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FLOTATION APPARATUS

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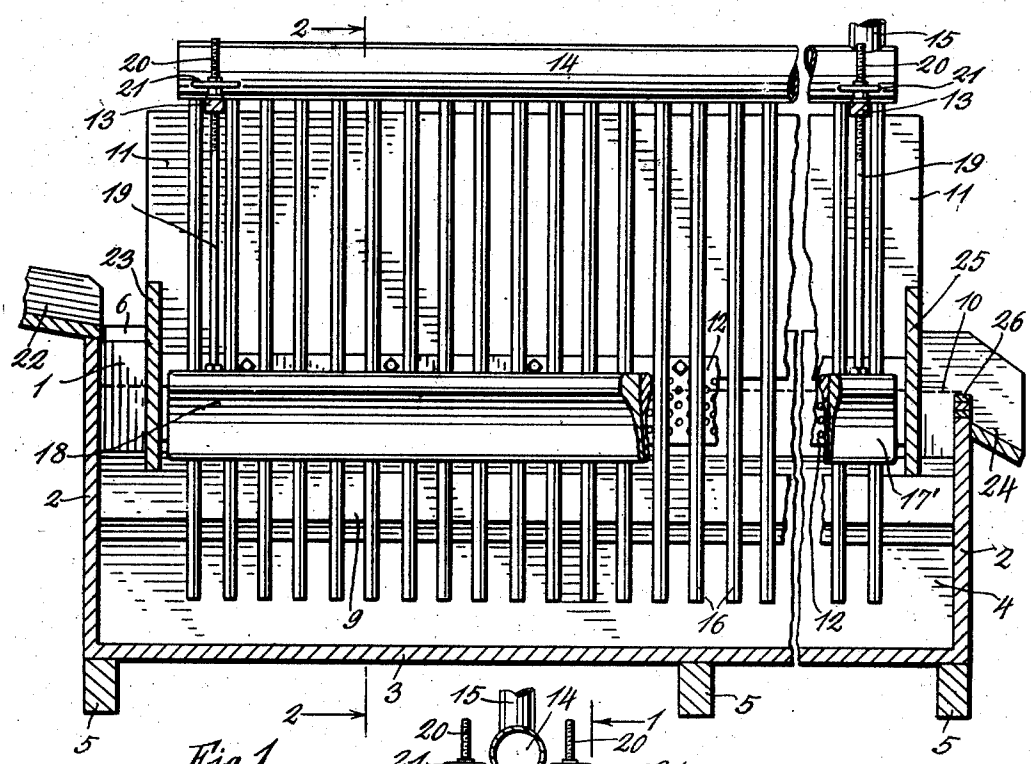

Fig. 1.

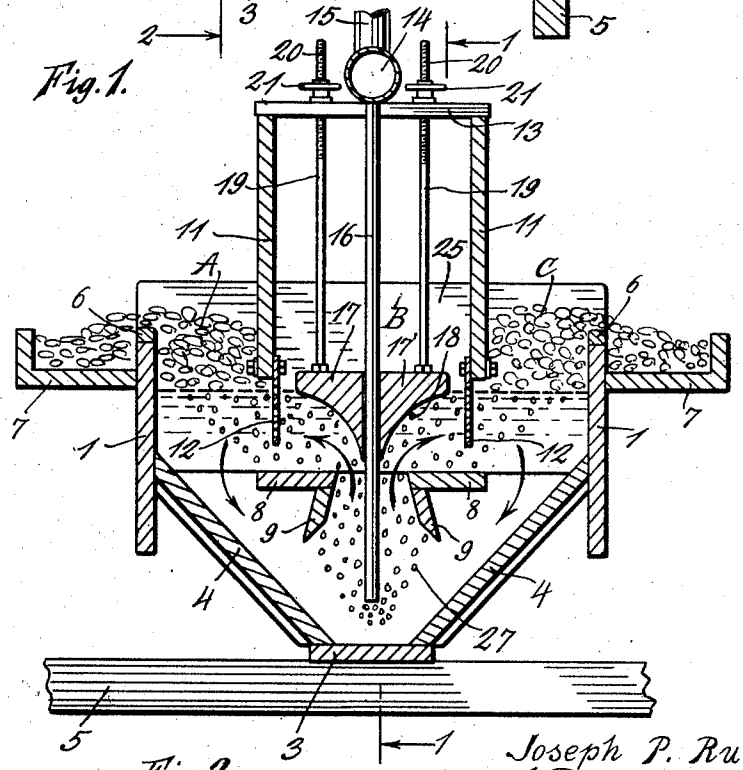

Fig. 2.

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FLOTATION APPARATUS

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This invention relates to improvements in machines for recovering mineral values from ore pulp by the flotation method and has reference more particularly to an improvement in the construction of the so-called pneumatic type of machine in which the agitation of the pulp is effected by means of compressed air.

