G. MOORE.

PROCESS OF REPLACING SOLVENTS IN PULPS.

APPLICATION FILED MAR. 3, 1915.

1,248,374.

Patented Nov. 27, 1917.

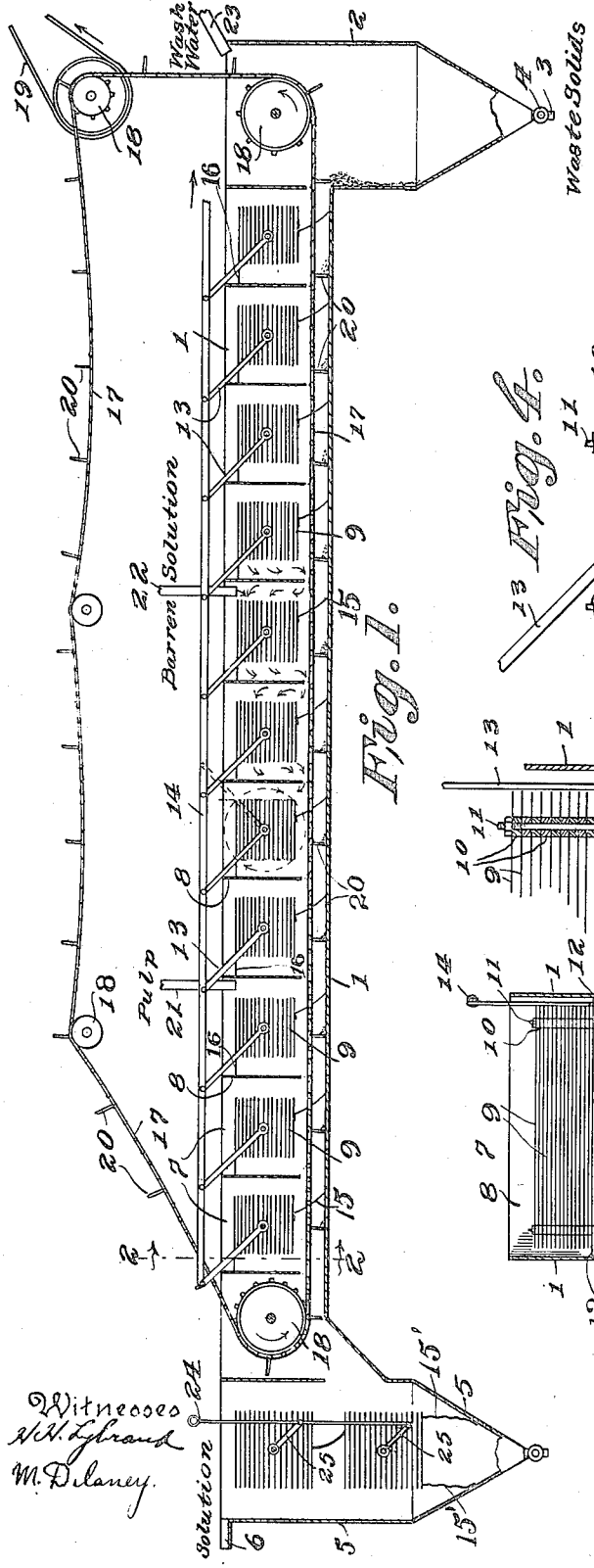


Fig. 1.

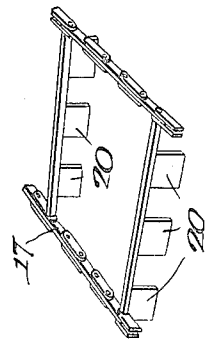


Fig. 7.

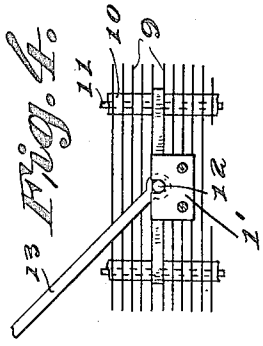


Fig. 4.

