

Oct. 8, 1940.

F. D. LEWIS

2,217,062

CENTRIFUGAL AMALGAMATOR

Filed Nov. 6, 1939

3 Sheets-Sheet 1

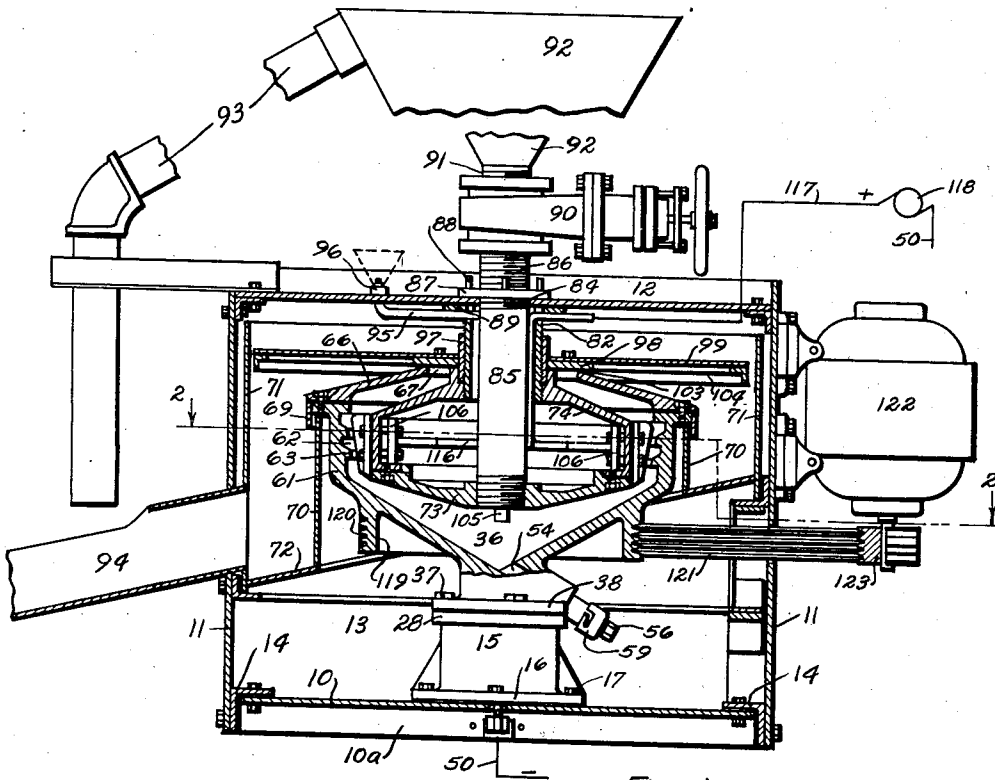


Fig. 1

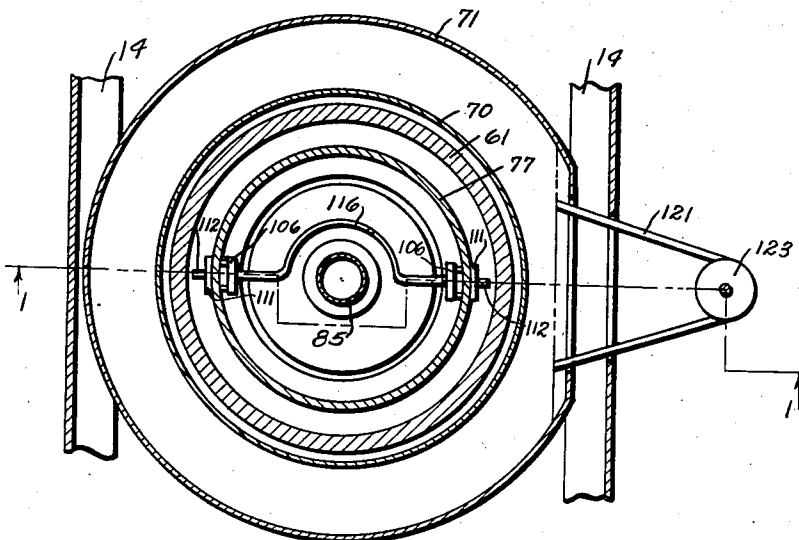


Fig. 2

Inventor:
Frank D. Lewis
By *Martin & Anderson*
Attorney

Oct. 8, 1940.

