

Aug. 13, 1929.

B. H. VARNAU ET AL
SUGAR CRYSTALLIZING APPARATUS.

1,724,627

Filed March 21, 1927

Fig. 1.

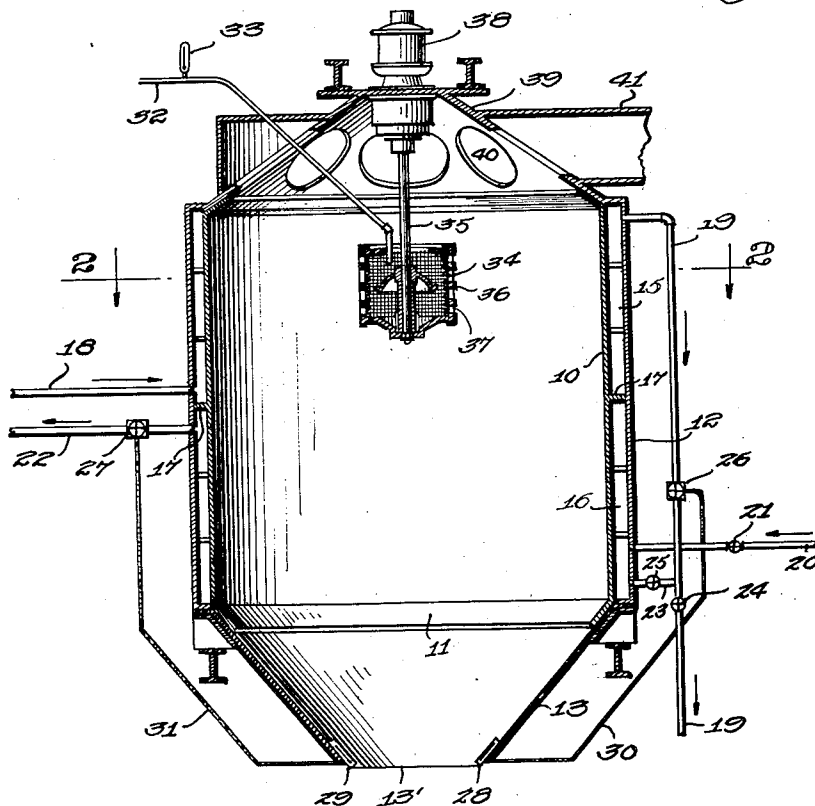
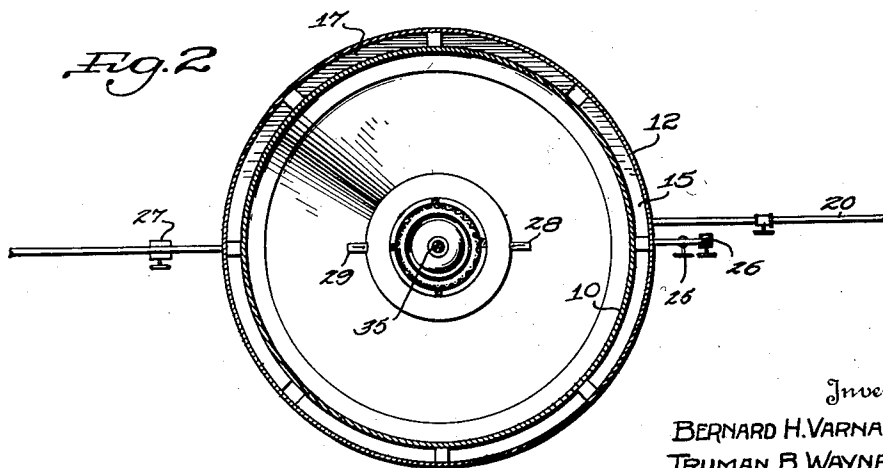


Fig. 2.



Inventor

BERNARD H. VARNAU
TRUMAN B. WAYNE

By

C. H. Parker
Attorney

UNITED STATES PATENT OFFICE.

BERNARD H. VARNAU AND TRUMAN B. WAYNE, OF SUGAR LAND, TEXAS.

