July 21, 1964 P. P. TSOCHATZOPOULOS 3,141,460

BLOOD COLLECTING ASSEMBLY

Filed July 7, 1961 2 Sheets-Sheet 1

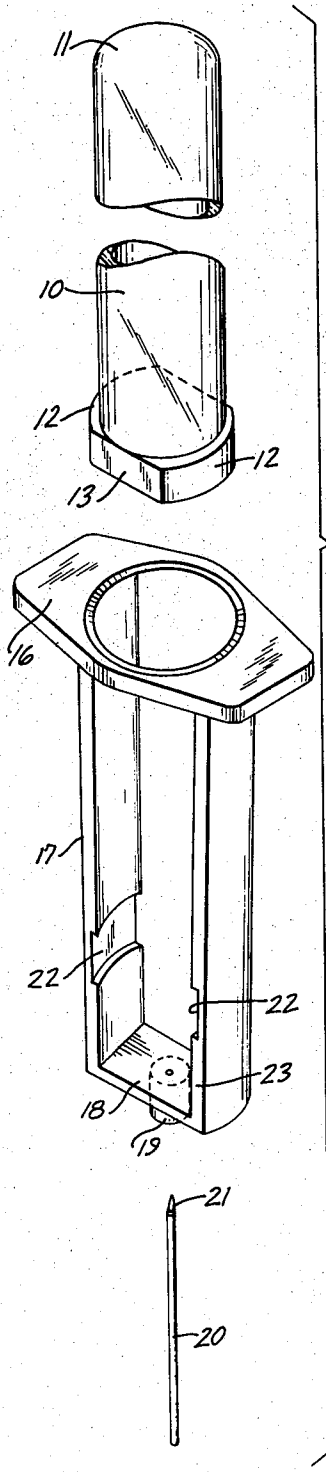

FIG. 1

FIG. 2

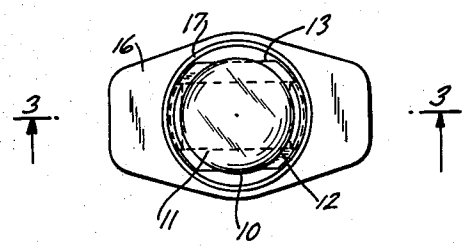

FIG. 3

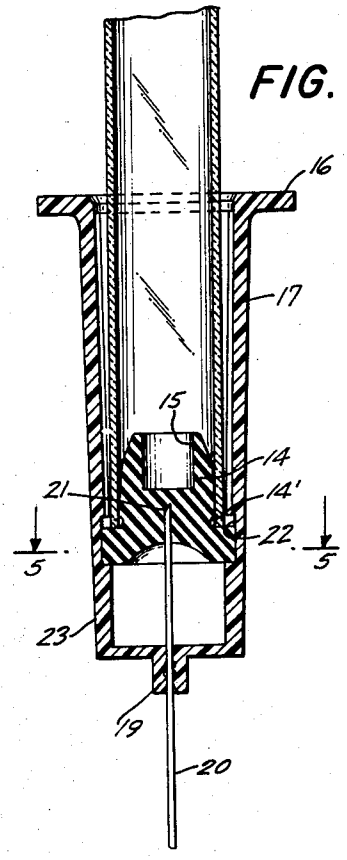

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FIG. 4

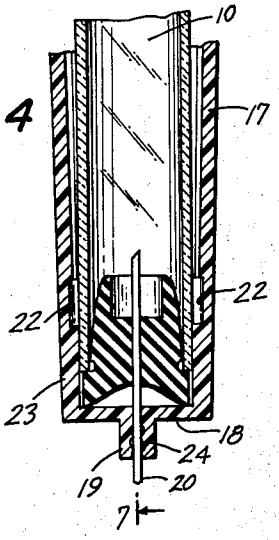


FIG. 5

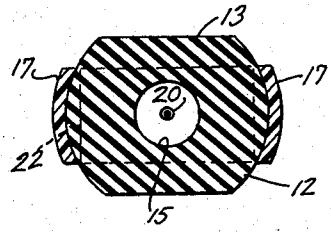


FIG. 6

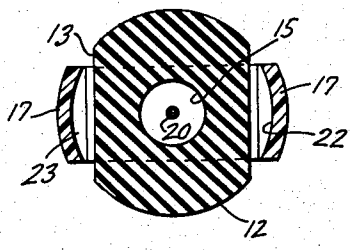


FIG. 8

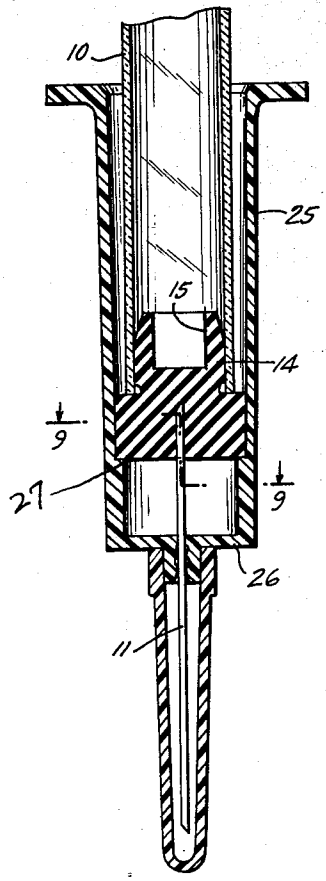
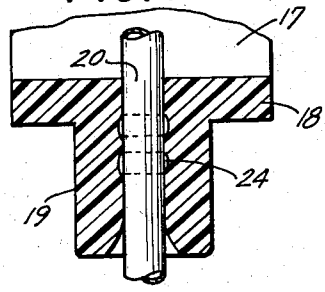


FIG. 7



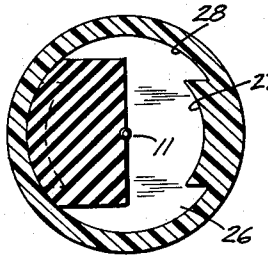


FIG. 9

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BLOOD COLLECTING ASSEMBLY

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This invention relates to a structurally and functionally improved blood collecting assembly, and in its more specific aspect aims to provide an assembly of alternate and/or improved type over that disclosed in the prior United States patent to Joseph J. Kleiner 2,460,641 of February 1, 1949.

It is an object of the invention to furnish an assembly which may be efficiently operated by a person lacking mechanical skill.

A further object is that of furnishing an assembly involving components of improved design.

Still another object is that of designing an apparatus which will include relatively few parts, each individually rugged and simple in construction and capable of economical production and in which those parts may be readily grouped together to furnish a unitary and cooperating structure.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating practical embodiments of the invention and in which