F. D. LEWIS

2,217,062

CENTRIFUGAL AMALGAMATOR

Filed Nov. 6, 1939

3 Sheets-Sheet 2

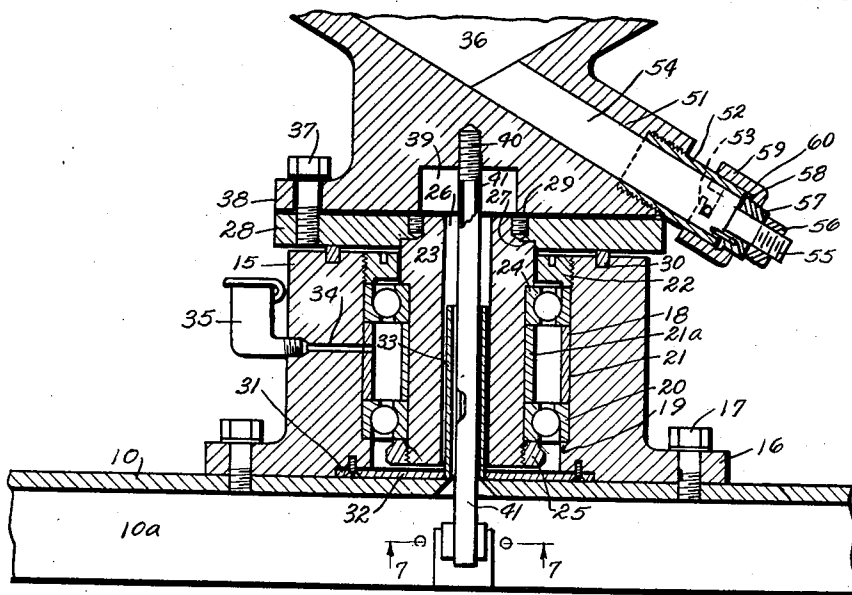


Fig. 3

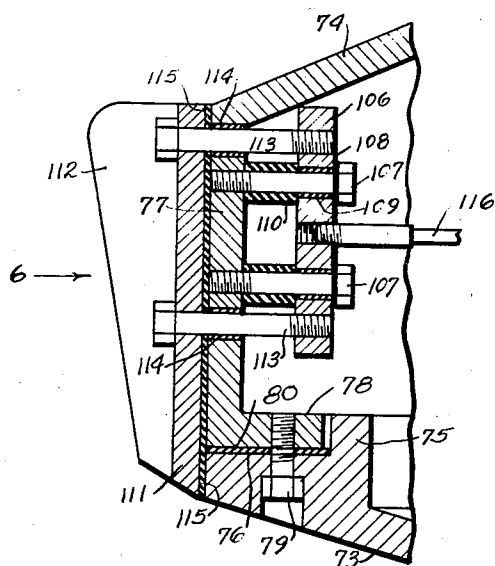


Fig. 5

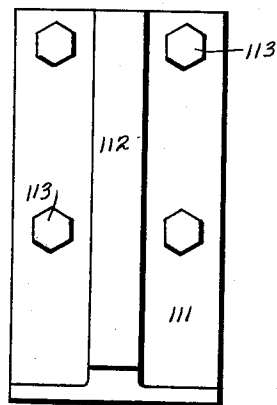


Fig. 6

Inventor:
Frank D. Lewis
By *Martin E. Anderson*
Attorney

Oct. 8, 1940.

