T. A. JANNEY.

ORE CONCENTRATING APPARATUS.

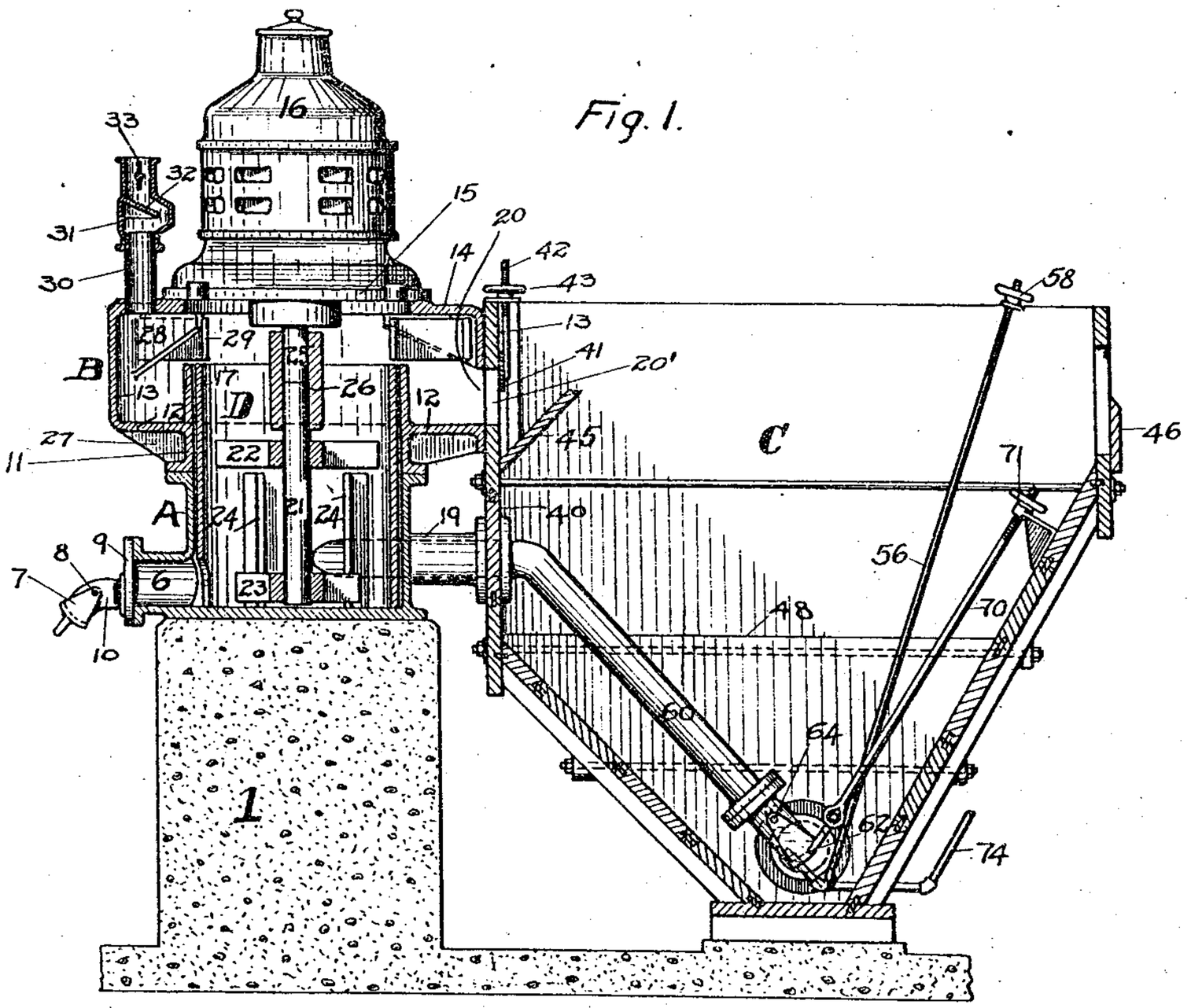
APPLICATION FILED AUG. 19, 1914.

