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MACHINE FOR CONCENTRATING THE HEAVIER AND VALUABLE PORTIONS OF ORE.

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1,241,861. Patented Oct. 2, 1917.

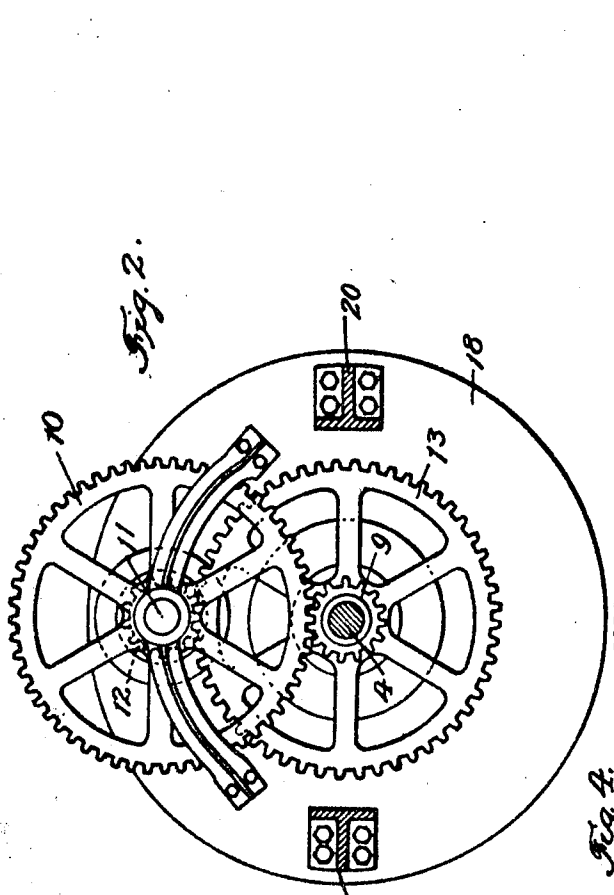


Fig. 2.

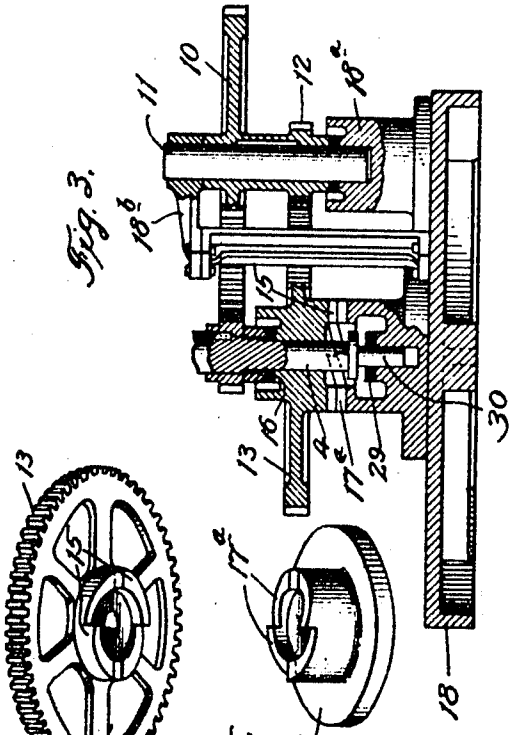


Fig. 3.

Fig. 4.

Fig. 5.

