Dec. 25, 1962 M. BENOZZO 3,070,229

APPARATUS FOR THE FROTH-FLOTATION OF MINERALS

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Fig.1

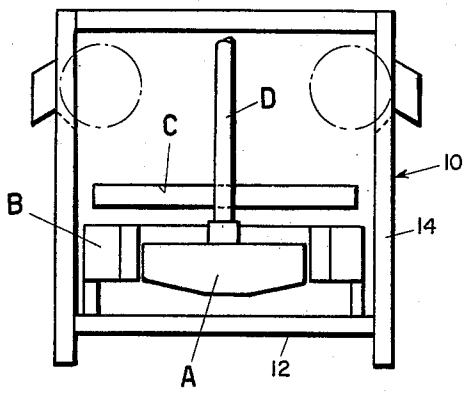
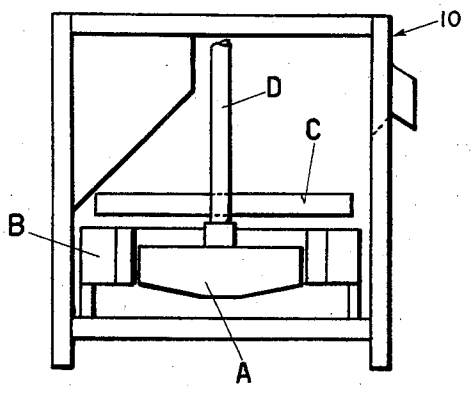


Fig.2



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Fig.3

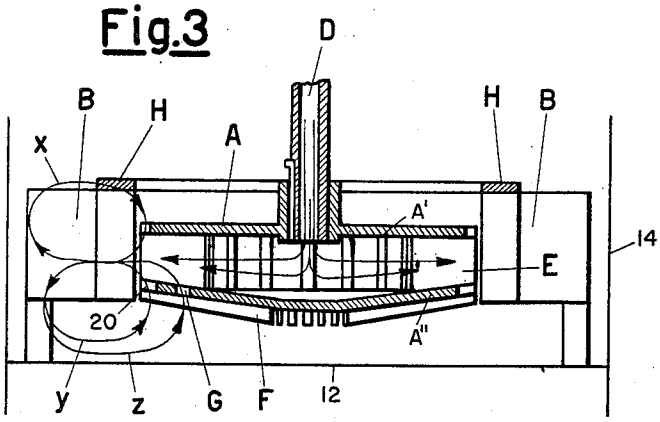
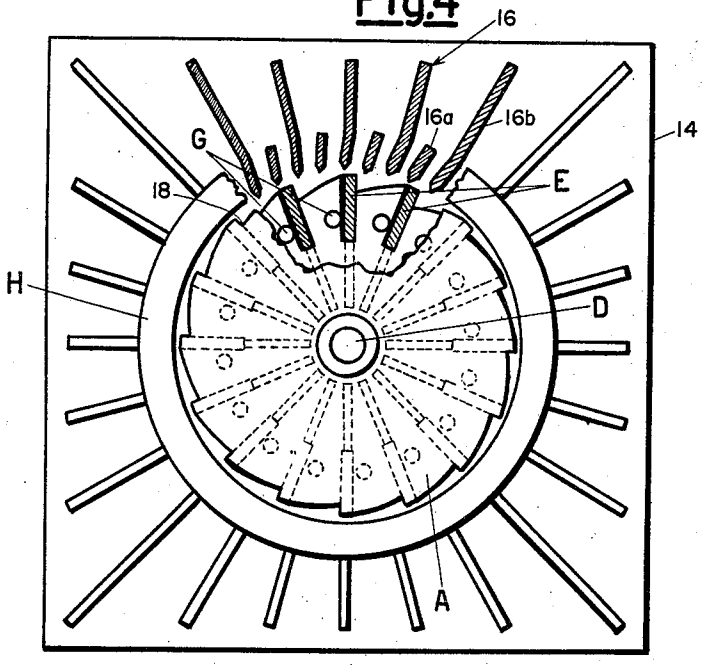


Fig.4



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United States Patent Office 3,070,229 Patented Dec. 25, 1962

3,070,229
APPARATUS FOR THE FROTH-FLOTATION OF MINERALS

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Filed July 13, 1959, Ser. No. 826,697
Claims priority, application Italy July 21, 1958
1 Claim. (Cl. 209—169)

It is known that a floating apparatus is constituted essentially of two parts, namely:

(1) A case the shape of which may be different as may be needed.

