J. D. DARLING.
MEANS FOR EFFECTING AQUEOUS SEPARATION.
APPLICATION FILED JUNE 9, 1904.
3 SHEETS—SHEET 3.

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MEANS FOR EFFECTING AQUEOUS SEPARATION.

No. 795,823.


Applications filed June 9, 1864. Serial No. 211,781.

To all whom it may concern:

Be it known that I, JAMES D. DARLING, of No. 4526 Greenway avenue, Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Effecting Aqueous Separation, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to an apparatus by the use of which I am able to effect the separation of certain pulverized or finely-divided substances from others with which they are mingled. It is especially applicable to the separation from the pulverized mixture containing them of those substances which have a peculiar disposition to associate themselves with oil. By reason of this disposition if such a pulverized mass be combined with a proper quantity of oil and then placed within the hereinafter-described apparatus and water be run through the apparatus, as hereinafter described, the mixture of the oil with that particular substance with which it associates will be separated from the other substances contained in the mixture. The separation is accomplished by an apparatus which is adapted to maintain the mass in aqueous suspension in a moving body of water with the interposition of a foraminite partition across the path of the water upon the side of the suspended mass toward which the current flows.

I have found that my apparatus is well adapted to the separation of carbonaceous materials from a pulverized mass with which they may be commingled—as, for example, the separation of graphite from the pulverized graphic ore in which it occurs; but my apparatus is applicable generally to the separation of all these substances which exhibit the peculiar quality of associating with oil, to which I have already made reference. It is also useful for the separation of quite different materials, including fibrous material—as, for example, for separating old paper-stock from the impurities with which it is mingled.

The apparatus comprises a receptacle with means for automatically regulating the inflow and outflow of water therefrom in such a way as to maintain the water therein at a constant level, notwithstanding a constant outflow; a stirring and disintegrating apparatus by means of which the aqueous suspension of the mass to be operated upon is effected; a foraminite partition upon that side of the receptacle, preferably the bottom, toward which the flow of the water takes place, whereby part of the suspended mass is prevented from being carried along with the current of water passing through the partition, while part of it, consisting of different material, is thus carried off and separated from that which remains, and a propelling apparatus by means of which the mass to be separated is constantly driven in opposition to the flow of the current of water away from the foraminite partition, and thus prevented from clogging it up. I have further provided means whereby the regulation of the inflow and outflow of the water is automatically controlled, so as to maintain equal pressure throughout the receptacle, notwithstanding the temporary clogging effect which may occur at the upper surface of the foraminite partition.

In the accompanying drawings I have shown and will describe a convenient example of a machine embodying my improvements, it being, however, understood that my invention is not limited to the particular apparatus thus described.

Figure I is a plan sectional view of such a machine, taken on the line I I in Fig. III. Fig. II is a side elevation of the same. Fig. III is a vertical central section of the same along the line III III of Fig. I.

1 1 are the standards of the machine.
2 is a cylindrical receptacle which is fitted with a conical bottom 3, united to the receptacle by an edge flange 4, meeting the corresponding flange 5 around the lower edge of the receptacle. Horizontally supported within the receptacle near the bottom is a spider frame 6, fitted centrally with a bearing 7 for a vertical shaft 8. Fitted to this shaft near its lower end is a pair of horizontal arms 9 9, provided with upwardly-extending teeth 10. Surrounding the shaft 8 is a sleeve 11, which similarly carries a pair of horizontal arms 12, provided with downwardly-extending teeth 13, so spaced as to intermesh with the teeth of the lower arms 9. The shaft 8 and sleeve 11 are driven in opposite directions by the paired bevel-gearing shown in the drawings and which needs no detailed description.

Immediately above the spider frame 6 is a perforated plate 15, resting upon the arms of the frame, and upon the perforated plate rests a fine-wire screen 16—say about seventy mesh. The edges of the perforated plate 15 and of the screen 16 may be secured between the flanges 4 and 5, with a gasket 17 surrounding them.

To the shaft 8 are secured, in addition to the
arms 9, two propeller-blades 20. These may be approximately in the plane of the arms 99. They must of course be in such position as to be free from contact with the teeth of the arms 12. These blades have their sides inclined, so that as the shaft 8 rotates they tend to drive the contents of the receptacle away from the screen and perforated plate.

The receptacle 2 is fitted with an opening 21, closed by a sluice-valve 22 just above the level of the screen.

23 is a feed-pipe by which water may be fed continuously into the receptacle from above. It is controlled by a hand-valve 26 and also by an automatic valve 27, the lever of which is pivotally connected with a float 28, rising and falling within the stand-pipe 29, which is attached to the side of the receptacle and which at its bottom communicates by a pipe 30 with the interior of the receptacle above the screen.

From the bottom of the receptacle leads the exit-pipe 32, controlled by a hand-valve 33. This pipe is also controlled by an automatic valve 34, the lever of which is pivotally connected to a link 35, which is pivoted to an upward rod 36, carrying at its upper end a cross-piece 37, from which depends a rod 38, which carries a float 39. This float rises and falls within a stand-pipe 40, which at its bottom communicates by a pipe 42 with the exit-pipe 32.

