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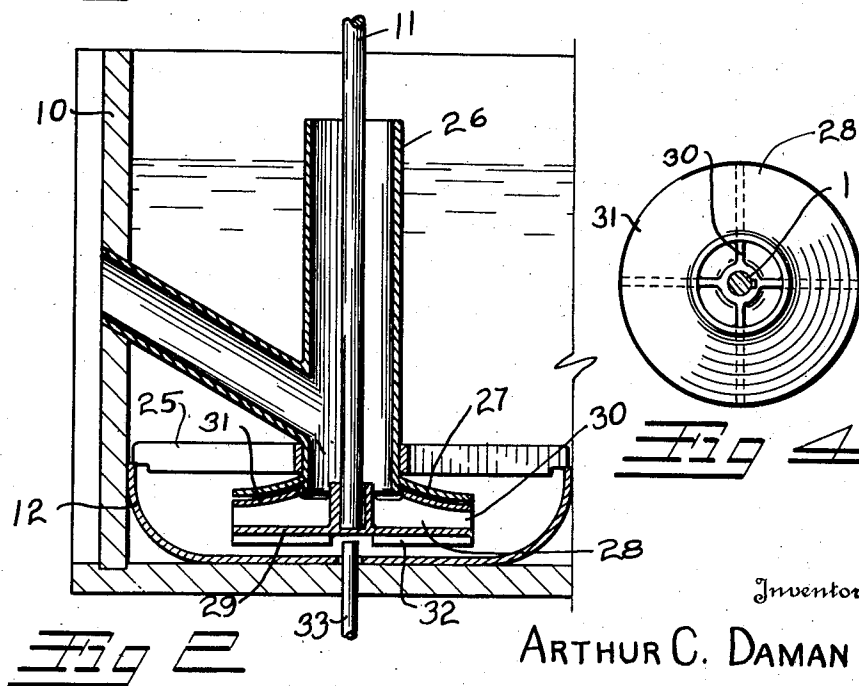
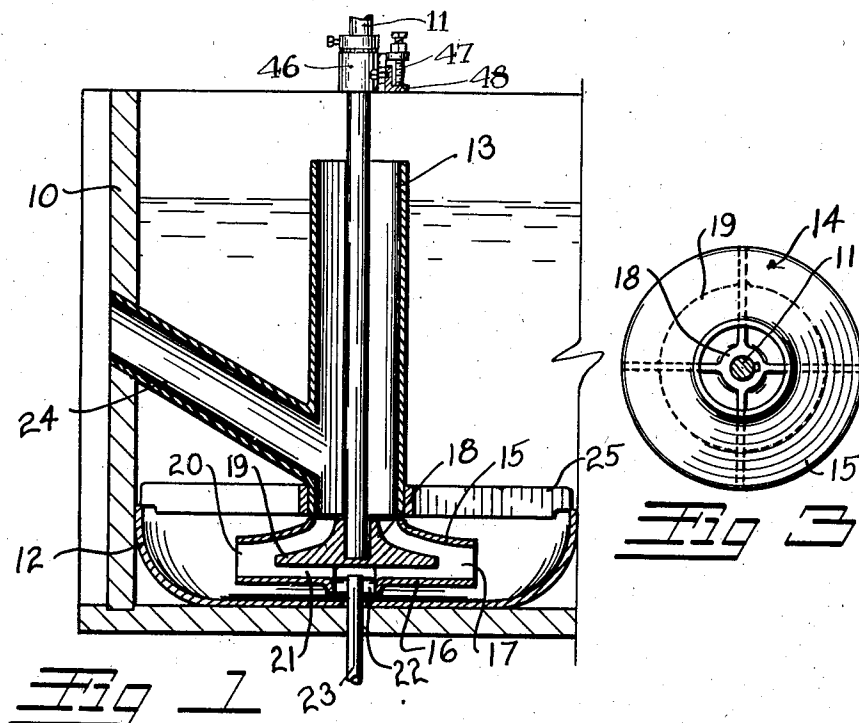
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1,985,153

