

Dec. 11, 1934.

J. J. MUNSON ET AL

1,983,805

GAS AGITATED CRYSTALLIZING AND CURING TANK

Filed Dec. 23, 1932

2 Sheets-Sheet 1

Fig. 2.

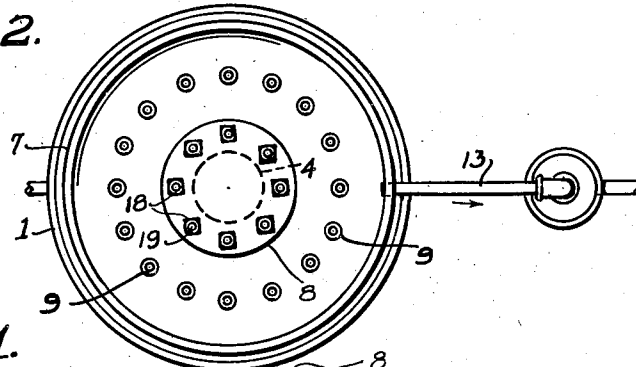
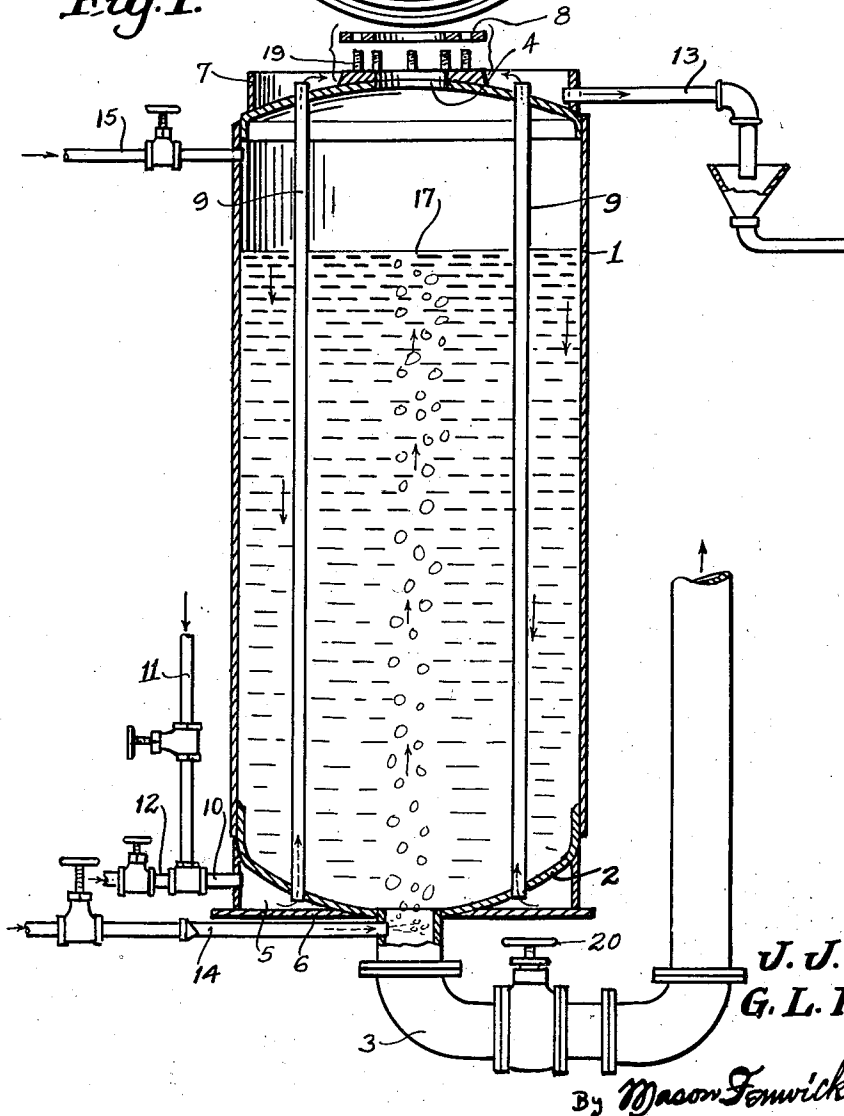


Fig. 1.

