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J. M. DAVIS
CENTRIFUGAL CLASSIFIER

2,642,991

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FIG. 1

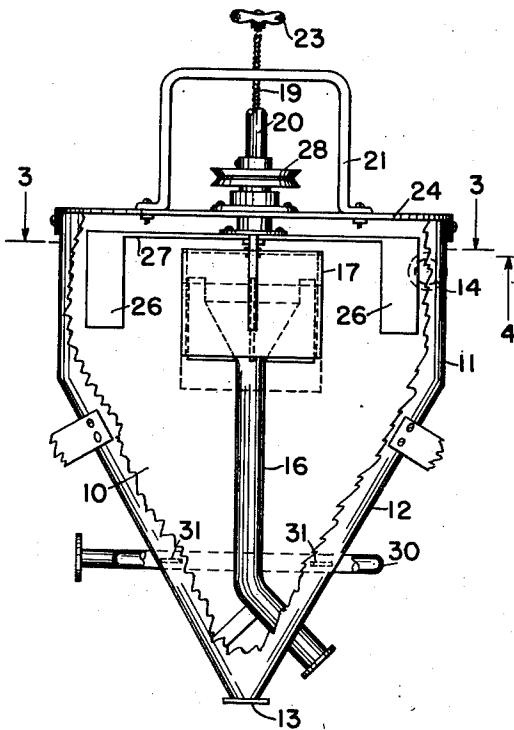


FIG. 2

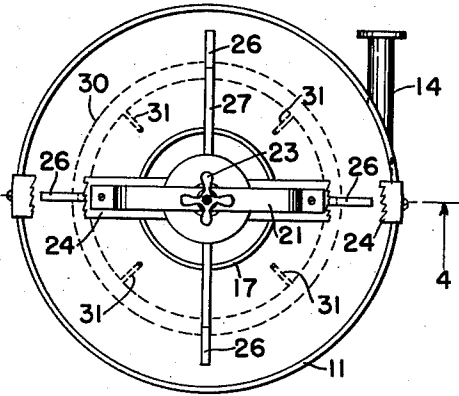


FIG. 4

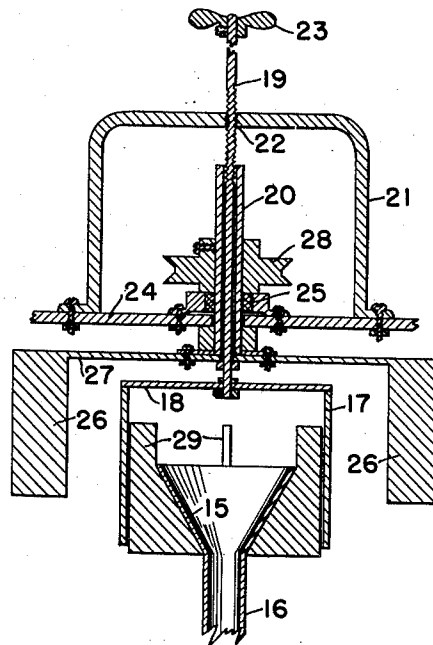
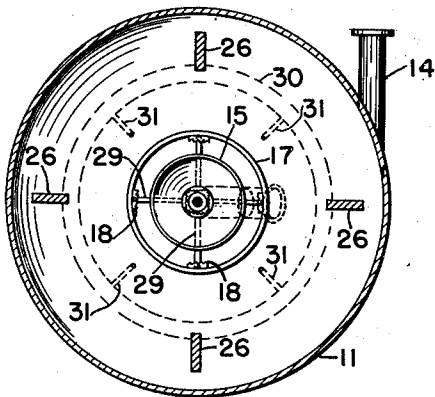


FIG. 3



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CENTRIFUGAL CLASSIFIER

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5 Claims. (Cl. 209-211)

1

This invention relates to a centrifugal classifier, and more particularly to a classification, desliming and dewatering device to separate materials, such as natural sands, crushed or ground metallic or non-metallic ores, as to particle size or gravity differentials, using the principles of centrifugal force, free settling and a controlled rising current within the apparatus.

An object of my invention is to provide a centrifugal classifier into which material is introduced tangentially and removed centrally or axially of the apparatus.

Another object of my invention is to provide an open top centrifugal classifier in which the angular velocity is readily controlled.

Another object of my invention is to provide a centrifugal classifier in which the zone of overflow is adjustable.

Another object of my invention is to provide a centrifugal classifier in which the particle size of separation is fully controlled.

Another object of my invention is to provide a centrifugal separator which is simple in design, inexpensive to manufacture, rugged in construction and efficient in operation.