FLOTATION APPARATUS

Filed July 10, 1928

2 Sheets-Sheet 1



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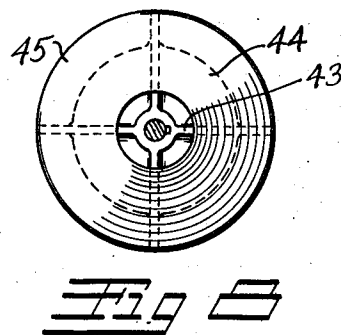
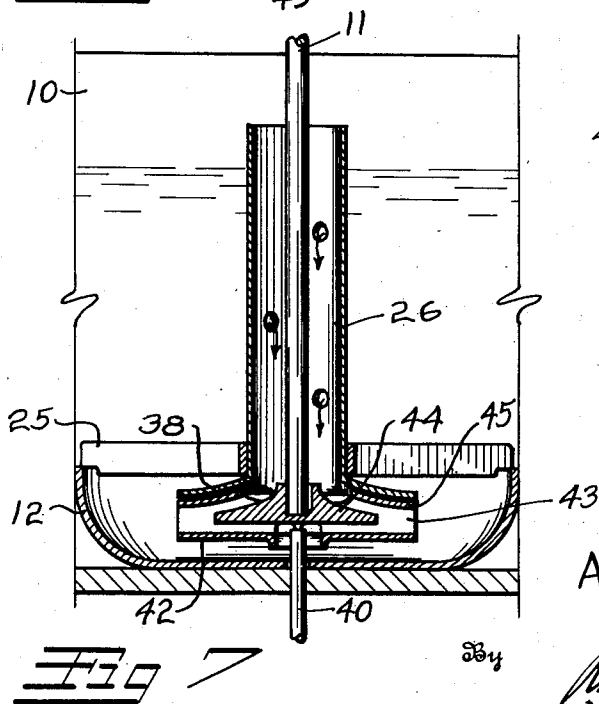
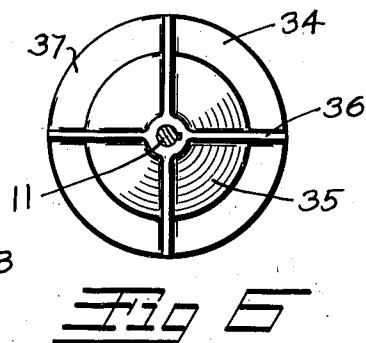
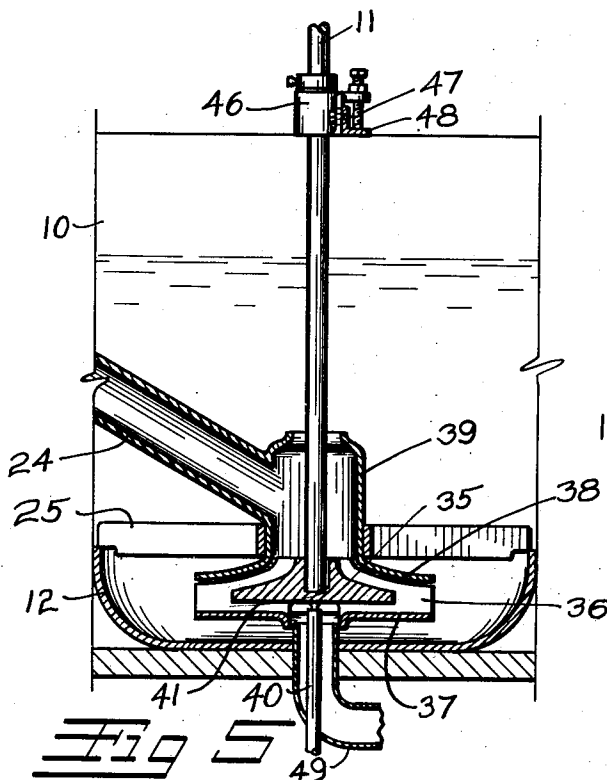
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FLOTATION APPARATUS

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

1,985,153

## FLOTATION APPARATUS

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Application July 10, 1928, Serial No. 291,583

9 Claims. (Cl. 261—93)

This invention relates to flotation machines more particularly to the impeller and the arrangement of the impellers for flotation machines.

The usual flotation machine impeller is required to raise the material into it by suction before projecting it by centrifugal action. The size of the material which can be handled in a machine of this character is therefore, limited by the size which can be successfully drawn upward by the impeller. The principal object of this invention is to provide an efficient impeller designed to receive the material upon its upper surface by the action of gravity. The range of size of the particles that can be handled by this improved impeller is therefore substantially increased.

Another object of the invention is to provide a horizontally rotating impeller which will receive pulp by gravity and eject the pulp combined with air in intimate relation by centrifugal action.

A further object of the invention is to provide an impeller which will receive falling pulp at its upper side and air at its lower side and eject the pulp and air, intimately mixed, at high velocity.

A still further object of the invention is to provide an impeller which will be more efficient in operation than the usual open type impellers and which will reduce the usual loss encountered by slippage or over-riding of the pulp over the blades of the impeller.

And a still further object of the invention is to so construct the impeller that it will not become frozen or locked in position by settling sand in case of a shut down.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

Fig. 1 is a vertical section through a flotation machine cell such as illustrated in my co-pending application, Serial No. 260,335, (Patent No. 1,942,803 dated Jan. 9, 1934) illustrating one form of my improved impeller in place therein.

