Dec. 24, 1968 R. CARSON 3,417,750

ASPIRATING MEANS AND ONE-WAY VALVE

Filed Oct. 22, 1965

FIG.1

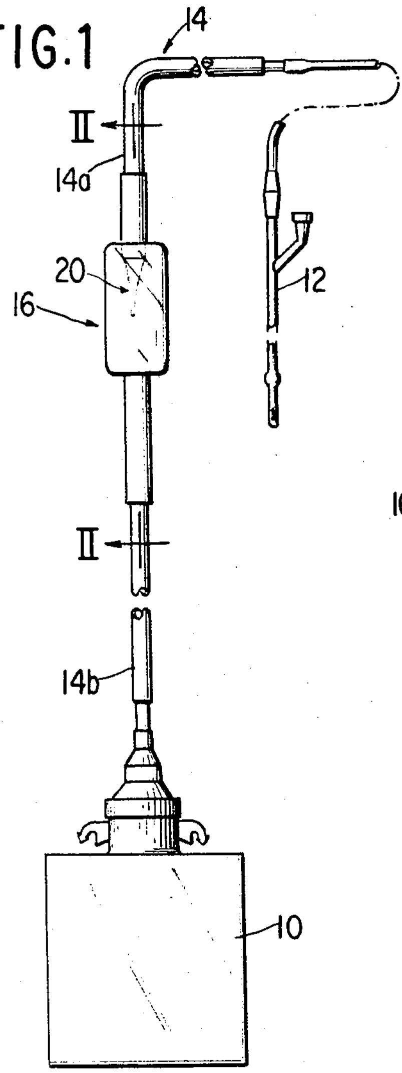


FIG.2

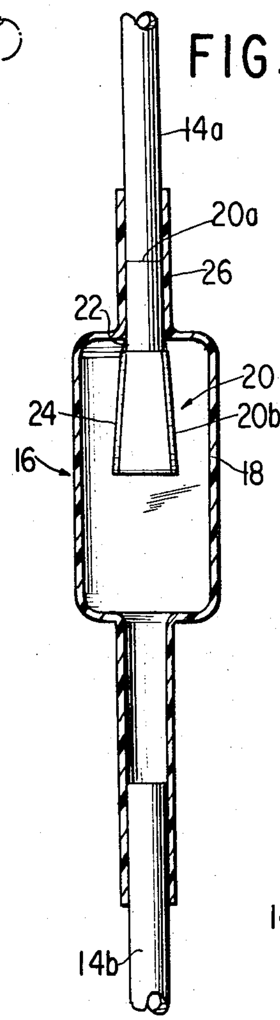


FIG.3

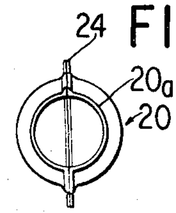


FIG.4

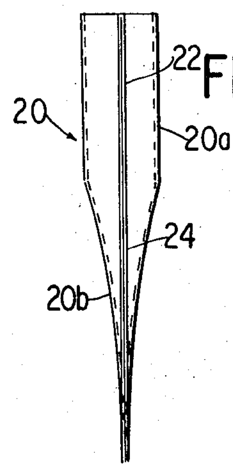
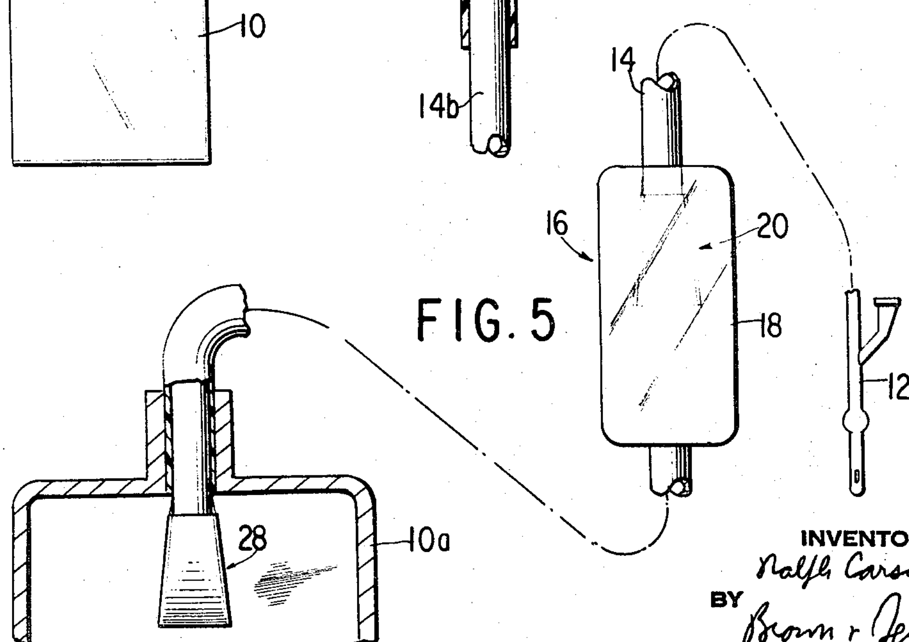