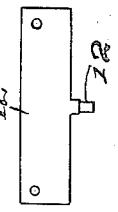


Fig. 5.

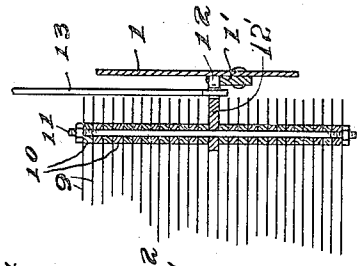


Fig. 3.

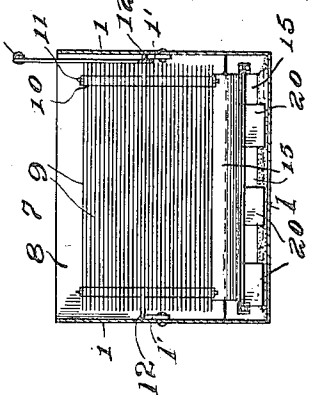


Fig. 2.

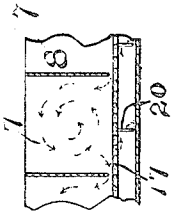


Fig. 6.

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UNITED STATES PATENT OFFICE.

GEORGE MOORE, OF JOPLIN, MISSOURI.

PROCESS OF REPLACING SOLVENTS IN PULPS.

1,248,374. Specification of Letters Patent. Patented Nov. 27, 1917.

Application filed March 3, 1915. Serial No. 11,900.

To all whom it may concern:

Be it known that I, GEORGE MOORE, a citizen of the United States, residing at Joplin, in the county of Jasper and State of Missouri, have invented certain new and useful Improvements in Processes of Replacing Solvents in Pulps; 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.

One of the objects of this invention is to separate suspensible solids from fluids in a minimum of time, with a minimum space occupied by apparatus, and with a maximum of efficiency.

Another object of this invention is the effective control of solutions of greater dissolved contents from diffusion in solutions of less dissolved contents during counter-movements of solids and replacing solutions.

A more detail object is the partial retarding of a body of replacing solutions in a manner enabling relative movement of portions thereof, counter to proportional movement of solids mixed with solutions to be replaced while other portions of the body remain relatively substantially stationary.

With these and further objects in view, as will in part hereinafter become apparent and in part be stated, the invention comprises certain novel steps and combinations of steps in a metallurgical process as will hereinafter be specified and claimed.

In the accompanying drawing illustrating an apparatus well adapted for the carrying out of the process:

Figure 1 is a longitudinal, vertical section.

Fig. 2 is a transverse section taken on the plane indicated by line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail view of a fragment of one of the settlers.

Figs. 4 and 5 are detail views of the pivots supporting settler plate baskets.

Fig. 6 is a fragmentary view similar to Fig. 1 showing the compartments with the settler plates omitted.

Fig. 7 is a fragmentary enlarged, detail, perspective view of a section of the scraper conveyer.

To the end of facilitating a clearer disclosure and aiding a more ready comprehension of the preferred steps of the present improved process, the structure delineated in the accompanying drawing will be described in detail.

Referring to the drawing by numerals, 1 indicates a tank or container which is preferably elongated horizontally. At one end of tank 1, a hopper 2 communicates with the tank and is provided with a discharge pipe 3 valved at 4 for facilitating and controlling discharge of tailings from the tank, and the end of the tank provided with hopper 2 will hereinafter, for facility of identification, be referred to as the forward end, while the opposite end will be considered the rear end. At the rear end of tank 1 is provided a settler compartment 5 provided with a launder 6 for decanting the more or less clarified solutions of maximum dissolved contents.