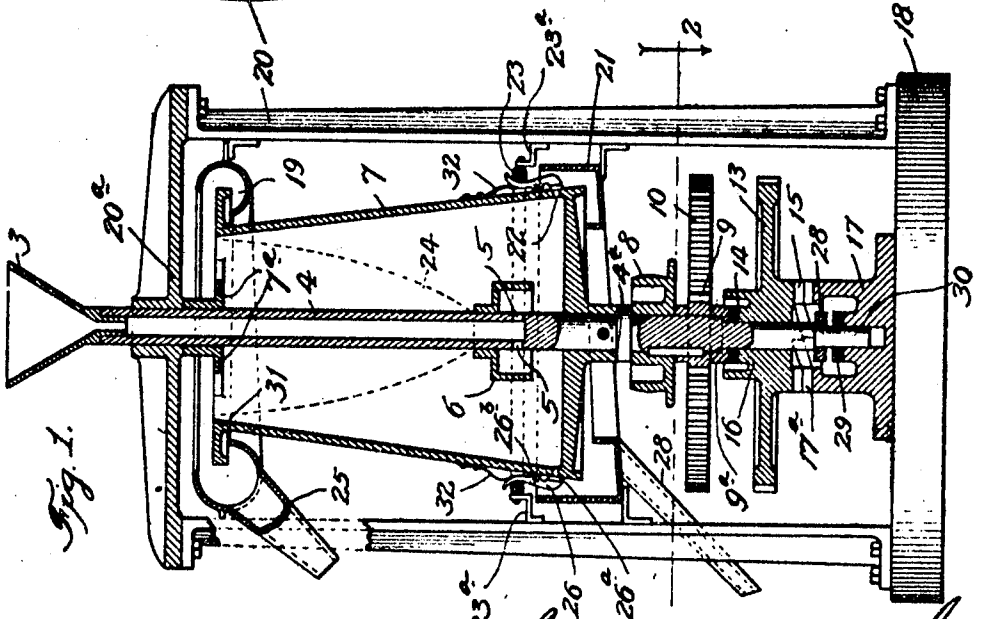


Fig. 1.

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MACHINE FOR CONCENTRATING THE HEAVIER AND VALUABLE PORTIONS OF ORE.

1,241,861. Specification of Letters Patent. Patented Oct. 2, 1917.

Application filed November 24, 1916. Serial No. 133,147.

To all whom it may concern:

Be it known that I, GEORGE I. LEONARD, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Machines for Concentrating the Heavier and Valuable Portions of Ore.

My invention relates, more particularly, to improvements in machines of the so-called centrifugal type.

As machines of this type have heretofore been constructed, the ore which is supplied to the machine in comparatively finely-ground condition and mixed with water to form a pulp, tends to pack after the machine has been operating a comparatively short length of time, preventing the heavier concentrates from penetrating the lighter particles of the mass, with the result that these valuable concentrates are washed out of the machine with the incoming ore.

My primary object is to provide a machine which may be operated continuously and wherein losses of concentrates from the above-referred to cause, are prevented; and other objects as will be apparent from the following description.

According to my invention I combine with the rotary motion of the receptacle, or bowl, into which the pulp to be concentrated is introduced and wherein the concentration is effected, a jarring or bumping action which jars the ore in the receptacle and produces sufficient agitation thereof to allow the heavier concentrates, by the centrifugal action, to work between the lighter particles, displacing the latter, and moving to the inner surface of the revolving receptacle, where these heavier concentrates gradually settle by gravity aided by the said jarring action so that the desired stratification, permitting the collection of the valuable concentrates is effected.

Referring to the accompanying drawings wherein I have shown a desirable form in which my invention may be embodied, Figure 1 is a view in sectional elevation of the apparatus. Fig. 2 is a section taken at the line 2 on Fig. 1 and viewed in the direction of the arrow, this view showing the reduction gearing for timing the jarring or bumping of the receptacle in which the concentrating operation is effected. Fig. 3 is a broken sectional side elevation of the construction shown in Fig. 2. Fig. 4 is a perspective view of a ratchet gear employed and forming a part of the mechanism of Fig. 3, the gear being viewed from its underside; and Fig. 5, a similar view of a ratchet and bearing socket coöperating with the ratchet of Fig. 4, this member being viewed from above.

The bowl or receptacle in which the concentration is to be effected, is represented at 7 and, as shown, is supported to extend in an upright position, on a shaft 4, this shaft being rotatably supported in the manner hereinafter described. The receptacle 7, which preferably is circular is cross-section and the walls of which converge upwardly as shown, is adapted to be driven in any suitable manner as through the medium of the belt pulley 8, this pulley being keyed to the lower end of the shaft 4 and fitting against a flange 4^a on this shaft. The shaft 4 is journaled at its upper end in a plate 20^a which surmounts standards or uprights 20 rising from the base 18, and extends through a cross-member 7^a at the top of the receptacle 7. The shaft 4 by preference is hollow from its upper end to a point slightly above the bottom of the bowl 7, as represented and contains laterally extending openings 5 opening into the interior of the bowl 7, a circular baffle device 6 being secured to the shaft 4. The upper end of the receptacle 7 which is open as indicated extends adjacent a trough member 19 of generally circular shape which surrounds the upper end of the bowl 7 and is provided with a discharge 25, this trough preferably inclining toward the discharge.

