Inventors:
Alexander M. Brown
Wayne K. Carrico
By: Spence, Wiegner, Allen,
Stelmen & McCord Ottis
ABSTRACT OF THE DISCLOSURE

Physiological fluid transfer apparatus including a double ended needle provided with a hub mounted in a holder. One end of the needle is adapted to be urged through a plug closing one end of an evacuated tube. The hub is provided with an annular shoulder adapted to engage the sealing closure of the evacuated tube circumjacent the needle point to prevent movement of the closure with the laterally adjacent portions of the holder. The tube and holder are further provided with coordinating indicia means to indicate a disposition of the tube relative to the holder wherein the needle is implanted in the closure short of penetration thereof into the evacuated interior of the tube.

This invention relates to apparatus for transferring physiological fluids and in particular to apparatus for transferring selectively to or from a suitable container fluids such as blood or the like through a cannula.

One conventional form of physiological fluid transferring apparatus comprises a blood collecting means having an evacuated tube provided with a rubber or plastic stopper adapted to be penetrated by an inner end of a hollow needle, or cannula, with the outer end of the cannula inserted subcutaneously into a person's vein. To facilitate the blood collection, it is desirable to provide in association with the cannula a holder which may be a deep cup-shaped member secured to a mid-portion of the needle and adapted to receive coaxially therein the end of the evacuated tube provided with the pierceable stopper, thus, in use the evacuated tube may be pressed against the inner end of the cannula with the holder after the outer end of the cannula is inserted in the person's vein whereupon blood may flow from the person's vein through the cannula and into the tube under the force of the original vacuum therein and the pressure of the blood in the vein.

The known constructions of the above described apparatus have a number of serious disadvantages materially limiting the usefulness and facility of use. More specifically, one problem arising with the known apparatus of this type is undesirable adherence of the stopper, or closure, portion of the tube with the end wall of the holder thereby causing substantial difficulty in the removal of the collected blood sample from the apparatus. The abutment of the stopper with the end wall of the holder has heretofore been required as means for indicating to the user a suitable ful penetration of the stopper by the cannula inner end. Another problem of the known constructions is the necessity for accurately positioning the holder on the mid-portion of the cannula so as to assure the proper penetration of the tube stopper when the stopper abuts the holder end wall while yet avoid unnecessary excessive length of the needle. Thus, a serious cost problem has arisen in the known blood collecting means due to the need to maintain exceedingly high dimensional tolerances in the several structures of the apparatus.

It is further desirable to provide in such collecting means some means for indicating a partial insertion of the cannula inner end in the stopper so that prior to the insertion of the outer end into the person's vein the inner end may be embedded partially within the closure but not sufficiently to be in fluid communication with the interior of the tube. Thus, only a small amount of additional movement of the tube need be subsequently effected after the outer end is inserted in the person's veins, thereby substantially facilitating the blood collection and making the collection less disagreeable to the person from which the blood is taken. Here again it is necessary to provide high degrees of dimensional accuracy to assure such desirable positioning of the cannula inner end within the stopper during this stage of the collection operation. Indicia means heretofore provided on the holder for use in judging this positioning of the tube relative to the holder for gauging this desirable limited penetration of the needle have not proven completely satisfactory because of relative difficulty in use.

The present invention comprehends a new and improved fluid transferring apparatus, such as for use in blood collection, eliminating the above discussed disadvantages of the known fluid transferring apparatuses in a novel and simple manner.

One feature of the present invention, therefore, is the provision of a new and improved apparatus for transferring physiological fluids and the like.

Another feature of the invention is the provision of such apparatus having new and improved means for controlling the penetration of the stopper of a fluid transfer container by a fluid transfer cannula, or needle.

A further feature of the invention is the provision of such apparatus wherein the means for controlling the penetration of the stopper by the cannula effectively precludes undesirable retention of the stopper in association with the holder subsequent to a fluid transfer operation. A still further feature of the invention is the provision of such apparatus wherein the abutting means comprises an extension of a hub secured to the cannula and removably carried by the holder.

Still another feature of the invention is the provision of such an apparatus wherein the hub is threaded into an annular boss on the holder end wall and the hub is provided with a stop collar for limiting the threading thereof into said boss to accurately dispose the inner end of the hub in spaced relationship to the end wall of the holder.

A still further feature of the invention is the provision of such an apparatus having means on the tube for alignment with the distal end of the holder to indicate the disposition of the tube wherein the cannula end is embedded in the tube stopper while yet out of fluid communication with the interior of the tube.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a diametric section of a fluid transfer apparatus embodying the invention;

FIGURE 2 is a diametric section similar to FIGURE 1, but illustrating the arrangement of the evacuated tube in the blood collecting means of the apparatus;

FIGURE 3 is an end view thereof, looking upwardly from the bottom of the apparatus, as shown in FIGURE 1;

FIGURE 4 is an enlarged fragmentary diametric section of the apparatus as arranged in FIGURE 1; and

FIGURE 5 is an enlarged fragmentary diametric section of the apparatus as shown in FIGURE 2.

