N. A. LOCKWOOD.

APPARATUS FOR THE GASEOUS TREATMENT OF SACCHARINE JUICES.

APPLICATION FILED FEB. 9, 1916.

1,195,044. Patented Aug. 15, 1916.

2 SHEETS—SHEET 1.

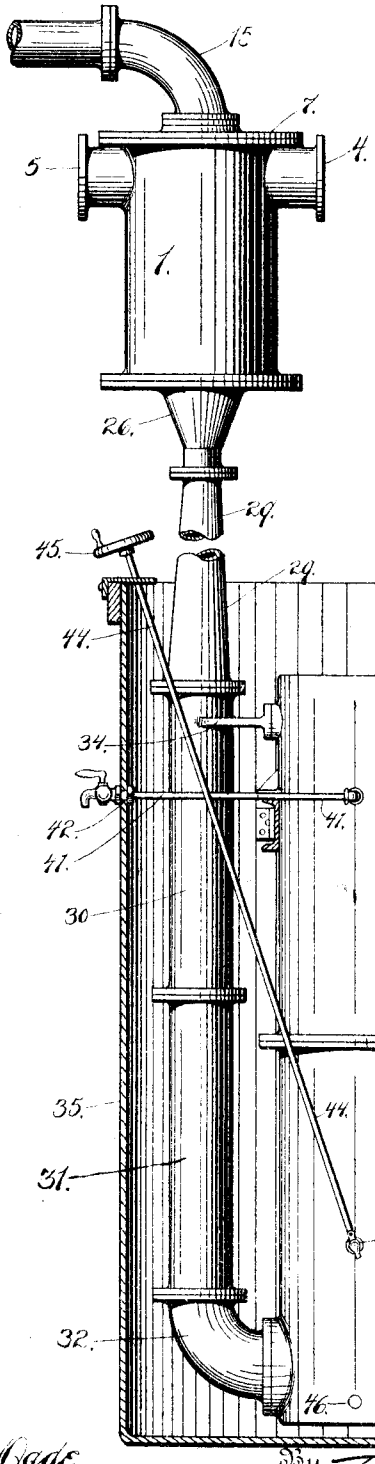


Fig. 1.

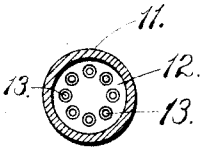


Fig. 4.

Witness
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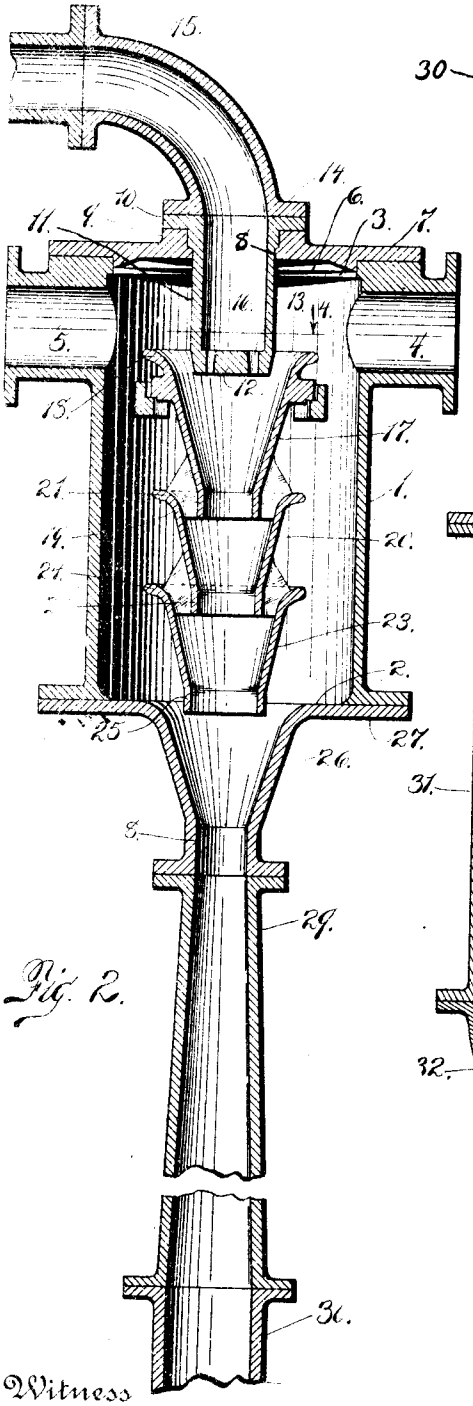


Fig. 2.

