

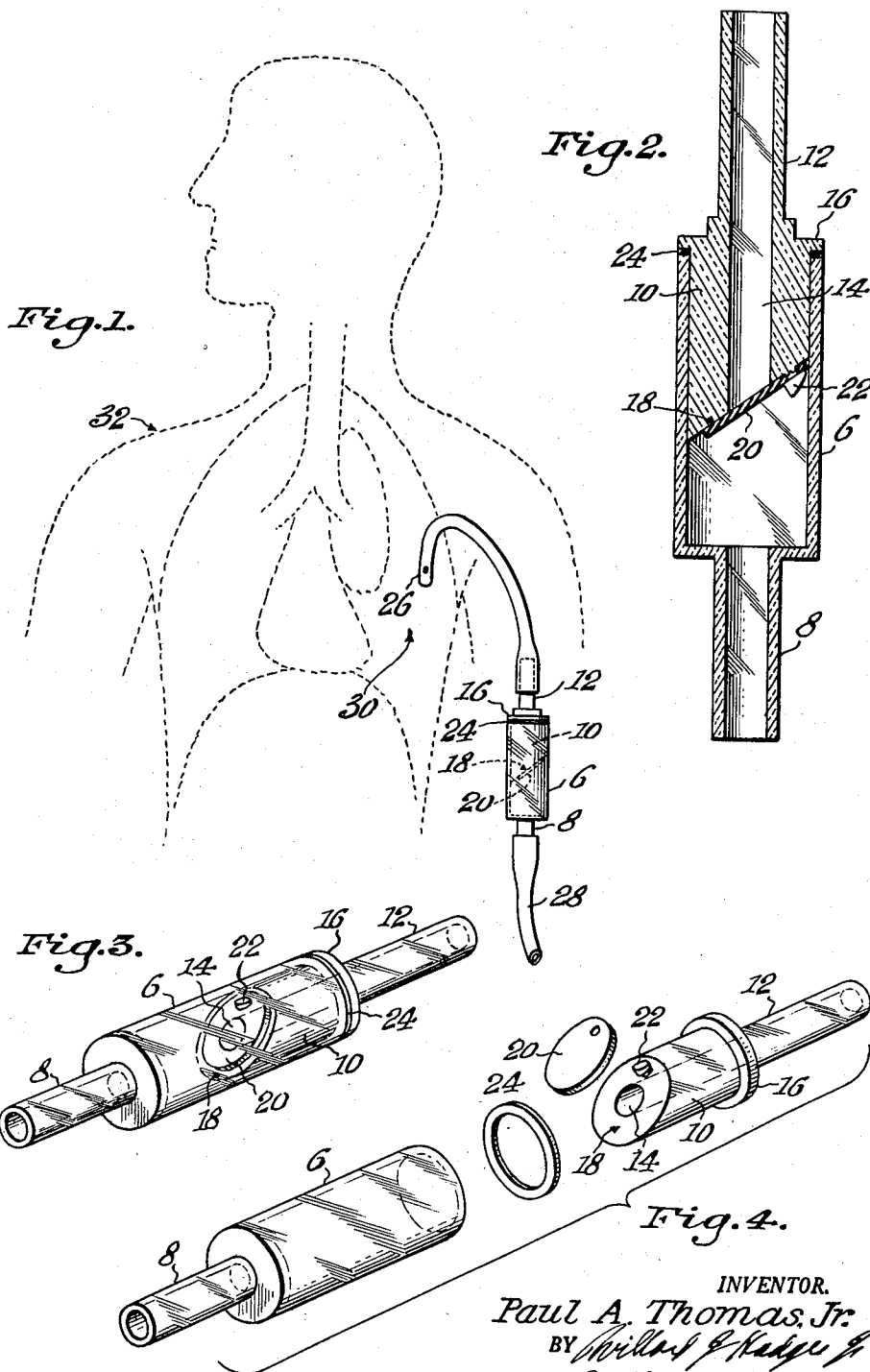
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P. A. THOMAS, JR

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FLUTTER VALVE FOR DRAINAGE OF THE PLEURAL CAVITY

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INVENTOR.
Paul A. Thomas, Jr.
BY *Miller & Hodge*
Bonifant Hamilton
ATTORNEYS

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FLUTTER VALVE FOR DRAINAGE OF THE PLEURAL CAVITY

Paul A. Thomas, Jr., San Francisco, Calif.