45 is a glass gage-tube fitted to the side of the receptacle and communicating at its bottom with the interior of the receptacle below the screen.

I will describe the operation of this apparatus, instancing its employment for the purpose of separating graphite from its pulverized ores. A mass of pulverized graphite ore is mingled with petroleum and placed within the receptacle. Water is admitted by the pipe 25 until the receptacle is nearly full. The stirring-arms and propeller-blades are set in rotation, and as soon as sufficient water has passed down through the screen to fill that portion of the receptacle which is below the screen and establish hydrostatic pressure from the bottom to the top of the receptacle the outflow of water through the pipe 32 is permitted. The stirring-arms and propeller-blades by their combined action maintain the mass in aqueous suspension. As the water passes constantly down through the suspended mixture of petroleum and graphic ore the gangue is washed out of the mixture and down with the current through the pipe 32, while the mingled petroleum and pure graphite forms a more and more homogeneous mass of buttery consistency which does not pass through the screen. After the gangue is all washed out the flow of the water is shut off and the remaining mixture of oil and pure graphite is removed at the opening 21.

For the proper operation of the process it is essential that the free flow of the water through the foraminate partition shall be maintained, and to this end it is necessary to maintain uninterrupted hydrostatic pressure throughout the receptacle both above and below the partition. If the partition becomes temporarily clogged, it will sometimes happen that the water runs out below it more rapidly than it can pass through, with the result that the supporting body of water below the screen is lost, so that the entire weight of water above the screen suddenly tends to press the solid contents of the receptacle against the screen with a more or less complete clogging of it, requiring a loss of considerable time before the proper continuance of the process can be secured. In order to avoid this contingency, the automatic regulating devices which have been described are provided. The moment that the proper hydrostatic pressure below the screen is lost the water begins to fall in the stand-pipe 40, causing the float 39 to drop, which immediately completely shuts off the further outflow of water, the pipe remaining closed until sufficient water has passed through the screen to restore the normal pressure to cause the level in the stand-pipe 40 to coincide with the water-level in the receptacle. At the same time the stand-pipe 29, which communicates with the receptacle above the screen and which consequently always maintains the same water-level as that in the receptacle, regulates automatically the inflow of water, so that when the receptacle is properly filled the further inflow is stopped until the water is flowing through at the normal rate. As long as the current of water passes through the partition freely the inflow and outflow should be maintained as nearly equal as possible, and the hand-valves 26 and 33 are adjusted so as to attain this end.

The propeller-blades are an important aid in preventing the clogging of the apparatus. They tend to constantly drive the solid material in the receptacle upward from the partition and by the suction beneath them maintain the screen free for the passage of the water.

Having thus described my invention, I claim—

1. An apparatus for effecting aqueous separation which consists of a receptacle; a water inlet and outlet to the same with means for regulating the flow of both; a foraminate partition interposed within the receptacle on the side toward which the water flows; an agitating apparatus within the receptacle on the side of the partition toward which the water enters; and propeller-blades in proximity to the partition by the rotation of which the material in the receptacle may be constantly driven away from the partition in opposition to the flow of the current, substantially as set forth.

2. In an apparatus for effecting aqueous separation, the combination of a receptacle;
an inlet and outlet whereby a constant current of water is maintained through the receptacle; means for maintaining the water in the receptacle at a predetermined height; a foraminite partition interposed within the receptacle; and means for constantly propelling the solid contents of the receptacle away from the foraminite partition in opposition to the flow of the current, substantially as set forth.

3. In an apparatus for effecting aqueous separation, the combination of a receptacle; a water-supply pipe at the top thereof; an exit for the water at the bottom thereof; a horizontal screen interposed across the receptacle; and a propeller apparatus mounted on the upper side of said screen which by its rotation drives the contents of the receptacle up from the screen against the downward current of the water, substantially as set forth.

4. In an apparatus for effecting aqueous separation, the combination of a receptacle; a water-supply pipe at the top thereof; an exit for the water at the bottom thereof; a horizontal screen interposed across the receptacle; and an automatic valve for regulating the outflow of the water controlled wholly by the pressure of the water which has passed through the screen, whereby upon the failure of the current to maintain an equal pressure both above and below the screen, the outflow of the water is automatically shut off, substantially as set forth.

5. In an apparatus for effecting aqueous suspension, the combination of a receptacle; a foraminite partition interposed across it; a water-supply pipe at the top; an exit for the water at the bottom; a stand-pipe with a float communicating with the exit; and a valve for regulating the outflow operated by said float, substantially as set forth.

6. In an apparatus for effecting aqueous separation, the combination with a receptacle; means for permitting the inflow and outflow of water to and from the receptacle; a foraminite partition interposed across the receptacle between the points of the inflow and outflow of the water; and automatic means whereby the inflow of the water is regulated according to the pressure of the water above the partition; and automatic means whereby the outflow of the water is regulated according to the pressure below the partition, substantially as set forth.

In testimony whereof I have hereunto signed my name, at Philadelphia, in the State of Pennsylvania, this 4th day of June, 1904.

JAMES D. DARLING.

Witnesses:

JAMES H. BELL,
E. L. FULLERTON.