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- [54] RETRACTABLE ASPIRATOR TUBING, AND
SHEATH, FOR SURGICAL USE
3 Claims, 5 Drawing Figs.**

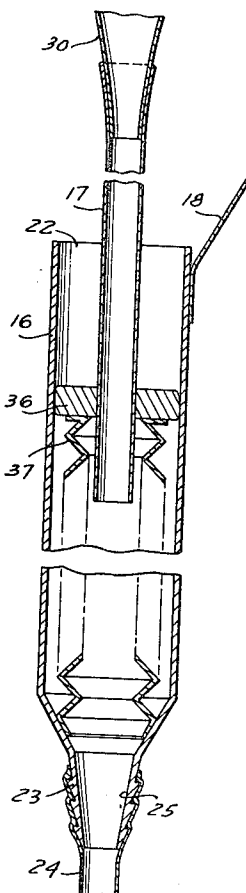
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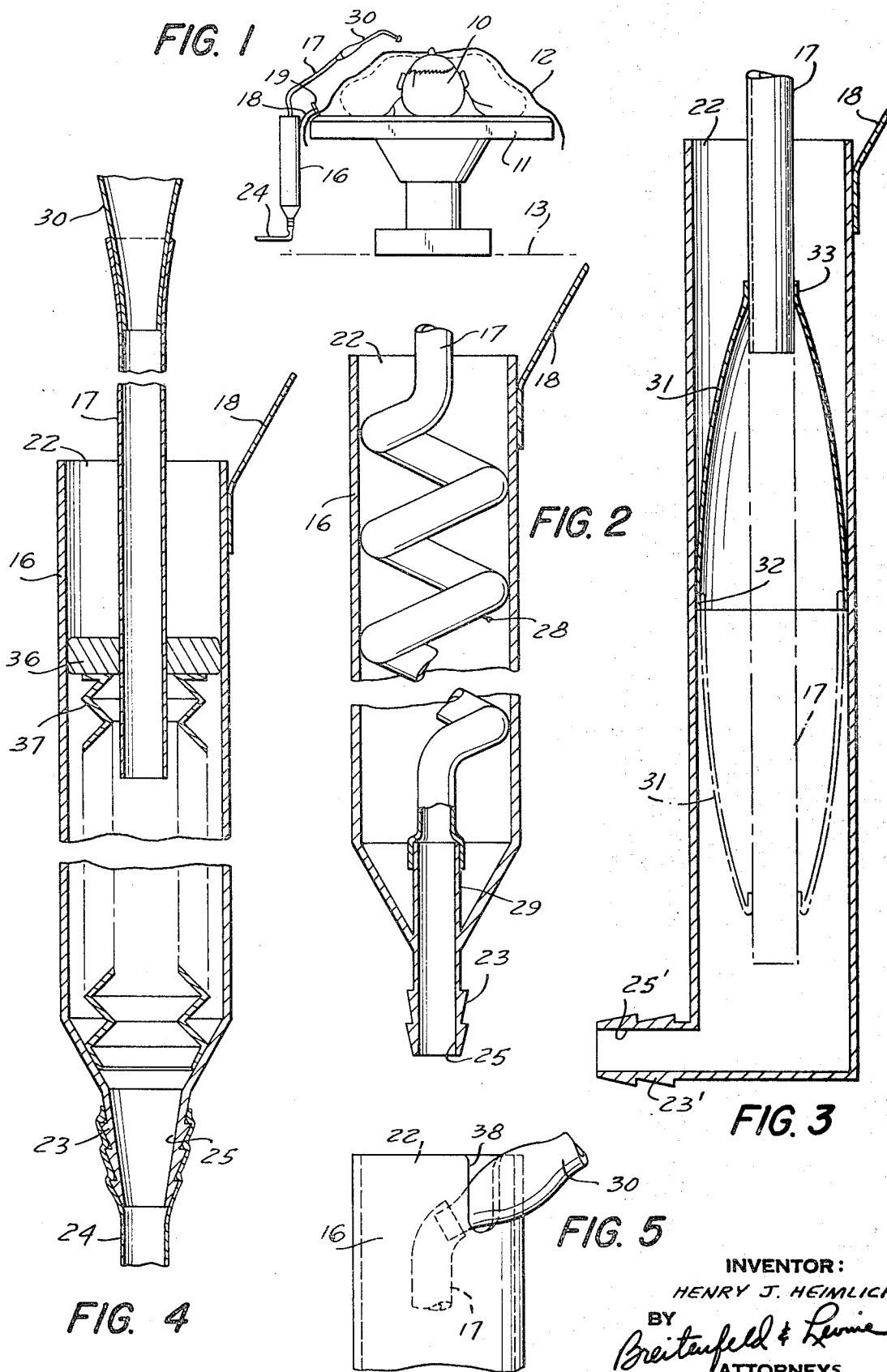
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ABSTRACT: Sheath open only at its ends can be mounted with one end in sterile field. Other end connected to suction source. One end of flexible tubing in sheath communicates with suction source. Other end of tubing may be withdrawn from sheath at will to transmit suction to operative field, and returned to sheath during periods of nonuse. Tubing may be resiliently formed for retraction, or sheath may have interior movable portion for retracting tubing upon occlusion of the latter.





