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2,314,822

MEANS FOR CONTROLLING SPECIFIC GRAVITIES

Filed March 28, 1940

2 Sheets-Sheet 1

Fig. 1.

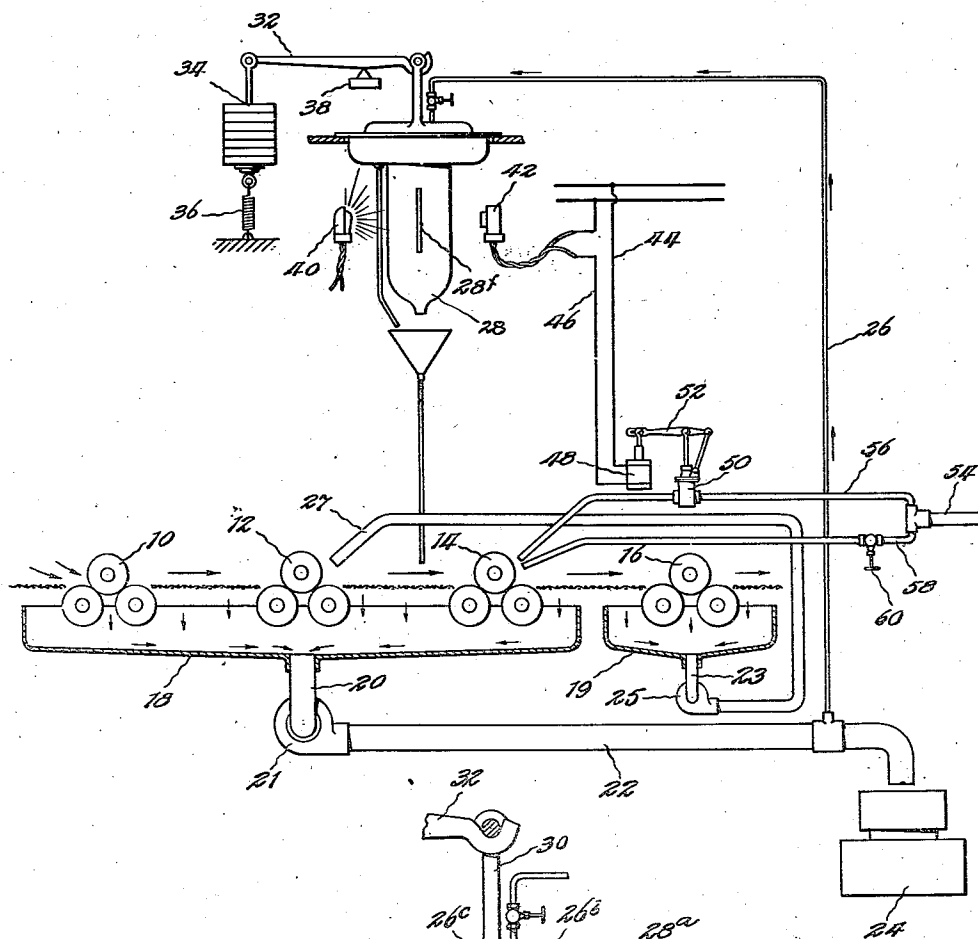
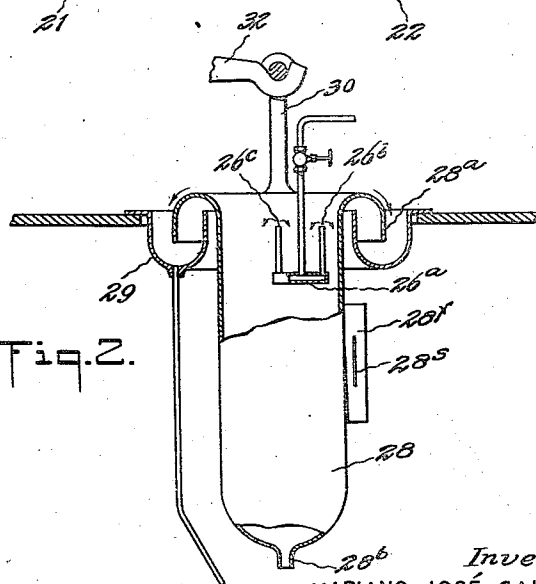


Fig. 2.



