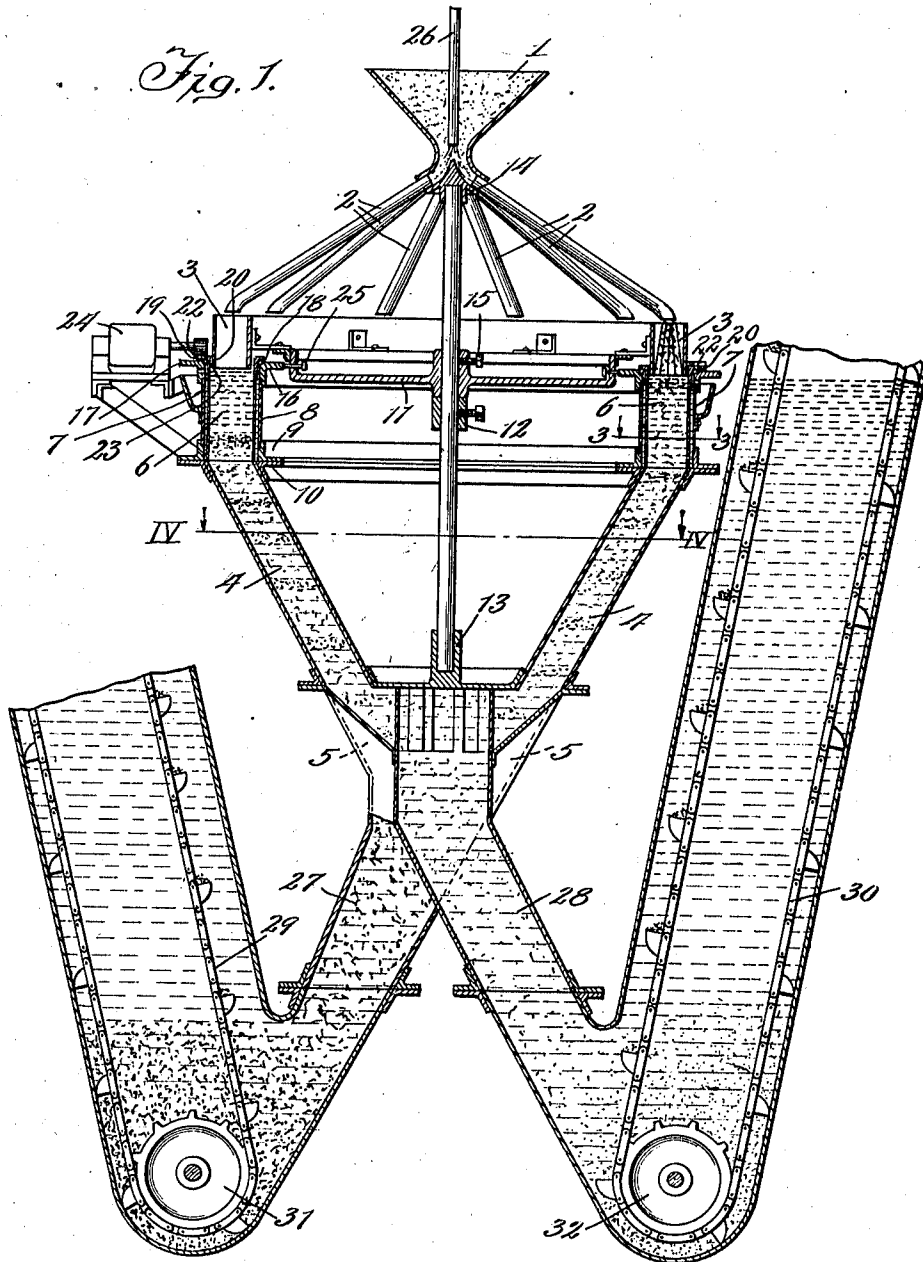


T. CHARLTON.
 APPARATUS FOR SEPARATING ORES.
 APPLICATION FILED FEB. 3, 1910.

1,003,704.

