April 25, 1933. A. LIMA, JR 1,905,295

APPARATUS FOR TREATING SUGAR CONTAINING LIQUID

Filed Sept. 9, 1931

FIG. 1.

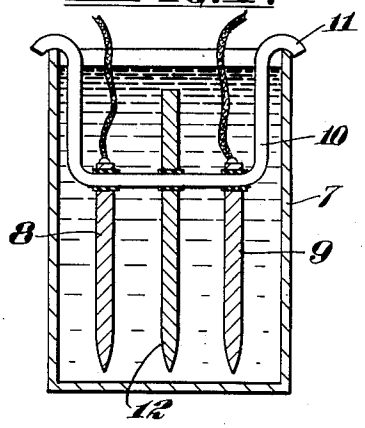


FIG. 2.

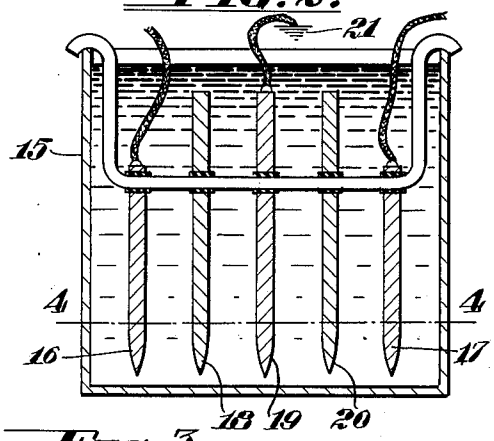


FIG. 3.

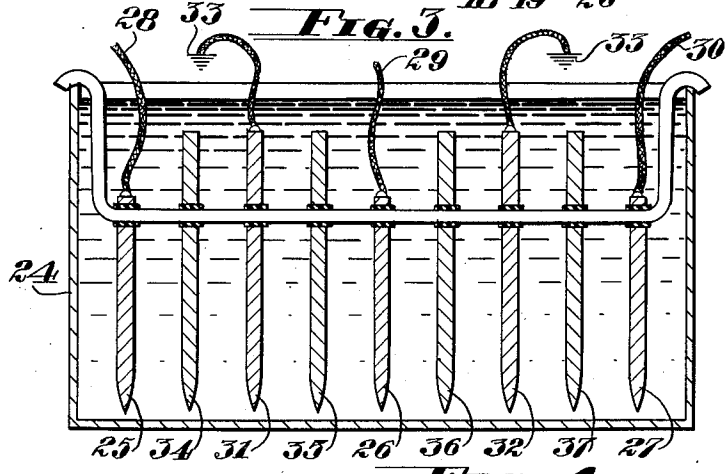


FIG. 5.

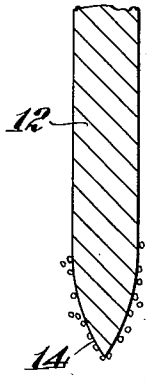


FIG. 4.

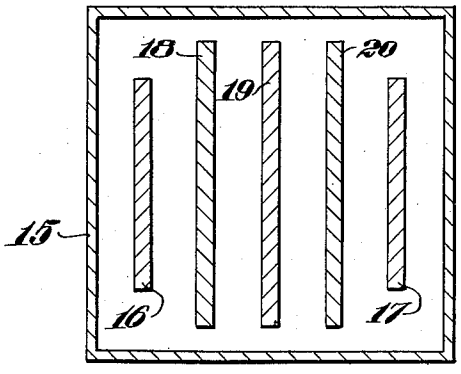
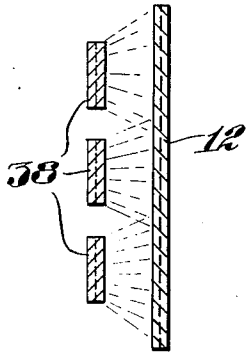


FIG. 6.



Inventor:
Alfred Lima, Jr.
By R. S. Bunn
Att'y.

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UNITED STATES PATENT OFFICE

ALFRED LIMA, JR., OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO ELECTRIFIED SUGAR COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF DELAWARE

APPARATUS FOR TREATING SUGAR CONTAINING LIQUID

Application filed September 8, 1931. Serial No. 561,840.

This invention relates to treating sugar containing liquids and more particularly has to do with apparatus for purifying and clarifying such liquids under the electrolytic method disclosed in my co-pending application, Serial Number 453,529, filed May 19, 1930, as well as in accordance with the methods forming a part of the invention hereof.

An object of the invention is to provide a comparatively inexpensive apparatus with which sugar containing liquids may be electrolytically purified and treated in a particularly thorough and expeditious manner and at a lower cost than has heretofore been possible.