As a preface to the following description it may be stated that the ore to be operated on and which is preferably preliminarily evenly-ground and screened to approximately the same mesh and mixed with enough water to form a pulp which will run freely, is fed into a funnel 3 carried by and surmounting the upper end of the shaft 4 from which it descends into the hollow portion of the shaft 4 and discharges therefrom through the openings 5 into the lower part of the receptacle 7, the baffle 6 serving to prevent the water and ore mixture entering the receptacle with such force as to disturb the stratification of the particles of different weight in the receptacle under the action hereinafter described, and causing the pulp to be evenly distributed about the receptacle.

In the operation of the mechanism the receptacle 7 is rotated, it being rotated at any speed found suitable for the class of concentrating to be done, this depending upon

the specific gravity both of the heavier values and the lighter particles mixed therewith. As the receptacle 7 revolves the inner surface of the mass of pulp therein will assume a position, generally that shown by the sectional line 24 in Fig. 1, and as the pulp continues to be fed through the shaft 4 into the receptacle 7, the overflowing lighter particles of the ore together with the water will pass out of the top of the receptacle 7 and thence flow into the trough 19 from which they will flow through the discharge 25.

The centrifugal action produced by the above stated operation will throw the pulp to the walls of the receptacle and the concentrates, being the heavier, will have a tendency to displace the lighter particles of the pulp and occupy the space nearest the walls of the receptacle. Such a stratification would occur in the continued operation of the receptacle 7 even if given a smooth rotary motion were it not for the fact that the lighter particles of the gangue would pack so closely that the heavier particles of the incoming pulp could not penetrate these packed lighter particles, and thus both the heavier and light particles of the incoming pulp would simply wash over the inner surface of the mass of ore particles in the receptacle 7 and escape through the upper end of the receptacle.

According to my invention this packed condition of the lighter particles is prevented by reason of the jarring or bumping action to which the receptacle 7 is subjected as above stated, the following being a description of the mechanism which I prefer to employ for this purpose:

Keyed on the shaft 4 below the drive pulley 8 is a pinion 9 held in place by a collar 9^a which screws upon a threaded part of the shaft 4, this collar holding the drive pulley and pinion 9 clamped between it and the flange 4^a. The pinion 9 meshes with a gear 10 keyed to a shaft 11 mounted in a bearing 18^a on the base 18 and a bracket 18^b on this base. The shaft 11 also has keyed thereto a pinion 12 which meshes with an idler gear 13 journaled on the lower end of the shaft 4 below the pinion 9, the gear 13 carrying on its upper surface a thrust bearing 14 which, ordinarily, carries the weight of the revolving parts mounted thereabove on the shaft 4. The lower end 30 of the shaft 4 is journaled in a socket member 7, this socket member having a bearing plate 29 coöperating, as hereinafter stated, with a thrust plate 28 carried by the shaft 4. The gear 13 is provided on its under surface with a series of ratchet teeth 15, shown as four in number, though the number thereof may be varied as desired, and the opposing upper surface of the socket member 17 is provided with corresponding ratchet teeth 17^a.

In the rotation of the shaft 4, as above stated, the pinion 9 rotates the gears 10 and 12 which latter, by being in mesh with the gear 13, drives the latter. In the rotation of the gear 13, as stated, the ratchet teeth 15 ride upon the inclined portions of the ratchet teeth 17^a causing the shaft 4 and the parts carried thereby to be intermittently raised and lowered. The socket in the member 17 into which the portion of the shaft 4 extends and is journaled, is preferably so arranged that the lower end of this shaft will always be out of contact with the base of this socket, and the depth of the teeth 17^a is slightly greater than the distance between the thrust-bearing plate 28 and the bearing plate 29 when the gear 13 is in its uppermost position. Thus, when the teeth 15 of the gear 13 in riding upon the cam surfaces of the teeth 17^a pass beyond the extreme edges of the latter, the gear 13 together with the shaft 4 and all the parts carried thereby will drop under the weight thereof until the plate 28 engages the plate 29 thus producing a jar upon all of the parts carried by the shaft 4. The shaft 4 in the continued rotation of the gear 10 bears at the plate 28 and 29 until the extremities of the teeth 15 contact with the cam surfaces of the teeth 17^a, whereupon the shaft 4 and the parts carried thereby again rise and drop when these teeth disengage, as above explained, this operation continuing intermittently throughout the rotation of the receptacle 7.

