April 4, 1939. H. E. GRILL ET AL 2,153,082

SUGAR CRYSTALLIZING APPARATUS

Filed Jan. 11, 1938 2 Sheets-Sheet 1

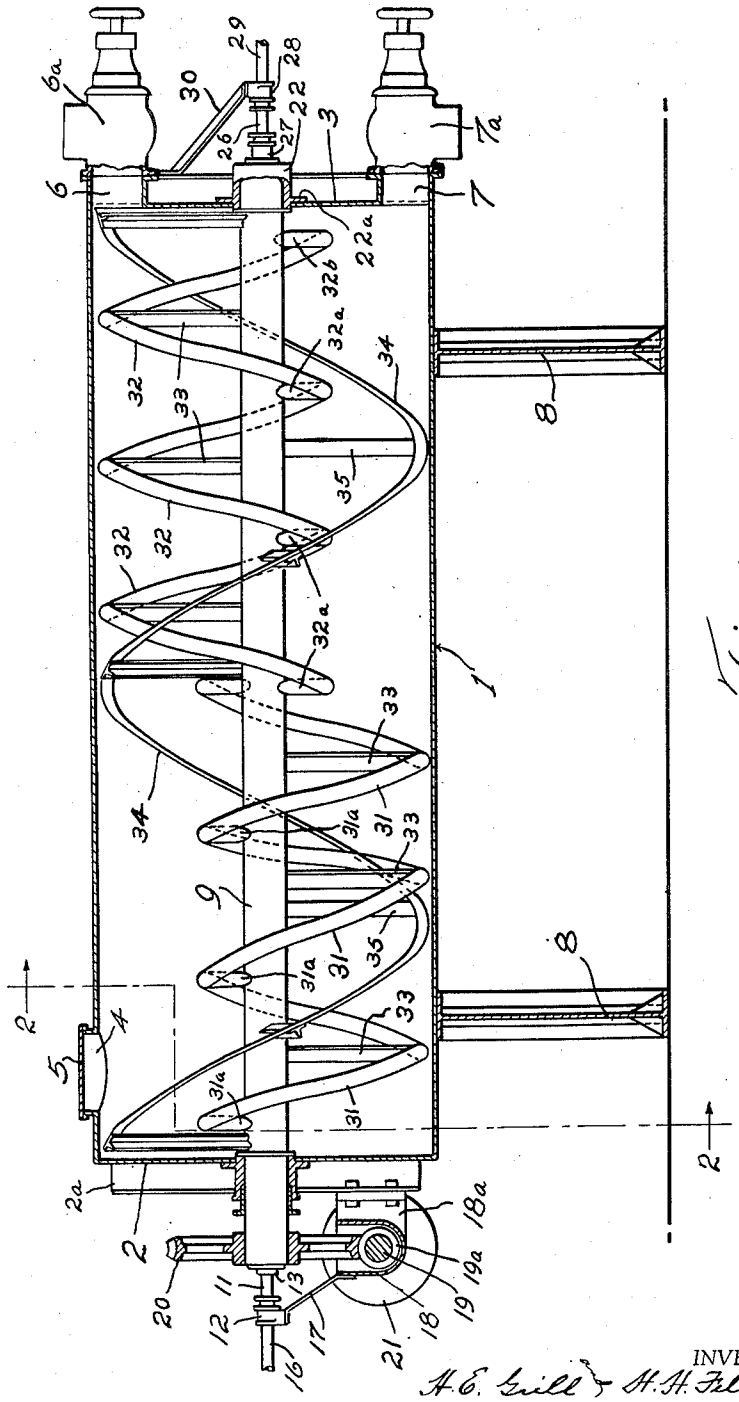


Fig. 1

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SUGAR CRYSTALLIZING APPARATUS

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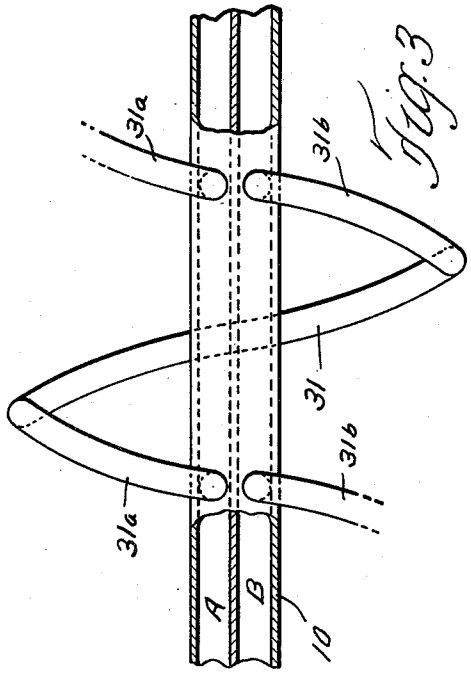


