No. 703,630. Patented July 1, 1902.

A. TEN WINKEL.

CENTRIFUGAL SEPARATOR.

(Application filed May 21, 1901.)

(No Model.)

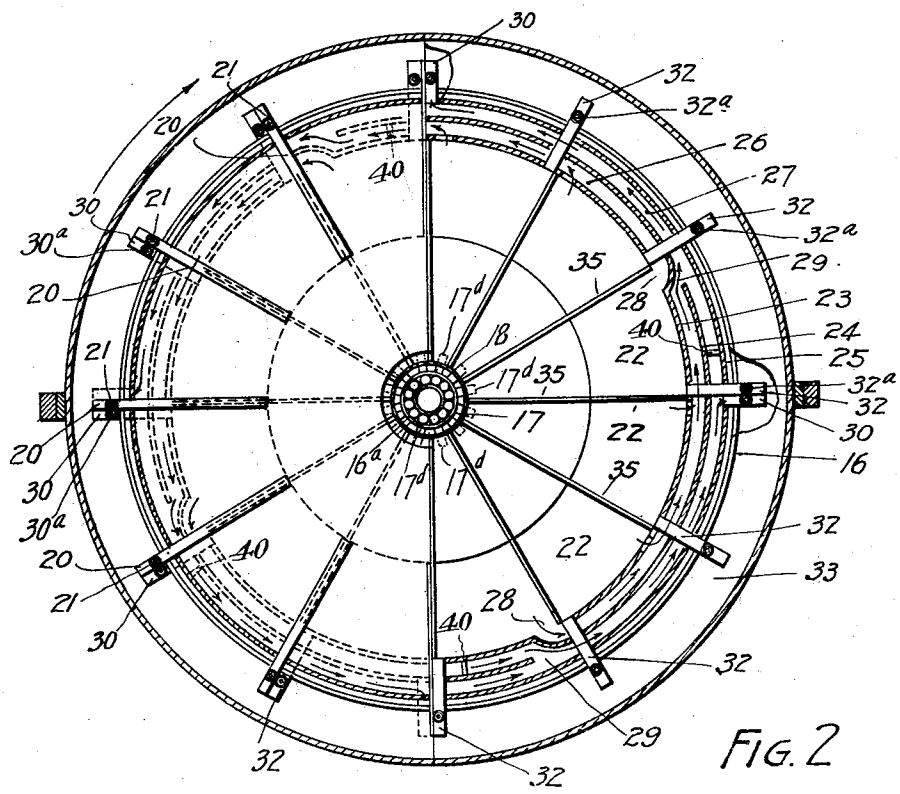

FIG. 2

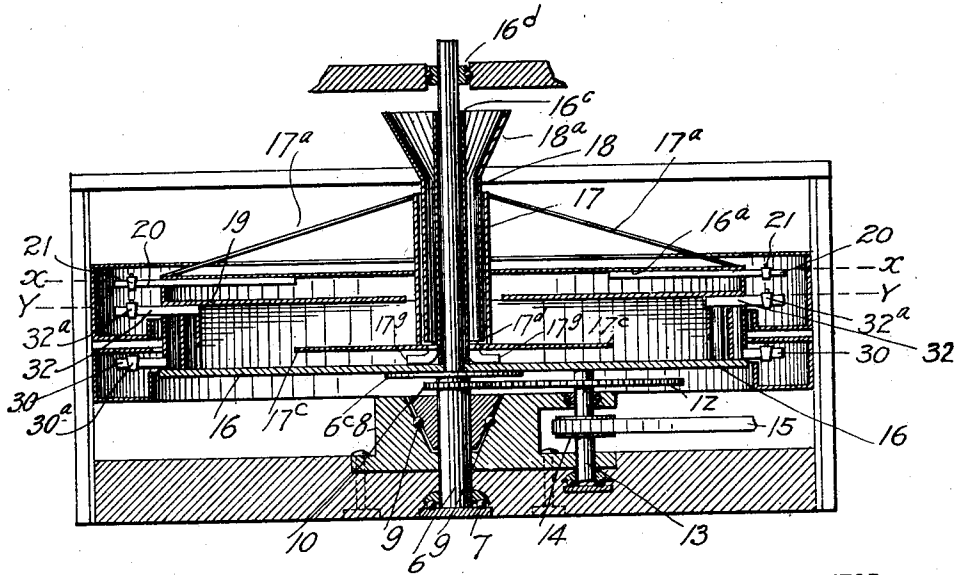

FIG. 1

WITNESSES:

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CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 703,630, dated July 1, 1902.

