

Jan. 14, 1930.

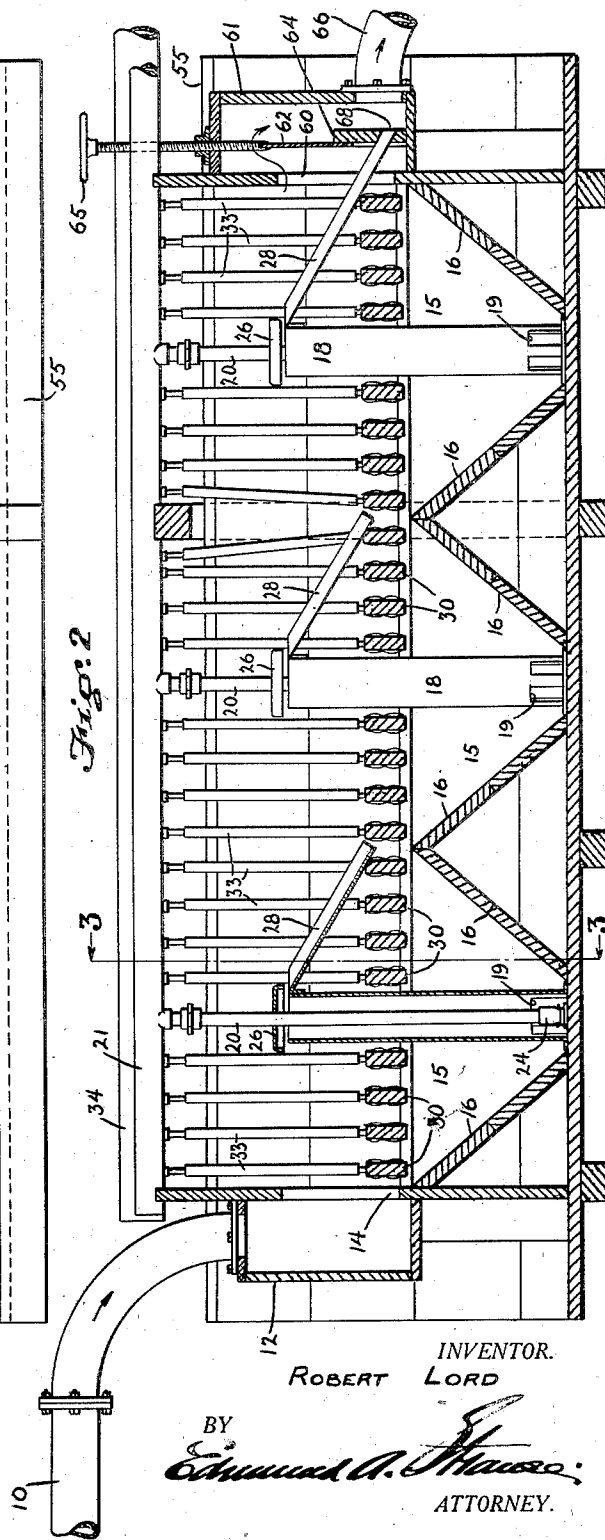
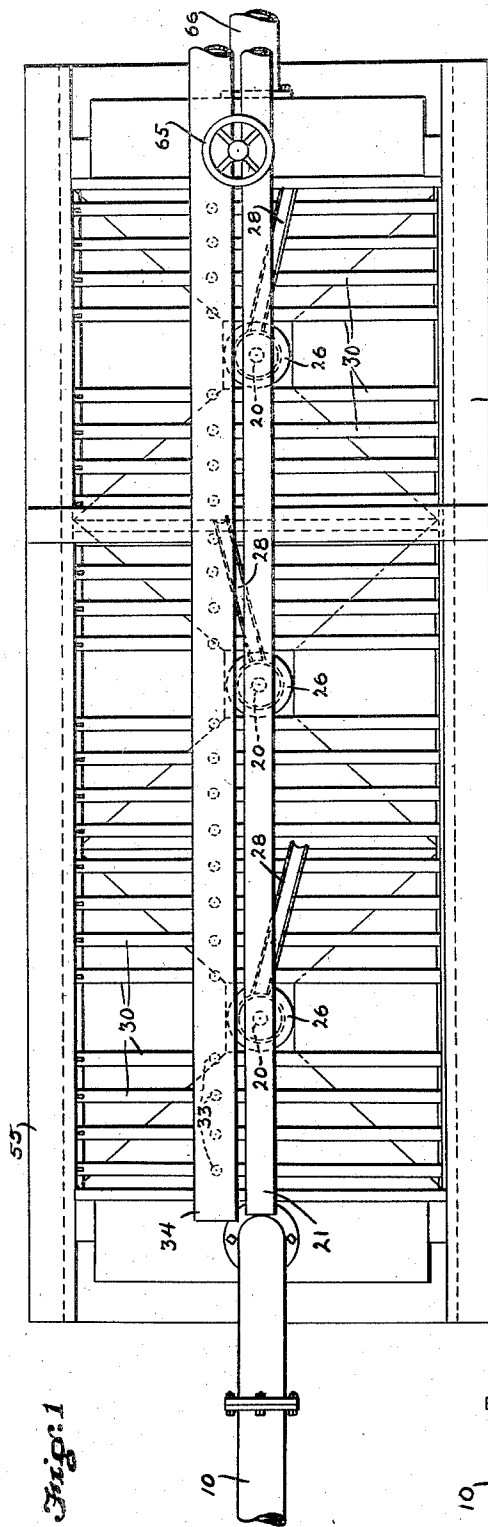
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1,743,926

