Jan. 9, 1940. C. A. BOYD ET AL 2,186,234

CRYSTALLIZING APPARATUS

Filed Dec. 7, 1938 2 Sheets-Sheet 1

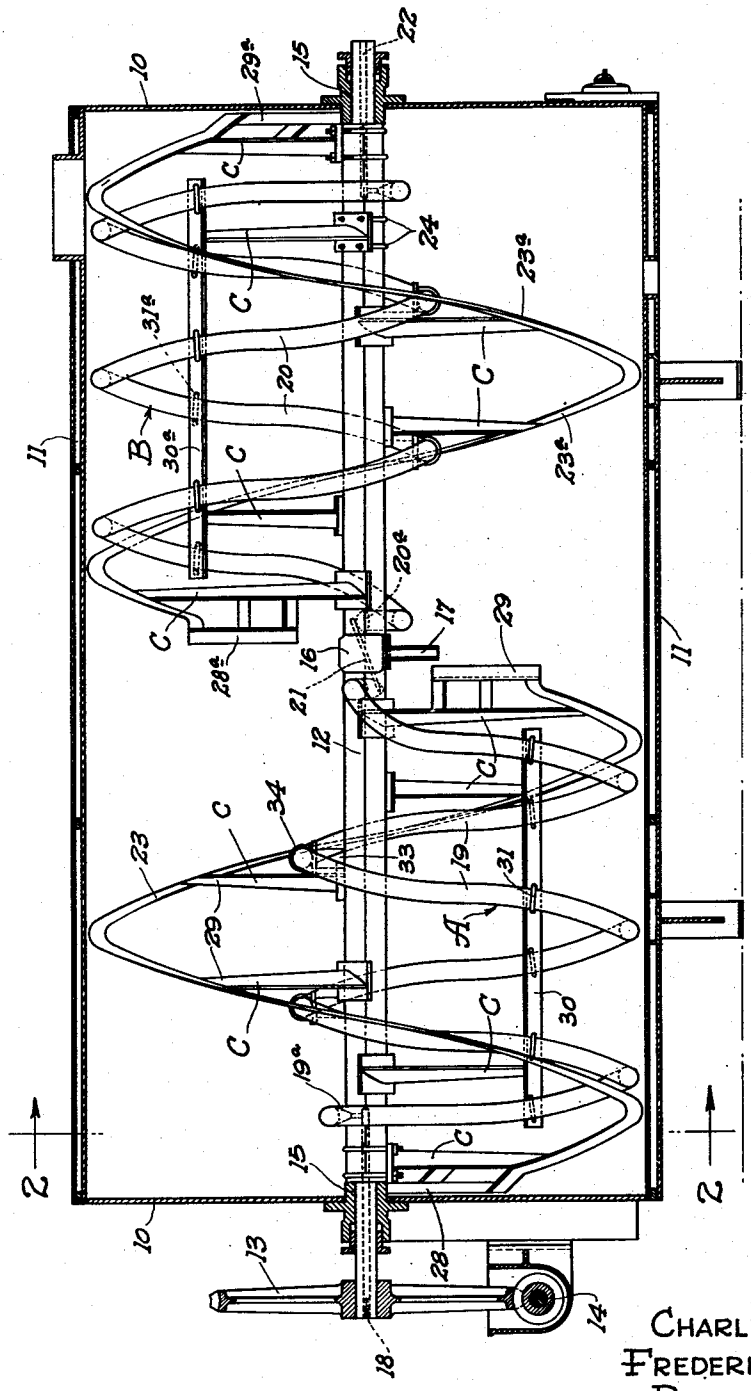


Fig. 1.

INVENTORS
CHARLES A. BOYD
FREDERICK B. KRAFT
PETER RAGBORG

BY Hull, Brock & West
ATTORNEYS.