Patented Sept. 19, 1911.

3 SHEETS-SHEET 1.



Witnesses:
Barclay
A. Knight.

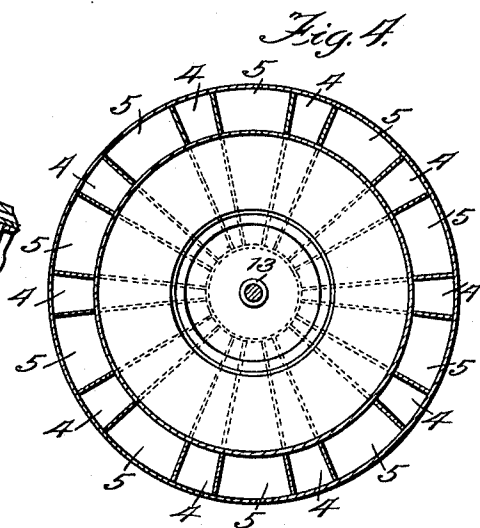
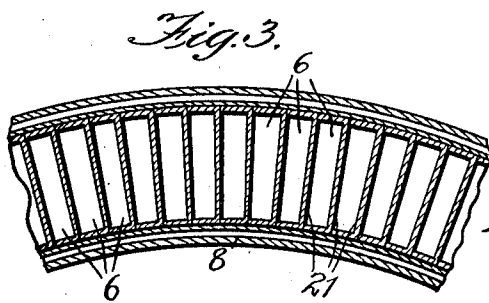
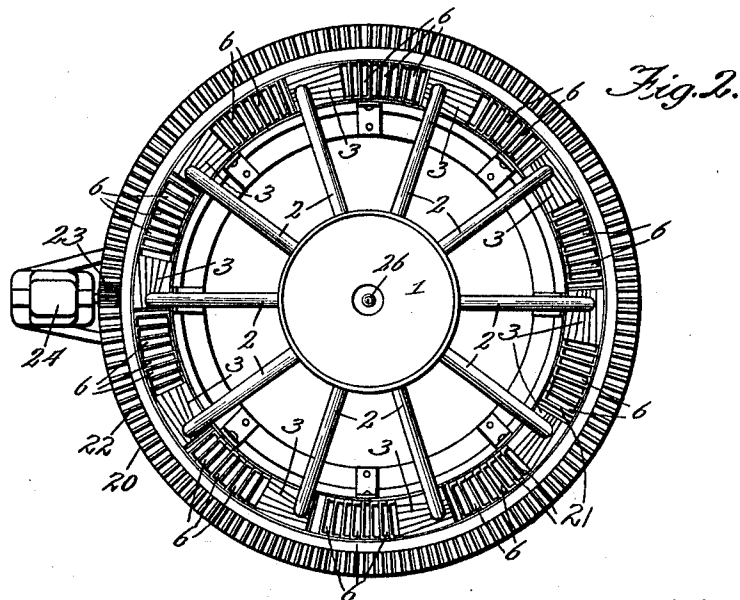
Inventor:
Thomas Charlton
 By *Brown & Hopkins*
 Att'ys.

T. CHARLTON.
 APPARATUS FOR SEPARATING ORES.
 APPLICATION FILED FEB. 3, 1910.

1,003,704.

Patented Sept. 19, 1911.

3 SHEETS—SHEET 2.



Witnesses:
Ed. D. Terry
At Knight.

Inventor:
Thomas Charlton
 By *Brooks Hopkins*
Atty.

T. CHARLTON.
 APPARATUS FOR SEPARATING ORES.
 APPLICATION FILED FEB. 3, 1910.

1,003,704.

Patented Sept. 19, 1911.

3 SHEETS—SHEET 3.

Fig. 5.

