Jan. 13, 1942. F. A. DROMGOLD 2,269,583

MATERIAL SEPARATION DEVICE

Filed Feb. 3, 1939

Fig. 1.

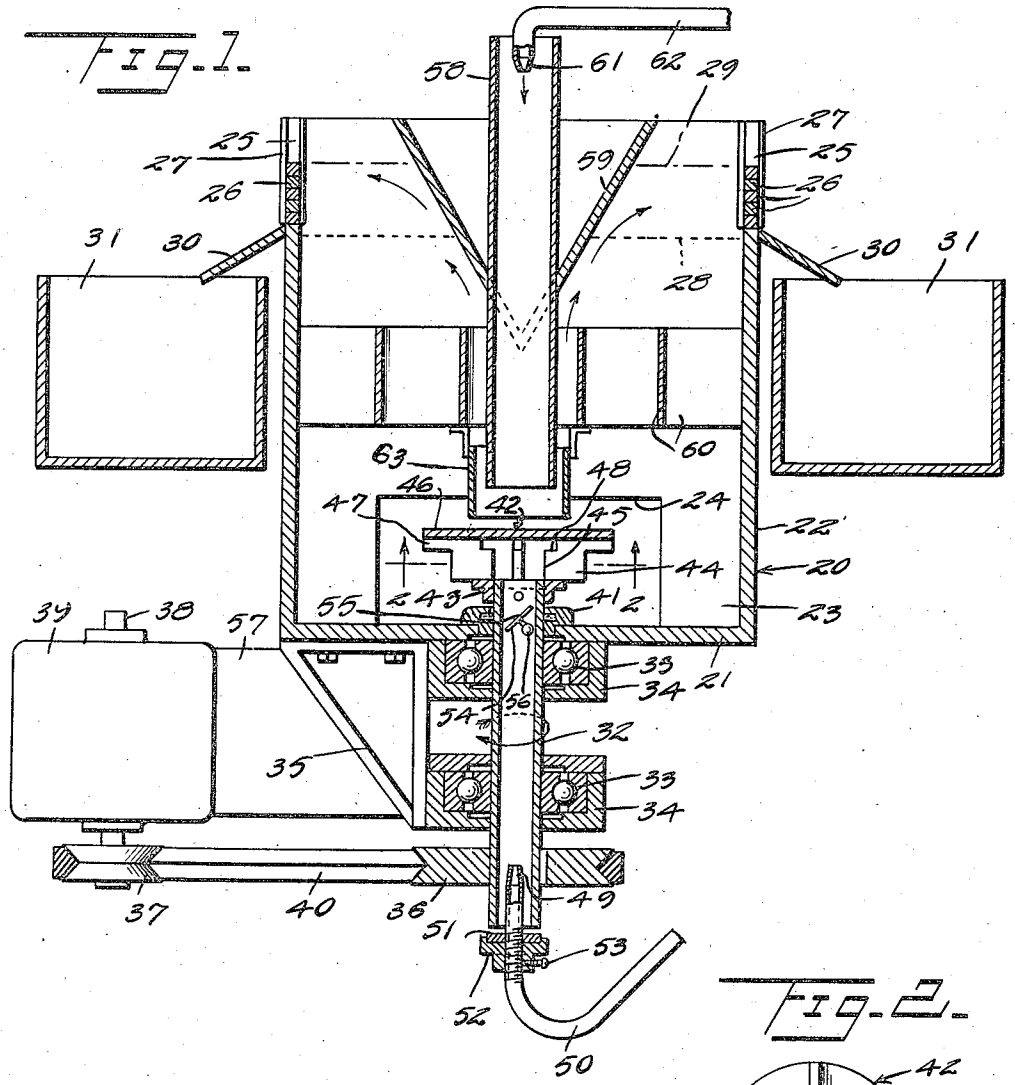
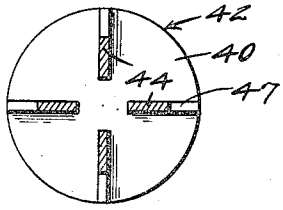


Fig. 2.