PNEUMATIC FLOTATION MACHINE

Filed Sept. 1, 1926

2 Sheets-Sheet 1



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Fig. 3

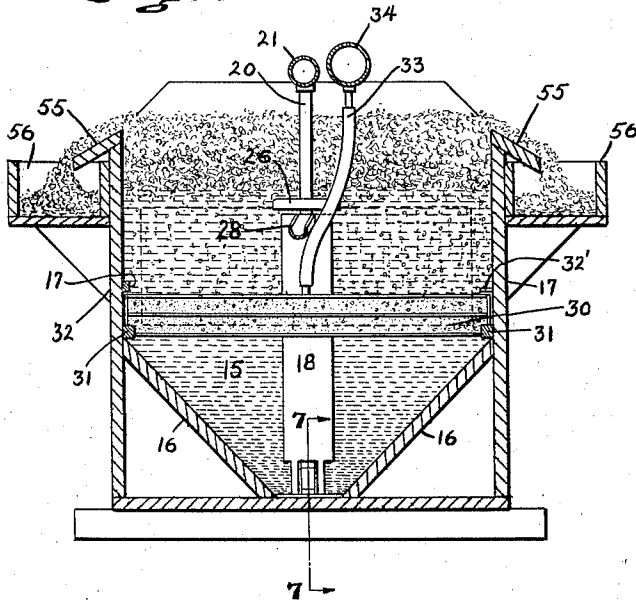


Fig. 5

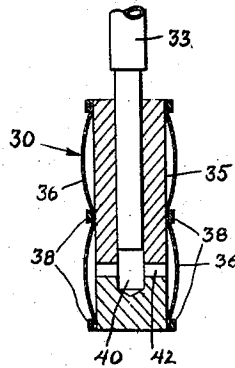


Fig. 4

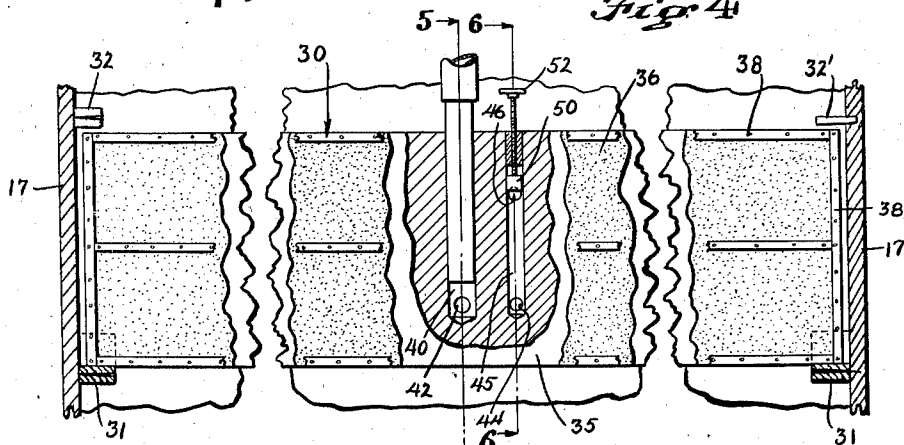


Fig. 6

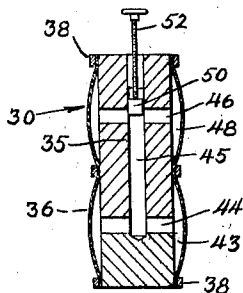
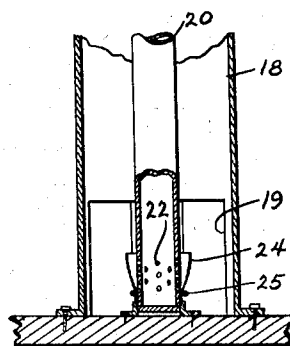


Fig. 7



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PNEUMATIC FLOTATION MACHINE

Application filed September 1, 1926. Serial No. 132,961.

The object of this invention is to provide a flotation apparatus for the recovery of metallic values by the mineral flotation method, whereby higher recovery may be obtained than heretofore and whereby such recovery may be had at less expense for apparatus and for air supply than has been possible with earlier equipment.

Briefly stated the invention resides in a container having its lower portion formed into a plurality of compartments preferably having walls converging toward the bottom for the direction of descending pulp toward the center of each compartment. At said center there is located a vertical tube or the like into the bottom of which the pulp passes and air under pressure is introduced for the purpose of agitation and levitation of the column whereby an upward circulation is established in the column due to the difference in hydrostatic head, thus causing a continuous discharge of aerated and agitated pulp from the top of the column into that portion of the container overlying the respective compartment. Below the pulp level and below the point of discharge from each circulating column, a plurality of aerating members is disposed, each of said members being of flat formation and arranged on edge for the discharge of air in diffused form from the sides thereof whereby the settling of pulp thereon and consequent clogging of air-escape passages will be prevented. In addition to the natural flow through the machine, means are provided for positively advancing a small portion of the heavier portions of the gangue from one compartment to the next. For proper air control, means are provided for separate introduction of air to the circulating column and the aerating members whereby the pressures and volumes may be regulated at will. The invention resides further in the various features, constructions and combinations thereof as herein disclosed and pointed out in the claims.

