PATENT SPECIFICATION

Convention Date (Germany): Sept. 22, 1938.

532,148

Application Date (In United Kingdom): Aug. 18, 1939. No. 23821/39.

Complete Specification Accepted: Jan. 17, 1941.

COMPLETE SPECIFICATION

Improvements in or relating to means for Securing the Membrane in Electro-decantation Devices

We, DUNLOP PLANTATIONS LIMITED, of 32, Osnaburgh Street, London, N.W.1, England, an English Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a membrane-supporting device for use in the purification, separation and/or concentration of colloids by electrodecantation.

In the electrodecantation method of purifying, separating and/or concentrating colloids, the colloid is subjected to an electrodialysis treatment between current-permeable membranes under conditions which bring about an unmixing in the inter-membrane space, this unmixing phenomenon manifesting itself by stratification of the sol. The conditions necessary for obtaining this result are discussed in British Patent Specification No. 492,030, which describes the application of the electrodecantation treatment to aqueous rubber dispersions.

A probable explanation of the phenomenon is given in the British patent specification referred to. Briefly, under the influence of the applied potential difference the colloid particles migrate towards one of the membranes and concentrate there until, given appropriate conditions, the accumulating particles come more under the influence of gravity forces and less under the influence of electrical forces tending to produce electrodeposition proper. The accumulated particles then rise or fall in the proximity of the membrane surface, according to their apparent density with respect to the remainder of the sol, and spread out layerwise through the cell liquid.

Since the layering is a consequence of processes occurring at a diaphragm surface, it will be apparent that the greater the number of diaphragm surfaces provided in the cell space transversely to the current direction, the more rapidly will the stratification take place, as has already been described in British Patent Specification No. 505,752. It is economically advantageous, therefore, to carry out the electrodecantation with the aid of a plurality of diaphragms, but the provision of such a plurality of diaphragms in a cell is often attended by mechanical difficulties. The object of the present invention is to provide a device including a membrane which has but to be placed in the cell liquid to subdivide the latter into a plurality of membrane-bounded compartments transverse to the current direction, so that the provision of the desired plurality of membranes in any cell becomes a very simple matter.

The device provided by the present invention consists of a framework having membrane-securing means mounted at each end and carrying rotatably mounted rollers arranged in staggered relationship, a membrane strip being looped round said rollers so as to extend in sinuous form from one end of the framework to the other and its ends being secured to said membrane-securing means.

By means of the device provided by the invention the cell liquid is easily subdivided into membrane-bounded compartments in the desired way, with consequent acceleration of the electrodecantation operation. Further, the membrane, which is very thin and relatively tender, is adequately supported by the device and so safeguarded from injury, and the difficulty of directly mounting it, or numerous small diaphragms, in the cell is eliminated.

The framework of the device preferably takes the form of a lower and an upper frame element. The rollers may be mounted on these elements so as to occupy a position between them substantially perpendicular thereto, bearings for the roller pins being provided in the frames. However, if desired the frame elements may be held at a fixed distance apart by means of rigidly secured mandrels arranged in staggered relationship, the rollers taking the form of sleeves slipped over said mandrels. The rollers are preferably arranged at opposite lateral sides of the framework, those at

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one side being staggered with respect to those at the other side.

The membrane-securing means for holding the membrane ends are disposed one at each end of the framework, preferably at corners thereof. The means at one end may be a rigidly fixed pillar, or a roller, that at the other end being either a fixed post or, preferably, a rotatably mounted roller adapted to be turned for the purpose of applying tension to the membrane. Such a tensioning roller may be spring controlled and provided with a locking mechanism, so that when the desired degree of tensioning of the membrane has been obtained by turning the roller the latter is secured in position and cannot turn back under the pull exerted by the tensioned membrane. If desired indicating means may be provided for showing the degree of tension which has been applied to the membrane by turning the spring-controlled roller.

The membrane-securing means, whether in the form of roller or fixed pillar, may be provided with a groove along the length thereof in which the membrane end may be secured.

The accompanying drawing shows by way of example one form of the device provided by the invention. In the drawing

Figure 1 shows one constructional example of the device in perspective;

Figure 2 is a plan view of the device inserted in the electrodecantation vessel; and

Figure 3 shows an enlarged partial longitudinal section through the tensioning means; whilst

Figures 4 and 5 are plan views of a membrane-securing roller and of a guiding roller respectively.

