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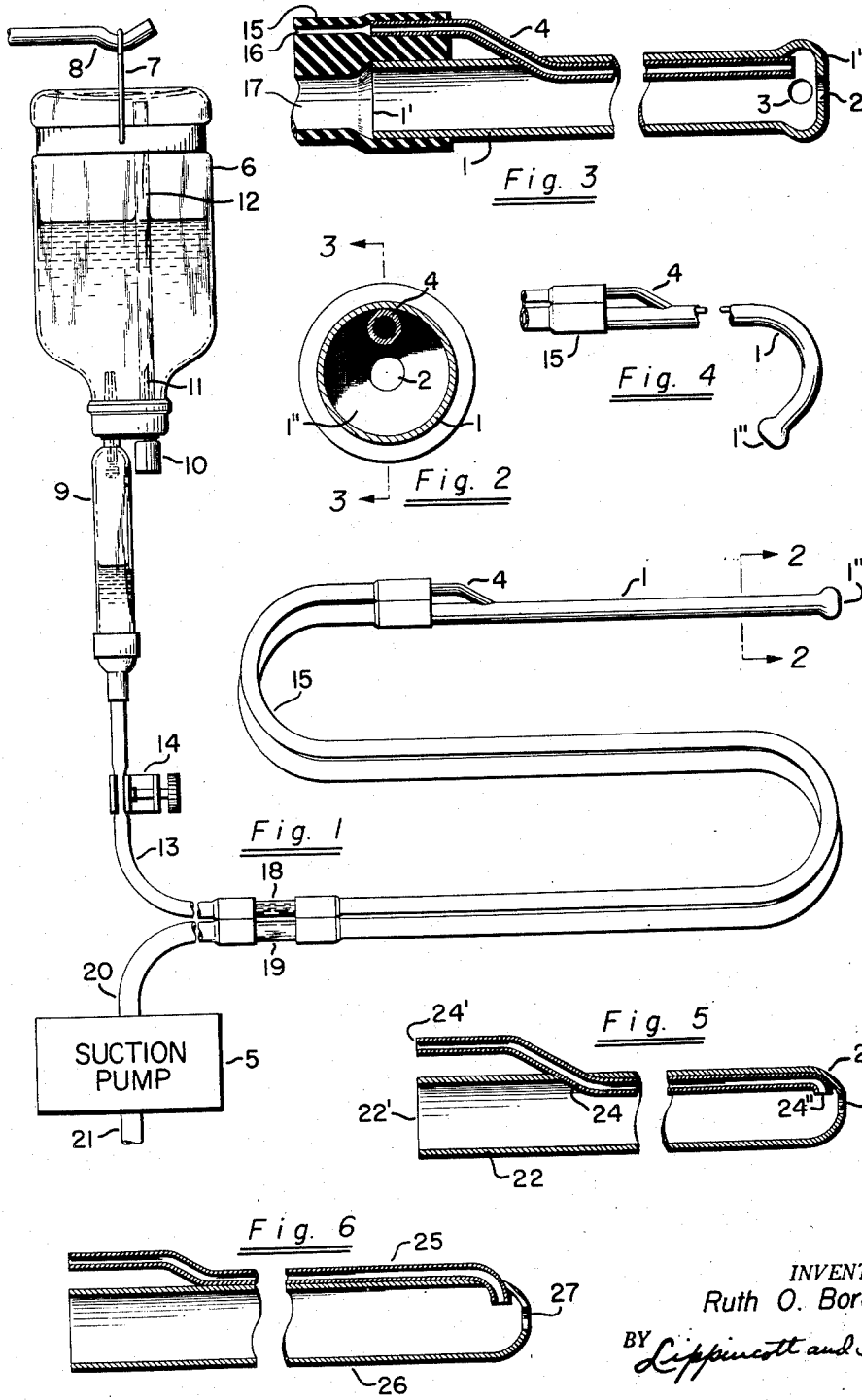
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NON-CLOGGING SURGICAL ASPIRATOR