In the accompanying drawings wherein one embodiment of the invention is set out by way of illustration:

Fig. 1 is a plan view of a flotation machine embodying the invention;

Fig. 2 is a longitudinal section there-through;

Fig. 3 is a cross section on line 3—3 of Fig. 2;

Fig. 4 is chiefly an elevation of one of the aerating members with a portion broken away to indicate the air introduction;

Figs. 5 and 6 are cross sections on the lines 5—5 and 6—6 of Fig. 4; and

Fig. 7 is a fragmentary section through the bottom of the circulating column taken on line 7—7 of Fig. 3.

The feed pulp is introduced into the machine through a pipe 10 into a receiving box 12 whence it is discharged through opening 14 into the first of a series of compartments 15 having four converging bottom walls 16 above the tops of which the side walls 17 of the container extend. At the center of each compartment the pulp is delivered into the bottom of an upstanding tube 18 through openings 19 in the lower end thereof, and, for the purpose of agitating, aerating and elevating the pulp in the column formed by the tube, air under pressure is introduced into the bottom of the column through a pipe 20 supplied from a manifold 21. The air escapes through a plurality of small apertures 22 and is directed upward by means of a rubber valve 24 which surrounds the pipe adjacent the apertures and is bound thereto below the apertures by a ring 25. The valve 24 stretches to pass the air and contracts to seal the apertures 22 when air ceases to flow. Sufficient levitation of the column of pulp in tube 20 is produced by the air introduced thereinto to cause the column to rise under the differences in hydrostatic head and be discharged from the top of the column preferably below the pulp level as shown, the discharged pulp being deflected laterally by a cap 26, so that the greater part of the pulp falls back into the surrounding compartment. A small portion of the pulp, however, falls into a trough 28 which conducts the same to a point beyond the edge of the next compartment, whereby the heavy particles of gangue are gradually advanced toward the discharge end of the machine.