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2 Claims. (Cl. 128—350)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

The present invention relates to a valve for drainage of the pleural cavity and more particularly to a flutter valve to be used in combination with a catheter to accomplish complete evacuation of air and fluid from the pleural cavity to permit re-expansion of the collapsed lung of a living subject.

The need for a simple, safe, one-way valve for use in combination with intercostal catheter drainage of the pleural cavity to permit emergency treatment and evacuation of casualties was recently re-emphasized during the Korean conflict. The need for such a valve would be particularly great in the emergency treatment of mass casualties which might be caused by any large scale civilian disaster such as an atomic attack. The prior art valves used for drainage of the pleural space have consisted primarily of waterseal bottles. When waterseal bottles are used, closed intercostal drainage of the chest instituted at forward medical installations is fraught with dangers because of the necessity of movement when casualties are taken to the rear. Unless extreme vigilance is maintained in caring for the intercostal catheters and waterseal bottles during transportation, the hazards of moving chest casualties are greatly aggravated. If the waterseal bottle should inadvertently be raised to a level above that of the patient's chest, backflow of fluid from the bottle through the catheter into the pleural cavity is almost certain to ensue with disastrous results in contamination of the pleural cavity.

Accordingly, it is an object of the instant invention to provide a small, light weight, one-way valve for use in combination with a catheter which will permit drainage of the pleural cavity but prevent any possible backflow of fluid through the catheter into the pleural cavity.

It is another object of the present invention to provide a one-way valve for drainage of the pleural cavity which will make possible the emergency treatment of chest casualties at forward medical installations and avoid the hazard of backflow of fluid into the pleural cavity when the patient is transported from the forward installation to a larger medical facility, such as a hospital, in the rear.

Another object of this invention is to provide a simple, effective, and relatively foolproof valve for drainage of the pleural cavity which can be applied to the rapid emergency treatment of mass casualties in a large scale disaster without any danger of backflow of fluid into the pleural cavity to cause contamination and serious complications.

A further object of the invention is to provide a simple, light-weight, one-way valve to allow exit of air and fluid from the pleural cavity to permit more flexible hospital management of spontaneous pneumothorax by making possible the surgical treatment of pneumothorax on a semi-ambulant basis at forward installations through the elimination of the waterseal drainage system taught by the prior art.

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A still further object of the instant invention is to make possible in time of war or when mass casualties occur the rapid emergency treatment and transportation of chest casualties over long distances with minimal observation.

Broadly described, the present invention comprises a valve means to be used in combination with a catheter to provide drainage of gas and fluid from the pleural cavity. The valve means permits the passage of gas or fluid in one direction with maximum ease but completely stops any passage of gas or fluid in the opposite direction.

In operation, one end of a catheter is introduced into the pleural cavity and is connected to the valve means at its other end. A second catheter leads from the other end of the valve means to a suitable discharge point. Gas and liquid may pass freely from the pleural cavity through the valve means to the discharge point but if any gas or fluid commences to flow back from the discharge point toward the pleural cavity the passage is completely blocked by the valve means which permits the flow of gases and fluids in one direction only. When desired, gentle suction may be applied to the discharge end of the drainage system to provide more rapid and efficacious removal of gases and fluids from the pleural cavity.

Further objects and a more thorough understanding of the invention may be obtained by referring to the following description and claims taken in conjunction with the accompanying drawings which disclose an illustrative embodiment of the construction forming the basis of the invention, and in which—

Fig. 1 is a schematic view showing the pleural cavity drainage system including the valve means connected for operation with a living subject;

Fig. 2 is a central vertical section of the valve means;

Fig. 3 is a perspective view of the valve means; and

Fig. 4 is an exploded perspective view of the valve means.

In accordance with the invention, a valve means is provided at an intermediate point in the pleural cavity drainage system which will permit the rapid and easy evacuation of gases and liquids from the pleural cavity toward the discharge point but which will absolutely prevent any backflow of gases or fluids from any point in the system below the valve back into the pleural cavity.

