

Sept. 18, 1928.

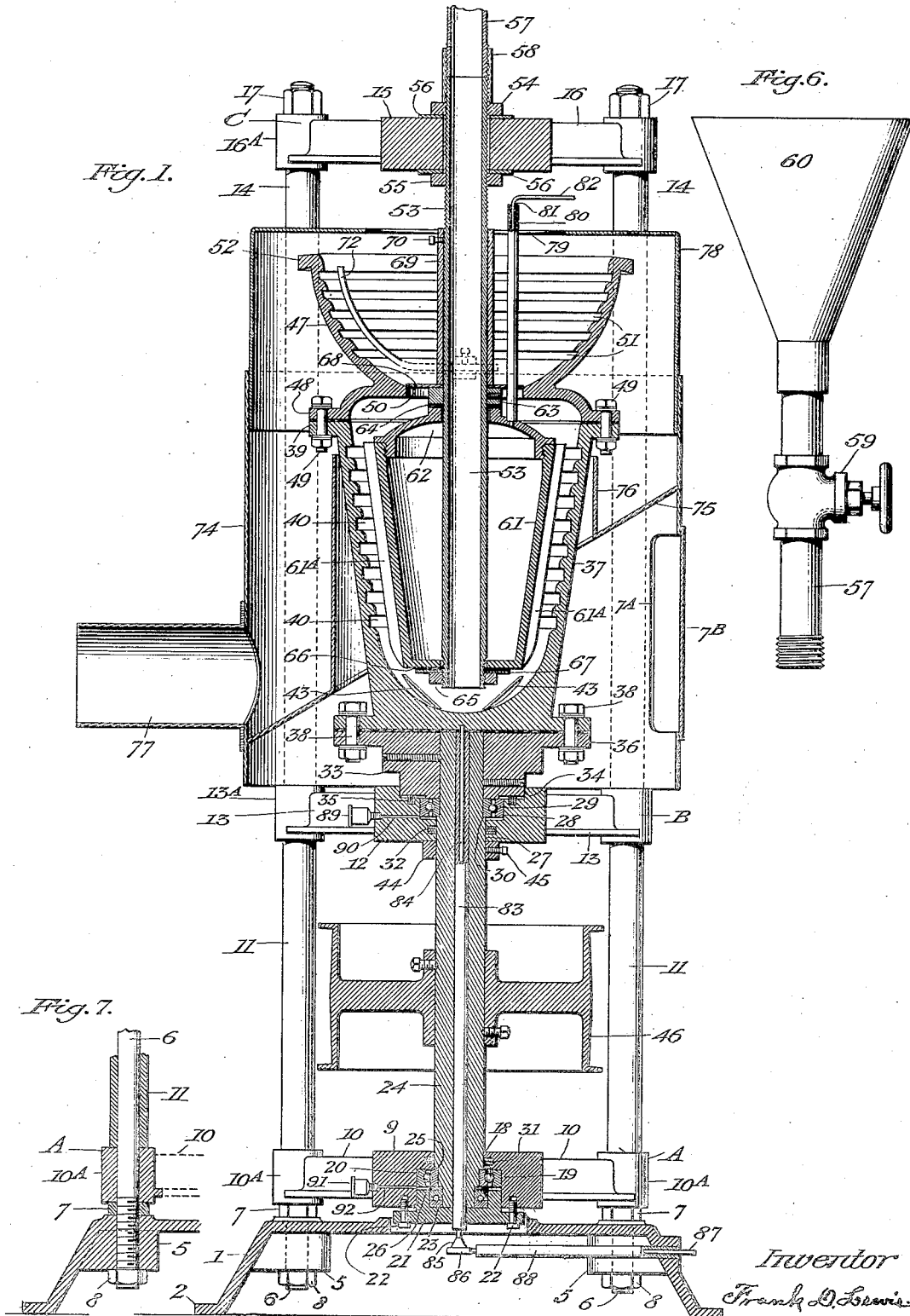
F. D. LEWIS

1,684,870

CENTRIFUGAL CONCENTRATING AND AMALGAMATING APPARATUS OF THE VERTICAL TYPE

Filed Oct. 17, 1927

2 Sheets-Sheet 1



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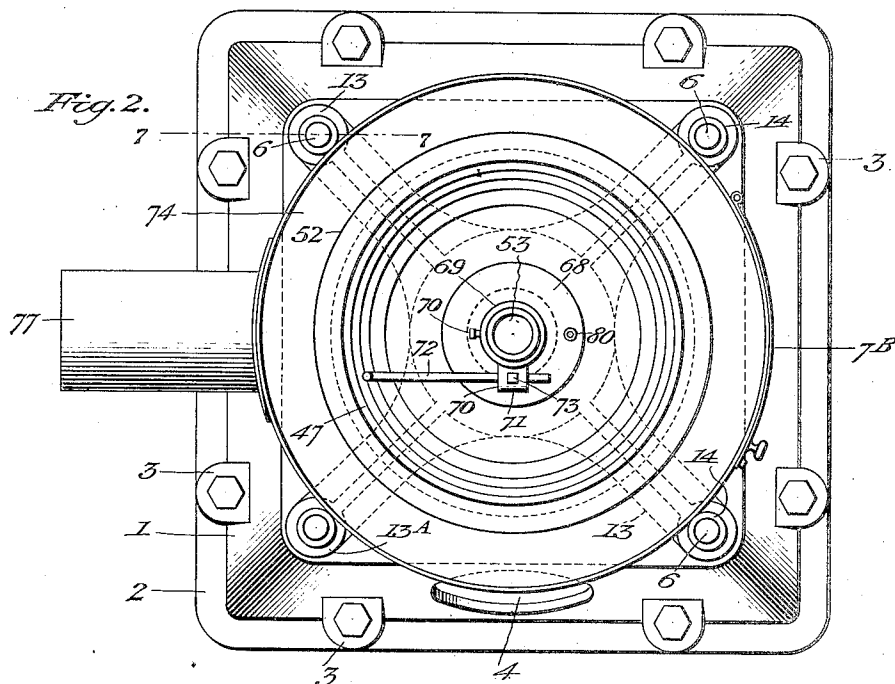
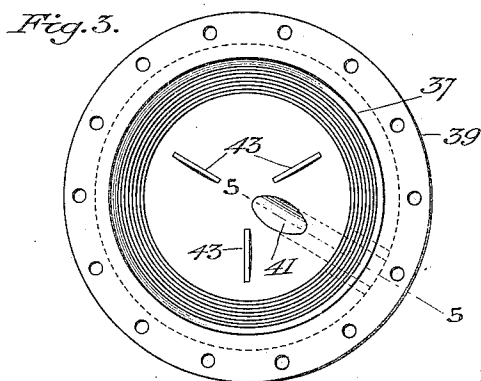
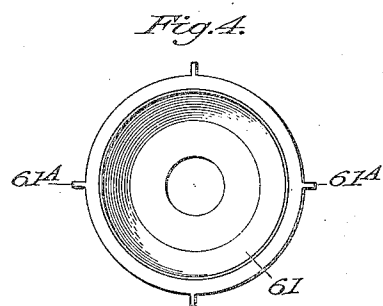
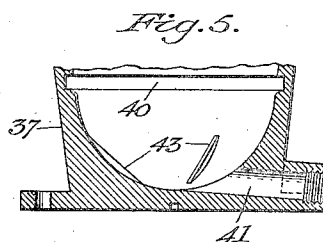
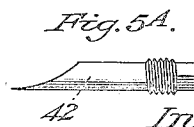
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL CONCENTRATING AND AMALGAMATING APPARATUS OF THE VERTICAL TYPE.

Application filed October 17, 1927. Serial No. 226,711.

This invention relates to centrifugal concentrating and amalgamating apparatus of the vertical type.

