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APPARATUS FOR RECOVERING SUGAR

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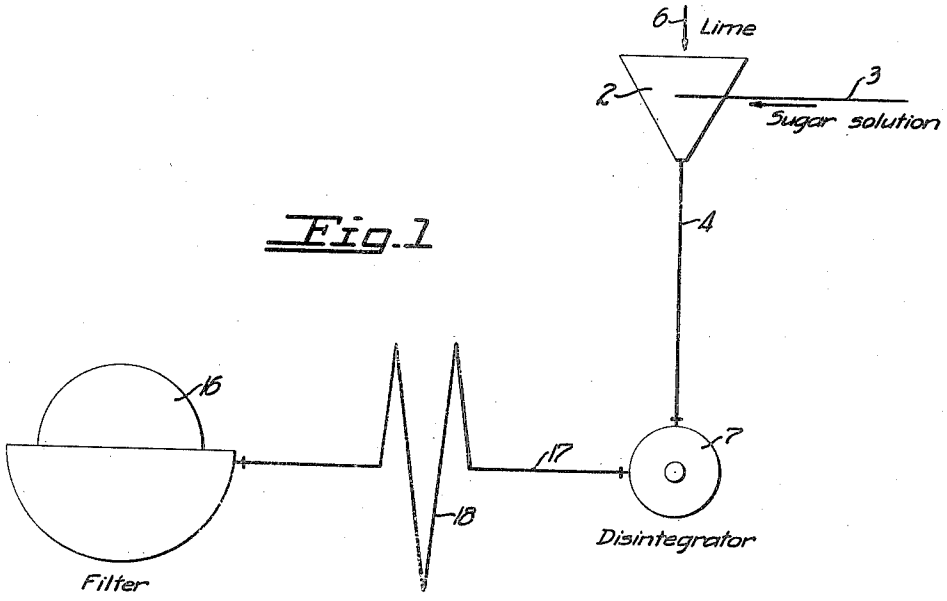


Fig. 1

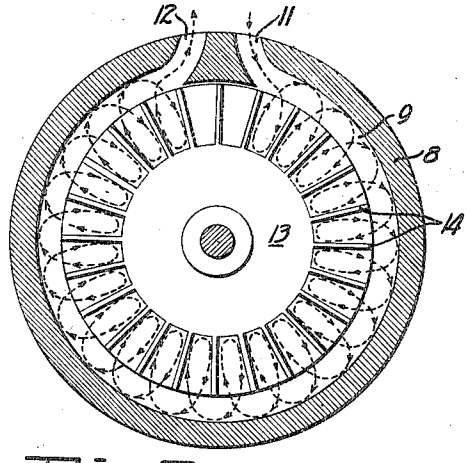


Fig. 2

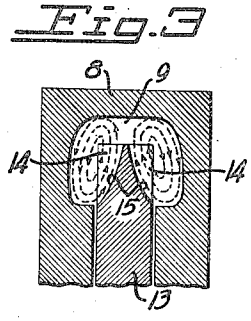


Fig. 3

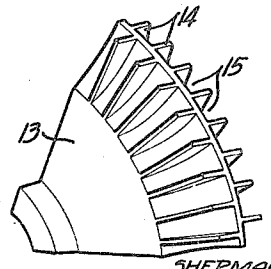


Fig. 4

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APPARATUS FOR RECOVERING SUGAR

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10 Claims. (Cl. 127—2)

The invention relates to the recovery of sugar from solution, and more particularly to beet sugar manufacture in which the sugar is precipitated out of a dilute molasses solution by the addition of lime.

It is among the objects of the invention to provide a continuous and rapid means for recovering sugar.

Another object of the invention is to increase the amount of sugar recovered.

A further object of the invention is to decrease the lime requirement.

A still further object of the invention is to provide improved means for disrupting the particles in the lime-sugar mixture.

The invention possesses other objects and features of advantage, some of which with the foregoing, will be set forth in the following description of our invention. It is to be understood that we do not limit ourselves to this disclosure of species of our invention, as we may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is a diagrammatic view showing the arrangement of apparatus embodying the invention.

