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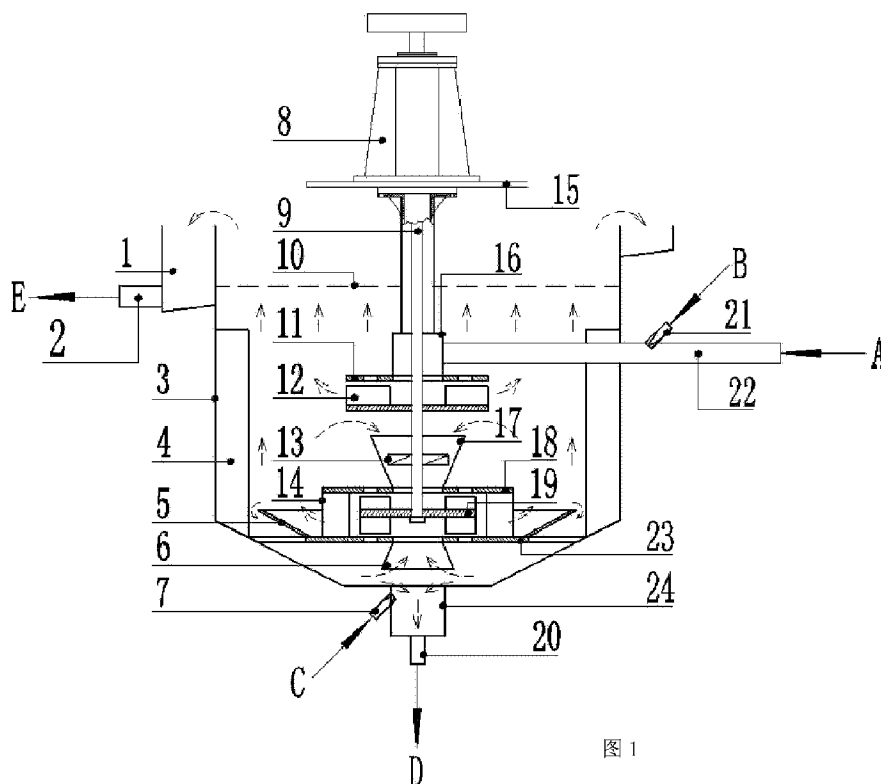
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(54) Titre : APPAREIL ET PROCEDE DE SEPARATION PAR FLOTTATION RAPIDE A CIRCULATION FORCEEE

(54) Title: DEVICE AND METHOD FOR FORCED CIRCULATION FAST FLOTATION SEPARATION



(57) Abrégé/Abstract:

A forced-circulating quick flotation separation apparatus and method. The separation apparatus and method comprises a transmission mechanism (8), a flotation cell (3), a quick flotation system, and a forced-circulating system. An inverted trapezoidal

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table is provided below the floatation cell (3), and a foam tank (1) is provided on the top of the floatation cell (3). A concentrate discharge pipe (2) is provided at the lowest position of the foam tank (1). A sieve plate (10) is provided at the foam tank (1) within a cylinder. The forced-circulating system is provided in the inverted trapezoidal table of the floatation cell (3). A plurality of flow guide plates (4) is provided between the forced-circulating system and the sieve plate (10). The transmission mechanism (8) is provided on the top of the floatation cell (3). The forced-circulating system consists of an upper flow guide cylinder (17), a propulsion wheel (13), a dispersion stator, a centrifugal mineralization wheel (19), and a lower flow guide apparatus provided below the centrifugal mineralization wheel (19) and fixed to the bottom of the floatation cell (3). The forced-circulating quick floatation separation apparatus features a simple structure, and the forced-circulating quick floatation separation apparatus and method has high sorting efficiency.

ABSTRACT

Disclosed is a device and method for forced circulation fast floatation separation, which is applicable for floatation of easy-to-float coarse mineral particles or coal particles. The device includes a transmission mechanism, a floatation tank, a fast floating system and a forced circulation system. An inverted truncated cone is arranged below the floatation tank, and a foam tank is arranged on a top of the floatation tank. A concentrate discharge tube is arranged at a lowest portion of the foam tank. A sieve plate is arranged in the cylinder at a level of the foam tank. The forced circulation system is arranged in the inverted truncated cone of the floatation tank. A plurality of flow directing plates are arranged between the forced circulation system and the sieve plate. The transmission mechanism is arranged on the top of the floatation tank. The forced circulation system is comprised of an upper flow directing cylinder, a propulsion wheel, a dispersion stator, a centrifugal mineralization wheel, and a lower flow directing device arranged below the centrifugal mineralization wheel and fixed at a bottom of the tank. The invention has a simple structure and high sorting efficiency.

Device and Method for Forced Circulation Fast Floatation Separation

Technical Field

The invention relates to a separation device and method, particularly applicable for use as a device and method for forced circulation fast floatation separation for floatation and separation of easy-to-float coarse mineral particles or coal particles.

