

[54] **PLASMA SEPARATOR WITH SQUEEZED SEALANT**

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[56] **References Cited**

UNITED STATES PATENTS

3,437,266	4/1969	Patterson	210/DIG. 23
3,647,070	3/1972	Adler	210/83
3,780,935	12/1973	Lukacs et al.	210/DIG. 23

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[57]

ABSTRACT

A blood collection and separator assembly of the type suitable for use in centrifuging blood to separate the plasma, the light phase, from the cellular portion, the heavy phase. The assembly includes a collection container and a pair of cylinders slidably disposed in the container. The first or top cylinder has a specific gravity greater than the light phase and the second or bottom cylinder has a specific gravity lighter than the heavy phase. Interposed between the cylinders are one or more layers of micro encapsulated beads of gelatin or other sealant. The average specific gravity of the first plus the second cylinders is between that of the plasma and red cells, so that the pair of cylinders float on and above the top of the heavy phase, thereby establishing the seal slightly above the interface between the light phase and heavy phase of the blood. When centrifuged the two cylinders move to the top of the packed red cells and break and squeeze out the sealant thereby forming a seal between the cylinders and the inner wall of the container slightly above the interface between the two phases of the blood.

5 Claims, 2 Drawing Figures

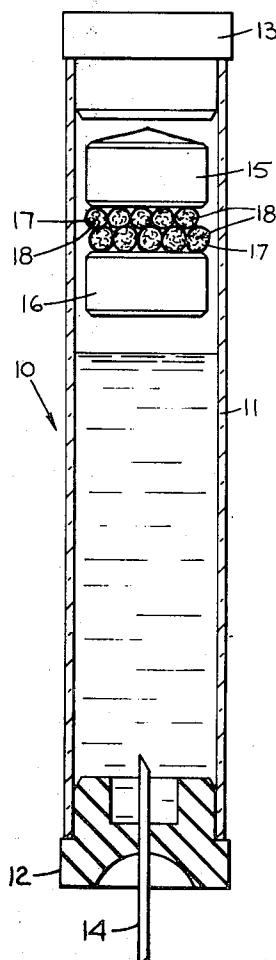


Fig. 1

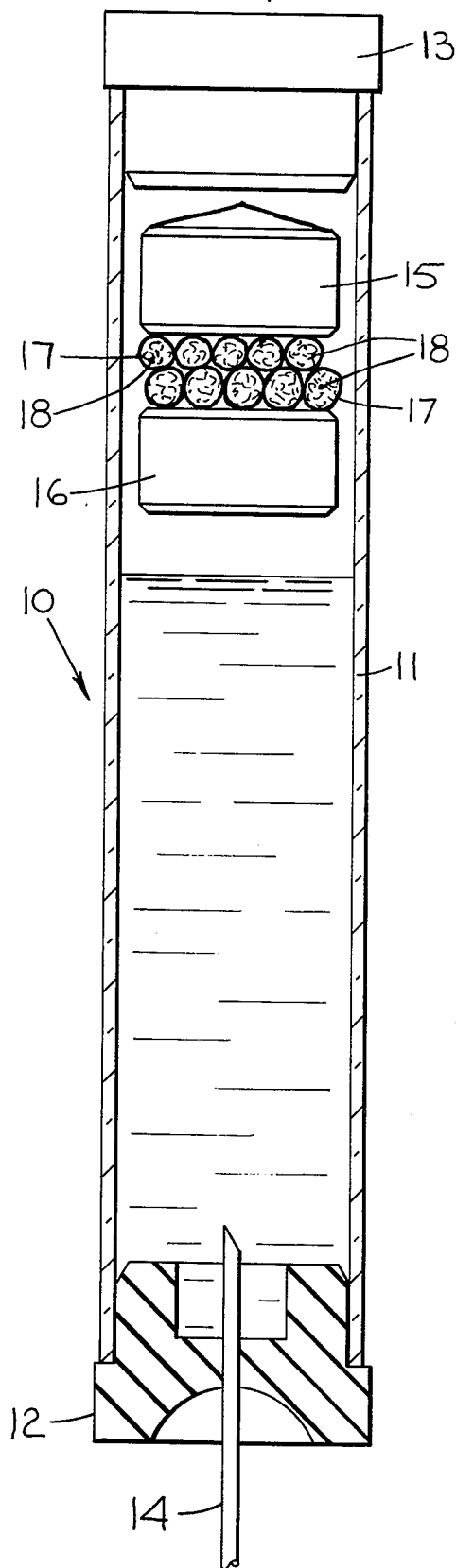
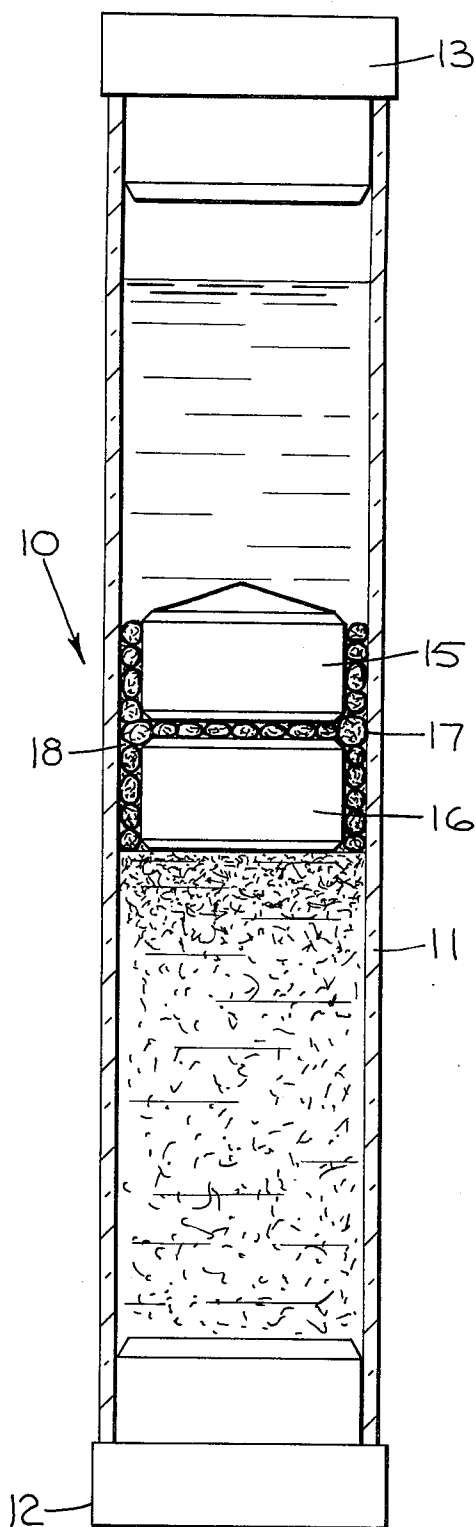


