

[54] **AGITATOR ASSEMBLY FOR RECOVERY OF MINERALS**

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[58] Field of Search 209/168-170; 261/87, 93; 259/107, 108, 95, 96, 23, 24, 43, 44, 7, 8

[56] **References Cited**

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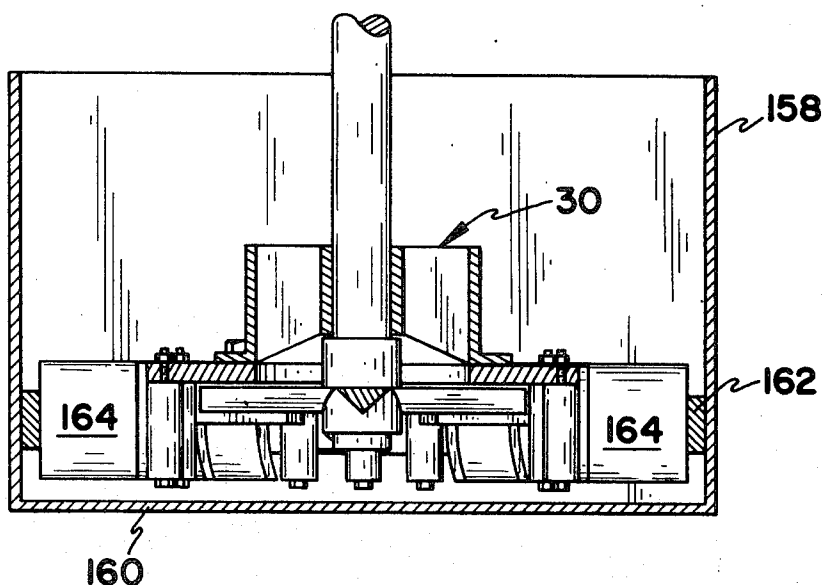
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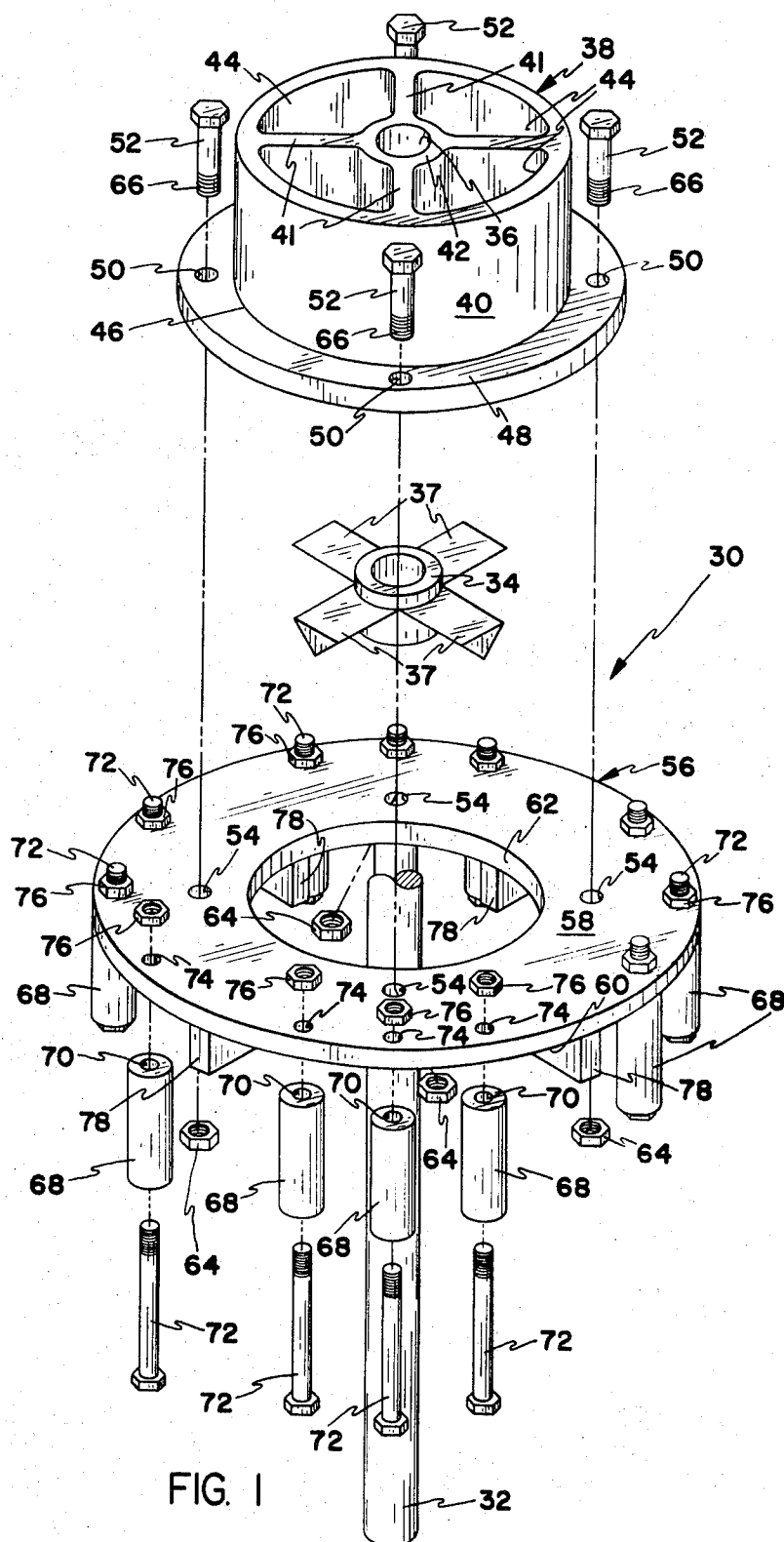
ABSTRACT

