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F. C. RAWOLLE

CENTRIFUGAL SETTLING MACHINE

Filed Aug. 7, 1924

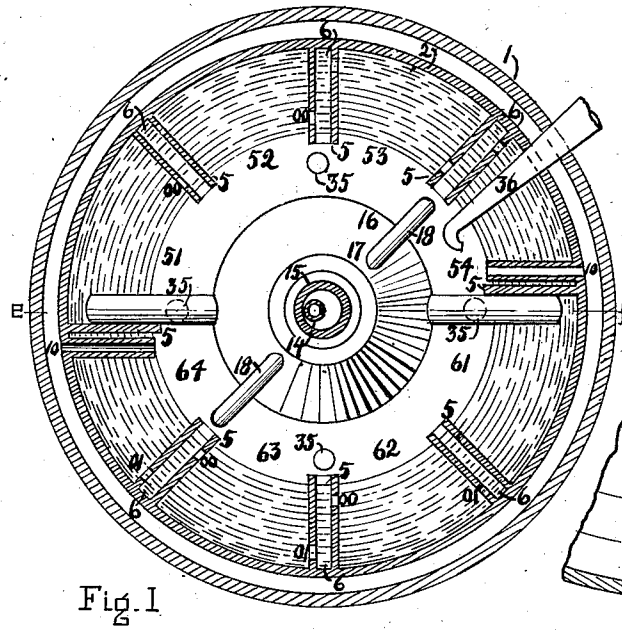


Fig. 1

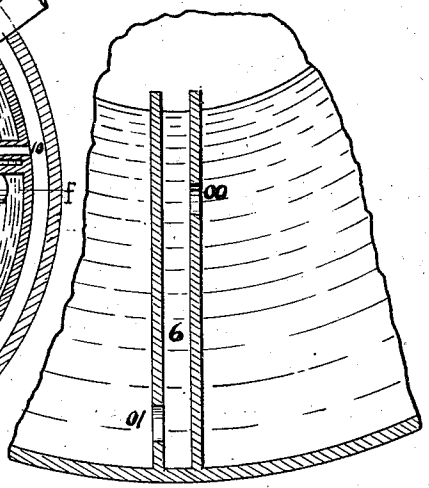


Fig. 3

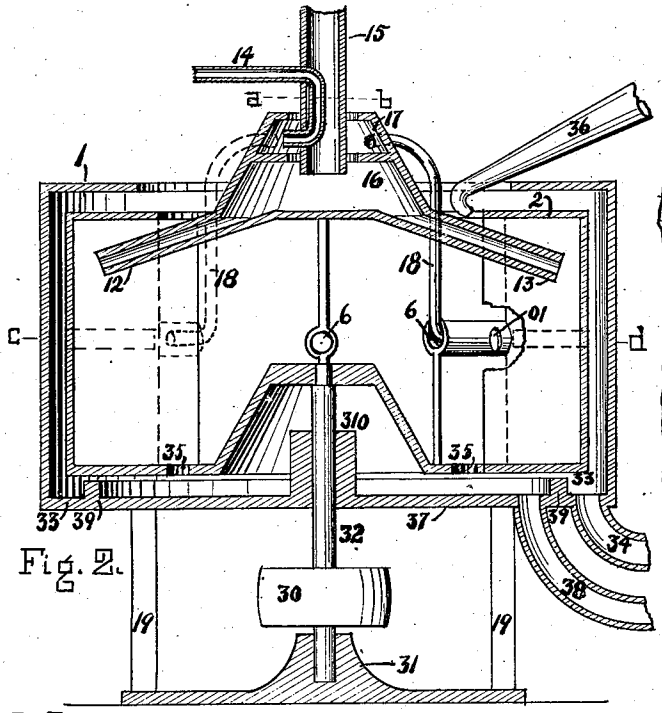


Fig. 2.

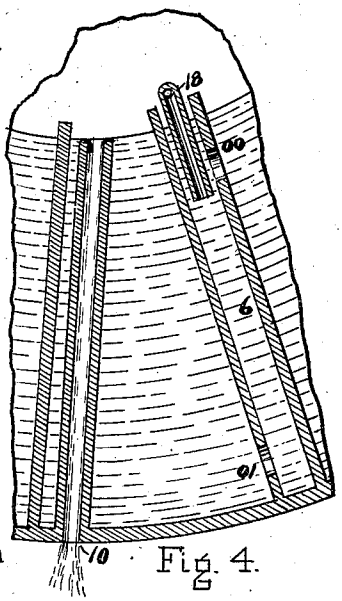


Fig. 4.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL SETTLING MACHINE.

