Aug. 6, 1968 A. M. BROWN ETAL 3,395,696

PHYSIOLOGICAL FLUID TRANSFER APPARATUS

Filed June 22, 1965

Fig. 1.

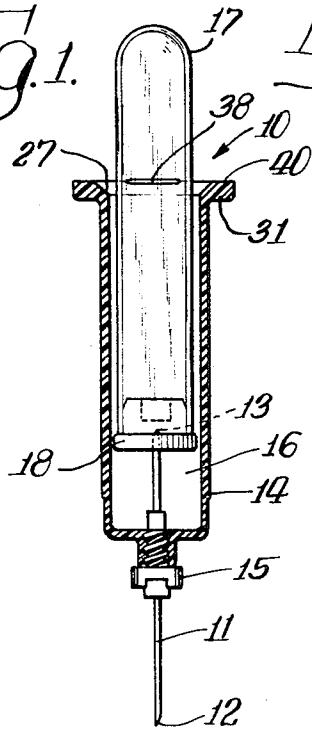


Fig. 2.

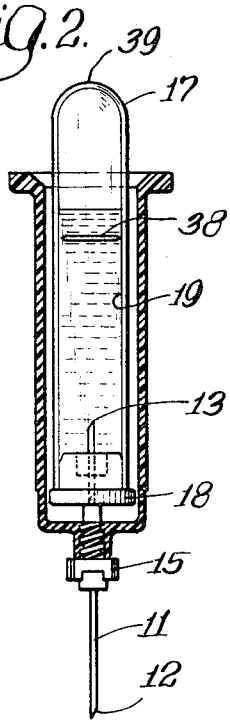


Fig. 3.

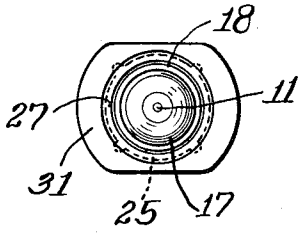


Fig. 4.

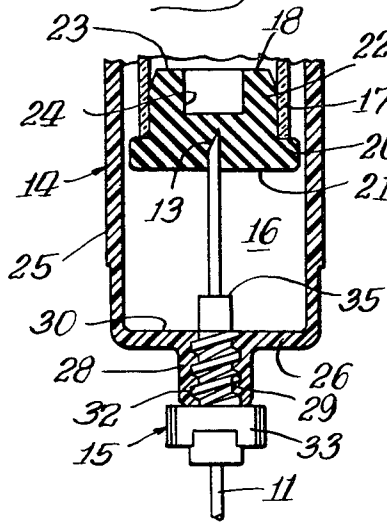
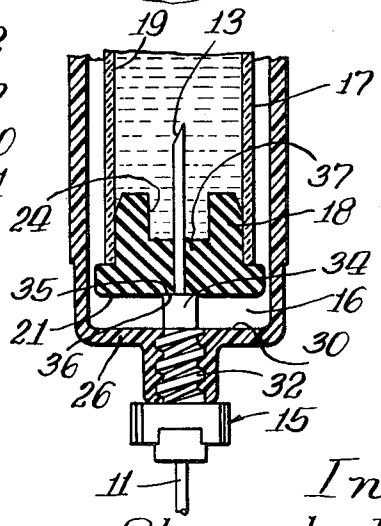


Fig. 5.



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PHYSIOLOGICAL FLUID TRANSFER APPARATUS

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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 to prevent engagement 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 within 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 apparatuses 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 a means for indicating to the user a suitable full 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 tansferring 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 an 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 an apparatus wherein the penetration control means comprises a means on the holder for abutting the portion of the closure immediately surrounding the cannula penetration while maintaining the portion of the closure laterally outwardly thereof spaced from the holder.

A 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 position;

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.

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 end 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 space **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 outwardly 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 penetration. 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 accurately controlled 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 as often occur in the conventional apparatuses 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 apparatuses and which, again, effectively hampers 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 diposition of the cannula end **13** relative to the inner surface **23** of the stopper. The projection **34** may be formed integrally with the hub and 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 indicium **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 not 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. Heretofore, 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.

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