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RETRACTABLE ASPIRATOR TUBING, AND SHEATH, FOR SURGICAL USE

This invention relates to surgical accessories, and more particularly to the aspirator, or suction, tubing employed during all major, and many minor, surgical operations.

During operations of this type, suction is used to remove blood and other fluid from the wound. For this purpose, a length of flexible tubing is furnished having a relatively rigid suction tip at one end, the suction tip being manipulated within the operative field when required, and laid aside when not in use. The other end of the tubing is connected to a source of suction commonly available in hospital operating rooms.

Several problems are presented by the suction tubing as it is used at the present time. These problems are, for the most part, related to the fact that at the time of a surgical operation, a sterile field exists in the immediate vicinity of the top of the operating table, but not elsewhere. Obviously, any portion of the suction tubing located within the sterile field must remain sterile, *i.e.*, must not leave the sterile field, throughout the duration of the surgery. Since a certain amount of slack is required in the tubing to permit the suction tip to be moved about the operative field, it is necessary to place a bulky length of tubing on the patient's chest, abdomen, or legs, this being the only available sterile storage area for the tubing. In this condition, the tubing interferes with the laying down of other instruments, and makes other steps in the operative procedure awkward. Furthermore, the tubing constantly becomes twisted and kinked during its use.

Another disadvantage of the existing system involves the fact that it is not uncommon for the sterile suction tubing, or a portion of it, or the suction tip, to fall off the operating table on to the floor, whereupon of course it becomes contaminated. When this occurs, any suction tubing remaining on the table must be dropped off and disconnected from the suction apparatus, and a new length of sterile tubing obtained and connected to the suction apparatus. This substitution obviously takes time, and should it be required when major bleeding occurs, which is the time when an aspirator is needed most, the delay may result in excessive blood loss and endanger the life of the patient.

It is a general object of the present invention to overcome these problems by providing a sterile storage region for the suction tubing, at periods of nonuse during the progress of a surgical operation, which may be conveniently located within the sterile field.

It is another object of the invention to provide such an arrangement wherein the slack suction tubing may be withdrawn from and returned to the storage region quickly and easily.

It is a further object of the invention to provide such an arrangement which can readily be connected to a conventional suction source.

To accomplish these objectives, the invention provides a sheath which may be mounted at the operating table with at least one of its ends in the sterile field. Near or at that end, the sheath is provided with an opening through which a sterile length of tubing, stored in the sheath, may be withdrawn from and returned to the sheath. At its other end, the sheath is provided with another opening adapted to communicate with the usual suction apparatus. Except for these openings, the sheath is completely imperforate, and hence the interior of the sheath, defining the tubing storage region, cannot become contaminated. If the internal diameter of the sheath is made sufficiently larger than the tubing diameter, the tubing may be returned to storage merely by holding the end of the tubing attached to the suction tip directly over the opening in the sheath and lowering the tubing into the sheath. However, it is preferable for some more automatic type of return system to be employed. For example, the tubing may be made so that in its normal condition it assumes a spiral shape. Furthermore, the force of the suction may be harnessed to retract the tubing by providing a piston or membrane within the sheath extending between the tubing and the sheath wall. Consequently, by merely pinching the tubing, the piston or membrane is caused

to move longitudinally within the sheath pulling the tubing with it.

In any case, with the tubing in retracted position, only a portion of the suction tip, or at most little more than the suction tip, extends from the sheath. Therefore, there is no danger of the tubing or any part of it falling to the floor and becoming contaminated.

Additional features and advantages of the invention will be apparent from the following description in which reference is made to the accompanying drawings.

