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METHOD AND APPARATUS FOR PREPARING MASSCOUITE FOR CRYSTAL EXTRACTION
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METHOD AND APPARATUS FOR PREPARING MASSECUE FOR CRYSTAL EXTRACTION

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This invention relates to a method and means for treating massecuitc prior to extraction of its sugar content.

As part of the refining of sugar, mixtures of sugar crystals and associated liquor are formed, usually comprising sugar crystals in mother liquor, or massecuitc. In other operations, sugar magma is produced which is a mixture of sugar crystals in a foreign liquor. As used in the specification "massecuitc" will be employed as a generic definition and "sugar magma" will be used as a species definition.

Under optimum conditions, sugar crystals will be formed at a crystallizer stage, or the like, with as much of the sucrose as possible taken from solution and deposited as crystals. However, none of the commercial extractions are perfect and there is an economic limit on how far the extraction can be pursued. The quality of the massecuitc produced in refining operations is variable and many cane sugar treatments produce what is termed a low-grade massecuitc which is very viscous and difficult to handle in modern equipment. In contradistinction, beet sugar refining usually produces massecuitc having better fluidity which permits continuous treatment in the refinery circuit and crystal separation in continuous centrifugals installed in such a circuit.

Accordingly, it is an object of this invention to provide a simple, efficient and economical method of treating massecuitc prior to crystal extraction to increase fluidity and improve sugar yield.

Another object of this invention is to provide a simple, efficient and economical method of feeding viscous massecuitc to a continuous centrifugal for promoting the separation of crystals from solution by the action of the centrifugal.

A further object of the invention is to provide a simple, economical and efficient crystallization treatment for massecuitc for higher sugar crystal yield and reduced sugar content in solution.

Still another object of this invention is to provide simple, durable and efficient apparatus for conditioning massecuitc to promote crystal formation and increase fluidity.

Yet another object of the invention is to provide simple, durable and efficient apparatus which may be automatically controlled to deliver conditioned massecuitc to a continuous centrifugal so as to increase sugar extraction by the centrifugal.

The present invention provides several innovations in sugar refining practices. It recognizes the need for a conditioning treatment of a massecuitc being delivered as feed to a continuous centrifugal. Such conditioning performs two useful functions. When massecuitc is viscous, it tends to ball up on the screen of a continuous centrifugal, does not distribute uniformly across the screen and thus impairs the efficiency of the centrifugal separation. The conditioning step of the present invention utilizing a substantial degree of aeration with effective distribution of fine air bubbles throughout the massecuitc by the beating action of the agitator increases fluidity to a rather uniform degree and thus delivers feed which the centrifugal can separate at maximum efficiency.

Also by such a conditioning treatment, the sucrose or sugar content of the liquor is reduced to a substantial degree with crystal buildup. As a result, a higher sugar yield is obtained from the massecuitc in conjunction with efficient separation of crystals from solution by the centrifugal action.

While the apparatus arrangement utilized in the conditioning treatment is relatively simple, it provides a highly efficient conditioning treatment and such treatment may include automatic controls by which a predetermined level is maintained and a desired retention time is provided in conjunction with treatment in continuous flows. Such controls also regulate the rate of feed to the centrifugal which is not overloaded and operates at optimum efficiency.

The same apparatus may be utilized as a crystallizer stage in some treatments. In the past, attempts have been made to introduce air into conventional crystallizer treatments, but such air introduction may result in foaming with undesirable consequences. Frequently, the foam becomes so intense as to result in spillage or other impairing the efficiency of the equipment into which the crystallizer discharge is fed at the completion of the crystallization treatment. Further, such crystallization treatments have been in the nature of batch treatments, rather than continuous operation, whereas the apparatus of this invention may be utilized effectively in a continuous circuit with the efficiency of the crystallization controlled by the amount of gaseous input and the retention time in the mixing stage.

In this connection, it is possible to use gases other than air in such treatments, particularly carbon dioxide and nitrogen. In sugar beet processing, CO₂ usually is available in the plant and may be piped to such crystallization stage. Aeration as provided in this crystallizer avoids foam formation, as the beating action of the agitator breaks up any large bubbles tending to form and distributes the air or other gas uniformly throughout the body of massecuitc in fine bubble formation. As a result, the aeration encourages crystal buildup with sucrose taken from solution that otherwise would remain in solution.

The practice of this invention will now be described with reference to the accompanying drawings. In the drawings, in the several views of which like parts bear similar reference numerals.

