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Freedman

[11] **3,792,978**

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[54] **ENVELOPE ASSEMBLY FOR SPOOL TYPE OXYGENATOR**

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[52] **U.S. Cl.**..... **23/258.5**, 128/DIG. 3, 210/321, 210/494

[51] **Int. Cl.**..... **A61m 1/03**

[58] **Field of Search** 23/258.5; 210/321, 494; 128/DIG. 3

[56] **References Cited**

UNITED STATES PATENTS

3,489,647	1/1970	Kolobow	23/258.5 X
3,508,662	4/1970	Miller	210/494 X
3,567,028	3/1971	Nose	23/258.5 X
3,729,377	4/1973	Leonard	23/258.5 X
3,738,813	6/1973	Esmond	23/258.5
3,741,395	6/1973	Zimmerman	210/321

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[57] **ABSTRACT**

The invention relates to an envelope assembly for a spool wound artificial lung. The envelope assembly is characterized by having unobtrusive tube attachments which allow the envelope to be wound smoothly and evenly about the spool of the oxygenator.

2 Claims, 3 Drawing Figures

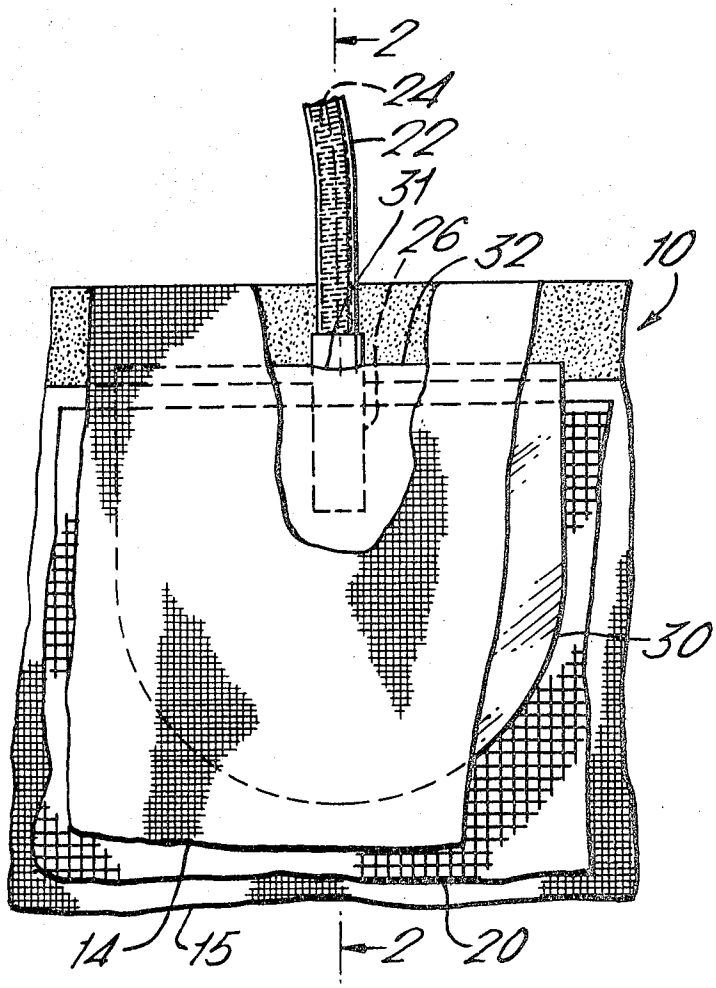


FIG. 1.