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2 Sheets-Sheet 1



INVENTOR.  
Ruth O. Borden  
BY *Leppincott and Smith*  
Attorneys

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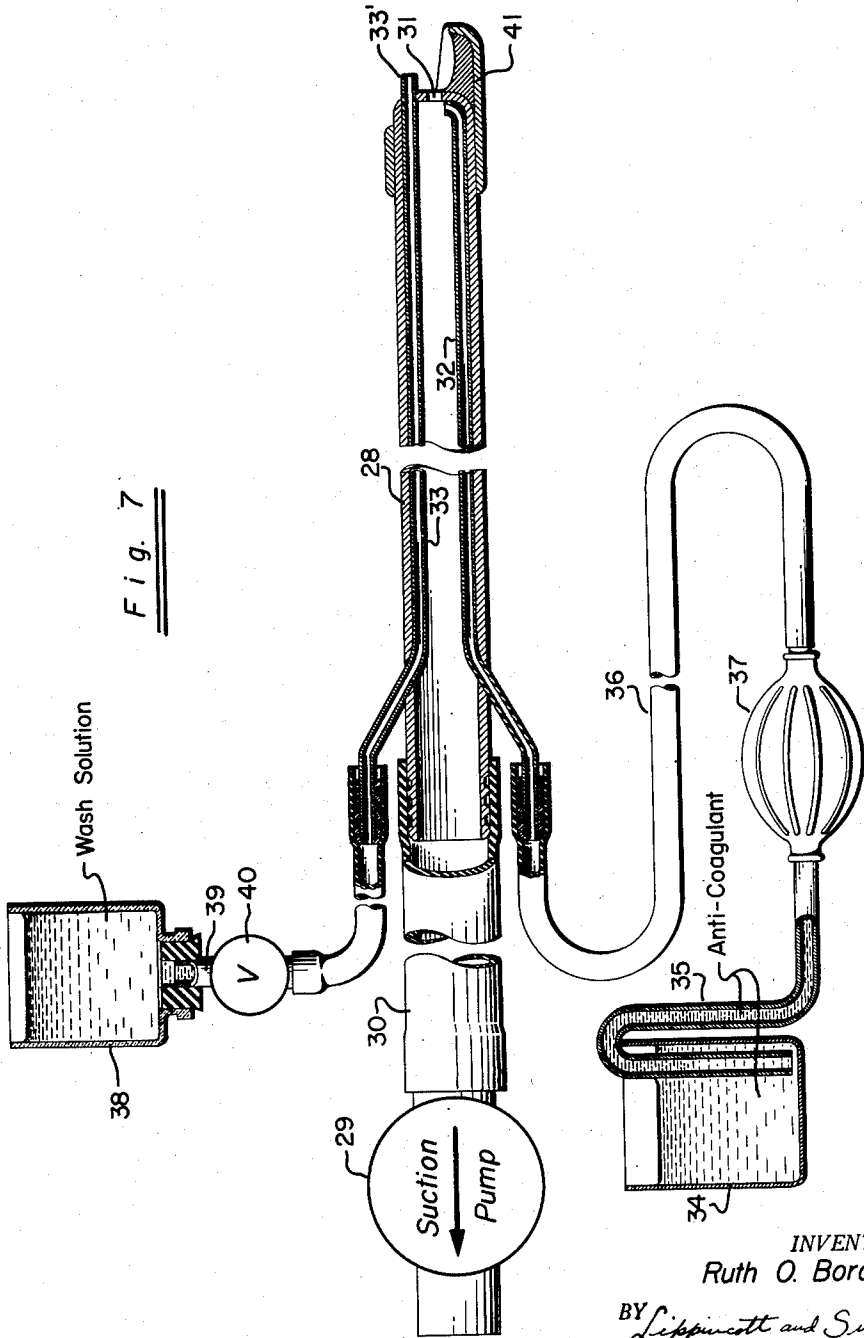
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Ruth O. Borden

BY *Lippincott and Smith*

Attorneys

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## NON-CLOGGING SURGICAL ASPIRATOR

Ruth O. Borden, San Jose, Calif.

