

May 29, 1934.

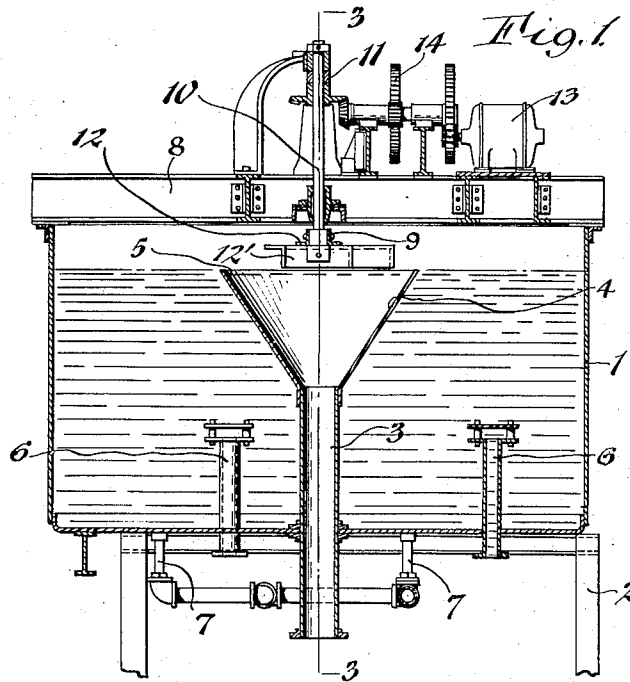
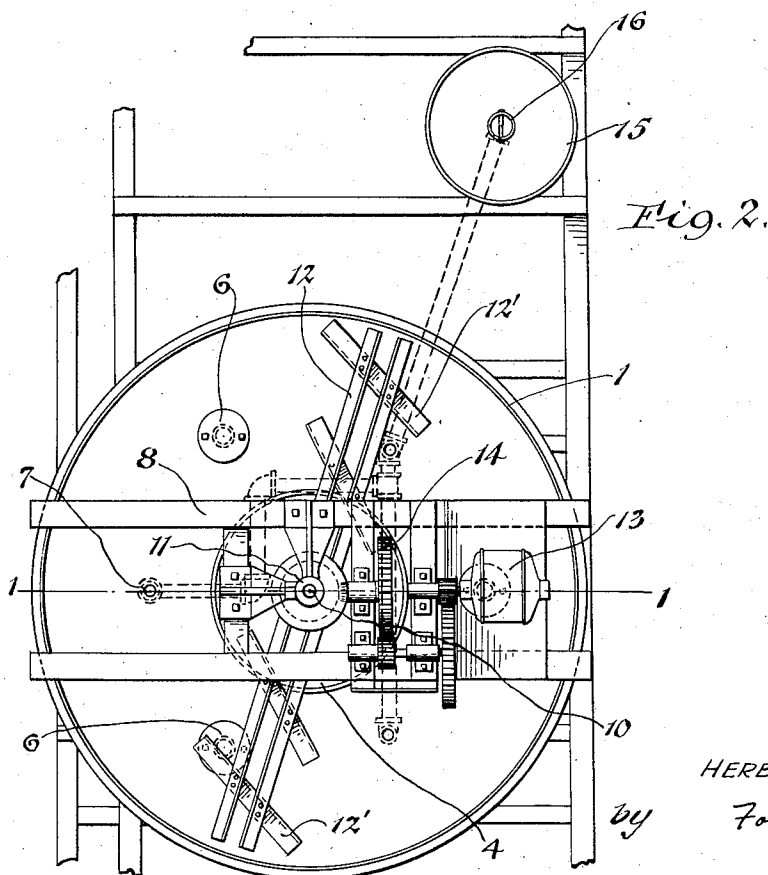
H. R. TUMIM