Inventor

J. J. MUNSON

G. L. PACE

By *Mason Fenwick Lawrence* Attorneys

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Fig. 4.

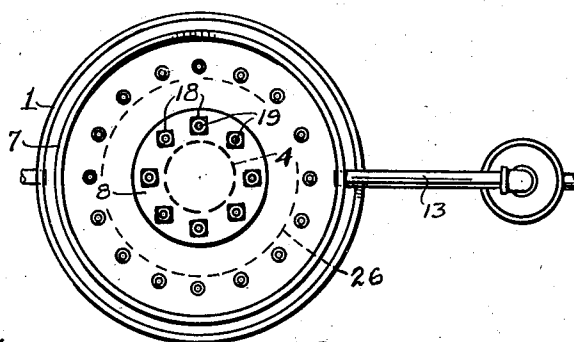
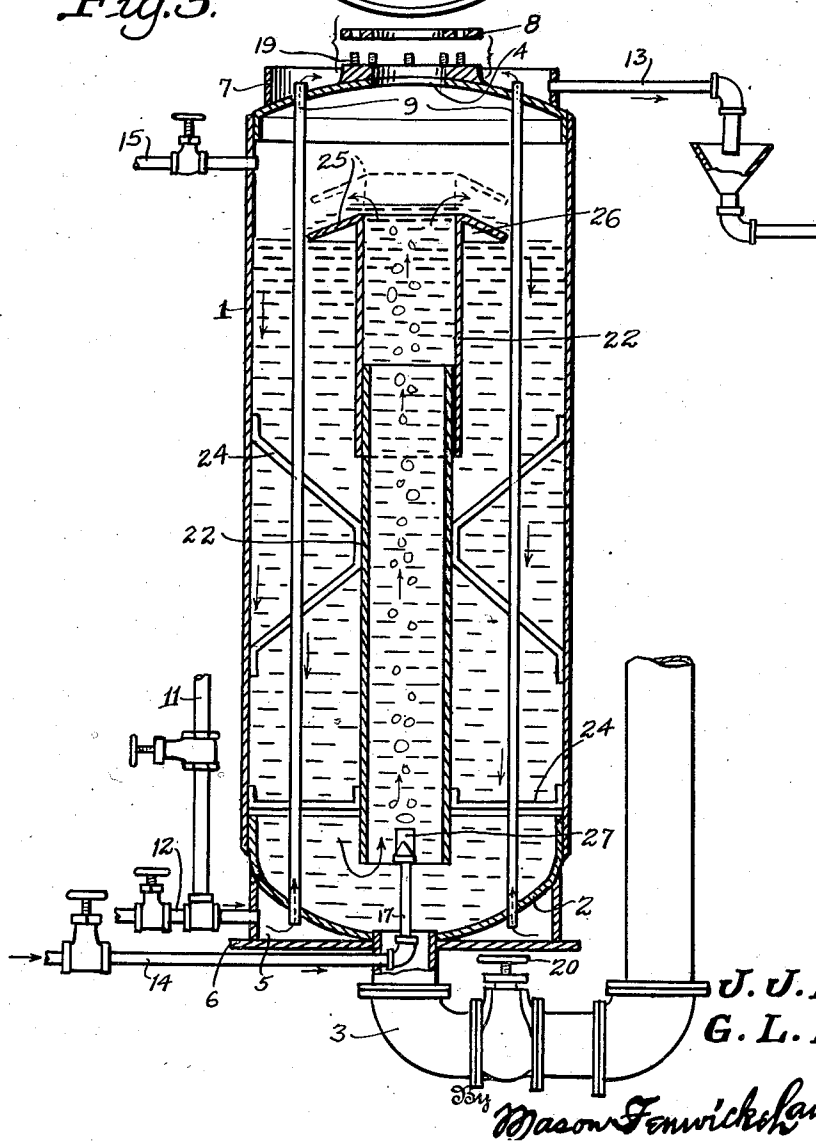


Fig. 3.



Inventors

J. J. MUNSON

G. L. PACE

Mason Fenwick Lawrence
Attorneys

UNITED STATES PATENT OFFICE

1,983,805

GAS AGITATED CRYSTALLIZING AND
CURING TANKJoseph J. Munson, Houma, and Gilbert L. Pace,
Montegut, La.