1,167,076.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

B. A. Mitchell

B. N. Dorenbach

INVENTOR

Thomas A. Janney

BY

Sheridan Wilkinson & Scott

ATTORNEY

T. A. JANNEY.

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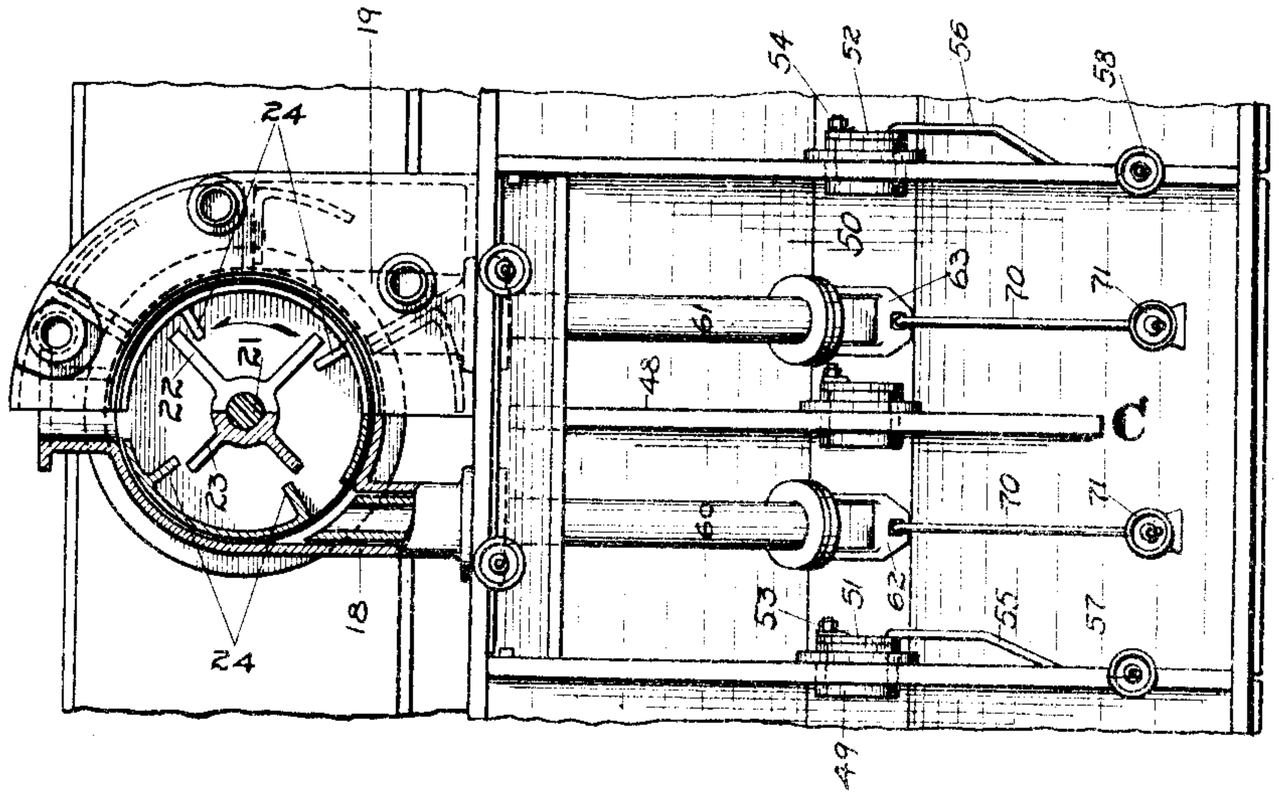
3 SHEETS—SHEET 2.