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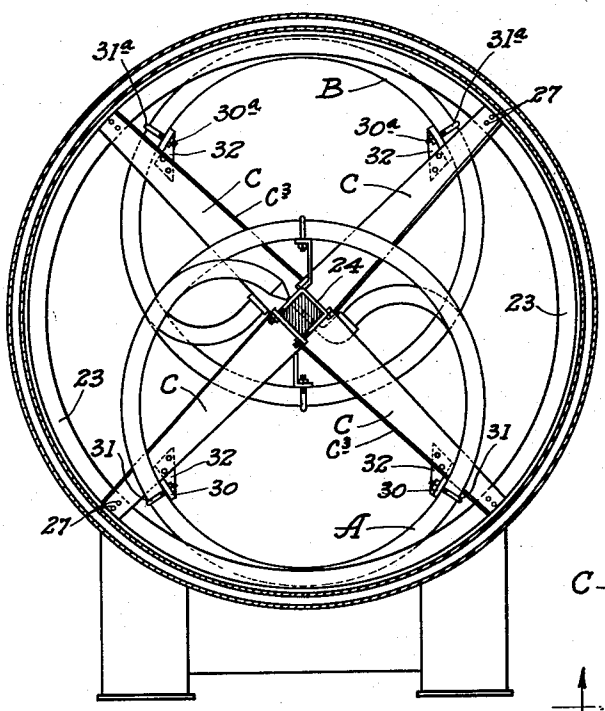


FIG. 2.

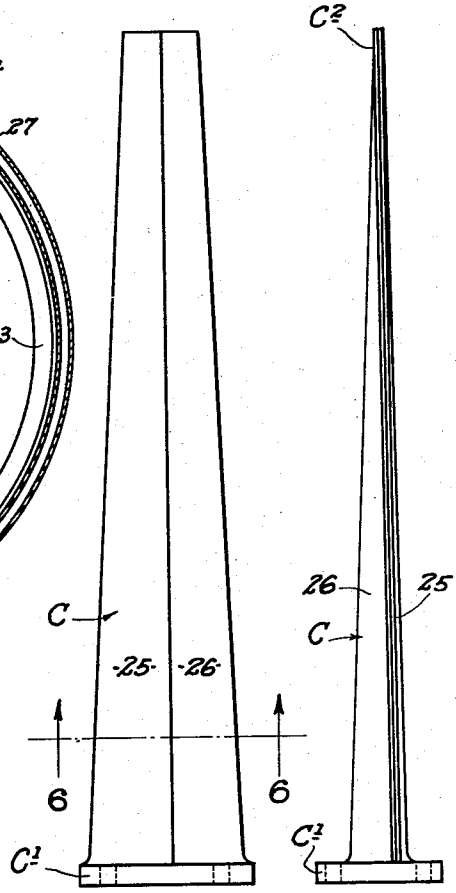


FIG. 3.

FIG. 4.

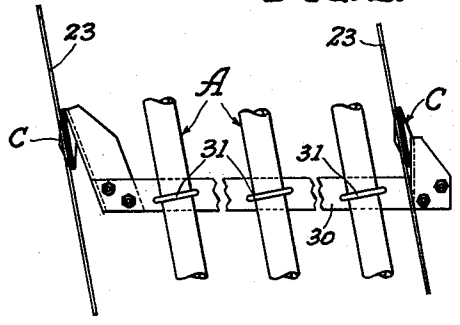


FIG. 7.

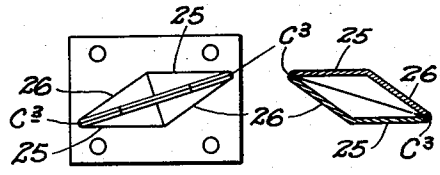


FIG. 5. FIG. 6.

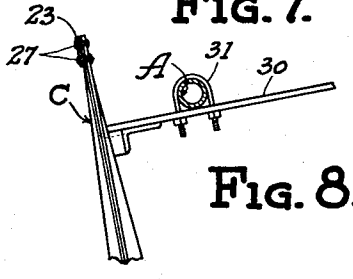


FIG. 8.