F. D. LEWIS
CENTRIFUGAL AMALGAMATOR

2,217,062

Filed Nov. 6, 1939

3 Sheets-Sheet 3

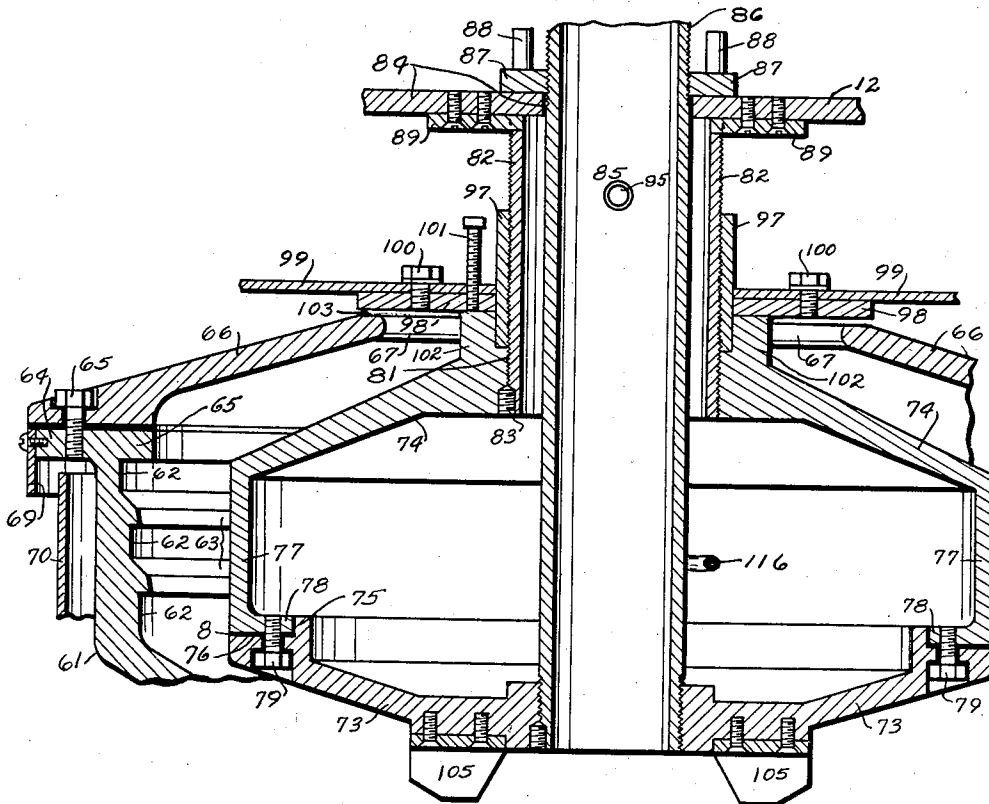


FIG. 4

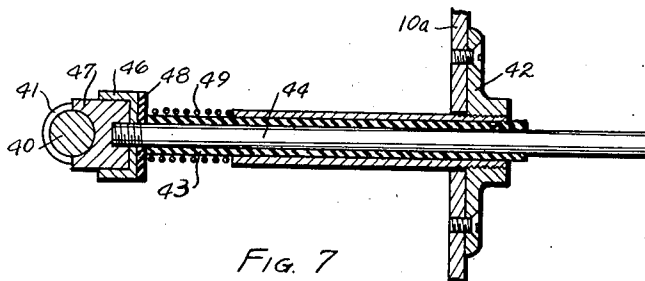


FIG. 7

Inventor:
Frank D. Lewis
By *Martin O. Anderson*
Attorney

UNITED STATES PATENT OFFICE

2,217,062

CENTRIFUGAL AMALGAMATOR

Frank D. Lewis, Denver, Colo.

Application November 6, 1939, Serial No. 303,067

13 Claims. (Cl. 209—199)

This invention relates to improvements in centrifugal amalgamators of the type disclosed in United States Patent No. 1,983,701, granted on December 11, 1934.

5 In the separation of gold from gangue, most mechanical methods depend on the action of gravity to effect the desired results. The specific gravity of gold being so much greater than that of the gangue particles causes it to sink and to come to the bottom where it is trapped in riffles or comes into contact with mercury and forms an amalgam with the latter.

10 It has long been recognized that if the differential between the forces acting on the gold and the gangue could be increased, it would greatly facilitate the separation. Since the action of gravity can not be changed, it was proposed to subject the material, mixed with water and sometimes with some chemical, to the action of centrifugal force whose intensity varies with the mass or the specific gravities and by this means the gold particles are acted upon by powerful forces that tend to move them away from the center of rotation.

15 It has also been proposed to send a direct current of electricity through the material in the direction of the centrifugal force for it has been found that a direct current passing through a solution containing gold particles in suspension exerts a translating action which causes the gold to move with the current. When the cathode is composed of mercury, the electric current appears to expedite the amalgamation.

20 The use of the direct electric current in a centrifugal amalgamator has been disclosed in the patent above identified and is therefore not broadly new.

25 The present invention relates to improvements in the construction of prior apparatus for the same general purpose in order to effect a more satisfactory operation, an increased capacity and to adapt the apparatus to the handling of coarser material such as placer gravel.

30 It has heretofore been the practice to make the rotating bowl of comparatively small diameter and of considerable length, which makes the machine high and difficult to balance. Since the value of the centrifugal forces varies with the square of the velocity, it is evident that if two bodies are rotated at the same angular velocity, but at radii equal respectively to R and $2R$, the linear velocity of the body rotating at the end of the $2R$ radius will be twice that of the other and the centrifugal force exerted per unit mass will be four times as great.

In the present apparatus therefore, the diameter of the rotating bowl has been increased and this makes it possible to decrease the speed of rotation, which in turn simplifies the problem of balancing the bowl.

5 The present machine is provided with means for agitating the pulp so as to maintain the solid particles in suspension and with means for adjusting the rate at which material flows through the same.

10 Having thus pointed out in a general way the important structural features of the machine, the construction of the latter will now be described in detail and for this purpose reference will now be had to the accompanying drawings in which the machine has been illustrated, and in which:

Figure 1 is a transverse sectional view taken on the diametrical vertical plane indicated by line 1—1, in Figure 2;

Figure 2 is a section taken on horizontal plane 2—2, Figure 1;

Figure 3 is a section through the bowl bearing taken on a diametrical plane corresponding to plane 1—1, Figure 2;

Figure 4 is a fragmentary section to a somewhat enlarged scale showing the means for adjusting the rate at which the material flows through the machine;

Figure 5 is a fragmentary section similar to Figure 1 and shows the construction to an enlarged scale;

Figure 6 is a side elevation looking in the direction of arrow 6, in Figure 5; and

Figure 7 is a section taken on line 7—7, Figure 3, and shows the electrical connection with a rotary conductor projecting downwardly from the bowl.