1,960,686

DECANTER

Filed July 26, 1929

2 Sheets-Sheet 1



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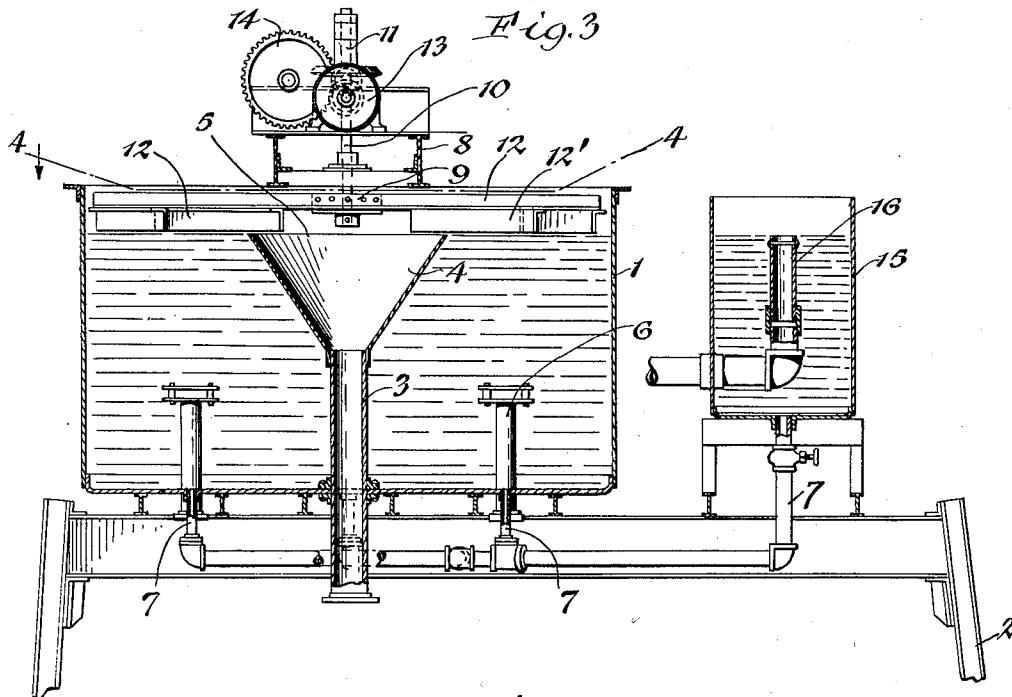
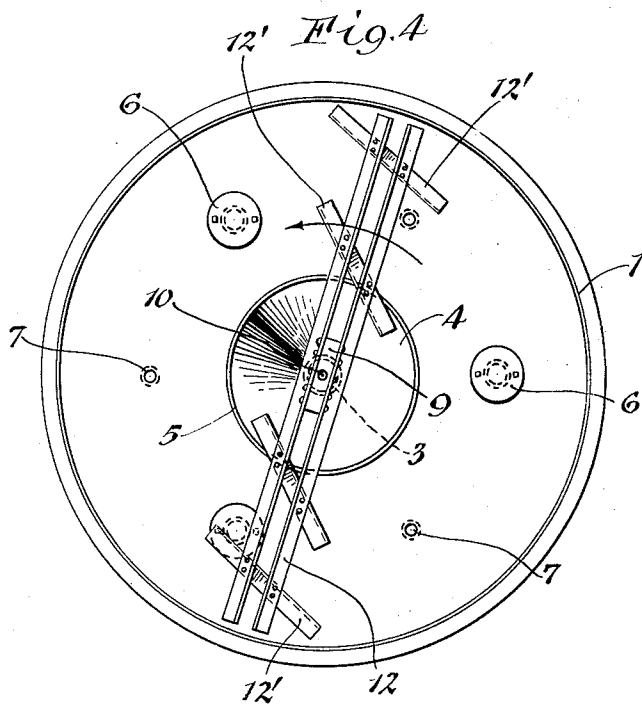
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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5 Claims. (Cl. 210—51)

This invention relates to a process and apparatus for thickening slurries, particularly for slurries containing particles lighter than the liquid in which they are suspended, and includes correlated improvements and discoveries relative thereto.

An object of the invention is to provide an efficient process and apparatus for the separation of solid particles from a liquid in which they are suspended and in which they have a tendency to float, by decanting off the solid particles which rise to the surface.

Another object of the invention is the production of a highly concentrated slurry in a single decantation operation.

