Feb. 28, 1961 E. O. RIEDEL 2,973,288

PROCESS AND APPARATUS FOR CONTINUOUS CENTRIFUGING OF VISCOUS SUGAR COMPOUNDS

Filed July 9, 1958

Fig. 1

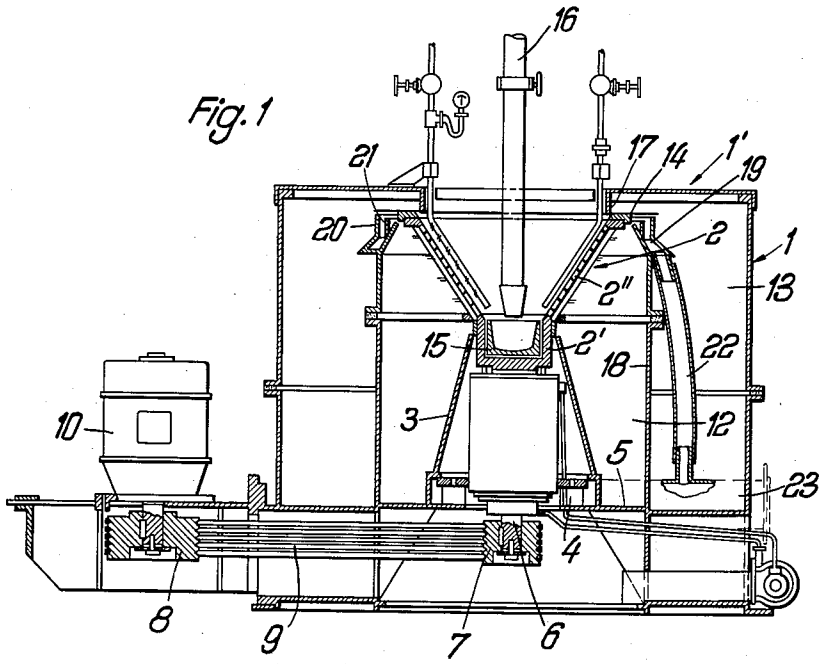


Fig. 2

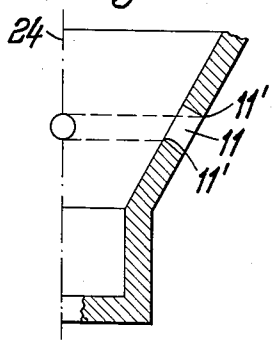
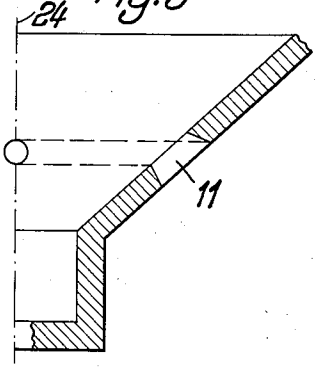


Fig. 3



Inventor:
ERICH OSKAR RIEDEL

by Mestern & Kollin
ATTORNEYS

United States Patent Office

2,973,288

Patented Feb. 28, 1961

2,973,288

PROCESS AND APPARATUS FOR CONTINUOUS CENTRIFUGING OF VISCOUS SUGAR COMPOUNDS

Erich Oskar Riedel, Gruiten, Germany, assignor to Hein, Lehmann & Co. Aktiengesellschaft, Dusseldorf, Germany

Filed July 9, 1958, Ser. No. 747,401

Claims priority, application Germany Jan. 4, 1958

5 Claims. (Cl. 127—19)

This invention relates to a process for continuous centrifuging of viscous sugar compounds and to an apparatus therefor, in which the sugar compounds are inserted in the lower end of a centrifuge bucket which widens upward conically and rotates at high speed, whereby the molasses is centrifuged through the separator openings of the bucket and the solid sugar is carried over the upper rim of the bucket.

In the sugar refining technology it has long been desired to devise a continuous centrifuging operation which yields good separation at the highest possible efficiency. Many methods have been proposed to that effect, but none have been found satisfactory for the principal reason that most of these known suggestions pertain to details in construction, whereby the fact usually is overlooked that the centrifuging of viscous sugar compounds is a complex problem in which many interdependent factors are involved. Therefore, a satisfactory solution in compliance with today's industrial standards can only be found if all these factors and their interdependences are considered with respect to process and apparatus used. It has been found, for instance, that the continuous centrifuging operation does not merely require the application of the so-called "thin-layer" process, but that, moreover, a definite thickness (or fineness) of the layer must be maintained, especially at the upper end of the centrifuge bucket. Also, it is to be considered that the layer traveling over the separating surface of the centrifuge bucket has a separating action of its own upon the mass to be centrifuged on account of that layer's gaps in volume. Furthermore, it is of decisive importance that centrifuging is carried out under avoidance of loss and breakage of the sugar crystals. Otherwise, the yield of separated sugar is decreased considerably, and the process becomes uneconomical, even at increased throughput. Finally, it must be recognized that an interdependence exists between the flow resistance of the separating surface and the crystals traveling on the same, the shape of the separator openings and the speed of travel which is influenced by the constantly changing friction factor and by the centrifugal force. All these factors greatly influence the centrifuging process.