35 The machine is enclosed in a housing having a bottom 10, sides 11, a top 12 and ends 13. The construction of the housing has not been shown in detail because it can be constructed in any suitable manner. The sides, ends, top and bottom are connected by angle irons 14 of which several have been shown. The part indicated by numeral 10 is the web of a wide channel beam whose flanges have been designated by reference character 10a.

40 Supported on the bottom 10, is a casting 15, which is provided around its lower end with a flange 16 that is provided with a number of holes for the reception of bolts 17 that secured the casting to the web or bottom 10. Casting 15 forms a bearing block and is provided with a central bore 18 having an annular shoulder 19 at its lower end. A ball bearing race 20 rests on

the shoulder and supported on this is a tubular sleeve 21 whose upper end serves as a support for the outer ball race of another ball bearing. A ring 22 has a threaded engagement with the upper end of the surface of the tubular opening and serves to clamp the ball bearing races in position. A stub shaft 23 is positioned in the inner ball bearing races which are clamped in position between the shoulder 24 and the nut 25 and held in spaced relation by sleeve 21a. Shaft 23 has an axial opening 26 and has its upper end of somewhat reduced diameter so as to form a shoulder 27. A circular plate 28 has a central opening for the reception of the reduced portions of shaft 23 and rests on the shoulder 27. Short screws 29 secure plate to the shaft. The upper end of the casting or bearing block 15 has an annular recess or groove in which is positioned a felt ring 30 whose function it is to keep dust and grit from entering the bearing.

It will be observed that the lower end of bearing block 15 has an annular rabbet 31 in which is positioned the peripheral edge of the round plate 32, which is secured to the bearing block by screws as shown. Plate 32 has a central opening in which is positioned the lower end of tube 33 whose upper end terminates at the level of the upper ball bearing. A hole 34 extends radially through the wall of block 15 and secured in the outer end of this hole is an oil cup 35. When oil is introduced through the cup, it will stand at the level of the top of pipe 33, which serves as an overflow. The lubricating system above described assures an ample and constant lubrication. A centrifugal amalgamating bowl 36 is supported on plate 28 to which it is securely attached by means of bolts 37 for the reception of which flange 38 is provided with holes. It will be observed from Figure 3 that the bowl is insulated from plate 28 by insulating sheets, bushings and washers which have been indicated by heavy black lines.

The under surface of the base of bowl 36 has a central cylindrical recess 39 whose bottom has a central threaded opening into which the upper end of bar 40 is threaded. Bar 40 is provided with a fiber sleeve 41 which has been shown broken away. Bar 40 projects below the under surface of the web 10 of the channel and serves as an electrical conductor.

Referring now to Figure 7 it will be seen that the flange 10a has a hole and has secured to its outer surface a pipe flange 42. A short pipe 43 has its outer end threaded into the opening in flange 42 and projects inwardly for some distance. The axis of pipe 43 is so positioned that it intersects the axis of bar 40. A copper bar 44 has an insulating sleeve 45 whose outer diameter is such as to make a sliding fit with the interior of the pipe 43. Attached to the inner end of bar 44 is a U-shaped brush holder 46 in which is secured the carbon brush 47. An insulating washer 48 surrounds the bar between the brush holder and the inner end of tube 45 and a helical spring 49 is positioned between the inner end of pipe 43 and washer 48 and serves to urge the carbon brush against the lower end of bar 40 so that electrical connection can be maintained while the bowl 36 rotates. A conductor 50 connects bar 44 with the negative of a direct current generator.

It will be observed from Figure 3 that the inner surface of the bowl is conical with its apex on the axis of rotation. For the purpose of draining the bowl an opening 51 has been provided

whose axis is preferably parallel with the surface of the bowl. Opening 51 must be closed during operation and for this purpose the following means has been provided. The outer end of the wall of opening 51 is provided with a short threaded section with which a short pipe 52 is connected. The inside diameter of pipe 52 is preferably the same as that of opening 51 and projecting from the outer surface of this pipe is a pin 53 that forms part of a bayonet lock. A shaft 54 extends through the opening 51 and has its outer end of reduced diameter as indicated by numeral 55. The outer end of the reduced portion is threaded for the reception of a nut 56. Positioned between the nut and the shoulder at the inner end of the reduced end portion is a tubular sleeve 57 whose inner end has an outwardly extending flange 58 which is engaged by a cooperating inwardly extending flange on the rotatable sleeve 59. A dowel pin interconnects sleeve 57 with a shaft 54 and inhibits relative rotation. A gasket 60 is positioned between the inner end of sleeve 57 and the outer end of pipe 52. The skirt of sleeve 59 has a bayonet slot for the reception of pin 53. When the parts are in position as shown in Figure 3, opening 51 is sealed against the loss of mercury and liquid. Shaft 54 prevents the hole from filling up and clogging. The conical side wall of the bowl terminates in an upwardly extending portion 61 whose inner surface has several grooves 62 that are separated by inwardly extending flanges 63. The upper edge of the side wall 61 terminates in an outwardly extending flange 64 and an inwardly extending flange 65 (see Figure 4). A cover 66 is attached to flange 64 by means of bolts 65, cover 66 is frusto-conical and has a central opening 67. A rubber gasket 68 separates the cover from the top of the bowl and bolts 65 are electrically insulated from the bowl by means of the usual insulating bushings and washers. A skirt 69 is secured to the outer periphery of flange 64 and projects downwardly therefrom so as to overlap the upper edge of the launder wall 70. The outer wall and the inclined bottom of the launder have been designated respectively by numerals 71 and 72.