Background

At present, the equipment used for mineral floatation separation mainly includes two types of equipment: floatation machine and floatation column. Among them, the floatation machine is considered to be relatively suitable for floatation of coarse mineral particles, and is widely used in industrial practice. According to the working principle, it can be divided into mechanical stirring floatation machine and air floatation machine. In a self-absorption mechanical stirring floatation machine, the pulp is aerated and stirred by rotation of an impeller or a rotor; while an aerated stirring floatation machine is a floatation machine that combines mechanical stirring and externally pressed-in air. An air-compressed floatation machine is fed with compressed air from an external compressor to aerate and stir the pulp. A gas-precipitating floatation machine changes the gas pressure in the pulp to cause the gas to be separated from the dispersed bubbles in the pulp and stir the pulp. All of the above floatation machines lack an effective mechanism of pulp circulation, mineralization and separation inside single equipment, especially for difficult-to-float mineral particles. In addition, for the disadvantages of poor floatation and dispersion, slow rising speed and the like present in floatation of coarse mineral particles, the main method for these machines to increase the recovery rate of mineral floatation is to increase the number of floatation machines. Therefore, it is necessary to design a new type of floatation machine based on the design of a reasonable floatation separation process to make up for the above shortcomings.

Summary

Technical Problems: to solve the above technical problems, the invention provides a device and method for forced circulation fast floatation separation having a simple structure. Through the implementation of fast flotation and forced circulation mineralization, the recovery capacity of coarse mineral particles is enhanced, so as to solve the problems of insufficient pulp circulation capacity and slow flotation speed of coarse particles in the existing tank flotation process, improve suspension capacity and flotation speed of coarse mineral particles, and enhance the recovery ability of coarse mineral particles.

Technical Solutions: in order to achieve the above technical objectives, the invention provides a forced circulation fast floatation separation device including a transmission mechanism, a floatation tank, a fast floating system and a forced circulation system;

the floatation tank including a cylinder; a funnel-shaped inverted truncated cone being arranged below the cylinder; a foam tank being arranged on a top of the cylinder; a concentrate discharge tube being arranged at a lowest portion of the foam tank; a sieve plate being arranged in the cylinder at a level of the foam tank; the forced circulation system being arranged in the inverted truncated cone of the floatation tank; a plurality of flow directing plates being vertically arranged on an inner side of a side wall of the floatation tank between the forced circulation system and the sieve plate; a gas dispersion box being arranged at a bottom of the inverted truncated cone of the floatation tank; a first micro-bubble generator being arranged at an angle of 45° to a vertical direction on a side wall of the gas dispersion box; a tailing discharge tube being arranged at a bottom of the gas dispersion box; the transmission mechanism being arranged on a top of the floatation tank; the transmission mechanism being fixed to the floatation tank through a support frame; a stirring shaft extending into the floatation tank and connecting to the forced circulation system being arranged below the transmission mechanism; a feed sleeve being arranged on the stirring shaft between the sieve plate and the forced circulation system; a feed pre-mineralization tube extending to an outside of the floatation tank being arranged on a side of the feed sleeve; a second micro-bubble generator being arranged at an angle of 45° to a feed direction on the feed pre-mineralization tube; a fast floating cover plate being arranged below the feed sleeve;

the fast floating cover plate being arranged in the middle of the floatation tank; a centrifugal dispersion wheel being arranged on the stirring shaft below the fast floating cover plate; the forced circulation system comprising an upper flow directing cylinder, a propulsion wheel, a dispersion stator, a centrifugal mineralization wheel, and a lower flow directing device arranged below the centrifugal mineralization wheel and fixed at a bottom of the tank; the dispersion stator being matched with the lower flow directing device; the propulsion wheel being arranged in the upper flow directing cylinder; a center of the propulsion wheel being penetrated by the stirring shaft; the lower flow directing device comprising a flow directing inverted cone, a discharge bottom plate, and a lower flow directing cylinder arranged in the middle of the discharge bottom plate; apertures being provided in a center and a periphery of the discharge bottom plate; the discharge bottom plate being arranged in the inverted truncated cone; the flow directing cylinder being arranged below the discharge bottom plate; the flow directing inverted cone being arranged above the discharge bottom plate; the centrifugal mineralization wheel being arranged in a center of the flow directing inverted cone; the dispersion stator comprising a plurality of rectangular pulp dispersion plates and a mineralization cover plate; the plurality of rectangular pulp dispersion plates being evenly along a radial direction and vertically arranged between an inner diameter of the flow directing inverted cone and the centrifugal mineralization wheel; the mineralization cover plate having a circular shape being arranged above the plurality of rectangular pulp dispersion plates; the stirring shaft passing through the mineralization cover plate and finally connecting to the centrifugal mineralization wheel.