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2 Sheets-Sheet 2

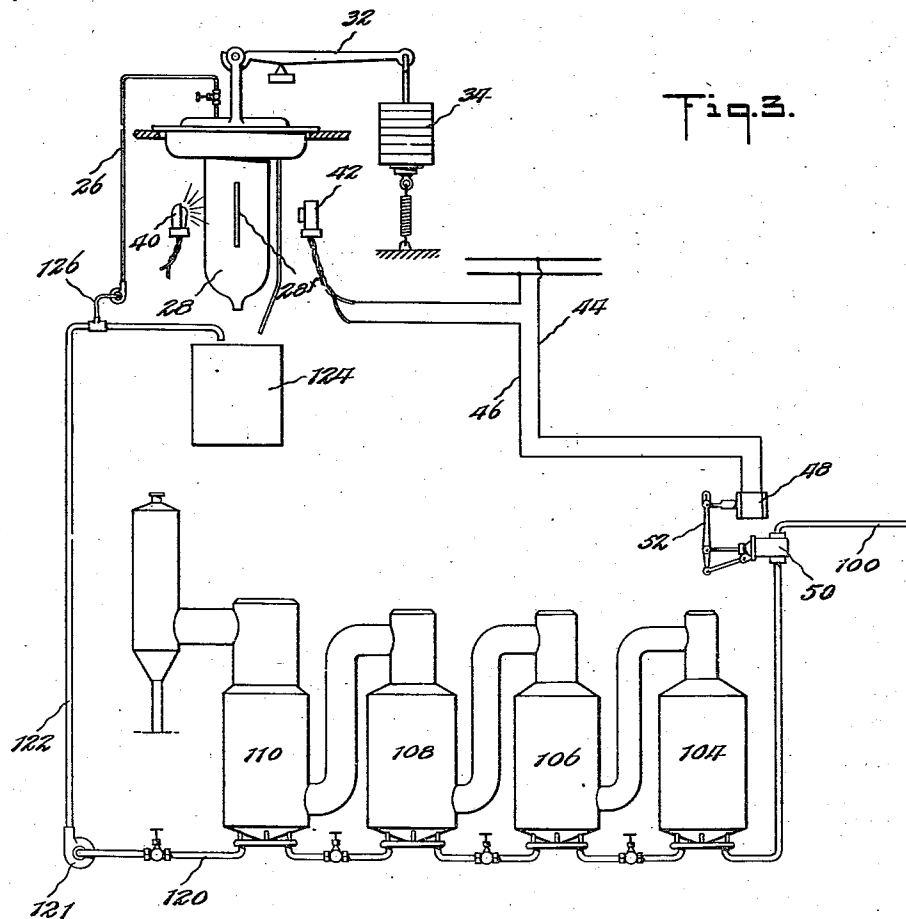


Fig. 3.

Howson and Howson

UNITED STATES PATENT OFFICE

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MEANS FOR CONTROLLING SPECIFIC GRAVITIES

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5 Claims. (Cl. 137—78)

This invention relates to apparatus for maintaining a constant specific gravity of fluids resulting from certain industrial processes, by controlling the inflow of fluid or a diluent to the process.

It is an object of my invention to provide an apparatus to control the specific gravity of any fluid by means which is responsive to variations in the weight of a constant volume of that fluid.

Another object of my invention is to provide a means to maintain constant the specific gravity of certain fluids, by apparatus operated by the movements of a balanced container containing a constant volume of the fluid, which is continually replaced and refreshed by constant flow of the fluid through the container.

Another object of my invention is to provide an apparatus of the above type with means for preventing the accumulation of sediment in the container while constantly renewing the liquid therein.

Other objects of my invention will become apparent as the invention is described in connection with the accompanying drawings.

