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DEVICE TO SEPARATE MINERALS BY SPECIFIC WEIGHT

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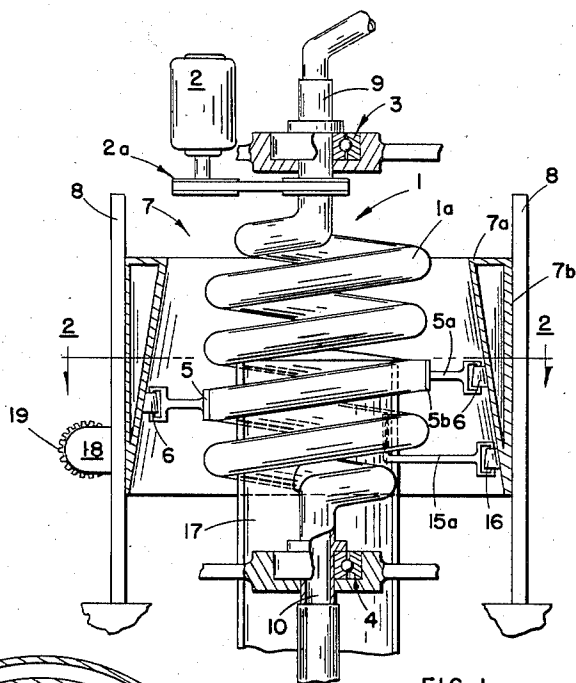


FIG. 1

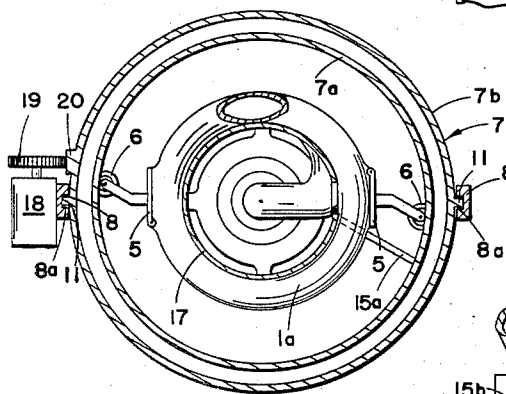


FIG. 2

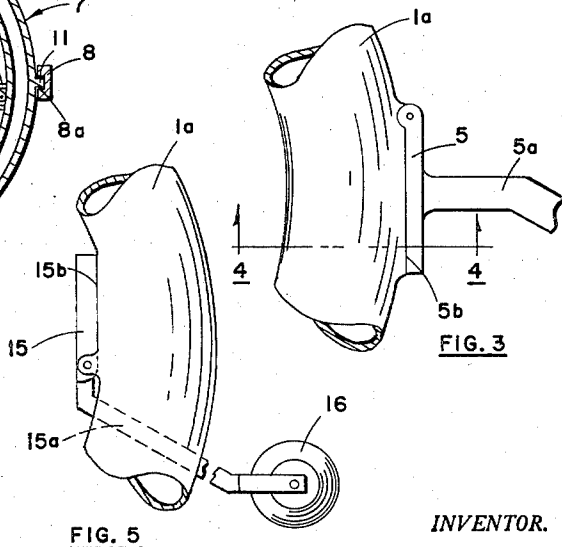


FIG. 3

FIG. 5

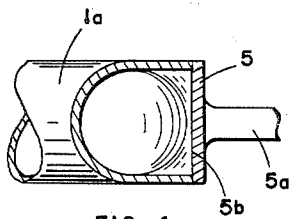


FIG. 4

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9 Claims. (Cl. 209—211)

This invention relates to a device to separate minerals by specific weight and, more particularly, to separate fines of minerals by specific weight.

In attempting to separate minerals by specific weight in accordance with the law of gravity, it has been found that grains of minerals of a certain size and smaller cannot be separated as the surface forces on the grains are greater than the force of gravity. To separate these fine grains it is, therefore, necessary to exert additional forces which will produce a greater component than the sole force of gravity. In this invention the additional force applied is centrifugal.