Further objects of the invention are to provide a means for preventing accumulation of a separated slurry at a point where it will interfere with the separation of slurry from the liquid not yet decanted.

Still another object is to provide a positive means for carrying a concentrated slurry over a dam or weir to separate it from settled liquor, and to provide an apparatus which will be practically automatic in operation.

These and other objects which will appear hereinafter are accomplished according to the present invention without loss of material due to splashing, etc., in a simple and efficient manner.

In the separation of solid particles from a liquid in which they are suspended by flotation of the solid particles to the surface, difficulty has been experienced heretofore in securing the removal of the layer of solid particles which rises to the surface, without entrainment of excessive liquid. Particularly is this true in the concentration of an indigo slurry produced, for example, by the drowning of a phenylglycine-caustic fusion mass in water and then aerating to convert indoxyl into indigo. The slurry thus produced contains indigo particles in such condition that they have a tendency to float, and it may be concentrated by decantation to facilitate the subsequent filtering operation.

In general, it may be stated that apparatus for concentration of slurries of this type (wherein the suspended solid matter has a tendency to float) perform the removal of the scum of solid particles by permitting them to rise to the surface of the liquid and bank against a weir or dam until they are carried over the brink by a skimmer bar, or by the flow of liquid over the brim or other means. However, in the separation of substances such as indigo which forms an exceedingly viscous slurry upon concentration, the

slurry does not flow readily over the brink, and further, does not readily flow away from the discharging side of the weir or dam. Mechanical means for carrying the concentrated indigo slurry over the brink, generally, have not been successful, partly due to the stiffness of the concentrated slurry, which resists any tendency to flow over the dam or away from the discharge side of the dam or weir.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

In the practice of the present invention, a thin slurry or a body of a liquid, carrying in suspension solid particles which are lighter and have a tendency to float, which is to be thickened, is impounded in a settling tank of convenient shape, where it is permitted to remain in a substantially quiescent state long enough to enable the light solids to rise and be distributed at the surface of the liquid. The solids which rise to the surface are floated towards a common area where they are collected and skimmed, and the skimmed material permitted to drop down a sharp incline. The liquid portion of the slurry, which has been clarified by the removal of solids, is withdrawn at a point near the bottom of the tank. The separation also may be continuously performed, by continuously impounding a thin slurry in a settling tank subduing the surge of the incoming liquid, permitting the body of liquor therein to remain in a quiescent state in order to enable the light solids to rise to the surface of the liquid, continuously floating the solids which rise to the surface towards a common area, where they are continuously skimmed and permitted to drop down a sharp incline, and continuously withdrawing the clarified liquor. Preferably, the common area is centrally located, since any material splashed about by the skimming means will merely fall into the main body of liquid being treated, instead of outside the apparatus. It is also preferable to introduce incoming liquid into the main body of liquid at or near the settling line, i. e., the line of demarkation between clarified liquid and floating solid formed by permitting the slurry to stand until the floating solid is of the desired concentration.

As an illustrative embodiment of a manner in

which the process may be carried out in practice and of the apparatus in which the process may be practiced, the following description is presented:

Figure 1 represents a sectional view along the line 1—1 of Figure 2; Figure 2 is a plan view of one embodiment of the invention; Figure 3 is a sectional view along the line 3—3 of Figure 1 showing the discharge regulating tank; and Figure 4 is a plan view of the apparatus with driving parts removed.

Referring to the drawings, a tank 1 of convenient size is mounted upon a supporting structure indicated generally by 2. At the center of the tank is located an upright discharge tube 3 which carries at its upper end a frustoconical member 4. During the operation of the apparatus, the tank 1 is filled with liquor to be decanted, up to or over a brim or dam 5.

Baffled inlets 6 are provided, extending upwardly from the bottom and terminating at or near the settling line which has been determined by permitting the liquor to stand in a quiescent state in the tank until a slurry of the desired concentration has formed at the surface. During operation of the apparatus, the tank being filled up to the brim 5 with liquor to be stratified, solids will rise slowly to the top of the tank, forming a slurry of increasing density as the surface is approached, or alternatively stated, liquor will become clear at or near the bottom with increasing quantities of entrained particles present as the surface is approached. An exit pipe 7 is provided at the bottom of the tank through which the clarified liquor near the bottom can be withdrawn.