FIG. 1 is an exploded perspective view of the parts embraced in one form of the assembly;

FIG. 2 is an end view thereof;

FIG. 3 is a sectional side view taken along the line 3—3 in the direction of the arrows of FIG. 2;

FIG. 4 is a fragmentary view similar to FIG. 3 but showing the parts in a different position;

FIG. 5 is a transverse sectional view taken along the line 5—5 in the direction of the arrows as indicated in FIG. 3;

FIG. 6 is a similar view but showing the parts shifted to a different position;

FIG. 7 is a fragmentary enlarged sectional side view of the forward end of the holder;

FIG. 8 is a fragmentary sectional side view similar to FIG. 3 but showing an alternative structure; and

FIG. 9 is a transverse sectional view taken along the line 9—9 in the direction of the arrows as indicated in FIG. 8.

Referring to FIGS. 1–3, the numeral 10 indicates a tube conveniently formed of glass and having a closed rear end 11. Its opposite end is open but sealed by a stopper. The interior of the tube is under a condition of vacuum. The stopper will preferably include a head portion embracing rounded end edges 12 and side edges 13 intervening the same. As illustrated, side edges 13 are flat. However, such edges may alternatively have a slightly oval shape. Integral with this head portion is a plug 14 which is conveniently formed with a groove 14' adjacent the zone of juncture with the head and may be counterbored as at 15. The stopper is formed of resilient material such as rubber and is forced into seating contact with the bore face of the tube so as to be under a condition of compression such that the vacuum within the interior of that tube is maintained.