In the illustrated embodiment of the invention (Fig. 4), the valve means comprises an outer cylindrical shell 6 having a catheter connecting tube 8 integrally connected to one of its ends, an inner barrel 10 having an outside diameter equal to the inside diameter of the outer cylindrical shell 6, and a second catheter connecting tube 12 integrally connected to one end of the inner barrel 10. The inner barrel 10 is provided with a centrally located tubular passageway 14 throughout its entire length. This tubular passageway 14 is of the same diameter as the inside diameter of the second catheter connecting tube 12 and is integrally connected therewith. The inner barrel 10 is slidably insertable within the outer cylindrical shell 6 to form a firm and positive joint between these two parts, and the inner barrel 10 is provided with an annular shoulder 16 which acts as a stop when the valve means is assembled by inserting the inner barrel 10 into the cylindrical shell 6. An inclined valve face 18 is provided on the inner end of the inner barrel 10. The inclined valve face 18 is covered by an occluding flap 20, which is constructed of rubber or some similar suitable elastic material, and the occluding flap 20 is removably anchored to the valve face by a peg hinge 22 which is integrally attached to the inclined valve face 18. A washer 24 is provided to form a positive seal between the base of the outer cylindrical shell 6 and the annular shoulder 16 of the inner barrel 10.

Ideally, the valve means is constructed of some trans-

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parent material in order to permit an observer to see fluid as it passes through the valve means.

In operation, the second catheter connecting tube 12 of the assembled valve means is attached to an intercostal catheter 26 (Fig. 1), and the first catheter connecting tube 8 is attached to a discharge catheter 28. The intercostal catheter 26 is then inserted into the pleural cavity 30 through an incision in the chest of a patient 32. With the pleural cavity drainage system thus established, gas or liquid trapped in the pleural cavity 30 is free to flow through the intercostal catheter 26 and the tubular passageway 14, to force open the occluding flap 20 against the very slight resistance which it offers, into the outer cylindrical shell 6, through the catheter connecting tube 8 and into the discharge catheter 28 from which it is discharged into a suitable receptacle.

Gentle suction or negative pressure may be applied to the free end of the discharge catheter 28 when the need for negative pressure drainage of the pleural cavity is indicated by clinical circumstances. When negative pressure is necessary or desirable, the patient may become non-transportable because of the auxiliary equipment which must be added to the system. When this condition exists, the valve means of the instant invention provides the advantage over the waterseal trap of the prior art that with the present invention, serious accidents due to backflow of fluid if the water sealed trap is mishandled are completely prevented by the non-backflow feature of the instant invention. Also, in time of emergency when the patient must become transportable, with the present invention negative pressure may be interrupted and the valve system will be left intact until circumstances are again stabilized to permit the reapplication of negative pressure.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. An apparatus for draining the pleural cavity of a living subject comprising a catheter having an intake end and a discharge end, the intake end of the catheter constructed for insertion directly into the pleural cavity, a one-way valve assembly having an intake portion and an outlet portion, the outlet portion comprising a large diameter first tube and a small diameter second tube integrally attached to it to form a continuous sealed passageway, the intake portion comprising a third tube having a small outside diameter part and a large outside diameter part, the large outside diameter part having a flat inclined face, the third tube having a centrally located

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passageway of uniform diameter, a resilient occluding flap hingedly attached to and covering the flat inclined face of the outside diameter part of the intake portion, the outside diameter part of the intake portion of the valve assembly fitting telescopically inside the large diameter part of the outlet portion to form a seal between the intake and outlet portions, the resilient occluding flap offering minimal resistance to passage of gas or liquid from the intake portion to the outlet portion and acting to completely block any flow in the opposite direction by forming a positive seal with the flat inclined face, and the small outside diameter part of the intake portion of the valve being connected to the discharge end of the catheter.

2. An apparatus for draining the pleural cavity of a living subject comprising a catheter having an intake end and a discharge end, the intake end of the catheter constructed for insertion directly into the pleural cavity, a one-way valve assembly having an intake portion and an outlet portion, the outlet portion comprising a large diameter first tube and a small diameter second tube integrally attached to it to form a continuous sealed passageway, the intake portion comprising a third tube having a small outside diameter part and a large outside diameter part, the large outside diameter part terminating in a flat inclined face, the third tube having a centrally located passageway of uniform diameter, a resilient occluding flap hingedly attached to and covering the inclined face of the intake portion, the outside diameter part of the intake portion of the valve assembly fitting telescopically inside the large diameter part of the outlet portion to form a seal between the intake and outlet portions, the entire valve assembly being transparent except for the occluding flap, the resilient occluding flap offering minimal resistance to passage of gas or liquids from the intake portion to the outlet portion and acting to completely block any flow in the opposite direction by forming a positive seal with the inclined face, and the small outside diameter part of the intake portion of the valve being connected to the discharge end of the catheter.

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