Fig. 3

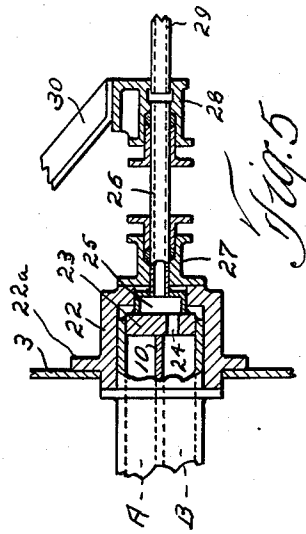


Fig. 5

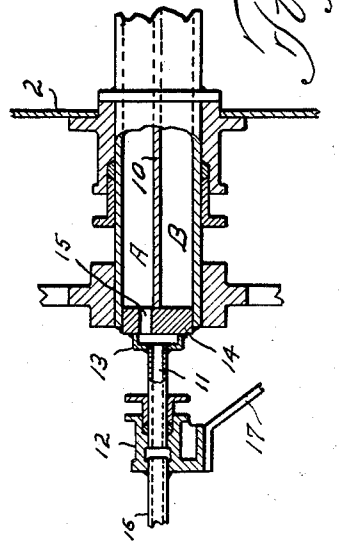


Fig. 4

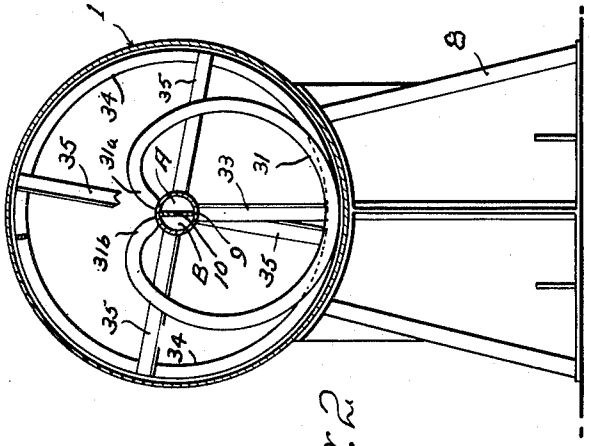


Fig. 2

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UNITED STATES PATENT OFFICE

2,153,082

SUGAR CRYSTALLIZING APPARATUS

Harry E. Grill, Willoughby, and Henry H. Feldstein, Cleveland, Ohio, assignors to The Kilby Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application January 11, 1938, Serial No. 184,452

1 Claim. (Cl. 127—15)

This invention relates to apparatus for effecting the crystallization of sugar from the mother liquid or from masseculte and has for its general object to improve and simplify the construction of such apparatus.

A further and more limited object of the invention is to provide an apparatus of this character which, while realizing all of the advantages due to the use of eccentrically mounted helical coils, will afford a particularly sturdy construction.

A still further object of our invention is to provide a crystallizing apparatus of the general type shown and described in our Patent No. 2,097,208, issued October 26, 1937, which is capable of use in factories and other places where the water pressure is materially lower than that required for the circulation of water through the cooling coils of the apparatus of said patent as well as that required for the circulation of such water through the coils of other crystallizing apparatus with which we are familiar. Further objects and advantages of the apparatus shown and described herein will be pointed out hereinafter.

In the drawings herein illustrating our invention, Fig. 1 represents a central longitudinal sectional view taken through a crystallizing tank, the coil and the shaft carrying the same being shown in elevation; Fig. 2 a detail in section corresponding to the line 2—2 of Fig. 1; Fig. 3 an enlarged detail in sectional bottom plan showing the construction of the shaft on which the coils are mounted and the manner of connecting the units of the coils therewith; Fig. 4 a detail in section of the receiving end of the shaft, the latter having been rotated 180° from its position in Figs. 1 and 2; and Fig. 5 a similar view of the delivery end of the shaft.

Describing the parts shown herein by reference characters, 1 denotes the main body of the crystallizer tank, which is preferably cylindrical, as shown, and which has its ends closed by heads 2 and 3. The tank is provided with a manhole opening 4 near one end thereof provided with a cover 5. The head 3 is provided near the top thereof with a filling connection 6 having a valve, indicated conventionally at 6a. It is also provided, near the bottom thereof, with an outlet connection 7 having a valve, which is indicated conventionally at 7a. The tank is conveniently supported by cradles 8.

9 denotes a hollow or tubular shaft, which is divided by a partition 10, extending longitudinally thereof, into two compartments or headers A and B. The cooling water is supplied to the compartment or header A through a pipe 11, serving as a trunnion which is journaled in the bearing 12 and which communicates at its delivery end with the interior of a casing 13 secured to a plug 14 which closes the receiving end of the shaft. This plug is provided with a port 15, whereby cooling water, supplied to the pipe 11 by the pipe 16, is delivered to the chamber or header A. The bearing 12 is shown as supported by a bracket arm 17 having its lower end connected to the adjacent wall of the housing 18 in which the worm shaft 19 is mounted, said shaft having thereon a worm 19a meshing with a worm gear 20 which is secured to the end of the shaft 9 which projects through the head 2 of the tank. The worm shaft 19 is shown as driven by a gear or pulley 21, which in turn may be driven from any convenient source of power. The housing 18 in turn is supported by a pair of brackets 18a, each of which is fastened to a bar 2a secured to the head 2. One of said brackets and bars is shown in Fig. 1.