The centrifugal force is effected in a spiral-shaped tube, having the configuration of the outer edges of screw thread, which is rotated at a fast rate. The tube is formed having straight and vertical intake and outlet ends with the spiral portion in between. It can be made of most metals and can be of any conventional cross-section, such as, round or square. The inlet and outlet ends have a common axis about which the tube is rotated by a motor means. The spiral portion of the tube has one or more horizontal discharge openings which can be closed and opened by individual shutters.

A sludge containing the mineral flows through the spiral in a continuous stream and the fast rotation creates the centrifugal force. This force in the spiral portion causes the heavy particles to move to the outside tube wall where they can be emptied through the adjustable discharge openings. The velocity of revolution can be varied for the individual mineral to be treated. It is also possible to regulate the quantity of the centrifuged product by changing the position of the shutters of the discharge openings correspondingly and in certain cases it may be of special advantage to place discharge openings on the inner wall as well as on the outer wall of the spiral.

Therefore, an object of this invention is to provide an improved method of ore dressing by employing a fast revolving spiral tube having horizontal discharge openings.

A principal object of this invention is to provide a device for the separation of minerals by specific weight in which heavy and light particles are discharged separately from adjustable openings in a fast rotating spiral tube.

A further object of this invention is to provide a device by which mineral fines can be separated from heavier particles by means of centrifugal force.

Other objects of invention will become apparent from the following description taken in connection with the accompanying drawings, in which

Fig. 1 is a partially cutaway view showing the screw thread shaped spiral tube mounted in operating position;

Fig. 2 is a cross-section of the spiral tube taken along the lines 2—2 of Fig. 1;

Fig. 3 is an enlarged plan view of a discharge opening with closed shutter on an outer surface of the spiral tube;

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Fig. 4 is a cross-sectional side view of a discharge opening with the shutter closed taken along the lines 4—4 of Fig. 3;

And Fig. 5 is a cross-sectional view of a discharge port with closed shutter on an inner surface of the spiral tube.

Referring to Fig. 1, showing the separator in position for operation, spiral tube 1 has three portions, namely, inlet portion 9, spiral portion 1a, and outlet portion 10. Inlet 9 and outlet 10 are straight and vertical, having the same vertical axis about which they rotate. Inlet portion 9 is mounted in bearing structure 3 and outlet portion 4 is mounted in bearing structure 4. The entire tube is rotated about its vertical axis by motor 2 via driving pulleys and belt system 2a. Discharge openings 5b are shown on the outer surface of spiral portion 1a with shutters 5 in the closed position. Shutter arms or levers 5a are extending substantially radially outward from spiral portion 1a toward jacket 7 and truncated-cone rollers or casters 6 are mounted on the outward ends of arms 5a. Jacket 7 has an outer cylindrical surface 7b and an inner truncated-cone surface 7a, having both ends open. Casters 6 roll on truncated-cone jacket surface 7a of jacket 7 which substantially surrounds spiral portion 1a. Inner discharge openings 15b can be employed and are shown on the inner surface of spiral portion 1a with shutters 15 in closed position. Shutter arm 15a extends substantially radially outward having caster 16 in position to roll on cone surface 7a when tube 1 is rotated. Open-ended separation cylinder 17 is mounted to rotate with tube 1, although it need not be so mounted.

Referring to Fig. 1 and to Fig. 2, showing a view taken along lines 2—2 of Fig. 1, a plan view of the lower part of spiral portion 1a is illustrated. Shutters 5 and 15 are shown closed with casters 6 and 16 against cone surface 7a. Outer cylindrical surface 7b of jacket 7 is shown in cross-section with upright mounting posts 8 having keys 11 on surface 7b riding in key slot 8a. Motor 18 which could be on either of posts 8 drives gear 19 which is engaged in rack 20 to raise and lower jacket 7.