FIG. 1 is a front elevation of a typical installation utilizing features of this invention in the conditioning treatment of massecuitc directed in continuous flow as feed to a continuous centrifugal unit;

FIG. 2 is a developed section through the mixing apparatus shown in FIG. 1 taken approximately on the line 2—2, and showing the massecuitc level maintained in the mixer; and

FIG. 3 is a top plan view of the mixing apparatus shown in FIG. 1 taken approximately along the line 3—3.
portion of each cycle of rotation and maintains the surface of the confined body of massecuite in contact with atmospheric air. In a preferred arrangement, alternate blades 13 are pitched at different angles so as to provide a greater degree of mixing of air and massecuite and to cause portions of the massecuite to be moved from lower portions of the contained charge to the upper portion thereof for exposure to atmospheric air.

The continued rotation of the shaft 12 and the action of the blades 13 carried thereby provides a progressive advance of material through the tamping member from its point of introduction through conduit 10. A sump outlet 23 is provided at the discharge end of the 24 which directs the discharge into a conduit at a rate determined by valve 28 as the feed to a continuous centrifugal 27. In the arrangement shown, the feed is regulated in relation to discharge with a level sensing device or member 25 relating flow through outlet 23 and setting a valve 26 in inlet conduit 10 in accordance with such determination so as to maintain a uniform level 19 in tamping member 11.

From the foregoing, it will be apparent that in a circuiting practice such as shown in FIG. 1, provision is made to deliver conditioned massecuite at a desired rate into a continuous centrifugal 27 for separation of the sugar crystals from associated solution therein. The conditioning treatment satisfies two objectives, in that the fluidity of the massecuite is increased so that it is in optimum condition for the separation action of the centrifugal. In addition, the combined aeration and agitation as provided in member 11 is effective in obtaining a final sugar extract from the solution which causes a buildup on sugar crystals already formed and results in the discharge of a solution having an extremely low sugar content.

The elongated tamping member 11 of FIG. 1 has been referred to in the preceding description as being open at its top particularly to supply atmospheric air in sufficient quantity to provide the desired aeration in the beating action. If desired, the top of the tamping member may be covered to protect against deposit of any foreign matter and side or end openings may be provided to maintain sufficient atmospheric air within the enclosure.

Also, when the tamping member is to be utilized in an operation in which gas other than atmospheric air is supplied, it will be desirable to have the top fully enclosed and side or end ports (not shown) provided for the introduction of such gas. For example, CO2 from a suitable plant source may be introduced at low pressure within such enclosure and the gas supply will be used in sufficient quantity in the mixing action to eliminate the need for any exhaust arrangement. However, if desired, a pressure relief valve may be provided to prevent buildup of excess gas pressures.

One of the requirements of efficient operation with continuous centrifugal apparatus is that the rate of feed to the centrifugal is controlled so as to permit optimum separation by the action of the centrifugal. As the characteristics of the feed to the centrifugal vary from time to time, a constant rate of feed is not satisfactory and in the practice of the present invention the feed to the centrifugal is delivered at a variable rate in accordance with a measurement of the power demand of the centrifugal so that less feed is introduced as the power demand exceeds an established or predetermined value and increases as the power demand becomes less than such value.

The circuiting arrangement for the feed control includes a lead connected to the centrifugal drive motor 29 and passing through a transformer 30 and connected to a transducer assembly 31 in which air is introduced at 32 and the current representative of the power demand of the centrifugal is changed from electrical energy to air pressure and the air pressure is directed into a pneumatic control 33 in connection with an adjusting device 34 regulating the setting of control valve 28. With this arrangement, if the power demand of motor 29 is less than an established standard, valve 28 will be opened slightly and if the power demand is more than the standard, the valve setting will be changed to reduce the flow into the centrifugal. Valves 35 and a gauge 36 in the transducer assembly permit operator control in addition to the automatic control of the normal operation of the circuit described above.

We have found that it sometimes is advantageous to the treatment to recirculate a portion of the syrup discharge of the centrifugal into the tamping member for mixing with the incoming tamping member. Such introduction provides a quick thinning effect which is particularly desirable when a highly viscous massecuite is being treated. A preferred arrangement for providing such action has been illustrated in FIG. 1. Syrup discharge through the syrup outlet 40 of centrifugal 27 is delivered into a suitable tank or receptacle 61 having means for dividing the flow, with one fraction passing through the centrifugal stage through an outlet 42 and another fraction is discharged through the intake end 43 of a centrifugal pump 64 from which it is conducted through a conduit or line 45 into the feed end of tamping member 11. Preferably line 45 is valve controlled as shown at 46 so that the total feed to member 11 can be balanced to the discharge through outlet 23 in the manner previously described.