Fig. 2 is a similar cross section illustrating a second form of the impeller.

Fig. 3 is a plan view of the impeller of Fig. 1.

Fig. 4 is a plan view of the impeller of Fig. 2.

Fig. 5 is a cross section through a flotation cell illustrating a third form of the impeller.

Fig. 6 is a plan view of the impeller of Fig. 5.

Fig. 7 is a cross section through a flotation cell illustrating a fourth form of the invention.

Fig. 8 is a plan view of the impeller of Fig. 7.

In the drawings the flotation cells are designated by the numeral 10 and the impeller shafts arranged to vertically rotate therein are designated by the numeral 11. In the bottom of each cell 10, a bowl-shaped liner 12 is placed to direct the impeller currents upwardly into the cell.

In the first form of my invention, illustrated in Figs. 1 and 3, the shaft 11 extends through a hollow air-column 13 which extends above the solution line in the cell and terminates immediately over the impeller which is designated in its entirety by the numeral 14.

The feed sleeve 13 is supported from a spider 25 which rests upon the bowl 12. The impeller 14 comprises a housing formed with a semi-conical top plate 15 and a bottom disc 16. The top plate 15 and the disc 16 are separated by impeller vanes 17. The impeller 14 is secured to the shaft 11 by means of a hub 18 within the housing, as shown at 19, which forms an upper pulp passage 20 and a lower air passage 21. The passages 20 and 21 are divided into a series of segment shaped passages by the vanes 17, the outlets of which are at the periphery of the housing.

The bottom disc 16 is opened at its center as shown at 22 to receive an air supply pipe 23. The top 15 of the impeller rides in close proximity to the lower edge of the stationary air column 13 and the end of the air supply pipe 23 is in close proximity to the bottom of the hub 19.

In use the impeller is rapidly rotated and pulp is fed into the air-column 13 at a point below the liquid level through a supply chute 24 or in any desired manner. This pulp falls upon the impeller, is sucked into the passages 20 and is discharged at the periphery by centrifugal action. Simultaneously, air from the column 23 will be drawn through the air passages 21 and discharged into the discharging pulp. This construction provides a very intimate mixture of the pulp and air and results in an efficient separation of the mineral and gangue.

In the second form of my invention, illustrated in Figs. 2 and 4, the column 13 terminates at its lower extremity in a circular shield 27 immediately above an impeller 28. The impeller 28 comprises a bottom disc 29 supporting impeller vanes 30 which carry an annular top plate 31. Upon the bottom of the disc 29 relatively narrow blades 32 are carried.

In operation of the second form, the pulp falls

on to the rapidly rotating disc 29 of the impeller. The centrifugal action of the rotation throws the pulp outwardly between the disc 29 and the plate 31. The small blades 32 pick up air from an air feed pipe 33, and beat it into an emulsion with the solution so that it will intimately mix with the discharging pulp.

In the third form of my invention, illustrated in Figs. 5 and 6, an open topped impeller 34 is employed supported from a disc-like hub 35. Impeller blades 36 project from the hub 35 and support an annular bottom plate 37. In this form of the invention the impeller is covered or protected by a cover plate 38 which is fixed to and supported on a feed sleeve 39.

In operation of the form of Fig. 5, pulp falls from the feed sleeve 39 between the blades 36 and upon the hub 35. This pulp is thrown outwardly by the rotation of the impeller and intimately mixed with air from an air feed pipe 40 which projects into the impeller through the bottom plate 37. The hub 35 is spaced from the bottom plate 37 to provide air passages 41.

In the fourth form of the invention as illustrated in Figs. 7 and 8, I employ an impeller somewhat similar to the impeller of Fig. 5, in that it has a bottom plate 42 supported on blades 43 from a disc-like hub 44. In this form, however, the impeller is enclosed by an annular top plate 45 which rotates with the impeller immediately below the shield 27.

The action of this impeller is similar to the one of Fig. 5, but escape of the material over the tops of the blades is prevented by the top plate 45.

It is desired to be understood that the various features of the various forms may be combined, that is, the form of Fig. 1 could be provided with a stationary shield similar to the shield 38 of Fig. 5, if desired. Or the shields could be omitted from the impellers of Figs. 2, 5, and 7, without departing from the spirit of the invention.

In the operation of the cell wear will occur by material passing between the end of the air-column and the impeller. This wear constantly increases the opening between the column and impeller and lessens the efficiency of the device. To accommodate for this wear, I provide a take-up device such as illustrated in Fig. 5, in which, the shaft 11 is supported on a step bearing 46 which can be raised or lowered by means of an adjusting screw 47 carried in an angle member 48 that supports the bearing 46. Thus as wear occurs between the blades and the shield the screw 47 can be tightened so as to raise the shaft 11 and bring the impeller into closer proximity with the column.