In Fig. 3, an enlarged plan view of an outer discharge opening is shown in the closed position. Opening 5b is covered by shutter 5 and arm 5a, partially cutaway, extends outward therefrom.

Fig. 4, taken along the lines 4—4 of Fig. 3, shows a side cross-sectional view of outer opening 5b in spiral portion 1a with shutter 5 closed and arm 5a extending outward therefrom.

Fig. 5 is a view similar to Fig. 4 except that it shows a cross-section of inner opening 15b in spiral portion 1a with shutter 15 closed and arm 15a extending outward therefrom, having roller 16 attached thereto.

In operation, tube 1 is caused to rotate at a pre-determined high speed, depending upon the size and type of mineral separation desired. The sludge containing the mineral flows into tube 1 through intake 9 and downward through spiral portion 1a toward outlet 10. By the fast revolution of tube 1, heavy particles of the mineral are forced to the outside wall of spiral portion 1a where they can be emptied through outer openings 5b when shutters 5 are opened. Shutters 5 are caused to open by centrifugal force when jacket 7 is raised when motor 18 turns gear 19 in rack 20. That is, when jacket 7 is raised, cone surface 7a is moved away from rollers 6 and 16 so that shutters 5 and 15 will be forced open. If inner openings 15b are provided, as they may or may not be, the lighter particles flow outward and downward into separation cylinder 17 are carried away, separated from the heavy particles flowing out of openings 5b, through a drain, not shown. The heavy particles will flow downward externally of separation cylinder 17 and are carried away through another drain, also not shown. The re-

maining sludge and any unseparated minerals flow outward through outlet 10 into a third drain, not shown.

In this device the treatment of the minerals can also be accomplished by a heavy liquid, as may be desirable, instead of by the use of pure water.

Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of this invention being limited only by the terms of the appended claims.

I claim:

1. A device to separate minerals by specific weight comprising a vertically disposed tube adapted for rotation about its vertical axis, said tube having a screw-threaded shaped spiral portion, said tube having an intake portion vertically above said spiral portion, said intake portion being substantially straight and vertical having its center substantially coincident with said vertical axis, said tube having a substantially straight and vertical first outlet portion having its center coincident with said vertical axis, said first outlet portion being below said spiral portion on said vertical axis, an open-ended jacket substantially surrounding said spiral portion, said jacket having a cylindrical outer surface and a truncated-cone inner surface, said cylindrical and cone surfaces being substantially vertically disposed and having a common center along said vertical axis, said jacket being adapted to be raised and lowered longitudinally along said vertical axis, said spiral portion having more than one substantially horizontally disposed discharge openings in the surface thereof, each of said openings having a hinged cover thereon, each of said hinged covers having an arm having one end attached thereto and extending substantially radially outward therefrom, said arm having its other end adjacent to said truncated-cone surface of said jacket, each of said arms having a substantially vertically disposed cone-shaped roller on said other end thereof adapted to roll on said truncated-cone surface when said tube is rotated; whereby when said jacket is raised said covers are free to move away from each of said horizontal openings and when said jacket is lowered, each of said covers are caused to move toward said horizontal openings.

2. The device according to claim 1 in which said intake portion and said first outlet portion are mounted on bearing surfaces whose centers are coincident with said vertical axis, motor means to cause said tube to be rotated, means to raise and lower said jacket, at least one of said horizontal openings in said spiral portion of said tube being on an inner surface of said tube so as to allow a discharge inward toward said vertical axis when said cover is moved away from said opening.

3. The device according to claim 1 in which said intake portion and said first outlet portion are mounted on bearing surfaces whose centers are coincident with said vertical axis, motor means to cause said tube to be rotated, means to raise and lower said jacket, at least one of said horizontal openings in said spiral portion of said tube being on an inner surface of said tube so as to allow a discharge inward toward said vertical axis when said cover is moved away from said opening, at least one of said horizontal openings in said spiral portion of said tube being on an outer surface of said tube so as to cause a discharge outward away from said vertical axis when said cover is moved away from said opening, and means to separate said inward and said outward discharges.