The primary object of the invention is to provide a vertically disposed amalgamating and concentrating cylinder which is supported on a power driven shaft, means being provided for supplying screened placer ground or ore pulp to the bottom of said cylinder, which, owing to its rotary motion, throws the inflowing material by centrifugal force against the face of the cylinder, where the gold and mineral concentrates therein are extracted, and the tailings product is discharged.

Further to provide a centrifugal amalgamating and concentrating apparatus for placer or other free gold material, comprising a tapered cylinder the inner face of which is formed with annular mercury receiving grooves and a bowl which is supported on said cylinder and communicating therewith and provided with annular grooves; a vertically adjustable supply pipe extending down through said bowl and cylinder; said pipe having a tapered member thereon for defining an annular space in said cylinder; pulp being supplied through said pipe to the bottom of said cylinder, said cylinder being supported upon the upper end of a power driven shaft, whereby pulp flowing to said cylinder is carried by centrifugal force against the face of the cylinder, where it is subjected to an amalgamating and concentrating action, the tailings passing out into the bowl and thence to a suitable launder, the grooves in said bowl being adapted to catch any mercury which escapes from the cylinder, means being provided for retarding the outflow from the concentrating cylinder to the bowl.

Further to provide means whereby the mercury in the grooves of the concentrating and amalgamating cylinder, as well as the product under treatment therein is subjected to the action of a current of electricity.

These and other objects which will hereinafter appear, are accomplished by the apparatus illustrated in the accompanying drawings in which,—

Figure 1, is a vertical sectional view

through the improved apparatus.

Figure 2, is a plan view thereof, the top spider bracket and launder cover being removed.

Figure 3, is a plan view of the amalgamating and concentrating cylinder.

Figure 4, is a plan view of the stationary, adjustable element which is suspended within the amalgamating cylinder.

Figure 5, is a sectional view through the bottom portion of the amalgamating cylinder.

Figure 5^A, is a view of the plug for the cylinder outlet.

Figure 6, is a side view of the feed hopper which is connected to the upper end of the feed pipe which supplies material to amalgamating cylinder, and

Figure 7, is a vertical sectional view through a portion of the base plate and one of the upright columns, on the line 7—7 of Figure 2.

Referring to the accompanying drawings, the numeral 1, designates the base plate of the improved apparatus, which is preferably square in outline and comprises a horizontal plate having depending outwardly inclined side members which terminate in a base flange 2, apertured lugs 3, being formed on the said flange through which bolts are passed for securing the base plate to a floor or support. By this construction a space of suitable height is provided beneath the horizontal portion of the base plate and a hand hole 4, is formed in one of its side members, for a purpose to be hereinafter set forth. A lug 5, is formed on the under side of the plate at each corner thereof and an unthreaded bolt hole extends through each lug and through the plate. Through each of these bolt holes is inserted the threaded end of a rod 6, of suitable length, and these rods are secured in the lugs by nuts 7 and 8, on the rods which are screwed, respectively against the upper side of the plate and against the under side of the lug, as shown most clearly in Figure 7. A spider casting A, rests upon the four nuts 7, and comprises a central hub 9, from which extend four radial arms 10, having apertured lugs 10^A, on their outer ends through which the rods 6, pass and

