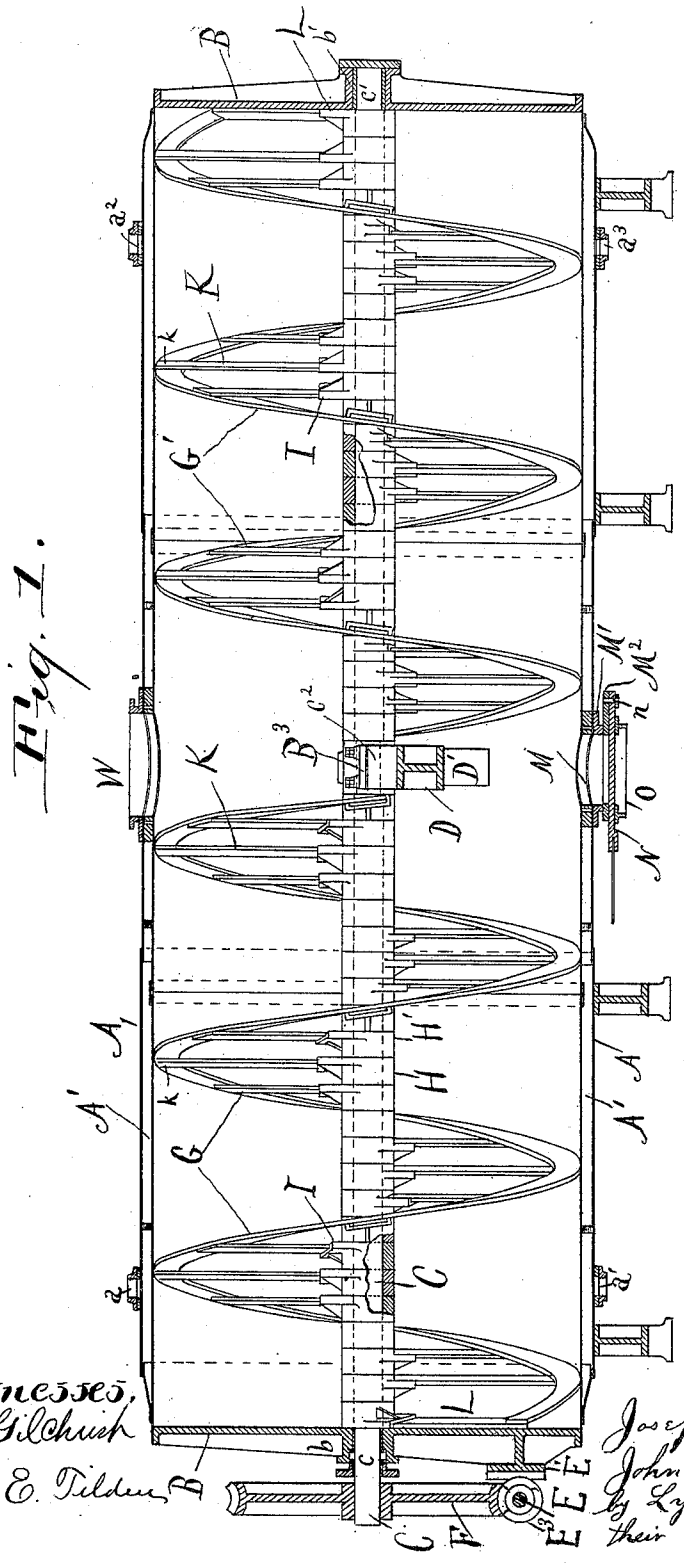
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J. F. KILBY & J. TAYLOR.

SUGAR CRYSTALLIZER.

No. 599,392. Patented Feb. 22, 1898.

Fig. 1.



Witnesses,
E. B. Gilchrist
Ella E. Tilden

Inventors
Joseph F. Kilby +
John Taylor
by Lynch Dorsey & Donnelly
their Attorneys.

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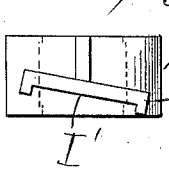
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Fig. 3