Tank 1, between the clarifying compartment 5 and the front end of the tank, is divided into a number of compartments 7 by partitions 8, 8. The compartments 7 serve to maintain retarded or slow moving portions of the column of fluids making up the contents of tank 1, so that opportunity is afforded for the settling of suspended solids in the compartments 7, and to augment the rate of settling therein, settler apparatus are preferably arranged in said compartments. As seen in Fig. 6, such apparatus may be omitted, and efficient results obtained, though the rate of settling of suspended solids would not be as great. Each of such settler apparatus consists of a series of juxtaposed settler plates 9, 9 held apart by interposed spacers 10 and being clamped together by retaining rods 11 so as to form a structure consisting of a large number of closely arranged thin plates. In Fig. 3 the parts have been shown on an exaggerated scale for clearness of disclosure, and to make definite one desirable embodiment of this apparatus, the proportions may be considered as indicating plates 9 of sheet steel approximately one-thousandth of an inch thick with the plates spaced apart approximately one quarter of an inch. The proportions may be varied with varying results. Supporting shafts 12 are journaled in brackets 1′, 1′ mounted in the tank 1, and the shafts 12 are connected by arms 13 to rod 14, so that when the shafts are oscillated through ninety degrees all of the plates of the several settlers are moved from the horizontal to the vertical position and are restored by a reverse angular movement of the

same length. To effect such oscillation of shafts, the actuating levers 13 are attached to the rod 14 which may be manually actuated or may be driven by any appropriate actuator not seen. Each shaft 12 is carried by a plate 12′ located between two of the plates 9 midway of the height of the respective basket of plates, the end portions of each plate 12 being penetrated by rods 11 for giving the respective shaft 12 an effective anchorage in the respective basket of plates. Rod 14 is preferably timed to be actuated at definite intervals ranging say from two to five minutes or more, according to the nature of the pulp being treated, each actuation of the rod consisting of a forward thrust and a return thrust, and since it is only desirable to swing the settler plates from a horizontal to a vertical position and to leave them in a vertical position only for a brief time sufficient for discharge of the settled coagulated solids, and then to restore the settler plates to their horizontal position and leave them in such horizontal position for a time sufficient for purposes of settling, the timing of the actuations of rod 14 will be consistent with such operations.

A flexible baffle or flap 15, preferably of canvas, is attached to the lower plate of each settler, the lower edge of the flap resting on the settled ore and the conveyer, allowing the scrapers to pass under the canvas. This baffle directs the replacing fluid entering from the preceding compartment 7 beneath the respective partition 8 upward and between the plates. The replacing fluid is also baffled by the extension 16 of the top-most plate of each basket of settler plates, which prevents the fluid from passing over and around the outside of the settlers instead of between the plates. Similar settlers and flexible baffles are arranged in the compartment 5 for clarifying the solution before discharging. The last-named settlers are turned through ninety degrees by drawing up the rod 24 engaging the levers 25 of said settlers. The preferably canvas baffles 15′, which depend from the lower end of the lower basket of settlers in compartment 5 engage the hopper bottom of the compartment so that the liquid is directed through between settler plates and prevented from passing around them.

Each of the partitions 8 terminates above the bottom of the tank 1 and leaves the lower portion of the tank a passage-way for materials and solutions, with which passage-way the lower ends of the several compartments 8 are in free communication. An endless conveyer chain 17 is arranged with its lower lap extending along the passage-way beneath the several compartments 7, the conveyer being sustained in the tank by the bottom thereof and guided by appropriate wheels or pulleys 18, 18, one of the pulleys 18 being actuated by a driving belt 19 for moving the conveyer 17. Scraper plates 20 carried by the chain 17 in position for engaging ore solids and dragging the same along the floor of tank 1 are designed to move solids along the tank to and discharge them into the hopper 2. During the course of such movement new surfaces of the solids are continually being exposed for affording access and the action of replacing fluid. Each of the several scrapers 20, as clearly indicated in Fig. 2, is preferably formed of spaced sections so as to leave intervening openings. In Fig. 2, the dotted lines indicate the relative location of the sections of the next preceding scraper so that the sections of any two succeeding scrapers taken together make up a practically complete wall across the passage-way into which the scrapers extend, the sections of one scraper being located in the longitudinal planes of the conveyer not occupied by the sections of the next succeeding and next preceding scrapers. Other arrangements of scraper sections may be employed as found desirable according to the materials being treated. The passageway below partitions 8 is thus baffled by scrapers 20.

