**Description**

The present invention is concerned with an apparatus for recovering and filtering in a sterile manner the blood collected during or after an operation, as well as a flexible disposable filtering pouch for this apparatus.

This type of apparatus functioning by vacuum aspiration is designed to be used for a coarse filtration of the blood, before the same is directed to a blood cleaning apparatus and, if desired, injected back to the patient (autotransfusion).

Such apparatuses are already known, for example from the U.S. patent 4 466 888, in which a pouch for the recovery of blood is fastened by clamping along its peripheral edges between the two parts of a rigid casing. However, such apparatuses proved to be substantially unpractical for collecting blood after an operation, owing to the fact that the tightness of the system is insufficient once the vacuum is disconnected. There are other types of such apparatuses which all have drawbacks, either because of the complexity of their use or of their manufacture, or because of their high cost, or further simply because they are ineffective.

Accordingly, the objective of the present invention is to provide an apparatus for recovering and filtering in a sterile manner blood produced during and after an operation, which makes it possible to remedy to the drawbacks of known apparatuses and which is simple to manufacture and to use, but nevertheless effective, and above all, which is fitted with a disposable part which is cheap.

The above-mentioned objective is achieved with the apparatus accor-

ding to the invention which has the characteristics set forth in claim 1.

Another objective of the invention is to provide a sterile flexible disposable pouch for recovering and filtering blood during and after an operation, which can be used in the apparatus according to the invention and which is constructed as set forth in claim 3.

The annexed drawing illustrates schematically and by way of example an embodiment of the apparatus and of the flexible disposable pouch according to the invention.

Figure 1 is an overall partially cross-sectional view of the apparatus in its operative state.

Figure 2 is a plan view of the flexible disposable pouch in the inoperative state and figure 3 is a cross-sectional view of a detail of this pocket.

With reference first to figure 1, the apparatus according to the invention includes a cylindrical container 1, made preferably of glass or of a rigid plastic material, of which the upper opening can be closed hermetically by a rigid cover 2, preferably made of metal, the tightness being ensured by a seal, for example a V-shaped silicone seal. The cover 2 is provided with, for example, a central opening 4 and an orifice 5 for communication with a source of vacuum. On this latter orifice, there is mounted fixedly a vacuum control device 6, provided with a control pressure gauge 7, a knurled adjustment knob 8 and a short connexion tube 9. The container 1, the cover 2 and the vacuum control device 6 are the permanent non disposable part of the apparatus according to the invention.

As to the disposable part of the apparatus according to the inven-

tion, which is illustrated by way of example in figures 1 to 3, it includes a flexible pouch 10, preferably made of PVC and comprised of two flat walls sealed together along their periphery 11. Viewed from above when lying flat, this pocket 10 is conically shaped at its upper and lower ends, to facilitate its introduction and removal respectively into and out from the container 1 through the central opening 4 of the cover 2.

When manufacturing this pouch 10, an internal filtering wall 12, which when laid flat has a shape identical to that of pouch 10, is sealed along its periphery between the two edges 11 of these two walls. This filtering wall is preferably comprised of a nylon meshing having openings ranging from 100 to 1000 microns, preferably in the order of 300 microns and it divides the inside of the pocket 10 into two chambers 13, 14 having both the same volume. Each one of the chambers 13, 14 is in communication with the outside of the pouch 10 by a flexible tubing 15, 16 and each tubing is fastened tightly by welding to the edges 11 of the two walls of the pouch.

The first chamber 13 into which opens the tubing 15 is completely tight and is designed for receiving the soiled blood to be filtered, for example after an operation and containing such debris as blood clots, bone fragments, etc. The blood is sucked into this first chamber 13 by the effect of a reduced pressure (referred to herein as "vacuum") inside the apparatus of the invention.

The second chamber 14 is provided with an opening, having for example, the shape of an elongated rectangle and carrying a strip 17 made of a hydrophobic material, i. e. impervious to liquids but pervious to air, which makes it possible to have the same pressure in this

second chamber as in the cylinder 1. The tubing 16 entering into this second chamber 14 extends to the bottom thereof, this tubing being designed for pumping the filtered blood out of the chamber 14 and directing it from there for example to a blood cleaning apparatus before being injected again, if desired, back into the patient's systemic circulation (autotransfusion).

Mainly for reasons associated with its manufacturing and as illustrated in figure 3, the hydrophobic strip 17 is a strip of a material of the "Millipore Filter" type fastened between a portion 18 of the outer wall of the pouch 10, in which a horizontal slot-shaped opening was cut out and two flaps 19, 19' of a plastic material identical to that of the wall 18 (for example PVC) by means of two horizontal welds 20, 20'.

Finally, the two flexible tubings 15, 16 intended for supplying and emptying the blood respectively to and from the pouch 10 are bonded to a cap 21 designed for introduction into the central opening 4 of the cover 2, to close the same in a tight manner by virtue of a ring-shaped sealing member 22.