which rest upon the nuts 7, as shown in Figures 1 and 7. Sections of tubing 11, are slipped over the rods 6, and rest on the lugs 10^A, of the spider arms 10, and a spider casting B, similar to the casting A, is slipped over the rods 6, and rests upon the upper ends of the tube sections 11. The spider B has a hub 12, and radial arms 13, terminating in apertured lugs 13^A, through which the rods pass, and upon the lugs 13^A of these arms rest tubes 14, which are slipped over the rods 6, and upon the upper ends of the tubes 14, rests the uppermost spider casting C, comprising a hub 15, and radial arms 16, having rod receiving lugs 16^A, on their outer ends, which rest upon the said tubes 14, and nuts 17, are screwed upon the upper ends of the rods 6, and against the ends of the arms 16, thus securing the spider C, upon the rods 6. The rods and tube sections constitute four columns which support the spiders in axial alinement, and the spiders support the apparatus proper, in a manner which will now be described. The hub 9, of the lower spider A, is formed with a circular shaft opening 18, which is counterbored from the under side of the hub to form a recess 19, in which is tightly fitted the outer ring of a ball bearing 20, which abuts against the end wall of the said recess. A gland 21, closes the recess 19, and is secured to the hub by bolts 22, which pass through the flange of the gland and into the hub and the gland carries a ball bearing 23. The lower end portion of a shaft 24, extends through the opening 18, in the hub of the lower spider A, and is stepped or shouldered to rest upon the inner ring of the ball bearing 20, as shown at 25, and it is again stepped or shouldered to rest upon a washer 26, which in turn rests upon the upper ring of the ball bearing 23. The shaft 24, extends through and beyond the hub 12, of the middle spider B, and the shaft opening 27 in the hub is counterbored to form a recess 28, for the reception of the outer ring of a ball bearing 29, the inner ring of which is secured upon the shaft and rests upon a shoulder 30, thereon. The ball bearings 20 and 29, prevent lateral movement of the shaft in any direction, while the ball bearing 23, receives the weight of the shaft and parts carried thereby. The hub 9 of the spider A, is provided with an annular groove 31, in which felt packing rings are placed which surround the shaft and protect the ball bearings from grit or other foreign matter; and the hub 12, of the spider B, is provided with an annular groove 32, in which are placed felt packing rings which also surround the shaft and protect the ball bearing 29. Upon the upper end of the shaft 24, is rigidly secured a circular block 33, the lower end of which fits in a counterbored recess 34, in the top of the hub 12, the bottom of this recess being

flush with the upper edge of the ball bearing 29, and an annular groove 35, is formed in the bottom of the recess 34, in which felt packing rings are placed which engage the bottom of the block 33, and protect the ball bearing 29, against grit and other foreign matter.

The top of the block 33, is formed with an annular flange 36, to which is secured the flanged lower end of a concentrating and amalgamating bowl or cylinder 37, by bolts 38. The top of this cylinder terminates in a flange 39, and its wall tapers from top to bottom, as shown, the inner face thereof terminating in a dome-like bottom. The inner face of this cylinder is formed with a series of spaced annular grooves 40, the upper edges of the walls between said grooves being rounded or curved, as shown, and these grooves are adapted to receive and hold mercury which is forced into them under centrifugal action, as will hereinafter appear. The bottom of the cylinder is provided with an outlet passage 41, the outer end portion of which is threaded, and this passage is normally closed by a plug 42. Three or more radial ribs 43, are formed on the dome-like bottom of the cylinder, the purpose of which will later appear. A collar 44, is secured to the shaft 24, by a set screw 45, and this collar bears against the under side of the spider hub 12, and prevents upward movement of the shaft under rotation. A belt wheel 46, is secured to the shaft and is adapted to be driven from a power source, not shown. A bowl 47, having a bottom flange 48, is secured upon the top of the concentrating cylinder 37, by bolts 49, which pass through the said flange 48, and through the flange 39, of the concentrating cylinder. This bowl has a circular opening 50, in its bottom which forms communication between the bowl and the concentrating cylinder, and the inner face of the bowl is formed with a series of spaced annular grooves 51, similar to the grooves 40 of the concentrating cylinder, and the top edge of the bowl terminates in a flange 52, the lower side of which is under cut, as shown, which arrangement will prevent liquid passing over the edge of the bowl, from flowing down over the outer surface of the bowl, as will be understood.

The threaded upper portion of a supply pipe 53, passes loosely through the hub 15 of the upper spider C, and is adjustably suspended from the hub by nuts 54 and 55, which are screwed upon the pipe and against the upper and lower sides, respectively, of the said hub, washers 56, being interposed between the nuts and the hub, as shown. This pipe projects a short distance above the hub, and extends down to within a short distance of the bottom of the concentrating cylinder. A continuation 57, of the supply

pipe is secured to the upper end of the same by a coupler 58, and this pipe section 57, is provided with a valve 59, for regulating the supply to the concentrating cylinder, and its upper end has a hopper 60, secured thereon.