Another object is to provide improved sugar-liquid purifying methods which may be readily and economically practiced to effect a thorough removal of the impurities from and the decoloration of the liquid, in a particularly efficacious manner.

A further object is to provide in apparatus and methods of the character described, a comparatively great electrolytic action, whereby to bring about a quicker and more thorough treatment of the sugar containing liquid, with a minimum expenditure of electrical energy.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed and illustrated by way of example in the accompanying drawing, in which:

Figure 1 is a vertical section of apparatus constructed in accordance with this invention;

Figure 2 is a vertical section of a modified form of the invention;

Figure 3 is a vertical section of another modified form;

Figure 4 is a sectional view taken on the plane of line 4—4 of Figure 2;

Figure 5 is an enlarged fragmentary view of one of the electrodes;

Figure 6 is a top plan view of a sectional electrode.

As shown in the accompanying drawing the sugar containing liquid to be treated is placed in a tank or like receptacle 7 and is subjected to an electrolytic action by means of electrodes 8 and 9 energized by an alternating current from a suitable source, not shown. Suitable means may be employed for supporting the electrodes in the tank. For example, a supporting bar 10 having hook terminals 11 may be used to support the electrodes as a removable unit, the electrodes being, of course, insulated from said bar.

While an effective electrolytic action will be produced by use of the electrodes 8 and 9, whereby the sugar containing liquid may be purified and clarified by following the method as particularly pointed out in the aforesaid co-pending application, the treatment of the liquid will obviously be greatly improved upon increasing the electrolytic action. The increase in the electrolytic action, however, should be effected without increasing the consumption of electrical energy, if an economical purifying operation is to be carried out. This is accomplished in the present invention by the use of supplemental electrodes which are not directly connected to the source of elecerical energy. One way of increasing the electrolytic action is provided for by the use of an auxiliary electrode 12 supported on the bar 10, in spaced relation to and between the electrodes 8 and 9. In this connection it should be noted that the electrodes 8, 9 and 12 are preferably made of aluminum in order to effect a chemical combination between the aluminum and the salts and free acids contained in the liquid, whereby carbon dioxide is formed.

Referring again to the auxiliary electrode 12 it is seen that opposite sides thereof are opposed to the electrodes 8 and 9 and that the electric current passing through the liquid between the electrodes 8 and 9, in the manner common in producing an electrolytic action, also passes through the auxiliary electrode or in some manner has an effect thereon such as to increase the electrolytic action as a whole without consuming any

more electrical energy than is ordinarily required to operate electrodes 8 and 9. The auxiliary electrode then acts upon its surfaces as do the electrodes 8 and 9 to produce the electrolytic action.

In this way a large working surface or electrode area is provided whereby to increase the electrolytic action beyond the extent of such action as may be produced with a given current consumption in the ordinary electrodes 8 and 9. As shown, the auxiliary electrode 12 may be of greater area than the electrodes 8 and 9, whereby to further increase the electrolytic action. Preferably the electrode 12 is longer and wider than either of the electrodes 8 and 9.

During the electrolytic action the carbon dioxide generated in the liquid under treatment, in the form of minute bubbles form on and adjacent to the electrodes, rise to the surface of the liquid and escape to the atmosphere. To facilitate the rise of these bubbles, the lower ends of the electrodes 8, 9 and 12 are beveled as at 14. By reason of these beveled ends, the gas formed at the lower ends of the electrodes will pass upward along both sides of the electrodes and will not collect at the lower ends of the latter or pass up one side only as would be the case without the beveled ends.

As shown in Figures 2 and 4, the apparatus may be modified so as to provide a greater electrolytic action than is possible with the first described apparatus and without increasing the consumption of electrical energy. In this modified form of the invention, the tank 15 and electrodes 16 and 17 are the same in construction and arrangement as the tank 7 and electrodes 8 and 9. However, instead of one auxiliary electrode I employ three designated 18, 19 and 20. The auxiliary electrode 19 is disposed between the electrodes 18 and 20 and the three electrodes are disposed between the main electrodes 16 and 17. To provide for electrical energization of the auxiliary electrodes the center one 19 is grounded as at 21. With this arrangement the five electrodes provide for a comparatively great electrolytic action without necessitating the consumption of any more electrical energy than the apparatus shown in Figure 1.

The apparatus shown in Figures 1, 2 and 4 is designed to use single phase alternating current but as shown in Figure 3, I may, by a simple and inexpensive modification of said apparatus, provide for the use of three phase current and by such use greatly increase the electrolytic action without appreciably increasing the consumption of electrical energy.