Figure 2 is a vertical sectional view of the disintegrator employed in the apparatus of the invention; and

Figure 3 is a fragmentary transverse sectional view of the disintegrator, showing a cross section of the fluid channel and enclosed rotor.

Figure 4 is a perspective view of the peripheral portions of the rotor, showing the positioning of the fins.

In terms of broad inclusion, the apparatus for recovering sugar embodying the invention comprises means for introducing lime into the sugar solution, and means for driving the mixture with a spiral motion progressing annularly through a closed channel. This particular handling of the fluid results in disrupting the particles in the mixture and exposing substantially all the lime to reaction, while at the same time permits a rapid uninterrupted flow of the solution through the system. After thus breaking up the particles, the mixture is circulated until the lime-sugar reaction is substantially complete, following which the mixture is filtered. The device for breaking up the particles comprises an annular channel through which the lime sugar mixture may flow continuously. A rotor having impeller blades or fins is mounted adjacent the channel, and is designed to impart a spiral movement to the fluid as the latter flows through the channel.

In greater detail, and referring particularly to the drawing, the apparatus embodying the invention comprises means for introducing lime into the sugar solution. As shown in Figure 1 the liming unit comprises a funnel 2 into which the sugar solution (dilute molasses) is introduced tangentially through a duct 3. This sets up a vortical movement in the solution as it discharges downwardly through the duct 4. The vortically moving solution in the funnel 2 presents a surface substantially free of foam, and provides a condition which is ideally adapted for entraining lime. Powdered lime is introduced into the throat of the vortex as indicated by the arrow 6, and is supplied in amounts such that the solution upon leaving the funnel carries substantially all the lime required to precipitate out the sugar.

After leaving the liming unit 2 the newly limed solution passes downwardly through the duct 4 to a disintegrator 7. This device, as better shown in Figures 2 and 3, comprises a casing 8 in which is formed an annular channel 9 of generally rectangular section and extending from an intake opening 11 to a discharge opening 12. A rotor 13 is journaled in the casing 8 and is arranged so that its peripheral portions project partially into the fluid channel 9. Note Figure 3. Suitable means, not shown, is provided for driving the rotor.

A plurality of fins 14 are spaced about the periphery of the rotor, and are arranged to project alternately from opposite sides of the rotor. See Figure 4. These fins are formed by recesses 15 cut in opposite sides of the rotor. As best shown in Figure 3, the corners of the channel 9 are preferably rounded, and the bottoms of the recesses 15 are curved reversely to the curved walls of the chamber.

As the limed solution enters the fluid channel 9 through the intake 11 it is caught by the fins 14 and started in its annular path along the channel 9. Simultaneously with this advancing movement, the fluid is thrown outwardly from the rotor by centrifugal force. The curvature at the base of the recesses 15 formed between the fins 14 imparts an outward rotating motion to the fluid as the latter is thrown radially from the rotor and into the open portions of the channel.

This turning action of the fluid results in a circulation which follows downwardly along the rounded sidewalls of the channel and then re-

enters the lower portions of the recesses 15 between the fins 14, whereupon the fluid is again given an outward rolling impulse. The dotted lines in Figure 3 clearly illustrate the manner in which the columns of fluid on each side of the rotor 13 are given the turning motion.

Since the rotor is rotating about the channel 9, the whirling columns of fluid are simultaneously advanced along the annular path formed by the channel. This combined rotary and longitudinal movement of the fluid column results in a spiral or helical motion progressing annularly about the closed channel. The dotted line in Figure 2 illustrates the spiral motion of the fluid as the latter advances annularly about the channel. Of course it is understood that this spiralling column of fluid is duplicated adjacent the opposite side of the rotor, as indicated in Figure 3.

It has been found that this particular handling of the limed solution, in a closed channel, produces a turbulence which results in effectively disrupting the particles in the solution. Applicants have discovered that the particles of lime in a sugar solution tend to become coated with the insoluble lime sugar compound, thereby rendering the lime within the particle unavailable for combination with the sugar. In order to expose substantially all the lime to reaction it becomes desirable to break up the particles.

