J. I. THOMAS.

FLOTATION APPARATUS.

APPLICATION FILED MAR. 25, 1919.

1,383,881. Patented July 5, 1921.

Fig. 1,

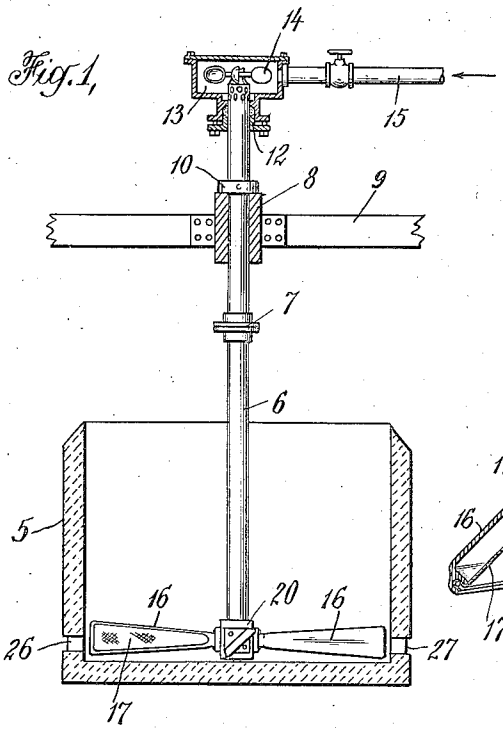


Fig. 3,

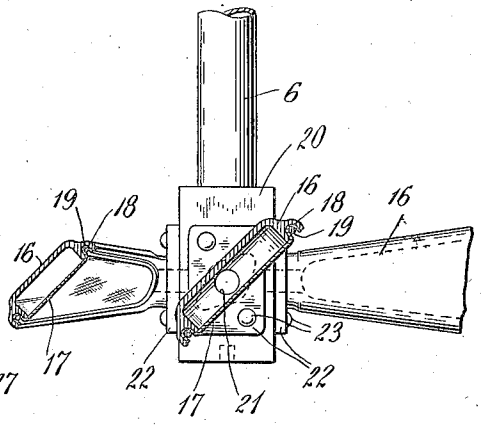
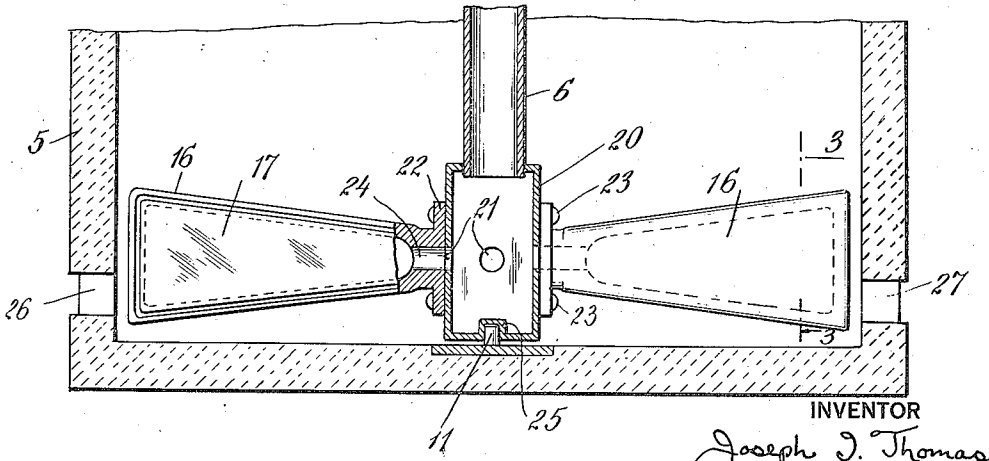


Fig. 2,



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FLOTATION APPARATUS.

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To all whom it may concern:

Be it known that I, JOSEPH I. THOMAS, residing at Garfield, in the county of Salt Lake, State of Utah, have invented certain new and useful Improvements in Flotation Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to flotation apparatus, and has for its object the provision of an improved apparatus for carrying out flotation operations and more particularly the concentration of mineral ores by flotation.