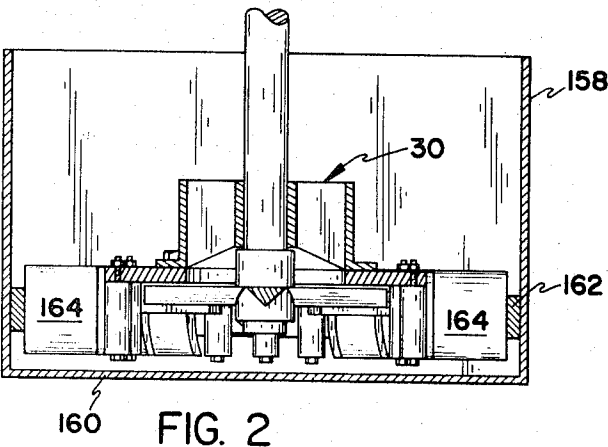
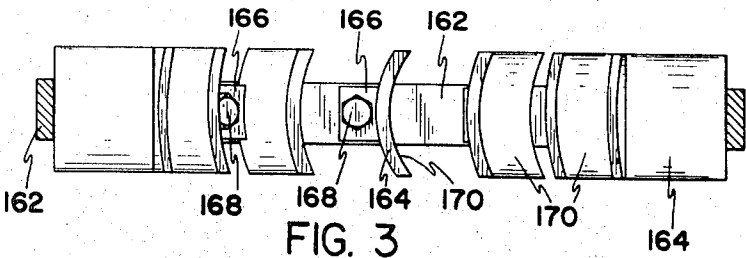
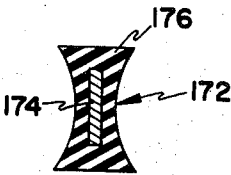
Apparatus for treating ore pulp in a treatment cell attendant to recovery of minerals therefrom, the apparatus having a rotatable shaft with an attached impeller. A stabilizer device is joined to the cell adjacent the impeller so that a shear zone is developed in the ore pulp, the stabilizer device being configured to maximize turbulence in the shear zone and minimize surging and boiling of the ore pulp at the surface thereof.

3 Claims, 4 Drawing Figures



SHEET 1 OF 2





AGITATOR ASSEMBLY FOR RECOVERY OF MINERALS

This application is a division of my copending U.S. Pat. application Ser. No. 842,528, Filed July 17, 1969, now U.S. Pat. No. 3,700,103.

FIELD OF THE INVENTION

The present invention relates to apparatus for the recovery of minerals from ore pulp and more particularly to standpipe and impeller structure used within a mineral treating cell, in conjunction with a novel stabilizer, to improve the circulating, aerating and conditioning of ore pulp during the recovery of minerals therefrom. The novel stabilizing structure causes increased contact of the ore pulp and treatment compounds in the cell while simultaneously avoiding excessive boiling at the surface of the pulp.

DESCRIPTION OF THE PRIOR ART

The recovery of minerals by froth flotation and related mineral treatment is well known. Generally, the well-known procedure includes circulating an ore pulp suspension or solution through a treatment cell and agitating the pulp to mix minerals within the pulp with frothing or other treatment compounds pursuant to recovery of the minerals.

It is also known to provide a series of rigid stator blades to break up air bubbles introduced into the ore pulp and expose minerals for attachment to the froth-forming bubbles. For example, see U.S. Pat. No. 2,767,964 and 2,973,095. Nevertheless, it has been found that impeller-stator combinations presently used create undesirable boiling of ore pulp at the surface of the treatment cell. The boiling and surging of the ore pulp cause minerals carried by froth bubbles upon the ore pulp surface to fall back into the ore pulp thereby substantially decreasing the effectiveness of mineral recovery and increasing the time and cost for recovery.