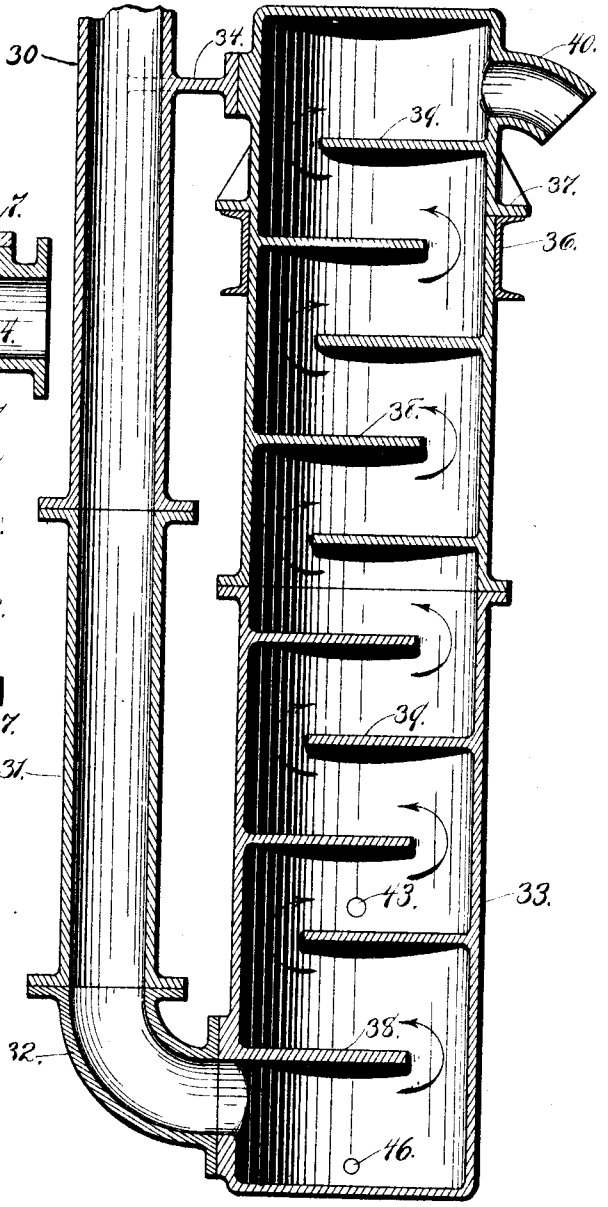


Fig. 3.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE GASEOUS TREATMENT OF SACCHARINE JUICES.

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To all whom it may concern:

Be it known that I, NELSON A. LOCKWOOD, a citizen of the United States, residing at Ogden, in the county of Weber and State of Utah, have invented certain new and useful Improvements in Apparatus for the Gaseous Treatment of Saccharine Juices; 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.

This invention relates to improvements in apparatus for the gaseous treatment of saccharine juices.

I am aware that, in the manufacture of cane sugar, in addition to treating the expressed raw cane juice with lime for defecation purposes, for a long time it has been customary to sulfur the raw juice, by impregnating the same with sulfur dioxid, for the purpose of decolorizing or bleaching the juice. Similarly, in the treatment of the raw diffusion juice from the sugar beet, in addition to the introduction of carbon dioxid, for the purpose of carbonation or causing the precipitation of the lime salts, employed to remove impurities, it has also been a common practice to sulfur the solution.

My invention, therefore, does not aim at the broad idea of treating saccharine juices with any particular gas or gases, but is directed to an improved apparatus for making that treatment more positive and effective.

The main principle on which prior devices of this character have operated has been to have the raw juice sprayed or caused to flow downwardly, in thin sheets or ribbon-like streams, over alternately disposed shelves, oppositely located in a closed receptacle, commonly known as sulfur boxes, while the gases were caused to flow upwardly therethrough and were partially absorbed by the down-coming juice. This, however, produced more of a bodily contact of the gases with the surface of the juice, and while absorption resulted, it is obvious that the more intimately the treating gas or gases are caused to commingle with the juice, the more effective will be the impregnation and absorption.