Patented Aug. 6, 1968
In the exemplary embodiment of the invention as disclosed in the drawing, a fluid transfer apparatus generally designated 10 is shown to comprise a cannula, or hollow needle, 11 having a first sharp tip, or end, 12 and an opposite sharp tip, or end, 13. The cannula is secured to a cup-shaped holder, or carrier, 14 by means of a hub 15 fixedly secured to the cannula so as to dispose the tip 13 within an open ended space 16 defined by the holder 14 adapted to receive a container, or tube, 17 having a stopper, or closure, 18 at one end adapted to be penetrated by the cannula end 13 as a result of movement of the tube 17 coaxially downwardly into the space 16 to the position of FIGURE 2. In this position, fluid transfer may be effected between the interior space 19 of the tube 17 and the outer end 12 of the cannula. Thus, for example, assuming that the tube 17 is to be used for blood collection, the disposition of the tube in the arrangement of FIGURE 2 permits blood to be drawn from a person's vein through the cannula end 12 and into the tube space 19 under the force of the original vacuum in the space 19 and the pressure of the blood in the vein. Upon collection of the desired quantity of blood the tube 17 is withdrawn axially outwardly relative to the cannula until the end 13 is out of communication with the space 19, whereupon further collection of blood is terminated.

The invention comprehends the provision in apparatus 10 of improved means for controlling the penetration of the stopper 18 by the cannula end 13. More specifically, as best seen in FIGURES 4 and 5, the stopper 18 includes an outer portion 20 having a planar outer end surface 21. The portion 20 is diametrically somewhat larger than the diameter of the tube 17 so as to overlie the end of the tube. The stopper further includes an inner portion 22 received within the tube end and having an inner end surface 23 provided axially with an inwardly opening recess 24. The stopper is preferably formed of a resilient material such as rubber, plastic, or the like, which may be readily installed into the end of the tube 17 with the space 19 within the tube being evacuated as desired.

The holder 14 herein comprises a deep cup-shaped member having a tubular side wall 25 provided at one end with an end wall 26 and, at the opposite end, defining an opening 27 to space 16. The stopper portion 20 is slightly smaller in diameter than the internal diameter of the side wall 25 to permit facilitated axial movement of the tube 17 through space 16. The end wall 26 is provided with an annular outwardly projecting boss 28 having a threaded bore 29 opening through an axially inner surface 30 confronting surface 16. As shown in FIGURE 4, surface 30 herein comprises a planar surface defining the inner end of the space 16. The distal end 31 of the side wall 25 may be turned to define a flange, as best seen in FIGURES 1 and 3. The holder 14 may be formed as by molding from a suitable material such as a plastic.

The cannula 11 comprises a conventional hollow needle structure formed of a suitable material such as stainless steel. The hub 15 is secured to the needle intermediate its ends 12 and 13 and is provided with an externally threaded portion 32 adapted to be threadedly received in the threaded bore 29 of the boss 28 for securing the needle coaxially in the holder end wall 26 with the inner end 13 spaced substantially inwardly from the wall surface 30 and the outer end 12 spaced substantially inwardly from the boss 28. The hub 15 herein is further provided with a collar 33 axially outwardly of the threaded portion 32 which is adapted to engage the outer end of the boss 28 at the limit of threading of the portion 32 into bore 29, thereby accurately positioning the cannula 11 axially in the end wall 26.

As best seen in FIGURE 5, means are provided for limiting the inward movement of the tube 17 into space 16 so as to maintain the end surface 21 of the stopper 18 spaced from the surface 30 of the holder end wall 26 at the innermost disposition of the tube 17. More specifically, the means for limiting the inward movement of the tube herein comprises a cylindrical projection 34 of the hub 15 extending axially inwardly from the threaded portion 32 to project a preselected distance inwardly from the holder surface 30 and thereby dispose an inner end surface 35 at a preselected distance from the surface 30 for abutment by the portion 36 of the stopper surface 21 immediately surrounding the cannula portion. The spacing between stopper surface 21 and holder surface 30 is made to be sufficiently great so that dimensional variations between the holder and hub may be readily accommodated without permitting the surfaces 21 and 30 to engage. On the other hand, the mounting of the hub 15 on the cannula, or needle, 11 may be readily accomplished so that the spacing of the cannula end 13 inwardly from the inner surface 35 of the hub projection 34 may be accurately preselected to be received fully within the space 19 in tube 17 after passing through the stopper 18. As shown in FIGURE 5, the recess 24 permits facilitated movement of the needle end 13 into space 19 by making the axial length of the center portion 37 of the stopper relatively short while yet the inner portion 22 thereof may have substantial length for positive sealed engagement with the tube wall.