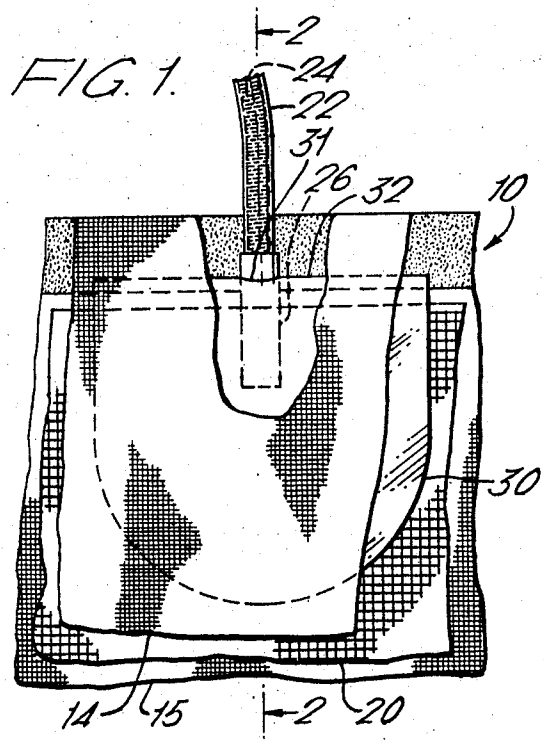


FIG. 2.

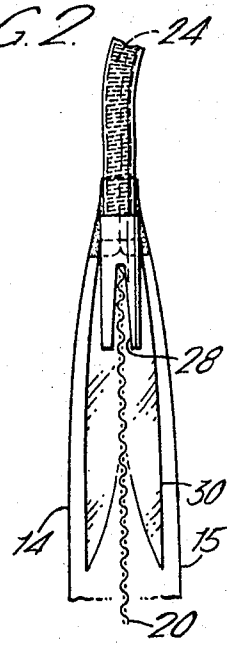
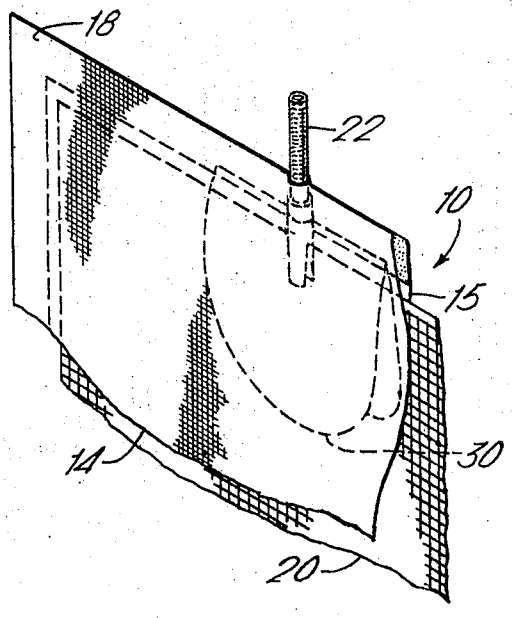


FIG. 3.



ENVELOPE ASSEMBLY FOR SPOOL TYPE OXYGENATOR

The invention relates to a new and improved envelope assembly for a spool wound artificial lung which may also be referred to as an oxygenator.

A spool wound artificial oxygenator as referred to above is disclosed in U.S. Pat. No. 3,489,647 to Theodor Kolobow titled, "Artificial Organ for Membrane Dialysis of Biological Fluids." The envelope assembly **11** as disclosed in the Kolobow patent is more or less schematic in nature and a practical embodiment thereof would have to be considerably modified to be effective for its intended purpose. The envelope **11** is wound around the spool or core **10** and, as is characteristic of membrane type oxygenators, the principle of gas diffusion through a membrane is utilized, there being an exchange of oxygen and carbon dioxide under conditions similar to those existing in the lungs. Without going unduly into detail at this point, it is essential to obtaining optimum conditions that the envelope be wound smoothly and evenly about the spool to avoid channeling of the blood. Winding in this desirable manner is not possible, however, if the tube attachments are bulky and cumbersome.

An object of the present invention is to provide a new and improved artificial lung or oxygenator envelope assembly having a tube attachment which is unobtrusive so as to not interfere with the capability of the envelope to be smoothly and evenly wound about the oxygenator spool.

