June 3, 1930. R. LORD 1,761,136

MINERAL FLOTATION APPARATUS

Filed Sept. 1, 1926 2 Sheets-Sheet 1

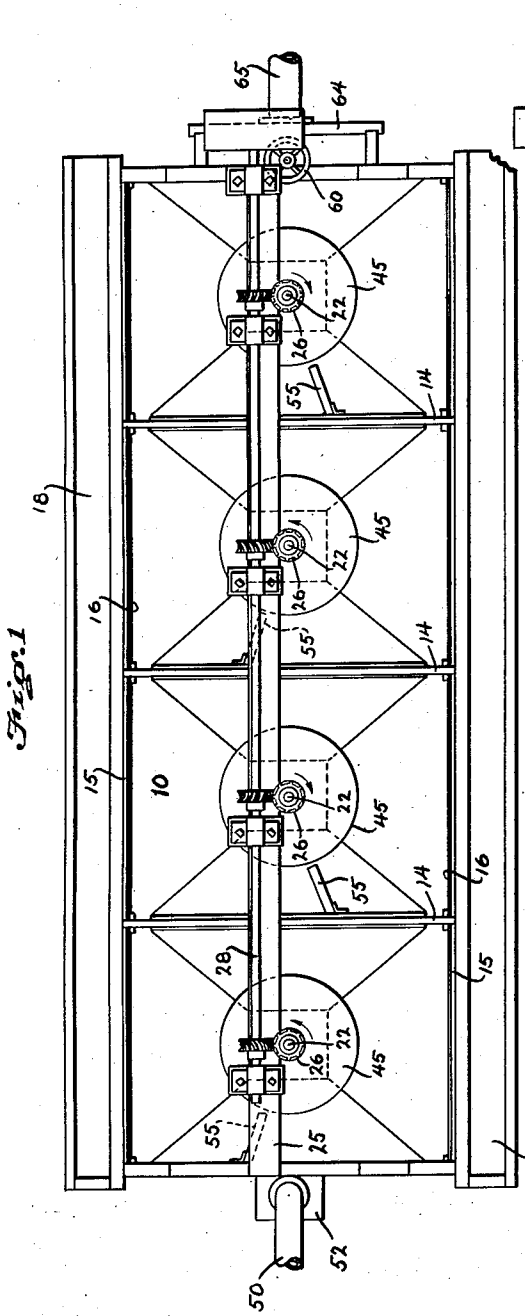


Fig. 1

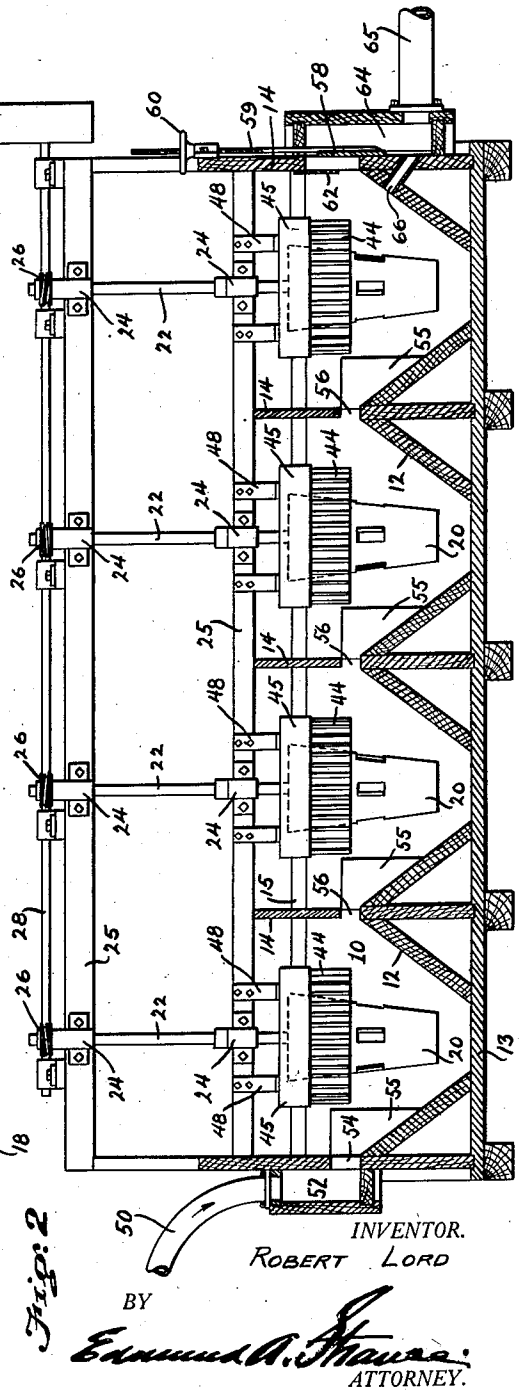


Fig. 2

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Filed Sept. 1, 1926 2 Sheets-Sheet 2

