

L. V. WATERHOUSE.
 APPARATUS FOR THE TREATMENT OF SULFID ORES.
 APPLICATION FILED JAN. 3, 1917.

1,346,286.

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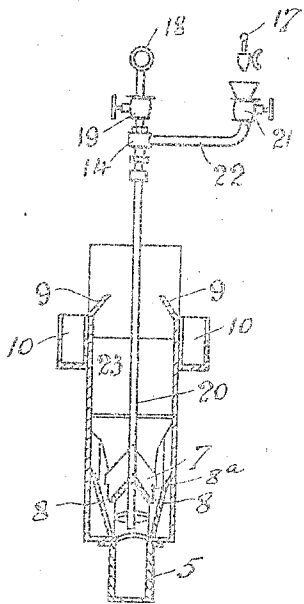


Fig. 2

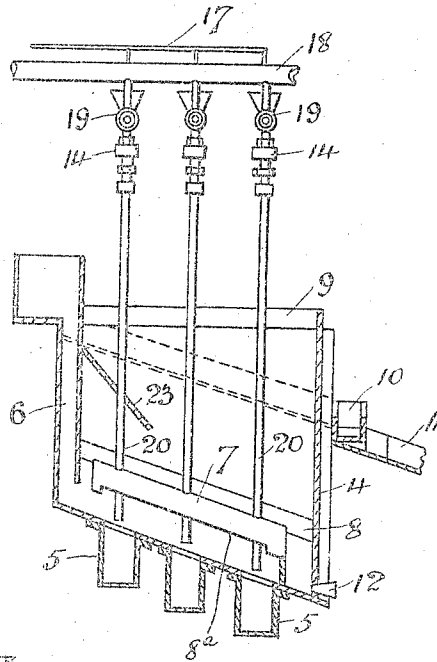


Fig. 1

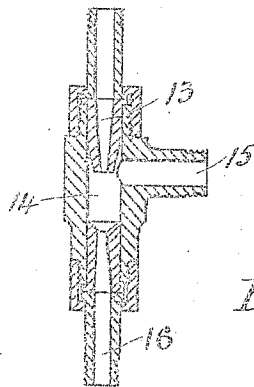


Fig. 3

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APPARATUS FOR THE TREATMENT OF SULFID ORES.

1,346,286.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LESLIE VICKERY WATERHOUSE, a subject of the King of Great Britain, residing at Queenstown, in the State of Tasmania, Commonwealth of Australia, have invented certain new and useful Improvements in and Relating to Apparatus for the Treatment of Sulfid Ores, of which the following is a specification.

This invention relates to the treatment of sulfid ores and sulfids by flotation for the separation of metallic sulfids from gangue or from other sulfids.

In the "agitation-froth" process, the pulverized ore is submitted to violent agitation in water in the presence of a suitable frothing medium with consequent aeration and emulsification followed by a float or froth of metallic sulfids. In some cases air is beaten into the pulp by means of immersed rotating impellers; in other cases air is drawn thereinto through a valve immediately below rotating impellers; in other cases the pulp is aerated in a centrifugal pump, and in still other cases it is stirred and emulsified by air or gas under pressure and then again treated by air under pressure to obtain a froth.

According to this invention I aerate, or charge with a gas other than air, water under pressure in an apparatus placed extraneously to a vat containing the pulp. This apparatus is in this specification referred to as a gasifier, that is to say, an apparatus in which the water is gasified or charged or mixed with a gas, or a mixture of gases. The water so prepared is delivered under pressure to the vat, with or without a quantity of a frothing medium such as eucalyptus or pine oil; if no frothing medium is introduced in the gasifier, the requisite quantity thereof will be added to the ore during grinding operations or by other known and suitable methods.

Means are provided by this invention for receiving the mixed sulfid bearing material into the vat or vessel; for causing a violent agitation of the pulp therein; for baffling the pulp; for keeping the agitation localized; and for the subsequent passage of the metallic sulfid or sulfids through a region of less agitation, where they separate from the gangue and eventually overflow from the vat as a dense froth.

The apparatus employed in the process is

illustrated in the accompanying drawings, in which—

Figure 1 is a side sectional elevation of the apparatus used for the purposes of this invention and showing special dash pots for receiving the water issuing from the gasifier.

Fig. 2 is a rear end sectional elevation of the same, and

Fig. 3 shows in sectional detail the gasifying means.

4 is the rectangular flotation vessel, preferably with a sloping bottom, in which are openings under which the cushion or dash pots 5 are attached. The moistened and pulverized ore or the like is introduced through the chute 6 to the highest point of the sloping bottom. Above the pots 5 is an inverted V-shaped and preferably inclined baffle 7 and at each side of the pots are boards 8 upon which the baffle rests. Narrow openings 8^a are left between the baffle 7 and the boards 8 through which the pulp rises. Other crowding boards 9 are placed at the top of the vessel. Over these the froth of sulfids bubbles before passing to launders 10 which are placed at each side of the vessel and join at the end of the latter with the concentrates launder 11. A tailings discharge 12 is placed at the lowest part of the vessel.