Other objects and advantages of the invention will become apparent from the following specification, drawings and appended claims:

FIG. **1** is a fragmentary front elevational view, partly in section, of an envelope assembly for an artificial lung which assembly embodies the invention;

FIG. **2** is a sectional view of the envelope assembly taken on line **2—2** of FIG. **1**; and

FIG. **3** is a perspective view of the envelope assembly shown in FIGS. **1** and **2**.

In the drawing, there is shown a corner section of an envelope assembly **10** which includes an attached tube **22**. The tube construction and the manner of its attachment to the envelope is the same whether it is to function as a gas inlet tube or a gas outlet tube.

The envelope assembly comprises a pair of rectangularly shaped membrane sheets **14** and **15** made of a gas permeable material such as silicone rubber, Teflon or polypropylene. These sheets have a thickness on the order of 0.005 inch. As the word "envelope" implies, the four joining edges of the sheets **14** and **15** are sealed with a suitable cement to form a seam **18** having a width on the order of ¼ inch.

Within the space bounded by the sealed edges of the envelope formed by the sheets **14** and **15** is sandwiched a spacer screen **20** which may be of any suitable material such as fiberglass, Saran or nylon and has a thickness on the order of 0.030 inch. Spacer screen **20** functions to maintain a desired spacing between the membrane sheets **14** and **15** to provide a gas chamber which resists collapsing when the external pressure on the sheets **14** and **15** is greater than the internal pressure.

It is of importance that screen **20** is spaced from the seam **18** and is definitely not cemented into the seam.

Tubing means are provided for admitting and exhausting gaseous fluids to and from the enclosed space between membrane sheets **14** and **15** which forms an enclosed chamber as stated above. Only one tube **22** is illustrated but it will be understood that any number of similarly constructed and installed tubes may be utilized. Tube **22** is made of silicon rubber and has a stainless steel, coiled spring **24** inserted therein in a known manner, the purpose of the spring being to prevent kinking of the tube and to present a resistance to the collapsing of the tube when the external environmental pressure exceeds the internal pressure.

The end of tube **22** is force fitted onto a cylindrically shaped, rigid plastic sleeve **26** having an internal diameter which is nominally the same as the external diameter of tube **22**. Sleeve **26** has a transversely extending slit **28** for receiving or accommodating the screen **20**.

In surrounding relation to the screen **20** and the sleeve **26** is a folded bib member **30**. Bib **30** has an opening which is centrally located relative to the center fold **32** thereof and in closely fitting relation to the sleeve **26**. Bib **30** is made of a polyester, cellulose acetate or other suitable plastic material and the purpose or function of it is to protect the inside surfaces of the membrane sheets **14** and **15** from any possibly sharp edge on the sleeve **26**.

In the manufacture of the envelope assembly the sleeve **26** is forced onto the end of the tube **22** and the sleeve is slipped into the opening **31** of the bib **30**. The edge of the screen **20** is inserted into the slit **28** of the sleeve **26** and the two membrane sheets **14** and **15** are then cemented together to form the seam **18** as described above. In this operation the lower end of the tube **22** and the upper end of the plastic sleeve **26** are in the seam proper between the sealed edges of the membrane sheets **14** and **15**. The folded edge of the bib **30** is likewise in the seam proper between the sealed edges of the membrane sheets **14** and **15**, as illustrated.

I claim:

1. A gas exchange envelope assembly for a spool type oxygenator comprising a pair of rectangularly shaped fluid permeable membrane sheets, said sheets being cemented together to form a peripherally extending seam and a chamber therebetween, a screen member in said chamber in closely spaced relation to the internal boundary of said seam, a tube having a sleeve attached at one end thereof in surrounding relation thereto, said tube end and a portion of said sleeve being cemented to and between said sheets within the boundaries of said seam, said sleeve having a transversely extending slit in straddling relation to said screen.

2. An envelope assembly according to claim **1** including a folded bib member having folded parts and an opening along the fold line thereof, said bib opening being in surrounding relation to said sleeve and said folded parts being in straddling relation to said screen.

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