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.
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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