The primary object of my invention, therefore, is to improve the conditions or methods heretofore employed, by causing the gases to come into more direct or intimate molecular contact with the particles of the mass of juice, rather than by surface contact and indirect partial absorption.

In the accomplishment of this end, my invention consists broadly in injecting the raw juice, preferably under a pumping pressure, in the form of spray or jets, into the apparatus, and simultaneously sucking in the treating gas or gases into intermingled or entrained relation therewith, by aspiratory action of the injecting means, at the entrance of the apparatus, causing an initial commingling of the juice and the gases. The juice and entrained gases are then conducted through a down-pipe or conduit, of suitable length, to a retarding chamber, having a series of alternating, oppositely disposed baffle plates or barriers, forming a tortuous passageway through the retarding chamber, and diminishing the velocity of the ascending liquid, as it rises in the retarder toward a discharge outlet at the upper end thereof. The gases naturally act on the juice during the passage through the down-pipe, and further react on the liquid in the retarder, resulting in more effective clarification and bleaching.

The methods of filtering out the remaining impurities from the clear juice, evaporation, crystallization, etc., may obviously be accomplished by the usual apparatus now employed for such purposes.

From a manufactural standpoint, another object of the invention is to produce such an apparatus, which is not only simple in construction and operation, but which is also durable, efficient in action, and comparatively inexpensive to manufacture.

For the purpose of a full disclosure, reference is had to the accompanying drawings illustrating a practical embodiment of the invention, which will be described in detail in the following specification, and the particular features of novelty of which will be more particularly pointed out in the appended claims.

Referring to the drawings, in which like characters designate the same parts in the several views:—Figure 1, is a vertical sectional view through the outer receiving tank, my improved apparatus being shown in elevation, and a portion of the receiving tank, and the down-pipe conduit being partially broken away. Fig. 2, is a longitudinal sectional view of the upper portion of my apparatus, showing the disposition of the in-

jector nozzle and cones, within the gas receiving casing or commingling chamber. Fig. 3, is a similar view of the lower portion of my apparatus, showing the disposition of the baffling plates or barriers within the retarding tank, and the outer receiving tank being omitted, and Fig. 4, is a transverse sectional view through the injector nozzle, taken on the line 4 of Fig. 2, and looking downwardly in the direction of the arrow.

1 designates a cylindrical casing, functioning as a mixing chamber, having a flanged open bottom 2 and top 3, the upper end of the casing being provided with inlets for the treating gases, the inlet for the sulfurous acid gas (SO_2) being indicated at 4, and the inlet for the carbonic acid gas (CO_2) being indicated at 5.

The casing 1 is provided with a flanged plate or head 6, snugly seated within the aperture 3 of the casing, its flanged rim portion 7 resting on top of the casing and securely bolted thereto to form a tight top closure for the mixing chamber. The central portion of the cover 6 is also apertured as at 8, and may be provided with the circular boss 9, on which is seated the flanged top 10 of an aspirator or injector 11, projecting through the aperture 8, into the mixing chamber, and which injector may have an integral bottom plate 12, provided with a plurality of jet orifices or nozzles 13, preferably of conical contour, and so disposed around the bottom plate 12 as to project the incoming raw juice, in the form of a spray or a series of jets, against the inner surface wall of the first hollow conical member hereinafter referred to.

Seated on the flange 10 of the injector is the flange 14 of the raw juice inlet pipe 15, leading from the source of raw juice supply (not shown) and registering with the hollow interior of the injector. The boss 9 and flanged heads 10 and 14 may be suitably bolted together.

Centrally within the mixing chamber are suitably supported an alined series of truncated hollow conical deflectors 17, 20 and 23, three being shown in the drawings. These conical deflectors may have flaring upper rims 18, 21 and 24, and cylindrical short extensions 19, 22 and 25 at their lower ends, but it is obvious that they may merely be simple cones. The upper portion of the cone 17, preferably projects substantially in line with the gas inlets 4 and 5, and the nozzle end of the injector projects a short distance within the cone 17. The lower or apex end 19 of the upper cone similarly projects within the upper portion of the intermediate cone 20, while the apex end of the cone 20 projects within the flaring upper portion of the lower cone 23, the apex ends of the cones having successively greater diameters than the preceding one. The lower end of the cone 23 also projects into a similarly disposed conical throat 26, flanged at 27 and securely bolted to the base flange of the casing 1. This conical throat 26 is also provided with a flanged apex 28 bolted to the flanged apex end of an inverted conical tube 29, terminating in one or more tubular sections 30 and 31, which latter are connected by an elbow 32 with the interior lower portion of a retarder or baffling tank 33, the arrangement forming a conduit, for the intermingled raw juice and gases, between the injector and the retarder.