Even when a highly viscous massecuite is being treated in such a circuit, the discharge through outlet 23 will have a high degree of fluidity and by recycling a portion of the syrup or sugar solution discharge of centrifugal 27 through the line 45 to the tamping member 11, the incoming massecuite delivered into the tamping member through conduit 10 is promptly mixed with the return material and the mixture is quickly brought to a more flowable condition by the beating action of blades 13 so that it receives a more intense beating and agitation, combined with aeration in its progressive movement through the tamping member.

In the preceding description, different operating practices have been described, some or all of which may be utilized in a given plant operation. A significant feature of the aeration and beating of massecuite or sugar magma is that the feed may be introduced into the treatment at prevailing temperatures and thus does not require special preparation for the treatment practices of this invention.

In preferred practice, the massecuite or sugar magma is treated in a confined zone in continuous flow with aerauling gas maintained or circulated in connection with the flow along the course of treatment. Such material with or without extraneous syrup is introduced at the upstream end of the course and discharged at the downstream end under controls which balance input volume to the volume of discharge thereby maintaining a uniform liquid level in the treatment. Consequently, by employing a tamping member of substantial length and a series of beating stages along its length, a substantial quantity of air or other aerauling gas is distributed in the massecuite or magma increasing its fluidity along the course and providing sufficient contact between the gas and solution so that the sucrose content in solution is substantially decreased.

When the massecuite preparation is utilized to control the feed volume and consistency to a separation stage, such as a continuous centrifugal, such feed can be prepared at optimum conditions for such separation. Also, where desired, automatic control may be provided in which the power demand of the centrifugal is the factor determining the feed control. Also, in such an installation extraneous solution may be circulated to the mixing and conditioning treatment from the syrup discharge of such centrifugal.

Finally, in some treatments, the sucrose extraction from the associated liquor may be utilized to eliminate a crystallizer stage ahead of the conditioning stage of this inven-
tion and the fact that the treatment may be performed at prevailing temperature makes such circuiting practice desirable in some plants.

We claim:

1. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

2. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

3. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval as feed at a controlled rate to a continuous centrifugal separation stage.

4. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

5. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and discharging the aerated massecuite after a predetermined retention interval as feed to a continuous centrifugal separation stage.

6. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated massecuite after a predetermined treatment interval as feed at a controlled rate to a continuous centrifugal separation stage.

7. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage at prevailing temperatures in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

8. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of heating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow directly into a centrifugal separator.
separation stage, and recycling some of the separated syrup of the separation stage into the massecuite flow adjacent its upstream end.

9. The method of preparing massecuite for crystal extraction, which comprises moving massecuite and extraneous syrup passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of beating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

10. The method of preparing massecuite for crystal extraction, which comprises moving massecuite and extraneous syrup passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of beating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow directly into a crystallization stage, recycling some of the separated syrup of the separation stage at a controlled rate into the massecuite flow adjacent its upstream end, and maintaining a uniform massecuite level in the treatment zone by balancing the volume of input material to the volume of discharge from said zone.

11. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining circulating nitrogen above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of beating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the nitrogen above said flow and thereby inducing entrainment of nitrogen into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, and continuously discharging the aerated flow after a predetermined treatment interval in said zone as feed directly into a continuous centrifugal separation stage.

12. The method of extracting the sucrose content from mother liquor in the treatment of massecuite in a continuous flow through a confined zone of substantial extent which comprises directing the continuous flow of massecuite passing from a crystallization stage along an enclosed course subject to continuous feed and discharge and in contact with a confined body of aerating gas, inducing entrainment of the aerating gas into the massecuite flow in fine bubble formation by beating the massecuite in a succession of stages by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby, whereby crystal formation in the massecuite is increased by sucrose extraction from associated solution, and continuously discharging aerated massecuite after a predetermined mixing in said flow as feed directly into a continuous centrifugal separation stage.

13. The method of extracting the sucrose content from liquor in the treatment of sugar magma in a continuous flow through a confined zone of substantial extent which comprises directing the continuous flow of magma along an enclosed course subject to continuous feed and discharge and in contact with a confined body of aerating gas, inducing entrainment of the aerating gas into the magma flow in fine bubble formation by beating the magma in a succession of stages by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of magma and into the aerating gas above said flow and thereby, whereby crystal formation in the magma is increased by sucrose extraction from associated solution, and continuously discharging aerated magma after a predetermined mixing in said flow as feed directly into a continuous centrifugal separation stage.