Fig. 2



PLASMA SEPARATOR WITH SQUEEZED SEALANT

BACKGROUND OF THE INVENTION

It is known to separate blood into its component parts by centrifugation, for example, the assembly disclosed in U.S. Pat. No. 2,460,641. However, this particular assembly does not employ a means for sealing the separated plasma or serum phase from the cellular phase.

It is also known to provide assemblies for manually separating the plasma or serum phase from the cellular phase, for example, as disclosed in U.S. Pat. Nos. 3,586,064; 3,661,265; 3,355,098; 3,481,477; 3,512,940; and 3,693,804. In all of these devices the serum is collected in a blood collection container and means are provided for separating the plasma or serum phase from the cellular phase employing filters, valves, transfer tubes or the like.

It is also known to provide assemblies for the sealed separation of blood in which a piston is actuated by centrifugal force such as is disclosed in U.S. Pat. Nos. 3,508,653 and 3,779,383. These devices use either a distortable piston made of resilient material or valve means associated with the piston to effect a sealed separation after centrifugation. It is also known that a liquid sealant can be used for the separated portions of a blood sample as is covered by U.S. Pat. No. 3,780,935, but such patent does not disclose the two cylinders for squeezing out the sealant of the present invention.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a plasma separator assembly including a collection container and a pair of cylinders with encapsulated sealant interposed between the cylinders slidably disposed in the container, which cylinders have specific gravities respectively greater and lower than blood so that upon centrifugation the sealant between the cylinders will be released and form a seal between the cylinders and the container wall slightly above the plasma-cellular interface.

It is another object of the invention to provide a plasma separator assembly which is economical to manufacture and can be used in conjunction with standard blood collecting equipment.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, references are made to the drawings which illustrate the preferred embodiment of the invention herein.

FIG. 1 is a sectional, elevational view showing the plasma separator assembly of the present invention and also illustrating a pointed cannula penetrating one of the stoppered ends of the container through which blood is introduced into the container prior to its separation.

FIG. 2 is a sectional, elevational view similar to the view of FIG. 1, showing the two cylinders and the interposed sealant forming an impervious barrier across the container at the plasma-cellular interface.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a better understanding of the invention herein a description of the drawings of the illustrative embodiments is had with particular reference to FIGS. 1 and 2.

In FIG. 1 the separator assembly 10 comprises a tubular member or container 11 which is sealed at its open ends by closure members 12 and 13. Such tubular member or container is preferably formed of glass but any other suitable material may be employed. Closure members 12 and 13 are preferably made of elastomeric material and are capable of being penetrated by a cannula 14 so that blood can be transferred from a blood source into the container under aseptic conditions. The closures 12 and 13 are preferably self-sealing so that when the cannula is removed from the closure 12 there will be no loss of blood passing through the penetration portion of closure 12 illustrated in FIG. 1.