The retarder may be of sectional construction and suitable contour, rectangular, or circular as shown and extends a substantial distance upwardly alongside the down-pipe or conduit sections 31 and 30, which it supports by its connection at the base with the elbow 32, and its upper end by the connecting rib 34. The retarder or baffle tank, itself, may be suspended within an outer receiving tank, for the clarified liquid, by the cross-channel bars 36, supported by the receiving tank 35, on which channel bars the lugs 37 of the retarder rest.

The interior of the retarder has a series of baffling plates or barriers 38 and 39, alternately projecting inwardly, in opposite directions, and extending substantially beyond the center of the tank, in overlapped relation, forming an interrupted tortuous passageway for retarding the flow of the ascending gaseous impregnated liquid. The lowermost baffle 38 is located just above the inlet elbow 32, and is disposed toward the opposite side of the tank, and the uppermost baffle 39 is oppositely arranged and is located just below the liquid outlet 40, which latter discharges into the outer or receiving tank 35, from whence the clarified liquid may be conducted to storage tanks and utilized at will for filtration, evaporation, crystallization, and centrifugal treatment.

41 designates a pipe leading into the top portion of the retarder, and provided at its outer end with a faucet 42, for sampling purposes.

43 designates a rotary plug drainage cock for the tank 33, connected by a spindle or rod 44, extending through and above the tank 35, with an operating lever or hand wheel 45, and 46 designates a plug closed drainage outlet at the bottom of the tank 33.

The cock 43 may be employed for drawing off the more or less settled clarified liquor, remaining in the retarding tank 33, after operations have ceased, and the lower plug closed drainage outlet 46 may be employed for drawing off the liquor in the bottom of the tank, and which liquor in the bottom of the tank may contain more or less sediment. Or these drainage cocks may be utilized in the operation of washing out the retarder tank.

As a matter of fact my device might be used independently as a carbonating or as a sulfurizing apparatus, in which case the juice would have to be run twice through the apparatus; but used conjointly for simultaneously carbonating and sulfurizing, the carbonic acid gas (CO_2) is introduced through the inlet 5, from a suitable source, and the sulfurous acid gas (SO_2) is introduced through the inlet 4, from the generator for the sulfur fumes, but as these sources of supply may be of common origin, they have been omitted from the drawings as unnecessary, not being a specific part of the invention itself. Also the raw juice may be led from tanks, or directly from the crushers in the case of cane juice, or from the diffusion vats in the case of beet juice. In practice, I preferably pump the raw juice through the inlet pipe 15, under an approximate pressure of forty pounds, from whence it is delivered to the injector nozzle 11, and through the orifices 13 in jets or sprays, leaving a hollow or open central zone, encompassed by the jets, providing a larger surface area for the initial contact of the treating gas or gases drawn in by the suctional or inductive action of the incoming juice. These jets may be directed to impinge against the inner conical wall of the first conical deflector, causing a splashing or diverting effect for more thoroughly mixing or commingling the particles of juice and treating gases, the gases sucked into the chamber 1 being also more positively drawn into and through the successive cones, in entrained relation with the juice, by the suction created by the juice itself passing therethrough. So also the juice successively passes through the intermediate and lower cones, the upper or base end of the inverted cones being open to allow of the entrance of the gases from the chamber 1 to more thoroughly permeate the juice with the treating gases during the initial stage of operation.

As the partially permeated juice passes into the conical throat 26, gases from the bottom of the chamber 1 are also drawn into the throat through the opening 2, and in passing through the throat 26 there is a more or less tendency toward a contraction or compression of the mixed juice and gas during passage, as it passes through the restricted necks or apex ends of the throat and the inverted conical tube section 29, in which latter there is an after tendency toward gradual expansion as the mixture passes therethrough to the cylindrical tube sections below.

Thus the juice and gases are quite thoroughly combined initially, the entrained gases further acting on the juice as they pass in commingled relation, in the same direction of flow, to the retarder wherein it is apparent that the mixture is more or less compressed and retarded in its tortuous passage around the baffles, causing in reaction a more intimate impregnation of the juice in its obstructed ascent to the discharge outlet.