4. The device according to claim 3 wherein said means to separate said inward and said outward discharges comprises a substantially open-ended cylinder disposed vertically having its longitudinal center and axis coincident with said vertical axis of said tube, said cylinder extending partially within the lower end of said jacket and extending substantially outward from and below said jacket,

said cylinder surrounding said tube below said spiral portion.

5. A device to separate minerals by specific weight comprising a spiral tube adapted for rotation, said tube having an intake portion, said tube having substantially vertical discharge means and horizontally disposed discharge means, said horizontal discharge means having a control means disposed radially outward from said spiral and being pressure responsive to a vertically disposed surface on a vertically adjustable member surrounding said spiral, said surface being disposed at an acute angle to the vertical so that vertical adjustment of said member in one direction allows said horizontal discharge means to open and adjustment in the other direction closes said horizontal discharge means.

6. A device to separate minerals by specific weight comprising a spiral tube adapted for rotation, said tube having an intake portion, said tube having a substantially vertical discharge outlet, said tube having at least one horizontally disposed discharge outlet, each horizontal discharge outlet being in a circumferential surface of said spiral, each horizontal discharge outlet having a sealing control means disposed radially outward from said spiral and being pressure responsive to a vertically disposed surface on a vertically adjustable member surrounding said spiral, said surface being disposed at an acute angle to the vertical so that vertical adjustment of said member in one direction allows each horizontal discharge outlet to open and adjustment in the other direction closes each horizontal discharge outlet.

7. A device to separate minerals by specific weight comprising a vertically disposed tube adapted for rotation about its vertical axis, said tube having a spiral portion, said tube having an intake portion vertically above said spiral portion, said tube having a vertical first outlet portion below said spiral portion, an open-ended jacket substantially surrounding said spiral portion, said jacket having a truncated-cone inner surface having its center on said vertical axis, said jacket being adapted to be raised and lowered longitudinally along said vertical axis, said spiral portion having at least one substantially horizontally disposed discharge outlet in the surface thereof, each outlet having a sealing control means disposed radially outward from said spiral and being in pressure responsive contact to said truncated-cone surface so that vertical movement of said surface in one direction allows each horizontal outlet to open and vertical movement in the other direction closes each horizontal outlet.

8. A device to separate minerals by specific weight comprising: a spiral tube adapted for rotation about a predetermined axis, said axis extending in the longitudinal direction of said spiral in the approximate center thereof, said tube having an intake portion, said tube having at least one discharge means on the circumferential surface of said spiral, each circumferential discharge means having a control means disposed radially outward from said axis of rotation, and means disposed at an angle to said axis to continuously operate said control means while said spiral tube is rotating, said last-mentioned means being in pressure-responsive relationship with said control means and being reciprocally movable in the general direction of said axis to cause a lessening of pressure on said control means when moved in one axial direction to allow said discharge means to open and to cause an increase of pressure on said control means when moved in the opposite axial direction to close said discharge means.

9. A device to separate minerals by specific weight comprising: a spiral tube adapted for rotation about a predetermined axis, said axis extending in the longitudinal direction of said spiral in the approximate center thereof, said tube having an intake portion, said tube having at least one discharge outlet means on the circumferential surface of said spiral, said circumferential discharge outlet means having a flow control means disposed radially

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outward from said axis and being pressure-responsive to a circumferentially continuous surface on a member surrounding said spiral, said member being movable in the direction of said axis, said surface being disposed at an angle to said axis so that movement of said member in one axial direction allows said circumferential discharge outlet means to open and movement in the other direction closes said circumferential discharge outlet means.

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6**References Cited in the file of this patent****UNITED STATES PATENTS**

629,596	Pardee	July 25, 1899
768,751	Janson	Aug. 30, 1904
2,311,606	Bannister	Feb. 16, 1943
2,584,976	Bailey	Feb. 12, 1952
2,700,469	Humphreys	Jan. 25, 1955
2,730,299	Kelsey	Jan. 10, 1956