Fig. 3

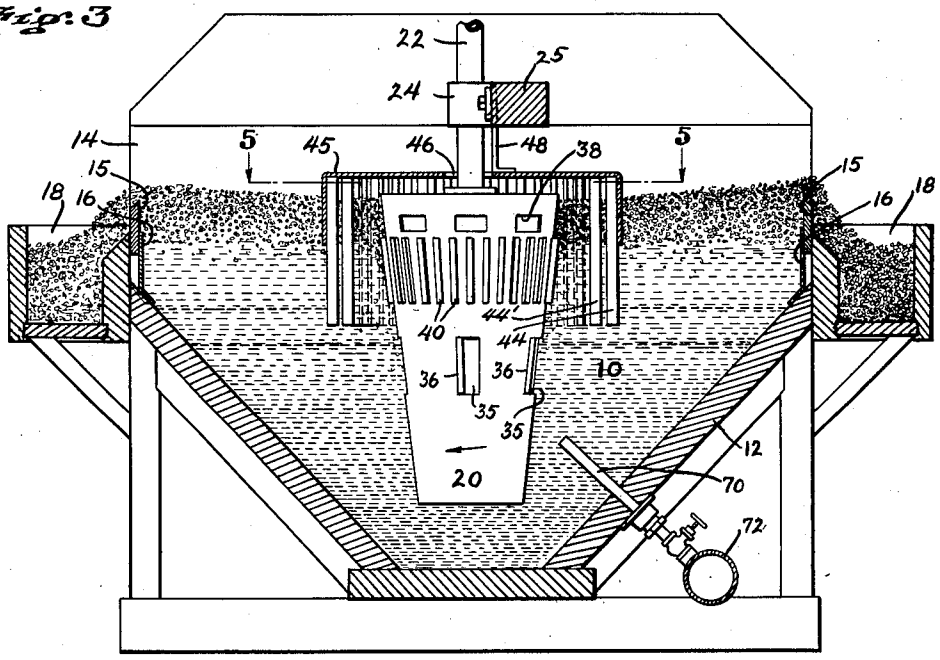


Fig. 4

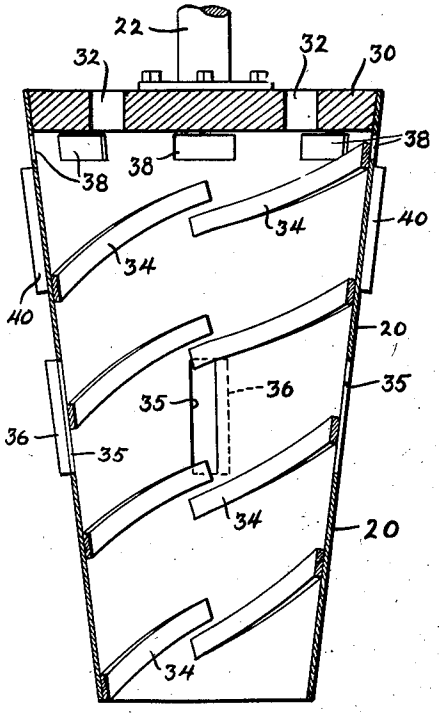
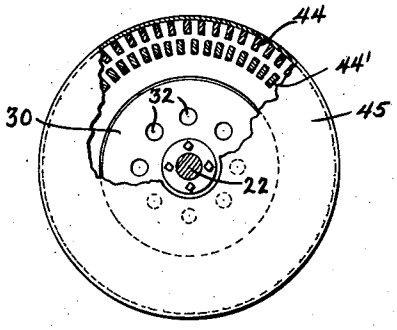


Fig. 5



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UNITED STATES PATENT OFFICE

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MINERAL-FLOTATION APPARATUS

Application filed September 1, 1926. Serial No. 132,962.

This invention relates to that type of mineral flotation machines wherein a rotary aerator is employed for the purpose of agitating the pulp and mixing air therewith to cause separation of the values.