Fig. 2



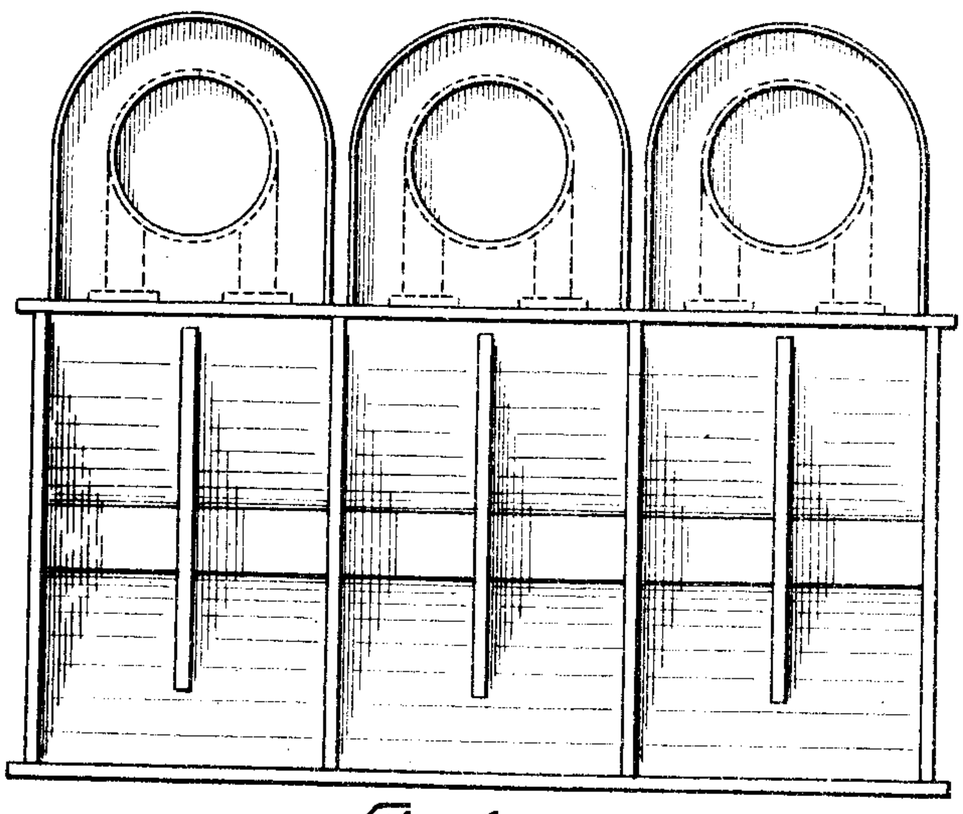


Fig. 4

WITNESSES:

B. A. Mitchell

B. N. Dorsenbach.

INVENTOR

Thomas A. Janney

BY

Brandon Wilkinson & Scott

ATTORNEY

T. A. JANNEY.

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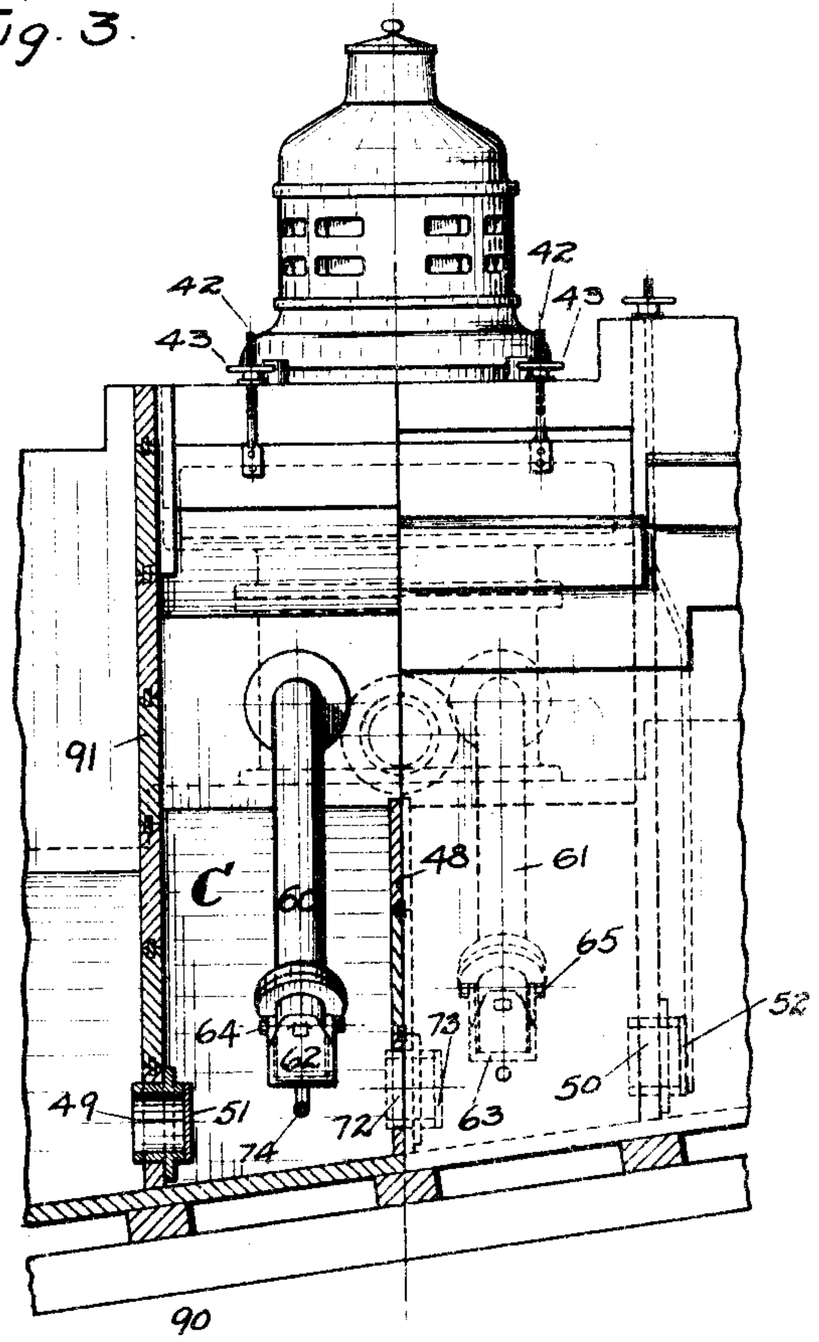
3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