The injecting means consist of the high pressure water inlet reducer and nozzle 13 that fits into the body 14 of the gasifier. The air or gas inlet 15 is adapted to discharge adjacent to the water nozzle in order that the gas and water shall mix in the body of the gasifier prior to the mixture being discharged through the outlet member 16 into the delivery pipe 20. The parts 13, 15 and 16 are screw threaded exteriorly to permit of the gasifier being connected up into the system, in which 17 is the frothing oil pipe, and 18 the main high pressure water supply pipe that is connected into the controlling valve 19 and from thence into the gasifier through the nozzle 13. The part 16 in the gasifier is connected into the delivery pipes 20: these terminate just above the pots 5 after passing through the baffle 7, and discharge the gasified water into the pots from the gasifier wherein the pressure is about 80 lbs. to the square inch. Above the first of the pots 5 is a baffle 23 located in the vat in such a way that as the pulp

here surges upward it will be checked by the baffle.

The columns of gasified or aerated water under pressure from the pipes 20 will stir up the pulp, and the upward irregular course of the streams will be controlled and regulated by the inverted V-shaped baffle 7. By this means the pulp is thoroughly and evenly mixed and gasified in the lower part of the vat.

Air or other gas is introduced through cock 21 and pipe 22, that is connected up to member 15 of the gasifier. The requisite quantities of the frothing agent can be introduced to the gasifier from the pipes 17 and 22 or be added to the pulp prior to its being fed to the frothing vessel. I prefer, however, to introduce a portion of the frothing medium through the gasifier, as the gas, water and frothing agent are more thoroughly mixed thereby. As the mixture thus obtained is discharged under pressure into the vessel, the pulp will become charged with innumerable minute bubbles, resulting in a very satisfactory froth carrying the bulk of the metallic sulfids.

There are three zones in the frothing vessel, namely, the lowest at the bottom of the vessel where the pots, baffle and crowding boards and the gasified water under pressure act together to keep the particles in motion; above this there is a calmer separating zone where the metallic sulfids sort themselves from the gangue, and on the top there is a zone for the assembling of the froth. This is deep and intense, and is caused to gradually overflow by the incoming material and water and is caught in the manner explained. The addition of water to the vessel through the gasifiers necessitates the thickening of the pulp before delivery to the frothing vessel, so that the density of pulp most suitable to the material being treated may exist in the vessel.

I have shown three of these agitating means to a frothing vessel, but the number of gasifiers and pipes will vary and may be more or less than three according to requirements. Nor do I confine myself to the exact pressure of water as above stated, namely a pressure of about 80 lbs. to the square inch, which I have employed with satisfactory results when treating the sulfid ores of the west coast of Tasmania.

Neither do I confine myself to any fixed dimensions of the pipes, jet openings and other parts of the gasifier, for the reason that the component parts of the latter must, for the best work, necessarily be dimensioned to suit the particular conditions of water pressure, degree of gasifying, size of vessel, character of ore, and so on.

Further, I do not confine myself to any specific temperature at which to carry on

this process as such will be variable according to the class of material treated.

The amount of frothing agent required to be added to the pulp will ordinarily be less than 0.1 per cent. of the ore, and all of it may either be added to the ore, or a portion such as one half may be fed to the pulp extraneously to the vessel, and the other half be admitted through the gasifier, or alternatively, the whole of the frothing agent may be admitted through the gasifier.

This invention may also be applied to the separation of one sulfid from other sulfids by a process involving selective or preferential actions. I, however, do not wish to make any claim to such preferential action. My invention has no concern with such except through the recovery with my apparatus and by means of the process herein described, of the sulfid or sulfids so prepared for treatment.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is—

1. In a sulfid-separation apparatus, a frothing vessel; means for delivering pulp to be treated to said vessel and having a discharge opening adjacent the floor of said vessel; baffling means located in said vessel; a dash-pot adjacent the floor of the vessel; and frothing fluid delivering means extending through the vessel and having a discharge opening adjacent the dash-pot and below the baffling means, the stream of fluid from said delivering means discharging downwardly toward the dash-pot.

2. In a sulfid-separation apparatus, a frothing vessel; a baffle board located in said vessel; a second baffle board located above the first baffle board adjacent thereto and coöperating therewith to form an agitation chamber in said vessel; and frothing liquid delivering means having a discharge opening in said agitation chamber and directed downwardly from said second baffle board.

3. In a sulfid-separation apparatus, a frothing vessel having a sloping floor; means for delivering pulp to be treated to said vessel having a discharge opening adjacent the highest part of the floor of the vessel; a baffle board located in the vessel and extending parallel to the floor thereof; inclined boards at the sides of the baffle board and arranged close to the baffle board to form an agitation chamber which receives the pulp from the discharge opening, the space between the boards and the baffle board permitting the material in the agitation chamber to pass therefrom; and liquid delivering means extending through the vessel and having a discharge opening extending into the agitation chamber, the stream from the discharge opening being directed toward the floor of the vessel.

4. In a sulfid-separation apparatus, a

frothing vessel; means for delivering pulp to be treated to the vessel and having a discharge opening adjacent the floor of the vessel; baffling means located in the vessel; a plurality of dash-pots adjacent the floor of the vessel and spaced from each other; and a plurality of frothing fluid delivering pipes extending through the vessel and each having a discharge opening below the

baffling means and adjacent a dash-pot, the streams from the delivering pipes being directed downwardly toward the dash-pots.

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

LESLIE VICKREY WATERHOUSE

Witnesses:

R. N. NEWTON,

D. CROWTHER.