Although I have described the invention in detail as illustrated, it will be understood that obvious minor changes might be made in the structural manufacture of the various elements without departing from the spirit of the invention, and without vitiating any of the principles thereof, and—

Having thus made a full disclosure of my improved apparatus and the operation of the same, what I claim is:—

1. In apparatus for treating saccharine juices, including a receiving receptacle having a suitable outlet and provided with an inlet for a treating gas, in combination with a juice injector, projecting within said receptacle and having a nozzle discharge so formed as to direct the injected juice within said receptacle in the form of a wall of juice having an open central zone, substantially as described.

2. In apparatus for treating saccharine juices, including a receiving receptacle having a suitable outlet and provided with an inlet for a treating gas, in combination with a juice injector, projecting within said receptacle and provided with a nozzle end having a plurality of jet orifices, functioning substantially as described.

3. In apparatus for treating saccharine juices, including a receiving receptacle having a suitable outlet and provided with an inlet for a treating gas, in combination with a juice injector, projecting within said receptacle and provided with a nozzle end having a plurality of tapering jet orifices functioning substantially as described.

4. In apparatus for treating saccharine juices, including a receiving receptacle having a suitable outlet and provided with an inlet for a treating gas, in combination with a juice injector, projecting within said receptacle and provided with a nozzle end having a plurality of circularly disposed jet orifices, for directing the injected juice into said receptacle in the form of a wall of jets having a central open zone, substantially as described.

5. In apparatus for treating saccharine juices, including a closed receptacle, forming a gas chamber, provided with an inlet for a treating gas, in combination with means for receiving and conveying the incoming juice and treating gas through and from said receptacle, including as an element a hollow truncated inverted cone, suitably mounted in said receptacle, and a juice injector directly discharging into said hollow cone, substantially as described.

6. In apparatus for treating saccharine

juices, including a closed receptacle, forming a gas chamber, provided with an inlet for a treating gas, in combination with means for receiving and conveying the incoming juice and treating gas through and from said receptacle, including as an element a hollow member, preferably in the form of a truncated inverted cone, suitably mounted in said receptacle adjacent said gas inlet, and a juice injector directly discharging into said hollow member, in inductive relation to said gas inlet, and functioning in the dual capacity of a juice inlet and as an aspirator for drawing said treating gas into said receptacle by the suctional force of the incoming juice itself, substantially as described.

7. In apparatus for treating saccharine juices, including a closed receptacle, forming a gas chamber, provided with an inlet for a treating gas, in combination with means for receiving and conveying the incoming juice and treating gas through and from said receptacle, including as an element a hollow member, preferably in the form of a truncated inverted cone, suitably mounted in said receptacle adjacent said gas inlet, and a juice injector directly discharging into said hollow member, in inductive relation with said gas inlet and functioning substantially as set forth, and said juice injector being provided with a nozzle end having a discharge so formed as to direct the injected juice within said hollow member in the form of a wall of juice having an open central zone, substantially as described.

8. In apparatus for treating saccharine juices, including a closed receptacle, forming a gas chamber, provided with an inlet for a treating gas, in combination with means for receiving and conveying the incoming juice and treating gas through and from said receptacle, including as an element a hollow member, preferably in the form of a truncated inverted cone, suitably mounted in said receptacle adjacent said gas inlet, and a juice injector directly discharging into said hollow member, in inductive relation with said gas inlet and functioning substantially as set forth, and said juice injector being provided with a nozzle end having a plurality of jet orifices, substantially as described.

9. In apparatus for treating saccharine juices, including a closed receptacle, forming a gas chamber, provided with an inlet for a treating gas, in combination with means for receiving and conveying the incoming juice through and from said receptacle, including as elements a hollow member, preferably in the form of a truncated inverted cone, suitably mounted in said receptacle adjacent said gas inlet, and a similarly disposed hollow throat, communicating with and closing the bottom of said receptacle and receiving the discharge from said internal hollow member, and an outlet conduit leading from said external hollow member, and a juice injector discharging into said internal member and constructed and functioning substantially as described.