E. A. Mitchell

B. L. Dorenbach.

INVENTOR

Thomas A. Janney

BY

Sheridan Wilkinson & Scott

ATTORNEY

UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

1,167,076. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed August 10, 1914. Serial No. 856,092.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus, of which the following is a specification.

The object of my invention is to provide an improved apparatus for carrying out flotation processes of concentrating ores.

The apparatus herein described and claimed is of the same general type as that set forth in my copending application, Serial No. 833,973, filed April 23, 1914, in that its operation involves repeated circulation of the ore pulp in each unit of the apparatus, but differs in the simplification of the connections between different units of the apparatus when arranged in series, thus economizing space, simplifying construction, and giving a more direct flow of the pulp from one unit of the apparatus to the next.

Another improved feature of the apparatus herein described and claimed is the use of an agitating vessel of less depth than, and arranged on a higher level than the related separating box or spitzkasten of the same unit. The shallower agitating vessel leads to a great economy in power by reason of the fact that the agitating blades are submerged under a much less head of liquid and hence impart the requisite stirring while working against a much decreased pressure, and at the same time the necessary depth of the separating box is maintained, thus giving ample opportunity for separation of the floating and sinking constituents and preventing disturbance of the floating material by the currents caused by removal of pulp from the bottom of the box.

The particular object and nature of my invention, and the scope thereof, will more fully appear from the following description, and the accompanying drawings of one form of apparatus embodying the same.

In the drawings, Figure 1 is a vertical section through the agitation vessel and the connected separating box. Fig. 2 is a plan view partly in section to more fully show the construction. Fig. 3 is an elevation of the apparatus, partly in section, from the right hand side of Fig. 1. Fig. 4 is a diagrammatic plan view of several units of the apparatus connected in series.

The apparatus rests upon a foundation 1 having an elevated pedestal to support the agitating vessel D at a higher level than the separating box C.

The agitating vessel in the particular form of the device illustrated, consists of two main castings, A and B, the former resting upon the foundation 1. In the lower casting A at the bottom of the agitation vessel, I provide a drainage spout 6 to which is fitted a valve consisting of plate 9 secured to the end of spout 6, tubular extension 10, and valve member 7 pivoted at 8 and adapted to control the outlet from the bottom of the agitation vessel. In operation the drainage spout 6 is closed and is opened only for the purpose of flushing out the apparatus when shut down for repairs or otherwise.

The upper casting B of the agitation vessel comprises a lower cylindrical part 11, seated on the lower casting 4, an outwardly extending substantially horizontal part 12, from which there extends upwardly the part 13, which is closed at its upper end by the inwardly extending top flange 14 and by the base 15 of the motor casing 16. The part 13, as shown in Fig. 2, is cylindrical in form on the side away from the spitzkasten, but rectangular on the side adjoining and communicating with the spitzkasten. A cylindrical lining 17 extends from the bottom of the main chamber of the agitation vessel to a point considerably above the outward projection 12 of the upper casting B, the lining being apertured opposite the spout 6, and opposite the ducts 18, 19 which form part of the lower casting and communicate with the separating box C.