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My invention relates particularly to centrifugal machines adapted for separating solids from liquids; and my primary object is to provide a centrifugal settling machine which will operate effectively and economically in separating solid matter in a finely divided state from a solution particularly when some of the fine, solid matter happens to be of the same specific gravity as the solution in which solid matter is practically suspended.

It may be preliminarily stated that according to a process for treating and dissolving crude shellac invented by me there is more or less of a percentage of impurities that remain suspended in the solution and these impurities must be separated from this solution before properly proceeding.

The accompanying drawings illustrate the preferred embodiment of my invention.

In the drawings, Fig. 1, represents a plan of the centrifugal settling machine constructed in accordance with the working principle of my invention. It is shown cut on the two levels, *a b*, and *c d*, shown in Fig. 2.

Fig. 2, shows a vertical section cut on the lines, *e* and *f*, (Fig. 1) through the vertical axial line of the machine. Fig. 3, shows an enlarged horizontal sectional view of one of the liquor conduits in one of the radial partitions between two compartments located in the rotating member or basket of the centrifugal settling machine. Fig. 4, shows an enlarged broken section of one of the two conduits in which water is mixed in with the liquor as it passes through from one compartment to the next. Adding water to a solution that is of high specific gravity, will lower the specific gravity of the mixture to such a degree that the particles that tend to remain suspended in the heavier liquor, will readily separate from this mixture of liquor and water. In the construction illustrated, there is the body 1, having somewhat the shape of a small tank, and which is supported on the legs, 19, 19, which are secured to the base, 31. The bottom, 37, is shaped to form a sludge receptacle, and is in effect a shallow pan, having a circular rim, 39, 39. This rim, 39, besides encircling this sludge receptacle, forms a circular trough, 33, 33, inside the periphery of the bottom, 37. A pipe, 34, discharges the liquid collecting in this trough, 33, while the pipe, 38, discharges sludge from the pan shaped space. Projecting upward from the center of the bottom, 37, is a bearing, 310, which, with the bearing in the base, 31, carries the shaft, 32. A pulley, 30, rotates this shaft, which is secured to the basket, 2.

The crude, dirty, unpurified liquor flows from its source of supply, through the fixed pipe, 15, into the liquor section of the rotating chamber, 16. There is a water section, 17, of this rotating chamber which will be referred to further on. From the liquor section, 16, of the rotating chamber, the solution of unpurified liquor enters the basket through the pipes, 12, 13, and is discharged directly from these pipes into the compartments, 51 and 61. These two pipes are secured to and rotate with the basket.

The basket, 2, is divided into sets of compartments. I have shown in this drawing four in each set and only two sets; although the number of sets or compartments may be of a lesser number or may be more. It is advisable in order to obtain a good running rotary balance that each set has the same number of compartments and that each set be so arranged that its compartments having like weights should balance centrifugally. In order to obtain a good balance, the number one compartment of one set is placed diametrically across the basket from the number one of the other set; and number two directly across from the other number two and so on.

For convenience in referring to individual compartments in this description, I have numbered each of the four compartments of each set separately. In one set the numbers are 51, 52, 53, 54. In the other set 61, 62, 63, 64. In describing the operation, I have referred to two like features instead of one, as the two must necessarily work similarly and both at the same time. Radial partitions, 5, separate these compartments, and these partitions may or may not be spaced inside the basket at uniform distances apart. Radial passageways, 6, are located in all these radial partitions except the first one of each of the two sets. These passageways, 6, have two openings each. One opening, 0 0, Figs. 3 and 4, receives a flow of liquor, taken from a centrifugal view point, near the top of the first compartments, 51 and 61, of the two sets. This liquor then flows further from the axial line of the basket through the passageways, 6 and 01 and out into the next compartments of the series, 52 and 62,

into which these openings connect. Under a centrifugal action liquid tends to seek a "circular level" and this tendency causes the flow through the passageways. Otherwise, one compartment would fill up centrifugally higher than another. After flowing through the openings 0 0, the flow passes into the next two compartments of the series. The action in these following compartments and passageways is approximately the same until the flow enters the passageways 6, 6, leading into the compartments 54 and 64, then an additional flow of water is added to the solution from the pipes, 18, 18, so that the liquor in these last two compartments obviously has a lighter specific gravity than in either of the others. In this process the added water does not harm the solution materially. Given that the solution changes to a lighter specific gravity and the solid particles remain the same, these solid particles must necessarily separate from the solution in a direction that is, centrifugally, toward the bottom of the compartments, 54 and 64. The outlet pipe, 10, Fig. 4, discharges from the "circular surface" of the clarified liquor. A much better clarification can be obtained by this method than by centrifuging the heavier solution only. Centrifuging the heavier solution clarifies to a large extent, but, after adding water to the already centrifuged solution a more complete clarification is attainable. A pipe, 14, carries the water into the water section, 17, of the revolving chamber, 16, and this water is carried to the compartments, 54 and 64 through the pipes, 18, 18. The pipe 14, passes into and down through the pipe, 15, and then into the water section, 17. Centrifugal action prevents the water in this water section from getting out in other directions than through the pipes, 18, 18. The nozzle, 36, delivers water with a jet action into the compartments in the basket, as it slows up in rotating speed. This jet action washes out the sludge or solid matter that accumulates in the compartments of the basket. The sludge and water, owing to gravity becoming more intense than centrifugal action, then drops through the holes, 35, into the pan shaped part of the bottom, 37, and then flows out through the pipe, 38.

