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CENTRIFUGAL SEPARATOR.  
APPLICATION FILED SEPT. 1, 1909.

946,444.

Patented Jan. 11, 1910.  
2 SHEETS—SHEET 2.

FIG. 3.

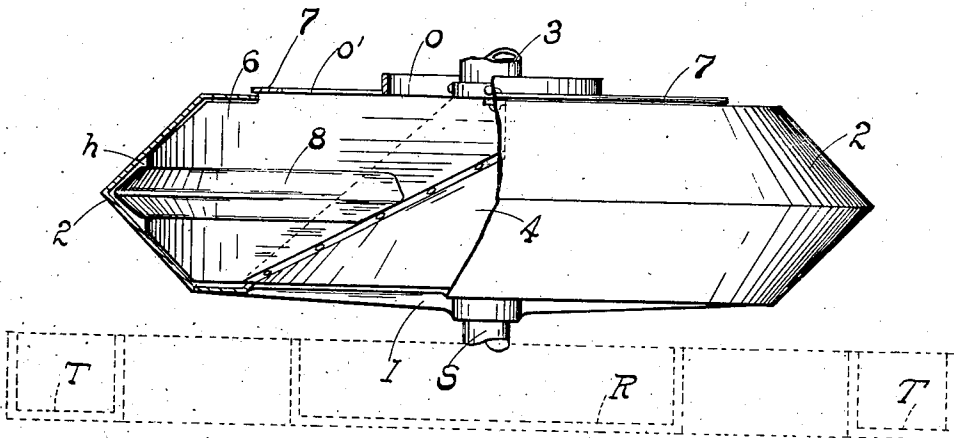
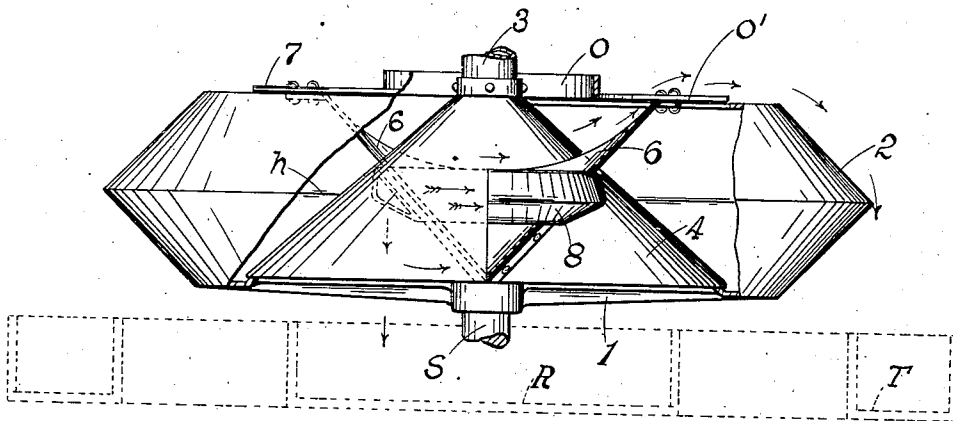


FIG. 4.

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## CENTRIFUGAL SEPARATOR.

946,444.

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*To all whom it may concern:*

Be it known that I, LABAN ELLSWORTH JONES, a citizen of the United States, residing at Anaconda, in the county of Deerlodge and State of Montana, have invented certain new and useful Improvements in Centrifugal Separators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in centrifugal ore separators; and it consists in the novel details of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a middle vertical section on the line 1—1 of Fig. 2 of the separator; Fig. 2 is a horizontal section on the line 2—2 of Fig. 1 with parts broken away; Fig. 3 is an elevation of the separator with parts broken away; and Fig. 4 is an elevation at right angles to Fig. 3, with parts broken away.

The present apparatus while primarily designed for the treatment of ore pulp with a view of separating the concentrates from the tailings as for example, in concentrating finely pulverized ore, slimes and the like, may be utilized for treating any kind of material mixed with water with a view of separating the coarser and heavier particles from the lighter and finer component.

The object here sought is to construct an apparatus in which the separation may be effected quickly; and although the operation of the invention herein is intermittent, the rapidity with which the container or centrifuge may be charged and discharged makes the method of separation not only practical, but cheap, entailing a minimum amount of labor and dispensing with the service of skilled mechanics to operate the machine.

The advantages of the invention will be best apparent from a detailed description thereof which is as follows:—Referring to the drawings, S, represents a central vertical drive-shaft to which rotation may be imparted in any suitable mechanical manner, that here shown being a pulley P from which leads a drive-belt B to any source of power (not shown). Carried by the shaft is a spider 1 to the arms of which is secured

the container or centrifuge 2 of substantially the shape as shown, the said container having peripheral converging or sloping walls forming an outer circular V-shaped groove or pocket *h* for the heavier particles or concentrates which separate out under the action of the centrifugal force with the rotation of the shaft S and the container 2 coupled thereto. Loosely mounted on, and freely rotatable about the shaft S is a quill or sleeve 3, to which is secured the upper end of a cone 4, the lower portion of the cone being rigidly connected to the sleeve by the arms of a spider 5, the cone being free to rotate in the container 2, the inner inclined wall of the container projecting upward to a point adjacent to the spider 5. Disposed along the upper surface of the cone 4 within the container or centrifuge 2 (and preferably riveted to the cone), are a series (two shown herein) of inclined plow-share shaped blades or wings 6 which are free to revolve within the container, fitting the latter neatly at all points except at the pocket *h*, said pocket being reserved for the projection and accumulation of the concentrates as presently to be seen. To the upper edges of the blades is anchored (preferably riveted) the revolving top 7 said top being provided with a central charging flanged opening *o* encompassing the shaft S and sleeve 3, and with marginal openings *o'* for the escape of the tailings as presently to be seen.