14. Apparatus for preparing massecuite for crystal extraction, comprising an elongated troughing member open at its top and enclosed on its sides and ends for confining a horizontal flow of massecuite and a body of aerating gas above said flow, a valve-controlled outlet at the downstream end of the troughing member for regulating the rate of outflow of treated massecuite from said member, means for passing the treated massecuite from said outlet as feed directly into a continuous centrifugal separation stage, means for feeding massecuite passing from a crystallization stage into said member at its upstream end at a controlled rate related to the discharge rate and determining a liquid level therein, a rotary shaft extending lengthwise through the interior of the troughing member and carrying a plurality of blades at intervals throughout its length rotating in close proximity to the bottom of the member and above the liquid level in each cycle of rotation for beating the flowing massecuite and entraining air in fine bubble formation therein so as to increase flowability of the massecuite, and drive means for rotating said shaft.

15. Apparatus for preparing massecuite for crystal extraction, comprising an elongated troughing member open at its top and enclosed on its sides and ends for confining a horizontal flow of massecuite and a body of aerating gas above said flow, a valve-controlled outlet at the downstream end of the troughing member for regulating the rate of outflow of treated massecuite from said member, means for passing the treated massecuite from said outlet as feed directly into a continuous centrifugal separation stage, means for feeding massecuite passing from a crystallization stage into said member at its upstream end at a controlled rate related to the discharge rate and determining a liquid level therein, a rotary shaft extending lengthwise through the interior of the troughing member and carrying a plurality of blades at intervals throughout its length rotating in close proximity to the bottom of the member and above the liquid level in each cycle of rotation for beating the flowing massecuite and entraining air in fine bubble formation therein so as to increase flowability of the massecuite, and drive means for rotating said shaft.

16. Apparatus for preparing massecuite for crystal extraction, comprising an elongated troughing member open at its top and enclosed on its sides and ends for confining a horizontal flow of massecuite and a body of aerating gas above said flow, a valve-controlled outlet at the downstream end of the troughing member for regulating the rate of outflow of treated massecuite from said member, means for passing the treated massecuite from said outlet as feed directly into a continuous centrifugal separation stage, means for feeding massecuite passing from a crystallization stage into said member at its upstream end at a controlled rate related to the discharge rate and determining a liquid level therein, a rotary shaft extending lengthwise through the interior of the troughing member and carrying a plurality of blades at intervals throughout its length rotating in close proximity to the bottom of the member and above the liquid level in each cycle of rotation for beating the flowing massecuite and entraining air in fine bubble formation therein so as to increase flowability of the massecuite, and drive means for rotating said shaft.
outlet to the liquid level in the troughing member, means for feeding massecuite passing from a crystallization stage into said member at its upstream end at a controlled rate established by the sensing means and determining a liquid level therein, a rotary shaft extending lengthwise through the interior of the troughing member and carrying a plurality of blades at intervals throughout its length rotating in close proximity to the bottom of the member and above the liquid level in each cycle of rotation for beating the massecuite and entraining air in fine bubble formation therein so as to increase flowability of the massecuite, and drive means for rotating said shaft.

17. Apparatus for preparing massecuite for crystal extraction, comprising an elongated troughing member open at its top and enclosed on its sides and ends for confining a horizontal flow of massecuite and a body of aerating gas above said flow, a valve-controlled outlet at the downstream end of the troughing member for regulating the rate of outflow of treated massecuite from said member, means for passing the treated massecuite from said outlet as feed directly into a continuous centrifugal separation stage means for feeding massecuite passing from a crystallization stage into said member at its upstream end at a controlled rate related to the discharge rate and determining a liquid level therein, a rotary shaft extending lengthwise through the interior of the troughing member and carrying a plurality of blades at intervals throughout its length rotating in close proximity to the bottom of the member and above the liquid level in each cycle of rotation for beating the flowing massecuite and entraining air in fine bubble formation therein so as to increase flowability of the massecuite, the blades at alternate intervals being pitched differently than the blades intermediate said intervals, and drive means for rotating said shaft.

18. The method of preparing massecuite for crystal extraction, which comprises moving massecuite passing from a crystallization stage in continuous flow through a confined treatment zone of substantial extent subject to continuous feed and discharge, maintaining aerating gas above and in contact with the flow along its course of travel through said zone, subjecting such flow to a succession of beating actions by a series of material contacting members spaced longitudinally throughout the extent of said confined treatment zone and passing alternately into the flow of massecuite and into the aerating gas above said flow and thereby inducing entrainment of gas into the massecuite flow as fine bubbles, whereby flowability of the massecuite is progressively increased and the sucrose content in solution is decreased, maintaining a uniform massecuite level in said zone by balancing the volume of input to the volume of discharge from said zone, continuously discharging the aerated flow into a continuous centrifugal separation stage, and regulating the discharge into the centrifugal separation stage in accordance with a measurement of the power demand of said centrifugal separation stage.

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