It is the object of this invention to produce a machine of the type referred to in which the pulp will be caused to circulate in closed currents, which combine at the center in a single upward current that is mixed with air whereby the sulfide or sulfidized particles move upwardly at a rate that approximates the speed at which the air bubbles rise. In this manner the sulfide particles will be given the maximum opportunity to come into contact with the air bubbles so as to facilitate the adherence of air and prevent the formation of violent agitation or strong counter-currents which would have a tendency to separate the particles from the bubbles or froth.

My invention, briefly described, consists of an elongated tank provided with downwardly and inwardly inclined sides terminating in a narrow flat bottom. Two spaced apart L-shaped partitions extend the entire length of the tank a short distance above the bottom. A row of air pipes have their upper ends connected to a manifold or header and pass downwardly between the L-shaped partitions, terminating a short distance above the bottom. Two vertical walls extend longitudinally of the tank above the pulp level and divide the tank longitudinally into three compartments, perforated plates are connected to the lower edges of the vertical walls and these extend downwardly below the water level. An adjustable deflector is located on each side of the row of pipes and these have their outer surfaces transversely concave and upwardly and outwardly inclined so as to deflect the bubbles towards the perforated partitions. When the tank is filled to the proper level with pulp and air is permitted to flow through the downwardly extending pipes, the air bubbles will mix with the pulp and reduce the specific gravity whereby the pulp will flow upwardly between the partition members and downwardly along the inclined sides, all as will be hereinafter more fully explained.

In order more clearly to describe the apparatus and its method of operation, reference will now be had to the accompanying drawing in which the preferred embodiment thereof has been illustrated and in which:

Fig. 1 is a longitudinal vertical section taken on line 1—1, Fig. 2; and

Fig. 2 is a transverse section taken on line 2—2, Fig. 1.

In the drawing I have shown a tank having spaced vertical side members 1, end members 2 and a horizontal bottom member 3. Inclined sides 4 extend from the inner surfaces of the side members 1 to the bottom member 3 in the manner shown in Fig. 2. This tank is supported on transverse beams 5. The upper edges of the vertical sides 1 are provided with removable strips 6, which can be replaced by strips of different height, if desired. Extending longitudinally along the outside of the vertical side members are launders 7 which are adapted to receive the froth that passes over the side strips 6 in the manner illustrated in Fig. 2 and which will hereinafter be more fully described. Two parallel spaced partition members comprising horizontal planks 8 and downwardly and outwardly inclined boards or planks 9 extend from one end of the tank to the other a short distance above the bottom 3 and down below the normal pulp level which has been indicated by dotted line 10. Vertical side walls 11 extend from one end of the tank to the other and are located parallel to each other and parallel to the side walls 1 so as to divide the upper surface of the tank into three compartments which have been indicated by letters A, B and C. The lower edges of the vertical walls 11 are provided with foraminated plates 12 that extend down below the normal pulp level and terminate a short distance above the upper surface of the planks 8 in the manner shown quite clearly in Fig. 2. Secured to the upper edges of walls 11 are transverse bars 13 which serve as supports for a manifold or header 14 that is connected to a source of compresed air supply by means of a pipe 15. Extending downwardly from

the header 14 are a plurality of pipes 16 that pass through the space between the partition members and terminate a short distance above the upper surface of the floor 3. When the air in the manifold 14 is under pressure, air will flow downwardly through the pipe 16 and be liberated near the bottom of the tank. A deflector is employed comprising two wedge-shaped sections 17 and 17′ which are identical in shape and size, but which are reversely arranged so as to form a compound deflector of substantially wedge-shape whose apex points downwardly. The inclined sides of this deflector are preferably curved in the manner indicated by numeral 18. Each deflector member is supported by means of two rods 19 which pass upwardly through the transverse bars 13 and have their upper ends provided with screw threads 20 with which the hand wheels 21 cooperate. By rotating the hand wheels, the deflectors may be raised and lowered so as to vary their position with respect to the pulp level 10. The tank is provided at one end with a sluice box 22 through which the pulp is fed into the tank. A baffle 23 is located a short distance inside of the end 2 and serves to direct the pulp downwardly towards the bottom of the tank in the manner quite obvious from the showing in Fig. 1. The other end of the tank is provided with a discharge spout 24. A baffle 25, which corresponds to the baffle 23 at the other end, extends downwardly to a short distance below the pulp level and is spaced from the discharge end 2, so as to form a passageway through which the pulp travels upwardly on its way to the discharge spout 24. The upper end of discharge wall 2 is provided with a plurality of removable strips 25 which can be removed one at a time or added one at a time so as to vary the liquid level.