A summary of the series of movements that complete one cycle of the operation is as follows: Liquor flows continually during rotation into the basket at the proper quantity through the pipe, 15, then down into and through the pipes, 12 and 13, into the compartments, 51 and 61. The heavier solid matter deposits on the bottom or inside surface of the walls of the basket, 2, and the floating material rises to the "circular level" of the liquor inside. As the liquor flows from one compartment to the next the heavier impurities remain on the bottoms, centrifugally, of each compartment. The two first compartments of each set usually contain the most of the heavy impurities, the two second compartments contain the next heavier impurities and the two third compartments contain very little if any of the heavy matter. The floating impurities mostly remain on the circular surfaces of the liquor of the two first compartments and they can not pass along with the flow to the next compartment, as floating particles must remain on the "circular surface" that is nearer the center of the basket. This material being above the level, centrifugally, can not enter the passages leading to the next. This floating sludge must be washed out through the holes, 35, along with the heavier sludge and the remaining liquor. The few solid impurities that stay in the liquor of the third two compartments, 53 and 63, usually have about the same specific gravity as the liquor solution and therefor will not separate from the solution by centrifugal action. By adding water into the fourth two compartments through the pipes, 18, the specific gravity of the liquid lowers while that of the solid impurities must remain the same. Obviously these solid particles must then settle and separate from the now lighter liquor just as do the heavier solid impurities in the two first compartments. The clarified liquor "overflows" out of the basket, 2, through the outlet pipe, 10, and is caught in the trough, 33. Depending on the capacity of the machine and on the proportion of impurities in the flowing liquor, the flow of liquor is stopped and the rotation of the basket is reduced to a slow speed. The liquor held up by the centrifugal action, then through its own weight sinks to the bottom of the basket and flows down through the holes, 35. Any of the sludge that sticks in the compartments is loosened by the jet of water, 36.

What I claim is as follows:

1. The process of separating particles from a solution, consisting of continuously feeding a solution, into a first body of a series, separating impurities by centrifugal action, discharging from the partially purified circular level of the first body into the second body, likewise separating impurities from the second body and discharging into the third body, likewise discharging into a fourth body but adding water to this discharge issuing from the third body, separating the impurities by centrifugal action and discharging the purified liquor from the circular surface of the fourth body and collecting the purified solution.

2. The process of separating particles from a solution consisting of continuously feeding a solution containing loose particles of a higher specific gravity than the solution along with other particles having about

the same specific gravity of the said solution, separating and settling the particles that are heavier than the solution by a centrifugal action that forces the heavier further from the center of rotation, then lightening the specific gravity of the solution by adding sufficient water to decrease the specific gravity to less than that of the solid particles remaining in suspension.

3. The process of separating solid particles from a solution consisting of continuously feeding a solution into a first body of a series, separating therefrom impurities of greater specific gravity than the solution by utilizing centrifugal action to move and hold the sinkable particles in this first body to a position farthest away from the center of rotation but to move the floatable particles to the circular surface of the solution nearest the center of rotation, utilizing this floatability to prevent the lighter particles from passing to the second body, passing this purer solution to the second body of the series undergoing further purifying, likewise passing to a third body, adding water to the solution and passing to a fourth body separating in the fourth body the solid particles that correspond in specific gravity to the solution in the third body and collecting the purified solution.

4. The process of separating solid particles from a solution consisting of continuously feeding a solution into a first body of a series, separating therefrom impurities of a greater specific gravity than the solution by utilizing centrifugal action to move and hold the sinkable particles in the first body to a position farthest away from the center of rotation but to move the floatable particles to the circular surface of the solution that is nearest to the center of rotation, utilizing this floatability to prevent the lighter particles from passing to the second body, passing this purer solution to the second body of the series undergoing further purifying, likewise passing solution to a third body, adding water to the solution and passing to a fourth body, separating in the fourth body the solid particles having the same specific gravity as the solution in the third body, collecting the purified solution, and flushing out by a jet action, all the floatable suspendable and the sinkable particles.

FREDERICK C. RAWOLLE.