The enlarged part 13 of the upper part of the agitation vessel is provided on the side thereof adjacent the separating box with an outlet opening 20 through which the pulp after being agitated and thrown upwardly over the upper edge of the lining 17, may flow to the separating box C.

The shaft 25 of an electric motor within the casing 16 is detachably connected to the agitator shaft 21 by a coupling 26, and two agitators 22 and 23, each consisting of four radial arms, are secured to the shaft 21. Projecting inwardly from the lining 17 of the agitation vessel D, are ribs or baffles 24, the arms of the lower agitator 23 being shorter than those of the upper agitator 22 in order to just clear the baffles and just

clear the inner surface of the lining 17. The upper casting B of the agitation vessel D is strengthened by braces 27 and 28 which are cast integral therewith. Liner plates 29, are bolted or otherwise secured to the braces 28 on the side thereof against which the pulp is thrown by the agitator. In the present instance the agitator is designed to revolve in the direction indicated by the arrow in Fig. 2. The braces 28 and liner plates 29, perform the additional function of preventing the pulp, which is thrown upwardly and outwardly by the agitator, from escaping through the air inlet pipes 30, which extend upwardly from openings in the top 14 of the agitation vessel, the upwardly extending pipes themselves forming an additional safeguard against escape of pulp. Upon the upper ends of the pipes 30 are valve casings 31, provided with valves 33 to regulate the admission of air, and with deflector plates 32 extending across the axes of the casings 31 to arrest any pulp that might be thrown upwardly in the pipes 30. The circular movement of the pulp as it is thrown upwardly is arrested by the plates 29, thus causing the pulp to fall into the launder formed outside of the liner 17 by the upper part of the liner, the outwardly extending floor 12 and the vertical wall 13.

The spitz box or separating box C is placed opposite and adjacent the agitation vessel D and is of the usual tapering form at its lower end. The side 40 of the separating box adjoining the agitation vessel is provided with an opening 20′, registering with the opening 20 in the enlarged part 13 of the agitation vessel, and a sliding valve or gate 41 is provided for regulating the opening 20—20′. The gate 41 is suspended on screw-threaded rods 42 in engagement with screw-threaded adjusting wheels 43 which rest upon supports at the upper edge of the wall of the box.

Extending upwardly and outwardly from a point below the opening 20—20′ I provide a guide plate 45 designed to give an upward direction to the pulp issuing from the opening 20—20′.

The box C is provided with an adjustable overflow gate 46. Extending upwardly from the bottom of the separating box C is a partition or baffle 48, the upper edge of the same being located about midway between the bottom of the box and the water level therein as determined by the overflow gate 46.

Pulp enters and leaves the apparatus through inlet and outlet openings 50 and 49, in the sides of the separating box, but is prevented by the baffle 48 from passing through the separating box without traversing the agitation vessel. Extending from the lower part of the separating box are two circulation pipes or ducts 60, 61, one on each side of the baffle 48. These pipes 60, 61 extend upwardly to the side of the box next the agitation vessel, where they communicate through ports in the side of the box, with the ducts 18, 19, extending outwardly from the lower part of the agitation vessel. The openings in the lower ends of the pipes 60, 61, are controlled by valves 62, 63, which have arms pivoted to said pipes as indicated at 64 and 65 and have an arcuate movement across the ends thereof. The valves 62, 63, are provided with operating rods 70, and are adjusted by hand wheels 71 screw-threaded thereon. The inlet and outlet openings 50 and 49, are regulated by valves 51, 52, which are operated by hand wheels 57, 58, screw-threaded on operating rods 55, 56. The baffle 48, is provided with an opening 72 at the lower part of the separating box, which opening is normally closed by a valve 73, when the apparatus is in operation, the valve 73 being opened only when one unit of a series is to be put out of operation without disturbing the operation of the other members or units of the series.

Water supply pipes 74, having their ends directed into the ends of the pipes 60 and 61, are provided for the purpose of flushing the apparatus in case it gets clogged through settlement of the pulp.

