(No Model.) 2 Sheets—Sheet 1.

J. B. WILKINSON.

APPARATUS FOR DEFECATING SACCHARINE JUICE.

No. 588,521. Patented Aug. 17, 1897.

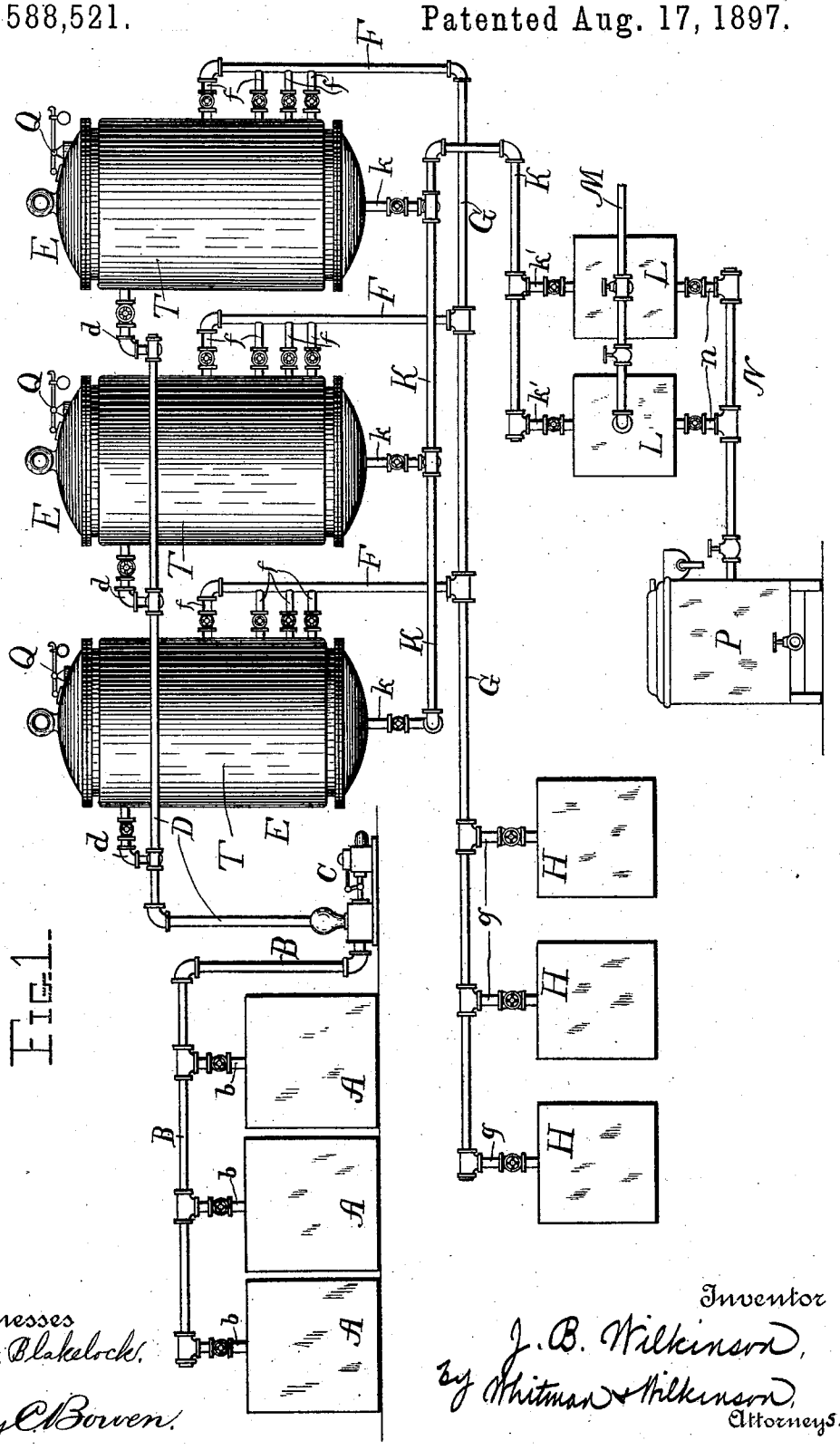


FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2

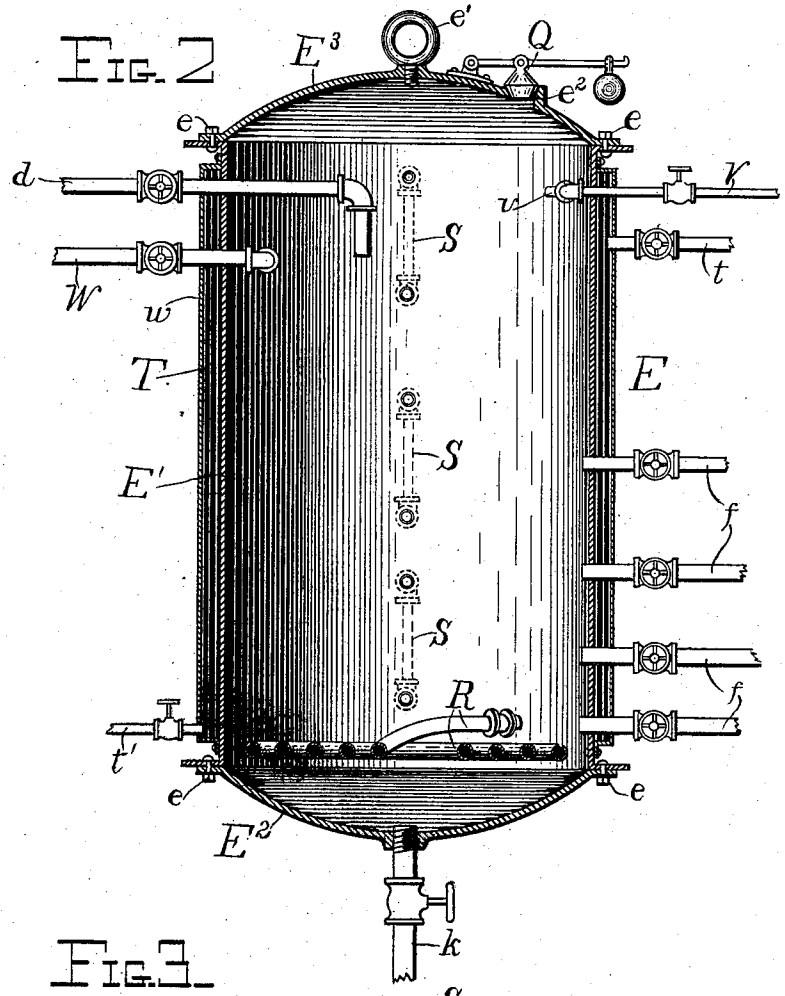
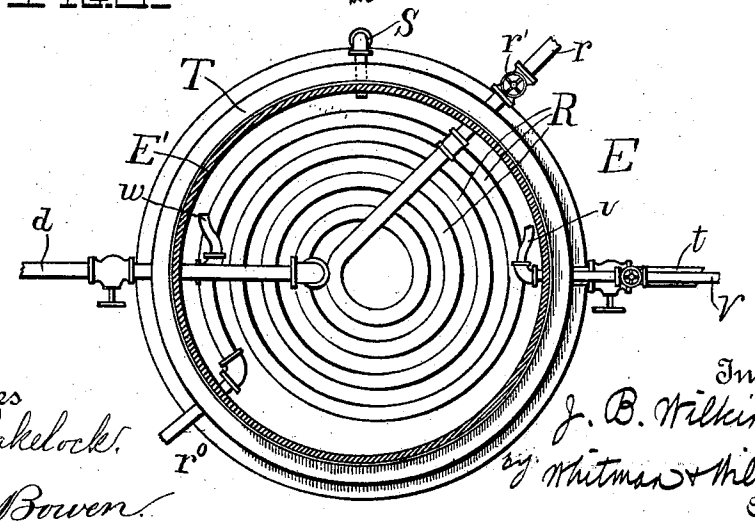


FIG. 3



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UNITED STATES PATENT OFFICE.

JOSEPH BIDDLE WILKINSON, OF NEW ORLEANS, LOUISIANA.

APPARATUS FOR DEFECATING SACCHARINE JUICES.

SPECIFICATION forming part of Letters Patent No. 588,521, dated August 17, 1897.