The fast floating system is arranged above the forced circulation system; the flow directing cylinder is an open inverted cone; the propulsion wheel is arranged in the flow directing cylinder and fixed to the stirring shaft; the discharge bottom plate is arranged at a conical position at the bottom of the tank, immediately below the pulp dispersion plates; a discharge hole is arranged between the discharge bottom plate and a tank wall of the inverted truncated cone; microporous ceramics are arranged in the first micro-bubble generator and the second micro-bubble generator.

A forced circulation fast floatation separation method using the forced circulation fast floatation separation device according to claim 1 includes the following steps:

a. first closing the tailing discharge tube; feeding a conditioned pulp into the feed pre-mineralization tube via a feed pre-mineralization tube inlet; feeding compressed air into the feed pre-mineralization tube through the second micro-bubble generator via a second micro-bubble generator inlet to mix with the pulp for pre-mineralizing the pulp;

b. the mixed and pre-mineralized pulp enters the feed sleeve; feeding the pulp in the feed sleeve into the floatation tank under the action of the rotating centrifugal dispersion wheel; the pulp enters a lower half portion of the inverted truncated cone through the hole and gap of the discharge bottom plate; feeding the compressed air into the gas dispersion box through the first micro-bubble generator via a first micro-bubble generator inlet to mix with the pulp; the mixed pulp enters the centrifugal mineralization wheel from the lower flow directing cylinder, and generates upward buoyancy in a continuously rising pulp level along the rectangular pulp dispersion plates and the flow directing inverted cone under the action of the centrifugal mineralization wheel; when the pulp level rises above the fast floating cover plate, the fast floating cover plate starts to enhance a suction force generated during rotation of the centrifugal dispersion wheel, so as to generate suction on the fed pulp and enhance circulation of the pulp and mineralization of mineral particles; opening the tailing discharge tube when the pulp level exceeds the sieve plate and is about 200 mm away from an overflow surface of an overflow tank; at this time, fast floating foams are formed by the fast floating cover plate and the centrifugal dispersion wheel; easy-to-float particles in the mixed and pre-mineralized pulp are mineralized and rise rapidly with the fast floating foams, rectified by the sieve plate and are discharged from a concentrate discharge tube outlet of the concentrate discharge tube on the foam tank; medium floatable particles are fed into the centrifugal mineralization wheel through the upper flow directing cylinder of a middling forced circulation system under the action of the propulsion wheel in order to further increase circulation of the pulp;

c. difficult-to-float particles inside the floatation tank flow out from the discharge hole at a center of the discharge bottom plate; a part of the particles are discharged from a tailing discharge tube outlet of the tailing discharge tube at the bottom of the tank, and the other part

of the particles are sucked into the centrifugal mineralization wheel through the lower flow directing cylinder in the middle of the discharge bottom plate under the action of centrifugal suction force of the centrifugal mineralization wheel; at this time, the fast floating cover plate, the discharge bottom plate and the centrifugal mineralization wheel form a space between the mineralization cover plate and the discharge bottom plate; a centrifugal force generated during rotation of the centrifugal mineralization wheel is dispersed into the floatation tank;

f. the compressed air is fed into the gas dispersion box via the first micro-bubble generator inlet of the first micro-bubble generator, and is sucked, along with the pulp, into the space formed between the mineralization cover plate and the discharge bottom plate through the lower flow directing cylinder in the middle of the discharge bottom plate;

g. the medium floatable particles and the difficult-to-float particles facilitates strengthening collisions between particles and bubbles under the action of the centrifugal mineralization wheel, and are dispersed into the tank by the rectangular pulp dispersion plates of the stator and the flow directing inverted cone; discharging the medium floatable particles and the difficult-to-float particles, after their rising is completed, as well as the fast floating foams, out of the tank; unmineralized particles are circulated and sorted inside the tank; discharging the tailing from the outlet of the tailing discharge tube at the bottom of the tank.

Beneficial Effects: compared with prior art, the pulp flow and flotation separation process of the present invention is more reasonable in use. The pulp after mixing and pre-mineralization is fed into the tank through the fast floating system, and the easy-to-float particles float out quickly. Collision of the medium floatable and difficult-to-float particles with bubbles is enhanced by the forced circulation system under the action of the centrifugal mineralization wheel, and they are dispersed into the tank by the inverted cone that can produce upward flow. The mineralized particles are quickly discharged from the tank together with the fast-floating foam, and the un-mineralized particles are circulated and sorted in the tank several times. The upward flow generated by the bottom diversion cone further improves the suspending capacity and flotation speed of coarse mineral particles. The forced circulation system enhances the mineralization effect of medium-floatable and difficult-to-float particles, and improves the recovery capacity of mineral particles.

Through the implementation of fast flotation and forced circulation mineralization, the recovery capacity of a single flotation machine for coarse mineral particles is enhanced, so as to solve the problems of insufficient slurry circulation capacity in the existing tank flotation process and slow coarse particle flotation speed. The suspension capacity and flotation speed of coarse-particle minerals are enhanced, the recovery capacity of coarse mineral particles is improved, and the flotation energy efficiency of a single flotation machine is increased.