In operation the apparatus may be used either in single units or in series as diagrammatically illustrated in Fig. 4. In operation the apparatus is first started or primed with water, ore pulp not being admitted until after the apparatus is started with water. In this way all liability is avoided of clogging the apparatus by settlement of the ore, which might occur if pulp were admitted before a current was established through the apparatus. In starting a single unit of the apparatus, the outlet valve 49 of the separating box is closed and the inlet and circulation valves opened. As soon as the apparatus fills with water to a height sufficient to submerge the lower agitator 23, the agitator commences to agitate and force the water upward in the agitation vessel D, and to throw it through the opening at the top thereof, whence it flows through the duct 20—20′ to the separating box C. A higher effective level or hydraulic head is thus established in the separating box and the water begins to flow back to the agitation vessel D through the ducts 60, 61, thus establishing the local circulation. Thereupon the outlet 49 is opened, and pulp instead of water is admitted through the inlet 50. If several units are to be operated in series as diagrammatically illustrated in Fig. 4, the several units are preferably arranged upon an incline, the pulp entering the highest unit and discharging from the lowest. In Fig. 3 I have shown the bottom of the separating box inclining downward from the inlet to

the discharge side, and this inclination is continuous in a series of machines, the bottom 90 extending under all of the separating boxes at the same inclination and the different boxes being separated from each other by vertical walls 91. The extent of local circulation imparted to the pulp in each unit of the apparatus may be regulated through adjustment of the valves and speed of the agitators, the circulation being brought about by the fact that pulp is discharged upward from the agitation vessels into the spitz box at a more rapid rate than it is supplied to and discharge from the apparatus through the inlet 50 and outlet 49. The baffles or partitions 48 prevent the heavy and coarse material or any part of the pulp from passing directly through the separating box without entering the agitation vessel and thus insure circulation. I provide an opening 72 in the baffle or partition 48, but this opening is closed in the operation of the apparatus by a valve 73. In case however it is necessary to stop the operation of any one unit of a series for repairs or other purpose, this may be done without interrupting the operation of the other members of the series, it being necessary merely to open the valve 73 in the partition or baffle, thus permitting the pulp to flow directly through the separating box C of the disabled unit, without traversing the agitation vessel thereof.

In operation it may be found advantageous to adjust the gate 41 controlling the port 20—20′ leading to the separating box from the agitation vessel with the lower edge of the gate beneath the liquid level. In this event air cannot flow into the agitation vessel through the port 20—20′, and I have therefore provided the air pipes 30 hereinbefore described, and the air valves 33 whereby the amount of air admitted to the agitation vessel may be controlled for the purpose of governing the character of froth produced.

What I claim is:

1. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, and means for moving an ore pulp upwardly in said vessel and into said box.

2. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

3. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with valved admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, valves in said ports, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

4. In a device of the class described, an agitation vessel, a separating box adjacent said vessel and communicating therewith through two ducts adjacent the bottom thereof, a baffle extending upward from the bottom of said box between said ducts to a point above the same, admission and discharge ports communicating with said box on opposite sides of said baffle, and means for moving an ore pulp upwardly in said vessel and into said box.

5. In an apparatus of the class described, a series of separating boxes and agitation vessels, each of said separating boxes having communication adjacent its lower end with an adjoining agitation vessel, and each box having communication adjacent its lower end with the next succeeding box, a duct extending from each agitation vessel above the liquid level in the adjoining separating box and opening into said box, means for forcing an ore pulp upwardly in said agitation vessels, and means for compelling pulp entering each box to pass through the adjoining vessel before passing to the next box.

6. In a device of the class described, an agitation vessel, a separating box extending to a lower level than said vessel, an upper duct connecting said vessel and box at a point higher than the liquid level therein, and a lower duct connecting the same beneath the liquid level, and means in said vessel for agitating an ore pulp and impelling the same upward through said duct.

7. In a device of the class described, a separating box provided with an overflow, an agitating vessel of less depth than said box and opposite the upper part thereof, said vessel having an opening above said overflow and leading to said box, said vessel and box being also connected by a duct leading from the lower part of said box, and means in said vessel for agitating an ore pulp and impelling same upwardly.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms

thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough.

9. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough, said partitions having orifices and valves controlling said orifices.

10. In a device of the class described, an agitation vessel and separating box communicating with each other by a duct extending above the liquid level in said box and opening into said box substantially at the liquid level, a substantially air-tight cover over said box, said cover having air inlet openings and means for controlling the inflow of air through said openings.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:
R. H. HAWLEY,
WALTER A. SCOTT.