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4 Claims. (Cl. 128—277)

This invention relates to aspirators for removing blood and other fluids from surgical operating areas.

A disadvantage of conventional aspirators for removing blood and other fluids from operating areas during surgical operations is that clotting or coagulation of the blood or other fluids may clog the aspirator. Consequently, during lengthy operations it has been necessary to clean or replace the aspirator, or repeatedly to dip the aspirator into an anti-coagulant solution during the course of the operation. This is a serious disadvantage, since anything that delays or interferes with the rapid progress of the operation can have dire consequences. Accordingly, an object of this invention is to provide a non-clogging aspirator that will rarely, if ever, become clogged by the clotting or coagulation of blood or other fluids being removed.

Furthermore, in the course of surgical operations it is often necessary to wash the tissue or parts being operated upon by introducing special fluids of a non-injurious nature and immediately removing such fluids from the area. The lavage fluids or wash solutions are often not readily available or not within the surgeon's immediate reach, and prior methods of introducing them, as by pouring from a vessel or applying from a syringe, may interrupt the progress of the surgical operation. Accordingly another object of this invention is to provide improved means for washing tissues or parts being operated upon.

Other objects and advantages of the invention will appear as the description proceeds.

Briefly stated, in accordance with one aspect of this invention, a surgical aspirator comprises a tube having openings at its front and back ends. Suction is applied to the back end of this tube by any suitable means, so that blood or other fluids that are to be removed from the operating area are drawn into the opening at the front end of the tube. A second tube opens into the front end of the first tube, and a diluent, which may contain an anti-coagulant, is continuously supplied through this second tube and mixed with the blood or other fluids entering the first tube, thereby inhibiting clotting or coagulation that might otherwise clog the aspirator.

In accordance with another aspect of this invention, still another tube is combined with the aspirator for supplying a wash solution to the operating area. This other tube terminates just outside the aspirator tip and directs a small stream or spray of the wash solution onto the tissues or parts being operated upon. The aspirator tip has a shape somewhat similar to a small spoon, so that the wash solution can be scooped up immediately and drawn away from the operating area by the aspirator.

This invention will be better understood from the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims. In the drawings,

Fig. 1 is a schematic view of a surgical aspirator embodying the principles of this invention;

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Fig. 2 is a transverse section of the aspirator tube taken along the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal section of the aspirator tube taken along the line 3—3 of Fig. 2, with a central length of the tube cut out;

Fig. 4 is a side elevation of the aspirator tube, with a central length cut out, showing a modification;

Fig. 5 is a longitudinal section of an alternative aspirator tube, with a central length cut out;

Fig. 6 is a longitudinal section of another alternative aspirator tube, with a central length cut out; and

Fig. 7 is a schematic view of another surgical aspirator embodying principles of this invention.

Referring now to Figs. 1 through 3 of the drawings, the improved surgical aspirator comprises a rigid metal tube 1 that is fully open at its back end 1' and is partially closed at its front end 1''. Preferably the front end of tube 1 has a diameter that is slightly enlarged relative to the major portion of the tube, as is best shown in Fig. 3. The front end of tube 1 contains a small opening 2 that preferably is centered in the front end of the tube, and a small opening 3 at one side of the tube, as shown. If desired, either of the holes 2 and 3 may be omitted, or other holes may be provided at various locations in the front end of aspirator tube 1. Preferably, holes 2 and 3 are smaller than the inside diameter of tube 1.

Another rigid metal tube 4, having an outside diameter that is smaller than the inside diameter of tube 1, is generally parallel to tube 1, as is best shown in Fig. 3, and is securely attached thereto by suitable means, such as by soldering. The major portion of tube 4, including the front end thereof, is inside of tube 1, somewhat off center, and the front end of tube 4 opens into the enlarged portion at the front end of tube 1 adjacent to holes 2 and 3. The back end of tube 4 is outside of tube 1 and is parallel to the back end of tube 1, as shown.

