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10 JUL 1985

SUBJECT: Patent Application Available for Licensing Assigned to U. S. of America as Represented by Secretary of the Army

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The enclosed copies of Army designated, government-owned patent application serial no. 732,335, filed 10 May 1985, by Eugene J. Schweitzer and Kenneth G. Swan, are submitted for publication by NTIS in the Federal Register and the Patent and Trademark Official Gazette as being available for licensing and foreign filing (encl 1).

FOR THE COMMANDER:

for F. A. Cook, LTC, JAGC
JOHN H. RAUBITSCHEK
Chief, Patents, Copyrights,
and Trademarks Division

Encl

SN: 732,335
Filed: 10 May 1985
Inventors: Eugene J. Schweitzer
Kenneth G. Swan

FORWARD FIELD AUTOTRANSFUSION DEVICE

ABSTRACT

A typical embodiment of the invention enables blood to be drawn from the pleural cavity of an injured patient for autotransfusion purposes. A chest tube is connected to an inlet check valve within a resilient bulb suction pump. Blood, drawn into the bulb, is expelled therefrom by manipulating the bulb to cause the blood to flow out of the bulb through a filter and a discharge check valve to a blood collection bag.

FORWARD FIELD AUTOTRANSFUSION DEVICE

BACKGROUND OF THE INVENTION

This invention relates to autotransfusion apparatus and, more particularly, to an autotransfusion apparatus that has a hand suction pump containing an Heimlich valve for admitting blood to the pump and another Heimlich valve through which filtered blood is discharged from the pump, and the like.

There are many occasions in which, for the purpose of transfusion, autologous blood (the blood of the person requiring transfusion) is preferable to homologous blood (the blood of a donor). Typically, autologous blood is preferable because it is readily available, cross matched and free from pyrogens, or substances that will produce fever in the patient. Further in this regard, fever and allergic reactions all are avoided as well as the risks of hepatitis or isoimmunization from homologous antigens. Contrary to blood drawn from banks, moreover, antologous blood is much less expensive and enjoys a platelet count that frequently is nearly normal.

It also has been found that blood collected from the pleural cavity (the volume within the membrane that lines the chest cavity) shortly after a gunshot wound provides better oxygen delivery to the tissue of the patient than blood that is obtained through a bank. Blood from a hemmorhage as a consequence of a chest injury has a further autotransfusion advantage. If drawn from this source, the blood usually does not clot.

There is a need for an inexpensive device that can draw blood, which is accumulating in the pleural cavity of an injured person, for transfusion back into the patient's body through a suitable vein, or the like. For many purposes, an acceptable apparatus also must be compact, portable and capable of use by relatively unskilled personnel in emergency conditions in which electrical power and many of the other facilities frequently enjoyed in modern medical practice are lacking or are available only intermittently.

SUMMARY OF THE INVENTION

These and other problems that have characterized the prior art are overcome through the practice of the invention. More particularly, an illustrative embodiment of the invention has a thoracostomy tube connected to a collapsible bulb, or suction pump. Within the pump, and connected to the thoracostomy tube, is a one-way flutter valve, or Heimlich valve, that enables blood to flow only from the pleural cavity, through the tube and into the pump in response to the development of low pressure within the bulb. The pump discharge is connected through a filter to another Heimlich valve, the second valve permitting blood to flow only from the pump in response to the generation of a relatively high pressure within the collapsible bulb.

A collection bag containing an anticoagulant receives the blood that is pumped from the second Heimlich valve. Upon accumulating a sufficient quantity of blood, autotransfusion is begun by inverting

Consequently, the invention provides the needed compact, inexpensive and uncomplicated device for use in emergency conditions in which only the most primitive facilities are available. These and other features of the invention will become more apparent through a study of the following detailed description of a preferred embodiment, taken with the drawing. The scope of the invention, however, is limited only through the scope of the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

The sole figure of the drawing is a schematic front elevation in partial section of a typical embodiment of the invention.

DESCRIPTION OF THE INVENTION

For a more complete appreciation of the invention, attention is invited to the drawing which shows a chest tube 10. Illustratively, the tube 10 is a typical thoracostomy tube, an open end of which (not shown in the drawing) is inserted through an incision 11 in chest 12 in order to penetrate the pleural cavity of an injured patient. For the purpose of this invention, the injury produces an accumulation of blood within the pleural cavity, and it is this accumulation of autologous blood that is to be drained from the pleural cavity for subsequent autotransfusion.

In accordance with an important feature of the invention, the end of the chest tube 10 that is outside of the incision 11 terminates in an inlet check valve 13. As shown, the check valve 13 controls flow

from the pleural cavity and that this blood, once withdrawn, can not flow back into the pleural cavity. A Heimlich, or flutter valve has been found suitable for the purposes of the check valve 13.