The opposite end of the shaft 9 is mounted in a journal 22 having a flange 22a by means of which it is secured to the head 3. This end of the shaft is also provided with a plug 23 having an outlet port 24 therethrough on the opposite side of the partition 10 from the port 15. Water within the compartment or header B is delivered through said port and into the interior of a casing 25, similar to the casing 13, and thence through a pipe 26, which is journaled in bearings 27 and 28 and thence to the waste pipe 29. The journal 27 is shown as secured, as by welding, to the outboard end of the journal 22, while the journal 28 is conveniently supported by a bracket arm 30 having one end connected thereto and its opposite end connected to the head 3. If desired, the shaft may be shortened and provided at each end with a hollow trunnion of smaller diameter than the diameter of the shaft, which trunnions are mounted within correspondingly smaller journals secured to the respective heads of the cylinder.

Secured to and rotating with the shaft 9 are two series of water circulating units 31, 32, the units of one series projecting from the shaft in the opposite direction from the units of the other series. Each unit 31 has its receiving end connected with the compartment or header A of the shaft and its delivery end connected to the compartment or header B, as will appear clearly from Figs. 2 and 3. Each unit is approximately circular in projection, as will be seen by reference to Fig. 2, its receiving and delivery ends 31a, 31b

being deflected inwardly toward the center of the circular portion of the unit for connection with the headers A and B. The centers of the circular portions of the units 32 are diametrically opposed to the centers of the circular portions of the units 31 and are connected to the headers or compartments A and B of the shaft at 32^a and 32^b, in the same manner as the units 31 are connected therewith.

The center of the peripheral portion of each unit is supported from the shaft by means of a radially extending bracket arm 33. It will be seen that the units are so arranged with respect to the shaft that they produce the effect, when the shaft is rotated, of two eccentrically mounted helical coils wherein the convolutions of one coil are diametrically opposed to the convolutions of the other coil, the coils being of the same pitch.

34 denotes a combined helical scraper and stirrer which is supported from the shaft by means of radially extending arms 35. The combined helical scraper and stirrer herein shown makes two complete convolutions about the shaft, its outer edge being in close proximity to the inner wall of the tank.

With the parts constructed and arranged as shown and described herein, it is believed that the operation will be readily understood. The tank body is filled with massecuite through the opening 4 and the shaft is rotated, water being supplied to the compartment or header A. Due to the shape and the eccentric mounting of the cooling units and the cooperation of the stirrer therewith, every point in a cross section taken through the massecuite is contacted by the cooling units as they rotate. This enables the heat interchange between the liquid circulating through said units and the massecuite in the tank to be accomplished with uniformity and with rapidity surpassing that which is obtained by any standard crystallizing apparatus with which we are familiar.

The assembly of shaft, circulating units and combined stirrer and scraper is particularly sturdy. This is due to the fact that the ends of each unit are connected directly with the shaft, it being noted that where the shaft and the units are made of the same metal, they may be connected by welding. If made of different metals, the connections would preferably be made by flanged joints.

It will be noted further that, due to the manner of supporting the units, only one bracket arm is needed for the support of each unit, thus reducing to a minimum the number of the bracket arms, which, if present in a large number, would increase the resistance to the longitudinal movement of the massecuite in the tank, with a less efficient contacting of all portions of the massecuite with the cooling units. A further and marked advantage which our improved crystallizing apparatus possesses over any other crystallizing apparatus with which we are familiar including the apparatus disclosed in our aforesaid patent, is its ability to operate with the efficiency noted hereinbefore while using cooling water having a very low pressure as compared with that necessary to effect satisfactory circulation through the coils of such former apparatus. It is possible to operate the apparatus disclosed herein under a water pressure of not exceeding 5 lbs. per square inch, whereas, with the use of a continuous coil having the same capacity as that of the units shown and described herein, a higher pressure is required. This adapts our apparatus for use in factories and other locations or localities where water pressures, such as are obtainable in most large cities, are not available.

When it is desired to remove the contents from the tank, this may be accomplished by removing the closure 7^a.

Having thus described our invention, what we claim is:

The combination, with a circular crystallizer tank, of a hollow shaft mounted within and extending longitudinally through said tank, the said shaft comprising a receiving header or compartment and a delivery header or compartment extending longitudinally thereof, a series of tubular units each having one end connected to the receiving header or compartment and its opposite end connected to the delivery header or compartment, each unit approximating in shape a convolution of a helical coil mounted eccentrically with respect to said shaft and having its outer or peripheral portion in proximity to the inner wall of the tank, a second series of oppositely arranged tubular units similar to the first mentioned units and connected in like manner to the headers or compartments of the shaft, a radially extending brace connecting the central peripheral portion of each unit with the shaft, a combined helical stirrer and scraper arranged concentrically with respect to the shaft and extending in proximity to the inner surface of said tank, supporting arms carried by said shaft and connected to said combined scraper and stirrer, means for rotating said shaft, means for supplying cooling liquid to the receiving header or compartment and for delivering such liquid from the delivery header or compartment of said shaft during the rotation thereof.

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HARRY E. GRILL.