Upon that part of the feed pipe 53, lying within the concentrating cylinder is secured a hollow frusto-conical member 61, which will hereinafter be termed a spacer, and which is closed at its upper end by a screw cap 62. The feed pipe 53, passes through the center of the cap 62, and through the bottom of the said spacer. An abutment collar 63, is secured upon the feed pipe immediately above the cap 62, a rubber gasket 64, being interposed between the cap and collar, and a clamp nut 65, is screwed upon the lower end of the feed pipe 53, a rubber gasket 66, and a washer 67, being interposed between the clamp nut and the bottom of the hollow spacer 61, and when the nut is tightened, the spacer is clamped between the nut and the abutment collar 63, and is thus securely held upon the feed pipe, concentric with the axis thereof. The spacer 61, is preferably copper, and its function is to define an annular channel or passage between itself and the inner face of the concentrating cylinder. The spacer is formed with four equi-distant vertically disposed vanes or ribs 61^A. The feed pipe may be adjusted vertically, with respect to the spider hub 15, by proper manipulation of the nuts 54 and 55, thereby to raise or lower the spacer. Resting upon the abutment collar 63, is a metal disk 68, which is held there against by a sleeve 69, which is slipped over the feed pipe, its lower end resting upon the said disk, the sleeve being secured to the pipe by a set screw 70.

In the lowest position of the spacer 61, the disk 68, closes the opening 50, in the bottom of bowl 47, as shown in Figure 1, but the disk may be raised to a greater or less height, by raising the feed pipe, in the manner before described, and locking it in the required position by the nuts 54 and 55. The disk controls the outflow from the concentrating cylinder to the bowl 47, and in this way the outflow may be retarded sufficiently to assure that the material or pulp passing through the cylinder, will be subjected to a thorough concentrating and amalgamating action. A lug 71, is secured to the sleeve 69, near the lower end thereof, and a rod 72, which constitutes a baffle, is secured at one end in a hole in the said lug by a set screw 73. The baffle is curved to correspond to the outline of the bowl, and extends substantially to the top of the said bowl. The baffle may be adjusted with respect to the face of the bowl, and its function is to cause an undercurrent in the liquid material or tailings as it passes out of the bowl under centrifugal action, whereby the same is pre-

vented from packing in the grooves 51, but any mercury which may pass from the concentrating cylinder to the bowl, will be caught and retained by the said grooves 51. The tailings overflow from the bowl 47, is caught by a launder 74, in the form of an outer circular sheet metal housing which surrounds the cylinder 37 and bowl 47, and rests on the end lugs 13^A of the spider arms 13. This housing has an inclined bottom 75, in the form of a flat ring which surrounds the cylinder 37, and an inner circular housing or wall 76, of the same diameter as the opening in the bottom, surrounds the cylinder, 37, and is secured at its lower edge to the said bottom, and the inner and outer housings, together with the bottom, constitute the launder which receives the tailings overflow from the bowl 47. The launder is provided with an outlet pipe 77, which is positioned at the lowest point of the bottom. A cap or cover 78, fits in the upper end of the launder and confines the splash from the tailings as they flow over the edge of the bowl, and the cap is provided with a circular opening 79, which permits access to the bowl. An opening 7^A, is formed in the housing 74, at a point diametrically opposite the outlet pipe 77, and is provided with a door 7^B. The opening permits access to the lower end of the concentrating cylinder, which is bolted to the block 33, on the upper end of the shaft 24. A brass tube 80, extends down through the opening 79, and through a hole in the disk 68, and is seated at its lower end in a recess in the cap 62, of the spacer 61. A fibre tube 81, is inserted in the brass tube, and a copper wire or rod 82, extends through the fibre tube and fits tightly in a hole in the spacer cap. The other end of the wire 82, is adapted to connect with one terminal of an electric generator or other electric current source, not shown.