In the drawings—

Fig. 1 is a diagrammatic layout of one form of my invention as applied to apparatus for maintaining the specific gravity of liquid resulting from the crushing of sugar cane;

Fig. 2 is a detailed view of a unit for containing a predetermined and constant volume of the liquid whose specific gravity is to be maintained constant;

Fig. 3 is a diagrammatic layout of my invention as applied to apparatus for maintaining constant the specific gravity of syrup resulting from the processing of defecated juice in a sugar-juice evaporating apparatus.

Referring to the drawings, Fig. 1 illustrates the invention as applied to a sugar crushing mill in which four sets of sugar cane crushing rolls, diagrammatically illustrated, are designated by the numerals 10, 12, 14 and 16. As the cane passes through the first three mills 10, 12 and 14, the raw sugar juice is squeezed out and caught in a receptacle or pan 18 beneath the mills and runs by gravity through a drain pipe 20 to a pump 21, which delivers to a pipe 22. This pipe 22 discharges the main portion of the juice to the juice scales 24. A small portion of the juice in the pipe 22 is bypassed through a small pipe 26 connected with the pipe 22 and is delivered into a balanced cylindrical container 28.

The juice from the last mill 16 is collected in a receiver 19 and is delivered through a pipe 23 to

a pump 25 and discharged through another pipe 27 to the bagasse matt just after it leaves the rolls 12.

The container 28 is mounted by a bail-like bracket 30 on one end of a scale beam 32. On the other end of the beam 32 is mounted a counterweight 34. The weighted end of the beam is anchored by a spring 36 to a fixed support. The scale beam pivots about a fulcrum 38.

The container is designed to be kept full to overflowing by a constant inflow in excess of the out-flow. For this purpose, the container 28 is provided with an over-flow lip 28a which may be formed by turning out the upper edge of the container 28. Also, the bottom of the container 28 is tapered to a central outlet 28b. The juice is delivered into the container 28 by means of the small bypass pipe 26 through a transverse header on the end thereof and located within the container. From the ends of the transverse header parallel delivery outlet pipes rise, their ends being below the top of the container.

In operation, the flow of liquid into the container 28 through the outlet 26b and 26c is greater than the amount of liquid flowing out of the discharge outlet 28b so that the container 28 is always kept full. Over-flow over the lip 28a is caught in a trough 29 which may be U-shaped in cross section and annular in form so as to cooperate with the lip 28a. The overflow into the trough 29 may be returned to the bagasse matt and the receiver 19.

From the foregoing, it may be observed that so long as the specific gravity of the liquid within the container 28 remains constant, the container will maintain a fixed position, being counterbalanced by the weight 34 and the anchor spring 36. Conversely, any variation in the specific gravity of the liquid within the container 28 will cause a corresponding upward or downward movement of the container. I make use of this movement of the container 28 to control the amount of maceration water delivered to the crushing rolls. In the form of invention illustrated in Fig. 1, this control is accomplished by means of a photo-electric cell arrangement to be presently described.

Maceration water is applied to the bagasse at a point where the bagasse leaves the rolls 14 and proceeds towards the rolls 16. The application of the maceration water is accomplished by delivery through a main supply pipe 54 which has two branches 56 and 58. The branch 58 has a manually operated valve 60 therein, by means of which a semi-permanent adjustment of the amount of maceration water passing through the

pipe 58 may be made. The branch 56 has an electrically operated valve 50, by means of which the amount of maceration water can be automatically varied. It may thus be seen that a fixed amount of maceration water will be applied to the bagasse matt through the pipe 58, but the total amount will be varied by increases or decreases in the variable amount applied through the pipe 56.

The operation of valve 50 through the photo-electric cell arrangement is accomplished by the following means. Radially projecting from the periphery of the tank is a fin or plate 28f having a vertical slot 28s therein. A source of light 40, such as an electric lamp, is placed on one side of this fin 28f while a photo-electric cell 42 is placed upon the other side. Thus, as the tank 28 moves up and down, the light beams from the source 40 will be interrupted or varied in intensity so as to vary the effect on the photo-electric cell 42.

The photo-electric cell is connected by conductors 44 and 46 to a solenoid 48 which is adapted to operate a balanced valve 50 by means of a lever 52 in a more or less conventional manner. The valve 50 may be constructed so as to permit more or less liquid to pass through it as the solenoid 48 is strongly or weakly energized.

