E. WAGNER.

OIL FLOTATION CONCENTRATION PROCESS.

APPLICATION FILED MAY 7, 1913.

1,235,083. Patented July 31, 1917.

Fig. 1.

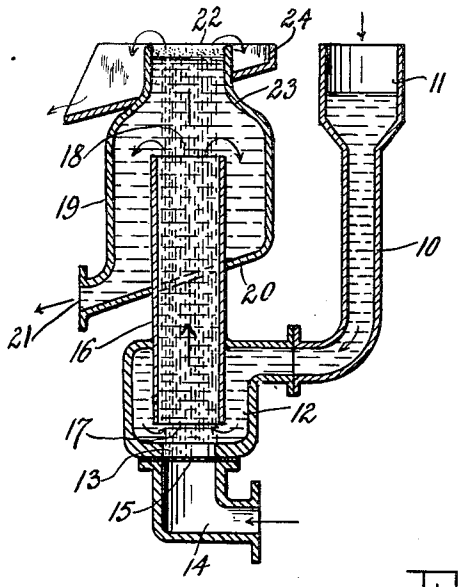


Fig. 2.

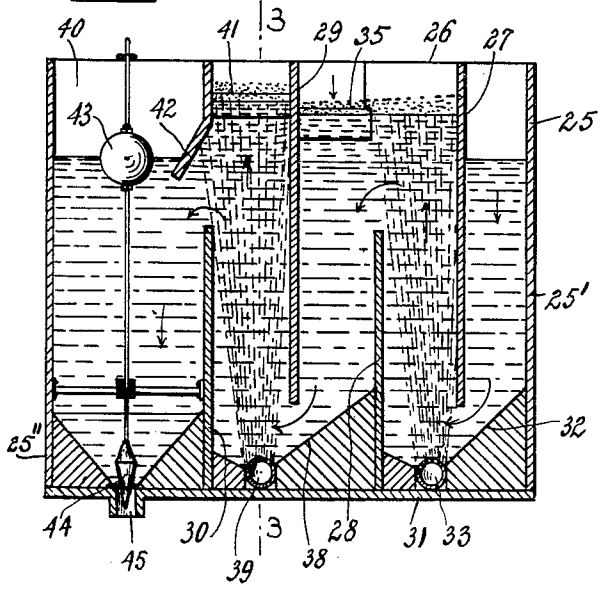
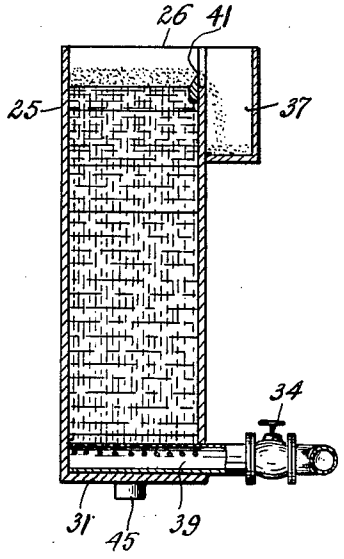


Fig. 3.



WITNESSES

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OIL-FLOTATION CONCENTRATION PROCESS.

1,235,083. Specification of Letters Patent. Patented July 31, 1917.

Application filed May 7, 1913. Serial No. 766,127.

To all whom it may concern:

Be it known that I, EMANUEL WAGNER, a subject of the King of Hungary, and resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Oil-Flotation Concentration Processes, of which the following is a specification.

The present invention relates to an improvement in concentration processes, or in other words to a method for separating the minerals from the containing gangue. More particularly the invention pertains to an improvement in the oil flotation concentration process which utilizes that peculiarity or characteristic of the mineral oils, or similar substances, which causes them, when mixed with ore in ground state, to adhere and cover the particles of minerals, but not the gangue. The mineral particles thus coated with a film of oil are rendered buoyant, that is to say they have a tendency or power to float in and on water or pulp, notwithstanding the fact that their specific gravity is greater than that of the water or pulp. It is a well known fact that the separation of minerals can be easier effected if the pulp containing the same is charged with air or gas bubbles, inasmuch as the bubbles of the air or gas in the pulp, in meeting the coated minerals or free oil particles, are covered with a film of oil, to which the mineral also adheres, thereby rendering the mineral buoyant, whereby it is brought to the surface.