This process may be used for dissolving soluble material from insoluble material and then replacing with water the soluble values mixed with solids, in which case the solvent is fed at a point near the point designated for the supply of barren solution and the material to be dissolved may be fed at the point designated for the entrance of the pulp. In this case, the great advantage of bringing the more resisting portions of the soluble material into the area of the strongest dissolving fluid and the further advantage of completely utilizing the last traces of dissolving power in the dissolving fluid by its contact with fresh undissolved material is added to the replacement value as already explained. Another valuable feature of the process is that the solutions may be discharged with a high degree of soluble contents due to the positive movement of the replacing fluids in one general direction which prevents any large weakening of the strength of the original solution by the intermingling of the replacing solutions of less dissolved contents.

In operation, pulp is supplied as, for instance, through a pipe 21 to one of the compartments 7 toward the rear end of the tank. Barren solution is supplied as through pipe 22 to one of the compartments 7 toward the front of the tank 1, and wash water is supplied through pipe 23 to the compartment immediately above the discharge hopper 2. The barren solution is, of course, the solvent solution substantially free from dissolved metals, and the wash water is the cleansing fluid employed for replacing in the solids

barren solution therein for preventing loss of such solution with the tailings. It is to be observed that between the point of intake of pulp and the point of intake of water, the body of barren solution acts as a buffer zone preventing passage of value bearing solution to the tailings discharge end and likewise preventing water from mixing with the value bearing solution.

The operation is, of course, a continuous one, the barren solution being supplied in quantities sufficient for insuring a countercurrent of replacing solution traveling along the passage-way beneath partitions 8 toward the clarifying compartment 5, while the solids are advanced in the opposite direction by the action of the conveyer 17. Wash water is supplied in quantities sufficient to replace the barren solution. The scraper plates 20 in dragging the solids along the floor of the tank 1 cause portions thereof to be agitated sufficiently to rise in suspension, and, to prevent travel of such suspended solids along with the countercurrent, the compartments 8 are provided, into which the suspended solids rise and are confined against further rearward progress, and given an opportunity for settling. When the settler apparatus is used, the solids settling thereon are allowed to become sufficiently coagulated to descend rapidly before being released or discharged, so that when discharged such solids quickly find their way down to the bottom of the tank, and are moved along such bottom with the main portions of solids. Any given particle of solid may become suspended and then coagulated and settled with other solids, and again suspended and so on repeatedly, but an advance is made each time and retrogression is almost impossible, and quite impossible to any extended degree, so that eventually even the light solids will be caused to arrive at the discharge hopper.

The improved process will be understood from the operation above stated and is characterized by movement of the pulp in contact with replacing fluid and in a counter direction while moving the fluid in the opposite direction, the flow of the fluid being baffled in a manner producing two essential effects consisting of, first, confining the channel at such frequent intervals as to largely or almost entirely prevent diffusion backward to the intake of the fluid; and, second, forming non-advancing or slowly advancing compartments of replacing fluid in which the solids rising in suspension under the action of the scrapers are induced to settle and may be returned into the main moving mass of pulp solids close to or at the point from which they rose in suspension, so that while parts of the slimes will naturally rise into suspension they will not to any great extent be carried along with the current of replacing fluid, and such particles as are carried therewith will not pass many of the compartments before again being lodged in the main mass of advancing pulp solids.

The process may be carried on without the settling plates but the latter increase the capacity of a tank of a given size. Other forms of settler surfaces may be used.

