June 29, 1926. 1,590,604

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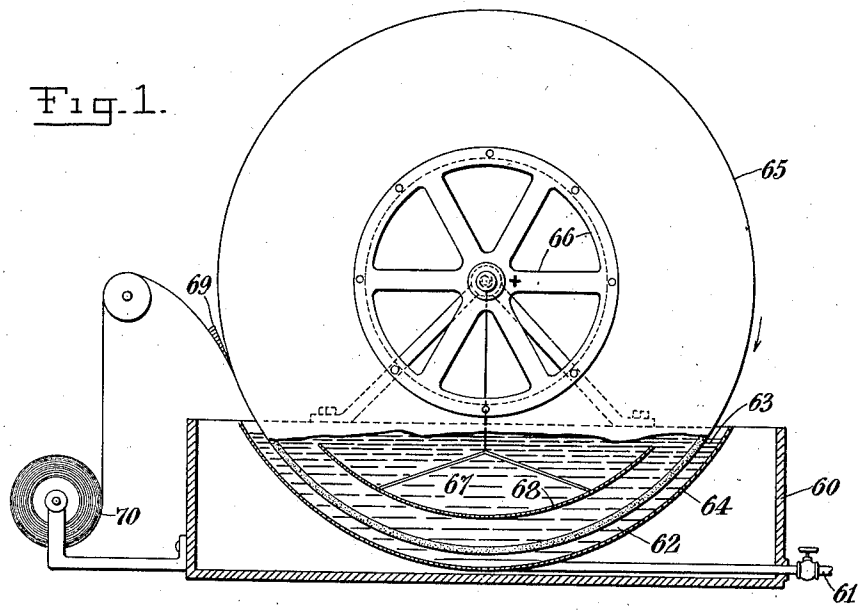
ELECTROLYTIC CELL

Filed June 21, 1924

Fig. 1.



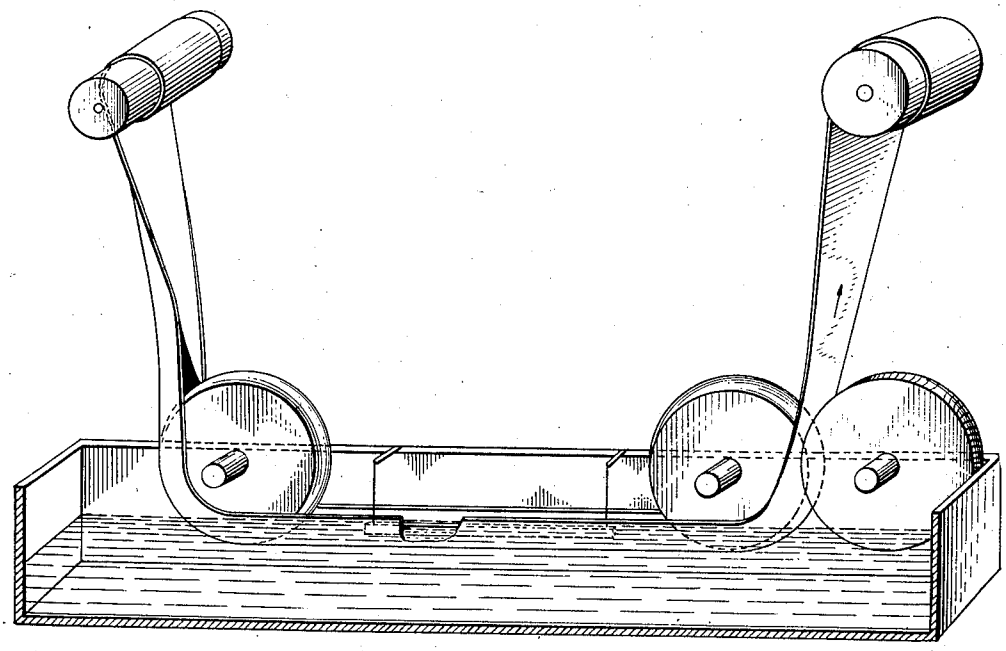


Fig. 2.

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Patented June 29, 1926. 1,590,604

UNITED STATES PATENT OFFICE.

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ELECTROLYTIC CELL.

Application filed June 21, 1924. Serial No. 721,378.