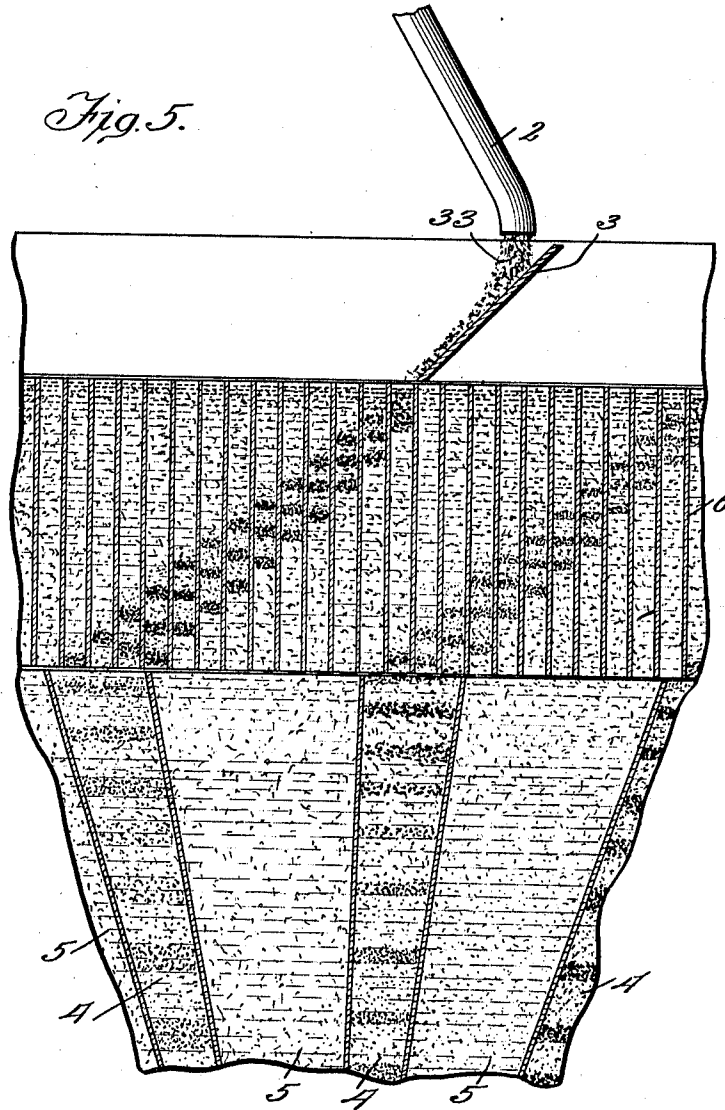
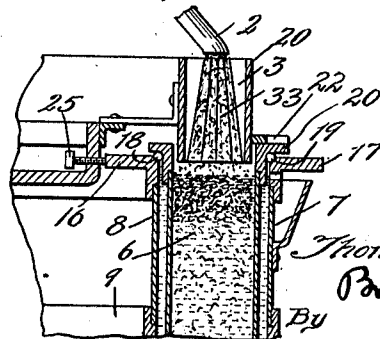


Fig. 6.



Witnesses:
R. D. Perry
A. Knight.

Inventor:
Thomas Charlton
Brown Hopkins
 By

Attys.

UNITED STATES PATENT OFFICE.

THOMAS CHARLTON, OF CHICAGO, ILLINOIS.

APPARATUS FOR SEPARATING ORES.

1,003,704.

Specification of Letters Patent. Patented Sept. 19, 1911.

Application filed February 3, 1910. Serial No. 541,725.

To all whom it may concern:

Be it known that I, THOMAS CHARLTON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Separating Ores, of which the following is a specification.

This invention relates to ore separators, and has for its general object to provide an improved means for separating ore pulps into the several ingredients composing the same.

One of the objects of this invention is to provide an improved apparatus having means for performing a continuous process which will be rapid, economical and effective.