Application December 23, 1932, Serial No. 648,689

5 Claims. (Cl. 127—16)

This invention relates to the manufacture of sugar and in particular to apparatus for treating the massecuite remaining as a residue of a series of vacuum boiling and centrifuging operations.

5 It is known that in the process of manufacturing sugar from the various sugar bearing plants, a thin juice or liquor with a relatively small percentage of sugar in solution is first extracted by various means. The liquor is then concentrated
10 usually in vacuum apparatus called vacuum pans until crystals of sugar are formed in the relatively thick and concentrated liquor. These grains of sugar are separated from the liquor which surrounds them by means of centrifugals
15 and the liquor from the centrifugals called molasses still containing large percentages of sugar are again carried back into process where more sugar is obtained by crystallizing in a manner similar to the first concentration and crystallization. Several such steps are usually employed
20 for extracting the maximum amount of sugar. In the latter steps, however, the molasses is usually boiled at low temperatures with a certain amount of fine crystal sugar introduced into it to form a seed on which the sugar from the molasses is deposited causing this seed or crystal
25 sugar to increase in size thereby reducing the quantity of sugar in the molasses. The crystals of sugar together with the surrounding liquor is called massecuite and magma. It is known
30 that at times this material is very gummy and it is very hard to separate the grains of sugar in the centrifugals.

35 It is well known that before the separation of the sugar crystals in the last massecuite, much less sugar is carried out in the final molasses if the massecuite is agitated and cooled before it is sent to the centrifugals for final separation. This agitating and cooling is usually carried out
40 in what are called crystallizers which are usually horizontal tanks with means provided for mechanical agitation usually in the form of stirrers and in some crystallizers, coils are provided through which cold water may be circulated for
45 the purpose of cooling and hot water circulated for the purpose of reheating when it is desirable to do so. The crystallizers employed at the present time afford a means of only very slow cooling and re-heating.

50 One of the objects of the invention is to provide means for more rapidly agitating and cooling the massecuite, thereby accelerating the process of sugar extraction and requiring fewer treating units for a given installation.

55 Another object of the invention is the provision of apparatus for agitating the massecuite by applying the principle of the aerated column, rather than by mechanical agitation.

Still another object of the invention is to provide novel apparatus for admitting gaseous or

liquid reagents to the massecuite for various purposes, such as decoloring, enhancing the fluidity of the non-sugar bearing portion, by oxidation or otherwise, for facilitating separation and drying of the sugar, etc.

Other objects of the invention will appear as the following description of preferred and practical embodiments thereof proceeds.

In the drawings, which accompany and form a part of the following specification, and
10 throughout the several figures of which, the same characters of reference have been employed to denote identical parts:

Figure 1 is a vertical section through a gas agitated crystallizing and curing tank, embodying
15 the principles of the present invention;

Figure 2 is a top plan view;

Figure 3 is a view similar to Figure 1, showing a modified form of the invention; and

Figure 4 is a top plan view of Figure 3.

20 Adverting first to that form of the invention illustrated in Figures 1 and 2, the numeral 1 represents a tank preferably arranged vertically having a convex bottom 2 preferably sloping to the middle portion where it is tapped by a valve controlled discharge pipe 3 for the massecuite. At
25 its upper end the tank is provided with means forming an opening for admitting the massecuite which is to be treated.

The lower end of the tank is provided with
30 means forming a header 5, and for purpose of affording support to the tank, the lower end 6 of the header may be flat. The upper end of the tank is provided with a flange 7 forming a receptacle. A series of vertical tubes 9 extend
35 longitudinally through the tank 1, their upper and lower ends extending into the receptacle and lower header, respectively, and being in communication with said receptacle and header. The tubes 9 are preferably arranged in cylindrical
40 formation somewhat adjacent the outer wall of the tank 1 and correspondingly remote from its axial portion.

The lower header 5 is in communication by a
45 pipe 10, either with a cold water source represented by the pipe 11, or a hot water supply through the pipe 12. The pipes 11 and 12 are valve controlled, and may be selectively operated. The water admitted to the lower header passes
50 upwardly through the tubes 9 into the receptacle and discharges by way of an over-flow pipe 13.