FIG.5



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ASPIRATING MEANS AND ONE-WAY VALVE

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ABSTRACT OF THE DISCLOSURE

A surgical drainage system which includes a simple pump in the form of a compressible cylindrical chamber containing a one-way flutter valve connected to the inlet from a drainage tube, the outlet end of the chamber being connected to a collection receptacle or the like, the flutter valve being preferably of a tapering form. A second one-way valve may be provided downstream of the chamber.

This invention relates to a device for use in a surgical drainage system, or the like, and more particularly to an aspirating means for removing obstructions from a drainage system and to a valve adapted for use in such a device.

In the process of draining body cavities, obstructions sometimes enter or attempt to enter the drainage apparatus where they might stop or otherwise impair the drainage flow. This problem may be encountered, for example, in a Foley catheter used for draining the bladder, wherein blood clots, mucous, or pus can obstruct the inlet eye of the catheter or the drainage lumen thereof. Such obstructions may be encountered in the process of continuous urinary drainage, particularly with infected patients or after surgery, or in an irrigation process where sterile fluid is introduced into the bladder by means of the catheter and thereafter drained through the catheter, the blood clots or mucous being washed away by the sterile fluid.

Similar obstructions may also be encountered in other drainage set-ups, for example, when a catheter or tube is used to drain fluid or mucous from any bodily site or cavity, e.g., peritoneal cavity, thorax, stomach, intestines.

In order to remove these obstructions and obtain normal drainage flow, it is frequently the practice to employ a suction device such as a hand pump or syringe to create a suction to withdrawn the obstruction. This practice is often inconvenient as it becomes necessary to disconnect or uncouple the drainage tubing, connect or otherwise apply the hand pump or syringe to the drainage system, and after removal of the obstruction, reconnect the drainage tubing. Between the time the drainage tubing is uncoupled and the hand pump or syringe connected up, fluid may continue to drain from the catheter thereby creating a problem of handling the drainage to prevent wetting and soiling of the work area. Also, disconnecting the tubing destroys the isolation of the drainage system from the surrounding elements thus increasing the possibility of introducing infection.

Accordingly, it is an object of the present invention to provide a one-way valve adapted for use in a device for aspirating a drainage system to remove obstructions and which is operable, as desired, without adversely affecting the integrity of the drainage system.

Another object is to provide a one-way valve adapted for use in an aspirating device in a drainage system, said device being operable to clear obstructions without creating an adverse back pressure in the drainage system.

Another object is to provide for delicate regulation of the degree of aspirating suction force.

A further object is to provide a device operable within

a drainage system to remove obstructions and which also functions to preclude the possibility of ascending infection.

A further object is to provide certain improvements in the form, construction, arrangement and material of the several elements whereby the above named and other objects may efficiently be attained.

A practical embodiment of the invention is shown in the accompanying drawings wherein:

FIG. 1 is an elevational view of an aspirating means connected within a drainage system.

FIG. 2 is an enlarged view partly in section of the aspirating means looking along the line II—II of FIG. 1.

FIG. 3 is a plane view of a flutter valve used in the aspirating means.