SUGAR-CRYSTALLIZING APPARATUS.

Application filed March 21, 1927. Serial No. 176,982.

This invention relates to an apparatus for use in the production of exceedingly fine, soft sugar crystals of substantially uniform character and more particularly to an apparatus for use in the rapid cooling of hot, supersaturated sugar solution of high purity, especially sucrose solutions such as are commonly employed in sugar factories and refineries in the manufacture of high grade granulated cane sugars.

The principal object of this invention is to provide an apparatus which will rapidly cool under predetermined conditions of control, concentrated sugar solutions in such a manner that crystallization occurs with the production of numerous very fine crystals which are sufficiently uniform in character to allow subsequent improvement of such crystals in the usual forms of crystallizers to the point where purgeable massecuites are obtained, and where the yields of sugar compare favorably with those now obtained by the conventional process of crystallization by concentration in vacuum pans.

Another object of this invention is to provide an apparatus for the production of "grain" without the necessity of resorting to the conventional vacuum pan treatment wherein means are provided for producing a spray or atomized mist of a concentrated sugar solution and means are provided for rapidly cooling such spray or mist under predetermined conditions of control for producing a great number of extra fine, soft crystals of uniform character.

Another object of this invention is to provide an apparatus for rapidly cooling concentrated sugar solutions of high purity wherein the sugar solution is directed against a rapidly revolving scatter plate and wherein a centrifugal basket is provided surrounding such scatter plate whereby the sugar solution thrown off therefrom is forced through the minute openings in the basket whereby the solution is converted in the form of a fine spray or mist, and wherein means are provided for rapidly cooling such spray or under predetermined conditions of control.

Other objects and advantages of this invention will be apparent during the course of the following description.

Heretofore in the production of sugar crystals it has been customary to boil the sugar solution to "grain" in vacuum pans and such "grain" has then been allowed to feed on the mother liquor until crystals of the desired

size have been formed. This procedure is attended with numerous practical difficulties and the grain produced is not uniform in character since the crystallization takes place over a considerable period of time with the result that the crystals formed develop into considerable size in comparison with the smaller crystals formed later. We have discovered that in dealing with certain types of sugar solutions we are able to dispense with the step of boiling to "grain" in vacuum pans by substituting for such step a rapid cooling of a concentrated sugar solution to lower the point of supersaturation of such solution. This may be advantageously accomplished by means of the apparatus hereinafter described. An important advantage of this apparatus is that it allows the production of sugar having exceedingly fine soft crystals of very uniform character, and eliminates the practical difficulties attending attempts to produce such sugar by the usual vacuum pan process. Also due to its principle of reducing the supersaturation point of the sugar solution to a point where a sufficient number of crystals are formed to insure the production of purgeable massecuites, it is possible to utilize the run-off granulated syrups from hot granulated massecuites without first diluting and heating such syrups and returning them for reboiling in vacuum pans. The result is that further yields of sugar are obtained directly from such run-off syrups without the use of additional steam which would ordinarily be consumed in reboiling, and the vacuum pans are released from the necessity of reboiling the syrups and are free to boil larger proportions of high grade first liquors from the char filtration processes.

In the accompanying drawing we have illustrated the preferred embodiment of our invention. In this showing,

Figure 1 is a vertical cross sectional view of the apparatus, and

Figure 2 is a transverse section taken on line 2-2 of Figure 1.

Referring to the accompanying drawing the reference numeral 10 designates an inner metallic cylinder preferably formed of copper or other metal having a high degree of heat conductivity and which is provided at the bottom thereof with a funnel-shape outlet 11. The inner cylinder 10 is arranged within an outer cylinder 12 formed of any suitable material, such for example as cast iron, copper or the like and is spaced there-