Application filed February 28, 1896. Serial No. 581,178. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BIDDLE WILKINSON, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Clarifiers and Defecators; and I 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 appertains to make and use the same.

My invention relates to improvements in apparatus for the defecation of cane-juice; and it consists of certain novel features hereinafter described and claimed.

The quality of sugar is largely determined by the clarification of the cane-juice.

To make good sugar, it is essential to have good clarification as a preliminary step. Other things being equal the better the clarification the better will be the sugar made. Not only this, but the quantity of sugar obtained from a given quantity of cane-juice will be proportionately increased with the degree of improved clarification unless clarifiants be used destructive to the crystalline character of the cane sugar.

There are two prominent processes employed in the clarification of cane-juice, both supplemented by chemical reagents. One is to cause its impurities through heat to rise and float on its surface, the other to cause a portion of the impurities to separate and through gravitation to settle on the bottom or near the bottom of the clarifying vessel. This last is known as "precipitation" or "sedimentation," and my invention relates especially to this latter process. The usual practice is to bring up the cane-juice to the boiling-point or a trifle below the same and to remove the scum which arises with a skimmer, continuing this process with the cane-juice at or near the point of ebullition until, in the judgment of the operator, the juice is sufficiently defecated. The heat is then shut off and the juice is then allowed to remain for a time to settle or is drawn off into what are called "precipitators" or "settling-tanks." The objections urged against this continued skimming process are that boiling excites constant currents of circulation in the juice, breaking up the particles of coagulated matter which had been brought into a state of mechanical suspension by the heat applied, and that these currents through the juice keep these particles of impurities in such constant agitation as to prevent their proper separation from the body of the juice. It is well known that the more minute the particles of matter are in a state of mechanical suspension in a fluid the more difficult is it to effect their separation from the fluid. Thus particles can be so finely divided that they will remain permanently suspended in a fluid or even in air, although the medium in which they are suspended be in a state of perfect rest. As these particles in cane-juice are, according to their amount, more or less obstructive to the formation of sugar of a high standard and have also a chemical character damaging not only to the quality but to the quantity of sugar, it becomes important as far as possible to remove them.

Following the process of skimming the juice ensues that of precipitation. As commonly practiced this is entirely inadequate to the end desired and fraught with various objections. Generally the skimmed juice is allowed to settle for a short time in the clarifier after being skimmed and then drawn off into other tanks for further precipitation or immediately into the concentrating-pans. This process is open to the following objections: First, the time allowed for effective precipitation is not sufficient for this purpose; second, decantation at the time of precipitation by breaking up the particles of coagulated matter renders their further separation more difficult and perhaps impossible, and, further, the sedimentation in open vessels presents the serious objection that exposure of the juice to the air subjects it to the danger of molecular changes through fermentation, this increasing in degree as the exposure is prolonged. It is safe to affirm that no juice can be allowed to remain a sufficient length of time in open vessels for proper precipitation without serious loss (through molecular changes) in quantity and quality of sugar. Cane-juice as run from the clarifiers and left in the open settling-tanks is in a most favorable condition for fermentation.

Fermentation is slow to take place below 60° Fahrenheit and is arrested at a tempera-

ture somewhat below the boiling-point. It is most favored between 70° and 100°. These data, then, taken from standard authorities, show that the valuable adjunct of clarification through precipitation in open tanks is surrounded with dangers and open to various objections. If the juice is hurried forward, precipitation is interfered with or arrested. If left long enough in the open tanks the evils, of fermentation ensue.

In the manufacture of sugar fermentation is believed to be the manufacturer's greatest foe. Could this evil be arrested he would have little difficulty in bringing his work in sugar-making to a high degree of perfection. The agents of fermentation are at work upon the juice as it runs from the mill and threaten it at almost every stage of its journey in its transformation into crystalline matter. It is a mistake to suppose that ferments have only done their evil work when these effects become apparent to our sight and taste. These are but the emphasized expressions of the ferment's assaults upon the sweet liquid, the insidious foe had been at work long before. From these premises it follows that the cane-juice should be hurried as rapidly as possible from the mill to the clarifier, and that the process of clarification should be done in closed vessels to exclude the air and in vessels of sufficient strength to bear safely a pressure of about fifteen pounds to the square inch above atmospheric pressure. Two advantages are presented by this procedure. First, the exclusion of the air would allow much longer time for precipitation of the impurities of the heated juice; second, heated to a higher temperature under pressure the protein or albuminose matter, so important to engender fermentation, would be more thoroughly separated and the germs of organic life necessary to produce fermentation more certainly destroyed. Cane-juice thus acted upon in closed vessels could be kept, as regards time, almost indefinitely without fermentation. The preservation of meats, fruits, and vegetables in sealed cans for long periods of time illustrate the value of clarifying cane-juice under conditions preventive of fermentation. In this method greater time would also be allowed to separate the impurities from its saccharine matter than that practiced in open vessels through skimming and precipitation.

