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(54) BLOOD BAG COMMUNICATION DEVICE

(71) We, TERUMO CORPORATION, a corporation organized and existing under the laws of Japan of 44-1, 2-chome, Hata-gaya, Shibuya-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to a device for allowing communication between blood bags.

The time is past in which whole blood was used to perform a blood transfusion, and now in order to make effective use of blood it is separated into components so that an appropriate blood component transfusion for each patient can be conducted. There has been proposed a so-called multiple bag which is integral, closed and sterilely sealed, and may be manipulated wholly from the outside and in which a plurality of soft plastics blood bags are interconnected by means of connection tubes. Such a multiple bag can be used, for example, to collect whole blood into a blood collecting bag and thereafter subject the collected blood to centrifugation for separating it into two parts, namely platelet-rich plasma and red blood cells, and transfer the upper layer of platelet-rich plasma into a smaller bag through the connection tube, so as to effect a two-part separation; and it can be used to subject the platelet-rich plasma to a further centrifugation for separating it into two parts, namely blood plasma and blood platelets, and transfer the upper layer of blood plasma into a still further, smaller bag through the connection tube, so as to effect a three-part separation.

40 It is necessary, when blood is subjected to centrifugation, to prevent unseparated blood from spreading to the interior of the connection tube. This is because the unseparated blood remaining in the connection tube, upon transfer of, for example, the separated platelet-rich plasma into the smaller bag, will be mixed with the plasma and

impair its purity. In the prior art, therefore, a thin film has been provided at that portion of the interior of the connection tube which is in the proximity of the blood collecting bag, to cut off communication between the blood collecting bag and the smaller blood bag. Then, after the blood has been subjected to centrifugation, this thin film is broken to restore the said communication and thereby transfer the separated plasma into the smaller blood bag. This arrangement has the drawbacks that it presents difficulties in operation and is hard for a beginner to handle. It is, moreover, troublesome to manufacture.

According to the invention, there is provided a device for use in allowing communication between blood bags comprising first tubing having one end for connection to a blood bag and connectable at its other end, by insertion one within the other, to further tubing itself connectable to another blood bag, and a communication pipe of hard plastics material having an open end and a sealed portion, the communication pipe being inserted and secured in the first tubing so as to block the first tubing and having between its sealed portion and open end a section of reduced wall thickness so that when the first tubing is connected to a blood bag and via such further tubing to another blood bag the blood bags can be brought into communication by breaking the communication pipe at said section.

In the accompanying drawing:

Fig. 1 shows longitudinal sections of the above-mentioned prior art apparatus for establishing communication between blood bags;

Fig. 2 illustrates a double blood bag employing a device according to this invention;

Fig. 3 is a longitudinal sectional view, along the lines III—III of portion A of Fig. 2, illustrating this device; and

Fig. 4 illustrates fused ends of communication pipes for devices according to the invention.

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In Fig. 1 reference numeral 1 denotes a connection tube for connecting a blood collecting bag to a smaller blood bag, the connection tube being partitioned by a thin film 2. Within the connection tube is inserted a breaking needle 3 to break the thin film (see Fig. 1A). Upon blood transfer, the breaking needle 3 is moved from outside the connection tube 1 to break the thin film and thereby to establish communication between the blood bags (see Fig. 1B).

Fig. 2 illustrates a double blood bag formed of a soft plastics material such as a transparent soft polyvinyl chloride, such double blood bag being used for separation of blood into two parts. The double bag includes a blood collecting bag 11 and a smaller blood bag 14 interconnected by a connection tube 13 made of soft plastics material, such as soft polyvinyl chloride, communication therebetween being initially blocked at that portion A which is in the neighbourhood of the blood collecting bag 11. The connection tube 13 is fitted into and secured to a semi-rigid plastics pipe 12 fitted to the blood collecting bag 11.

A blood collecting needle 16 is pierced into the vein of a person whose blood is to be sampled and a suitable amount of blood is collected in the blood collecting bag 11 through a blood sampling tube 15. Thereafter, the collected blood is subjected to centrifugation under appropriate conditions. The blood in the bag 11 is separated into two parts-platelet-rich plasma and red blood cells. After the communication between the bag 11 and the smaller bag 14 has been established as described below, the upper layer of platelet-rich plasma is transferred into the smaller bag 14 thus completing the blood separation.

The blood bag communication device according to the invention employed in the Fig. 2 double blood bag is shown in Fig. 3. As already mentioned, the blood collecting bag 11 is fitted with the semi-rigid plastics pipe 12 connected to the connection tube 13. The connection tube 13 is fitted into the connection pipe 12 and secured thereto by using an adhesive or by high frequency fusion welding. A short connection tube similar to the tube 13 may instead be provided on the bag 11, and the free end thereof fitted into and secured to the pipe 12. A communication pipe 17 is fitted into the end of the connection tube 13 nearest the blood collecting bag and is secured thereto by using an appropriate adhesive or by high frequency welding. The end portion 17a of the communication pipe 17 on the blood collecting bag side is hermetically sealed by, for example, fusion. In this condition, communication between the blood collecting bag 11 and the smaller bag 14 is completely blocked.