FIG. 4 is an elevational view of the flutter valve.

FIG. 5 is an elevational view of an alternate embodiment showing a drainage system employing an aspirator means and a flutter valve downstream thereof.

Referring to the drawings, a drainage bottle **10** is connected to a catheter **12** by the drainage tube **14**, the latter being arranged to provide a downhill flow path for fluid flow from the catheter **12** to the drainage bottle **10**. Connected to the drainage tube **14** is an aspirating means, indicated generally at **16** which comprises a hollow chamber **18** made of a flexible and resilient material, e.g. plastic, such as transparent polyvinyl chloride, adapting it to be manually compressed to force the air out and thereafter to resume its normal unflexed condition (FIG. 2) to draw air back in, as will be further described. A one-way valve **20** is connected to the drainage tube **14** upstream of the chamber **18** to prevent air or fluid from passing up the drainage tube **14** to the catheter **12** when the chamber **18** is being compressed.

As will be evident from the drawings, normal drainage flow will pass from the catheter **12**, through the one-way valve **20** and chamber **18**, and thence to the drainage bottle **10**. If an obstruction is encountered in the catheter which stops or otherwise impairs the drainage flow, it is only necessary to manually compress the chamber **18** to force the air out toward the collection bottle **10** as the one-way valve **20** prevents air flow upstream toward the catheter **16**. Thereafter, section **14*b*** of the drainage tube between the chamber **18** and the collection bottle **10** is blocked off, for example, by clamping it or folding it on itself to kink it, so that as the chamber **18** is released and resumes its uncompressed condition (FIG. 2) it will create a reduced pressure upstream of the chamber **18** to draw in any obstruction through the catheter and thereby clear the path for normal fluid flow. It will be observed that the chamber **18** is connected to the drainage tube **14** so that it is not necessary to disconnect the latter or in any way impair the integrity of the drainage system in order to operate the aspirating device and to resume normal drainage flow after aspiration. The aspirator **16** will normally provide sufficient suction to draw in the obstruction and pass it through the lumen of the catheter **16** to the drainage tube **14**, the latter generally having a larger lumen to readily pass the obstruction. To vary the degree of suction force, the chamber **18** may be compressed to a greater or lesser degree, as desired. Thus, when initiating aspiration, the chamber may be compressed slightly the first time. If this does not clear the obstruction, then it may be compressed a greater amount until the required suction is established. In this way suction may be progressively increased, thereby providing delicate regulation to protect the patient from excessive suction is established. In this way suction may be progressively increased, thereby providing delicate regulation to protect the patient from excessive suction in the body cavity.

As shown in the drawings, the one-way valve **20** is connected to the end of the upstream section **14***a* of the drainage tube so as to reside within the chamber **18** at a position spaced from thee inner walls of the chamber, thereby preventing formation of an unbroken path of liquid film through which bacteria might otherwise pass from the bottle **10** upstream to the drainage tube **14** to the patient.

The valve itself may be made from two identical sheets of plastic film (e.g. polyvinyl chloride) placed on top of one another and heat sealed along their longitudinal edges. The upper section **20***a* of the valve, heat sealed along opposite edges **22**, is adapted to be opened to a generally cylindrical shape to fit over the end of the drainage tube **14** while the lower section **20***b*, heat sealed along opposite edges **24**, extends beyond the drainage tube **14** into the chamber **18**. The lower section **20***b* is cylindrical at one end and flattened at the other whereby the lower portion, as viewed from one side (FIG. 2), flares outwardly while when viewed from a position ninety degrees therefrom (FIG. 4), it tapers inwardly to form a flat terminating end. With this construction, it will be evident that liquid or air will pass freely downstream through the valve as the pressure of the fluid within the lower section **20***b* spreads the flattended end portion. However, air or fluid will not flow upstream through the valve because when the pressure acting on the outside of the lower section **20***b* is greater than that on the inside (which condition is required to provide the upstream or reverse flow), the flat end section **20***b* will be pressed together.