The mechanism best adapted to the clarification of juice in closed vessels may present itself in different forms to different persons, but I have shown one form of apparatus which I believe suitable for this purpose.

Reference is had to the accompanying drawings, in which the same parts are indicated by the same letters throughout the several views.

Figure 1 represents the apparatus in elevation. Many of the non-essential elements are omitted and the apparatus is shown diagrammatically. Fig. 2 represents a central vertical section through one of the clarifiers, and Fig. 3 represents a horizontal section along the line 3 3 of Fig. 2 and looking down.

A represents one of a plurality of tanks in which the raw juice is carried from the mill in any convenient way, and in which the lime or other chemical reagents are added to the juice before it is carried over to the clarifiers. There should be enough of these tanks A to allow them to be frequently washed out, so that fermentation may be as far as possible avoided before the juice gets to the clarifiers. The juice is pumped from these tanks A through the branch pipes b and the main pipe B to the pump C, whence it is delivered through the pipe D and the branches d to the clarifiers E. These various main and branch pipes are provided with valves wherever required, and so, in fact, are all the pipes in the system, and it will not be necessary to refer to these valves specifically.

The clarifiers E are preferably made of a cylindrical shell E′ with spherical bottom E^2 and dome-shaped top E^3, and both top and bottom are secured to the cylindrical shell, so as to make a steam-tight joint, as by bolts e, or in any other convenient way. The top E^3 is made detachable for purposes of occasional cleaning out, and is preferably provided with an eyebolt e', to which a tackle can be hooked, whereby the top may be conveniently lifted off after the bolts e are unscrewed. This top or cap E^3 is also preferably provided with a valve-seat e^2 for the safety-valve Q, but this valve-may be connected to the shell E′ or attached to the clarifier in any convenient way.

The heated juice is drawn from the clarifier through the branch pipes f and the pipes F into the pipe G, whence it is delivered through the pipes g to the tanks H, from which tanks the clarified juice is pumped to the vacuum pans or other concentrating apparatus. (Not shown.) The settlings in the bottoms E^2 are drawn off through the pipes k into the pipe K, whence they are delivered through the pipes k' into the tanks L. The clearer portion of the liquid in the tanks L is drawn off through the pipe M, while the more turgid portions are drained through the pipes n and the main pipe N to the filter-press P, which is operated in the usual well-known way.

The juice in the clarifiers is heated by a steam-pipe, preferably in the form of a coil R, the steam being fed in through the pipes r and controlled by the valve r', while the condensed water from this coil R either escapes, as at r^o, or is led to the hot-well by any suitable pipe. (Not shown.) Any other arrangement of heating-pipes may be adopted, if preferred.

Sight-tubes S are preferably provided on each clarifier, but these are not absolutely necessary. In practice it would be preferable to have a sufficient number of the clarifiers to allow the heated juice to cool slowly and to settle gradually, but if it be desired

to expedite the process of cooling a water-jacket T, inclosing each clarifier or a part thereof, may be added to the apparatus, if desired. Thus I have shown such a water-jacket, which is illustrated in detail in Fig. 2, the cold water being fed in through the pipe *t* and escaping through the pipe *t'*, but this water-jacket would not ordinarily be necessary.

For purposes of cleaning out the clarifier and to avoid removing the cover E^3 more often than is absolutely necessary I provide a wash-out pipe W for water and a steam-pipe V for injecting steam into the clarifier after the juice has been withdrawn therefrom. In order to obtain the best effects from this jet of steam or water, the same may be either provided with roses or they may be provided with orifices set at an angle to the inner surface of the cylindrical shell, whereby a spiral or vertical direction may be given to the steam or water, and thus the various parts of the interior of the shell may be more thoroughly cleansed than were these jets to be projected directly in toward the center of the clarifier. These steam and water pipes should also preferably be so arranged that a hose may be coupled onto the same when the top E^3 is removed, and thus each and every part of the interior of the clarifier may be reached by the steam or water, or both.