Brief Description of Drawings

FIG. 1 is a schematic structural diagram of a forced circulation fast floatation separation device according to the invention.

Wherein, 1-foam tank, 2-concentrate discharge tube, 3-floatation tank, 4-flow directing plate, 5-flow directing inverted cone, 6-lower flow directing cylinder, 7-first micro-bubble generator, 8-transmission mechanism, 9-stirring shaft, 10-sieve plate, 11-fast floating cover plate, 12-centrifugal dispersion wheel, 13-propulsion wheel, 14-pulp dispersion plate, 15-support frame, 16-feed sleeve, 17-propulsion wheel, 18-mineralization cover plate, 19-centrifugal mineralization wheel, 20-tailing discharge tube, 21-second micro-bubble generator, 22-feed pre-mineralization tube, 23-discharge bottom plate, 24-gas dispersion box, A-feed pre-mineralization tube inlet, B-second micro-bubble generator inlet, C-first micro-bubble generator inlet, D-tailing discharge tube outlet, E-concentrate discharge tube outlet.

Detailed Description

The embodiments of the invention will be further described in detail below in conjunction with the accompanying drawings:

As shown in FIG. 1, the invention provides a forced circulation fast floatation separation device, including a transmission mechanism 8, a floatation tank 3, a fast floating system and a forced circulation system;

the floatation tank 3 including a cylinder; a funnel-shaped inverted truncated cone being arranged below the cylinder; a foam tank 1 being arranged on a top of the cylinder; a

concentrate discharge tube 2 being arranged at a lowest portion of the foam tank 1; a sieve plate 10 being arranged in the cylinder at a level of the foam tank 1; the forced circulation system being arranged in the inverted truncated cone of the floatation tank 3; a plurality of flow directing plates 4 being vertically arranged on an inner side of a side wall of the floatation tank 3 between the forced circulation system and the sieve plate 10; a gas dispersion box 24 being arranged at a bottom of the inverted truncated cone of the floatation tank 3; a first micro-bubble generator 7 being arranged at an angle of 45° to a vertical direction on a side wall of the gas dispersion box 24; a tailing discharge tube 20 being arranged at a bottom of the gas dispersion box 24; the transmission mechanism 8 being arranged on a top of the floatation tank 3; the transmission mechanism 8 being fixed to the floatation tank 3 through a support frame 15; a stirring shaft 9 extending into the floatation tank 3 and connecting to the forced circulation system being arranged below the transmission mechanism 8; a feed sleeve 16 being arranged on the stirring shaft 9 between the sieve plate 10 and the forced circulation system; a feed pre-mineralization tube 22 extending to an outside of the floatation tank 3 being arranged on a side of the feed sleeve 16; a second micro-bubble generator 21 being arranged at an angle of 45° to a feed direction on the feed pre-mineralization tube 22; a fast floating cover plate 11 being arranged below the feed sleeve 16; the fast floating cover plate 11 being arranged in the middle of the floatation tank 3; a centrifugal dispersion wheel 12 being arranged on the stirring shaft 9 below the fast floating cover plate 11; the forced circulation system comprising an upper flow directing cylinder 17, a propulsion wheel 13, a dispersion stator, a centrifugal mineralization wheel 19, and a lower flow directing device arranged below the centrifugal mineralization wheel and fixed at a bottom of the tank; the dispersion stator being matched with the lower flow directing device; the propulsion wheel 13 being arranged in the upper flow directing cylinder 17; a center of the propulsion wheel 13 being penetrated by the stirring shaft 9; the lower flow directing device comprising a flow directing inverted cone 5, a discharge bottom plate 23, and a lower flow directing cylinder 6 arranged in the middle of the discharge bottom plate; apertures being provided in a center and a periphery of the discharge bottom plate 23; the discharge bottom plate 23 being arranged in the inverted truncated cone; the flow directing cylinder 6 being

arranged below the discharge bottom plate 23; the flow directing inverted cone 5 being arranged above the discharge bottom plate 23; the centrifugal mineralization wheel 19 being arranged in a center of the flow directing inverted cone 5; the dispersion stator comprising a plurality of rectangular pulp dispersion plates 14 and a mineralization cover plate 18; the plurality of rectangular pulp dispersion plates 14 being evenly along a radial direction and vertically arranged between an inner diameter of the flow directing inverted cone 5 and the centrifugal mineralization wheel 19; the mineralization cover plate 18 having a circular shape being arranged above the plurality of rectangular pulp dispersion plates 14; the stirring shaft 9 passing through the mineralization cover plate 18 and finally connecting to the centrifugal mineralization wheel. the fast floating system is arranged above the forced circulation system; the flow directing cylinder 17 is an open inverted cone; the propulsion wheel 13 is arranged in the flow directing cylinder 17 and fixed to the stirring shaft 9; the discharge bottom plate 23 is arranged at a conical position at the bottom of the tank, immediately below the pulp dispersion plates 14; a discharge hole is arranged between the discharge bottom plate 23 and a tank wall of the inverted truncated cone; microporous ceramics are arranged in the first micro-bubble generator 7 and the second micro-bubble generator 21.

