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APPARATUS FOR THE HEAT TREATMENT OF SUGAR SOLUTIONS
EITHER COMPLETELY OR PARTLY CRYSTALLIZED

Filed Oct. 10, 1929

2 Sheets-Sheet 1

FIG. 1.

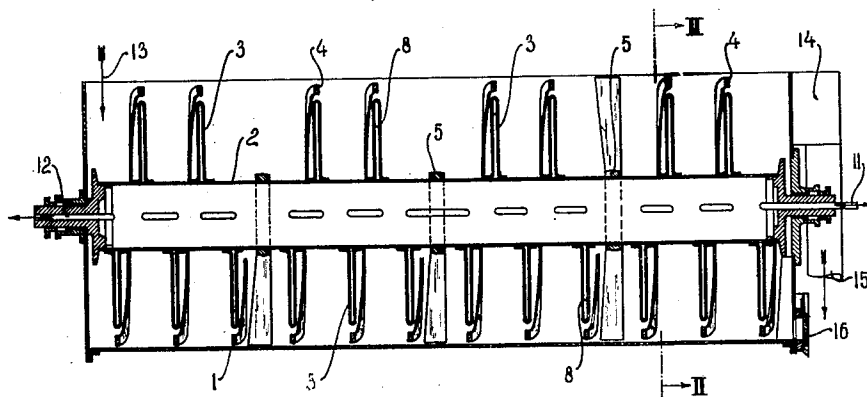


FIG. 3.

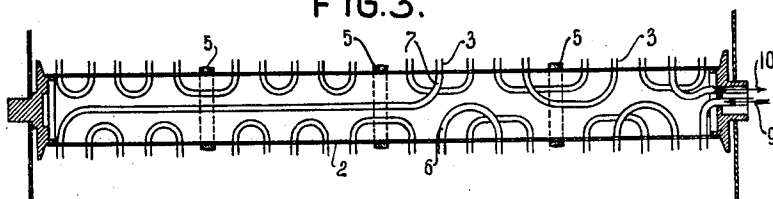
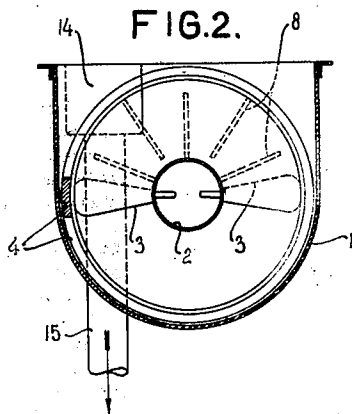


FIG. 2.



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FIG. 4.

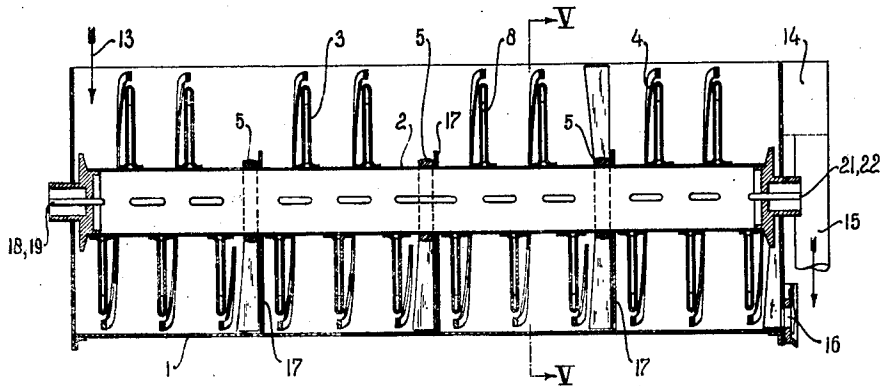


FIG. 5.