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2,269,583

MATERIAL SEPARATION DEVICE

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4 Claims. (Cl. 261—93)

This invention relates to material separation devices and more particularly to a device adapted for separation of various types of material, such as metals or the like by the flotation process.

An object of this invention is to provide an improved apparatus and process for separation of metals which are finely ground or comminuted to which water or a liquid is added to form a pulp, and which are discharged into a cell or chamber where chemicals or other re-agents are added and wherein the material is agitated and aerated in order to form a froth on the top or surface of the pulp or liquid, which froth is adapted to carry off the desired materials.

Another object of this invention is to provide in a flotation device of this kind an improved agitating means and aeration means so as to permit the use of a smaller agitating means and also permit the rotation of the agitating means at a higher speed and less power.

A further object of this invention is to provide in a combined agitating and aeration means whereby the re-agent will be drawn into the cell and the material by the suction formed upon rotation of the agitating means.

A further object of this invention is to provide in a flotation separator means within the separator for recirculating the material in the cell, the material being continuously returned to the spreader which forms a part of the agitator.

A still further object of this invention is to provide an agitating means of this kind which is so constructed that it can be operated through the medium of a relatively small power motor or other source of power supply and at the same time agitate the material to the desired degree in order to form the froth on top of the liquid for the purpose of carrying off by the flotation process the desired metals or other material.

A further object of this invention is to provide an improved agitating and aeration means which can be readily mounted in the present construction of flotation apparatus as a substitute for the present agitating and aeration means.

A further object of this invention is to provide an improved process of removing metals or other material from ore.

A further object of this invention is to provide an improved process wherein the incoming material is discharged directly upon the upper surface of the agitator and then thrown outwardly by centrifugal force so that the incoming material will not only be agitated by means of the agitating blades forming a part of the agitating device, but will also be agitated and prevented from packing in the bottom of the cell by contact with the agitator as the material is entering the flotation cell.

A further object of this invention is to provide an improved agitating means for a flotation separator cell wherein the agitator is so constructed that the pulp is prevented from clogging up the air outlet forming part of the agitator so that the air discharged through the agitator will be discharged in the form of air bubbles in order to assist in the separation of the desired material.

To the foregoing objects and to others which may hereinafter appear, the invention consists of the novel construction, combination and arrangements of parts as will be more specifically referred to and as illustrated in the accompanying drawing wherein are shown embodiments of the invention, but it is to be understood that changes, variations and modifications may be resorted to within the scope of the invention as claimed.

In the drawing:

Figure 1 is a vertical section taken transversely through one cell of a flotation device constructed according to an embodiment of this invention,

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Referring to the drawing, the numeral 20 designates generally one cell forming part of a flotation separator which includes a bottom wall 21, upstanding side walls 22 and end walls 23. One of the end walls 23 separates the cell 20 from a second or adjacent cell which is similar to the cell 20 and this wall 23 which is an inner wall is provided adjacent the lower end thereof with an opening 24 permitting communication between the cell 20 and the next or adjacent cell in order that the pulp may flow from one cell to the other. The side walls 22 are provided adjacent the upper portion thereof with outlet openings 25, the height of which is controlled or regulated by means of slats forming weirs 26 which are slidably mounted in guide members 27.

The cell 20 is adapted to have a fluid or pulp therein which has a level indicated by the dotted line 28. The agitation of the material in the cell 20 will form what is termed a froth on top of the fluid or pulp and this froth rises to the height shown by the dot and dash line 29. The height of the froth is controlled by means of the slats or weirs 26 and the froth then overflows the weirs 26 and discharges over a shield or plate 30 into a receptacle or launderer 31. At the present time, it is the practice to discharge the incoming pulp or comminuted material into one side of

the cell 20 at a point below the fluid level 28 and in the direction of a rotatable agitating device mounted in the cell 20. However, the present agitating means and the method of discharging the material into the cell 20 has a disadvantage of requiring a relatively high powered means connected to the agitator in order to keep the agitator rotating at the desired rate of speed to thoroughly agitate the material.