In the concentration of ores by flotation, the mineral ore pulp is subjected to the action of gas bubbles, whereby those particles of the mineral which have an affinity or attraction for the bubbles of gas are carried to the surface by the buoyant action of the gas bubbles and are floated off, usually in the form of an overflow froth. The gas bubbles should be disseminated in a fine state of subdivision throughout the mass of the ore pulp and various means have heretofore been employed and suggested for introducing a gaseous flotation medium into the ore pulp in a suitably fine state of subdivision.

The present invention contemplates the provision of a flotation apparatus having, in combination with a suitable container, an improved gaseous fluid distributer for introducing into the ore pulp gaseous fluid in a finely disseminated state. In accordance with the invention, the container and distributer are arranged for relative rotation with respect to each other, and the distributer is mounted within the container, and preferably near the bottom thereof, and comprises a hollow body provided with means permitting the escape from the interior thereof of gaseous fluid in a finely disseminated state. In its preferred form, the hollow body is of blade-like configuration and has one wall thereof formed of a porous medium so disposed that the escape of gaseous fluid therethrough exerts an impelling action tending to effect the desired relative rotation of the container and distributer. In view of its ability to thus perform the function of exerting an impelling action, in addition to its function of distributing gaseous fluid within the ore pulp, the hollow body may be aptly described as an impeller. Where this impelling action is sufficient to effect the desired relative rotation between these two elements, no additional means need be provided for this purpose, and in other cases the impelling action may be supplemented in any suitable manner, as, for example, by positive mechanical rotation of either the container or the distributer. Gaseous fluid under pressure is supplied to the hollow body of the distributer in any suitable way, and in the preferred form of the invention, a plurality of hollow bodies are symmetrically disposed about a hollow shaft and are secured to the shaft with their hollow interiors in communication with the hollow interior of the shaft, whereby the gaseous fluid may be introduced through the hollow shaft.

A flotation apparatus embodying the principles of the invention is illustrated, by way of example, in the accompanying drawings, in which;

Figure 1 is a sectional elevation of the apparatus;

Fig. 2 is an elevation, partly in section, of the lower portion of the container and the distributer; and

Fig. 3 is a detail explanatory view, partly in section, of the lower end of the distributer.

The flotation apparatus or cell illustrated in the drawings comprises a container 5, preferably circular in shape, which may be of concrete or other suitable material. In practice, a plurality of these cells are arranged in series or cascade, the ore pulp being fed into the first or head cell and progressively subjected to a flotation treatment in each cell of the series, and the tailings discharged from the end or last cell. The floated values or concentrates are carried over the edge of each cell as an overflow froth and are collected in any convenient manner, as is well understood in the art.

A hollow shaft 6 is vertically and centrally disposed within the container 5. This shaft is preferably made in two sections which are bolted, or otherwise suitably secured, together by a coupling 7, so as to permit the convenient removal of the distributer from the container. The shaft 6 extends through a rigid stationary sleeve or bearing 8 mounted in a beam 9, or the like. A thrust ring 10 secured to the shaft rests on the sleeve 8 and serves to support the shaft. A pin 11 is preferably set in the bottom of the container 5 and serves as a guide pin for the bottom of the shaft 6, as will be more fully explained hereinafter. It will, of course, be understood

that any other suitable construction may be employed for rotatably mounting the shaft 6, or for otherwise securing the desired relative rotation between the container and the gaseous fluid distributer.