Suction for drawing blood or other fluids from the operating area through holes 2 and 3 of the aspirator is provided by any suitable suction means such as suction pump 5. A liquid diluent and anti-coagulant is contained in a reservoir comprising a glass jar 6 supported by a bail 7 that may be hung upon any convenient supporting means such as bracket 8. Jar 6 has an outlet opening into a gauge glass or drip regulator 9 which is normally partially filled with the liquid diluent and anti-coagulant, the supply of which is continuously replenished from jar 6. The rate at which liquid flows from jar 6 into gauge glass 9 depends upon the rate at which air enters jar 6 through filter 10, capillary tube 11 and inlet tube 12. Liquid flows out of gauge glass 9 through a rubber tube 13, and this flow is regulated by a valve, which may consist of a small adjustable clamp 14 that constricts or pinches a portion of tube 13.

A flexible conduit 15 has two fluid channels 16 and 17. Conduit 15 preferably is an integral structure which may be made by vulcanizing or otherwise joining 2 rubber tubes together. There may be a lengthwise web joining the two tubes, as shown. The back end of metal tube 4 is connected to reservoir 6 through channel 16 of conduit 15, a small length of glass tubing 18, rubber tubing 13, and gauge glass 9. The back end of tube 1 is connected to suction pump 5 by channel 17 of conduit 15, a small glass tube 19, and a rubber tube 20.

In the operation of the improved aspirator the liquid diluent and anti-coagulant flow continuously from jar 6 through gauge glass 9, tube 13, conduit 15 and metal tube 4 to the enlarged portion at the front end of aspirator tube 1. There the diluent and anti-coagulant is mixed with the blood or other fluid drawn into the aspirator tube through holes 2 and 3. The mixture passes through tube 1, channel 17 of conduit 15, and tubes 19 and 20

to suction pump 5, from which the mixture is discharged through an outlet 21 to any suitable receptacle or drain. The diluent and anti-coagulant mixes with the blood or other fluid as soon as it is drawn in through holes 2 and 3, and thus prevents clotting or coagulation that might otherwise clog the aspirator. Even if holes 2 and 3 should become clogged temporarily the aspirator tends to be self-clearing since the front end of tube 1 will then become filled with the diluent and anti-coagulant solution, which in most instances will clear holes 2 and 3. There is no substantial flow of the diluent and anti-coagulant out of the aspirator apparatus, and consequently little possibility of these liquids coming into contact with tissue of the patient.

There is also little possibility of the aspirator becoming clogged by particulate matter, such as small bits of bone, because the opening at its tip is much smaller than the diameter of the aspirator tube. Consequently any particulate matter that does get through the small opening at the tip cannot clog the relatively large aspirator tube.

Although the aspirator tube 1 is shown in Figs. 1 and 3 as a straight tube it may be bent into any desired shape. For example, Fig. 4 illustrates an aspirator in which the tube 1 has been bent into a hooked shape that is very convenient for many surgical operations. It will be understood that tube 4 is bent along with tube 1 so that the front end of tube 4 remains adjacent to and inside of the front end of tube 1.

Reference is now made to Fig. 5 which illustrates an alternative form of the aspirator tube. Metal tube 22 has a wholly open back end 22' and a partially closed front end 22'' containing a small opening 23 through which blood or other fluid may be drawn into the aspirator. A smaller metal tube 24 has a back end 24' that is outside of and parallel to the back end of tube 22, as shown. The front end 24'' of tube 24 is inside of the front end of tube 22 and is adjacent to aspirator opening 23, as shown. The front end of tube 24 is bent transverse to the front end of tube 22 so that the liquid diluent and anti-coagulant supplied through tube 24 passes across opening 23 in a manner that is very efficient for preventing the clogging of the aspirator opening. The back end of tubes 22 and 24 are connected to conduit 15 in the same manner as is illustrated in Fig. 1, it being understood that tubes 22 and 24 replace tubes 1 and 4, and that no other changes in the Fig. 1 apparatus need be made.