A forced circulation fast floatation separation method using the forced circulation fast floatation separation device according to claim 1 includes the following steps:

a. first closing the tailing discharge tube 20; feeding a conditioned pulp into the feed pre-mineralization tube 22 via a feed pre-mineralization tube inlet A; feeding compressed air into the feed pre-mineralization tube through the second micro-bubble generator 21 via a second micro-bubble generator inlet B to mix with the pulp for pre-mineralizing the pulp;

b. the mixed and pre-mineralized pulp enters the feed sleeve 16; feeding the pulp in the feed sleeve 16 into the floatation tank 3 under the action of the rotating centrifugal dispersion wheel 12; the pulp enters a lower half portion of the inverted truncated cone through the hole and gap of the discharge bottom plate 23; feeding the compressed air into the gas dispersion box 24 through the first micro-bubble generator 7 via a first micro-bubble generator inlet C to mix with the pulp; the mixed pulp enters the centrifugal mineralization wheel 19 from the lower flow directing cylinder 6, and generates upward buoyancy in a continuously rising pulp

level along the rectangular pulp dispersion plates 14 and the flow directing inverted cone 5 under the action of the centrifugal mineralization wheel 19; when the pulp level rises above the fast floating cover plate 11, the fast floating cover plate 11 starts to enhance a suction force generated during rotation of the centrifugal dispersion wheel, so as to generate suction on the fed pulp and enhance circulation of the pulp and mineralization of mineral particles; opening the tailing discharge tube 20 when the pulp level exceeds the sieve plate 10 and is about 200 mm away from an overflow surface of an overflow tank; at this time, fast floating foams are formed by the fast floating cover plate 11 and the centrifugal dispersion wheel 12; easy-to-float particles in the mixed and pre-mineralized pulp are mineralized and rise rapidly with the fast floating foams, rectified by the sieve plate 10 and are discharged from a concentrate discharge tube outlet E of the concentrate discharge tube 2 on the foam tank 1; medium floatable particles are fed into the centrifugal mineralization wheel 19 through the upper flow directing cylinder 17 of a middling forced circulation system under the action of the propulsion wheel 13 in order to further increase circulation of the pulp;

e. difficult-to-float particles inside the floatation tank 3 flow out from the discharge hole at a center of the discharge bottom plate 23; a part of the particles are discharged from a tailing discharge tube outlet D of the tailing discharge tube 20 at the bottom of the tank, and the other part of the particles are sucked into the centrifugal mineralization wheel 19 through the lower flow directing cylinder 6 in the middle of the discharge bottom plate 23 under the action of centrifugal suction force of the centrifugal mineralization wheel 19; at this time, the fast floating cover plate 11, the discharge bottom plate 23 and the centrifugal mineralization wheel 19 form a space between the mineralization cover plate 18 and the discharge bottom plate 23; a centrifugal force generated during rotation of the centrifugal mineralization wheel 19 is dispersed into the floatation tank;

f. the compressed air is fed into the gas dispersion box 24 via the first micro-bubble generator inlet C of the first micro-bubble generator 7, and is sucked, along with the pulp, into the space formed between the mineralization cover plate 18 and the discharge bottom plate 23 through the lower flow directing cylinder 6 in the middle of the discharge bottom plate 23;

g. the medium floatable particles and the difficult-to-float particles facilitates strengthening collisions between particles and bubbles under the action of the centrifugal mineralization wheel 19, and are dispersed into the tank by the rectangular pulp dispersion plates 14 of the stator and the flow directing inverted cone 5; discharging the medium floatable particles and the difficult-to-float particles, after their rising is completed, as well as the fast floating foams, out of the tank; unmineralized particles are circulated and sorted inside the tank; discharging the tailing from the outlet D of the tailing discharge tube 20 at the bottom of the tank.