Heretofore, as far as known, the air or gas bubbles were introduced into the pulp by chemical action, their size and carrying capacity being enlarged by the application of vacuum. Another way to introduce the air or gas bubbles into the pulp was to beat air into the pulp by quickly rotating propellers. According to another method the ore pulp is brought into contact with a porous medium through which air or other gas is caused to pass.

The main objects of the present invention are to render the above mentioned process more effective, to simplify the introduction of air or gas bubbles into the pulp, and to predetermine the size of said bubbles so as to impart to them the maximum carrying capacity.

With these and other objects in view, which will more fully appear as the nature of the invention is better understood, the same consists in the process hereinafter fully described and pointed out in the appended claims.

Broadly speaking, the process consists in introducing compressed air in a finely divided or disseminated state at the bottom of an ascending pulp current containing the coated mineral to be separated, permitting the minerals to overflow on top of the current or column, and discharging the gangue below the overflow of the concentrates.

Two of the many possible apparatus for carrying out the process are illustrated in the accompanying drawings, in which:—

Figure 1 is a central vertical section taken through such an apparatus; Fig. 2 is a similar section taken through a modified device; and Fig. 3 is a section taken on line 3—3 of Fig. 2.

Referring now more particularly to Fig. 1 of the drawings, the numeral 10 indicates a pulp feed pipe which is provided at its upper end with a hopper-like enlargement 11, and leads to a compartment 12, having an aperture 13 in its bottom, which communicates with an air chamber 14. The aperture 13 is covered by a perforated plate 15, its perforations or openings being of sizes best suited to the purpose. Into the compartment 12 extends a separating chamber 16, the lower open end 17 of which is disposed at a distance above the perforated plate 15, while its upper open end 18 projects into a compartment 19, having a slanting bottom 20, that is arranged below the upper end 18 of the separating chamber. The compartment 19 is provided with an outlet 21 at or near its bottom. The upper section of the compartment 19 is contracted, an opening 22 being formed in its top which is arranged in registering position with the upper end 18 of the chamber 16. In contracting the upper end of the compartment 19, a conical portion 23 is provided above the upper end 18 of the chamber 16 for a purpose hereinafter to be described. A launder 24 is formed around the contracted section of the compartment 19, into which the concentrates flow over the top of said compartment.

The operation of this device is as follows: The pulp which has been treated with oil, with the result that the particles of minerals

therein are coated with oil, is led into the hopper 11 and carried by the feed pipe 10 into the compartment 12. Compressed air is forced into the chamber 14, from which it passes through the small perforations in the plate 15 upward into the separating chamber 16. It is obvious that in order to obtain a good separation, the air or gas bubbles must be small so that they can be easily covered with a film of oil, thereby transforming them, as it were, into balloons. The upward flow of the pulp in the separating chamber 16 is started mainly by the action of air which is admitted thereto, forming an air lift of comparatively small velocity, the upward flow being, of course, materially aided by the head of the liquid between the inlet and outlet.

The air meets the bottom of the ascending pulp current, the maximum size of the bubbles being effectively controlled by the pressure of the air and the sizes of the openings in the perforated plate. Eddy currents which would interfere with a proper separation are avoided, inasmuch as the directions of the flow of the pulp and air coincide, that is to say, both rise upward, the air naturally rising faster than the pulp traveling in the same direction. Inasmuch as the pulp in the separating chamber and the compartment 19 contains air, its specific gravity is smaller than that of the pulp in the feed pipe 10, and for this reason the level of the pulp in the compartment 19 will be higher than that in the feed pipe 10. The oil coated mineral particles, aided by the oil coated air bubbles, rise to the level of the pulp in the compartment 19 forming foam or scum above said level, and flow over the edge of the said compartment into the launder, and are carried therefrom to a suitable place for further treatment. It is to be observed that the conical portion 23 of the compartment 19 guides the floating oil coated mineral to the surface of the pulp. The gangue being unable to rise above the level of the pulp, travels toward the bottom 20 of the compartment 19, where it is discharged through the outlet 21. The separating chamber 16 may be considered as an air lift, although the velocity of the upward flow therein is smaller than usual in air lifts. It is, however, sufficiently large to prevent even the coarsest gangue particles contained in the pulp from staying behind.