Other and further objects and advantages of my invention will be apparent from the following description taken in connection with the accompanying drawing in which like characters of reference designate corresponding parts throughout the several views, and wherein:

Fig. 1 is a side elevation, with parts broken away, showing a centrifugal classifier embodying my invention.

Fig. 2 is a top plan view of the apparatus shown in Fig. 1.

Fig. 3 is a cross-sectional view taken along the line 3-3 in Fig. 1.

Fig. 4 is a cross-sectional view taken along the line 4-4 in Fig. 2.

In the embodiment chosen for illustration, an open top tank 10 is provided with a cylindrical upper side wall 11, and a cone shaped lower wall 12 which terminates in a discharge opening 13. The conical wall 12 makes an angle of approximately 60° with the horizontal. Material is introduced into the tank 10 tangentially about the cylindrical upper side wall 11 through the conduit 14.

Heavy classified material is discharged from the tank 10 through the lower central opening 13, and lighter classified material is discharged from the tank 10 through an upper central discharge opening 15 comprising a funnel shaped end on the discharge tube 16. The discharge

2

tube 16 extends downwardly about the central vertical axis of the tank 10 to a point near the lower discharge opening 13 and then extends outwardly from the tank. It will be noted that both the discharge opening for the heavier classified material and the discharge opening for the lighter classified material are located about the central vertical axis of the tank 10, the discharge opening for heavier material being positioned at the bottom of the conical lower wall 12 and the discharge opening for lighter classified material being positioned in the upper portion of the tank in the cylindrical walled section and substantially on a level with the inlet conduit 14.

The zone of overflow from the tank 10 into the discharge funnel 15 is controlled by a collar 17 which fits about the funnel 15 and is slidably mounted for vertical adjustment. The collar 17 is carried by cross members 18 secured to a screw threaded rod 19 which extends upwardly through the hollow shaft 20 and is supported by upper brace member 21 which is threaded at 22 for cooperation with the threaded rod 19 to raise and lower the collar 17 by turning motion imparted to the hand wheel 23 which is fixed to the upper end of the rod 19. The brace 21 is fastened to the cross-frame member 24 which extends across the open top of the tank 10.

The hollow shaft 20 is journaled for rotation in the bearing 25 which is also mounted on the cross-frame member 24; and the shaft 20 carries on its lower end a plurality of impeller blades 26 which depend from the spider arms 27. The impeller blades 26 are positioned in the zone of overflow near the top of the tank 10. Rotary motion is imparted to the impeller blades 26 through pulley 28 which is secured to the hollow shaft 20 and is driven by any suitable source of power (not shown). The swirl of the rising current within the collar 17 is diminished and broken up by fins 29 attached to the outer periphery of the funnel 15 and extending outwardly to the collar 17. The fins 29 are spaced about the outer periphery of the funnel 15 and are shaped to have an inner surface to conform to the wall of the funnel and to have an upright outer surface to conform to the cylindrical wall of the collar 17. The fins 29 have an upstanding rectangular upper portion extending above the upper edge of the funnel 15, and a lower portion extending downwardly approximately to where the funnel 15 merges with the discharge tube 16.

Water or other diluent is introduced into the tank 10 through manifold 30 and tubes 31, the

3

tubes 31 being connected to the manifold 30 and arranged to enter the tank 10 near the bottom of the cone shaped lower wall 12 near or slightly above where the axially extending discharge tube 16 turns outwardly from the tank.

In the operation of my apparatus, material to be classified is introduced into the tank 10 tangentially through the inlet conduit 14 at the liquid level in the tank. Rotary motion imparted to the impeller blades 26 causes these blades to sweep around in the tank 10 to aid the tangentially introduced material to swirl around the cylindrical upper wall 11. As the material is thus swept around inside the tank 10, the heavier material will slide down the walls of the tank to be discharged through the discharge opening 13 which may be controlled by conventional means (not shown). Water or other diluent in desired quantity is admitted to the tank 10 through tubes 31 and passes upwardly through the center of tank 10. The rising current along the central axis of tank 10 may pass into the lower end of collar 17 and past the fins 29 which serve to break up swirling motion and cause the lighter material passing upwardly between the collar 17 and the funnel 15 to overflow quietly into the funnel and pass out through the discharge tube 16. The collar 17 is adjusted vertically by hand wheel 23 to select the zone of flow over the top of collar 17 and into funnel 15. As the heavier material gravitates to the bottom of the tank 10 and is discharged through the lower central opening 13, lighter material flows gently through the upper central outlet.