On the back of each blade 6 is secured a curved concentrate-discharge pipe 8, the outer end of which opens into the pocket *h*, the inner open end of the pipe discharging the material through the wall of the cone at a point adjacent to the drive-shaft, the material being caught in a receptacle R whence it may be conducted to any convenient point for subsequent treatment. The tailings discharged through the openings *o'* and which run over the outer walls of the container, are caught in a suitable trough T whence they may be conducted to any suitable point. To the upper end of the sleeve 3 is slidingly feathered (though free to revolve with the sleeve) the movable clutch member 9 controlled by a suitable lever 10, said member 9 cooperating with the relatively fixed clutch section or member 9'

keyed or otherwise secured to the shaft S. On the opposite or under side of the clutch section 9 is an arresting support or bearing 11 which the member 9 may engage when dis-  
5 engaged from its complementary section 9'.

The operation of the separator is substantially as follows:—The operator sets the shaft S and the container 2 coupled thereto into rotation to the required speed. There  
10 is then run into the container from any suitable source (not shown) through the inlet opening *o* the necessary charge of liquid pulp, the operator at the same time coupling the sleeve 3 to the shaft by effecting the nec-  
15 essary engagement between the clutch members 9, 9'. This sets the blades or wings 6 rotating, the liquid soon attaining its full revolving speed. When the wings and their sleeve are thus coupled or clutched to the  
20 shaft, the parts S, 1, 2, 3, 4, 5, 6, 7 and 8 (and the pulp) revolve as a unit about the axis of the shaft, the centrifugal force under the circumstances projecting the heavier and coarser particles of the pulp outwardly into  
25 the pocket *h*; the finer particles or tailings distributing themselves interiorly to the circle defining the inner limits of the pocket. The depth (or width) of this pocket obviously, may be varied by varying the radial  
30 dimensions of the blades, the available pocket proper being the space between the converging walls of the container measured from the vertex of the angle between said walls to the adjacent edge of the blade 6. In  
35 order to remove the concentrates thus separated under the action of the centrifugal force, the operator disengages the clutch members, the member 9 settling down on the bearing 11, such disengagement uncoupling  
40 the sleeve 3, cone 4 and blades 6 with their pipes 8 from the shaft S. The shaft S and container 2 of course, continue at their original speed of rotation, but the blades 6 and  
45 pipes 8 necessarily slow down. By reason of this differential in the speeds between the container and blades, the material concentrated in the pocket *h*, and whose inertia tends to carry it around at the speed ac-  
50 quired by the container, is constrained (since it can not pass the blades) to enter the pipes 8 through the ends which open into the pocket, after which it flows through said  
55 pipes toward the cone 4, being discharged from the pipes through the wall of the cone into the receptacle R. The momentum acquired by the lighter portions of the liquid carries the liquid out of the discharge opening *o'*, the liquid being in a measure directed  
60 toward said openings by the formation of the blades. Once this liquid or tailings has passed out of the openings *o'* from which it is expelled by centrifugal force, it is collected in the trough T whence it may be conducted to any suitable point. Thus the two

portions are separated and the machine is 65 ready for another charge.

The time for charging and discharging a tank or container of several hundred gallons of pulp need not be more than a few sec-  
70 onds; and the entire operation though intermittent, may be readily made automatic by the skilled mechanic. The pipes 8 serve to scoop up, collect or gather the concentrates accumulated in the pocket *h*, during the pe-  
75 riods of differential speeds between the container and the blades, the curvature of the pipes causing an easy discharge of the material as the latter is constrained to enter the pipes under the conditions referred to. Of  
80 course, the direction of rotation of the machine is necessarily opposite to the direction in which the outer ends of the pipes 8 open, as indicated by the curved arrows in Fig. 2. During the periods of differential speed be-  
85 tween the container and blades obviously the outer ends of the pipes 8 traverse the path of the pocket; that is to say they sweep along the pocket as long as the differential in the speed continues. For purposes of the  
90 present invention it is of course immaterial how this differential is brought about. That shown here is but one method of accomplishing it. The differential is not limited to a  
95 relatively slower speed in the blades, for the blades might even be stationary for the time being, a condition which would arise when the blades had actually stopped while the container proper was still rotating; and it  
100 would not be outside of the spirit of the present invention were the differential to result from a rotation of the blades in one direc-  
105 tion while the container was rotating in an opposite direction, the "differential" being a difference in speed between two bodies rotating positively, or one positively and the  
110 other negatively. In any of these cases the outer ends of the pipes 8 would scoop up the concentrates during their traverse of the pocket *h*. In effect, the cone 4 may be con-  
115 sidered as a section of the container, since the cone wall serves to hold the liquid fully as much as do the walls of container 2 proper. So that we may consider the parts  
120 2 and 4 as constituting a sectional container in which one of the sections serves to support the means for conducting away the concentrates accumulating in the opposite section during the periods of the differential in speed between the sections.