The intermediate portion of the communication pipe 17 is formed with a section of reduced wall thickness for division of the pipe 17, for example, an annular notch 17b, and when it is desired to establish communication between the bag 11 and smaller bag 14, the pipe 17 can be manually broken at this notch 17b from outside the connection pipe 12. The section of reduced wall thickness may be constituted by such an annular notch as mentioned above but may be constituted also by one prepared by reducing the large thickness section, for example, by heating and stretching the same. Furthermore, where the reduced wall thickness portion is formed as a notch, a plurality of notches may be intermittently provided in the same circumference. Moreover, such notch or notches may be provided either in the outer circumference or in the inner circumference, or both. Note here that to ensure that the provision of a section of reduced wall thickness in the pipe 17 enables the pipe 17 to be easily broken into two pieces, namely a free piece and a fixed piece, the pipe 17 is made of hard plastics such as hard polyvinyl chloride.

In this way, communication between the bag 11 and smaller bag 14 can be established to permit transfer of the blood from the bag 11 to the smaller bag 14. In order that the free piece of the communication pipe 17 which has been created as a result of dividing the pipe 17 may be prevented from entering the blood collecting bag 11, an annular projection 12a is provided on the inner circumference of the pipe 12. The free piece is blocked by this annular projection 12a and is prevented from entering the bag 11.

The sealed portion of the communication pipe 17 need not be provided at the extreme end 17a, though its provision at the end 17a is preferred. It may however be provided in the region between the notch 17b and the end 17a.

The relationship between or among the respective inner and outer diameters of the pipe 12, connection tube 13 and communication pipe 17 may be various, provided the outer diameter of the pipe 17 is smaller than the inner diameter of the pipe 12, and may be properly determined with regard to easiness of blood transfer.

The hermetic seal of the end portion 17a of the communication pipe 17 is preferably effected by the fusion method, and it is preferred that the end portion of the fused section should be slightly in contact with the inner wall of the pipe 12. By so doing, the free piece of the pipe 17 is prevented from being brought into abutment with the fixed piece of the pipe by the blood flow when blood transfer is carried out. The abovementioned fusion preferably is conducted as illustrated in Fig. 4 in accordance

with the dimension of the inner diameter of the connection pipe 12. Figs. 4A and B are front views of the end portion 17a of the communication pipe 17, and Fig. 4A illustrates a linearly fused condition in the case where the inner diameter of the connection pipe 12 is relatively large, while Fig. 4B illustrates the pipe end as fused into a V-shape in the case where the inner diameter of the connection pipe 12 is relatively small. By fusing into the V-shaped as illustrated in Fig. 4B the terminal parts *a*, *b* and *c* of the end portion 17a are prevented from being strongly pressed against the inner wall of the connection pipe 12 even where the inner diameter thereof is relatively small.

As described above, the blood bag communication device of the invention is characterized in that the communication pipe formed with the section of reduced thickness in its intermediate portion is fitted into and secured to the tubing for interconnection of the blood bags, and when communication between the blood bags is desired, the communication pipe has only to be divided at the reduced thickness section from the outside. Accordingly, the blood bag communication device of the invention is easy to handle and requires no skill as compared with the prior art apparatus wherein a thin film is used to block the communication between the blood bags and is broken, in order to establish communication, by means of a breaking needle. Furthermore, the securing of the communication pipe to the connection tube has only to be performed by using an adhesive or by high frequency welding, resulting in easy manufacture.

WHAT WE CLAIM IS:—

1. A device for use in allowing communication between blood bags, the device comprising first tubing having one end for

connection to a blood bag and connectable at its other end, by insertion one within the other, to further tubing itself connectable to another blood bag, and a communication pipe of hard plastics material having an open end and a sealed portion, the communication pipe being inserted and secured in the first tubing so as to block the first tubing and having between its sealed portion and open end a section of reduced wall thickness so that when the first tubing is connected to a blood bag and via such further tubing to another blood bag the blood bags can be brought into communication by breaking the communication pipe at said section.

2. A device according to claim 1 in which the first tubing is connected at its other end to such further tubing by insertion one within the other.

3. A device according to claim 1 or 2 wherein the communication pipe is formed of hard polyvinyl chloride.

4. A device according to claim 1 or 2 or 3 wherein the section of reduced thickness in said communication pipe is constituted by a notch.

5. A blood bag communication device substantially as described herein with reference to Fig. 3 of the accompanying drawings.

6. A blood bag communication device substantially as described herein with reference to Fig. 3 together with Fig. 4 of the accompanying drawings.

7. A double blood bag incorporating a device according to any one of claims 1 to 5.

8. A double blood bag substantially as hereinbefore described with reference to Figs. 2 to 4 of the accompanying drawings.

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2. A device according to claim 1 in which the first tubing is connected at its other end to such further tubing by insertion one within the other.

3. A device according to claim 1 or 2 wherein the communication pipe is formed of hard polyvinyl chloride.

4. A device according to claim 1 or 2 or 3 wherein the section of reduced thickness in said communication pipe is constituted by a notch.

5. A blood bag communication device substantially as described herein with reference to Fig. 3 of the accompanying drawings.

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