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

It is a primary object of the present invention to provide improved turbulence and improved contact of ore pulp with air bubbles and treatment compounds within the treatment cell without causing a correspondingly high boiling of the pulp into the froth column formed by the mineral laden bubbles upon the surface of the said ore pulp.

The present invention provides an impeller structure comprising improved fluid flow control through the impeller structure. A novel device is disposed adjacent the impeller structure, the stabilizer device being uniquely configured so as to form a shear zone adjacent the impeller wherein substantial turbulence and intimate contact with mineral-treatment compound mixture is accommodated. The unique configuration of the stabilizer device and the relationship between the stabilizer device and the impeller structure prevents excessive boiling at the surface of the ore pulp. In this specification, ore pulp means a solution and/or suspension of mineral bearing ore prior to the extraction of all valuable minerals therefrom.

Another important object of the present invention is to provide novel stabilizer structure which avoids excessive boiling of the ore pulp at the surface thereof.

Another primary object of the present invention is to provide novel structure in a stabilizer, or agitator de-

vice, in combination with the impeller with rotating standpipe, wherein the said stabilizer comprises a plurality of radially placed blades which are concave, or curved, wherein the concavity, or curvature of the said blades is in the vertical plane of the said blade, and the said curvature extends from the bottom edge of the blade to the top edge of the blade.

A further and important object of the present invention is to provide a novel structure in a stabilizer which imparts a rotational movement to the ore pulp and the mineral-bearing froth.

These and other objects and features of the present invention will become more fully apparent from the following description and appended claims taken in conjunction with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of one presently preferred embodiment of the impeller structure and cylindrical collar of the invention;

FIG. 2 illustrates in cross section a stabilizer device embodiment disposed within a treatment cell, the impeller structure of FIG. 1 being illustrated in normal position adjacent the stabilizer device;

FIG. 3 is a elevational view shown partly in cross section illustrating the configuration of the blades of the stabilizer device illustrated in the embodiment of FIG. 2;

FIG. 4 illustrates in cross section another stabilizer device blade embodiment.

DESCRIPTION OF PREFERRED EMBODIMENTS

The Embodiment of FIG. 1

The component parts of the impeller structure generally designated 30 is illustrated in exploded perspective in FIG. 1. The structure 30 comprises a central shaft 32 which may be a solid or tubular shaft as desired, and is normally telescopically disposed first through a cylindrical sleeve 34 having a plurality of impeller blades 37 radially projecting outwardly therefrom. Each of the impeller blades 37 has an inverted triangular configuration so that as the impeller blades are rotated with the sleeve 34, ore pulp (not shown) in contact therewith will be thrust generally downwardly. The shaft 32 is non-rotatably joined to the sleeve 34 such as with a spline joint or key or the like.

The shaft 32 is also telescopically disposed through aperture 36 comprising part of a cylindrical collar or standpipe generally designated 38. The collar 38 comprises an annular outer wall 40. The cylindrical collar 38 is interiorly hollow and is connected to a central hub 42 with spokes 41 radially projecting inwardly from the outer wall 40. The spokes 41 are preferably identical in number as and aligned with the impeller blades 37. The hub 42 defines aperture 36, aperture 36 being centrally disposed completely through the hub 42. Hub 42 is interiorly provided with a key in order to be nonrotatably joined to the shaft 32. Alternatively, hub 42 may be otherwise permanently non-rotatably secured to the shaft 32.

The outer wall 40 and the spokes 41 cooperate to define a plurality of passageways 44 which open above and below the cylindrical standpipe 38. The passageways 44 have an important purpose which will be hereinafter more fully described. The lower end 46 of the standpipe 38 is provided with a peripheral flange 48 which projects outwardly from the standpipe 38. The

flange 48 is provided with spaced apertures 50 through which bolts 52 are normally disposed.

Bolts 52 are adapted to be similarly disposed through corresponding apertures 54 disposed at spaced locations in an annular disc 56. Annular disc 56 has a substantially smooth planar upper surface 58 and similarly, a substantially smooth lower planar surface 60. Disc 56 has an enlarged circular aperture 62 disposed central of the disc and having a dimension which is essentially the same as the inside dimension of the cylindrical standpipe 38. The cylindrical standpipe 38 may be disposed upon the upper surface 58 of the disc 56 and secured thereto by bolts 52 and made secure thereon by threading nuts 64 on the respective threaded ends 66 of bolts 52. Clearly, if desired, the disc 56 may be non-rotatably joined to shaft 32 by hub 34 and blades 37, making them integral with disc 56 so that spokes 41 and hub 42 of the standpipe 38 are unnecessary.