It will be noted from the foregoing that when the gear wheel 13 drops, as above stated, it receives the shock only of the dropping of its own weight, as the bearings 28 and 29 are subjected to the heavy portion of the shock and a part of the revolution of the shaft, the shaft 4 and the parts supported thereon being carried by the gear 13 through the thrust-bearing 14 only when the teeth 15 are in contact with the teeth 17^a. The result of such an arrangement is that of providing a machine which while presenting the necessary jarring action for producing the desired results, is not liable to become impaired by continued use.

The effect of rotating the receptacle and imparting thereto a jarring action, preferably once every one-half to one second, is to maintain the solid portions of the pulp in such a degree of agitation that the heavier concentrates may, under the centrifugal action break their way therethrough until they reach the wall of the receptacle 7 where, under the action of gravity augmented by the jarring action produced, they settle down into the lower corners of the receptacle, thus producing the desired stratification of the different particles of the pulp.

It is desired that the heavy concentrates or values be withdrawn periodically from

the receptacle 7 after concentration therein, without interrupting the operation of the latter, and for this purpose I prefer to provide the mechanism shown and of which the following is a description: The wall of the receptacle 7 adjacent to the bottom of the latter contains a series of holes 22, in number, according to the requirements, and coöperating with these holes are buttons 26[a] attached to short lever arms 26 which are journaled between their ends on the outer surface of the receptacle 7 as indicated at 26[b], the upper ends of these levers coöperating with springs 32 which normally hold the buttons 26[a] in seated position over the openings 22. The upper outwardly-facing portions of the levers 26 are curved as indicated and run freely at the inside of a ring 23 supported on brackets 23[a] secured to the uprights 20, the outer extremity of the curved portions of these levers projecting outwardly beyond the vertical plane in which the innermost edge of the ring extends. The levers 26 and ring 23 are so disposed relative to each other that when the shaft 4 is in uppermost position the ring 23 will be out of engagement with the out-turned ends of the levers 26 and the springs 32 will hold the openings 22 closed, but when the shaft 4 and the receptacle 7 drop as hereinbefore explained, the outwardly-turned ends of these levers will ride against the ring swinging these levers against the action of the springs 32 and unseating the buttons 26[a], thus freeing the openings and permitting portions of the concentrate lying in the receptacle at the openings, to discharge therethrough, the machine being preferably provided with a trough 21 which inclines downwardly to a discharge spout 28 and which serves to intercept, and to discharge through the spout 28, the concentrates discharged from the receptacle 7 through the openings 22 as stated.

While I have illustrated and described a particular embodiment of my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention, it being my intention to claim my invention as fully and completely as the prior state of the art will permit.

What I claim as new and desire to secure by Letters Patent, is:

1. In a concentrating machine, the combination of a rotating receptacle, means for imparting a movement to the receptacle at an angle to the plane of its rotation, means for feeding into the receptacle the pulp to be concentrated, said receptacle containing openings in its lower portion, valves controlling the opening and closing of said openings, means for intermittently opening said valves, and means operating in timed relation to the movement of said receptacle at an angle to the plane of its rotation, for intermittently opening said valves.

2. In a concentrating machine, the combination of a rotating receptacle, a hollow shaft upon which said receptacle is mounted, said shaft containing orifices opening therethrough into the receptacle near the bottom of the latter for admitting into said receptacle, pulp introduced into the upper end of said shaft, said shaft being movable up and down, ratchet means coöperating with said shaft for producing up and down movement of the latter to effect the jarring of the receptacle, means for constantly discharging the waste-product from said receptacle, said receptacle containing orifices in its lower portion, valves controlling said orifices, and means operating intermittently and simultaneously with the said jarring action for discharging the concentrates through the orifices in said receptacle.

GEORGE I. LEONARD.