Application filed May 21, 1901. Serial No. 61,295. (No model.)

To all whom it may concern:

Be it known that I, AUGUST TEN WINKEL, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Centrifugal Separators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in centrifugal separators adapted to separate the precious metals from the gangue or to effect a separation between substances of any kind which are of different specific gravity.

In this specification the apparatus will be described with special reference to its use in separating the precious metals from gangue with which they are mingled either in placer material or pulverized ore, though it must be understood that my improvement is not limited to this use.

The invention will now be described in detail, reference being made to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken through my improved apparatus. Fig. 2 is a combination view, the left half being a section taken on the line $x\,x$ and the right half a section taken on the line $y\,y$, Fig. 1.

The same reference characters indicate the same parts in both views.

Let the numeral 5 designate a suitable stationary frame, in the base 5^a of which is journaled a shaft 6. The lower extremity of this shaft is mounted on bearing-balls 7, while above this extremity the shaft is provided with an inverted-cone-shaped part 6^a, engaging a counterpart socket formed in a block 8, secured to the base. In the parts 6^a and 8 is formed a raceway for the bearing-balls 9.

It is my intention to reduce to a minimum the friction incident to the operation of the machine, since it will be operated at a high rate of speed.

Above the cone-shaped bearing the shaft is provided with a fast pinion 10, meshing with a relatively large gear 12, fast on a shaft 13, journaled in the base of the frame and provided with a fast pulley 14, connected with a belt 15, running from a line-shaft or from any suitable motor. (Not shown.) Made fast to the vertical shaft and resting on a platform 6^c thereon is a cylindrical tank or receptacle 16, closed at the top, as shown at 16^a. To this top part is secured a sleeve 17, which projects both above and below the top of the tank and is supported by braces 17^a. This sleeve is open at the top, and into it is passed a feed-pipe 18, terminating at its lower extremity a short distance from the bottom of the tank, its upper extremity being provided with a hopper-shaped mouth 18^a. This feed-pipe is secured to the upper part of the stationary framework. The shaft 6 is surrounded by a sleeve 16^c, attached to the bottom of the tank, and engages a bearing 16^d above the sleeve. The lower extremity of the sleeve 17 is provided with a circular plate 17^c, which extends outwardly in the tank to prevent the material from rising as it leaves the feed-pipe. This plate also projects inwardly beneath the feed-pipe and is made fast to the sleeve 16^c. Immediately below the feed-pipe the plate 17^c is provided with openings 17^d, from which nozzles or outwardly-bent open-ended discharge-pipes 17^g lead. There is one of the nozzles for each sector-shaped compartment 22 hereinafter described.

Located within the tank below the top 16^a is a horizontal partition 19, which is secured to the outer wall of the tank and open around the sleeve 17, as shown at A, for the discharge of the water which passes out through discharge-pipes 20, open at both ends and provided with suitable valves 21 for regulating the escape of water from the tank. Below the partition 19 the chamber of the tank is divided by radial partitions 35 into a number of sector-shaped compartments 22, surrounded by three circular partitions 23, 24, and 25, forming two concentric chambers 26 and 27. Each compartment 22 has an outlet 28, leading to the concentric chamber 26, and the partition 24 is provided with opening 29, leading to the chamber 27, which is provided with outlets 30 to a mineral trough or receptacle 31. Each compartment 22 is also pro-

vided with an outlet 32 for the sand or gangue, which passes into a trough 33 above the trough 31. The mineral-outlets 30 and the gangue-outlets 32 are provided with suitable valves 30^a and 32^a, respectively. The partitions 35 extend from the circular wall 23 to the sleeve 17. Hence the compartments 22 are closed except where the water escapes at A around the sleeve and at the outlets 30 and 32 for the mineral and sand, respectively. The gangue trough or receptacle 33 is broken away in the right half of Fig. 2 to disclose the mineral-outlets.