Supported by and attached to the top 12 which is the upper surface of the web of a wide channel corresponding in size and position to the channel designated by 10 and 10a, is a hollow stator whose bottom member has been designated by numeral 73 and whose top has been designated by numeral 74.

Referring now more particularly to Figure 5, it will be seen that member 73 has its upper surface provided with an upwardly extending circular flange 75 to the outside of which is an annular flat surface 76. The top 74 has a downwardly projecting cylindrical wall 77 that terminates in an inwardly extending flange 78. Bolts 79 extend through openings in the outer peripheral edge of bottom 73 and are threadedly connected with flange 78. The flat surface 76 and the outer surface of flange 78 are separated by a rubber gasket 80 whose function is to form a seal. The top 74 has a central opening 81 whose wall is threaded. A pipe 82 has its lower end in threaded engagement with the threads on the wall of opening 81. Screws 83 serve to prevent relative rotation between top 74 and pipe 82. The web 12 has an opening 84 through which pipe 85 extends. The lower end of pipe 85 is threaded in an opening in bottom 73 as clearly shown in Figures 1 and 4. The up-

per end of pipe 85 has a threaded section 86 that extends above the top web 12 and a nut 87 engages this threaded section. Nut 87 has its upper surface provided with radially spaced pins 88 that may be engaged by a suitable bar for turning the nut. A ring 89 is attached to the under side of web 12 and has a circular opening in concentric relation to pipe 85 and the diameter of this opening is the same as the outside diameter of pipe 82 and serves to center this with respect to pipe 85. It is now evident that when the parts described are assembled as shown in Figure 1, the upper end of pipe 82 will be forced against the under surface of web 12 when pipe 85 is put under tension. Interlocking means between pipe 82 and ring 89 prevents these parts from rotating relative to each other.

A gate valve 90 is attached to the upper end of pipe 85 and this is also connected with the lower tubular end 91 of feed hopper 92. An overflow pipe 93 is attached to the hopper adjacent the top thereof and extends to the discharge launder 94.

A pipe 95 passes through a hole in pipe 82 and into a hole in the wall of pipe 85 and its outer end projects through a hole in web 12. The upper end of the pipe has a removable plug which may be removed and replaced by a funnel which has been shown dotted. Pipe 95 serves to admit mercury to the interior of pipe 85 whenever mercury must be supplied or added to bowl 36. Pipe 95 also serves to prevent pipes 82 and 85 from rotating relative to each other and relative to the web 12.

Threaded to pipe 82 is a sleeve 97 to which is attached by welding or some other suitable means, a ring 98 whose outer diameter is larger than opening 97. A circular plate 99 is attached to ring 98 by screws 100. Set screws 101 extend through the plate 99 and the ring 98 in position to engage the upper surface of the annular flange 102. It will be observed that there is a small opening 103 between the under surface of ring 98 and the upper edge of top 66 which serves as the outlet for pulp from the amalgamating bowl. The size of opening 103 can be increased or decreased by loosening the set screws 101 and rotating sleeve 97 on page 82. After the adjustment has been made the parts are clamped in adjusted position by screws 101. A splash skirt or flange 104 is secured to the under side of plate 99 near its periphery and adjacent the outer launder wall 71.

During the operation of the machine bowl 36 rotates at a high speed while the stator 73, 74 remains stationary. The material is fed into the rotating bowl through pipe 85 and will soon begin to rotate with the bowl. It has been found that unless means is provided to prevent it, the solid material contained in the pulp under treatment will settle to the bottom of the rotating bowl and form a cake which greatly interferes with the efficient operation of the machine and which also interferes with cleaning the bowl. It has been found that by the simple expedient of providing the under surface of the stator part 73 with two diametrically positioned lugs 105, the material in the bottom bowl 36 will be maintained in an agitated or turbulent condition, which serves to retain the solids in suspension and as a result of this there is no sedimentation. The lugs 105 may be cast integral with member 73 or attached thereto by bolts or screws.

When the machine is in operation, a quantity of pulp is maintained in the feed hopper 92 and

the hydrostatic head thus produced will produce a flow of liquid downwardly through pipe 85 into bowl 36, thence upwardly between the inner surface of the bowl and the outer surface of the stator, thence inwardly along the under surface of cover 66 through opening 67, through opening 103 and into the launder. The rate of flow can be controlled in two ways, (a) the gate valve 90 can be manipulated, or (b) the plate 98 can be adjusted vertically so as to vary the cross sectional area of opening 103. A sufficient quantity of mercury is maintained in bowl 36 to fill the grooves 62, but not enough to pass over the inner surface of flange 65.