The holder will include a rear or inner plate 16 formed with an aperture the diameter of which is such that the head of the stopper will freely pass therethrough. Extending forwardly or outwardly from plate 16 in line with the edge of its aperture and at opposite points therein are strips or legs 17. These elements converge towards each other and mount at their forward ends a bridging strip 18. The latter, on its outer face, may support a hub or tip 19 perforated for the passage of a cannula therethrough. That cannula will embrace a body 20 having a suitable piercing outer end (not shown) and a stopper piercing inner end 21.

The inner end of the cannula extends into the bore of the holder, or, in other words, into the space between the strips or legs 17. Those legs are provided with grooves 22 in their inner faces. With the illustrated proportions of the parts those grooves will lie in a plane beyond the stopper-piercing end 21 of the cannula. Outwardly of grooves 22, strips 17 may be thickened as indicated at 23 so that the forward side-wall faces of the grooves will be of a height greater than the corresponding rear faces.

While it is preferred that the diameter of the aperture in plate 16 be greater than the distance between the opposite curved edge portions 12 of the stopper head, it is also preferred that the distance between the inner faces of strips 17 at a point short of grooves 22 be substantially equal to the distance between these curved edges. Likewise, it is preferred that the inner faces of the strips or legs be transversely curved along a radius substantially equal to that defining the arcuate surfaces 12. Accordingly, as the tube assembly or structure is projected through the aperture in plate 16 or the holder, these curved edges 12 will engage with the inner faces of the strips 17. Due to the compressible nature of the stopper, it may be so projected to a point where its curved edge portions 12 are within the zone of grooves 22, into which the stopper head will expand as in FIG. 3.

While the present assembly may be used in diverse applications, it is primarly intended to be employed in the collecting of blood. This relation will, accordingly, be described. Thus, during pre-use of the assembly, as in FIGS. 1 and 3, the curved edge portions of the stopper head are aligned with strips 17 and projected forward through aperture 16 into the holder. This projection will continue until the curved edge portions 12 slideably engage the inner faces of the legs or strips 17 and, due to the converging of the latter, are slightly compressed by the same. Thereupon, the head of the stopper will ride into the spaces defined by grooves 22 within which it will expand. The dimensions of the parts should preferably be such that under this expansion the adjacent edges on the stopper head yieldingly bear to a slight extent against the base portions of grooves 22.

Therefore, the alignment of the evacuated tube will have been maintained during the projection of the latter to the zone of grooves 22, after which it will be retained against accidental displacement. Projection beyond this point will be prevented incident to the height of the forward walls defining the grooves, or in other words, the thickened portions 23 of the holder. Accordingly, even if the tube assembly is somewhat carelessly handled, the head of the stopper engaging the forward side-wall surfaces of the grooves will be prevented from further projection.

Accordingly, a condition as shown in FIG. 3 is established. Under this, the inner stopper penetrating end 21 of the cannula is embedded and sealed within the body of the stopper material. Therefore, no communication is established between the interior of the tube and the lumen of the cannula, so that the condition of vacuum within that tube will be maintained. With the assembly employed for blood collecting purposes, the operator will now grasp the holder and introduce the outer end of the cannula into the vein of a donor. Following this, the tube portion of the assembly will be axially rotated through 90°. Accordingly, the curved edge portions 12 will slide out of engagement with the base surfaces of grooves 22, or, in other words, shift from the locked position shown in FIG. 5 to an unlocked position as illustrated in FIG. 6.

In the latter view, it will be apparent that the distance between the flattened side faces 13 of the stopper head is less than the distance between the legs or strips 17 in their zone 23 of thickening. Accordingly, the tube may now be projected to the position shown in FIG. 4, at which the head of the stopper bears against the end member 18. Under those circumstances, the inner end of the cannula extends beyond the stopper into the tube bore. Therefore, aside from venous pressure, the vacuum within the tube interior will assist in the aspirating of blood through the lumen of the needle into the tube to fill the latter to the desired extent. Thereupon, the tube may be retracted to the position shown in FIG. 3 or else may be entirely withdrawn from the holder and the outer end of the cannula withdrawn from the vein of the donor.