WHAT IS CLAIMED IS:

1. A forced circulation fast floatation separation device, comprising a transmission mechanism (8), a floatation tank (3), a fast floating system and a forced circulation system;

the floatation tank (3) comprising a cylinder; a funnel-shaped inverted truncated cone being arranged below the cylinder; a foam tank (1) being arranged on a top of the cylinder; a concentrate discharge tube (2) being arranged at a lowest portion of the foam tank (1); a sieve plate (10) being arranged in the cylinder at a level of the foam tank (1); the forced circulation system being arranged in the inverted truncated cone of the floatation tank (3); a plurality of flow directing plates (4) being vertically arranged on an inner side of a side wall of the floatation tank (3) between the forced circulation system and the sieve plate (10); a gas dispersion box (24) being arranged at a bottom of the inverted truncated cone of the floatation tank (3); a first micro-bubble generator (7) being arranged at an angle of 45° to a vertical direction on a side wall of the gas dispersion box (24); a tailing discharge tube (20) being arranged at a bottom of the gas dispersion box (24); the transmission mechanism (8) being arranged on a top of the floatation tank (3); the transmission mechanism (8) being fixed to the floatation tank (3) through a support frame (15); a stirring shaft (9) extending into the floatation tank (3) and connecting to the forced circulation system being arranged below the transmission mechanism (8); a feed sleeve (16) being arranged on the stirring shaft (9) between the sieve plate (10) and the forced circulation system; a feed pre-mineralization tube (22) extending to an outside of the floatation tank (3) being arranged on a side of the feed sleeve (16); a second micro-bubble generator (21) being arranged at an angle of 45° to a feed direction on the feed pre-mineralization tube (22); a fast floating cover plate (11) being arranged below the feed sleeve (16); the fast floating cover plate (11) being arranged in the middle of the floatation tank (3); a centrifugal dispersion wheel (12) being arranged on the stirring shaft (9) below the fast floating cover plate (11); the forced circulation system comprising an upper flow directing cylinder (17), a propulsion wheel (13), a dispersion stator, a centrifugal mineralization wheel (19), and a lower flow directing device arranged below the centrifugal mineralization wheel and fixed at a bottom of the tank; the dispersion stator being

matched with the lower flow directing device; the propulsion wheel (13) being arranged in the upper flow directing cylinder (17); a center of the propulsion wheel (13) being penetrated by the stirring shaft (9); the lower flow directing device comprising a flow directing inverted cone (5), a discharge bottom plate (23), and a lower flow directing cylinder (6) arranged in the middle of the discharge bottom plate; apertures being provided in a center and a periphery of the discharge bottom plate (23); the discharge bottom plate (23) being arranged in the inverted truncated cone; the flow directing cylinder (6) being arranged below the discharge bottom plate (23); the flow directing inverted cone (5) being arranged above the discharge bottom plate (23); the centrifugal mineralization wheel (19) being arranged in a center of the flow directing inverted cone (5); the dispersion stator comprising a plurality of rectangular pulp dispersion plates (14) and a mineralization cover plate (18); the plurality of rectangular pulp dispersion plates (14) being evenly along a radial direction and vertically arranged between an inner diameter of the flow directing inverted cone (5) and the centrifugal mineralization wheel (19); the mineralization cover plate (18) having a circular shape being arranged above the plurality of rectangular pulp dispersion plates (14); the stirring shaft (9) passing through the mineralization cover plate (18) and finally connecting to the centrifugal mineralization wheel.

2. The forced circulation fast floatation separation device according to claim 1, wherein the fast floating system is arranged above the forced circulation system; the flow directing cylinder (17) is an open inverted cone; the propulsion wheel (13) is arranged in the flow directing cylinder (17) and fixed to the stirring shaft (9); the discharge bottom plate (23) is arranged at a conical position at the bottom of the tank, immediately below the pulp dispersion plates (14); a discharge hole is arranged between the discharge bottom plate (23) and a tank wall of the inverted truncated cone; microporous ceramics are arranged in the first micro-bubble generator (7) and the second micro-bubble generator (21).

3. A forced circulation fast floatation separation method using the forced circulation fast floatation separation device according to claim 1, comprising the following steps:

a. first closing the tailing discharge tube (20); feeding a conditioned pulp into the feed pre-mineralization tube (22) via a feed pre-mineralization tube inlet (A); feeding compressed air into the feed pre-mineralization tube through the second micro-bubble generator (21) via a

second micro-bubble generator inlet (B) to mix with the pulp for pre-mineralizing the pulp;

b. the mixed and pre-mineralized pulp enters the feed sleeve (16); feeding the pulp in the feed sleeve (16) into the floatation tank (3) under the action of the rotating centrifugal dispersion wheel (12); the pulp enters a lower half portion of the inverted truncated cone through the hole and gap of the discharge bottom plate (23); feeding the compressed air into the gas dispersion box (24) through the first micro-bubble generator (7) via a first micro-bubble generator inlet (C) to mix with the pulp; the mixed pulp enters the centrifugal mineralization wheel (19) from the lower flow directing cylinder (6), and generates upward buoyancy in a continuously rising pulp level along the rectangular pulp dispersion plates (14) and the flow directing inverted cone (5) under the action of the centrifugal mineralization wheel (19); when the pulp level rises above the fast floating cover plate (11), the fast floating cover plate (11) starts to enhance a suction force generated during rotation of the centrifugal dispersion wheel, so as to generate suction on the fed pulp and enhance circulation of the pulp and mineralization of mineral particles; opening the tailing discharge tube (20) when the pulp level exceeds the sieve plate (10) and is about 200 mm away from an overflow surface of an overflow tank; at this time, fast floating foams are formed by the fast floating cover plate (11) and the centrifugal dispersion wheel (12); easy-to-float particles in the mixed and pre-mineralized pulp are mineralized and rise rapidly with the fast floating foams, rectified by the sieve plate (10) and are discharged from a concentrate discharge tube outlet (E) of the concentrate discharge tube (2) on the foam tank (1); medium floatable particles are fed into the centrifugal mineralization wheel (19) through the upper flow directing cylinder (17) of a middling forced circulation system under the action of the propulsion wheel (13) in order to further increase circulation of the pulp;