The heavier material is introduced and retained near the outer wall of my apparatus, and the lighter material is moved toward the center for discharge. The heavier material falls by gravity to the bottom and is washed by the diluent entering from the manifold 30, and the diluent and lighter material rises to the top and passes through the collar 17 to the outlet funnel 15 or overflows the top of the collar 17 as determined by the vertical adjustment of the collar 17. As the collar 17 is raised, more of the lighter material floating on the surface is required to flow downwardly in the tank and is swept around by the rotating blades 26 before passing into the collar 17 and out of the tank through the funnel 15 and discharge tube 16. Because the discharge tube 16 extends downwardly along the central axis of the tank, it offers only a minimum of resistance to the rotation of the material being classified.

It will be obvious to those skilled in the art that I have provided apparatus of great usefulness and high efficiency; and that, while one very practical embodiment has been shown and described, many modifications and changes can be made without departing from the scope of my invention as defined in the appended claims.

I claim:

1. In a centrifugal classifier, an open top tank having a cone shaped wall portion, means for introducing material substantially tangentially into said tank, a lower discharge opening for heavier classified material, an upper discharge opening for lighter classified material, both said discharge openings being positioned about the central vertical axis of said tank, and a tubular collar within said tank and surrounding said upper discharge opening and arranged for vertical adjustment with respect thereto, said collar extending above and below said upper discharge opening and being spaced therefrom so

4

as to form a flow channel between said collar and said upper discharge opening for the flow of said lighter classified material therethrough, said collar being open at both ends for the flow of said lighter classified material into said channel and outwardly through said upper discharge opening.

2. In a centrifugal classifier, an open top tank having a cone shaped wall portion, means for introducing material tangentially into said tank, impeller blades arranged in said tank to impart rotary motion to material in said tank to be classified, a lower discharge opening for heavier classified material, an upper discharge opening for lighter classified material, both said discharge openings being positioned about the central vertical axis of said tank, and a tubular collar within said tank and surrounding said upper discharge opening and arranged for vertical adjustment with respect thereto, said collar extending above and below said upper discharge opening and being spaced therefrom so as to form a flow channel between said collar and said upper discharge opening for the flow of said lighter classified material therethrough, said collar being open at both ends for the flow of said lighter classified material into said channel and outwardly through said upper discharge opening.

3. In a centrifugal classifier, an open top tank having a cylindrical upper wall portion and a cone shaped lower wall portion, means for introducing material tangentially into said tank, impeller blades arranged in the upper portion of said tank to impart rotary motion to material in said tank to be classified, a lower discharge opening for heavier classified material at the bottom of said cone shaped lower wall portion, an upper discharge opening for lighter classified material, both said discharge openings being positioned about the central vertical axis of said tank, and a tubular collar within said tank and surrounding said upper discharge opening and arranged for vertical adjustment with respect thereto, said collar extending above and below said upper discharge opening and being spaced therefrom so as to form a flow channel between said collar and said upper discharge opening for the flow of said lighter classified material therethrough, said collar being open at both ends for the flow of said lighter classified material into said channel and outwardly through said upper discharge opening.

4. In a centrifugal classifier, an open top tank having a cylindrical upper wall portion and a cone shaped lower wall portion, means for introducing material tangentially into said tank, impeller blades arranged in the upper portion of said tank to impart rotary motion to material in said tank to be classified, a lower discharge opening for heavier classified material at the bottom of said cone shaped lower wall portion, an upper discharge opening for lighter classified material, said upper discharge opening comprising a funnel shaped end on a discharge tube extending downwardly about the central vertical axis of said tank, and a tubular collar within said tank and surrounding said funnel shaped end and arranged for vertical adjustment with respect to said end, said collar extending above and below said upper discharge opening and being spaced therefrom so as to form a flow channel between said collar and said upper discharge opening for the flow of said lighter classified material therethrough, said col-

5

lar being open at both ends for the flow of said lighter classified material into said channel and outwardly through said upper discharge opening.

5. In a centrifugal classifier, an open top tank 5 having a cylindrical upper wall portion and a cone shaped lower wall portion, means for introducing material tangentially into said tank, impeller blades arranged in the upper portion of said tank to impart rotary motion to material in 10 said tank to be classified, a lower discharge opening for heavier classified material at the bottom of said cone shaped lower wall portion, an upper discharge opening for lighter classified material, said upper discharge opening comprising 15 a funnel shaped end on a discharge tube extending downwardly about the central vertical axis of said tank, a tubular collar within said tank and surrounding said funnel shaped end and arranged for vertical adjustment with respect to 20 said end, said collar extending above and below

6

said upper discharge opening and being spaced therefrom so as to form a flow channel between said collar and said upper discharge opening for the flow of said lighter classified material there-through, said collar being open at both ends for the flow of said lighter classified material into said channel and outwardly through said upper discharge opening, and fins positioned within said channel to guide the flow of material there-through.

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