(2) A device for mixing air with slurry, the slurry being the mixture of solid with liquid.

It is also known that the more vigorous and well-distributed the diffusion of the gas (air) within the slurry, the more effective is the floating apparatus.

It is an object of the present invention to provide a flotation machine or apparatus, the air-and-slurry mixing device of which has maximum effectivness for the purpose of enhancing the output and efficiency of the apparatus.

The apparatus employed with froth flotation heretofore, are distinguished in three main categories, namely:

(1) Apparatus with mechanical stirring wherein the slurry is fed to the stirring mixer and the air, necessary for the formation of the bubbles, is directly sucked by the stirrer with the aid of various contrivances.

(2) Apparatus with merely pneumatic stirring (Callow type and the like).

(3) Apparatus with combined stirring and mixing wherein the slurry is fed to the stirrer (from top and from bottom) and the air necessary for the formation of bubbles is supplied by an external source (compressor).

The disadvantages of such types of apparatus are apparent, namely:

(*a*) The types of class (1) have the drawback of the impossibility of measuring the air in function of the delivery (flow rate) of the slurry, not only, but at the request of air increase, consequent to an increase of slurry delivery, the air needed for the formation of the bubbles decreases automatically, the total delivery of the stirrer being constant.

(*b*) The disadvantages of the types of class (2) are apparent owing to the facility of clogging of the porous septa constituted generally by fabrics and owing to the facility of sedimentation in the apparatus in the case of slurries containing coarse elements and elements of high specific gravity.

(*c*) The types mentioned at (3) finally have the drawback that the slurry passes only once through the stirrer and, therefore, the mixing of air and slurry results in a deficiency.

The apparatus, according to the present invention and in particular its mixing device, has the purpose of rendering possible a perfect emulsifying of air and slurry since the mixture of solid and liquid comes repeatedly in contact with the gas (air), the controlled quantity of which is formed by an external source.

In the drawings:

FIGURES 1 and 2 are side elevational views, partly in section, of the flotation apparatus or machine;

FIGURE 3 is a detailed vertical sectional view, and,

FIGURE 4 is a top plan view, partly in section.

Referring more particularly to the drawings, the flotation machine comprises a casing 10, having a bottom wall 12 and upstanding side walls 14. In the casing, the rotatable impeller or rotary mixer A and diffuser are mounted. The rotatable impeller A is mounted in the casing above the bottom wall 12 and includes upper and

lower vertically spaced discs A′ and A″ which are connected by a series of vertically disposed and radially extending fins E. The upper disc is flat while the lower disc A″ is slightly frusto conical.

A hollow shaft D is suitably connected to the upper disc A′ and communicates with the space between the discs, as shown in FIGURE 3. The shaft D rotates the impeller and supplies air to the space between the discs.

The diffuser B is mounted in the casing in a manner surrounding the impeller and extends to a height higher than the impeller. The diffuser includes a horizontally disposed flat ring-shaped member H located a substantial distance above the upper disc A′ and being of substantial radial width. The member H extends outwardly to and is concentric with the upper disc A′. Fixed, spaced radial fins 16, as shown in FIGURES 3 and 4, are carried by the ring-shaped member H and are disposed around the impeller. The radial fins 16 include short fins 16*a* and long fins 16*b* disposed in alternating relation, as shown in FIGURE 4, with the long fins 16*b* terminating adjacent the upstanding side walls 14. Means is provided for feeding slurry into the casing above the impeller and includes the slot C provided laterally in the wall of the casing 10, as shown in FIGURES 1 and 2, while means is provided for withdrawing the slurry from the casing and includes a slot (not shown) placed at the same height or at a lower height on another upstanding wall of the casing. The slurry is thus fed above the impeller.