In the drawings:

FIG. 1 is an end elevation of an operating table during surgery;

FIG. 2 is a longitudinal cross-sectional view through a sheath according to this invention;

FIG. 3 is a similar view through an alternative embodiment of the invention;

FIG. 4 is a similar view through another embodiment of the invention; and

FIG. 5 is a side elevational view of one end of a sheath.

Referring to FIG. 1, the sterile field within which a surgical operation is performed is, generally, the region occupied by the patient 10, the top 11 of the operating table, and the sheets 12 covering the patient and table. The region outside the sterile field, *e.g.*, the floor 13, is unsterile.

A sheath 16, which may have a generally cylindrical shape, is provided for temporarily storing a length of suction tubing 17. The sheath may be supported at the operating table, such as by means of a tab 18 secured to the sheath. The tab may be pinned to the sheets 12 in any convenient location, either by a separate pin 19 or by a pin (not shown) permanently secured to the tab 18. In this way, at least the upper end (as viewed in the drawings) of the sheath 16 may be located within the sterile field. The length of the sheath should be such that when the operating table is in its lowest position of adjustment, the sheath does not touch the floor.

The sheath should be formed of a relatively rigid material capable of being sterilized, and if desired may be formed of a relatively inexpensive material, such as a suitable plastic, so that it may be disposed of after each use. The tubing should be formed of a flexible material, such as a suitable plastic, capable of being sterilized and which may, if desired, be disposable. Both the sheath and the tubing must, of course, be sufficiently stiff so that they do not collapse when their interiors are subjected to suction.

At its upper end, the sheath 16 has an opening 22 through which the tubing 17 is withdrawn from, and returned to, the sheath. Since the opening 22 is within the sterile field, the interior of the sheath does not become contaminated through this opening. The lower end of the sheath is provided with means for connecting the sheath to a source of suction. This means may include, as shown in FIGS. 2 and 4, a tapered region terminating in an axially arranged nipple 23 having external annular serrations, the end of tube 24 connected to a suction source (not shown) being stretched over the exterior of the nipple. The nipple 23 surrounds an opening 25 through which the suction source communicates with the interior of the sheath. In the alternative, as shown in FIG. 3 the bottom of the sheath may be squared, and the nipple 23' surrounding the opening 25', may project laterally from the sheath 16. Although the lower end of the sheath may extend into an unsterile region, since the opening 25 does not communicate with the surroundings, the interior of the sheath cannot become contaminated through this opening.

As mentioned above, the tubing 17 can simply be dropped into the sheath 16 for storage. However, for the sake of convenience and to make the device more helpful to the surgeon, some means may be provided to assist the retraction of the tubing. Three examples of such means are shown in FIGS. 2-4. In FIG. 2, the tubing 17 is formed so that it normally assumes the shape of a coil or helix 28, the lower end of the tubing being connected to an inwardly projecting extension 29 of the nipple 23. At its upper end, the tubing is furnished with a

suction tip 30 of the usual type. When suction is needed, the tip 30 is pulled to the wound, and the tubing 17 tends to straighten as it is withdrawn from the sheath. After use, as the tip 30 is moved back toward the sheath, and due to the inherent resilience of the tubing material, the tubing 17 neatly coils upon itself within the sheath. If desired, a spring (not shown) may be employed to aid retraction of the tubing.

In FIG. 3, a frusto-conical membrane 31 is provided within the sheath 16 serving as a partition for separating the interior thereof into an atmospheric pressure region above the membrane and a suction region below it. The membrane is impermeforate and formed of a flexible material, such as a sheet plastic. The larger end 32 of the membrane 31 is secured in an airtight manner, such as by heat sealing, along an annular area of the inner face of the sheath wall about midway between the ends of the sheath. The smaller end 33 of the membrane is similarly secured to the outer face of the tubing 17 near the lower end of the latter. The membrane 31 and tubing 17 are shown, in full lines in FIG. 3, in the position they assume when the suction tip 30 is in use and the bulk of the tubing 17 is withdrawn from the sheath. When it is desired to retract the tubing, it is necessary simply to occlude the interior of the tubing, such as by pinching it near the tip 30. The suction thereupon pulls the membrane 31 downwardly, along with the tubing 17, into the position shown in dot-dash lines in FIG. 3. The tubing may then be released, and the suction will offer no resistance to subsequent withdrawal of the tubing from the sheath. It may also be pointed out that the membrane 31 prevents any blood or other fluid from contacting, and possibly contaminating, the inner faces of the sheath wall above the end 32 of the membrane.