When the machine is in operation, the tank 16 is rotated at a high rate of speed through the instrumentality of the mechanism heretofore described. The material to be treated is fed into the tank through the pipe 18 and passes therefrom into the bottom of the tank by way of the nozzles 17^g, which give it a forceful outward impetus. The flange 17^c prevents the material from rising when first discharged into the tank. Under the influence of the tank's rapid rotation, which is in the direction of the arrow in Fig. 2, the mineral particles being heavier than the water and gangue are carried outwardly through the water and gangue and rearwardly at the same time. By reason of their greater specific gravity these mineral particles have a tendency to remain behind the water and gangue during the tank's rotation, hence their rearward travel. The combined action of the centrifugal force and this rearward tendency cause the mineral particles to travel toward the openings 28 of each compartment 22. These mineral particles pass through the openings 28 into the circular compartment 26 and travel rearwardly therein, as indicated by the arrows, until a cut-off 40 is reached, when these mineral particles pass through an opening 29 into the compartment 27, in which they continue their rearward travel until the mineral-outlet 30 is reached, when they pass into a receptacle 31. It will be observed that the rotation of the tank in the direction indicated by the arrow has a tendency to induce a rearward current in the mineral particles and water in the concentric chambers surrounding the sector-shaped compartments 22. This is because of the gravity of the mineral particles giving them a tendency to remain behind. Hence they do not travel forward in the direction of the tank's rotation, but have a backward tendency, as before explained when describing the action of the mineral particles in the compartments 22.

The sand or gangue, which while lighter than the mineral is heavier than the water, has a tendency to settle. This sand is carried outward in the compartments 22 by the centrifugal force. Instead of traveling rearwardly with the mineral it seeks the forward corners of the sector-shaped compartments and passes through the outlets 32 directly into the gangue-receptacle 33.

My object is to maintain the water in the compartments 22 in a comparatively quiescent state, particularly the lower stratum of the water carrying the mineral particles, and thereby prevent disturbance by reason of suction at the mineral-outlets. I therefore compel the mineral to travel rearwardly in the concentric compartments 26 and 27 a considerable distance before the mineral-outlet 30 is reached. The tank should be constantly full of water during the operation of the machine, and enough water must be fed to the machine with the material or otherwise to accomplish this end. A portion of the water will escape with the mineral and sand at the outlets 30 and 32. The balance of the water and lighter gangue will rise through the opening A and escape through the discharge-pipes 20.

When the apparatus is in use for the saving of slimes exclusively, the sand-outlets 32 are closed.

By reason of the valves in the different outlets 20, 30, and 32 the discharge from the tank of water, sand, and mineral may be regulated according to the character of the material under treatment and as circumstances may require.

The radial partitions 35 may be horizontally slotted to receive the circular plate 17^c.

Having thus described my invention, what I claim is—

1. In a centrifugal ore-separator, the combination of a revoluble tank, radial partitions located therein and forming sector-shaped compartments, circular partitions surrounding the radial partitions and forming a concentric compartment, the outer extremities of the radial partitions engaging the inner circular partition, whereby the sector-shaped compartments have no communication with each other, outlets from the sector-shaped compartments to the concentric compartment, for the mineral, and mineral-outlets from the concentric compartment but not in line with the corresponding outlets from the sector-shaped compartments.

2. In a centrifugal separator, the combination of a revoluble tank having a number of sector-shaped compartments having no communication with each other, a feed-pipe arranged to discharge simultaneously into all of said compartments the feed-pipe having a distinct outlet to each sector-shaped compartment, circular partitions surrounding the sector-shaped compartments, and forming a concentric compartment, outlets from the sector-shaped compartments to the concentric compartment, and an outlet from the concentric compartment but remote from the corresponding outlets from the sector-shaped compartments.