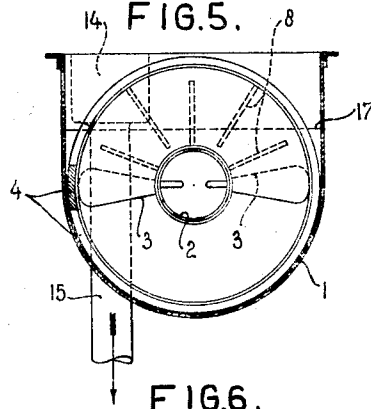
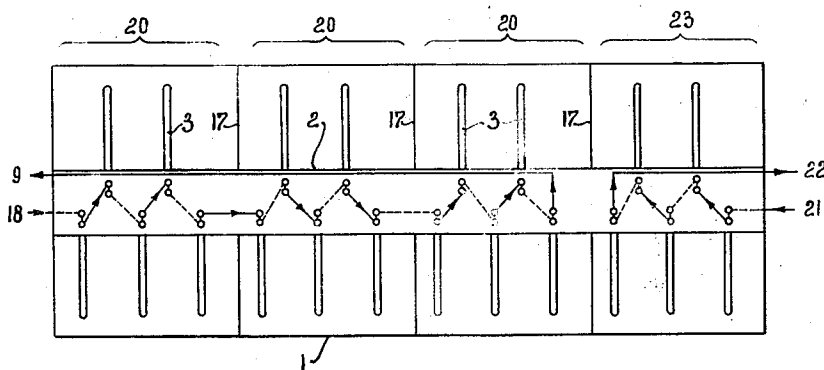


FIG. 6.



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APPARATUS FOR THE HEAT TREATMENT OF SUGAR SOLUTIONS EITHER COMPLETELY OR PARTLY CRYSTALLIZED

Application filed October 10, 1929, Serial No. 398,787, and in the Netherlands October 11, 1928.

This invention relates to apparatus for cooling saturated crystallizing sugar solutions in order to promote the growth of the crystals already present, or for heating, i. e. boiling sugar juices, or for moistening crystallizing sugar solutions, or for other similar purposes.

Ordinary practice is to treat saturated crystallizing sugar solutions in a stationary cylindrical, open or closed trough provided with a stirring device composed of tubes.

In accordance with the present invention, the stirrer is fitted with hollow plates disposed substantially at right angles to the axis of rotation and forming part of the path of a cooling and/or a heating medium.

Preferably, the shaft of the stirrer is hollow so as to provide sufficient space for accommodating the connecting pipes by means of which the cooling or heating medium is caused to flow through the plates in any desired manner.

The trough may be divided into compartments by means of partitions, over the upper edges of which the mass under treatment is forced by the stirrer. In such apparatus cooling may be effected in certain compartments, whereas, for instance, in the last compartment the mass may be heated and if desired, also moistened so as to render it better adapted to be treated in centrifugal separators.

The stirring may be effected by the ordinary helicoidal blades secured as usual to the shaft, or to the hollow plates.

Apparatus provided with a stirring device composed of tubes has the disadvantage that the exchange of heat is not uniform and that it is difficult to accommodate the required cooling or heating surface without arriving at a very heavy construction, whereby the resistances and, consequently, the power consumption are increased and a heavy transmission gear is required.

The said disadvantages are avoided in apparatus made in accordance with this invention. The said hollow plates offer only little resistance and have a relatively large heat exchanging surface. The hollow plates may be divided by baffles into compartments

through which the cooling or heating medium flows in series. Furthermore, the hollow plates may be provided with the required number of suitably covered handholes, whereby the inner walls of the plates are rendered accessible for cleaning purposes.

The annexed more or less diagrammatic drawings illustrate some embodiments of the invention.

Fig. 1 is a longitudinal section of one embodiment, taken through the axis of the stirrer.

Fig. 2 is a cross sectional elevation along the line II—II in Fig. 1.

Fig. 3 is a longitudinal sectional elevation showing the connecting pipes located within the hollow shaft of the stirrer.

Fig. 4 is a longitudinal section of a second embodiment, taken through the axis of the stirrer.

Fig. 5 is a cross sectional elevation along the line V—V in Fig. 2.

Fig. 6 is a diagram of the circulation of cooling and heating medium through the hollow plates of said second embodiment.

The hollow shaft 2 of the stirrer located within the trough 1 is driven by means not shown on the drawings. Secured to said shaft are hollow plates 3 and also a plurality of helicoidal stirring and conveying blades 4. The said hollow plates are disposed at right angles to the axis of rotation and each form a sector having an angular length of about 200°, see Fig. 2.

How the stirring blades 4 are connected to the shaft 2, although this detail is of no importance as far as the invention is concerned, is shown in Figs. 1 and 4, and how said blades are connected to the hollow plates 3 on shaft 2 by means of strips 4a welded or otherwise secured both to said blades and said plates.

