United States Patent [19]

Watin

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[54] **FLOTATION APPARATUS**

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[52] **U.S. Cl.** **209/169,** 261/87

[51] **Int. Cl.** **B01f 3/04**

[58] **Field of Search** 261/87; 209/169

[56] **References Cited**

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[57] **ABSTRACT**

The efficiency of the agitator shown in French Pat. No. 1,200,365 is improved by enveloping the outer bars defining two coaxial and oppositely disposed frustums of cones with a sheet of perforated material.

3 Claims, 2 Drawing Figures

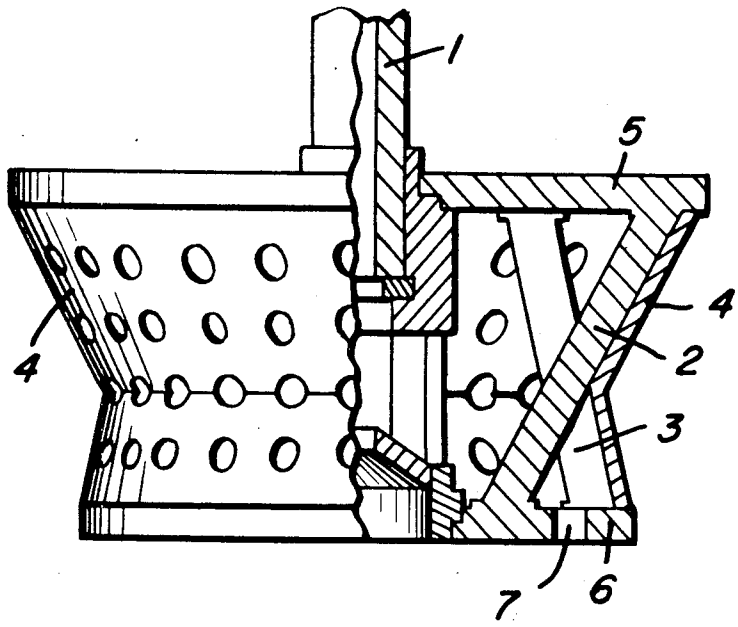


FIG. 1

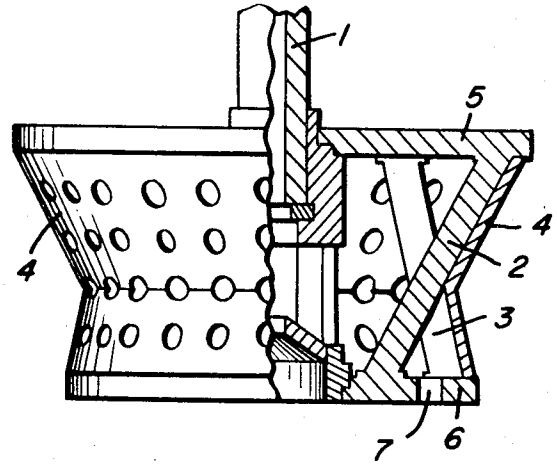
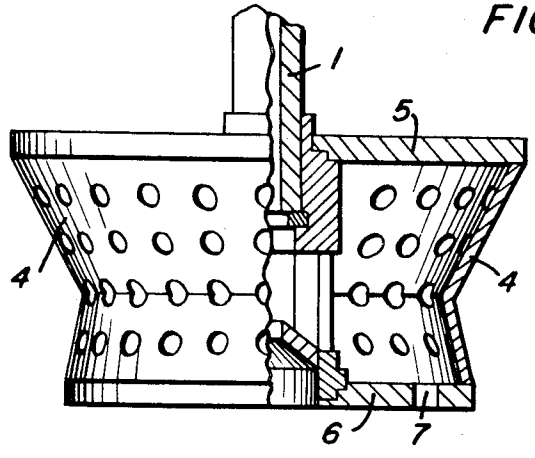


FIG. 2



FLOTATION APPARATUS

The present invention relates to improvements in flotation with mechanical agitation.

It is well-known that flotation is a method for screening finely comminuted particles, which is widely used for the concentration of ores, coal, slimes, etc. Flotation is carried out in tanks through the bottom of which a pulp is introduced, this pulp being a mixture of water and the product to be treated, generally admixed with foaming agent and several other products.

For a long time past, this method has been carried out in a static form; to this end a gas was caused to pass in the flotation tank; the bubbles of said gas passing through the pulp, thereby collecting the mineral particles and bringing them to the liquid surface where the foam and froth could be recovered. This method of flotation had a generally poor efficiency as a result of the bad diffusion of the reagents and of the gas in the tank, and also due to the sedimentation of the pulp caused by inadequate agitation of the pulp by the passage of the gas.

This method of flotation was subsequently improved by the use of mechanical agitation ensuring aeration by cavitation. In spite of the increase in the cost of treatment due to the wear of the agitators and to the substantial consumption of energy, the efficiencies obtained under these conditions are such that this form of dynamic flotation has become almost universally adopted.

An example of suitable agitator has been described in French Pat. No. 1,200,365 filed on Apr. 30, 1958. This device comprises two series of agitating bars arranged following the generator lines of two coaxial and oppositely disposed cones. The ends of these bars are mounted on two circular bases pierced with holes to permit the circulation of the pulp. The gas which is generally air, is preferably injected into the tank along the axis of the cones.