To introduce the flexible disposable pouch 10 into the container 1, one only needs to first wind up this pouch along its vertical axis and then to slip it in its wound up form through the central opening 4 of the cover 2, this introduction being facilitated by the conical shape of its lower part. Then the cap 21 is fitted into said opening 4 of the cover 2. The apparatus according to the invention is then ready for use, provided of course that the vacuum controlling device is connected to a source of vacuum (not illustrated). The soiled blood arriving for example from a probe used by the surgeon is sucked into the first cham-

ber 13 of the pouch 10 via the tubing 15 and owing to the fact that the apparatus is under vacuum, the blood flows through the filter/grid 12 into the second chamber 14, from which the blood can be pumped out of the pouch 10 via the tubing 16. The hydrophobic strip 17 which is provided in this second chamber 14 has three purposes : first, it serves to produce a vacuum in the pouch 10 and then as a means for indicating that the second chamber is full, the inflow of blood being interrupted when the blood level in this chamber rises above the top of said strip 17. This hydrophobic band also provides a sterile barrier between the blood contained in the pouch and the environment.

Thus, the present invention provides an apparatus for recovering and filtering blood during and after an operation, which offers several advantages compared to known apparatuses :

- The fact that the apparatus has a reusable non disposable part including all the connections to the source of vacuum makes unnecessary for the user to carry out a number of operations, which are often difficult and awkward. In fact, the container 1 with its cover 2 can be fastened permanently to the source of vacuum. One only needs to introduce a flexible pouch 10 as described above and to fasten the cap 21 tightly inside the central opening 4, so that this pouch be subjected to the same reduced pressure as the container 1, owing to the presence of the hydrophobic strip 17 which allows the inside of the container to communicate with the inside of said pouch, and that the blood be sucked via the tubing 15 which will have been connected beforehand to another tubing for evacuating the blood from the patient. The connection of the filtering pouch to the source of vacuum is hence substantially automatic.

- As explained previously, the hydrophobic strip 17 acts as a control system for warning when the chamber 14 containing the filtered blood is full.
- Owing to its design, the tightness of the apparatus according to the invention is considerably improved, and it can therefore also be used for collecting blood after an operation and more particularly under conditions when the vacuum source must be disconnected, for example during the transport of the patient, the container 1 being closed hermetically and the vacuum being maintained therein for a sufficient duration of time.
- Contrary to other known apparatuses having a maximum allowable volume lesser than 2 liters, the apparatus according to the invention can be designed to receive higher volumes of blood, for example up to about 5 liters, in particular because it is provided with a rigid cover, for example which is made of metal and which can therefore be made with a large diameter, without any risk of implosion.
- Finally, the disposable part of the apparatus according to the invention, namely the flexible filtering pouch, is not only easy to use but also its manufacture is relatively simple and above all inexpensive.

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**CLAIMS**

1. Blood collecting and filtering apparatus comprising a tightly closed rigid enclosure as well as a filtration disposable flexible bag (10) disposed in service position inside of said enclosure, said rigid enclosure being formed of a container (1) and a removable cover (2), and said bag having two internal rooms separated the one from the other by a filtering wall (12), a first room (13) being connected to the outside by an inlet pipe (15) which is fed in blood to be treated, and a second room (14) being connected to the outside by an outlet pipe (16) for the filtered blood, characterized by the fact that this cover is provided with an adjustable device (6) for connecting to a reduced pressure line and presenting a traversing opening (4), and by the fact that the fittering wall (12) is provided with an opening which is closed by an element (17) made of an air permeable and liquid tight material, both respectively inlet and outlet pipes (15,16) passing in a tight manner through a plug (21) closing in service position the traversing opening (4) of the cover (2).

2. Apparatus according to claim 1, characterized by the fact that it comprises tightness joints (3,22) between the cover (2) and the container (1) respectively between the plug (21) bound to the disposable flexible bag (10) and the traversing opening (4) of the cover (2), and by the

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fact that said adjusting device of the connection to a vacuum system comprises an adjustment member (6) of the pressure and a manometer (7).

3. Disposable flexible bag for the collection and the filtration of blood usable with the apparatus according to claim 1 and comprising two internal rooms (13,14) separated the one from the other by a filtering wall (12), a first room (13) being connected to the outside by an inlet pipe (15) which is fed in blood to be treated, and a second room (14) being connected to the outside by an outlet pipe (16) of the filtered blood, characterized by the fact that the wall is provided with an opening closed by an element (17) made of an air permable and liquid tight material, both respectively inlet and outlet pipes (15,16) passing in a tight manner through a plug (21), intended to close in service position the traversing opening (4) of the cover (2) of the apparatus.

4. Bag according to claim 3, characterized by the fact that it is constitued by two superimposed walls of plastic material and of a filtration netting (12) also of plastic material which is fixed between this two walls by welding of the peripheral edges (11) thereof.

5. Bag according to claim 4, characterized by the fact that the wall of said second room (14) has a horizontal rectuangular opening in its upper portion, and by the fact that this opening is closed by a band (17) of a hydropho-

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bic material.

6. Bag according to claim 5, characterized by the fact that said hydrophobic band (17) is provided at least on one side of movable flaps (19,19') of plastic material.

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