INVENTORS
CHARLES A. BOYD.
FREDERICK B. KRAFT.
PETER RAGBORG.
BY Hull, Brock & West.
ATTORNEYS

Patented Jan. 9, 1940 2,186,234

UNITED STATES PATENT OFFICE

2,186,234

CRYSTALLIZING APPARATUS

Charles A. Boyd, Chagrin Falls, Frederick B. Kraft, Cleveland, and Peter Ragborg, Euclid, Ohio, assignors to The Kilby Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application December 7, 1938, Serial No. 244,434

2 Claims. (Cl. 127—15)

This invention relates to apparatus for effecting the crystallization of sugar from the mother liquid or massecuite and has for its general object to improve the efficiency of such apparatus. More specifically, our invention relates to the construction of the arms by which the convolutions of the coils and the helical stirrers are supported from the shafts of such apparatus and to the cooperating features of the arms, coils and stirrers. The details of construction whereby the improvements in the efficiency of the crystallizing apparatus are obtained will be brought out in connection with the drawings forming a part hereof wherein Fig. 1 represents a central longitudinal sectional view through a crystallizing tank having our invention therein, the coils, the shaft, and the combined stirrer and scraper being shown in elevation; Fig. 2 a detail in section corresponding to the line 2—2 of Fig. 1 and looking in the direction of the arrows; Fig. 3 a side elevation and Fig. 4 an edge elevation of one of the supporting arms shown in the preceding views; Fig. 5 a top plan view of one of said arms; Fig. 6 a cross sectional view taken through one of said arms and corresponding to the line 6—6 of Fig. 3; and Figs. 7 and 8 are details in plan and in sectional side elevation of the connections between the arms, the convolutions of a coil and the combined stirrer and scraper.

Describing the various parts herein by reference characters, 10 denotes a crystallizer tank, preferably cylindrical in cross section and provided with a jacket 11, for cooling liquid, surrounding the cylindrical body thereof. 12 denotes a shaft extending through the heads of the tank, one end of the shaft being provided with a worm gear 13 driven by a worm 14, the shaft being mounted in journal boxes 15 in the heads of the tank. 16 denotes a central bearing for the shaft, said bearing being carried by a support 17 extending transversely of the tank and secured at its opposite ends to the inner wall thereof. The shaft is provided with an inlet channel 18 at one end, which channel forms part of the conduit by means of which water is supplied to and through the sections of the coil, which in turn are secured to the shaft within the tank.

Two helical coil sections of opposite eccentricity are shown at A and B; that is to say, each section comprises a plurality of convolutions 19, 20, respectively, the centers of the convolutions of one coil section being diametrically opposite the centers of the convolutions of the other coil section. The receiving end of the coil section A communicates with the channel 18, as indicated at 19a, while the delivery end of the said coil section communicates with a channel 21 in the bearing 16, the delivery end of said channel communicating in turn with the receiving end 20a of the coil section 20. The delivery end of this coil section communicates with a delivery channel 22 in the end of the shaft on which the said coil section is mounted. It will be noted that the portions of the convolutions of the coil sections A and B which are more remote from the shaft extend in close proximity to the inner wall of the tank while the opposite portions of the convolutions are in close proximity to the shaft.

23 and 23a denote helical combined stirrers and scrapers, the pitch of these combined stirrers and scrapers being preferably the same as the pitch of the helical coil sections A and B. For the purpose of bracing the coil sections and the combined stirrers and scrapers as well as for supporting these parts from the shaft, we employ the special construction of arms shown in detail in Figs. 3–6 inclusive and connect them to the said coil sections and to the combined stirrers and scrapers in the manner shown in Figs. 1, 2, 7 and 8.

The supporting arms

Each of these arms is indicated generally at C and comprises generally a base and means for securing the same to the shaft, the arm proper which is carried by the base being of the blade-type and being specifically diamond-shaped in section. As the shaft shown herein is square in section, the base C′ is shown as flat and is secured to the shaft by means of U-bolts 24. Obviously, if the shaft were circular in section, the base would be curved to conform to the curvature of the outer surface of the shaft and the bases would be secured to the shaft by suitable bolts or studs.