While the pipes 11 and 12 are referred to as supplying water, it is obvious that steam or any other fluent medium of heat exchange might be substituted for water without transcending the
55 scope of the invention.

An air or gas pipe 14 is tapped into the discharge pipe 3 near the point at which it debouches into the tank 1, and is adapted to dis-
60

charge a jet of air or gas which rises along the axial region of the tank.

A compressed air supply pipe 15 communicates with the tank above the level of the body of massecuite. A cover plate 8 is provided for the opening 4, but said cover plate is left off until it is desired to discharge the massecuite from the tank 1.

In operation, a suitable quantity of massecuite is discharged by any suitable means into the tank 1, rising for instance, to the level indicated at 17. As has been indicated above, the massecuite is sticky, gummy, perhaps semi-fluid, and difficult to agitate. It may first be subjected to a heating process by means of hot water or steam, turned into the tubes 9. After the viscosity of the massecuite has decreased to the desired degree of fluidity, the heating may be discontinued and air or gas is admitted through the pipe 14, the same bubbling up through the axial portion of the massecuite and forming an aerated column which rises, the unaerated massecuite from the outer portions of the tank descending to take the place of the central column thus displaced. In this manner, continuous circulation of the massecuite is produced, upward along the axis of the tank, and downward along its peripheral portion and along the pipes 9. The vertical arrangement of the pipes presents no impediment to the circulating liquid, and the friction of the liquid against said pipes brushes away any inert part of the massecuite which might tend to stick to said pipes, thus promoting a continuous presentation of fresh surfaces of the massecuite body to the tubes, ensuring a maximum rate of heat exchange. The air is not only primarily useful as an agitating agent, but it also oxidizes the gummy constituents of the massecuite, rendering the non-sugar bearing portion more fluid so that when the treated massecuite is returned to the centrifuge, the separation and drying of the sugar will be facilitated. In this connection, the admixture of oxygen with the air, or the use of pure oxygen, accelerates the oxidizing of the gummy matters and, consequently, shortens the processing of the mass. The opening 4 affords a discharge for the spent air or gases.

It is desirable, after having agitated the massecuite for some time, to cool the massecuite while agitating it in order to obtain the maximum degree of crystallization of the contained sugar. For accomplishing this function, the source of cold liquid is turned on whereupon the header 5, and the receptacle at the top as well as the tubes 9, are filled with circulating cool or cold liquid. In view of the optimum rate of heat interchange brought about by the vertical arrangement of the tubes 9 in the circulating liquid, the mass becomes cool in a much briefer time than in other known crystallizers.

Other gases, besides air and oxygen, may be employed for agitating the body of massecuite as well as processing it. For example, carbon dioxide or sulphur dioxide may be employed, the latter chiefly for its decoloring effect.

As a result of the cooling of the massecuite during the agitation and processing thereof, it has again become quite stiff and viscous by the time it is ready to be discharged. In order to expedite the discharge of the massecuite, hot water or steam is again turned into the tubes 9. This softens the film of massecuite immediately adhering to the tubes 9 permitting the massecuite to flow clean from said tubes instead of leaving

adhering masses on said tubes which would remain during the introduction of the next charge of massecuite, and slow up the heating and circulation of the succeeding charge.

Vertically arranged tubes have the advantage over the horizontal type tubes in that in this final heating for the purpose of facilitating the charge of the massecuite, the whole body of massecuite is not heated, but it is for the most part discharged cold in the very best condition for subsequent treatment. The cover plate 8 is now put in place and secured in any suitable manner as for instance, by nuts 18 on studs 19, which pass through apertures in said cover plate. When the tank has been thus sealed, compressed air is introduced by way of the pipe 15. The discharge valve 20 is then opened and the compressed air above the level of the massecuite displaces the latter, which is forced out of the discharge pipe 3. The valve 20 is then closed, the cover plate 8 removed and the tank 1 is ready for another batch of massecuite.