The expansion occurring in the rear of each partition 8 as the solutions pass beneath the partition and enter the next compartment enables the solutions to move more slowly within each compartment than at the points beneath the lower edge of each partition between the compartments, whereby a better opportunity is provided for settling of solids in the slowly moving solutions in each compartment, such as would not be afforded if the solutions moved at all points with the velocity manifested immediately beneath the lower edge of each partition. The travel of the solutions along the column of solutions toward the rear thereof, will occur with movements relative to each compartment such as are indicated by the arrows applied to a few of the compartments in Fig. 1 of the drawing. The baffles 15 prevent a direct travel of the more rapidly moving solutions across the lower part of compartments 7 between partitions 8. It will, of course, be understood that while the velocity of the current has been referred to, the movement at any point will be slow since the general movement of solutions must be sufficiently slow as not to cause the carrying of any large amounts of solids onward to the final compartment 5, and at the same time, the movement of the solutions will be as rapid as consistent with this result, to which end the provision of the settler baskets materially adds since coagulated settled solids may descend from the surface of said baskets through a current of solutions without being carried away thereby when suspended solids would be carried by such current.

In the practising of the improved process, it is not of vital importance that the only opening between partitions should be the opening through which the conveyer passes but one of the important phases of the process is that the area of discharge from one compartment to the next shall be sufficiently restricted to insure that the fluid advances through whatever openings are provided in the proper direction so that there shall be no back-flow or as little as possible.

What I claim is:

1. In a process of replacing solvents in pulps, advancing solids and replacing fluid counter to and in contact with each other while retarding the advance of upper portions of the fluid.

2. In a process of replacing solvents in

pulps, advancing solids and replacing fluid counter to and in contact with each other while retarding the advance of upper portions of the fluid, settling suspended solids in such upper portions and returning the suspended solids to the advancing solids.

3. In a process of replacing solvents in pulps, moving portions of a body of replacing fluid relatively quickly in one general direction, and moving other portions of the same body of fluid relatively slowly in the same general direction, while moving solids in the body of fluid in a general direction counter to the general movement of the fluid.

4. In a process of replacing solvents in pulps, advancing solids and replacing fluid counter to and in contact with each other while retarding the advance of upper portions of the fluid, settling suspended solids in vertically spaced layers and returning the said layers of solids to the advancing solids.

5. In a process of replacing solvents in pulps, advancing solids and replacing fluid counter to and in contact with each other while retarding the advance of the fluid at its surface.

6. In a process of replacing solvents in pulps, advancing solids and replacing fluid counter to and in contact with each other while retarding the advance of the fluid at the surface thereof and down to the lower portions of the fluid.

7. In a process of replacing solvents in pulps, advancing solids and replacing fluid counter to and in contact with each other while preventing direct advance of upper portions of the fluid.

8. In a process of replacing solvents in pulps, moving the replacing fluid and solids of a body of replacing fluid and solids counter to and in contact with each other while restricting the flow of the fluid at spaced intervals.

9. In a process of replacing solvents in pulps, moving the replacing fluid and solids of a body of replacing fluid and solids counter to and in contact with each other while restricting the movement of the fluid at spaced intervals, laminating the fluid between the points of restriction and directing the unlaminated fluid into the laminations.

10. In a process of replacing solvents in pulps, moving the replacing fluid and solids of a body of replacing fluid and solids counter to and in contact with each other, laminating the body at spaced intervals, and directing the unlaminated fluid into the laminations.

11. In a process of replacing solvents in pulps, moving the replacing fluid and solids of a body of replacing fluid and solids counter to and in contact with each other, the solids being moved in the form of a settled mass, laminating the fluid at spaced intervals, directing the unlaminated fluid into the laminations, settling solids in the laminations, and returning such settled solids to the mass of settled solids.

12. In a process of replacing solvents in pulps, delivering pulp to a body of replacing fluid, moving the solids of such pulp along the body of fluid toward a point of discharge, and advancing the fluid counter to the movement of the solids while retarding the advance of portions of the fluid.

13. In a process of replacing solvents in pulps, advancing solids and replacing solution counter to and in contact with each other while maintaining a substantially non-advancing area of replacing solution communicating with the advancing solution, and directing light solids rising in the advancing solution into the non-advancing area.

14. In a process of replacing solvents in pulps, settling solids from slimes, moving these solids in one direction in replacing fluid, moving replacing fluid in a contrary direction, and retarding portions of the advancing fluid to permit settling of the solids.

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

GEORGE MOORE.

Witnesses:
E. G. HOAG,
L. H. MOORE.