Each of these arms diminishes gradually in width and thickness from the base to the outer end, the outer end being flattened, as shown at C^2, for a purpose to be described. As will appear from the drawing, each arm has the shape in section of a narrow diamond, and it is preferred that the longer diagonal of the diamond shall make an angle with the axis of the shaft equal, or substantially equal, to the angle made therewith by the pitch of the convolutions of the coils and the pitch of the combined scrapers and stirrers. When secured in place upon the shaft, each arm will have opposed parallel faces 25 at right angles to the plane of the axis of the shaft and other opposed parallel faces 26 forming a greater angle therewith than is formed by the longer

diagonal of the diamond. Owing to the arrangement of the inclined faces 26 on the arms C, one set of such faces will operate to impart movement of the massecuite longitudinally of the tank when the shaft is revolved in one direction, while the other set of faces will operate to move the massecuite longitudinally of the tank in the opposite direction when the direction of rotation of the shaft is reversed. It is preferred to make each of these arms of two symmetrical triangular sections having their edges welded together, as shown at C^3. This insures adequate strength, together with lightness of construction.

The outer flattened end of each arm C forms the same angle with respect to the axis of the shaft as does the longer diagonal of the diamond-shaped portion thereof; and the flattened end of each arm is connected to the combined stirrer and scraper, in any suitable manner, as by welding or by means of bolts 27.

Each of the combined stirrers and scrapers 23 is connected at its opposite ends with extension brackets 28, 29 and 28^a, 29^a, which extension brackets are also connected to the adjacent arms C.

30 and 30^a denote longitudinal bracing bars which are secured to the portions of the convolutions of the coils A and B, respectively, which are remote from the shaft, as by means of U-bolts 31, 31^a, the said bars being secured to the arms C by means of brackets 32, the said brackets in turn being secured to suitable adjacent faces of the arms, preferably by being welded thereto. The centers of the portions of the convolutions of the coil sections which are closer to the shaft are supported directly from the latter, as by means of brackets 33 each having one end secured to the shaft and its opposite end connected to a convolution of the coil section as by means of a U-bolt 34.

With the parts constructed and arranged as described, the operation can be readily understood. The shaft 12 being rotated, the coils A and B and the combined stirrers and scrapers 23 and 23^a will operate in a well known manner to effect the movement and cooling of the massecuite and the resultant crystallization of the sugar from the latter. In this operation, the appropriate faces 26 of the arms C will cooperate with the coils A and B and the combined stirrer and scraper in moving the massecuite longitudinally of the tank, while the shape of the arms enables them to pass through the massecuite with a minimum of resistance. This capability of the arms is of importance, especially when the crystallization has proceeded to a stage where the sugar content of the massecuite has become excessive. The only resistance to the passage of the arms through the massecuite when the sugar content has reached this stage of concentration is the inclination of one of the faces 26; the faces 25, being at right angles to the axis of the shaft, offer no resistance to such movement.

Another objection to the use of arms as ordinarily constructed is that they permit and encourage the accumulation of a considerably large amount of sugar thereon which has to be removed. By constructing the arms in the manner shown and described herein, we have been able to overcome this objection.

Having thus described our invention, what we claim is:

1. The combination, with a crystallizer tank, of a shaft mounted within and extending longitudinally through said tank, a helical coil of tubing surrounding said shaft, a combined helical scraper and stirrer also surrounding said shaft and having a pitch which will impart a movement to the massecuite longitudinally of the tank, means for circulating cooling liquid through said coil, arms secured to the said shaft and extending substantially radially therefrom, the said arms having each in section the shape of an elongated or narrow diamond, each diamond having opposed faces extending at substantially right angles to the axis of rotation of said shaft and the other opposed faces thereof forming acute angles with the plane of the axis of said shaft, the angle or pitch of the longer diagonal of each diamond coinciding substantially with the pitch of the combined stirrer and scraper, and means for securing the outer ends of the said arms to the combined stirrer and scraper.

2. In the combination recited in claim 1, the helical coil being mounted eccentrically with respect to the shaft, longitudinally extending brace bars secured to the arms and to the convolutions which project the greater distance from the shaft and brackets secured to the shaft and to the convolutions which are in closer proximity to the shaft.

CHARLES A. BOYD.
FREDERICK B. KRAFT.
PETER RAGBORG.