A hole is drilled axially through the shaft 24, and is fitted with a fibre tube 83, and a copper rod 84, extends through this tube, its upper end fitting tightly in a hole in the bottom of the concentrating cylinder. The lower end of this rod is preferably spread or enlarged as shown at 85, to present a relatively large bearing surface, and this spread end 85, rests upon a flat enlargement 86, on the end of a copper rod 87, which extends through a fibre tube 88, which is supported in a hole in one side of the base plate 1. The outer end of the rod 87, is adapted to connect with the other terminal of the aforesaid current source. Thus an electric current, from the current source, passes through the wire 82 to the copper spacer and thence through the pulp to the concentrating cylinder, and thence through the rod 84, to the rod 87, and thence to the power source. The electric current passing through the cylinder, causes the mercury in the grooves 40, to

more readily receive and hold the gold contained in the pulp, as the pulp is brought into contact with the mercury under the centrifugal action imparted by the said cylinder.

In operation a sufficient quantity of mercury is supplied to the cylinder through the supply pipe, to fill the grooves in the said cylinder flush with its surface; the cylinder is then given a rotary motion of three hundred or more revolutions per minute, whereby the mercury under centrifugal action fills all of the grooves, each ring of mercury constituting an amalgamating surface. Pulp from screened placer ground or from ore treating mills, is then supplied to the hopper 60, and passes down through the supply pipe to the bottom of the cylinder 37, the supply being regulated by the hand valve 59, and this pulp is thrown outward under centrifugal action against the surface of the cylinder. The gold which is the heaviest substance in the pulp, will hug the surface of the cylinder, and as the pulp rises in the space between the cylinder and the spacer 61, the gold will come in contact with the mercury in the grooves and will be caught thereby, and the other substances in the pulp will automatically arrange themselves in the order of their specific gravities, and thus the material is given both a concentrating and an amalgamating treatment, as it passes over the surface of the cylinder. The ribs 43, on the bottom of the cylinder, assist the centrifugal action imparted to the pulp, and this action is further augmented by the violent contact of the pulp with the vanes or ribs 61^A, on the face of the stationary spacer, whereby the said pulp is thrown out against the face of the cylinder. The tailings product passes into the bowl 47, through the opening 50, in the bottom thereof and the discharge through this opening is regulated by the disk 68, so that the discharge from the cylinder will be in proportion to the inflow to the cylinder, but the disk will retard the discharge sufficiently to subject the material to a thorough concentrating and amalgamating action. Thus, all of the gold will be caught and held by the cylinder 37, as well as any silver that may be in the material in metallic condition, but the gangue or tailings passes into the bowl 47, and over the rim of the bowl to the launder whence it passes off through the outlet pipe 77. The gangue is prevented from packing in the grooves 57, of the bowl by the baffle 72 which causes an undercurrent in the pulp, but any mercury escaping from the cylinder 37, will be caught and retained in the grooves of the bowl.

A lubricating cup 89, is screwed into the end of a passage 90, in the spider hub 12, leading to the ball bearing 29, and a sim-

ilar lubricating cup 91, is screwed into the end of a passage 92, in the spider hub 9, leading to the ball bearings 20 and 23.

After a run has been made, and the cylinder and bowl come to a standstill, the mercury in the cylinder grooves, and any mercury that may have entered the grooves in the bowl, will run down to the bottom of the cylinder, and may be drawn off through the outlet 41, by removing the plug 42. The gold is then separated from the mercury in the usual manner, as by straining the mercury through chamois skin, and the mercury is reserved for further use.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In an amalgamating and concentrating apparatus of the character described, the combination with a vertically disposed shaft and means for rotating the same; of a hollow tapered cylinder secured upon the top of said shaft the inner face of which is provided with spaced annular mercury-receiving grooves and terminates in a dome-like bottom, a bowl secured upon said cylinder having an opening in the bottom communicating with said cylinder, a stationary feed pipe extending through said opening and terminating near the bottom of said cylinder, a tapered element on said feed pipe for defining an annular space in said cylinder next the wall thereof, a disk on said feed pipe in relation to the opening in said bowl for controlling the outflow from the cylinder, said bowl having a plurality of annular grooves in its inner face.