The same result is achieved by the alternative structure shown in FIGS. 8 and 9. In the former figure it will be seen that the holder includes a tubular body 25 having its forward end closed as at 26. That end mounts a cannula 11 as previously described. In the same relative position as grooves 22 of the earlier form, the holder 25 is provided with inwardly extending portions or steps 27, as especially shown in FIG. 9. These are disposed at diametrically opposite points within the bore of the holder and are spaced a distance less than the distance between the curved edge surfaces 12 of the stopper head. Accordingly, as the latter is projected in line with them, they will act as stops to arrest inward movement of the tube. This will establish a condition such as has been shown in FIG. 8 and corresponds to the condition illustrated in FIG. 3.

Thereupon, the physician or other user will proceed to introduce the outer end of the cannula into a vein of the donor. Following this, by rotating tube 10 edge portions 12 will be shifted substantially 90°. The distance between the inwardly extending parts 27 is less than the distance between the flattened faces 13 of the stopper. Therefore, the operator may now proceed to further project the tube groupings to a position corresponding to that illustrated in FIG. 4, with the same results as prevailed and were previously described in connection with the earlier figure. Following the collecting of the desired quantity of blood, the cannula is withdrawn from the donor's vein and the tube is retracted to free it from the holder.

In both forms of apparatus it will be understood that as this retraction occurs the aperture formed by the cannula incident to its penetrating the stopper will be closed due to the self-sealing function of the stopper inherent to its resiliency. It is also apparent that while the present teachings are of especial utility when employed in the collecting of blood and have been so described and claimed, that the apparatus may be used to advantage in withdrawing or collecting other liquids. Therefore, the word "blood" is used in a definitive, rather than a limiting, sense.

Thus, among others, the several objects of the invention as specifically aforenoted are achieved. Obviously, numerous changes in construction and rearrangements of the parts may be resorted to without departing from the spirit of the invention as defined by the claims.

What I claim is:

1. A blood collecting assembly including, in combination a rigid tube having one end closed and a pierceable stopper sealing its opposite end to maintain a condition of vacuum within its interior, a holder defining an axially extending bore slideably receiving said opposite tube end and the stopper carried thereby, a cannula mounted by the forward end of said holder and having a stopper-piercing point extending into the bore of the latter, and stop means forming a fixed part of said holder projecting into said bore and arresting the sliding movement of said tube at a zone short of that at which the piercing end of the cannula penetrates through said stopper, the stopper having a radial extension included therein providing the part engaged by said stop means, said extension having a length greater than the transverse dimension of the holder bore within the zone of said stop means and a width less than such dimension.

2. In an assembly as defined in claim 1, a head portion forming a part of said stopper and said head portion providing said extension.

3. A blood collecting assembly including, in combination a tube structure comprising a rigid tube having one end closed and a pierceable stopper sealing its opposite end to maintain a condition of vacuum within its interior, a holder defining an axially extending bore slideably receiving said opposite tube end and the stopper carried thereby, a cannula mounted by the forward end of said holder and having a stopper-piercing point extending into the bore of the latter, stop means forming a fixed part of said holder and providing an obstruction extending from its bore surface to arrest the sliding movement of said tube at a zone short of that at which the piercing end of the cannula penetrates through said stopper, said stop means engaging the stopper of said tube structure, said structure being rotatable within said bore to cause such stopper to extend to one side of said stop means whereby said tube structure is further slideable to a position at which its stopper is disposed adjacent the forward end of the holder with the piercing point of the needle penetrating through said stopper into the tube interior, said holder being formed with relatively recessed bore surfaces and said stopper having extended portions keying into said recessed surfaces to prevent relative rotation of the holder with respect to the tube and to guide such structure in its movement into said holder and restrain it against axial rotation with respect to the latter.

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