In order to provide an improved agitating means whereby the power necessary to agitate the material may be reduced and at the same time the agitator may be rotated at a relatively high speed, I have provided a shaft 32 which is journalled in anti-friction bearings 33 carried by bearing housings 34 supported by a bracket 35 fixed to the bottom 21 of the cell 20. The shaft 32 in the present instance is preferably hollow and the lower end of the shaft 32 has a pulley or driven member 36 fixed thereto. A driving member 37 is secured to the shaft 38 of a motor or other suitable power means 39 and the drive member 37 is connected to the driven pulley 36 by a belt or flexible drive means 40. The bottom 21 of the cell 20 is provided with a gland or bearing member 41 through which the shaft 32 projects. A combined agitating and aerating means generally designated as 42 is fixed to the inner or upper end of the hollow shaft 32 and comprises a hub 43 which is fixed to the upper end of the shaft 32 and a plurality of radially arranged agitating blades 44 are fixed to the upper or inner side of the hub 43. The agitating blades 44 have their inner edges 45 positioned in spaced relation one to another and preferably the inner edges or ends 45 of the blades 44 are spaced apart a distance substantially equal to or greater than the outer diameter of the hollow shaft 32. A disc 46 is fixed to the upper or inner edges of the blades 44 and preferably the blades 44 are provided with auxiliary blades or extensions 47 which project outwardly beyond the outer edges of the blades 44 and are relatively narrow in construction being disposed immediately below the lower surface of the plate 46 and terminating at their outer ends at the outer end or marginal edge of the disc 46. The blades 44 are also provided at their upper inner corners with cut-out portions 48 forming an air chamber laterally of the axis of the shaft 32.

A nozzle 49 is disposed within a hollow shaft 32 and is connected to a pipe 50 which is connected to a source of re-agent supply so that the re-agent will be discharged upwardly in the hollow shaft 32. A valve member 51 carried by a valve head 52 which is threaded onto the pipe 50 is adjustable relative to the lower end of the shaft 32 in order to control the quantity of air entering the lower end of the shaft 32. In the present instance, the head 52 is threaded on the pipe 50 and may be locked in adjusted position by a set screw 53.

A butterfly valve 54 is mounted on a shaft 55 extending diametrically across the hollow shaft 32 and a weight 56 is dependently secured to the shaft 55 and gravitatingly swings the butterfly valve 54 to a closed position. In the present instance, the power member 39 is secured to an extension or supporting arm 57 which may be formed as part of the bracket 35 so that the bearings 34 and the power member 39 may be mounted as a unit below the cell 20.

A feed pipe 58 is dependently supported in the cell 20 in a position with the lower or discharge end thereof positioned closely adjacent the upper surface of the plate 46 and positioned with the axis of the discharge member 58 co-planar with the axis of the drive shaft 32. A pair of inwardly convergent baffle members 59 are secured to the end walls 23 of the cell 20 at a point adjacent the upper portion thereof so that as the material in the cell 20 moves upwardly, this material will move laterally to each side or in the direction of the two weirs 26. The cell 20 may also be provided with a plurality of vertically disposed baffles or partitions 60 which are positioned at a point above the bottom 21 and below the upper end of the cell 20. A nozzle 61 is positioned within the feed pipe 58 and is connected to a pipe 62 which is adapted to be connected to a source of re-agent supply so that if desired the re-agent may be discharged into the incoming material and at the same time a re-agent may be discharged upwardly into the shaft 32 where the latter re-agent is drawn by the suction formed by the rotating blades 44 into the cell 20. In certain instances, it is found desirable to discharge at least a small quantity of re-agent into the incoming material and in certain other instances it is found desirable to discharge substantially all of the re-agent into the incoming material, while in still other instances, it is found desirable to eliminate the discharge of a re-agent into the feed pipe 58 for mixture with the incoming materials.