The upper end of the hollow shaft 6 is connected in any suitable manner to the source of compressed gaseous fluid. In the apparatus shown in the accompanying drawings, the upper end of the shaft extends through a stuffing box 12 into a chamber 13. A Pelton wheel 14 is mounted on the upper end of the shaft in the path of the discharge of the compressed gaseous fluid from the supply pipe 15. The action of the gaseous fluid current on the wheel 14 operates to rotate the shaft, and is of advantage in case the impelling action of the gaseous fluid as it escapes from the distributer is not of sufficient force to effect the desired rotation. Other mechanical means may, of course, be employed to effect the desired rotation of the distributer. From the chamber 13, the gaseous fluid escapes into the upper open end of the shaft 6 and thence into the hollow interiors of the blade-like bodies or impellers 16 of the distributer.

The distributer illustrated in the accompanying drawings has four hollow bodies 16 symmetrically positioned about the shaft 6 and secured thereto, in proximity to the bottom of the container 5. Each body 16 consists of a main body portion resembling generally a shallow tray, and having more or less the general configuration of a propeller blade. To this end, the hollow bodies 16 may be slightly twisted or spiraled, in order to conform more nearly to the usual configuration of a propeller blade.

The open side of the main body portion of each impeller 16 is covered by a porous medium, such, for example, as a piece of canvas 17. The canvas can be held in place by means of a rope 18 driven into a groove 19 around the outer edge of the main body portion. The main body portion may be a casting of iron, of from one-fourth to three-eighths inches in thickness, although it will, of course, be understood that I do not intend to limit myself to these dimensions. The impellers 16 may be secured to the shaft 6 by means of a square plug coupling 20 which is screwed to the lower end of the shaft and is provided with four openings 21, one on each side thereof, for affording communication with the interiors of the hollow impellers 16. Each impeller is provided at its inner end with a base-plate 22 which is secured to the coupling 20 by bolts 23, so that the opening 21 registers with an opening 24, in the base of the impeller, communicating with the hollow interior thereof. The closed bottom of the hollow plug coupling 20 is provided with an indentation or cup 25 into which the guide pin 11 projects for the purpose of steadying or guiding the lower end of the shaft 6.

The impellers are secured in position with the porous medium 17, which forms a substantially plane or flat wall thereof, disposed at such an angular inclination that the escape of gaseous fluid through this medium exerts an impelling action on the distributer tending to effect its rotation. In the apparatus shown in the accompanying drawings, this impelling action operates to effect rotation of the distributer in a clockwise direction, as viewed from above. While, in the accompanying drawings, the impellers are illustrated as arranged with the porous wall thereof lowermost, it will of course be understood that this arrangement may be reversed and the porous wall may accordingly be uppermost, if desired.

The operation of the apparatus will be understood by those skilled in the art from the foregoing description. The ore pulp is supplied to the container 5 in any suitable manner. In the cell shown in the accompanying drawings, two openings 26 and 27 are provided near the bottom, through one of which the ore pulp is supplied to the cell and through the other of which the pulp is withdrawn. During the flotation treatment, the gaseous fluid distributer is slowly rotated and gaseous fluid, for example, compressed air, under a pressure of say five to eight pounds per square inch, is admitted to the supply pipe 15. The gaseous fluid escapes through the porous wall of each of the impellers in a finely disseminated state, and rising through the ore pulp in this fine state of subdivision effects the flotation of the particles of floatable mineral in the pulp.

The rotation of the gaseous fluid distributer in conjunction with the improved construction thereof, as contemplated by the present invention, results in the introduction of a very even and uniform supply of gaseous fluid into the ore pulp. The distribution of gaseous fluid throughout the ore pulp is accordingly remarkably even and uniform, and, as is well recognized in the art, this is of particular advantage in the flotation operation. The amount of canvas, or other suitable porous medium, is materially less in my improved gaseous distributer than in present types of flotation cells in which porous mediums are provided for the introduction of a gaseous fluid. As a result of my improved construction, the impeller is very easily removed from the container and the canvas, or other porous medium, can be thus convenienlty renewed. Since the amount of canvas provided for each impeller is of relatively small area, little difficulty is experienced from the stretching or bulging of the canvas, as is the case in flotation apparatus in which the porous medium covers the entire bottom of the cell or container.