Let us now assume that the tank is filled with pulp up to the dotted line 10 and that compressed air is supplied through pipes 14, 15 and 16. This air will be released near the bottom of the tank and will form bubbles such as indicated by reference numerals 27 in Fig. 2 and these bubbles will mix with the pulp and reduce its specific gravity, thereby causing it to flow upwardly between the partition members in the direction indicated by the upwardly and outwardly curved arrows. When these bubbles strike the curved surface 18 of the deflector they will be made to travel outwardly toward the foraminated plates 12 and most of the pulp and air bubbles will pass through the openings in these plates into the compartments A and C. The froth containing the mineral values will accumulate in the froth compartments A and C and when the froth level has reached a point above the top of the strip 6, the froth will flow into the launders 7 in the manner indicated. The sulfide particles and the metallic mineral values which have not become entrained by the air bubbles will pass downwardly about the outside of the partitions in the direction indicated by the downwardly and inwardly pointing arrows in Fig. 2. There will, therefore, be a circulation of the pulp in opposite direction about the two parallel partitions so that whatever values fail to become entrained at first will have an opportunity to become entrained with the air bubbles on their second or subsequent passages upwardly between the partitions. Pulp can be continuously fed into the tank through the sluice 22 and therefore there will be a continuous flow of pulp toward the discharge spout 24. As this pulp moves from the intake toward the discharge end of the tank, it will circulate about the partitions and will therefore have a spiral motion in its passage through the tank. This spiral motion, as above intimated, gives repeated opportunities for the metallic values to become enmeshed in the foam and therefore the separation is exceedingly well accomplished.

It will be observed from the drawing and from the above description that this flotation apparatus has no rotating parts and that the only movable parts connected therewith are the deflectors 17 and 17′. There are, therefore, no bearings to be deleteriously affected by the pulp and there is nothing to wear out.

The deflectors 17 and 17′, as above explained, can be adjusted by means of the hand wheels 21 and it is apparent that when they are located as shown in Fig. 2 with the curved surface 18 almost entirely beneath the pulp 11, the upward flow of bubbles will be turned outwardly so that very little of the air will escape into the compartment B. By moving the deflectors upwardly, it is evident that there will be a greater area between the foraminated plates 12 and the deflectors and therefore there will be a greater opportunity for the air to escape into the central chamber. By means of this adjustment it is possible to regulate to a considerable extent the production of froth and the effectiveness of the apparatus.

I want to call particular attention to the great simplicity of this device and to the fact that by it the pulp is made to travel in a helical path from one end of the tank to the other so as to bring every particle of metallic value into contact with the air bubbles whereby a very efficient operation is obtained. The liberation of the air near the bottom 3 prevents the pulp from settling on the bottom and keeps it always well stirred and agitated.

When the deflectors occupy the position shown in Fig. 2, the pulp, together with the air bubbles entrained therewith, will have a passageway of much smaller area to flow through than when the deflectors are in a more elevated position and therefore the ve-

locity of flow is greatest at this position, wherefore more of the air will flow into the froth compartment than when the deflectors are located higher. If the deflectors were removed entirely, it is evident that the greater part of the air would pass upwardly from the air lift into compartment B and therefore a greater amount of air would be required to do the same amount of work.

It will be observed that the air lift compartment, which comprises the space between the partition members as well as that between the vertical walls 11, has a pulp overflow whose bottom surface is the top of the planks 8 over which the pulp flows on its way back to the air lift compartment and that this is below the froth overflow.

Having described my invention what I claim as new is:

1. In a pneumatic flotation apparatus, a tank, two parallel spaced partition members extending longitudinally of the tank, said members being spaced from the sides and bottom of the tank and located below the normal liquid level, means for introducing compressed air at spaced intervals along the tank at points adjacent the bottom and directly below and between the spaced partitions, spaced parallel vertical walls extending longitudinally of the tank, the lower edges of said walls extending a short distance below the normal liquid level and provided with foraminations, an elongated horizontal wedge-shaped deflector located between said walls, the point of said deflector extending downwardly and means for adjusting the deflector in a vertical direction.

2. A pneumatic flotation apparatus comprising, in combination, a tank having an elongated air lift compartment, an elongated froth compartment on each side of the air lift compartment, means for releasing compressed air near the bottom of the air lift compartment, an elongated deflector located in the air lift compartment, said deflector having a wedge shaped cross section and arranged with its point projecting downwardly and terminating below the level of the liquid and means for adjusting the deflector vertically.

3. A pneumatic flotation apparatus comprising a tank having an elongated air lift compartment having a froth-compartment along each side, the air lift compartment being separated from the frothing compartments by means of walls which are provided with foraminations, means for releasing compressed air near the bottom of the air lift compartment whereby bubbles are formed and means located within the air lift compartment for directing the air bubbles outwardly towards the foraminations and means for adjusting the position of the deflector so as to control the flow of air and pulp through the foraminations.

4. In a flotation apparatus having an elongated tank provided with an upwardly concave bottom surface, means for supplying pulp to one end of said tank, a discharge spout at the other end, a launder secured to each side of the tank adjacent the top thereof, said launders being adapted to catch froth that overflows the upper edges of the sides, a pair of spaced parallel partition members extending from one end of the tank to the other, said members being located between the bottom and the normal pulp level, a vertical wall member located above each partition member, the lower edge of each wall member projecting downwardly into the pulp and having foraminations, a compressed air header extending longitudinally of the tank above the same and a plurality of pipes extending downwardly from the header between the vertical wall members and between the partition members, said pipes terminating adjacent the upper surface of the bottom the combination with the above elements of an elongated deflector located adjacent the pipes between the vertical wall members and means for adjusting the position of the deflector vertically.

In testimony whereof I affix my signature.

JOSEPH P. RUTH, JR.