Over each compartment 15, and below the

pulp level and the top of the column 18, a plurality of aerating units 30 is disposed, each of these units being arranged horizontally and supported edgewise on the sides 17 of the container by means of notched rests 31 which receive the lower edge of the unit and being retained at the upper edge by a stationary stop 32 and a removable stop 32' which permit removal of the unit when desired. The vertical position of the units is also maintained by means of the depending air supplying pipes 33 which are connected with an air manifold 34 at their upper ends and whose lower ends enter bores or passages in said units.

Each aerating unit 30 comprises a block of wood 35 on each side of which a strip of canvas 36 is secured by means of straps 38 some of which extend around the edges thereof and one of which extends through the middle to divide the canvas into upper and lower longitudinally extending sections. The lower reduced end of the respective air pipe 33 enters a passage or bore 40 extending from the upper edge of the unit, and the air is conducted from passage 40 laterally through two ducts 42 into the spaces 43 which are formed between the block 35 and the lower strip of the canvas 36 by the bulging out of the canvas under the air pressure. Part of the air so introduced is diffused through the meshes of the canvas in finely divided form for aeration of the pulp alongside. Another part of the air passes from the spaces 43 by way of ducts 44 in the block 35 to a channel 45 whence it is carried upward to ducts 46 and discharged into the spaces 48 formed between the block and the upper strip of canvas by the bulging of the canvas under the air pressure as in the case of the lower spaces 43. The amount of air passed into these upper spaces 48 may be controlled by means of a valve 50 operated by a handle 52. In this manner thorough aeration of the pulp above and between the aerating units is accomplished in conjunction with the aeration and agitation in the circulating column 18, with the result that a heavily-laden froth is formed.

The froth so obtained rises to the top of the apparatus and passes over the lips 55 at the sides thereof into the launder 56. The denuded pulp together with the heavier particles of gangue discharged into the troughs 28 is gradually carried through the machine from one cell to the next and further denuded of its values until it passes through an opening 60 in the end of the last cell into a discharge box 61, where it rises over the top of the end gate 62 which is adjustable in a block 64 and determines the level of the pulp in the apparatus. The pulp then falls to the bottom of box 61 and is discharged as tailings through the outlet 66 along with the heavy gangue descending down the last trough 28

which discharges through a port 68 in the block 64 to the outlet side of said box 61.

As will be apparent from the foregoing, the pulp containing the proper flotation oils or other agents, is directed by the converging bottom walls 16 toward the entrance openings at the bottom of the circulating column 18, and the pulp in said column is agitated, aerated and caused to ascend by the introduction of air under pressure from the pipe 20 past the rubber valve 24, said pulp overflowing at the top of the column and then being thoroughly aerated by the finely divided air being diffused through the canvas strips 36 on both sides of the aerating units 30, this air issuing under pressure from the air pockets 43 and 48 behind the upper and lower canvas sections. Thus the pulp is repeatedly aerated in each compartment, gradually passing from one to the next, the heavy particles likewise being gradually advanced by the troughs 28 from cell to cell so that heavy sulfid particles are repeatedly subjected to aeration. Preferably, the air is supplied to the circulating columns and to the aeration units 30 by separate manifolds 21 and 34 in order that the pressures may be separately controlled as conditions may require. For example, by increasing the pressure in the circulating columns, agitation and circulation may be increased at will without increasing the aeration and flotation effect from the aeration units. On the other hand, the volume of air from the units 30 may be increased or decreased to vary the flotation effect without any variation in the agitation and circulation. However, the pressure required in the aeration units 30 need be only sufficient to overcome the resistance offered by the canvas to the passage of the air. This is due to the fact, that there is no settling of the pulp on the canvas to clog its meshes and to the fact that the thorough agitation in the circulating columns keeps the coarser portion in suspension and relieves the aeration units of that duty. As a result very low air pressure may be employed, resulting in lower power consumption. This method also offers maximum opportunity for the flotation of the entire sulfid value in the pulp, due generally to the features mentioned and to the fact that the coarse particles are allowed to remain under treatment for longer periods of time than usual.