It has already been explained that a direct current of electricity is passed through the pulp while it is flowed through bowl 36 and the means for this purpose will now be described.

Referring now more particularly to Figure 5, it will be seen that a copper plate 106 is attached to the inside of the cylindrical wall 77 by means of bolts 107, which are insulated from this plate by means of a fiber sheet 108 and bushings 109. Insulating spacers 110 separate plate 106 from the wall 77. A plate 111, provided with a vertical lug 112, is attached to the stator by means of bolts 113 that pass through sleeves 114 of insulating material positioned in openings in wall 77. A sheet 115 of insulating material separates plate 111 from the wall 77 and bolts 113 have threaded connection with plate 106. When bolts 113 are put under tension, the insulating sleeves or spacers 110 are put under compression. It will be evident that plates 106 and 111 are electrically connected and both are insulated from the stator member 77. There are preferably two plates 111 positioned at diametrically opposed points so that they will not interfere with the dynamic balance of bowl 36.

Plates 106 are connected by means of a well insulated conductor 116 and this is connected by another conductor 117 to the positive brush of a direct current generator 118. The negative brush of the generator is connected with the bar 44, shown in Figure 7 by means of a conductor 50. It is understood, of course, that the direct current may be obtained from a rectifier or any suitable direct current source, but if a direct current supply is not available, it may be obtained from an alternating current supply by means of a motor driven D. C. generator or a mercury rectifier.

It will be observed that the bottom of bowl 36 is provided with a downwardly extending cylindrical flange 119 whose outer surface has grooves 120 for the reception of V-shaped belts 121. The bowl is driven from a motor 122 whose drive shaft is provided with a grooved pulley 123.

Operation

Let us now consider that the machine above described is operating and that the bowl is turning at the proper speed. Either before the machine starts or afterwards, a quantity of mercury is introduced into the bowl through pipe 95 and this is moved upwardly as a result of the centrifugal forces developed by the rotation. The amount of mercury introduced is sufficient to fill the mercury grooves, but should leave the inner edges of the ribs 63 exposed or only slightly covered. The pulp to be treated, which may be ground ore or placer sand and/or gravel which has been properly screened, is introduced into the hopper 92 and when valve 90 is opened this pulp will flow downwardly through pipe 85 into

the bottom of the rotating bowl. The rotation of the bowl tends to produce a rotation of the pulp and the latter will then move upwardly along the bottom and over the rib 63, thence inwardly under the cover and out through the space between the upper edge of top 66 and plate 58. It will be noted that since the hopper 92 is positioned at some distance above the bowl, there is hydrostatic head to cause the pulp to flow in the absence of centrifugal force, and the latter is therefore not depended on to produce the movement of the pulp through the bowl. The hydrostatic head makes it possible for the pulp to flow inwardly underneath the top 66 until it reaches the opening 67. The rate at which the pulp flows can be controlled either by the valve 90 or by the position of the plate 98. As above described, plate 98 can be moved up or down so as to increase or decrease the opening between its lower surface and the top of member 66. When the position of plate 98 is depended on entirely to regulate the flow, the gate valve may be run in full open position. The lugs 105 are stationary and project into the pulp so as to produce a turbulence that prevents sedimentation taking place at the bottom of the bowl, thereby assuring that all of the solids will pass through the bowl and out into the launder. The flanges 112 also produce a turbulence or disturbance of the pulp which inhibits stratification along the mercury grooves.

Since gold is very heavy compared to gangue, the action of the centrifugal forces will cause these to move outwardly and to come in contact with the mercury surface, whereupon it amalgamates with the latter. Rusty gold and gold that may have film of oil will be partly cleaned by the friction produced between it and the gangue particles by their way through the bowl and such gold particles will be amalgamated along with the cleaner gold. During operation a direct current is passed through the pulp from the flanges 112 to the mercury in the bowl and this unidirectional current has a tendency to produce a translation of the gold particles outwardly, thereby expediting and facilitating the separation.

Attention is called to the fact that in this particular apparatus, the theory of electroplating is not depended on to effect a transfer of the gold, but rather the property of a current of causing a movement of the physical particles in the direction in which the current travels.

After the machine has been run for some time, it can be stopped and drained through opening 51. The mercury amalgam will naturally settle to the bottom as soon as the machine ceased to operate and this is naturally drained and the mercury subjected to proper treatment for removing the gold or other amalgamated metals from it. In the actual machine, the bottom of the bowl is provided with a counterbalancing weight to compensate for the projection containing the opening 51, but even where this is not done, there is no appreciable vibrations set up due to this unbalanced condition, because the unbalanced portions are so near the shaft 23, that their unbalancing effect is not appreciable.