The shields over the impellers serve to prevent sand from settling into and around the impellers when the machine is shut down, thus requiring but a minimum of power to again place the machine in operation.

The air supply pipes 23, 33, and 40 can in some installations be dispensed with. In which event, the lower portions of the impellers will act to draw material from the cell or from a source outside the cell through a conductor 49, for recirculation.

This conduit is of particular value in the re-treatment of middlings or other products of the cell. Retreatment of material in the cell may be effected by openings 13a in the air-column, as shown in Figure 7, by which the material may be re-circulated through the impeller.

While a specific form of the improvement has

been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what I claim and desire secured by Letters Patent is:—

1. In flotation apparatus, a flotation cell, an impeller element in the lower portion thereof, including a housing having an ingress opening and peripheral egress opening, a stationary conductive-element communicating directly with the ingress-opening and extending above a determinate liquid-level in the cell, for the admission of air to the impeller element, means for feeding material to the impeller element, and a shaft carrying the impeller element, a bearing for said shaft, and adjusting mechanism apart from said bearing so arranged that the operation thereof will cause a movement of the impeller element toward or away from said stationary element.

2. In flotation apparatus, a flotation cell, a rotary, vertically movable shaft, an impeller at the lower end of the shaft, within the flotation-cell, including a housing having an ingress-opening and peripheral egress-openings, a stationary conductive-element communicating directly with the ingress-opening and extending above a determinate liquid-level in the cell, for the admission of air to the impeller element, means for feeding material to the impeller element, a bearing for the shaft, and adjusting mechanism apart from said bearing so arranged that the operation thereof will cause vertical adjustment of the shaft.

3. In flotation apparatus, a flotation cell, an impeller element in the lower portion thereof, including a housing having an ingress opening and peripheral egress openings, a stationary conductive-element communicating directly with the ingress-opening and extending above a determinate liquid-level in the cell, for the admission of air to the impeller element, a shield at the lower end of the conductive-element covering the impeller-housing, around its ingress-opening, a shaft carrying the impeller element, a bearing for said shaft, adjusting mechanism apart from said bearing so arranged that the operation thereof will cause a movement of the impeller element toward or away from said stationary element.

4. In flotation apparatus, a flotation cell, an impeller element in the lower portion thereof, including a housing having an upper ingress-opening, a bottom-opening opposite thereto, and peripheral egress openings, a stationary conductive-element communicating directly with the ingress opening and extending above a determinate liquid level in the cell, for the admission of air to the impeller element, a conduit for the admission of a gas under pressure to the impeller element through the bottom opening, and means for feeding material to the impeller element.

5. In flotation apparatus, a flotation cell, an impeller element in the lower portion thereof, including a housing having an upper ingress-opening, a bottom opening opposite thereto, and peripheral egress-openings, a stationary conductive-element communicating directly with the ingress opening and extending above a determinate liquid level in the cell, for the admission of air to the impeller element, a conduit for the admission of a gas under pressure to the impeller element, projecting through the bottom opening with its end in close proximity to a superposed surface of the impeller, and means for feeding material to the impeller element.

6. In flotation apparatus, a flotation cell, an

impeller element in the lower portion thereof, including a housing having upper and lower ingress-openings and peripheral egress-openings, a stationary conductive-element communicating with the upper ingress-opening and extending above a determinate liquid-level in the cell, for the admission of air and material to the impeller element, a conduit for the admission of gas under pressure to the impeller element, and a stationary feed-pipe connected with the lower ingress-opening of the impeller element.

7. In flotation apparatus, a flotation-cell, an impeller element in the lower portion thereof, including a housing having upper and lower ingress-openings and peripheral egress-openings, a stationary conductive-element communicating with the upper ingress-opening and extending above a determinate liquid-level in the cell, for the admission of air and material to the element, a stationary feed-pipe connected with the lower ingress-opening of the impeller element, and a pipe extending through the lower ingress open-

ing for the supply of a gas under pressure to the impeller element.

8. In flotation apparatus, a flotation cell, an impeller element in the cell, a stationary conductive element communicating with the impeller element, a shaft carrying the impeller element, a bearing for said shaft, and adjusting mechanism apart from said bearing so arranged that the operation thereof will cause a movement of the impeller element toward or away from the stationary element.

9. In flotation apparatus, a flotation cell, a rotary, vertically movable shaft, an impeller element at the lower end of the shaft, within the cell, a stationary conductive element communicating with the impeller element, a bearing for the shaft outside the cell, and mechanism apart from said bearing so arranged that the operation thereof will cause a movement of the impeller element toward or away from said stationary element.

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