e. difficult-to-float particles inside the floatation tank (3) flow out from the discharge hole at a center of the discharge bottom plate (23); a part of the particles are discharged from a tailing discharge tube outlet (D) of the tailing discharge tube (20) at the bottom of the tank, and the other part of the particles are sucked into the centrifugal mineralization wheel (19) through the lower flow directing cylinder (6) in the middle of the discharge bottom plate (23) under the action of centrifugal suction force of the centrifugal mineralization wheel (19); at

this time, the fast floating cover plate (11), the discharge bottom plate (23) and the centrifugal mineralization wheel (19) form a space between the mineralization cover plate (18) and the discharge bottom plate (23); a centrifugal force generated during rotation of the centrifugal mineralization wheel (19) is dispersed into the floatation tank;

f. the compressed air is fed into the gas dispersion box (24) via the first micro-bubble generator inlet (C) of the first micro-bubble generator (7), and is sucked, along with the pulp, into the space formed between the mineralization cover plate (18) and the discharge bottom plate (23) through the lower flow directing cylinder (6) in the middle of the discharge bottom plate (23);

g. the medium floatable particles and the difficult-to-float particles facilitates strengthening collisions between particles and bubbles under the action of the centrifugal mineralization wheel (19), and are dispersed into the tank by the rectangular pulp dispersion plates (14) of the stator and the flow directing inverted cone (5); discharging the medium floatable particles and the difficult-to-float particles, after their rising is completed, as well as the fast floating foams, out of the tank; unmineralized particles are circulated and sorted inside the tank; discharging the tailing from the outlet (D) of the tailing discharge tube (20) at the bottom of the tank.