Referring now to Figs. 2 and 3 of the drawings, it is to be observed that the apparatus illustrated in these figures is substantially a multiplcation of the device hereinabove described. More particularly it consists of a receptacle 25, in the case shown in the drawings of oblong configuration, its top 26 being open. In this receptacle are arranged a plurality of partitions, denoted by the numerals 27, 28, 29 and 30. The partitions 28 and 30 extend from the bottom 31 of the receptacle toward its top, but stop short a considerable distance below said top. The partitions 27 and 29 extend from the top toward the bottom and stop short of said bottom. In this manner a circuitous passage is obtained constituting feed pipes and separating chambers, as will be hereinafter described. The first feed chamber is formed between the end wall 25′ of the receptacle and the partition 27. The properly prepared pulp, fed into this passage, is deflected by its inclined bottom 32 onto a perforated pipe 33, which extends throughout the width of the receptacle, compressed air being admitted into the same, which will in the manner above described act on the pulp while the latter is traveling upward in the separating chamber formed between the partitions 27 and 28. The admission of compressed air into the pipe is controlled by a valve 34. The concentrates flow over the edge 35 into a trough 37, the surface of the pulp in this latter chamber being higher than that of the pulp in the feed passage. The gangue unable to rise above the surface of the pulp enters the feed compartment formed between the partitions 28 and 29 and is guided by the inclined bottom 38 of this compartment onto a second perforated tube 39, and undergoes in the separating chamber formed between the partitions 29 and 30 a similar treatment until it is discharged as tailings into a compartment 40, which is formed between the partition 30 and the end wall 25″ of the receptacle 25. The overflow edge 41 in the last separating chamber is, preferably, adjustable and is set higher than the edge 35, inasmuch as the level of the pulp in the last separating chamber will rise higher than in the first separating chamber. A deflector 42, arranged above the partition 30, causes the oil coated mineral particles to take a course toward the overflow edge 41. The compartment 40 contains a float 43, which controls a valve 44, the latter being adapted to close the outlet 45. The purpose of this arrangement is to keep the level of the pulp constant. It is obvious that similar means may be used in connection with the device shown in Fig. 1 of the drawings.

The operation of this device is in all respects identical with the one shown in Fig. 1 of the drawings, the fact that a plurality of separating chambers are arranged in series does in no way change its mode of operation. In both of the apparatus described foam or scum composed of air bubbles covered with films of oil carrying the mineral is formed above the surface of the pulp in the separating chambers. The depth of this foam is controlled by the location of the deflectors 23 and 42, respectively, by the arrangement of the overflow edges, and,

of course, by the quantity of the air used. It depends more or less on the depth of the pulp column in the apparatus.

While herein two specific apparatus have been described for carrying out the process of the present invention, it is obvious that others may just as well be made use of, the invention lying mainly in the use of air in an upwardly flowing current of pulp as separating means, a layer of foam carrying the minerals being formed upon the surface of the pulp, the compressed air being furnished in a finely disseminated state to form bubbles acting as a lifting agent, the size of said bubbles being predetermined according to the requirements.

What I claim is:—

1. The process of concentrating ores which consists in mixing with the ore in ground state oil and water, introducing air under pressure into an ascending current of the pulp so formed, permitting the minerals to overflow on top of the current, and discharging the ascending gangue below the overflow and above the level of introduction of the air.

2. The process of concentrating ores which consists in mixing with the ore in ground state oil and water, introducing air bubbles of definite size under pressure into an ascending current of the pulp so formed, permitting the minerals to overflow on top of the current, and discharging the ascending gangue below the overflow and above the level of introduction of the air.

3. The process of concentrating ores which consists in mixing with the ore in ground state oil and water, introducing air under pressure at the bottom of an ascending current of the pulp so formed, permitting the minerals to overflow on top of the current, and discharging the ascending gangue below the overflow and above the level of introduction of the air.

4. The process of concentrating ores which consists in mixing with the ore in ground state oil and water, introducing air bubbles of definite size under pressure at the bottom of an ascending current of the pulp so formed, permitting the minerals to overflow on top of the current, and discharging the ascending gangue below the overflow and above the level of introduction of the air.

Signed at New York, in the county of New York and State of New York, this 2nd day of May, A. D. 1913.

EMANUEL WAGNER.

Witnesses:

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S. BIRNBAUM.