of said opening being of greater diameter than said tubing, said manipulator means having a chuck portion intermediate its ends, said opening extending through said chuck portion and having a diameter within said portion which is less by a predetermined amount than the diameter of said tubing and needle when assembled together, said opening including a tapered portion adjoining the opening through said chuck portion and decreasing in diameter toward said chuck portion, said chuck portion surrounding said tubing and needle and gripping said tubing, said chuck portion including a plurality of resilient segments, and said manipulator means including a cap member for urging said segments toward said tubing.

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