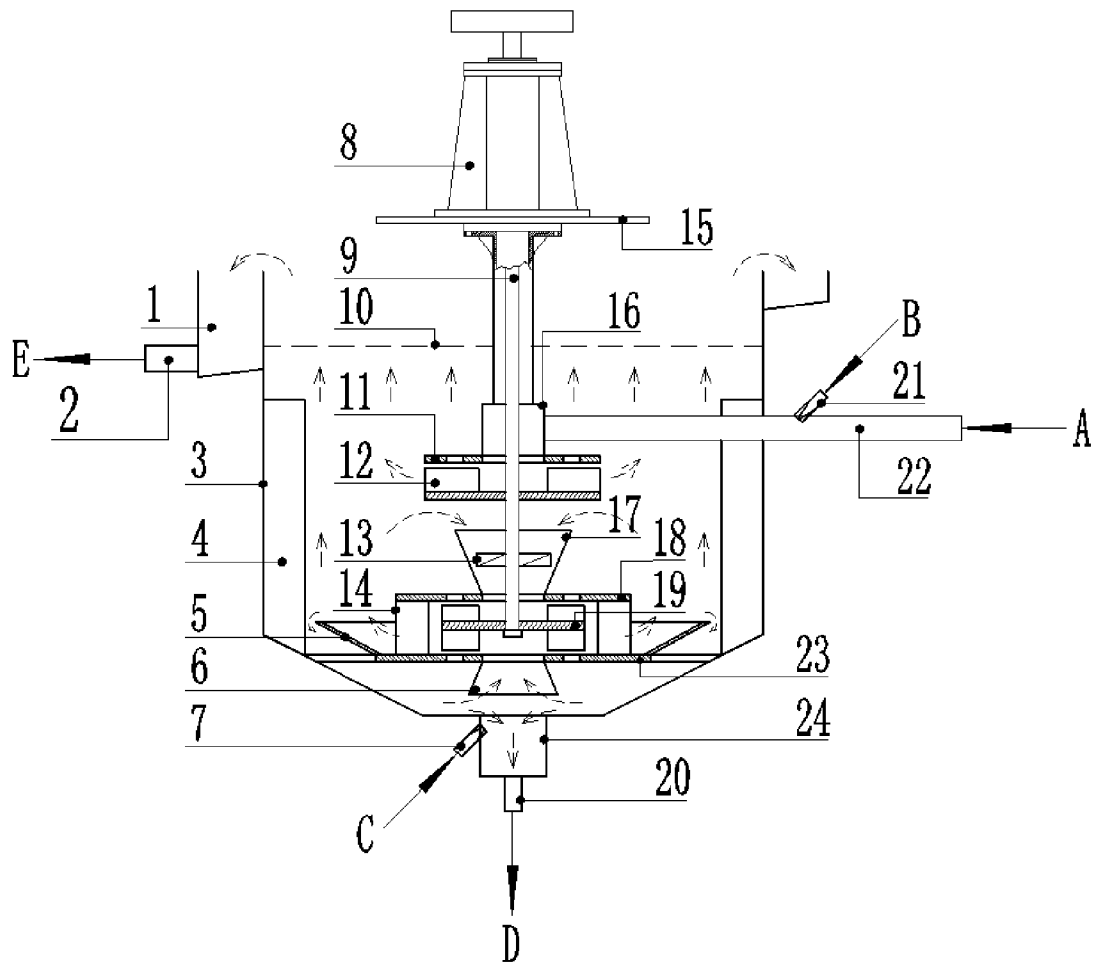


FIG. 1

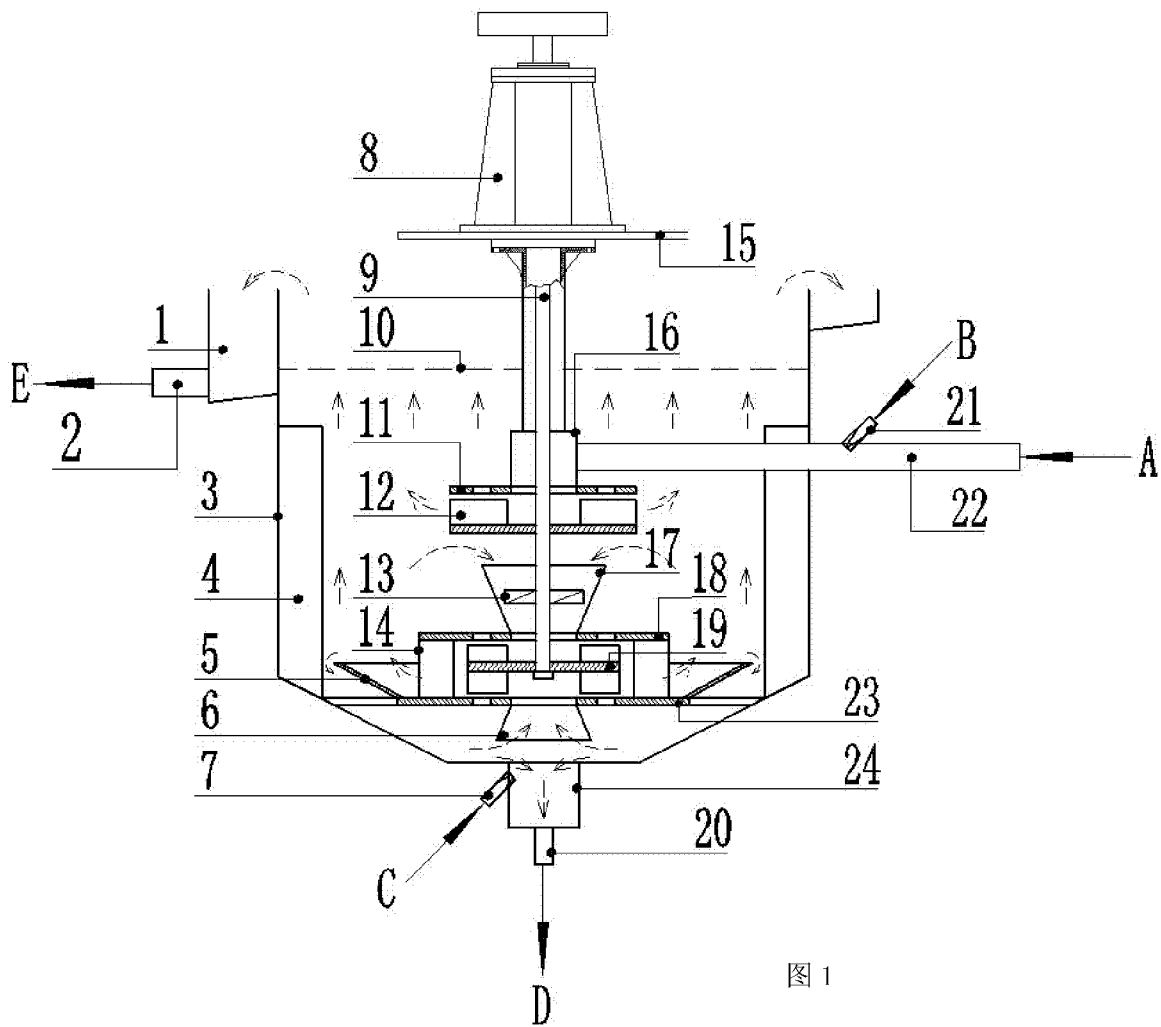


图 1