On the basis of the above considerations it now has been found that viscous sugar compounds can be refined by continuous centrifuging, and that simultaneously highest throughput, best possible separation and extensive avoidance of breaking of the sugar crystals can be attained when the materials to be centrifuged are conducted to the separating surface of the centrifuge bucket at constant acceleration, and when the quantities of the materials entered and the revolutions of the centrifuge bucket are balanced, while considering the changing consistency of said materials, in such a manner that a continuous and comparatively slowly traveling fill of crystals prevails upon the separating surface which is completely covered. This continuous fill, due to its gaps in volume, exerts an additional separating action upon the materials which travel faster. A further requirement is that the thickness

of the layer of materials at the upper end of the centrifuge bucket must be less than 4.5 mm.

It has been proven in practice that, by maintaining the above conditions, a continuous process is attained which yields large throughput and excellent separation, particularly in view of the fact that loss or breakage of sugar crystals is practically nonexistent. It, therefore, is important that the materials be entered into the separating surface under constant acceleration and travel over said separating surface in a definite film thickness which has well-defined upper and lower limits. The feed of the materials to be centrifuged must be regulated so that it remains continuous but that the film thickness of the centrifuged material on the upper end of the centrifuge bucket does not exceed 4.5 mm. If this layer is thicker than 4.5 mm., it has been found in practive that the separation yield decreases, because the separating effect is insufficient due to the short dwelling time of the materials to be centrifuged on the separating surface. On the other hand, constant coverage of the separating surface with crystals must be ensured because otherwise loss and breakage of the crystals occurs.

For carrying out the above process, a sugar centrifuge is used which is equipped with a centrifuge bucket. The latter is disposed in a housing in a known manner, rotates around a vertical axis at high speed and contains separating openings for the molasses which spin out. This centrifuge, according to the present invention, is characterized by the following combined features:

The centrifuge bucket is equipped with an adjustable drive, preferably an infinitely variable drive. At its lower end, the centrifuge bucket has an accelerator pot which is not perforated and serves to accelerate the materials to be centrifuged to the rotational speed of the separating surface of the bucket. Also, the bucket has an even separating surface with elongated separating openings disposed in axial direction. The upper cover of the housing supports a fishing ring which reaches downward to the upper rim of the bucket and is substantially of the same diameter as the latter. Finally, on the upper rim of a wall separating the molasses collector from the solid sugar collector, a channel is installed which is equipped with deflector plates to prevent entry of molasses into the solid sugar collection chamber.

A centrifuge containing the above-mentioned features is distinguished particularly by the fact that a constant and continuous layer of material can be maintained on an even, conical separating surface, furthermore by constant acceleration of the entered material to the rotational speed of the separating surface, by eliminating the influence of rebounding sugar lumps on the operation of the centrifuge and on the separating surface, due to the action of the fishing ring, disposed near the upper rim of the bucket, and, finally, by preventing undesirable entry of molasses into the solid sugar collection chamber.

Moreover, the construction of the separating openings according to the invention takes into consideration the traveling motion and the outer crystal structure of the solid sugar particles by favoring, on the one hand, the separation while, on the other hand, not substantially exerting a detrimental abrasion on the solid sugar. In this respect, it has been found particularly advantageous to shape the separating openings so that the projections of their effective limiting edges on a plane surface leading through the axis of the bucket is preferably a circle or, at least, an oval whose long sides lie in the direction of the axis.

One embodiment of the apparatus according to the invention is described in the accompanying drawing.

In the drawing,

Fig. 1 is a longitudinal section through the sugar centrifuge according to the invention,

Figs. 2 and 3 are schematic representation of two different executions of separating openings in the centrifuge bucket.

The sugar centrifuge shown in Fig. 1 substantially consists of the housing 1 in which centrifuge bucket 2 is disposed, rotating around a vertical axis. Bucket 2 is solidly supported by way of base 3 and an elastic bearing 4 on the bottom 5 of the housing. The centrifuge bucket is driven by shaft 6 which leads centrally through base 3. Shaft 6, in turn, is driven by way of V-belt pulleys 7 and 8 and V-belt 9 by an electric motor 10 whose revolutions preferably are adjusted by an infinitely variable transmission, which is not shown. The centrifuge bucket 2 is provided with separating openings 11 and is surrounded by an inner chamber 12 which collects the molasses which are spun out through said openings, and also by an outer chamber 13 in which the solid sugar is collected which leaves the centrifuge bucket by way of its upper rim 14.