Located at the top of the tank and mounted on the framework 8, is a revolvable skimmer 9 which comprises a vertical revolvable shaft 10 mounted in suitable bearings 11 and at the lower end of which are secured skimmer arms 12. The shaft is rotated by suitable means, as for example, by a motor 13 and a train of gears and counter shafts indicated generally by 14. Flights 12' carried by the skimming arms 12 are adjusted to skim over the surface of the body of liquor in the tank with a slight clearance over the brim 5, and may be mounted at an angle to the arms 12 so as to propel or float the thickened slurry which collects at the surface, towards the common area occupied by a funnel 4, at the brim of which it is carried over by continued rotation of the skimmer arms. The slurry which passes over the brim slides down the inclined sides of the funnel 4, through a discharge tube 3, and may be carried from the apparatus in any suitable manner.

The discharge of clarified liquor from the tank may be regulated by any suitable means, as for example, by the use of an auxiliary overflow tank. As shown, Figure 3, the discharge regulating apparatus comprises a tank 15 of conventional form in which clarified liquor from tank 1 is introduced through the pipe 7. An overflow pipe 16 which is adjustable is provided in this tank. Clarified liquor entering the tank 15 through pipe 7 rises in the tank and overflows through the overflow pipe 16. By adjusting the pipe 16 for differences in level between the liquor in tank 1 and in tank 15, the rate of discharge of liquor from tank 1 can be regulated.

The process and apparatus herein described are applicable to various situations where it is desirable or necessary to separate slurries, especially those of the nature of the indigo slurry herein

described, that is, which consist of a liquid carrying in suspension a solid which is lighter and has a tendency to float on the surface of the liquid. It is further to be understood that the process of the present invention is not limited by the apparatus herein disclosed, and that equivalent constructions may be used in adapting the invention to particular situations. The invention therefore is not to be limited except as defined by the appended claims when construed in the light of the specification.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus for the separation of solid particles from a liquid in which they are suspended, which comprises a settling tank for containing a body of liquid having suspended therein solid particles having a tendency to float, means for introducing similar liquid at a point close to the settling line of said liquid in the tank, a tube projecting through the tank and terminating with its upper brim substantially on a level with the surface of the body of liquid in the tank, a skimmer mounted to propel material across the surface of the body of liquid and to carry it over the brim of the tube, and a discharge for clarified liquid.

2. An apparatus for the separation of solid particles from a liquid in which they are suspended, which comprises a settling vessel having an inlet for the introduction of liquid to be decanted and a discharge opening in the bottom of the vessel, a centrally disposed tube projecting upwardly through the bottom of the tank and terminating with its upper edge substantially on a level with liquid in the vessel, and a skimmer carrying flights mounted to move over the surface of the liquid in the vessel.

3. A method for the separation of solid particles from a liquid in which they are suspended, which comprises continuously impounding a body of liquid containing such particles, permitting the impounded body of liquid to remain in a substantially quiescent state whereby the solid particles rise and collect at the surface, removing the collected solids by skimming, continuously withdrawing the clarified liquid from near the bottom of said body of liquid, and continuously introducing liquid containing solid material at a point close to the settling line between the solid and clarified liquid.

4. In a method for the separation of solid particles from a liquid in which they are suspended, the improvement which comprises introducing the liquid containing suspended solid material into an impounded body of such liquid at a point close to the settling line between the solid and clarified liquid.

5. An apparatus for the separation of solid particles from a liquid in which they are suspended which comprises a tank for impounding a body of liquid carrying a solid so suspended that it has a tendency to float toward the surface of said liquid, means for introducing additional liquid into said tank at a point close to the settling line of said liquid as determined by allowing said liquid to remain in a quiescent state until a slurry of the desired concentration has formed at the surface of said liquid, means for removing solid material from the surface of said liquid, and means for removing clarified liquid from a point below the settling line.

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