The numeral 5 indicates a hub or boss secured to shaft 2 and carrying one or more arms 5a. The hub portions are shown in section, the arms thereon in side elevation. The drawings show only one arm 5a on the left hand side and also one arm on the central hub 5, and two arms 5a on the right hand side of hub 5, but it will be understood that

any suitable number of arms may be provided on each hub.

Fig. 3 shows more fully how the medium flows. In connection therewith, the following explanation is furnished:

It should be borne in mind that the double lines 3 in this figure symbolize the hollow plates secured on the hollow shaft 2 and in communication therewith. The flow of the medium entering at 9 can be traced as follows: From pipe 9 the fluid flows from the right into the first plate 3₁ and circulates therethrough as symbolized by arrow 30. Thereupon it flows through a connecting pipe 31 located within the hollow shaft 2 into the third place 3₃, when it enters into the fifth plate 3₅, also through a connecting pipe 32 within shaft 2. It then passes in succession, by pipes 33, 34, through plates 3₇ and 3₉, whence it flows directly into the left hand plate 3₂₀ by means of pipe 35. From plate 3₂₀ it flows in the reverse direction, i. e. to the right, successively through plates 3₁₉, 3₁₈, 3₁₇, 3₁₆, 3₁₅, 3₁₄, 3₁₃, 3₁₂, 3₁₁, 3₁₀, 3₈, 3₆, 3₄, 3₂, by means of connecting pipes not indicated by references and is discharged through pipe 10.

Each sectoral plate 3 is connected with an inlet pipe 6 (see Fig. 3) and with an outlet pipe 7 and is provided with baffles 8, whereby the cooling or heating medium is forced to flow in zigzag through the plates. In accordance with Fig. 3 cooling water is delivered at 9 and discharged at 10, after having circulated through a plurality of hollow plates 3 and connecting pipes. In the apparatus shown in Fig. 1, the cooling water enters through the pipe 11 and leaves the apparatus through the pipe 12. The partly crystallized mass to be treated is fed into the trough as at 13 and discharged through an overflow 14 and a pipe 15. Alternatively, a slide valve 16 may be used to discharge the mass, or both means may be employed in combination.

Although each plate 3 may have a relatively large heat exchanging surface, the mass within the trough can readily be conveyed in longitudinal direction. The plates cut through the slowly moving mass without being subjected to excessive resistance.

In accordance with Figs. 4-6, the trough is provided with three transverse partitions 17. The boiled crystallizing solution introduced as at 13 is thrown over the top edges of said partitions by means of arms 5a each carried on a boss 5. The cooling water is delivered through a pipe 18 and discharged through a pipe 19, so that the mass within the compartments 20 (Fig. 6) is gradually cooled down. The pipes 21, 22 however serve for the circulation of a heating medium through the plates 3 in the compartment 23.

The trough may be made so long, or a plurality of troughs may be connected in se-

ries so that the flow of the boiled mass is continuously cooled and remains within the apparatus during the full period required for the growth of the crystals. Stated in other language, the mass is fed in a continuous stream to the centrifugal separators.

The described apparatus can be used with equal advantage for boiling sugar juice, for which purpose the trough should be provided with an air-tight cover and be connected with means adapted to create a vacuum therein. As a matter of course, the heating surface of the hollow plates should then be ample for the purpose in view.

What I claim is:—

1. Apparatus for the treatment of sugar solutions and the like in a receptacle by the aid of temperature changing medium, comprising hollow plates through which said medium flows, a shaft upon which said plates are arranged in juxtaposition, said shaft extending through the receptacle, said plates being in the form of circular disks adapted to partially fill the cross sectional area of the receptacle so that consecutive plates fill up substantially alternative halves thereof.

2. Apparatus according to claim 1, in which pipes are arranged within said shaft, adapted to furnish communication between said plates.

3. Apparatus according to claim 1 in which the lower part of the receptacle is divided by transverse partitions and blades adapted to convey the content of the receptacle over said partitions out of one compartment into the adjacent compartment.

4. Apparatus for the treatment of sugar solutions comprising a receptacle, a revolving shaft in said receptacle, plates mounted in juxtaposition on said shaft substantially at right angles to the axis thereof, said plates being in the form of circular disks adapted to partially fill the cross sectional area of the receptacle so that consecutive plates fill up at least alternative halves thereof.

In testimony whereof I affix my signature.
RICHARD BONATH.