Disposed in the container are a pair of sliding cylinders, the first or top cylinder 15 having a specific gravity greater than the light phase of blood (greater than 1.03) and the second or bottom cylinder 16 having a specific gravity lower than the heavy phase of blood (less than 1.09 sp.g.). The average specific gravity of the first cylinder plus the second cylinder is between the plasma and red cells, for example 1.06. The first cylinder carries one or more layers of micro encapsulated beads 17 containing gelatin or other sealant 18.

When operating the separator assembly of the invention herein it is preferred that the assembly be evacuated so that when cannula 14 penetrates closure 12 blood will fill container 11 automatically. It is also contemplated to provide a separator assembly suitable for use with blood collecting assembly disclosed in U.S. Pat. Nos. 2,460,641, 3,469,572 and 3,494,352.

After the cannula 14 is withdrawn and container 11 is filled with blood the assembly is placed in a centrifuge and the blood is separated by initially employing moderate centrifugal force. This precipitates or separates the blood cells into the lower portion of container 11 and automatically moves the cylinders 15 and 16 to float on the plasma-red cell interface. Thereafter the rotational speed of the centrifuge is increased which causes the squeeze between the cylinders to increase and ruptures the encapsulated beads and squeezes out the sealant (FIG. 2). The sealant surrounds the two cylinders and contacts the inner wall of the container and forms a seal across the container between the light and heavy phases of the blood.

Then the centrifugal forces are terminated and the separated blood sample is ready for use. As desired, the plasma can be taken from one end and/or the concentrated red cells can be taken from the other end.

While variations of the invention herein may be had, the objectives of the invention have been illustrated and described.

Having described the invention, what is claimed is:

1. A separator assembly, capable of separating blood into its component light phase or plasma and heavy phase or cellular portion comprising:

- a container having at least one open end which is adapted to receive blood for subsequent separation into a light phase and a heavy phase;
- a closure sealing the open end of the container, the closure being formed of a self-sealing elastomeric

material which is penetrable by a cannula through which blood to be separated is conducted into the container;

- c. a pair of cylinders and rupturable capsules of sealant slidably mounted in the container, the upper cylinder having a specific gravity greater than the light phase, the lower cylinder having a specific gravity less than the heavy phase, and the combined cylinders plus capsules having a specific gravity between the two phases of blood; and
 - d. said rupturable capsules of sealant having a specific gravity between the two phases of blood and being interposed between the two cylinders, whereby when centrifugal force is used the blood separates into its light and heavy phases, the cylinders move through the light phase and come to a stop at the top of the heavy phase, and the pressure between the cylinders ruptures the capsules and releases the sealant to form a seal slightly above the interface between the phases.
2. The separator of claim 1 wherein the said container comprises a tubular body open at each end in which closures formed of elastomeric material are mounted in sealing engagement with the tubular body and the cylinders are disposed adjacent one of said closures.
3. The separator of claim 1 wherein the sealant is gelatin.
4. A separator assembly capable of separating blood into its component light phase, plasma, and heavy phase, cellular portion comprising:
- a. a container for receiving blood having closures at each end for sealing the container;
 - b. a pair of cylinders plus rupturable capsules of sealant slidably mounted in the container adjacent the upper closure, the upper cylinder having a specific gravity greater than the light phase, the lower cylinder having a specific gravity less than the heavy phase of blood, and the combined cylinders plus capsules having a specific gravity between the two phases of blood; and
 - c. said rupturable capsules of sealant having a specific gravity between the two phases of blood and being interposed between the two cylinders,

whereby when centrifugal force is used the blood separates into its light and heavy phases, the cylinders move through the light phase and come to a stop at the top of the heavy phase, and the pressure between the cylinders ruptures the capsules and releases the sealant to form a seal slightly above the interface between the phases.

5. A separator assembly capable of separating blood into its component light phase of plasma and heavy phase of cellular portion comprising:
- a. a tubular container having two open ends;
 - b. resilient closure means adapted to close said ends with at least one said closure means capable of being penetrated by a cannula for filling with blood;
 - c. a slidable pair of cylinders plus rupturable capsules containing sealant mounted in said container, said cylinders being located initially adjacent the closure opposite to that through which the cannula may penetrate, the space within the tube and between the penetrable closure and the cylinders forming a first chamber for receiving blood from the cannula;
 - d. the upper cylinder having a specific gravity greater than the light phase of blood, the lower cylinder having a specific gravity less than the heavy phase of blood, and the combined cylinders plus capsules having an average specific gravity between the two phases of blood; and
 - e. the rupturable capsules containing sealant having a specific gravity between the two phases of blood and being interposed between the two cylinders;
 - f. said slidable cylinders being adapted to move automatically to float on the top of the interface between the phases while moderate centrifugal force is used to precipitate the cellular portion of the blood with the displaced plasma flowing into the upper portion of the first chamber;
 - g. the cylinders being further adapted to automatically stop in the plasma slightly above the heavy phase and rupture the capsules and release the sealant to form a seal slightly above the interface between the phases.

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