In the use and operation of this device, the ground material or pulp is discharged into the feed pipe 58 shown in Figure 1 and co-incident with the discharge of the ground material or pulp, the agitating member 42 is set in operation. When the agitating member 42 is set in rotation by the power member 39, the blades 44 will agitate and aerate the pulp or liquid. The valve member 54 in the shaft 32 will gradually open upon rotation of the shaft 32 so that when the blades 44 are rotating a suction in the shaft 32 will be formed drawing air past the valve member 51 into the pipe 32. As the air is drawn into the shaft 32, the upwardly moving air will also draw up the re-agent which is discharged from the nozzle 49. If desired the re-agent in the pipe 50 may flow to the nozzle 49 by gravity although where a spray is used, the re-agent may be placed under a suitable pressure, thus spraying the re-agent in an upward direction in the shaft 32. The upwardly moving air will draw the re-agent into the cell 20 where the re-agent is thoroughly mixed with the material in the cell 20 and is also thoroughly mixed with the material moving downwardly through the feed pipe 58. The material from the feed pipe 58 is dropped onto the rotating plate 46 which will centrifugally throw the material laterally and at the same time the inwardly, outwardly and upwardly moving air will mix with the material and will also carry some of the ground material upwardly in the cell 20. The rotation of the agitating member 42 will cause a froth or foam to occur above the liquid or pulp level 28 and this froth may then be taken off over the weir 26. In order to provide a means whereby the pulp in the cell 20 may be prevented from forming whirlpools I have provided the parallel baffle members 60 which are positioned slightly above the agitating member 42. It will be apparent from the foregoing that the quantity of air drawn into the cell 20 is proportionate to the speed of the agitating member 42 and as soon as the agitating member 42 stops rotating the fluid in the cell 20 is prevented from flowing downwardly through

the shaft 32 by the gravity closing valve member 54.

With a combined agitator and spreader as hereinbefore described the incoming material is prevented from clogging up the agitating blades, and the spreader serves not only as a means for centrifugally spreading the material above the agitator, but also as a means to prevent clogging of the air chamber formed as part of the agitator.

In order to provide a means whereby the pulp in the cells 20 may be continuously recirculated so as to thereby remove the desired product therefrom, recirculation member 63 is supported about the feed pipe 58. These recirculation members have their upper and lower ends open, and their upper ends are disposed below the normal pulp level. The material flowing downwardly through the member 63 discharges onto the spreader member 46.

The novel construction of the agitator blades and the combined air feeding means provides an air pump and agitating means for the material, the air pump being so designated as to prevent the material clogging the air inlet. This is accomplished through the placement of the spreader between the incoming material and the agitator.

What I claim is:

1. A flotation separator comprising a cell member, a vertically disposed hollow shaft journalled in said cell, driving means for said shaft, one end of said shaft extending exteriorly of said cell and communicating with the atmosphere, air controlling means on the outer end of said shaft, a centrifugally opening valve carried by said shaft, an agitating member on the inner end of said shaft, and means discharging material in the direction of said agitating member.

2. A flotation separator comprising a cell member, a vertically disposed hollow shaft journalled in said cell, driving means for said shaft, one end of said shaft extending exteriorly of said cell and communicating with the atmosphere, air controlling means on the outer end of said shaft, an agitating member on the inner end of said shaft, means discharging material in the direction of said agitating member, means discharging a re-agent into said shaft and centrifugally opening valve means in said shaft.

3. A flotating separator comprising a cell member, a vertically disposed hollow shaft journalled in said cell, driving means for said shaft, one end of said shaft extending exteriorly of said cell and communicating with the atmosphere, air controlling means on the outer end of said shaft, a centrifugally opening valve in said shaft, agitating blades fixed to said shaft in said cell, said blades being formed with cutout portions to provide an air chamber concentrically thereof and inwardly of the inner end of the shaft.

4. A flotation separator comprising a cell member, a vertically disposed hollow shaft journalled in said cell, driving means for said shaft, the outer open end of said shaft communicating with the atmosphere, air controlling means adjacent the outer end of said shaft, an agitating member on the inner end of said shaft, and centrifugally opening valve means in said shaft inwardly of the outer end thereof.

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