Furthermore, my improved construction is simple and inexpensive, and the various parts thereof are subjected to very little wear during the normal use of the apparatus. In this connection I wish to point out that the escape of the gaseous fluid through the porous wall of the impellers operates in effect to slightly raise the distributer and thus relieves the bearing thrust between the sleeve 8 and the ring 10, so that the distributer may be said to have somewhat of a floating bearing, by which the wear and friction are materially reduced. The circular shape of the container 5 enables the froth overflow to take place around the entire periphery of the cell, whereby the froth overflow may be removed from the cell in the most effective manner.

The porous walls of the hollow bodies of the distributer are of sufficient total area to provide the introduction into the ore pulp of the necessary quantity of gaseous fluid, and, in combination with the rotation of the distributer, insures an even and uniform distribution of gaseous fluid. At the same time the total quantity of porous medium, such as canvas, required for the hollow bodies is relatively small, and, when worn out or impaired in efficiency, can be renewed at very slight expense and with little practical inconvenience.

What I claim is: —

1. A flotation apparatus comprising in combination a container and a gaseous fluid distributer relatively rotatable with respect to each other, said distributer being arranged within said container and comprising a hollow blade-like body having a porous medium forming a substantially plane wall thereof for permitting the escape therefrom of gaseous fluid in a finely disseminated state, said hollow blade-like body being so disposed that the escape of gaseous fluid from the interior thereof through said porous medium exerts an impelling action tending to effect relative rotation between said container and said distributer, and means for supplying gaseous fluid to the interior of said body.

2. A flotation apparatus having in combination with a container, a gaseous fluid distributer comprising a hollow blade-like body mounted for rotation within said container and near the bottom thereof and having a substantially plane wall formed of a porous medium permitting the escape from the interior of the body of gaseous fluid in a finely disseminated state, said porous wall being disposed at an inclination such that the escape of gaseous fluid therethrough exerts an impelling action on said body, and means for supplying a gaseous fluid to the interior of said hollow body.

3. A flotation apparatus comprising in combination a container and a gaseous fluid distributer relatively rotatable with respect to each other, said distributer being arranged within said container and near the bottom thereof and comprising a plurality of impellers each of which has a substantially plane porous wall for permitting the escape from the interior thereof of gaseous fluid in a finely disseminated state, the porous walls of said impellers being disposed at an inclination such that the escape of gaseous fluid therethrough exerts an impelling action tending to effect relative rotation between said container and said distributer, and auxiliary means for effecting relative rotation between said container and said distributer.

4. A flotation apparatus having in combination with a container, a gaseous fluid distributer comprising a hollow impeller mounted for rotation within said container and near the bottom thereof and having one wall thereof provided with a porous medium permitting the escape from the interior of the body of gaseous fluid in a finely disseminated state, said porous wall being disposed at an inclination such that the escape of gaseous fluid therethrough exerts an impelling action on said impeller, means for supplying gaseous fluid under pressure to the interior of said impeller, and auxiliary means actuated by the gaseous fluid supplied to said impeller for rotating the propeller.

5. A flotation apparatus comprising in combination a container and a gaseous fluid distributer relatively rotatable with respect to each other, said distributer being mounted within said container, and near the bottom thereof, and comprising an impervious, hollow, blade-like body, having a substantially plane porous wall disposed at an inclination such that the escape of gaseous fluid therethrough exerts an impelling action on said distributer, and means for supplying a gaseous fluid to the interior of said hollow body.

6. A flotation apparatus comprising in combination a container and a gaseous fluid distributer relatively rotatable with respect to each other, said distributer being mounted within said container, and near the bottom thereof, and comprising a plurality of symmetrically positioned, impervious, hollow, blade-like bodies, each of which has a substantially plane porous wall disposed at an inclination such that the escape of gaseous fluid therethrough exerts an impelling action on said distributer, and means for supplying a gaseous fluid to the interior of said hollow bodies.

In testimony whereof I affix my signature.

JOSEPH INGRAM THOMAS.