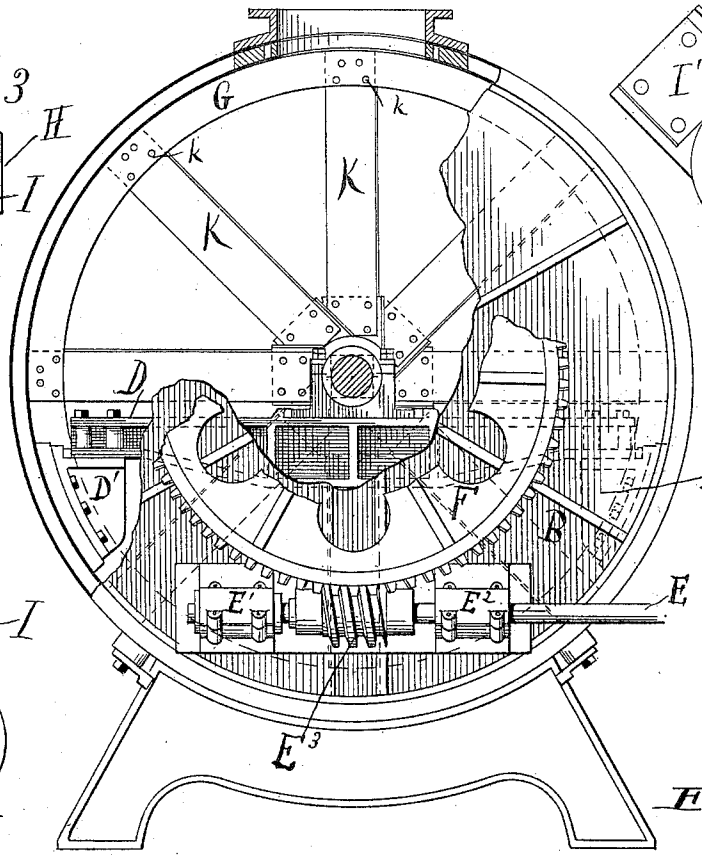


Fig. 4

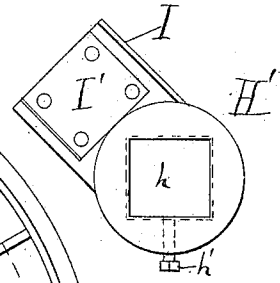


Fig. 5

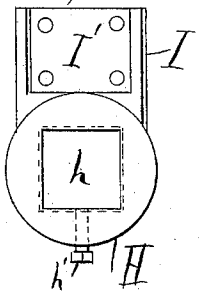


Fig. W.

Fig. 6

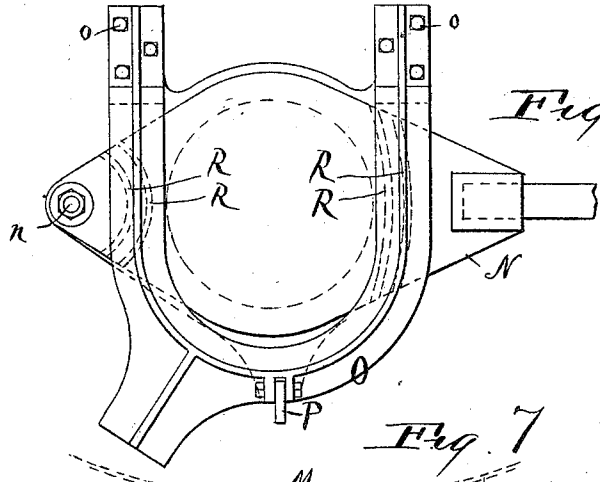
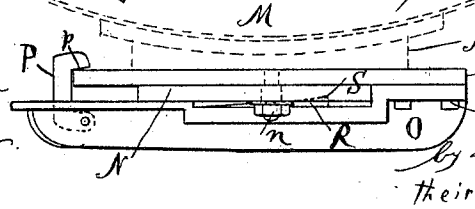


Fig. 7



Witnesses.
E. B. Gilchrist
Ella E. Tilden

Inventors.
Mr Joseph F. Kilby
& John Taylor,
by Lynch Dorsey & Donnelly
their Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH F. KILBY AND JOHN TAYLOR, OF CLEVELAND, OHIO; SAID TAYLOR ASSIGNOR TO SAID KILBY.

SUGAR-CRYSTALLIZER.

SPECIFICATION forming part of Letters Patent No. 599,392, dated February 22, 1898.

Application filed July 10, 1896. Serial No. 598,660. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH F. KILBY and JOHN TAYLOR, of Cleveland, Cuyahoga county, Ohio, have invented certain new and useful Improvements in Crystallizers; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

Our invention relates to sugar-crystallizers of the class operating on the crystallization-in-movement method; and it consists in the peculiar arrangement of the parts of said crystallizer, whereby the solution as it is fed to the machine is agitated to and fro and intimately mixed and is also so agitated that all the particles of the solution come in contact with the heat imparted from the shell of the machine, and at the same time the finished product or material is fed toward the vertical center of the crystallizer, and thus to the outlet.

It also consists in a certain construction and arrangement of spirals arranged within the casing, whereby when the casing is well filled with syrup or other solution and the spirals caused to operate through the medium of the shaft by which the spirals are carried the material will be caused to be thoroughly intermingled, agitated, and uniformly heated.