My invention relates to improvements in electrolytic cells and more particularly cells for subjecting solutions of organic material to electrolysis. In copending application Ser. No. 341,953, filed Dec. 2, 1919, there is described a method of treating organic material such as a solution of cellulose in cupro-ammonia solution by placing a layer thereof on a platinum belt and passing the belt through an electrolytic cell in which the belt serves as the anode, whereby the copper of the solution is removed electrolytically and deposited upon a copper or other anode and the ammonia is also freed, and the cellulose is deposited on the platinum anode belt and the solvent constituents removed from the cellulose electrolytically. A platinum belt, however, is quite expensive but if copper or other similar metals were used for the anode belt, the copper or other metal therefrom would pass into solution and into the cellulose deposited thereon and thus make it impossible to satisfactorily free the cellulose of copper. The main object of the present invention is to provide an electrolytic cell of this class which does not require a platinum electrode or only a small one. I preferably accomplish this by placing the anode in a conducting solution which does not attack the anode and placing the cupro-ammonia cellulose solution in another part of the cell and separating the two solutions by a separator or permeable membrane, on which the organic solution or material is laid, or deposited. In this case the current passes through both solutions and through the separator or membrane, causing the copper from the cellulose solution to be deposited on the cathode while the cellulose adheres to or is collected on the separator, being prevented thereby from travelling to the anode, and since the separator separates the cell into two compartments with the anode in one and the cathode in the other, and the solution in the anode compartment is different and does not attack the anode, the removal of the copper or other metal solvent constituent from the cellulose by electrolysis may be proceeded with satisfactorily. The invention in its broad aspects may be employed in other forms and further objects, advantages and features will more clearly appear from the detail description given below taken in connection with the accompanying drawings which form a part of this specification. In the drawings Fig. 1 is an elevation, partly in section of an embodiment of one form of my improvements, and Fig. 2 is a perspective, partly in section illustrating a modification.

Referring to Fig. 1, 60 indicates a suitable container provided on the inside with a copper bottom 64 which may form the cathode of the cell. 65 indicates a rotating drum provided with a porous or permeable periphery which forms the separating means of the cell. This porous periphery may be made of porous earthenware or felt. The drum is hollow with an opening in its end at the center through the journal frame 66. A conducting solution is introduced into the drum through this opening. An anode 68 is hung from the axle of the drum, inside the drum, so as to be suspended in a substantially stationary position in the solution 67 and on the outside of the drum the container holds the conducting solution or electrolyte 63 in the chamber 62. The solution 67 may be dilute sulphuric acid or nitric acid and in which case the anode 68 is made of platinum but since the electrode is stationary and may be small the cost is not so excessive. However, I prefer to make the solution of ammonium nitrate and the anode 68 may be of carbon, which is not attacked by the ammonium nitrate. It will be seen that the drum with its porous or permeable periphery acts as a separator forming two compartments, one outside the drum and one inside the drum, the anode being in one with a conducting solution and the cathode being in the other with the solution of cupro-ammonia solution of cellulose 63, or other organic material. A drain-off is provided for the electrolytic solution chamber 62 at 61, and as the solution 63 therein gradually becomes exhausted it is withdrawn, and fresh solution may be introduced in the top of the chamber.

With the current passing between the electrodes, the drum is slowly rotated and a film of substantially pure cellulose is deposited upon the periphery of the drum electrolytically and passes out with the drum and is removed by the scraper 69 and may be wound upon the reel as indicated at 70,

or if desired the porous element 65 may remain stationary and a suitable belt of felt or camel's hair filter cloth unattacked by the solution may be drawn around the lower periphery of the same through the electrolyte to take the film, and the belt and film may then be separated as indicated.

Since the anode 68 is unattacked by the solution 67 no metal therefrom will pass through the deposited cellulose to contaminate the latter and since the anode is stationary and not a travelling belt it may be relatively small and inexpensive. Where a suitable flexible porous belt is used it is only necessary to have a guide therefor in order to separate the electrolyte and the anode solution such as ammonium nitrate. Where a porous drum is used the ends of the drum are coated preferably with paraffine so that the current passes only through the rim or periphery forming a uniform flat ribbon-like film. In fact, instead of using a wool belt, a strip or ribbon of cellulose itself may be washed in a dilute solution of sulphuric acid, thus rendering it insoluble in the electrolytes though sufficiently porous to allow for the passage of the current therethrough, and the pure cellulose will be deposited thereupon and may be readily removed therefrom.

In the arrangement shown in Fig. 2 there is an outer tank carrying the cupro-ammonia cellulose electrolyte and provided with a pair of convex pulleys carrying a suitable belt such as wool which in turn carries a nitro-ammonia solution with an anode therein, and a cathode in the outside electrolyte, it being understood that both electrolytes are maintained at the same level. The current passes through the belt leaving the pure cellulose thereon to be removed as aforesaid, while the copper from the cellulose accumulates upon the cathode.

Where special forms are to be produced with the cellulose such for instance as drinking cups, the nitroammonia electrolyte and the anode are placed within the porous jar upon which the cellulose cup is to be formed and this is then in turn immersed in the cupro-ammonia cellulose electrolyte in an outer container or tank with a cylindrical cathode. The current passing from anode to cathode deposits a cellulose cup on the jar and carries all the metallic solvent from the cellulose cup formed on the outside of the porous jar, until the desired thickness is obtained, after which it may be readily removed and treated in any desired manner.

While I have described my improvements in great detail and with respect to preferred forms thereof, I do not desire to be limited to such details or forms since many changes and modifications may be made and the improvements embodied in widely different forms without departing from the spirit and scope of the invention in its broader aspects; hence I desire to cover all modifications and forms coming within the language or scope of any one or more of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. An electrolytic cell comprising a container, having an anode and cooperating cathode therein, a separator between said electrodes, an electrolyte solution on one side of the separator and a different conducting solution on the other side of the separator, the current passing between said electrodes passing through said solutions and separator the electrolyte solution and separator being such that material from the electrolyte solution is electro-deposited on the separator.