It will be observed that the bowl in the present case is much lower than in other centrifugal amalgamating machines and is also of greater diameter which makes it possible to reduce the speed for obtaining a certain centrifugal force

and due to this lower speed, the vibrations that might otherwise be set up, due to slightly unbalanced conditions, will not be as effective for producing vibrations as they would be in a bowl operating at a higher speed.

Although the machine illustrated and described is believed to embody the preferred construction, it is to be understood that such changes may be made in the construction as may be found necessary, providing they are within the scope of the appended claims.

Having described the invention what is claimed as new is:

1. An amalgamating device of the centrifugal type having a vertically disposed shaft, a bowl attached to the upper end of the shaft and means for rotating the shaft and bowl, the bowl having its inner surface provided with mercury receiving grooves, an upwardly tapering cover attached to the upper edge of the bowl, the cover having a central opening, a frame on which the parts are supported, a circular stator concentrically positioned in the bowl, means comprising a tubular compression member and a tubular tension member for suspending the stator from the frame, a plate positioned above the opening in the cover of the bowl and extending beyond the edge of the opening, means for adjustably connecting the plate to the tubular compression member whereby its distance from the bowl cover can be adjusted to regulate the discharge therefrom, the said tubular tension member extending entirely through the stator whereby it serves as a conduit for introducing material into the bowl.

2. An amalgamating device of the centrifugal type having a vertically disposed shaft, a bowl attached to the upper end of the shaft and means for rotating the shaft and bowl, the bowl having its inner surface provided with mercury receiving grooves, an upwardly tapering cover attached to the upper edge of the bowl, the cover having a central opening, a frame on which the parts are supported, a circular stator concentrically positioned in the bowl, means comprising a tubular compression member and a tubular tension member for suspending the stator from the frame, a plate positioned above the opening in the cover and extending beyond the edge of the opening, means for adjustably connecting the plate to the tubular compression member whereby its distance from the bowl cover can be adjusted to regulate the discharge therefrom, and a splash plate attached to the adjustably positioned plate and extending beyond the edges thereof, a flange extending downwardly from the under surface thereof to form a stop for material discharged from the bowl, the tubular tension member extending entirely through the stator whereby it serves as means for introducing pulp into the bowl.

3. An amalgamator of the centrifugal type comprising in combination, a frame, a vertically disposed shaft rotatably mounted in the frame, an amalgamating bowl attached to the upper end of the shaft, a hollow stator positioned in the bowl, means for suspending the stator from an upper portion of the frame, said means comprising a tubular tension member extending entirely through the stator and through an opening in the frame, a tubular compression member surrounding the tension member, the tubular compression member having its lower end in engagement with the stator and its upper end in engagement with the frame member through which the tension member extends, the outer surface

of the tension member being threaded, and a nut on said threaded section for engaging the frame and putting it under tension whereby the stator will be moved upwardly and exert pressure on the compression member.

4. An amalgamator of the centrifugal type comprising in combination, a frame, a vertically disposed shaft rotatably mounted in the frame, an amalgamating bowl attached to the upper end of the shaft, a hollow stator positioned in the bowl, means for suspending the stator from an upper portion of the frame comprising a tubular tension member extending entirely through the stator and through an opening in the frame, a tubular compression member surrounding the tension member, the tubular compression member having its lower end in engagement with the stator and its upper end in engagement with the frame member through which the tension member extends, the outer surface of the tension member being threaded, a nut on said threaded section for engaging the frame and putting it under tension, whereby the stator will be moved upwardly and exert pressure on the compression member, and means for interlocking the tubular compression member and the frame to prevent the compression member and the stator from turning relative to the frame when the nut is rotated on the tension member.

5. An amalgamator of the centrifugal type comprising in combination, a frame, a vertically disposed shaft rotatably carried thereby, an amalgamating bowl attached to the upper end of the shaft, a hollow stator positioned in the bowl, means for suspending the stator from an upper portion of the frame comprising a tubular tension member extending entirely through the stator and through an opening in the frame, a tubular compression member surrounding the tension member, the tubular compression member having its lower end in engagement with the stator and its upper surface in engagement with the frame member through which the tension member extends, the outer surface of the tension member being threaded, a nut on said threaded section for engaging the frame and putting it under tension whereby the stator will be moved upwardly and exert pressure on the compression member, the walls of the tension and compression members having radially aligned openings, the frame member through which the tension member extends having an opening, and a pipe extending through the three openings, said pipe serving to prevent the tension and compression members from rotating relative to each other and relative to the frame, said pipe serving also to introduce mercury into the bowl.