In the operation of the device the clarifier is filled with juice very nearly to the top of the cylindrical portion, and then steam is turned on to the heating-coil R. The heat is continued until a pressure of about fifteen pounds above that of the atmosphere is attained on the inside of the clarifier, at which pressure the temperature of the liquids is about 240° Fahrenheit, prior to which time all of the albumen will have been coagulated. This pressure may be noted either from an ordinary pressure-gage (not shown) attached to the clarifier, or from the blowing off of the safety-valve Q. After the heated juice has remained long enough to cool and settle sufficiently the clearer portions are drawn off through the pipes *f*, while the scum and sediment are drawn off through the pipe *k*, as has been hereinbefore described.

After discharging, each clarifier should be either washed out through the steam and water pipes already mentioned, or the tops may be periodically removed and the clariffer thoroughly cleaned out.

By having a large vessel, which is heated and cooled gradually, the connection-currents are not violent and the solid particles are not broken up so fine as to fail to be readily precipitated during the process of cooling.

The exclusion of the air prevents the molecular changes due to fermentation. The application of the high heat is destructive to those forms of germ-life upon which fermentation depends. These are some of the principal advantages of my improved process and apparatus, to which may be added the maintenance of the exclusion of air and the preservation of the juice at a temperature above that which permits fermentation for a sufficient length of time to permit more perfect free precipitation of the coagulated elements of the juice, the employment of a higher degree of heat to coagulate the vegetable albuminoids than is possible in open vessels, where the separation of these impurities is only partial, and the quiescent condition of the juice during the process of precipitation, as well as the simplicity of the operation of clarification in closed vessels.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus for defecating and clarifying cane-juice, a closed vessel adapted to withstand internal pressure, a pump and pipes for supplying juice to said vessel, a steam-coil mounted in said vessel near the base thereof and adapted to heat said juice from contact with the exterior of said steam-coil, pipes for drawing off the clearer portion of the juice after it has been settled, and a separate pipe for drawing off the sediment from the base of said vessel, and a jacket inclosing the sides of said vessel, with means for injecting fluid into said jacket for cooling the contents of said vessel, substantially as described.

2. In an apparatus for defecating and clarifying cane-juice, a closed vessel adapted to withstand internal pressure, a pump and pipes for supplying juice to said vessel, a steam-coil mounted in said vessel near the base thereof and adapted to heat said juice from contact with the exterior of said steam-coil, pipes opening into the said vessel near the base thereof for drawing off the clearer portion of the juice after it has settled, and a separate pipe opening into the base of said vessel for drawing off the sediment, and a jacket inclosing the sides of said vessel, with means for injecting fluid into said jacket for cooling the contents of said vessel, substantially as described.

3. In an apparatus for defecating and clarifying cane-juice, a closed vessel provided with a steam-tight top entirely removable, and a safety-valve, a pump and pipes for supplying juice to said vessel and for drawing off the juice therefrom when desired, and a steam-coil mounted in the said vessel near the base thereof and an opening through the sides of said vessel, and adapted to heat the juice by contact with the exterior of said coil, and a jacket inclosing the sides of said vessel, with means for injecting fluid into said jacket for cooling the contents of said vessel, substantially as described.

4. In an apparatus for defecating and clarifying cane-juice, a closed vessel with a steam-tight top wholly removable, and a curved bottom, a pump and pipes for supplying juice to said vessel, a steam-coil mounted in said vessel near the base thereof and adapted to heat

the juice from contact with the exterior of said coil, pipes mounted in the sides of said vessel near the base thereof for drawing off the clearer portion of the juice after it has settled, and a separate pipe connected to the lower portion of the curved bottom and adapted to draw off the sediment from the said vessel, and a jacket inclosing the sides of said vessel, with means for injecting fluid into the said jacket for cooling the contents of said vessel, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH BIDDLE WILKINSON.

Witnesses:
E. H. BINDLEY, Jr.,
JOHN J. SANCIE.