The disintegrator of our invention has been found especially suited for this purpose, because the problem is not merely that of providing means for disrupting the particles, but to provide such means which will operate without interfering with a rapid flow of the solution through the system. The capacity of a plant for handling molasses depends upon the rate of solution flow through the factory. Our disintegrator permits a rapid uninterrupted flow of solution through the system, while at the same time effecting the desired breaking up of the particles.

After leaving the channel 9 of the disintegrator 7 as shown in Figure 1, the solution passes to a filter 16 through a suitable duct 17. This duct is preferably looped in a large coil 18 so as to provide a length of duct sufficient to permit substantial completion of the lime sugar reaction before the solution reaches the filter.

We claim:

1. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, a filter, means for delivering the limed solution continuously to the filter and including a channel in which the lime-sugar mixture may flow, and an element movable in said channel for driving the mixture with a spiral motion through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction.

2. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, a filter, means for delivering the limed solution continuously to the filter and including a channel in which the lime-sugar mixture may flow, and an element projecting partially into and movable longitudinally of said channel and having fins extending transversely of the channel for disrupting the particles in the mixture.

3. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, a filter, means for delivering the limed solution continuously to the filter and including an annular channel in which the lime-sugar mixture may flow, and a rotor having its peripheral portions movable in said channel for disrupting the particles in the mixture.

4. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, a filter, means for delivering the limed solution continuously to the filter and including an annular channel in which the lime-sugar mixture may flow, and a rotor having its peripheral portions projecting partially into the channel and having fins projecting from opposite sides thereof and extending transversely of the channel for disrupting the particles in the mixture.

5. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, a channel in which the lime-sugar mixture may flow, an element movable in said channel for driving the mixture with a spiral motion through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction, a filter, and a duct for conveying the mixture from said channel directly to the filter and having a length sufficient to permit substantial completion of the lime-sugar reaction.

6. Apparatus for recovering sugar from solution comprising means for introducing lime into the solution, an annular channel in which the lime-sugar mixture may flow, a rotor having its peripheral portions movable in said channel for driving the mixture with a spiral motion progressing annularly through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction, a filter, and a duct for conveying the mixture from said channel directly to the filter and having a length sufficient to permit substantial completion of the lime-sugar reaction.

7. Apparatus for recovering sugar from solution comprising a filter, a duct for conveying the solution in a continuously advancing stream to the filter, a liming unit interposed in said duct for introducing lime into the advancing stream of solution, a disintegrator interposed in the duct between the liming unit and the filter and having an annular channel, and a rotor having its peripheral portions projecting into the channel and having recesses formed in its peripheral portions to provide fins for impelling the lime-sugar mixture through the channel, said recesses having curved inner walls for imparting an outward turning motion to the mixture, whereby the mixture is driven with a spiral motion through the channel.

8. A disintegrator for limed sugar solutions comprising an annular channel through which the solution may flow, and a rotor having its peripheral portions projecting into the channel and having recesses formed in its peripheral portions to provide transversely extending fins for impelling the solution through the channel, said recesses having curved inner walls for imparting an outward turning motion to the solution, whereby the latter is driven with a spiral motion advancing annularly through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction.

9. A disintegrator for limed sugar solutions comprising an annular channel having rounded side walls through which the solution may flow, and a rotor having its peripheral portions projecting into the channel and having recesses formed in its peripheral portions to provide

transversely extending fins for impelling the solution through the channel, said recesses having rounded inner walls curved reversely to the side walls of the channel for imparting an outward turning motion to the solution, whereby the latter is driven with a spiral motion advancing annularly through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction.

10. A disintegrator for limed sugar solutions comprising an annular channel through which the solution may flow, and a rotor having its peripheral portions projecting partially into the central portions of the channel and having recesses formed in both sides adjacent its peripheral portions to provide fins projecting outwardly from opposite sides of the rotor for impelling the solution through the channel, said recesses having curved inner walls for imparting an outward turning motion to the solution, whereby the latter is driven with a spiral motion advancing annularly through the channel to disrupt the particles in the mixture and expose substantially all the lime to reaction.

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