By limiting the movement of the stopper 18 by its abutment with the relatively small surface 35 of the hub projection 34, removal of the tube from the holder subsequent to a blood transfer may be readily effected as a result of the effective elimination of substantial suction holding forces and to occur in the conventional apparatus of this type wherein the outer surface of the stopper is permitted to engage the end wall of the holder. Further, the small area of the surface 35 effectively precludes a radial expansion of the stopper portion 20 sufficient to cause engagement thereof with the side wall 25 of the holder as sometimes occurs with the known apparatus and which, again, effectively bars removal of the tube 17 from the holder as a result of the suction built up in the space 16 between the end wall 26 and the closure portion 20 in attempting to remove the tube under these conditions. Still further, the provision of the small stop 34 in fixed accurate association with the cannula 11 effectively minimizes the cost of construction of the fluid transfer apparatus, while yet assuring high accuracy in the disposition of the cannula end 13 relative to the inner surface 33 of the stopper. The projection 34 may be formed integrally with the stop 20 or may be formed of a suitable material such as plastic, or metal, thereby effectively minimizing the cost of the structure.

As shown in FIGURES 1 and 2, the tube 17 may further be provided with an indelible 38 comprising a line extending circumferentially of the tube adjacent the other end 39 thereof which is accurately positioned on the tube so as to be aligned with the outer end surface 40 of the holder and flange 31 when the cannula end 13 is disposed within the closure 18, but yet in communication with the tube space 19. As the mark 38 is readily observable at all times relative to the outer surface 40 of the holder flange 31, the disposition of the tube in the position of FIGURES 1 and 4 is readily effected with a high degree of accuracy. Therefore the know apparatuses have employed difficult-to-read indicia means on the holder requiring the observation of the disposition of the inner portion of the tube or stopper at times resulting in the over-insertion of the cannula end so as to provide communication with the space 19 prior to the insertion of the opposite end 12 in the person's vein, thus destroying the vacuum and requiring the substitution of another tube. While the invention has been described primarily in connection with the use of the apparatus as a blood collecting apparatus, it is obvious that the apparatus may be arranged to function as a means for delivering fluid from a filled tube 17 through the cannula end 12.

While we have shown and described one embodiment of our invention, it is to be understood that it is capable
of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. In an apparatus for transferring physiological fluids including a cannula having opposite ends and a hub intermediate said ends, holder means mounting said cannula hub and a tube provided with a sealing closure having an outer end surface arranged to be penetrated by one of said cannula ends, means for controlling the extent of penetration of said one cannula end through said outer end surface comprising means associated with said hub defining a flat annular shoulder for abutting the portion of the outer end surface of said sealing closure contiguous to the portion thereof penetrated by the cannula for preventing abutment of said outer end surface with said holder means.

2. The apparatus of claim 1 wherein said outer surface of said sealing closure is substantially planar and said sealing closure is provided with an inner end surface being an inwardly opening center recess having a transverse extent greater than that of said annular hub shoulder.

3. In an apparatus for transferring physiological fluids including a cannula having opposite ends, a hub fixedly secured coaxially on said cannula intermediate said ends and having an external thread, a cup-shaped holder having an end wall provided with a threaded bore, said hub being threadedly secured to said holder in said bore to project a preselected distance inwardly from said end wall, and a tube provided with a sealing closure having an outer end surface arranged to be penetrated by one of said cannula ends, means for controlling the extent of penetration of said one cannula end through said outer end surface comprising an extension of said hub inwardly from the threaded portion having a planar end surface arranged for abutting the portion of the outer surface of said sealing closure contiguous to the portion thereof penetrated by the cannula and preventing abutment of said end surface with said end wall; and means on said tube for indicating a disposition of the tube within said holder wherein said one cannula end is embedded within said closure out of communication with the interior of said tube and spaced from said planar end surface of said hub.

4. The apparatus of claim 3 further including stop means fixedly associated with the hub for engaging a portion of said holder wall for limiting the threading of the hub into said bore whereby said end surface of the hub is accurately positioned a preselected distance inwardly of the plane of said holder end wall.

5. The apparatus of claim 3 wherein the end wall is provided with an annular boss defining said threaded bore and having an outer end, said apparatus further including a collar on said hub for engaging said outer end of the boss for limiting the threading of the hub into said bore whereby said end surface of the hub is accurately positioned a preselected distance inwardly of the plane of said holder end wall.

6. The fluid transferring apparatus of claim 1 wherein said holder means includes a wall extending radially outwardly from said hub and said means associated with the hub prevents abutment of said tube end surface with said wall.

7. The fluid transferring apparatus of claim 1 wherein said hub is removably mounted on said holder means.

8. The fluid transferring apparatus of claim 1 wherein said holder means includes a side wall extending parallel to the axis of the cannula and substantially beyond one of said cannula ends for guiding said sealing closure coaxially of said one cannula end during penetration of said closure thereby.

9. The apparatus of claim 8 wherein said tube is provided with indicia means spaced from said closure and said side wall is provided with a distal end spaced from said hub a preselected distance such that said one end of the cannula is embedded within said closure short of communication with the interior of said tube when said indicia means is aligned with said distal end.

References Cited

UNITED STATES PATENTS

3,123,073 3/1964 Barr et al. 128—276
3,141,460 7/1964 Tsoczatopulos 128—276
3,162,195 12/1964 Dick 128—276
3,200,813 7/1965 Christakis 128—2

RICHARD A. GAUDET, Primary Examiner.

S. BRODER, Assistant Examiner.