It will be noted that an aeration unit 30 may be removed and replaced without affecting operation of the others, thus insuring continuous operation even during repair.

What I claim is:

1. In mineral flotation apparatus, a circulating column and an aeration compartment adjacent thereto, said column being connected at its bottom with said compartment and discharging from its top into said compartment, means for introducing air into the bottom of said column to produce agitation

and circulation, and a series of aeration units in said compartment for aerating the pulp from said column.

2. In mineral flotation apparatus, a circulating column and an aeration compartment adjacent thereto, said column being connected at its bottom with said compartment and discharging from its top into said compartment, means for introducing air into the bottom of said column to produce agitation and circulation, and a series of aeration units in said compartment for aerating the pulp from said column, each of said units being horizontally disposed in the compartment and positioned on its edge, and each unit having means on its sides for discharging air from each side in finely divided form.

3. In apparatus for mineral flotation, an aeration compartment, a circulating column communicating at its bottom with said compartment and receiving therefrom the material to be acted upon, the top of said column discharging into said compartment, a series of air-diffusing units in the upper portion of said compartment, means for supplying air under pressure to the bottom of said column, and separate means for supplying air which may be under a different pressure to said units.

4. In apparatus for mineral flotation, an aeration compartment having converging bottom walls, a circulating column upstanding from the lowest point thereof and connected at its bottom with said compartment and discharging into the upper portion thereof, means for introducing air into said column for producing circulation and agitation, and a series of aerating units arranged across said compartment.

5. In mineral flotation apparatus, a circulating column, a compartment connected with the bottom of the column to feed thereto and receiving the material to be treated from the top of the column, means for introducing air into the column, and a trough leading from the top of said column for receiving a small amount of the heavier particles, said trough discharging beyond the edge of the compartment.

6. In mineral flotation apparatus, a compartment, a circulating column connected with said compartment at its bottom and discharging into said compartment at its top, a perforated pipe for feeding air into the bottom of said column, and a rubber valve about the perforations of the pipe adapted to permit passage of air into surrounding pulp and to close against the perforations to prevent entrance of pulp into the pipe when air passage ceases.

7. In mineral flotation apparatus, an elongated aeration unit adapted to be disposed on its edge, comprising a block, a canvas strip secured to one face of said block, a strap extending longitudinally of the canvas for di-

viding it into upper and lower sections, and passages in the block for feeding air under pressure into the spaces between the canvas and the adjacent wall of the block.

8. In mineral flotation apparatus, an elongated aeration unit adapted to be disposed on its edge, comprising a block, a canvas strip secured to one face of said block, a strap extending longitudinally of the canvas for dividing it into upper and lower sections, and passages in the block for feeding air under pressure into the spaces between the canvas and the adjacent wall of the block, the upper space being fed by a passage leading from the lower space.

9. In flotation apparatus, a tank having a determined liquid level, and an aerating element beneath said level, comprising a substantially vertical board, a porous covering for the board spaced from the sides thereof, and means for connecting the space between the board and the covering with a source of pressure fluid.

10. In flotation apparatus, a tank having a determined liquid level, and an aerating element below said level, comprising a supporting member extending between opposite sides of the tank in a substantially vertical position, a porous covering for the member, spaced from a side thereof, and means for connecting the space between the member and the covering with a source of air under pressure.

In witness that I claim the foregoing I have hereunto subscribed my name this 3rd day of August, 1926.

ROBERT LORD.