The arrangement of FIG. 4 is similar to that of FIG. 3 in that the suction is used as an aid in retracting the tubing. However, in this embodiment, a piston 36 replaces the membrane 31. The piston 36 fits snugly but slidably within the sheath 16, and is formed with a hole at its center, the lower end of the tubing 17 being fixed in airtight manner within the hole. Here again, when the interior of the tubing is occluded, the piston 36 is pulled downwardly by the suction and the tubing 17 moves with it. With the tube 17 open, it may be withdrawn from the sheath 16 without resistance from the suction. An imperforate accordian pleated tube 37 is secured in airtight manner at its upper end to the under face of the piston 36, and at its lower end to the inner face of the sheath. The tube 37, which collapses as the piston moves downwardly and expands as it moves upwardly, serves to keep blood and other fluid from contacting the inner face of the sheath, and limits the upward movement of the piston so that the latter does not leave the sheath.

At its upper end, the sheath 16 is formed with a notch 38 (FIG. 5) within which the suction tip 30 may be rested while not in use. In the alternative, the opening 22 may be eliminated by closing the upper end of the sheath, and leaving only a side opening near the upper end similar to the notch 38. In such a case, the opening will be large enough to allow passage of the tubing, but will be too small to permit the widened region of the suction tip 30 to pass through it.

The invention has been shown and described in preferred form only, and by way of example, and many variations may be made in the invention which will still be comprised within its spirit. It is understood, therefore, that the invention is not limited to any specific form or embodiment except insofar as such limitations are included in the appended claims.

I claim:

1. For use in a surgical operating room wherein there is a sterile field at the operating table surrounded by an unsterile field:

- a. a length of flexible tubing for transmitting suction to the sterile field;
- b. a sheath having an inside diameter larger than the outside diameter of said tubing, so that a portion of said tubing may be stored in said sheath but withdrawn at will;

- c. means for securing said sheath at the operating table with at least one end in the sterile field, said sheath having a first opening near said one end;
- d. means for connecting the other end of said sheath to a source of suction, said sheath having a second opening near said other end through which said suction source can communicate with the interior of said sheath;
- e. one end of said tubing being arranged within said sheath and communicating with the suction source, said tubing extending out of said sheath through said first opening;
- f. said sheath being completely closed except for said openings near its ends, whereby the interior of said sheath always remains sterile and prevents contamination of said tubing during the periods that the latter is stored within said sheath; and
- g. a partition within said sheath dividing the interior thereof into an atmospheric pressure region and a suction region, said partition being a flexible frusto-conical membrane, the larger end of said membrane being secured in airtight manner along a continuous annular path to the inner surface of said sheath, the smaller end of said membrane being formed with an opening whose margin is secured to said tubing in an airtight manner, and at least part of said membrane being movable longitudinally with respect to said sheath, whereby when said tubing is in an extended condition out of said sheath occluding its interior, such as by pinching the tubing, causes said membrane to shift in a direction toward the suction source and thereby retract said tubing into said sheath.

2. For use in a surgical operating room wherein there is a sterile field at the operating table surrounded by an unsterile field:

- a. a length of flexible tubing for transmitting suction to the sterile field;
- b. a sheath having an inside diameter larger than the outside diameter of said tubing, so that a portion of said tubing may be stored in said sheath but withdrawn at will;
- c. means for securing said sheath at the operating table with at least one end in the sterile field, said sheath having a first opening near said one end;
- d. means for connecting the other end of said sheath to a source of suction, said sheath having a second opening near said other end through which said suction source can communicate with the interior of said sheath;
- e. one end of said tubing being arranged within said sheath and communicating with the suction source, said tubing extending out of said sheath through said first opening;
- f. said sheath being completely closed except for said openings near its ends, whereby the interior of said sheath always remains sterile and prevents contamination of said tubing during the periods that the latter is stored within said sheath;
- g. a partition within said sheath dividing the interior thereof into an atmospheric pressure region and a suction region, said partition being a piston snugly but slidably accommodated within said sheath for longitudinal movement with respect to the latter, said piston having an opening whose margin is secured to said tubing in an airtight manner, whereby when said tubing is in an extended condition out of said sheath occluding its interior, such as by pinching the tubing, causes said piston to shift in a direction toward the suction source and thereby retract said tubing into said sheath; and
- h. a flexible tube secured at one end to the inner face of said sheath along a path surrounding said second opening of said sheath, and the other end of said tube being secured to the face of said piston directed toward the suction source, said other end surrounding said opening in said piston.

3. The arrangement defined in claim 2 wherein said tube is accordian folded.