from to provide a jacket between the inner and outer vessels. The inner cylinder or cooling vessel 10 is securely attached to the outer cylinder 12 and a funnel-shaped outlet 13, provided with an opening 13', is secured to the outer cylinder 12 and the funnel-shaped outlet of the inner cylinder 10. The jacket between the inner and outer cylinders is divided into two portions 15 and 16 by means of the annular partition 17 and these compartments are adapted to contain water for cooling the inner cylinder 10. Means are provided for maintaining a circulation of water through the compartments 15 and 16. The compartment 15 is cooled by means of water introduced through the inlet pipe 18 and discharged through the pipe 19. As indicated in the drawing the point of entrance of the water into the compartment 15 is near the bottom thereof and the point of discharge of the water through the pipe 19 is adjacent the top of the compartment 15. The lower compartment 16 is provided with a water inlet pipe 20 provided with a valve 21 and an outlet pipe 22. If desired a portion or all of the water discharged from the upper compartment 15 may be introduced into the lower compartment 16 through the pipe 23 by means of the valves 24 and 25. The amount of water introduced into the compartments 15 and 16 is controlled by means of automatic thermostatic control valves 26 and 27 arranged in the outlet pipes 19 and 22. The automatic valves 26 and 27 are controlled by means of thermometers 28 and 29 connected by suitable lead wires 30 and 31 to such valves. As will be understood the valves 26 and 27 are set to open and close at a predetermined temperature.

A pipe 32 for delivering the sugar solution to be treated and provided with a thermometer 33 is adapted to deliver the sugar solution upon a scatter plate 34 mounted upon a rotatable spindle 35 within a centrifugal basket 36 also mounted on the spindle 35. The centrifugal basket 36 is provided with a mesh screen 37 having a plurality of openings of the desired size therein. The spindle 35 is adapted to be rotated by means of an electric motor 38 preferably mounted upon the upper portion of the substantial frusto-conical extension 39 of the outer cylinder 12. The extension 39 of the cylinder 12 is provided with openings 40 which are in communication with a manifold 41 connected to a suction fan (not shown) whereby a current of air may be drawn upwardly through the opening 13' in the bottom of the funnel-shaped outlet 13.

In the preferred practice of our process a hot supersaturated sugar solution of suitable purity and density is discharged through the pipe 32 on to the scatter plate 34 which is preferably revolving at a high rate of speed. The sugar solution is thrown

outwardly by centrifugal force against the perforated walls of the centrifugal basket 36. The sugar solution is forced through the openings in the perforated wall 37 of the basket 36 and against the inner wall of the cooling vessel 10, whereby the solution is atomized to a fine spray and rapidly cooled by being delivered against the inner wall of the cooling vessel 10. Cooling water is circulated within the compartment 15 to aid and effect this cooling and a current of cold air may also be drawn upwardly through the cooling vessel by means of the fan communicating with the manifold 41. The rate at which the cooling water is supplied and circulated in the compartment 15 is controlled by means of the automatic control valve 26 which has previously been adjusted to allow the required temperature drop between the temperature of the in-flowing liquor and that of the cooled solution being discharged through the opening 13'. The rate and amount of cooling to be effected depends on the nature of the sugar solution under treatment and is the subject matter of our copending application Serial Numbers 133,594, filed September 4, 1926, and 133,595, filed September 4, 1926. As heretofore set forth the cooling water may either be discharged completely through the upper compartment 15 or may be circulated through the compartment 16. The rate at which the cooling water is circulated in the compartment 16 is controlled by means of the control valve 27 which has previously been adjusted in the manner heretofore set forth. In the event that additional cooling water is required in the compartment 16 such water may be supplied through the pipe 20. By virtue of the arrangement of inlet and outlet pipes and the control valves described, a great flexibility of the cooling capacity of the apparatus is provided.

When cooling sugar liquors of high purity and of satisfactory density and color, such as those usually found in the first and second run-offs, from hot granulated cane sugar massecuites, the operator has simply to regulate the temperature of the ingoing syrup to the point where unsatisfactory crystal formation already present in the run-off syrups is eliminated and then regulate the amount of cooling water to secure the desired temperature drop. The sugar solution in cooling will acquire an extremely uniform crystal setting of fine crystals almost instantaneously, and this liquor is then discharged through the opening 13' and conveyed to suitable crystallizers for further improvement in the well known manner.