The centrifuge bucket 2 is provided, at its lower end 2', with a non-perforated accelerator pot 15 into which the materials to be centrifuged are entered by way of supply pipe 16. Said materials are conducted to the lower rim of separating surface 2'' at constant acceleration to the rotational speed of said separating surface 2''. To the upper cover 1' of the housing, a fishing ring 17 is fastened which extends to the upper rim 14 of the centrifuge bucket 2 and whose diameter is just slightly smaller than that of the upper rim of the bucket. This fishing ring prevents sugar particles, spun out with high velocity, from rebounding into the centrifuge bucket. This is of importance because rebounding sugar chunks would interfere with the centrifuging operation and, furthermore, would damage the separating surface.

At the upper edge of separating wall 18, disposed between the molasses collection chamber 12 and the solid sugar collection chamber 13, a channel 19 is provided for drawing off molasses which is equipped with annular deflector plates 20, 21 and which serves to prevent traveling of the spun-out molasses over the upper edge of the separating wall 18 into the solid sugar collection chamber 13. A pipe 22 leads directly from channel 19 to the molasses drain 23 of the collection chamber 12.

The openings 11 in the centrifuge bucket are shaped as shown in Figs. 2 and 3. They are elongated in the direction of the bucket axis 24 and preferably are formed so that the projection of their effective limiting edges 11' on a plane surface leading through the bucket axis 24 is a circle or at least an oval whose long sides lie in the direction of the axis. Practice has shown that this formation of the outlet openings 11 leads to a good separation because it takes into account the traveling motion and the outer structure of the sugar crystals. Moreover, it has been found that in this manner an abrasive action of the separating surface on the sugar crystals traveling thereover is largely inhibited. As comparison of Figs. 2 and 3 shows, the separating openings 11 must be kept the more elongated, the more the generatrix of the bucket cone is inclined toward the vertical or toward axis 24, respectively.

In order to insure continuous centrifuging, the amount of charge of materials to be centrifuged, introduced through pipe 16, and the rotational speed of the centrifuge bucket 2 are balanced so that a continuous crystal fill totally covers the separating surface 2'' which fill travels comparatively slowly. This fill, due to its gaps in volume, exerts an additional separating action upon the materials to be centrifuged which travel at greater speed. The mutual balancing of the charge and the rotational speed of the centrifuge bucket thereby must be executed in such a manner that not only a constantly continuous fill is present on the separating surface, but also so that the layer thickness of the materials to be centrifuged on the upper rim 14 of bucket 2 remains smaller than 4.5 mm. When these operating conditions are maintained, not only a large throughput is effected, but also a separation which is hitherto unequaled, particularly with respect to quality and structure of the centrifuged solid sugar. To attain this, it is essential to keep to a minimum loss and breakage of sugar crystals. This is accomplished with the process and apparatus according to the present invention.

What I claim is:

1. Apparatus for continuous centrifuging of viscous sugar, comprising an outer housing, an inner housing spaced from said outer housing and provided with a bottom portion, both said housings forming a first chamber therebetween for centrifuged sugar, said outer housing provided with a top portion having a central circular opening, a base mounted on said inner housing's bottom portion, a substantially frusto-conical centrifuge bucket mounted for vertical axial rotation on said base, said bucket having an upper edge portion aligned with said opening and wider than said bucket's bottom portion and a separating wall portion provided with a plurality of openings, variable speed means for rotating said bucket at high rotational speed, said base and said bucket forming a second chamber with said inner housing for collecting molasses spun through the openings in said bucket, an accelerator pot in the bottom portion of said bucket for receiving and accelerating the material to be centrifuged, a fishing ring secured in the opening in the top of said outer housing and extending downward toward the upper edge portion of said bucket for preventing sugar from rebounding into the bucket, said fishing ring corresponding substantially to the diameter of said bucket's upper edge portion, means for supplying material to said pot, a channel extending about the upper edge portion of said bucket for draining molasses from said second chamber, a molasses drain mounted in said apparatus, and a pipe connecting said channel with said molasses drain.

2. The apparatus according to claim 1, wherein the centrifuge bucket is provided in the area of its separating surface with longitudinal separating openings extending in an axial direction.

3. The apparatus according to claim 2, wherein said separating openings are formed in such a manner that the projection of their effective limiting edges produces a circular form in axial direction, on a plane extending through the bucket.

4. The apparatus according to claim 2, wherein said separating openings are formed in such a manner that the projection of their effective limiting edges produces a longitudinal oval form in axial direction, on a plane extending through the bucket.

5. A process for continuous centrifuging of viscous sugar compounds, comprising feeding centrifuging material to a centrifuge bucket at an evenly increasing speed, while adjusting the rotation of the bucket to the amount of material charged at a comparatively slow moving crystal flow rate, covering the separating surface and exerting an additional separating effect on the centrifuging material, while keeping the layer thickness of the centrifuging material at the top of the centrifuging bucket smaller than 4.5 mm.

References Cited in the file of this patent

UNITED STATES PATENTS

242,110	Carstaedt	May 31, 1881
1,753,023	Roberts	Apr. 1, 1930