The check valve 13 is mounted within a suction pump 14. Preferably, the suction pump 14 is a flexible, collapsible hollow bulb that can be manually compressed to expel its contents through a filter 15, e.g. Dacron-wood (40-micra). Upon relaxation, or release of the pressure compressing the pump 14, the inherent resiliency of the bulb restores it to the shape shown in the drawing, thereby producing a low pressure within the interior of the bulb.

A discharge check valve 16, secured to the suction pump 14, is in fluid communication with the interior of the pump through the filter 15. It has been found, moreover, that a flutter, or Heimlich valve is suitable for the purpose of the discharge check valve 16. The discharge check valve 16 communicates with a tubular manifold 17 that, in turn, is connected by means of a tubular "ell" 20 to a blood collection bag 21.

An air vent 22 is provided on the side of the collection bag 21 that accommodates the discharge end of the "ell" 20. As a matter of convenience, the collection bag 21 can be a one liter plastic bag that contains an anticoagulant. A number of anticoagulants are available. Thus, a citrate-phosphate-dextrose solution, an acid-citrate dextrose solution or heparin are suitable auticoagulants. Heparin, however, is the preferred because it does not require refrigeration, and thus is

In operation, the open end of the chest tube 10 is inserted through the incision 11 to penetrate the pleural cavity of an injured patient to establish fluid communication with blood accumulating as the consequence of an injury. The suction pump 14 is squeezed manually in order to expel air from the bulb through the filter 15, the discharge check valve 16, the manifold 17, the "ell" 20, the collection bag 21 and the air vent 22. Action of the inlet check valve 13, moreover, prevents the air from flowing into the pleural cavity through the tube 10.

The compressive force applied to the pump 14 is released, and the inherent resiliency of the bulb structure restores the bulb to its usual, generally spherical shape. Because air can not be drawn back into the pump 14 through the flow checking action of the discharge check valve 16, a pressure that is relatively lower than atmospheric is established within the bulb. The pleural cavity, however, is usually at, or close to atmospheric pressure. Consequently, the blood accumulated in the pleural cavity flows from the chest in the direction of arrow 23 through the tube 10 and the inlet check valve 13 into the pump 14.

The pump 14 is once more squeezed. Because the pump 14 now has a charge of blood from the pleural cavity, the pressure created by squeezing the bulb forces the blood to flow out of the bulb and into the collection bag 21 by way of the filter 14, the discharge check valve 16, and the "ell" 20.

As the blood fills the collection bag 21, it mixes with the anticongulant and purges residual air in the bag through the air vent 22.

Upon filling the blood collection bag in the foregoing manner, the "ell" 20 is disconnected from the manifold 17. The bag 21 then is coupled to a venous or other suitable transfusion conduit and inverted to autotransfuse the patient. Naturally, the process can be repeated several times with the same apparatus.

The device that characterizes the invention permits autologous blood to be transfused in very primitive, emergency conditions with a simple, inexpensive and easily stored apparatus by relatively unskilled personnel.

PRIOR ART STATEMENT

A number of proposals have been advanced to enable blood to be drawn from the pleural cavity of a patient for autotransfusion purposes. The following collection of United States Patents are typical of these proposals:

United States Patent No. 4,048,064 granted to W. T. Clark, III, on September 13, 1977 for "Biocompatible Hemoperfusion System" requires an elaborate mechanical apparatus, including a peristaltic blood pump.

United States Patent No. 4,215,688 granted August 5, 1980 to D. S. Terman et al. for "Apparatus For The Extracorporeal Treatment Of Disease" is a complicated apparatus requiring a blood centrifuge, a plasma treatment chamber, and the like.

United States Patent No. 4,424,053 granted January 3, 1984 to L. D. Kurtz et al. for "Disposable Autotransfusion Device" discloses a spring loaded movable wall liquid collection chamber.

United States Patent No. 4,428,744 granted January 31, 1984 to R. L. Edelson for "Method And System For Externally Treating The Blood" discloses a blood processing apparatus that requires ultraviolet radiation and a photoactive

United States Patent No. 4,445,884 granted May 1, 1984 to L. D. Kurtz et al. for "Air Purge Unit For Auto Transfusion Apparatus" deacribes a red blood cell filter in which the red blood cells block the flow of fluid through the filter.

Among the publications, the text Gunshot Wounds by Kenneth G. Swan and Roy C. Swan, Wright-PSG Publishing Company, Inc., Littleton, 1980, pages 95 to 97 describes a cumbersome device that requires a number of separate components for a gravity-flow apparatus.

None of these references, however, suggest a simple, manually operated device for drawing blood from a pleural cavity and collecting that blood for subsequent autotransfusion. These references fail to suggest an apparatus that can be used by untrained personnel in field conditions and without access to electrical power, water, and the like.