Another object is to provide an improved apparatus for separating ores which will reduce to a minimum the number of operations involved in a process of this nature.

Another object is to provide an improved apparatus having means for separating ore during one continuous operation into any required number of its ingredients.

Other and further objects will appear in the specification and be more particularly pointed out in the appended claims, reference being had to the accompanying drawings exemplifying the invention.

In the drawings—Figure 1 is a vertical section through the axis of a separator constructed in accordance with the principles of the present invention. Fig. 2 is a top plan view of the machine shown in Fig. 1. Fig. 3 is a partial section of the machine taken on the line 3—3 of Fig. 1. Fig. 4 is a section on the line IV—IV of Fig. 1. Fig. 5 is an enlarged detail section of a portion of the separator showing the pulp in process of separation. Fig. 6 is an enlarged detail sectional view corresponding to the upper right hand portion of Fig. 1.

According to the present invention, the ore is first reduced to a pulp and is then introduced into a plurality of unit separators which are submerged in a tank containing a quiescent and non-circulating liquid, such for example as water, of less specific gravity than the ore or other material to be separated, and these unit separators are caused to

move, preferably in a circle successively over the open tops of ducts or a plurality of receptacles for the ingredients of the ore. In each separator, after the pulp has been introduced thereto, said pulp as it settles through the water automatically divides by gravity into the ingredients of which it is composed. According to a natural law, the velocities at which the several ingredients of equal size settle through the water will correspond to their specific gravities, the heaviest being at the bottom and the lighter at the top. In this invention, advantage is taken of this fact by providing means for drawing off each ingredient automatically at the moment it reaches the bottom of the separator unit. It is therefore possible by disposing receptacles for catching these ingredients at regularly spaced intervals and in interposing other receptacles therebetween at suitable intervals, to intercept the gangue, to have said ingredients and gangue separated and collected in separate receptacles, from which they may be conveyed in any suitable manner. In the use of this invention, the velocity of the moving separator units must be so regulated as to insure each unit passing over a given receptacle at the moment the ingredient intended for that receptacle reaches the bottom of the separator unit and the water in the moving separator unit is dead or maintained in a quiescent condition as contradistinguished from flowing or agitated water.

In describing the particular embodiment of the invention shown in the drawings, the parts of said apparatus will, for the sake of convenience, be described in the order in which the material passes through the machine.

At the top of the machine means for introducing an ore pulp to the machine is provided by means of a hopper 1, which empties into a plurality of conveyer tubes 2, said tubes discharging into a plurality of chutes 3. The chutes 3 are widened radially so as to distribute the pulp laterally of the separator units presently to be referred to. At a suitable distance below the chute 3 are ducts or receptacles arranged in groups 4, 5, said receptacles being in the

form of tubes discharging downwardly for conveying off the respective ingredients and gangue after the separation. Interposed between the chutes 3 and the receptacles 4, 5, are a plurality of separator units 6, which, together with the receptacles 4 and 5 are maintained full of water in a manner presently to be set forth. In order to provide means for moving these separator units into and out of communication successively with each of the receptacles 4 and 5, said units are preferably revolvably mounted directly above the upper open ends of the receptacles 4 and 5, said open ends being arranged for this purpose in a circle within the same plane. The separator units 6 are preferably constructed tubular in form open at both ends and are of comparatively small area. In order to maintain the receptacles 4 and 5 and the separator units 6 full of water, a tank, preferably annular in form, is connected with the upper ends of the receptacles 4 and 5, and extends in a circle about said upper ends. This tank is constructed of cylindrical plates 7 and 8, which may be rigidly connected to the receptacles 4 and 5 in any suitable manner, such as by the annular angle bars 9 and 10. A spider 11 is rigidly mounted upon a fixed vertical shaft 12, said shaft being supported in sockets 13 and 14, arranged below and above said spider. A set screw 15 may be conveniently used for rigidly securing said spider to the shaft. Adjustably mounted upon the outer ends of the spider 11 is an annular angle bar 16, which is also mounted on the top of the cylindrical plate 8. At the top of the plate 7 is mounted a second annular angle bar 17, which is disposed oppositely to the bar 16, both of said bars being provided with run-ways or recesses 18 and 19 for the reception of balls for revolvably mounting the separator units 6. According to the preferable construction of these units as shown in the drawings, each unit consists of a tubular member open at both ends, the upper end being provided with an annular flange 20 by means of which it is supported upon the balls in the recesses 18 and 19. As a preferable means for constructing these tubular units 6, a plurality of channeled sections 21, (see Fig. 3), are arranged in series as shown in said figure; and to provide means whereby said units may be revolved about the axis of the machine, the series of said units have rigidly secured thereto an annular rack 22, with which meshes a pinion 23, which pinion is carried by the shaft of a motor 24. The motor 24 is mounted in any suitable manner adjacent to the periphery of the rack 22. Set-screws 25 having threaded connections with the arms of the spider 11 serve to adjust the inner angle bar 16 radially with respect to the outer angle bar 17, so as to