Referring now to that form of the invention shown in Figures 3 and 4, the tank, lower header, upper receptacle and the water and gas connections are essentially the same as in that form of the invention already described, excepting that the gas connection may be slightly modified in a manner which will presently be explained. This form of the invention is characterized by the presence of a co-axial, tubular, interior shell for determining a positive upward circulation of the massecuite in the region of the axis of the tank. Said shell comprises a lower fixed section 21 and an upper telescoping section 22. The lower section is held in place by suitable braces 23 and 24. The upper telescoping section is formed at its upper end with an umbrella-like flange 25 unitary with the cylindrical portion of the shell 22 at its inner periphery and extending downward so that its free edge lies in a plane at a lower level than that of its upper open end. An air chamber 26 is formed beneath said flange which floats the upper section 22 on the bottom of the massecuite, the outer edge of the flange 25 dipping into the massecuite and imprisoning the air beneath said flange. The object of this construction is to preserve the efficacy of the aerated column within the shell.

Whether the upper level of the body of massecuite is high or low, the upper section 22, floating, will follow it so that the aerated column discharging over the umbrella-like flange will never be very much higher than the level of the liquid outside.

If the height of the shell were fixed, and a relatively small quantity of massecuite were being treated, the disparity in the heights of the aerated column and the surrounding massecuite would prevent the aerated column rising high enough to over-flow the upper end of the shell.

In this form of the invention, the gas pipe 14 is shown formed with a nozzle 27 which extends within the lower end of the shell, in some measure constricting the lower end of said shell and quickening the velocity of the entering massecuite.

While we have in the above invention, disclosed what we believe to be preferred and practical embodiments of the inventive concept, we do not wish to be understood as limiting our invention to the specific arrangements or details of construction as shown, since these are merely by way of example, and it is conceivable that the invention may be embodied in many other specific

forms without going beyond the scope of the appended claims.

What we claim is:

1. Apparatus for curing massecuite comprising
5 a tank positioned with its axis vertical, an open
ended shell substantially vertically arranged in
the middle of said tank and spaced from the bot-
tom thereof, means for creating an aerated col-
umn in said shell, and a series of tubes extend-
10 ing vertically through said tank arranged an-
nularly between said shell and the wall of said
tank adapted for the selective passage of hot or
cold heat exchanging medium therethrough.
2. Apparatus for curing massecuite comprising
15 a tank, means for creating an aerated column in
the middle portion of a body of massecuite in said
tank, comprising an open ended shell supported
in said tank, means for admitting gaseous fluid
under pressure to the lower end of said shell, a
20 series of tubes adapted for the selective passage
of hot or cold heat exchanging medium there-
through, extending through said tank in a direc-
tion substantially parallel to said shell and in the
region of down-flow of said massecuite produced
25 by said aerated column, a header at the bottom
of said tank with which the lower ends of said
tubes communicate, means for supplying hot or
cold fluid to said header, and an open receptacle
30 at the top of said tank into which the upper ends
of said tubes debouch, for receiving the discharge
from said tubes and an overflow for said receptacle
at a point below the upper edge thereof.
3. Apparatus for curing massecuite comprising
35 a tank, means for creating an aerated column in
the middle portion of a body of massecuite in said
tank, said means comprising an open ended shell,

means for admitting gaseous fluid under pres-
sure to the lower portion of said shell, said shell
being formed in sections, the lower section includ-
ing a lower fixed section and an upper buoyancy-
actuated section telescoping freely relative to said
5 lower section for adjusting the height of said shell
to the level of massecuite in said tank.

4. Apparatus for curing massecuite comprising
a tank, means for creating an aerated column
10 in the middle portion of a body of massecuite in
said tank, said means comprising an open ended
shell, means for admitting gaseous fluid under
pressure to the lower portion of said shell, said
shell being formed in sections, the lower section
being fixed and the upper section telescoping rel-
15 ative to said lower section, said upper section
being buoyant in the body of massecuite so as to
automatically adjust its height to the level of
said body of massecuite.

5. Apparatus for curing massecuite comprising
20 a tank, means for creating an aerated column in
the middle portion of a body of massecuite in said
tank, said means comprising an open ended shell,
means for admitting gaseous fluid under pressure
to the lower portion of said shell, said shell being
25 formed in sections, the lower section being fixed
and the upper section telescoping freely relative
to said lower section, said upper section being
formed with an outwardly and downwardly ex-
tending peripheral flange imprisoning a body of
30 air between its edge and the body of massecuite
in said tank, thereby forming a float for adjusting
the height of the aerated column to the level of
the body of massecuite.

JOSEPH J. MUNSON. 35
GILBERT L. PACE.