The object of the invention is to provide such a device wherein the rotary aerator will produce the maximum diffusion of air through the pulp for the most efficient recovery of the sulfide values contained therein, and wherein such aerator may be employed in a simple tank without the necessity for partitions and other complications aside from some means to arrest the froth and to prevent surging.

Briefly, the invention resides in a frusto-conical hollow aerating rotor whose smaller open end depends in the pulp container and whose upper end carries an apertured head having a driving shaft connected therewith. This aerator is provided with lower and upper slots, and interiorly with a series of broken spiral riffles which assist in elevating the pulp, while its exterior is provided with series of preferably vertical riffles which promote agitation and aeration. During high speed rotation of the aerator air which is drawn through the apertures in the head, is thoroughly mingled with the whirling pulp rising on the interior of the rotor, the aerated mixture being discharged through the slots. Series of stationary baffles, preferably arranged in staggered relation, are vertically disposed around the upper portion of the rotor and extend both above and below the pulp level to arrest the froth being hurled from the rotor, to break said froth into streams and cause entrainment of additional amounts of air. Working in conjunction with the aerator, there is a stationary baffle which is placed below the pulp level on a cell wall and at an angle thereto for the purpose of deflecting the rotating pulp body toward the rotor and prevent surging of the pulp and froth. The invention resides further in the various features and details of construction and in the combinations and arrangements of parts herein set forth.

In the accompanying drawings wherein one embodiment of the invention is disclosed by way of illustration,

Fig. 1 is a plan view of a four cell flotation machine equipped with the invention;

Fig. 2 is a longitudinal vertical section therethrough;

Fig. 3 is a cross section through one of the cells;

Fig. 4 is a vertical section through the aerator, and

Fig. 5 is a horizontal view taken approximately on the line 5—5 of Fig. 3.

The apparatus shown comprises a plurality of cells 10 each of which has inclined lower walls 12 converging toward the bottom 13, adjustable side walls 15 working in guides 16 being provided for determining the level of the froth overflowing into the launder 18.

In each of the cells there is mounted one of the aerating rotors 20 of the present invention, this rotor being frusto-conical in form and depending into the pulp with its smaller end open and directed downward. Said rotor 20 is supported by a drive shaft 22 mounted in bearings 24 on timbers 25 and driven by means of gearing 26 from a line shaft 28. The shaft 22 is fixed to a head 30 mounted in the larger and upper end of the rotor 20, whereby the rotor is supported and driven. The head 30 is apertured at 32 for the admission of air to the interior of member 20 to mingle with and be entrained by the swirling and discharging pulp.

The interior of the aerator 20 is provided with a series of broken riffles 34 spirally arranged from bottom to top thereof which riffles serve to assist elevation of the pulp. A portion of the pulp is discharged through a series of vertically disposed slots 35 arranged at about the middle of the aerator and having vertically disposed riffles 36 adjacent their edges on the outside of the aerator and at that edge of each slot which is in the direction of rotation of the aerator. The rest of the pulp rises on the interior of the aerator with the assistance of the spiral riffles 34 and is discharged through an upper series of slots 38. On the outer side of the aerator below the slots 38 and above slots 35 there is provided

a peripheral series of vertically disposed riffles 40 which serve further to agitate and aerate the pulp.

Spaced somewhat from the upper portion of the aerator 20, there is provided an annular series of vertically disposed stationary baffles 44 which extend below the pulp level and above the froth level, said series cooperating preferably with an inner annular series of like baffles 44′ staggered with relation thereto. These baffles 44 and 44′ are carried by a cap 45 apertured at 46 to receive the shaft 22 and supported on the timber 25 by means of a bracket 48.

Pulp is fed from a pipe 50 into a receiving box 52 at one end of the apparatus whence it passes through inlet 54 into the first compartment 10, being directed according to the direction of travel of aerator 20 by means of a baffle 55 which is mounted on the end wall of the cell at an angle thereto and below the pulp level. This baffle serves not only to direct the inflowing pulp but also to prevent surging, to deflect the swirling pulp in the cell toward the aerator 20 and to cause the heavy particles to travel down the inclined walls 12 to the center where they will be picked up by the action of the aerator and be passed therethrough repeatedly. The pulp passes from one cell to the next through ports 56 in the end walls 14, the baffles 55 in each cell directing the pulp as desired. It will be noted that, as indicated by arrows in Fig. 1, the aerators 20 in adjacent cells rotate in opposite directions, and that in order to properly direct the pulp the baffles 55 are therefore inclined oppositely in adjacent cells.