Having described my invention, what I 120 claim is:—

1. A centrifugal separator comprising a container rotatable about a fixed axis and provided with inlet and discharge openings, a member confined in the container and sus-  
125 ceptible of independent rotation about said axis, means for temporarily effecting a con- joint rotation of said member and container

about the axis and a subsequent independent rotation at different speeds, and means on said member for removing the concentrates and simultaneously directing the tailings liquid to its point of discharge from the container during the period of differential speed.

2. A centrifugal separator comprising a container rotatable about a fixed axis and provided with inlet and discharge openings, a member confined in the container and susceptible of independent rotation about said axis, means for temporarily effecting a conjoint rotation of said member and container and a subsequent independent rotation at different speeds, means on said member for removing the concentrates from the container during the period of differential speed, and simultaneously directing the tailings liquid to the discharge openings therefor.

3. A centrifugal separator comprising a container, rotatable about a fixed axis, and provided with inlet and discharge openings, a member confined in the container and susceptible of independent rotation about said axis, means for temporarily effecting a conjoint rotation of said member and container about the axis and a subsequent independent rotation of the member at a lower rate of speed, means on said member for removing the concentrates, and means for simultaneously directing the tailings liquid to its point of discharge from the container during the period of such lower speed of rotation.

4. A centrifugal separator provided with a centrifuge or container having an open top and closed bottom and sides and an outer pocket formation for the projection of the concentrates, and means for collecting the concentrates from said pocket and conducting the same out of the container through the inner wall thereof during the rotation of the latter.

5. A centrifugal separator provided with a centrifuge or container having an outer pocket formation for the accumulation of the concentrates, and conduits movable along the path of said pocket for collecting the concentrates from said pocket and conducting the same out of the container during the rotation of the latter.

6. A centrifugal separator provided with a centrifuge or container having an outer pocket formation for the accumulation of the concentrates, and pipes opening in a direction opposite to the rotation of the container and traversing the pocket for gathering the concentrates and conducting them out of the container through the wall contiguous to the axis of rotation of the separator.

7. A centrifugal separator comprising a

container rotatable about a central axis and provided with a feed opening; a cone rotatable in the container about said axis and provided with an opening for the discharge of the concentrates, a top coupled to the cone and closing the top of the container, said top being provided with openings for the discharge of the tailings liquid, a series of blades disposed along the upper surface of the cone within the container, the latter being provided with an outer circular pocket for the accumulation of the concentrates, pipes disposed on the rear walls of the blades and opening with their outer ends in the pocket and in a direction opposed to the direction of rotation of the container, the inner ends of the pipes discharging through the openings in the cone-walls, means for coupling the cone to the shaft to effect a rotation thereof conjointly with the container, and subsequently releasing the same, whereby the velocity of the cone and blades and pipes carried thereby slows down, the parts operating substantially as and for the purpose set forth.

8. In combination with a rotatable shaft, a container having a closed bottom fixed thereto, a sleeve mounted loosely on the shaft, a cone carried by the sleeve and rotatable in the container, a clutch for coupling the sleeve to the shaft for effecting conjoint rotation of the container and cone, a series of inclined blades on the cone confined in the container, a top surmounting the blades and provided with discharge openings for the liquid, the blades directing the liquid to said openings, a circular pocket encompassing the container-chamber, and pipes carried by the backs of the blades having their outer ends opening into the pocket in a direction opposed to the direction of rotation of the container, the inner ends of the pipes discharging the concentrates toward the shaft through the walls of the cone, substantially as set forth.

9. In a centrifugal separator, a container having a closed bottom rotatable about a fixed central axis and provided with an outer circular pocket for the projection of the concentrates, in combination with a series of pipes having their outer ends opening into the pocket in a direction opposed to the rotation of the container, and their inner ends discharging toward the axis, and a member to which said pipes are secured rotatable about the axis independently of the container.

10. In a centrifugal separator, a container composed of two independently rotatable sections adapted to acquire a difference between their respective speeds of rotation, a pocket in one of the sections for the accumulation of the concentrates, and means on the opposite section for removing the concen-

trates through the wall of said section during the periods of differential speed between the sections.

11. In a centrifugal separator, a container  
5 composed of outer and inner sections rotatable at different speeds about a common axis, the outer section being provided with a suitable chamber formation for the accumulation of the concentrates, and pipes coupled  
10 to the inner section and disposed so as to gather the concentrates and conduct them

out of the container through the wall of said inner section during the periods of different speeds of rotation of the respective container sections.

In testimony whereof I affix my signature,  
in presence of two witnesses.

LABAN ELLSWORTH JONES.

Witnesses:

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JAMES T. ROBERTS.