It further consists in the peculiar construction of the machine in detail, whereby the parts are strongly connected and supported, yet easily assembled together, and are at the same time readily replaced in case of accident.

In the drawings, Figure 1 is a view, partly in longitudinal vertical section, of the crystallizer-shell, showing the agitators or conveyers of the machine. Fig. 2 is an end view, partly in section and broken away, so as to show more clearly the bridge and driving mechanism. Figs. 3, 4, and 5 illustrate the mode of constructing the hubs for the arms which connect the "rim" of the agitators or conveying-screws to their operating-shaft. Figs. 6 and 7 illustrate, respectively, in plan and side elevation the outlet gate or valve at the lower end of the crystallizer.

A represents a casing, which is formed double, so as to provide a space A′, which extends around the crystallizer and is adapted to receive and contain either steam, hot water, or cold water. This double casing extends to the full length of the crystallizer and is provided on its outer wall, at top and lower sides, with inlet and outlet openings or ports a a' a^2 a^3 for circulation of the heating or cooling medium. The opening a may be used as a steam-inlet and the opening a^3 as a steam-outlet, and the opening a' may be used as a cold-water inlet and the opening a^2 as an outlet for the same, or the inlets and outlets may be reversed as desired, according to the locality of the supply or convenience of attachment.

B B′ represent the heads of the crystallizer, which are preferably formed of cast metal and provided with journals b b' for bearing the shaft C at its ends.

The shaft C is formed, preferably, square in cross-section, excepting at its bearing ends c c' and preferably at its central part c^2, where it is supported by a bearing B^3, formed on a bridge D. The bridge D is suitably mounted in the casing A about central between the ends of the casing and is supported on seats D′ D′, which are in turn secured to the inner shell of casing A.

E represents a driving-shaft which is journaled in bearings E′ E^2, which are in turn secured to the head B in any suitable manner. The shaft E has mounted on it and secured thereto a worm E^3, which meshes with and drives the worm-gear F, which is in turn secured to one end of shaft C outside of head B.

The shaft E, worm E^3, and worm-gear F are the driving mechanism of the shaft C and its agitators or conveyers.

The agitators or conveyers G G′ are both formed with a spirally-arranged rim, the outer diameter of which is just about the same as the inner diameter of the casing. These spiral rims G G′ are arranged so that they are of opposite pitch, one, G, being a right-hand spiral, and the other, G′, a left-hand spiral, and are so run or revolved longitudinally in the crystallizer-casing that they tend to feed toward the center.

H H′ represent hubs which are provided with orifices h, which are adapted to fit on the square portion of the shaft C and are preferably secured in place by means of set-screws h'.

Extending out from each hub H and H′ is a lug I, provided with a seat or recess I′ and

bolt-holes *i*. The lugs I are so located on the hubs as to be at an angle to the faces of the hub and to the line of the orifices *h*, according to the pitch of the spiral rim and flat arms K, and are bolted or secured at one end to the lugs I and fit in seats I′, and at their outer ends the arms K are riveted or bolted to the side of the rim at *k*.

It will be noticed that we have formed the lug I of the hub H, as shown in Fig. 5, with its sides parallel to the side walls of the orifice *h*, while the lug I of the hub H′ extends out diagonally to the side walls of the orifice *h*. By this arrangement only two patterns of hubs are necessary, and they are easily replaced when broken.

By alternating the hubs H and H′ and giving the hub of the same kind a quarter-turn on the shaft each time one is placed on the shaft it will be seen that in one revolution around the shaft eight arms K are provided, as shown in Figs. 1 and 2, and also by reversing the faces of the hubs a right or left hand pitch is attained. Thus it follows that where eight arms are used the distance from face to face of the hubs must be one-eighth that of the pitch of the rim.

The above construction of hubs and arrangement of the same is an important feature in our machine, inasmuch as it allows of the arms being formed flat and easily fastened to both hubs and rims, and also in repairs any of the hubs are easily replaced and a multiplicity of patterns is obviated, as two patterns only of hubs are used in the entire construction of both conveyers. The orifices *h* in the hubs H H′ are shown in the drawings square, as we prefer to use them thus, and also form the portions of the shaft square to fit these orifices; but it is obvious that other shapes may be used (such as octagon) for both orifices *h* and shaft C or that the orifices might be formed cylindrical and the shaft cylindrical and the hubs keyed to the shaft.

At the extreme end of the rims, where they respectively abut against the heads of the crystallizers, we have formed the end arms K into scrapers, and make them lie close to the end walls by reversing the hub, so as to bring the edge of the arm against the heads, as shown at L L, Fig. 1. Thus it will be seen that the arms at L L will act as scrapers and, in connection with the spiral rims of the screws, will scrape and free the more solid particles which may adhere to the walls of the crystallizer.