The pulp level is controlled by an overflow gate 58 at the end of the apparatus, this gate being adjustable through the medium of a screw 59 and an adjusting wheel 60. The pulp in leaving the machine passes first under a baffle 62 and then over the gate 58 into the discharge box 64 from which it is conducted by pipe 65. The heavier portions of gangue may be shunted into the discharge box 64 by a small pipe 66 leading directly from the last of the cells 10.

If for any reason it is desired to introduce additional amounts of air in order to improve flotation conditions, this may be done as by means of a nozzle 70 supplied from an air line 72, or otherwise.

In operation, the rotation of the aerator causes the pulp to be drawn in through its open lower end and forced upward along its inner walls by centrifugal force and the influence of the spiral riffles 34. This action causes a hollow space to be formed at the upper center portion within the aerator while the pulp itself is thrown out through the lower slots 35 and also through the upper slots 38. At the same time air is forcibly drawn in through the openings 32 in the head 30 of the rotor and is entrained in the pulp as it is hurled through said slots, thus causing positive aeration of the pulp. In addition, the advancing riffles 36 on the outer face of the rotor act to displace the pulp outside said rotor thereby creating a partial vacuum behind each riffle which assists further in entraining air in the pulp as it passes through the slots 35. Further agitation and aeration of the pulp is produced by the vertical riffles 40 on the outer wall of the aerator above the slots 35. As a result, the pulp mass is thrown from the upper portion of the rotor in a finely divided form thoroughly mingled with finely diffused air and in a form to produce a large volume of froth. The force of the moving mass is reduced by engagement with the staggered series of baffles 44 and 44′ which serve also to break the froth up into streams and to cause entrainment of additional amounts of air. Thus, when the froth and pulp pass out from said baffles 44 and 44′, the maximum amount of froth has been formed and it is in a state for maximum discharge into the launders thereby resulting in maximum recovery of the sulfid values.

With this construction it is not necessary that the cell 10 be divided with partitions to separate a rotor compartment from a settling compartment. On the other hand, the separation of the froth takes place at the top of the same compartment in which the rotor operates, and at the same time the action of the aerating rotor maintains perfect circulation of the pulp in the cell, assisted only by the action of the deflecting baffle 55 which directs the pulp body toward the aerator and insures passage of the heavier particles to the lower center whereby they are picked up by the pulp stream entering the lower end of the aerator. By rotating the aerators in adjacent cells in opposite directions and by arranging the baffles 55 to assist passage of the pulp in like directions, the pulp body is kept moving in constantly changing directions and the opportunity for maximum agitation, aeration and flotation is provided. Vertical arrangement of the baffles 40 on the rotor produces better aeration than an angular arrangement, and an increase in the number thereof increases aeration, although material elongation thereof does not appear to proportionately improve results.

What I claim is:

1. In apparatus for mineral flotation, a hollow frusto-conical aerator adapted to be partially submerged in pulp and having a central pulp chamber having spiral riffles on its inner wall, said aerator having slots therethrough for the discharge of pulp and also having a pulp inlet opening at the lower portion thereof and openings at its upper end for entrance of air into the aerator, and vertically disposed riffles on its outer wall.

2. In apparatus for mineral flotation, a

hollow frusto-conical aerator having a pulp inlet, a compartment receiving the same and adapted to contain pulp, adjustable means to determine the pulp level, said aerator being adapted to work in the pulp and having openings therein for the discharge of pulp therethrough, means on the aerator to assist movement and agitation of the pulp, and vertically disposed baffles about the upper end of the aerator and extending above the pulp level for intercepting the aerated pulp body discharge from the aerator.

3. In apparatus for mineral flotation, a cell comprising a single compartment, a hollow aerator having inlet and discharge openings and mounted to rotate therein and adapted to discharge aerated pulp, baffles arranged about the aerator to intercept the discharged pulp, and a vertically extending baffle on the cell wall to direct the body of the pulp toward the aerator.

4. In apparatus for mineral flotation, a plurality of connected cells, an aerator having inlet and discharge openings and rotatably mounted in each cell and adapted to discharge pulp, the aerators in adjacent cells being rotated in opposite directions, and a deflecting baffle in each cell set at an angle to a wall thereof and adjacent the inlet thereto to direct pulp toward the rotor and in a direction corresponding with the direction of rotation thereof.

In witness that I claim the foregoing I have hereunto subscribed my name this 3rd day of August, 1926.

ROBERT LORD.