In order to provide an increased area on which the differential pressure may act to thereby enhance the sealing effect, the lower section **20***b* of the valve may be made to taper outwardly as the terminating edge is approached. Thus the greatest area exposed to the differential pressure will be located closest to the terminating edge of the valve to provide the greatest sealing effect thereat. The width of the flat end may be greater than $\pi d/2$ where d is the diameter of the cylindrical section **20***a*.

In order to facilitate fitting the upper section **20***a* to the end of the drainage tube, said upper section **20***a* may have a slight taper, that is, it may have a slight conical shape when fitted on the tube **14**, with the larger end disposed at the upper terminating end.

The heat seal **22** for the upper section **20***a* may be made relatively narrow as the latter has to be folded back to be accommodated within the inlet section **26** of the chamber **18**. The heat seal **24** on the lower section **20***b* of the valve, however, may be as wide as necessary to insure that the flat condition of this section of the valve will be maintained. Since, in the illustrated embodiment, the valve is initially made from two flat sheets of plastic film heat sealed along longitudinal edges, the tendency will be for the lower section **20***b* to assume its flat condition as best shown in FIG. 4. This is desirable in order that it will seal immediately upon encountering any differential pressure attempting to effect reverse flow.

It will be understood that the valve may also be made from a single sheet of plastic film folded over on itself and heat sealed along one longitudinal edge or further that, it may be made from a sleeve having diametrically opposed folds along longitudinal edges corresponding to the location of the heat seals **22** and **24** in the illustrated embodiment. The folds may also have heat seals to assist in maintaining the aforesaid flat condition.

The drainage system is, of course, made air tight and to this end, adhesive may be used as required, for example, between the drainage tube **14** and the inlet section **26** of the aspirating chamber **18**.

As previously mentioned, the downstream section **14***b* of the drainage tube is clamped or otherwise blocked off when the aspirator creates a suction on the catheter. As may be desired, a second-one-way valve may be placed in the drainage system downstream of the aspirator to avoid having to block off this section of drainage tubing. As shown in FIG. 5, a one-way valve **28**, similar to the one previously described, is placed on the end of the drainage tube and disposed within the drainage bottle **10***a*. Thus, when the chamber **18** is collapsed, air will flow through the one-way valve **28** to the collection bottle, but when the chamber is released and aspiration commences, the one-way valve **28** will prevent reverse flow from the collection bottle **10***a* to the chamber **18**.

Since the one-way valve **20** or **28** serves as a check valve to prevent reverse flow, it will be evident that such valve has a wide variety of applications and is not necessarily limited to use in or with an aspirating device. For example, the valve may be used in a conventional drainage set-up (without an aspirator) by installing it on the end of the drainage tube within a collection device, such an arrangement being similar to that shown in the lower left hand portion of FIG. 5.

It will be understood that various changes may be made in the form, construction and arrangement of the several parts without departing from the spirit and scope of the invention and hence I do not intend to be limited to the details shown or described herein except as the same are included in the claims or may be required by disclosures of the prior art.

What I claim is:

1. A surgical drainage system comprising a catheter, a drainage tube leading therefrom to a collection container, a cylindrical chamber connected in said drainage tube and having an inlet and outlet, said drainage tube having an end passing through said inlet and terminating in said chamber, one-way flutter valve carried on said end of the drainage tube and disposed in said chamber, said chamber being made of a flexible resilient material adapted to be compressed and released to initiate aspiration of the drainage system, said flutter valve preventing upstream flow to the catheter when the chamber is compressed while permitting downstream flow during normal drainage and aspiration.

2. A surgical drainage system having a drainage tube leading from a body cavity to a collection container, a chamber connected to said drainage tube through which drainage fluid flows, said chamber being cylindrical, compressible and adapted to return to uncompressed form to initiate aspiration of said drainage system, said drainage tube having an end terminating in said chamber and a one-way flutter valve operatively connected to said end of the drainage tube to prevent reverse flow to the body cavity when the chamber is compressed, said valve being wholly contained in said chamber and spaced from the inner walls thereof.

3. A surgical drainage system according to claim **2** in which the flutter valve tapers outward and downward from a circular diameter approximately equal to that of the drainage tube to a flat width substantially greater than said diameter.

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