Reference is now made to Fig. 6 which illustrates another alternative aspirator tube. This embodiment is similar to that illustrated in Fig. 5, except that the major portion of the smaller metal tube 25 is outside of the larger metal tube 26. However, the front end of tube 25 opens into the front end of tube 26, as shown, and a liquid diluent and anti-coagulant is discharged by tube 25 into the front end of tube 26 adjacent to the aspirator opening 27 in the same manner as in the embodiments hereinbefore described.

Referring now to Fig. 7 of the drawings, still another surgical aspirator embodying principles of this invention includes a metal aspirator tube 28 connected to a suction pump 29 by a flexible conduit 30. Tube 28 has a small opening 31 in its tip through which fluids are drawn into the aspirator. Two smaller metal tubes 32 and 33 are attached to and extend along the length of aspirator tube 28, as shown. Tube 32 opens into the interior of tube 28 adjacent to opening 31, while tube 33 extends through the right end of tube 28 and terminates in an opening or nozzle 33' external to the aspirator tip.

Anti-coagulant contained in a reservoir 34 is drawn therefrom through a syphon 35, a flexible conduit 36 and tube 32 into the interior of the aspirator tube for inhibiting clotting and clogging, in a manner similar to the operation of the other non-clogging aspirator hereinbefore described. This flow of the anti-coagulant is induced by the reduced pressure within tube 28 produced by

suction pump 29 and may be aided by gravity if reservoir 34 is positioned above the aspirator tube. To initiate the flow of anti-coagulant through the syphon 35, and to increase the flow rate when desired, a double-valved pressure bulb 37 may be provided in the flexible conduit.

A wash solution contained in a reservoir 38 is supplied through a flexible conduit 39 and a valve 40 to tube 33. When valve 40 is opened, wash solution is ejected from nozzle 33' in a small stream or spray for washing the tissues or parts being operated upon. The aspirator tip includes a small spoon-like member 41 which may be used to scoop up the wash solution immediately after its application, as well as to scoop up blood and other fluids that are to be removed. The bowl of spoon-like member 41 is adjacent to opening 31 so that liquids scooped up by the spoon-like member are immediately drawn into the aspirator and carried away.

It should be understood that this invention in its broader aspects is not limited to specific embodiments herein illustrated and described, and that the following claims are intended to cover all changes and modifications that do not depart from the true spirit and scope of the invention.

What is claimed is:

1. A surgical aspirator comprising first and second tubes rigidly connected together parallel to each other, a spoon-like aspirator tip having a bowl, the front end of said first tube having an opening adjacent to said bowl, the front end of said second tube opening outside said tip above said bowl, means for applying suction to the back end of said first tube, and means for supplying a wash solution to the back end of said second tube.

2. A surgical aspirator comprising a first tube having an opening of smaller diameter at one end thereof, second and third tubes rigidly attached to said first tube, said second tube having an end opening into the interior of said first tube adjacent to said opening, and said third tube having an end opening outside of said first tube adjacent to said opening.

3. A non-clogging aspirator for removing blood from surgical operating areas, comprising a first rigid tube having front and back ends, suction means, a flexible tube connecting the back end of said first rigid tube to said suction means, a second rigid tube having front and back ends, the front end of said second rigid tube opening into the front end of said first-rigid tube, a reservoir for containing a supply of anti-coagulant, and a flexible tube connecting said reservoir to the back end of said second rigid tube, the front end of said first rigid tube being partially closed and having an opening smaller than the interior diameter of said first tube, said opening being substantially centered in the front end of said first tube, the front end of said second-rigid tube being parallel and off-center with respect to said first rigid tube.

4. A non-clogging aspirator for removing blood from surgical operating areas, comprising a first rigid tube having front and back ends, suction means, a flexible tube connecting the back end of said first rigid tube to said suction means, a second rigid tube having front and back ends, the front end of said second rigid tube opening into the front end of said first rigid tube, a reservoir for containing a supply of anti-coagulant, and a flexible tube connecting said reservoir to the back end of said second rigid tube, the front end of said first rigid tube being partially closed and having an opening smaller than the interior diameter of said first tube, said opening being substantially centered in the front end of said first tube, the front end of said second rigid tube being bent perpendicular to the front end of said first rigid tube.

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