10. In apparatus for treating saccharine juices, including a receptacle adapted to initially receive the juice to be treated and a suitable treating gas, and provided with an outlet conduit of substantial length to permit of the action of said gas on said juice during their passage therethrough, in combination with means at the other end of said outlet conduit, operating to cause the juice to flow with a less accelerated motion to positively retard the final delivery of the juice and treating gas and enabling the gas in its reaction on said juice to be more thoroughly absorbed thereby, substantially as described.

11. In apparatus for treating saccharine juices, the combination of a receptacle adapted to initially receive the juice to be treated in conjunction with a suitable treating gas, said receptacle being provided with an outlet conduit of substantial length to permit of the action of said gas on said juice during their passage therethrough, in combination with a retarding chamber at the other end of said outlet, and being provided with internal means for diverting the passage of the juice and gases therethrough and positively retard their passage with a less accelerated movement, enabling the gases to react on the juice to cause a more thorough final impregnation and absorption in said retarding chamber, substantially as described.

12. In apparatus for treating saccharine juices; the combination of a gas chamber; a series of alined hollow truncated inverted cones, suitably mounted in said chamber, the apex end of one cone projecting in proximity to the hollow base portion of the next succeeding cone; an inlet for delivering raw juice within the first cone of the series; means for introducing a treating gas or gases to said gas chamber, into initial contact with the incoming raw juice, and a conduit, leading from said gas chamber and disposed to receive the discharge from the last cone of the series, for carrying off the combined juice and gases from said cones and chamber, in commingled relation and in the same direction of flow, substantially as described.

13. In apparatus for treating saccharine juices; the combination of a gas chamber; a series of alined hollow truncated inverted cones, suitably mounted in said chamber, the apex of one cone projecting in proximity to the hollow base portion of the next succeeding cone; an injector for delivering raw

saccharine juice within the first cone of the series; means for introducing treating gas into said gas chamber; and a conduit leading from said gas chamber and disposed to receive the discharge from the last cone of the series, said conduit consisting of a plurality of tubular elements, including a conical throat, similarly disposed as said internal cones, communicating with and closing the bottom of said gas chamber, and an oppositely disposed conical tube, having its apex end adjoining and communicating with the open apex end of said conical throat, substantially as described.

14. In apparatus for treating saccharine juices; the combination of a retarding chamber having a delivery outlet; and means coöperating therewith to initially treat the incoming juice with a treating gas, and conducting same to said retarding chamber, in commingled relation and in the same direction of flow, said retarding chamber being provided with alternately opposed overlapping baffles, for diverting the passage of the treated juice therethrough in a tortuous path and with a less accelerated movement, enabling the gases to react on the juice and cause a more thorough final impregnation and absorption of the treating gas by said juice, substantially as described.

15. In apparatus for treating saccharine juices; the combination of a gas chamber; an injector for delivering the juice to said chamber at a substantial pressure; means for introducing a treating gas to said chamber into contact with said incoming juice; means in said chamber for aiding the initial mixture of said juice and treating gas; a conduit leading from said gas chamber and extending a substantial distance below same for conducting said juice and entrained gas from said chamber, in the same direction of flow, and enabling said gas to act on said juice; a retarding chamber at the lower end of said conduit and communicating at its bottom therewith, said retarding chamber extending vertically of said conduit, and being provided with a discharge outlet at its upper end; and baffling means within said retarding chamber for obstructing and diverting the passage of the ascending treated juice, causing the same to flow upwardly at a diminished speed to permit a prolonged reaction of the gases on the juice and cause a more thorough final impregnation and absorption of the treating gases by said juice, substantially as described.

16. In apparatus for treating saccharine juices; the combination of a gas chamber; a series of alined hollow truncated inverted cones, suitably mounted in said chamber, the apex of one cone projecting in proximity to the hollow base portion of the next succeeding cone; an injector for delivering the saccharine juice under a substantial pressure, within the first cone of the series; means for introducing treating gas into said chamber into initial contact with the incoming juice; a conduit communicating with the bottom of said gas chamber and disposed to receive the discharge from the last cone of the series, said conduit extending a substantial distance below said chamber; a retarding chamber communicating at its bottom with the lower end of said conduit, said retarding chamber extending vertically alongside of said conduit and being provided with a discharge outlet at its upper end; and a series of alternately opposed overlapping baffles located in said retarding chamber, for obstructing and diverting the course of the ascending juice into a tortuous path, causing the same to flow upwardly at a diminished speed, substantially as described.

In testimony whereof I affix my signature.

NELSON A. LOCKWOOD.