3. In a centrifugal separator, the combination of a revoluble tank, a central sleeve attached to the tank, a feed-pipe projecting downwardly into said sleeve, radial partitions extending outwardly from the sleeve and dividing the tank into a number of sector-

shaped compartments into which the material issuing from the feed-pipe passes, circular partitions surrounding the radial partitions and forming a concentric compartment in communication with the sector-shaped compartments, the radial partitions extending to the inner circular partition, whereby the sector-shaped compartments have no communication with each other and outlets from the concentric compartments for the mineral passing thereto from the sector-shaped compartments.

4. In a centrifugal separator, the combination of a revoluble tank, a feed-pipe located at the center of the tank, a sleeve secured to the tank and into which the feed-pipe projects, radial partitions arranged around the said sleeve and dividing the tank into sector-shaped compartments, into which the feed-pipe discharges, and a mineral-outlet from each sector-shaped compartment, the said compartments having no communication with each other.

5. The combination of a revoluble tank, a central sleeve attached thereto, a feed-pipe projecting into said sleeve, radial partitions arranged around the sleeve and dividing the space within the tank into a number of sector-shaped compartments having no communication with each other, each compartment being provided with an outlet for the mineral, said outlet being located remote from the feed-pipe and a circular compartment surrounding the sector-shaped compartments, and into which the mineral-outlets from the sector-shaped compartments discharge.

6. The combination of a revoluble tank, a central sleeve attached to the tank, a feed-pipe projecting into the sleeve, radial partitions surrounding the sleeve and dividing the tank into sector-shaped compartments having no communication with each other, provided with two outlets, one being for the mineral and the other for the gangue, the mineral-outlet being located below the gangue-outlet, and a circular compartment surrounding the sector-shaped compartments, and into which the mineral-outlets from the sector-shaped compartments discharge.

7. The combination of a revoluble tank, a central feed-pipe, radial partitions surrounding the feed-pipe and dividing the tank into sector-shaped compartments provided with two outlets, one being for the mineral and the other for the gangue, the mineral-outlets being located below and in the rear of the gangue-outlets, the sector-shaped compartments having no communication with each other, and a circular compartment surrounding the sector-shaped compartments, and into which the mineral-outlets from the sector-shaped compartments discharge.

8. The combination of a revoluble tank, a central feed-pipe, a sleeve attached to the tank and into which the feed-pipe projects, partitions dividing the tank into sector-shaped compartments having no communication with each other, a horizontal partition closing said compartments at the top except for a short distance around the sleeve, a top for the tank said top being located above the horizontal partition and closing the tank above, and a water-outlet between the top of the tank and the horizontal partition, the sector-shaped compartments being provided with outlets for the mineral and separate outlets for the gangue.

9. The combination with a suitable frame, of a vertical shaft journaled therein, a tank mounted to rotate with said shaft and closed at the top, radial partitions dividing the tank into a number of sector-shaped compartments having no communication with each other, a central feed-pipe communicating with all the said compartments, circular partitions dividing the space around the radial partitions into two concentric compartments, outlets from the sector-shaped compartments to the inner concentric compartment, outlets from the inner concentric compartment to the outer similar compartment, cut-offs located at said last-named outlets, and outlets for the mineral, leading from the outer concentric compartment.

10. In a centrifugal separator, the combination of a revoluble tank, a vertical shaft to which said tank is secured, a sleeve attached to the tank and surrounding the shaft, another sleeve attached to the tank outside of the first-named sleeve, a feed-pipe projecting into the tank between the two sleeves, a plate attached to the bottom of the outer sleeve, and projecting below the feed-pipe to the inner sleeve to which it is attached, said plate having openings below the feed-pipe, and nozzles leading from said openings into the tank.

11. In a centrifugal separator, the combination of a revoluble tank, radial partitions dividing the tank into sector-shaped compartments, a vertical shaft to which said tank is secured, a sleeve attached to the tank and surrounding the shaft, another sleeve attached to a tank above and outside of the first-named sleeve, a feed-pipe projecting into the tank between the two sleeves, a plate attached to the bottom of the outer sleeve and extending below the feed-pipe, to the inner sleeve to which it is attached, said plate having openings below the feed-pipe, and nozzles or discharge-pipes directed outwardly from said openings into the tank, there being a nozzle for each sector-shaped compartment.

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

AUGUST TEN WINKEL.

Witnesses:

D. C. SHICK,

MARY C. LAMB.