6. An amalgamator of the centrifugal type comprising in combination, a frame, a vertically disposed shaft rotatably mounted in the frame, an amalgamating bowl attached to the upper end of the shaft, a hollow stator positioned in the bowl, means for suspending the stator from an upper portion of the frame comprising a tubular tension member extending entirely through the stator and through an opening in the frame, a tubular compression member surrounding the tension member, the tubular compression member having its lower end in engagement with the stator and its upper surface in engagement with the frame member through which the tension member extends, the upper outer surface of the tension member being threaded, a nut on said threaded section for engaging the frame and putting the member under tension whereby the sta-

tor will be moved upwardly and exert pressure on the compression member, an upwardly tapered cover removably attached to the upper end of the bowl, the cover having an opening which is smaller than the stator, a sleeve threaded to the outer surface of the compression member, a plate secured to the sleeve, the plate being larger than the opening in the cover and perpendicular to the axis of rotation of the bowl, said plate being adjustable towards and away from the cover by rotating the sleeve on the compression member, and means for clamping the plate in adjusted positions.

7. An apparatus as defined in claim 6 in which the stator is provided at its lower end with two diametrically positioned downwardly extending lugs for agitating pulp in the bowl.

8. An apparatus as defined in claim 6 in which the plate secured to the adjustable sleeve carries a circular plate of larger diameter whose under surface is provided with a downwardly extending peripheral flange which serves as a stop for material discharged from the bowl.

9. An amalgamator of the centrifugal type comprising, in combination, a frame having vertically spaced supporting members, a shaft carried by the lower frame member for rotation about a vertical axis, an amalgamating bowl attached to the upper end of the shaft and electrically insulated therefrom, the bowl having a circular upwardly flaring wall whose inner surface is provided with parallel circular mercury grooves, a removable upwardly tapered cover secured to the upper edge of the bowl, said cover having a central opening, the upper supporting member of the frame having an opening in axial alignment with shaft, a tubular tension member passing through the opening in the frame and terminating in the bowl a short distance above the bottom thereof, a hollow stator positioned in the bowl and attached to the lower end of the tubular tension member, a tubular compression member positioned between the top of the stator and the upper frame member, the upper end of the tubular tension member being threaded for the reception of a nut, two diametrically positioned lugs attached to the outside of the stator and electrically insulated therefrom, means for connecting the lugs to the positive pole of a source of direct current, means for electrically connecting the bowl to the negative pole of said current supply, mercury in the bowl, means for rotating the bowl, and means for feeding ore pulp through the tubular tension member.

10. A centrifugal amalgamator, having a bowl mounted for rotation about a vertical axis, said bowl having an upwardly tapered removable cover provided with a central opening, a hollow circular stator positioned in the bowl, means for supporting the stator comprising a tubular tension member extending through the opening in the cover and entirely through the stator, means for holding the stator against rotation, two electrical conducting plates positioned in the stator on diametrically opposite sides thereof, said plates being insulated from the stator, an outwardly projecting lug attached to the outer surface of the stator directly opposite each plate, said lugs being electrically insulated from the stator, means for electrically connecting each lug with a plate, means for connecting the plates with the positive pole of a source of direct current, means for connecting the bowl to the negative pole of said source, means for rotating the bowl, means for feeding

pulp to the bowl, and means for controlling the rate of flow of the pulp.

11. An apparatus as defined in claim 10 in which the means for controlling the rate of feed comprises a plate adjustably mounted above the opening in the bowl cover, and means for moving it towards and away from the bowl to vary the size of the outlet therefrom.

12. An apparatus as defined in claim 10 in which the means for controlling the rate of feed comprises a plate positioned above the opening in the bowl cover and is adjustable towards and away from the cover to vary the size of the outlet from the bowl, and in which a splash plate is carried by the adjustable plate, which projects beyond the latter and is provided with a downwardly extending flange to serve as a stop for materials discharged from the bowl.

13. An amalgamator of the centrifugal type, comprising, in combination, a frame having spaced upper and lower supporting members, a bearing block positioned on the upper surface of the lower bearing block, a shaft journaled in the bearing block for rotation about a vertical axis, an amalgamating bowl removably attached to the upper end of the shaft and electrically insulated therefrom, the shaft having an axial opening, an electric conductor extending through the opening in the shaft with its upper end in electrical

contact with the bowl, the side wall of the bowl being upwardly flaring and provided on its inner surface with a plurality of vertically spaced mercury grooves, an upwardly tapering cover removably secured to the bowl, the cover having an opening concentric with the axis of rotation, a circular stator positioned in the bowl, means for supporting the stator comprising a pipe which extends entirely through the stator and through a hole in the upper frame member, a cylindrical sleeve surrounding the pipe, the stator having its top provided with a threaded opening with which the lower end of the sleeve is operatively connected, the upper end of the sleeve engaging the under surface of the upper frame member, the upper end of the pipe having a threaded section, a nut on the threaded section for engagement with the upper surface of the frame, said nut serving to put the pipe under tension and the sleeve under compression, the outer surface of the sleeve being threaded, a cylindrical bushing in threaded engagement with the sleeve, a plate attached to the bushing, said plate being larger than the opening in the top of the bowl, and movable towards and away from the bowl to vary the distance therebetween, means for rotating the bowl, and means for feeding pulp into the bowl adjacent the center of its bottom.

FRANK D. LEWIS.