While we have described the preferred type of apparatus for converting the sugar liquor into a fine spray to promote the instantaneous temperature drops required it will be obvious that we may employ other

forms of whirling spray apparatus such as a rotating nozzle. However we prefer to employ the type of centrifugal spray herein before described because of its large capacity and self-cleaning properties and because of the fact that with this construction it is possible to project a spray of sugar liquor substantially in a straight line at right angles to the surface of the inner wall of the cooling chamber with sufficient force to penetrate the sugar film formed on such surface whereby the building up of additional amounts of such film is substantially prevented.

While we have described in detail the preferred embodiment of our invention it will be understood that the size, shape and details of construction of our apparatus may be varied without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. An apparatus of the character described comprising a chamber, a rotatable scatter plate arranged within said chamber, a rotatable centrifugal basket surrounding said scatter plate, means for discharging liquid on to said scatter plate, means for modifying the temperature of the inner wall of said chamber, and means for regulating the extent to which the temperature of said inner wall of said chamber is modified.

2. An apparatus of the character described comprising a chamber provided with an outlet adjacent the bottom thereof, means for producing a spray of liquid in said chamber, a water jacket surrounding said chamber, means for circulating water in said water jacket, and means for controlling the amount of liquid circulated in said jacket, said last named means including thermostatic valves controlled by electric thermometers arranged adjacent the outlet of said chamber.

3. An apparatus of the character described comprising a chamber, means for producing a spray of liquid in said chamber, a water jacket surrounding said chamber, said water jacket comprising a plurality of compartments, means for circulating water in said compartments, means for discharging the water circulated through one of said compartments into another of said compartments, and means for controlling the amount of liquid circulated in said compartments.

4. An apparatus of the character described comprising a chamber, a rotatable scatter plate arranged within said chamber, a centrifugal basket surrounding said scatter plate, means for delivering liquid on to said scatter plate, a water jacket provided with two compartments surrounding said chamber, means for introducing water into the upper of said compartments adjacent the lower portion thereof, means for discharging the water from said last named compartment adjacent the upper portion thereof, means for intro-

ducing water into said lower compartment, means for discharging water therefrom, means for discharging the water from said upper compartment into said lower compartment, an outlet member arranged adjacent the bottom of said chamber, electric thermostatic valves for controlling the amount of water circulated through said water jacket, and electric thermometers arranged adjacent the bottom of said outlet member for controlling said valves.

5. In an apparatus of the character described comprising a chamber, means for introducing liquid into said chamber, and means for controlling the temperature within said chamber, the combination of a rotatable scatter plate arranged within a perforated member for projecting a spray of said liquid at high velocity against the inner surface of said chamber substantially at right angles thereto.

6. In an apparatus of the character described comprising a chamber, means for introducing liquid into said chamber, and means for controlling the temperature within said chamber, the combination of a rotatable centrifugal basket for projecting a spray of said liquid at relatively high velocity against the inner surface of said chamber substantially at right angles thereto.

7. An apparatus of the character described comprising a chamber provided with an outlet adjacent the bottom thereof, means for producing a spray of liquid in said chamber, and means for regulating the temperature within said chamber, said regulating means being controlled by the temperature adjacent the outlet end of said chamber.

8. An apparatus of the character described comprising a chamber provided with an outlet adjacent the bottom thereof, means for producing a spray of liquid in said chamber, a water jacket surrounding said chamber, means for circulating water in said water jacket, and temperature responsive means arranged adjacent the outlet end of said chamber for controlling the amount of water circulated in said water jacket.

9. An apparatus of the character described comprising a chamber, a rotatable distributing member arranged within said chamber, a rotatable centrifugal member surrounding said distributing member, means for delivering liquid to said distributing member, means for modifying the temperature of the wall of said chamber, and means for regulating the extent to which the temperature of said wall is modified.

In testimony whereof we affix our signatures.

BERNARD H. VARNAU.
TRUMAN B. WAYNE.