insure a concentric mounting for said angle bars.

Arranged above and discharging into the hopper 1 is a supply pipe 26 for water or other liquid, which serves at the same time to maintain the pulp in suitable fluid condition to carry out the process, and also to maintain the tank, units 6 and receptacles 4 and 5 full of water so that the water will form a liquid seal for the units.

As hereinbefore intimated, the receptacles 4 and 5 are connected below in groups to chutes or receptacles 27 and 28, there being a chute and group for each ingredient into which the ore is to be separated. According to the present embodiment, but two ingredients have been arranged for, the chute 27 being for the concentrated metalliferous portions, while the chute 28 is designed to collect the gangue or waste. As will be seen from Fig. 1, the receptacles 4 discharge into the chute 27 to convey the material to a common point, while receptacles 5 discharge into the chute 28 to also convey the material therein to a common point. Suitable means, such as the endless chain conveyers 29 and 30 may be provided for removing the ingredients from the bottoms of the chutes 27 and 28, said conveyers for this purpose being caused to pass around sprockets 31 and 32 arranged at the foot of said chutes 27 and 28 with their receiving portions submerged. With this arrangement the materials may be conveyed above the liquid level without influencing the liquid.

Referring now to Fig. 5, the steps of the process performed by the described apparatus will now be outlined. In this figure, a single tube 2 is shown discharging the liquid pulverized ore or pulp 33 on to one of the chutes 3, which chute in turn discharges successively into the separator units 6 which pass thereunder by reason of their revolution about the axis of the machine. The units are thus charged intermittently and being filled with water, the pulp 33, as it enters each unit 6, begins to undergo a gravitational separation, such as is indicated diagrammatically in Fig. 5. As shown in this figure, the receptacles 5 for gangue are made larger than the receptacles 4 for the concentrate, to allow for the greater bulk of the gangue. The revolution of the unit 6 is regulated in such manner as to cause a unit 6 to move from a chute 3 to the next receptacle 4 by the time one portion of the concentrate has settled from the top to the bottom of such unit. When, therefore, said unit begins to open into communication with the top of receptacle 4, the bottommost body of concentrate has reached the lower end of the tubular unit 6, so that it will pass into the receptacle 4 during the movement of the unit 6 across the opening of

said receptacle. In order to avoid confusion, the action of but a single unit 6 has been indicated on Fig. 5.

By the provision of the separator units the water will be confined in such a manner as to break up circulation thereof when the units are rotated so that the water in each unit will be maintained in a quiescent condition thereby effecting a perfect separation and the particles deposited in the units will be controlled by and be confined therein and directed to the receptacles which receive the separated particles.

Obviously, the several parts of the apparatus may be constructed and arranged to provide for a separation of the ore pulp into any desired number of ingredients that may be necessary, the disclosure herein set forth being for the purpose of illustration only.