Although the consumption of energy of this type of flotation agitator is notably lower than with other known agitators, this consumption of energy is still a substantial factor of the cost of flotation.

One of the objectives of the present invention is consequently to provide a flotation apparatus which involves a much lower consumption of energy without impairing efficiency.

Another objective of this invention is to provide such an apparatus which is simple, strong and inexpensive but ensures an excellent outstanding agitation.

I have found surprisingly that these objectives, and other ones which will appear further below, are achieved by a flotation apparatus as described above, wherein the agitator comprises a perforated sheet presenting the form of two coaxial and oppositely disposed frustums of cones joined along their small bases.

In an embodiment of the invention, said perforated sheet envelopes at least partly a crossed bars agitator as described in the above-mentioned French Patent.

In another embodiment of the invention, said perforated sheet is mounted along the large bases of the cones on two parallel circular plates which are provided with holes to permit the passage of the pulp.

In both embodiments, the apex angles of both cones are chosen as a function of the kind of material to treat. The gas necessary for the flotation is preferably injected into the pulp along the axis of the agitator.

Both embodiments of the device according to the invention are described below, reference being made to the accompanying drawings, in which:

FIG. **1** is a diagrammatic view, partly in cross-section, of an embodiment of the device;

FIG. **2** is a similar view showing another embodiment of the device.

The agitator shown in FIG. **1** comprises a hollow shaft **1** which is used for the introduction of the aerating air. Around shaft **1** are mounted two series of bars arranged following the generator lines **2** of a first cone, on the one hand, and following the generator lines **3** of a second cone, on the other hand. These bars are covered on their whole length by a perforated sheet **4** fixed on them by any suitable means, like welding. Of course, sheet **4** presents the same form as the external form of the assembly constituted by the two series of bars, i.e., the form of two coaxial and oppositely disposed frustums of cones joined along their small bases. The ends of bars **2** and **3** are fixedly mounted on two circular plates **5** and **6** which are provided with holes **7** to permit the passage of the pulp.

The thickness of sheet **4** is 10 mm. It is provided with a regular pattern of holes the diameter of which is 40 mm and which are 40 mm apart from each other. The apex angles of the cones following which the bars **2** and **3** are arranged are respectively about 30° and 55°.

In order to test its effectiveness, an agitator of this type with a height of about 200 mm and a diameter of 440 mm was placed in a flotation tank of 1 m^3 which was filled with water until its level above the bottom of the tank reached 1 meter. The agitator was rotated at 340 r.p.m. The consumption of energy was measured as a function of the amount of air injected, the latter being successively 0, 500 and 700 liters per minute. The results of these tests are given by Table 1 below, each numerical value being the average result of eight experiments.

TABLE

Flow of injected air (l/mn)	0	500	700
Consumption of power (kwh)			
without sheet **4**	2.04	1.64	1.44
with sheet **4**	1.79	1.45	1.22

It is noteworthy that the combination of perforated sheet **4** according to the invention with the agitator according to the aforementioned French Pat. No. 1,200,365 lowers the consumption of power by about 20 percent, whatever the flow of injected air may be, without impairing substantially the agitation efficiency.

The agitator shown in FIG. **2** comprises also the perforated sheet **4**, the shape of which is also two coaxial and oppositely disposed frustums of cones **4***a*, **4***b* joined along their small bases. This sheet is directly mounted on circular base-plates **5, 6,** which are pierced to permit the passage of the pulp. This assembly is rigidly mounted on shaft **1**, like the device shown in FIG. **1**, but bars **2** and **3** of FIG. **1** are not present in this embodiment.

The inner surface of sheet **4** can be provided with asperities or ribs or can be corrugated (not shown) in order to increase the agitation efficiency.

The parts of the agitator according to the invention can be coated with an abrasion-resistant material like rubber or plastic. They can also be wholly fabricated with such material.

I claim:

1. A flotation apparatus comprising: a tank for holding a body of liquid pulp containing finely comminuted solids to be floated from suspension; an agitator rotatable in said tank; means for rotating said agitator; and means for flowing gas into the pulp along the axis of said agitator; said agitator comprising a shaft, two circular base plates mounted perpendicularly on said shaft, said base plates being parallel to each other and pierced with holes, and at least one perforated sheet between said base plates, said at least one perforated sheet lying on the surfaces formed by two coaxial and oppositely disposed frustums of cones, said cones joined along their small bases, the large bases of said cones meeting the outer edges of said two base plates.

2. A flotation apparatus according to claim 1 wherein said agitator further comprises two series of elongated agitating bars mutually spaced apart, each series of elongated bars spaced apart from said shaft and arranged following the generator lines of two coaxial and oppositely disposed cones, said bars extending between said plates with their ends rigidly mounted on said plates; said bars positioned so that they at least partially contact said at least one perforated sheet.

3. A flotation apparatus according to claim 1 wherein said at least one perforated sheet is shaped in the form of two coaxial and oppositely disposed frustums of cones joined along their small bases, the large base of each cone being respectively fixed along the outer edges of said base plates.

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