2. An electrolytic cell comprising a container, having an anode and cooperating cathode therein, a separator between said electrodes, a solution of organic material on one side of the separator and a different conducting solution on the other side of the separator, the current passing between said electrodes passing through said solutions and separator the solution of organic material and separator being such that organic material is electro-deposited on the separator.

3. An electrolytic cell comprising a container, having an anode and cooperating cathode therein, a separator continuously moving through said cell and between said electrodes, a solution of organic material on one side of the separator and a different conducting solution on the other side of the separator, the current passing between said electrodes passing through said solutions and separator, and depositing the organic material on the separator.

4. An electrolytic cell comprising a container, having an anode and cooperating cathode therein, a separator between said electrodes, a solution of cellulose on one side of the separator and a different conducting solution on the other side of the separator, the current passing between said electrodes passing through said solutions and separator leaving the cellulose deposited on the separator while solvent constituents are removed therefrom electrolytically.

5. An electrolytic cell comprising a container, having an anode and cooperating cathode therein, a separator between said electrodes, a solution of cellulose on one side of the separator and a different conducting solution on the other side of the separator, the current passing between said electrodes passing through said solutions and separator leaving the cellulose deposited on the separator while solvent constituents are removed therefrom electrolytically, and means for moving said separator through the cell while electrolysis is proceeding.

6. An electrolytic cell comprising a container having two cooperating electrodes

therein, a conducting solution between said electrodes and means for passing a layer of cellulose material through the cell between said electrodes while the current is passing between the electrodes.

7. An electrolytic cell comprising a container having two cooperating electrodes therein between which the current passes, a layer of cellulosic material in the cell between said electrodes, a solution of cellulose on one side of said layer of celluosic material between it and one electrode and a different conducting solution on the other side of said layer of cellulosic material and between it and the other electrode.

8. An electrolytic cell comprising a container having two cooperating electrodes therein between which the current passes, a separator in the cell between said electrodes, a solution of cellulose on one side of the separator between it and one electrode and a different conducting solution on the other side of the separator between it and the other electrode, the current acting to deposit cellulose from cellulose solution on the separator.

9. An electrolytic cell comprising a container having two cooperating electrodes therein between which the current passes, a separator in the cell between said electrodes, a solution of cellulose on one side of the separator between it and one electrode and ammonium nitrate on the other side of the separator between it and the other electrode, the current acting to deposit cellulose from cellulose solution on the separator.

10. An electrolytic cell comprising a container, a permeable membrane dividing the container into two compartments, an anode in one compartment, a cathode in the other compartment cooperating with anode, a solution of organic material in one compartment and a different conducting solution in the other compartment the solution of organic material and the separator being such that organic material is electro-deposited on the separator.

11. An electrolytic cell having therein an anode and cathode cooperating therewith, a permeable membrane between said electrodes dividing the cell into two compartments and a rotating drum adapted to dip into said cell, said membrane being carried at the periphery of said drum.

12. An electrolytic cell having therein an anode and a cathode cooperating therewith, a solution of cellulose in the cell and a solution of ammonium nitrate in the cell, said solutions being so arranged that the current passing between said electrodes passes through both solutions.

13. An electrolytic cell having therein an anode and a cathode cooperating therewith, a solution of cellulose in the cell and a solution of ammonium nitrate in the cell, said solutions being so arranged that the current passing between said electrodes passes through both solutions, separating means for separating the cellulosic from the other solution.

14. An electrolytic cell having therein an anode and a cathode cooperating therewith, a solution of cellulose in the cell and a solution of ammonium nitrate in the cell, said solutions being so arranged that the current passing between said electrodes passes through both solutions, separating means for separating cellulose from the other solution, said separating means being carried on a rotating member.

15. An electrolytic cell having an anode and a cathode therein, a separator between said electrodes and an electrolyte solution of organic material between the separator and one electrode whereby upon passage of current between the electrodes the organic material is electro-deposited upon the separator.

16. An electrolytic cell having an anode and cathode therein, a separator between said electrodes, and an electrolyte solution of cellulose between the separator and the cathode whereby upon passage of current between the electrodes the cellulose is deposited on the separator.

17. An electrolytic cell having an anode and cathode therein, a separator between said electrodes and a solution of cellulose between the separator and cathode.

18. An electrolytic cell having an anode and cathode therein, a separator between said electrodes and a solution of cellulose between the separator and cathode, and means for moving the separator through the cell.

19. An electrolytic cell having a stationary anode and a stationary cathode therein, a separator positioned between said electrodes, and an electrolyte solution of organic material between the separator and one electrode, whereby upon passage of current organic material is deposited on the separator.

20. An electrolytic cell having a stationary anode and a stationary cathode therein, a separator positioned between said electrodes, and an electrolyte solution of organic material between the separator and one electrode, whereby upon passage of current organic material is deposited on the separator and solvent constituents are removed from the organic material electrolytically, and means for moving the separator through the cell during such deposition and removal.

In testimony whereof I have signed my name to this specification.

EDWIN TAYLOR.