It is also to be understood that the chutes 3 being adjustably mounted or supported with respect to the tubes 2, their discharge ends may be adjusted forwardly or backwardly with respect to the receptacles or tubes 4 and 5 so as to vary the point of discharge of the material from the chutes into the tubes 2 with relation to the receptacles or tubes 4 and 5. This may be accomplished by an angular adjustment or rotation of the vertical shaft 12, and as the spider 11 is secured to the shaft the latter will also be correspondingly adjusted. After such adjustment, the parts may be held in their adjusted positions in any desired or suitable manner not necessary to illustrate. The spider may also be adjusted with relation to the shaft by loosening the set-screw 15, which forms a connection between the shaft and the spider.

What I claim is:

1. In an ore separator a plurality of upright circularly arranged tubular separator units open at both ends, a plurality of fixed ducts above which the units are located, said ducts being adapted to receive the separated materials from the units, a shaft disposed centrally with respect to the units, means whereby the rotation of the shaft forwardly or backwardly will correspondingly move the separator units horizontally with respect to the ducts to positively control the different separated elements, a stationary hopper supported above the units, said hopper being provided with a plurality of fixed discharge outlets therefrom for depositing the ore pulp into the said units and with respect to which outlets the units are also movable, and a supply pipe disposed to discharge liquid substantially into the center of the hopper to move the ore pulp to the said discharge outlets.

2. In an ore separator, the combination of a plurality of traveling receiving units for the ore open at both ends and containing liquid in a stagnant condition with respect

to the units and into which ore pulp is deposited, the ingredients of the pulp being automatically separated within the units by gravity, means for supplying ore to the units at different points in their line of travel, means for receiving the separated materials from the units and depositing them at a common point, and a common mechanism for removing the separated materials from the last said point.

3. In a machine for separating materials of different specific gravities, a tank, a series of upright open-ended settling chambers therein arranged in and substantially filled with a quiescent and non-circulating liquid of less specific gravity than such materials, feeding means common to said chambers, and means for moving said chambers into register with the feeding means, said chambers to receive charges of materials to be separated and to discharge said separated materials from their lower ends at different points in the order of their specific gravities.

4. In a machine for separating materials of different specific gravities, a tank, a series of non-communicating open-ended upright, separating chambers therein arranged in and substantially filled with a quiescent and non-circulating liquid of less specific gravity than such materials, means common to said chambers for feeding said materials thereinto, and means for moving said chambers to successively receive the materials to be separated and to discharge said materials at different points from their lower ends separated in the order of their specific gravities.

5. In a machine for separating materials of different specific gravities, a tank, a plurality of non-communicating open-ended settling chambers therein having vertical walls arranged in and substantially filled with a quiescent and non-circulating liquid of less specific gravity than such materials, means for feeding said materials to said chambers, a plurality of receptacles located beneath said chambers, and means for moving said chambers with relation to said feeding means and said receptacles to receive and separate said materials and to discharge the same in the order of their specific gravities into said receptacles.

6. In a machine for separating materials of different specific gravities, a tank, a circuit of non-communicating open-ended upright settling chambers therein each chamber having a uniform cross-sectional area throughout its length arranged in and substantially filled with a quiescent and non-circulating liquid of less specific gravity than said materials, means for continuously feeding materials to be separated successively to said chambers, a plurality of receptacles located beneath said chambers, and means for moving said chambers with

relation to said feeding means and said
receptacles to receive the materials and to
discharge the same from the lower ends
thereof into said receptacles separated in
the order of their specific gravities.

5 In testimony whereof I have signed my
name to this specification, in the presence of

two subscribing witnesses, on this 1st day of
February A. D. 1910.

THOMAS CHARLTON.

Witnesses:

J. H. JOCHUM, Jr.,

A. O. KNIGHT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."