A plurality of downwardly depending fingers 68 is disposed adjacent the outer periphery of disc 56. Each finger comprises a cylindrical abrasive resistant rubber tube having a central throughbore 70. An elongated bolt 72 is adapted to be disposed through the bore 70 and also through apertures 74 spaced adjacent the periphery of disc 56. Nuts 76, threadedly secure bolts 72 and fingers 68 to the disc 56.

The attachment feature of the fingers 68 to the disc 56 is particularly important since prior to the instant invention, impeller fingers comprised a permanent part of the impeller structure. Frequently, the fingers would become broken or otherwise unusable and it was necessary for the entire impeller structure to be either discarded or substantially repaired. The above described embodiment accommodates placement and replacement of impeller fingers in a rapid and efficient manner without disturbing the remainder of the impeller structure.

The underside 60 of the disc 56 is also provided with radially downwardly projecting vanes 78. Vanes 78 are permanently secured to the disc 56 and radially traverse the lateral dimension of the disc from the apertures 62 to the peripheral edge thereof. If desired, the vanes 78 may also be removably attached to the disc 56.

The above-described impeller structure 30 accommodates downward channeling of ore pulp (not shown) through the passageways 44 in the standpipe 38 and through the impeller blades 37 which thrust the ore pulp downwardly. Depending fingers 68 and vanes 78, in addition, agitate and condition the ore pulp.

The Embodiment of FIGS. 2-4

FIG. 2 illustrates a treatment cell 158 which is circular in horizontal cross section and which has a flat bottom 160. Impeller structure 30 which is substantially identical to the impeller structure 30 illustrated in FIG. 1, is disposed within the treatment cell 158 essentially centrally and located vertically so that the low relief stand-pipe or collar 38 has the upper opening of passageways 44 sufficiently far below the surface of the pulp being agitated so that the suction caused by recirculation of the ore pulp through passageways 44 does not disturb the froth column which is floating upon the upper surface of the suspended pulp.

Near the bottom of the treatment cell 158 is mounted an annular metal ring 162 (best shown in FIG. 3). The metal ring 162 is rigidly mounted upon the interior sur-

face of the cell 158 somewhat above the bottom 160 and is provided with a plurality of spaced rigid baffles or stabilizer blades 164. Each blade 164 is provided with an L-shaped bracket 166 which has an aperture (not shown) adapted to be aligned with a bore hole (not shown) shown in the annular ring 162 so that a bolt 168 may be threadedly disposed therein to secure the stabilizer blades 164 in position around the annular ring.

It is particularly important that each of the stabilizer blades 164 is arcuately shaped so that the concave surface 170 of the stabilizer blade 164 faces a direction opposite the direction of rotation of the impeller structure 30. It has been found that this particular configuration improves the contact between ore pulp and air bubbles and other treatment material while simultaneously preventing excessive boiling and surging at the surface of both the ore pulp and the froth column. It is not intended, however, that the stabilizer blades 164 be limited only to use in treatment cell 158, which is circular in horizontal cross section. The novelly designed stabilizer blades 164 along with metal ring 162 and brackets 166 can easily be modified to fit in similar relation to the impeller 30 and treatment cell which has a rectangular or other horizontal cross section.

If desired, the stabilizer blade 172 may be substituted for the blade 164 above described. Stabilizer blade 172 comprises an inner metal core 174 which is disposed within resilient material 176 such as rubber having a biconcave configuration. When the stabilizer blade embodiment of FIG. 4 is rigidly joined to the annular ring 162, the impeller structure 30 may be rotated in either direction to accomplish the same advantageous result above described.

From the foregoing it is apparent that new and improved structure for treating ore pulp pursuant to the recovery of minerals therefrom has been provided by substantially increasing the effectiveness of aeration, agitation, conditioning and related treatment without excessive surging and boiling adjacent the top surface of the ore pulp while at the same time imparting a gentle rotational movement to the froth column mass.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A device for use in a mineral recovery flotation cell comprising:

vat means into which mineral-bearing pulp and treatment material are placed;

circulation means comprising rotatable, shaft means extending generally vertically into the interior of the vat, and impeller means non-rotatably attached to the shaft means within the interior of the vat and rotatable with the shaft means to cause continuous suspension of mineral in the pulp;

stationary stabilizer means horizontally spaced from and circumferentially disposed around the impeller means within the interior of the vat, the stabilizer means comprising a plurality of spaced blades each

5

having radially and vertically disposed edges and at least one curved surface the axis of curvature being generally horizontal against which the pulp and air within the pulp are displaced by the impeller to improve mineral recovery.

2. The device of claim 1 wherein the stabilizer blades each have two opposed concave surfaces the axis of

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curvature extending in a generally horizontal direction thereby accommodating improved agitation upon rotation of the impeller in either direction.

3. The device of claim 1 wherein at least one stabilizer blade comprises an inner metal core disposed within resilient material.

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