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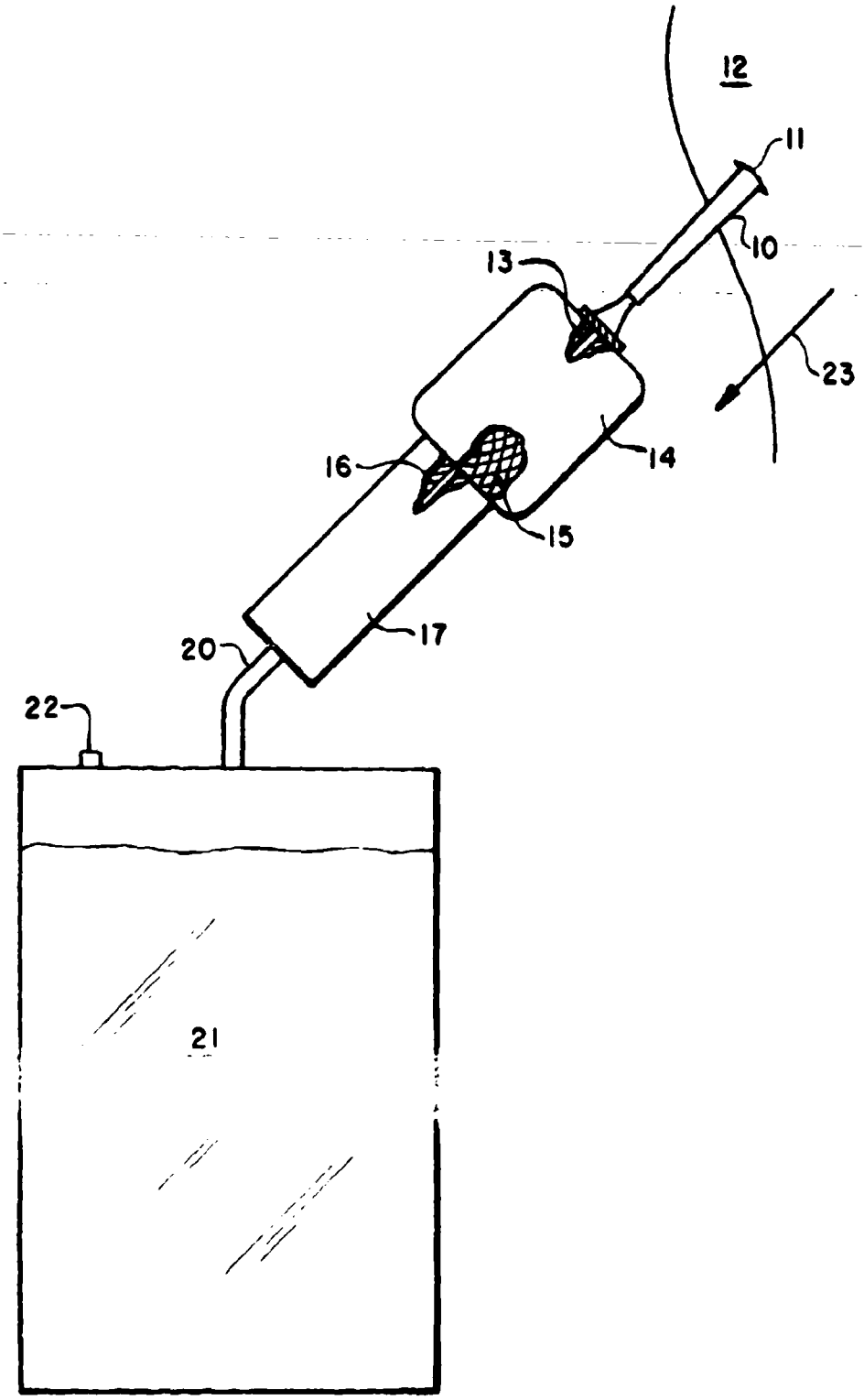
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ATTY. DOCKET NO. | SER. AL NO.

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

APPLICANT: Eugene Schweitzer et al.

FILING DATE | GROUP

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4 0 4 8 0 6 4	9-13-77	W. T. Clark, III	210	23R	
	AB	4 2 1 5 6 8 8	3-5-80	D. S. Terman et al.	128	214R	
	AC	4 4 2 4 0 5 3	1-2-84	L. D. Kurtz et al.	604	"	
	AD	4 4 2 8 7 4 4	1-31-84	R. L. Edelson	604	"	
	AE	4 4 4 5 8 8 4	5-1-84	L. D. Kurtz et al.	604	"	
	AF						
	AG						
	AH						
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FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES / NO
AL						
AM						
AN						
AO						
AP						

OTHER PRIOR ART *Including Author, Title, Date, Pertinent Pages, Etc.*

AR — Kenneth G. Swan and Roy F. Swan, Gunshot Wounds, Wright-PSG Publishing Co., Inc., Littleton, MA, 1981, pp. 95-97.

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EXAMINER | DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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