2. In an amalgamating and concentrating apparatus of the character described, the combination with an amalgamating and concentrating cylinder and means for rotating the same; of a discharging bowl on the top of said cylinder, having an opening in the bottom thereof communicating with the cylinder, a stationary adjustable feed pipe extending down through said opening and terminating near the bottom of the cylinder, a disk on said pipe, in relation to said opening for controlling the outflow from the cylinder, a baffle in said bowl in the form of a rod adjustably secured at one end to said pipe, and curved to correspond to the curvature of the bowl, said curved portion being spaced from the surface of the bowl, said bowl having a plurality of spaced annular grooves in its inner face.

3. In an apparatus of the character described, the combination of a hollow concentrating cylinder having a plurality of spaced annular grooves on its inner face, a bowl on the top of said cylinder, the inner face of which is formed with a plurality of spaced annular grooves, an opening being formed in the bottom thereof which communicates with the cylinder, an adjustable

stationary feed pipe extending through said opening and terminating adjacent the bottom of said cylinder and a disk on said pipe in relation to the opening, for regulating the outflow from said cylinder, and means for rotating said cylinder.

4. In an apparatus of the character described, the combination with a power driven shaft, a hollow amalgamating and concentrating cylinder on the upper end of said shaft and insulated therefrom, a stationary feed pipe extending into said cylinder and a cylindrical element on said feed pipe for defining an annular space in said cylinder next the inner face thereof; of an electric current conductor connected at one end to said cylindrical element, an electric current conductor extending axially through said shaft and insulated therefrom, the upper end of said conductor being in electrical contact with said cylinder, a stationary conductor against which the lower end of said conductor rests, whereby an electric current passes from one of said conductors to said cylindrical element and thence to the concentrating cylinder through the liquid material therein and thence to the conductor in said shaft, said concentrating and amalgamating cylinder being formed with a plurality of spaced annular mercury receiving grooves.

5. In apparatus of the character described, the combination with an amalgamating and concentrating cylinder and means for rotating the same, of a discharging bowl on the top of said cylinder having an opening in the bottom thereof, communicating with the cylinder, a stationary vertically adjustable feed pipe extending down through said opening and terminating near the bottom of the cylinder, a tapered element on said feed pipe for defining an annular space in said cylinder next the wall thereof, said tapered element having verti-

cally disposed baffles thereon, a disk on said feed pipe in relation to the opening in said bowl, for controlling the outflow from the cylinder, said bowl having a plurality of annular grooves in its inner face.

6. In apparatus of the character described, the combination with a tapered amalgamating and concentrating cylinder, and means for rotating the same, and a discharging bowl on the top of said cylinder having an opening in its bottom communicating with the cylinder; of a vertically adjustable stationary feed pipe, which extends down through said opening and terminates near the bottom of said cylinder, a tapered element on said feed pipe for defining an annular space in said cylinder next the wall thereof; a collar on said feed pipe, a disk supported on said collar in relation to the opening in the bowl, for controlling the outflow from the cylinder, and means for clamping the disk upon the collar.

7. In apparatus of the character described, the combination with a hollow tapered cylinder having spaced annular grooves in its inner face, and a bowl on the top of said cylinder having an opening in the bottom thereof of less diameter than the cylinder, and spaced annular grooves in its inner face; of a vertically adjustable stationary feed pipe which extends down through said opening and terminates near the bottom of the cylinder, a tapered element on said pipe for defining an annular space in the cylinder next the wall thereof, a disk on said pipe in relation to said opening, for controlling the outflow from the cylinder, a baffle on said pipe within said bowl, and means for rotating said cylinder.

In testimony whereof, I affix my signature.

FRANK D. LEWIS.