As shown in Figure 1, the base consists of a lower frame element 1, rectangular for example, and an upper frame element 2, which latter may advantageously be made as narrow as possible in order not to hinder too greatly removal from the cell liquid. Both frame elements contain bearing holes for a plurality of guiding rollers 3, arranged in staggered relationship, and for the two membrane-securing rollers 4 and 5. The number of guiding rollers may be selected at will according to the number of cells required. In the constructional example illustrated, for the sake of simplicity only four guiding rollers are provided, whereby the cell liquid will be subdivided into six membrane-bounded compartments.

The membrane 6, consisting for example of a long and very thin strip of the substance known under the Registered Trade Mark Cellophane, is firmly clamped at one end to the roller 4, and is then passed to and fro round the guiding rollers 3, and finally secured by the other end to the periphery of the roller 5. For the attainment of the requisite tension the roller 5 is provided with tensioning means.

For use the device carrying the membrane 6 is inserted (Figure 2) in the decanting vessel 7 between two outer cells 8 which contain the electrodes and the inner walls of which, facing the vessel interior, are in the form of membranes. The longitudinal walls of the compartment cells thus provided are formed by the membrane, and the transverse walls by the guiding rollers 3 at one end of each cell and by the walls of the vessel 7 at the other end. The bottoms of the compartment cells are constituted by the bottom of the vessel 7, with a common serum outflow aperture, while the cells are free at the top for the separation of the layer of low specific gravity. In order to obviate relatively large current losses the membrane-supporting device should be of such a size that the interstices between the walls and bottom of the containing vessel and the membrane or its guiding members are kept as small as possible. The feeding of the colloid to be treated (latex for example) into the individual cells can only be effected laterally from the vessel walls.

The ends of the membrane may be secured, as shown for example in Figure 4, by slipping the ends reinforced with indiarubber cords 10 or the like, into dove-tail-shaped grooves 9 in the roller or post 4 and in the roller 5. The stretching of the membrane is then effected by rotating the roller 5 by means of a turning knob 13, shown in Figures 1 and 3. For the purpose of limiting the tension in the membrane a spiral spring 15 may for example be provided, one end of which is secured to the turning knob 13 and the other to the axial bolt 11 of the roller 5. The turning knob 13, mounted loose upon the end of the bolt, may also be equipped with a pointer 14, which moves over a stationary scale 12, and which can be clamped to the latter by means for instance of a resilient engagement of its end 17 in marginal notches, or by means of pins, screws or the like.

Figure 5 shows in plan view an alternative form for the guiding rollers. Here 3^1 represents a mandrel, the pins 11 at the ends of which are firmly secured to the frame elements 1 and 2. The roller element takes the form of a sleeve 16, of glass, porcelain, vulcanite or the like, which is slipped on to the said mandrel. This sleeve turns on the

mandrel as the membrane is stretched, whereby any possibility of the membrane being injured during the stretching operation is eliminated.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A removable device for subdividing the cell liquid in the electro-decantation treatment of a colloidal dispersion into a plurality of membrane-bounded compartments transverse to the current direction, consisting of a framework having membrane-securing means at each end and carrying rotatably mounted rollers arranged in staggered relationship, a membrane strip being looped round said rollers so as to extend in sinuous form from one end of the framework to the other and its ends being secured to said membrane-securing means.

2. A device as claimed in claim 1 in which the framework consists of a lower frame element and an upper frame element situated at a spaced distance thereover, the rollers extending substantially verically between the said frame elements.

3. A device as claimed in claim 1 or 2 in which the rollers are arranged at opposite lateral sides of the framework, the rollers on one side being staggered with respect to those on the other side.

4. A device as claimed in claim 2 or 3 in which the rollers take the form of sleeves mounted on fixed mandrels holding the upper and lower frame elements at a spaced distance apart.

5. A device as claimed in any one of the preceding claims in which at least one of the membrane-securing means takes the form of a rotatably mounted roller.

6. A device as claimed in any one of the preceding claims in which the membrane-securing means has a longitudinal groove for accommodating the end of the membrane.

7. A device as claimed in claim 5 in which one membrane-securing means in the form of a roller is spring controlled and is provided with a locking mechanism for securing it in position after being turned sufficiently to tension the membrane strip to the desired extent.

8. A device as claimed in claim 7 having indicating means for showing the degree of tension applied to the membrane strip on turning the spring-controlled roller.

9. The improved device for subdividing the cell liquid in the electrodecantation treatment of a colloidal dispersion into a plurality of membrane-bounded compartments transverse to the current direction substantially as hereinbefore described with reference to the accompanying drawing.

Dated this 18th day of August, 1939.

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