Located centrally at the lower part of the casing A is an opening M, communicating with the interior thereof. Secured around this opening M is a flanged head M′. (Shown more clearly in Fig. 7 in dotted lines.) To the lower end of head M′ is secured a plate M^2, which forms the seat for sliding gate or valve N, which is pivoted at *n* to plate M^2.

In order to hold gate N to its seat when closed, we have provided a frame O, which is secured or bolted to plate M^2 at *o o*, as shown in Figs. 6 and 7, and is provided with a swinging lock or hook P, having the under side of its beak or engaging face *p* inclined, as shown. Secured to the upper face of frame O are a series of inclines R R R R. (Indicated in Fig. 6 by dotted lines, and one of which is shown in Fig. 7.) These inclines are formed concentric with the pivot of the valve or gate N, as are also inclined recesses or seats S formed in the said valve. (Indicated by dotted lines in Fig. 7.) Thus it will be seen that as the valve is closed it is brought tightly to its seat, and as it is opened it is released and slides freely. The lock or hook P is designed to engage plate M^2 with its inclined beak and acts both as a support to the free end of frame O and as a means of clamping the parts O and M^2 more tightly together, and thus holding the gate or valve N more tightly locked when closed. The hook P is thrown back when it is desired to open the valve N.

The operation of our device is as follows: After the material or syrup has reached the required consistency it is fed into the central opening W at the top of the crystallizer until the casing is full. This opening is then closed. The agitator is set in motion and the material driven toward the center of the machine and caused to intimately mix, and the particles are also caused to pass each other by the reversed screw. This keeps the mass in motion, and every particle is kept at the same temperature, inasmuch as they are caused to come in direct contact with the casing, which in turn is kept at the desired temperature, as hereinbefore explained.

What we claim is—

1. A crystallizer, comprising in its construction a double-walled casing for the reception of a heating or cooling medium, a shaft, an agitator carried by said shaft consisting of two spirals having reverse pitch, each convolution of said spirals being secured to a series of radial arms, each arm extending obliquely to the shaft so as to correspond to the pitch of the spirals, and each arm being in turn secured to the obliquely-projected portion of a separate hub, and said hubs being in turn firmly secured to the shaft, substantially as shown and described.

2. A crystallizer, comprising in its construction, a shaft and spiral agitator, said agitator being composed of a spiral rim, a series of arms secured direct to each convolution of said rim at their outer ends and at their inner ends being secured to lugs projected obliquely from hubs, said lugs being at an angle oblique to the face of the hubs, each radial arm being extended obliquely to said shaft so as to correspond with the pitch of the spiral, and the said hubs being independent and mounted on the shaft, substantially as shown and described.

3. A crystallizer, comprising in its construction a double-walled casing for the reception of a heating or cooling medium, a shaft, an agitator carried by said shaft consisting of

two spirals having reverse pitch, each convolution of said spirals being secured to a series of radial arms, each arm extending obliquely to the shaft so as to correspond to the pitch of the spirals, one end of each arm being secured direct to the spiral rim and the other end projected from a lug obliquely to the face of the hub, and each hub being independent and mounted on said shaft, and an arm arranged at the outer end of each spiral so as to act as a scraper in connection with the outer end of each spiral rim, substantially as shown and described.

4. In a spiral agitator or crystallizer, the combination with a suitable shaft, of a series of separate hubs secured to the shaft, said hubs having recessed lugs extending outward therefrom and obliquely thereto in such a manner as that when the hubs are mounted on the shaft, said lugs will face in the same direction as the line of pitch of the rim, a series of radial arms secured to each convolution of the spiral, each arm extending obliquely to said shaft so as to correspond with the vertical pitch of the spiral, and each arm being rigidly secured at one end to the recessed portion of the lugs, and at the other end direct to the rim of the agitator, substantially as shown and described.

5. In a crystallizer, the combination with an outlet communicating with the interior of said crystallizer, of a gate or valve pivoted to its seat, and a frame beneath said valve provided with inclines concentric with the valve-pivot and acting in inclined recesses in the valve, all operating substantially as shown and described.

6. In a crystallizer, the combination with an outlet communicating with the interior of said crystallizer, of a gate or valve pivoted to its seat, and a frame beneath said valve provided with inclines concentric with the valve-pivot and acting in inclined recesses in the valve, and a lock or hook having an inclined beak adapted to lock the parts together, substantially as set forth.

In testimony whereof we sign this specification, in the presence of two witnesses, this 26th day of June, 1896.

JOSEPH F. KILBY.
JOHN TAYLOR.

Witnesses:
W. E. DONNELLY,
ELLA E. TILDEN.