In this form of the invention the tank 24 is provided with three main electrodes 25, 26 and 27, each connected by conductors 28, 29 and 30 with a source of three phase alternating current, not shown. Disposed between the electrodes 25, 26 and 27 are auxiliary electrodes 31 and 32 each of which is grounded as at 33. Between the grounded electrodes and the adjacent main electrodes are additional electrodes 34, 35, 36 and 37. each of which is unconnected in the circuit and free from ground connections.

It is now apparent that by using a three phase current, I may use three main electrodes, two grounded auxiliary electrodes and four additional auxiliary electrodes which latter are free from electrical connection with the source of current or the ground.

These nine electrodes provide for a maximum electrolytic action with a comparatively small current consumption and therefore make possible a thorough expeditious, yet most economical purifying operation.

The electrodes of all the forms of the invention are made of aluminum and each is beveled at its lower end for the purposes aforementioned. Each electrode is preferably in the form of an imperforate plate but I may, as shown in Figure 6, use sectional electrodes comprised of three or more sections 38. Such a sectional arrangement is suited for the main electrodes which are directly connected to the source of current. The sectional construction increases the working area of the electrodes and tends to increase the electrolytic action without necessitating a like increase in current.

The apparatus of this invention is particularly well suited for carrying out the method set forth in my aforesaid copending application but may be used for other methods also.

I have found that by adding to the sugar containing liquid to be treated under the aforesaid process or under other process, a powdered aluminum in such quantity that the aluminum particles will be held in suspension throughout the liquid, a great increase in the electrolytic action and in the generation of carbon dioxide are provided with but a small consumption of electric current. Such a method is comparatively inexpensive yet facilitates and increases the yield of white sugar in a particularly efficacious manner.

In this method treatment of the liquid under the electrolytic action requires less than 45 minutes with the liquid at a temperature of less than 100 degrees centigrade, the heat generated by the electrodes usually being sufficient to provide and maintain this temperature. Although I find in the present method, as in my former application, that it is desirable to use carbon in the form of powdered animal charcoal as a decoloration agent during the period of subjecting the liquid to the electrolytic action, such carbon may be omitted and yet the advantages of the aluminum powder will be present. In

fact the use, as aforesaid, of powdered aluminum will greatly improve any electrolytic purifying method.

Where the apparatus is used to electrolytically purify raw, sugar-containing juice, the addition of a small quantity of sea water to the juice has the effect of producing decoloration of the juice as well as to facilitate the purifying action.

It will now be seen that the apparatus of this invention and also the methods hereof provide for a most economical yet efficacious treating of sugar containing liquid to effect the purifying and decoloration thereof in a thorough manner and to insure a high yield of pure sugars.

I claim:

1. In apparatus for treating sugar containing liquid, a tank for such liquid, means for subjecting such liquid in said tank to an electrolytic action, comprising aluminum electrodes at least one of which is unconnected with the source of electrical energy for the other of said electrodes, except through the conductivity of the electrolyte during the electrolytic action, and means for grounding said unconnected electrode.

2. In apparatus for treating sugar containing liquid, a tank for such liquid, means for subjecting the liquid to an electrolytic action, including electrodes certain of which are unconnected from the source of electric current for the other electrodes, and means for grounding one of said unconnected electrodes.

3. In apparatus for treating sugar containing liquid, a tank for such liquid, means for subjecting the liquid to an electrolytic action, including electrodes certain of which are unconnected from the source of electric current for the other electrodes, and means for grounding one of said unconnected electrodes, the other of said unconnected electrodes being disposed on opposite sides of the grounded electrodes.

4. In apparatus for treating sugar containing liquid, a tank for such liquid, means for subjecting the liquid to an electrolytic action, including electrodes certain of which are unconnected from the source of electric current for the other electrodes, and means for grounding one of said unconnected electrodes, the other of said unconnected electrodes being disposed on opposite sides of the grounded electrodes and between the electrodes which are connected with the source of electrical energy.

5. In apparatus for treating sugar containing liquid, a tank for such liquid, means in the tank for subjecting the liquid to an electrolytic action, including electrodes directly connected with a source of alternating current, another electrode between the first named electrodes, means for directly grounding the second named electrode, and other electrodes located between the connected electrodes and said grounded electrode, and being independent of electrical connection with said source of current.

6. In apparatus for treating sugar containing liquid, a tank for such liquid, means in the tank for subjecting the liquid to an electrolytic action, including electrodes directly connected with a source of alternating current, another electrode between the first named electrodes, means for directly grounding the second named electrode, and other electrodes located between the connected electrodes and said grounded electrode, and being independent of electrical connection with said source of current, said first named electrodes being smaller in area than the other electrodes.

ALFRED LIMA, JR.