From the foregoing, it will be understood that variations in the specific gravity of the liquid within the container 28 will cause the photo-electric cell to operate solenoid 48 and valve 50, so as to cause a greater or lesser amount of water to be delivered through the pipe 56 through the bagasse matt. Thus the apparatus may be set to maintain a substantially constant specific gravity of the juice resulting from the crushing of the sugar cane in the mills 10, 12, 14 and 16.

Referring to the form of the invention shown in Fig. 3, the invention is there applied to controlling the delivery of defecated juice to a four-effect evaporator of sugar manufacturing apparatus. In this form of the invention, the control means is exactly the same as that described in connection with Figs. 1 and 2, but it is employed to control the delivery of the defecated juice to the apparatus, rather than to control the delivery of a diluent.

In Fig. 3, the defecated juice comes to the first stage of the multiple-effect evaporating apparatus through a delivery pipe 100. In this pipe 100, there is an automatically operated valve 50 which is controlled by a solenoid 48 through a photo-electric cell 42 in the same manner as in the previously described form of the invention. The juice goes through the valve 50 into the first of the four-effects 104, 106, 108, 110 of the evaporator, and leaves the last effect through a pipe 120 delivering to a pump 121 which discharges to a pipe 122 leading to the reservoir 124. A portion of the syrup in the pipe 122 is by-passed through pipe 126, pump 125 and pipe 26 to the specific gravity tank 28 in the same manner as the previously-described form of the invention.

From the foregoing, it will be apparent that any change in the specific gravity of the syrup entering the tank 28 will be reflected in a movement of that tank and a simultaneous variation in the operation of the photo-electric cell 42. Thus, if the syrup becomes too heavy, the solenoid 48 will cause the valve 102 to open to admit additional amount of defecated juice to the first

effect of the evaporator. In this manner, the delivery of the juice through the evaporator is regulated by the quality of the syrup leaving the evaporator. The control is automatic and maintains a constant specific gravity of the material or syrup leaving the evaporator.

Although I have described my invention in connection with two forms of apparatus for treating sugar bearing materials, I do not limit the invention to the art of sugar making. The principles of the invention may be applied generally to any industrial process in which the specific gravity of material leaving the process is to be maintained constant. In any such process, my invention may be applied to control the inflow of a diluent or of the amount of raw materials to the process.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore, I do not limit the invention to the specific embodiment shown and described.

I claim:

1. A unit for controlling the specific gravity of solutions comprising a tank for the solution having an overflow lip and an outlet toward which the tank bottom converges downwardly, a balance beam, means to support said tank from one end of said beam, a weight and an anchored spring at the other end of said beam and acting counter to the tank, and means operating without physical contact with said tank, balance beam or associated parts, as the tank is caused to rise and fall by changes in the specific gravity of its contents for controlling the specific gravity of the solution.

2. Apparatus as claimed in claim 1, wherein said operating means comprises a photo-electric cell, electrically controlled valve means operated by said cell, and means on said tank to interrupt a light beam focused on said cell, in response to variations in the tank position caused by variations in the specific gravity of the tank contents.

3. Apparatus as claimed in claim 1, wherein said operating means comprises valve means for regulating the flow of liquid used in treating the solution whose specific gravity is to be controlled, and means responsive to movement of said tank caused by variations in the specific gravity of the tank contents to operate said valve means.

4. The means to maintain a predetermined specific gravity of solutions issuing from an industrial apparatus comprising a liquid container, a scale beam supporting said container, means counterbalancing said container when said container is filled with liquid of predetermined specific gravity, means to deliver continuously to said container a sample of the solution whose specific gravity is to be controlled, means to deliver liquid to said apparatus for varying the specific gravity of the solution, means to regulate the flow of said specific-gravity-varying liquid through said delivery means, and electro-responsive means to operate said regulating means, said electro-responsive means operating without physical contact with said container, scale beam or associated parts, as the container is caused to rise and fall by changes in the specific gravity of its contents.

5. Apparatus as claimed in claim 4, wherein the container has an outlet toward which the bottom of the container converges downwardly.

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