The peripheral edge of the upper disc A′ is formed with circumferentially spaced notches 18, the notches cooperating with the radial fins to produce a circulation of slurry upwardly and outwardly around the flat ring-shaped member H and inwardly back through the spaces between the radial fins, generating a circulation along the path X, as shown in FIGURE 3. The peripheral edge of the lower disc A″ is formed with circumferentially spaced notches 20, the lower disc having radial ribs F on its underside vertically aligned with said fins 16. The lower disc is formed with vertical openings G which are disposed in circumferentially spaced fashion and lie on a circle disposed inwardly of the peripheral edge of the disc. The vertical openings or holes are disposed immediately in advance of the vertical fins E and the fins or ribs F in the direction of rotation of the impeller with the openings being located relatively closely adjacent the ribs. The ribs coact with the openings to aid in forcing fresh slurry into said impeller. The radial ribs F have the double task of removing any possible deposits of sediments at the bottom of the casing and of conveying through the holes or openings G a quantity of slurry, higher than that of the fresh feed. Thus, there are generated streams of slurry represented diagrammatically by Y and Z in FIGURE 3.

The lower disc A″ is spaced above the bottom wall by a distance less than one-fifth the diameter of the impeller.

The notches 20 cooperate with the radial fins and the ribs F to produce a circulation outwardly from the last-named notches and downwardly and back through said openings G, as aforedescribed.

The total height of the diffuser D is greater than the height of the impeller so that the diffuser extends above the upper disc of the impeller so as to avoid abnormal movements of the slurry and, therefore, abnormal energy consumption.

By way of example without limitation we report the metallurgical results of comparison obtained at equal other conditions (reactants, comminution and density of the slurry) with a cell as hereinbefore described and with a cell of the type having mechanical stirring, operating with a sulfur mineral ore in the shape of sulfide (FeS_2).

	Cell with mechanical agitation, percent S	Cell as described hereinbefore, percent S
Feed	20.50	20.50
Concentrates	47.50	48.20
Residues after 2'30	10.00	6.30
Residues after 5'	6.00	2.15
Residues after 14'	1.20	0.80

(The symbol (') means "minutes", e.g. 2'30=two minutes and thirty seconds.)

I claim:

A flotation machine comprising a casing having a bottom wall and upstanding side walls, a rotatable impeller mounted in the casing above the bottom wall and including upper and lower vertically spaced discs, vertical fins radially disposed between the discs and connecting the discs in spaced relation, a hollow shaft connected to the center of the upper disc and communicating with the space between the discs, said shaft rotating the impeller and supplying air to the space between the discs, a diffuser mounted in the casing surrounding the impeller and rising to a height higher than said impeller, said diffuser including a horizontally disposed flat ring-shaped member located a substantial distance above, outwardly adjacent to and concentric with the upper disc and being of substantial radial width, and fixed spaced radial fins carried by the ring-shaped member and disposed around the impeller, said last-named radial fins including short fins and long fins disposed in alternating relation, with said long fins terminating adjacent said upstanding side walls, means for feeding slurry into the casing above the impeller, means for withdrawing the slurry from the casing, the peripheral edge of the upper disc being

formed with circumferentially spaced notches, said notches cooperating with said last-named radial fins to produce a circulation of slurry upwardly and outwardly around said flat ring-shaped member and inwardly back through the spaces between said last-named radial fins, the peripheral edge of said lower disc being formed with circumferentially spaced notches, said lower disc having radial ribs on its underside vertically aligned with said first-named fins and being formed with vertical openings disposed in circumferentially spaced fashion and lying on a circle disposed inwardly of its peripheral edge, said vertical openings being disposed immediately in advance of said first-named vertical fins and ribs in the direction of rotation of said impeller, said openings being located relatively closely adjacent the ribs, the ribs coacting with the openings to aid in forcing fresh slurry into said impeller, said lower disc being spaced above the bottom wall by a distance less than one-fifth of the diameter of the impeller, said last-named notches cooperating with the last-named radial fins and said ribs to produce a circulation outwardly from the last-named notches and downwardly and back through said openings.

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