

May 29, 1923.

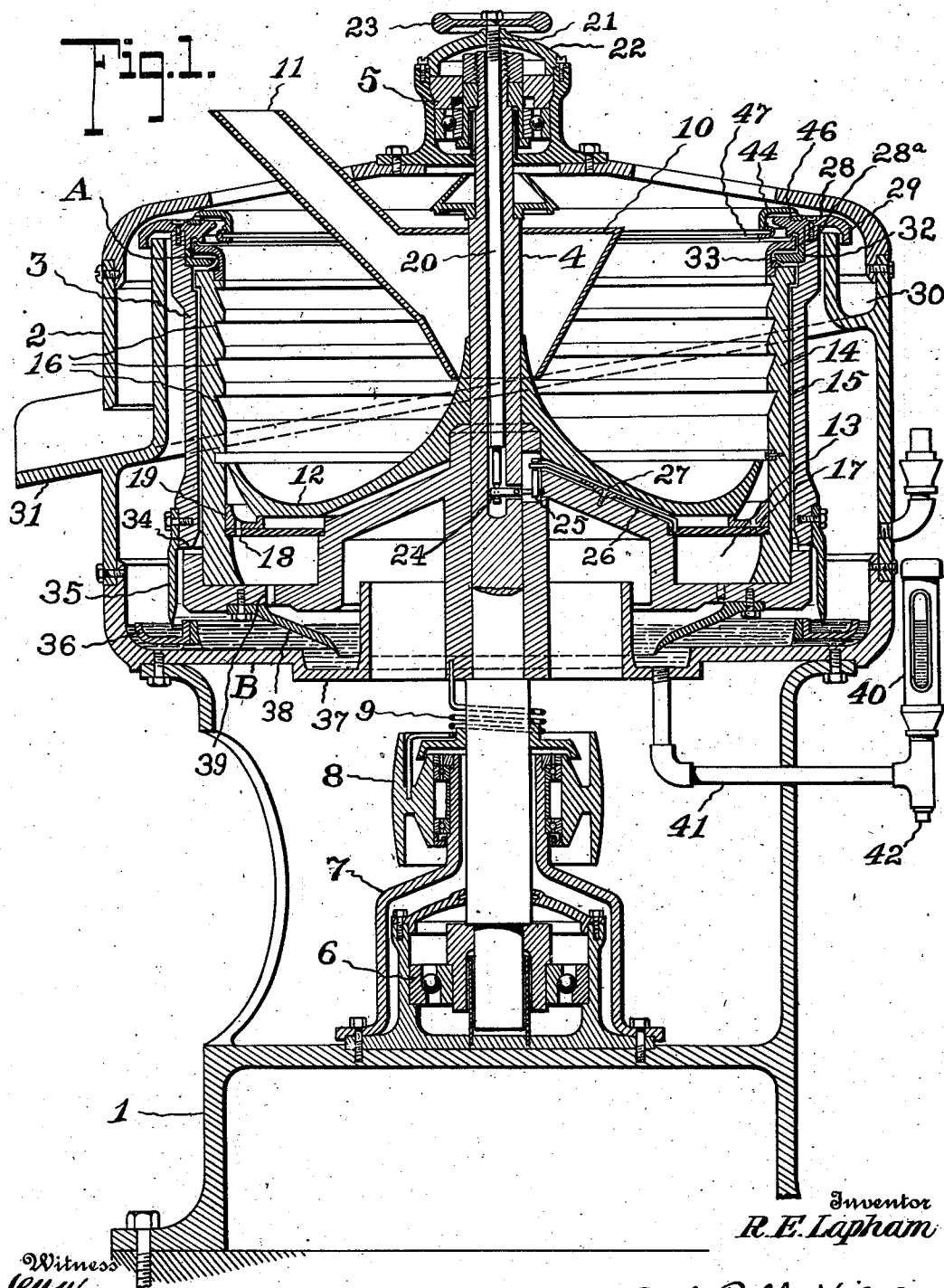
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CENTRIFUGAL SEPARATING MEANS

Filed Aug. 7, 1920

3 Sheets-Sheet 1



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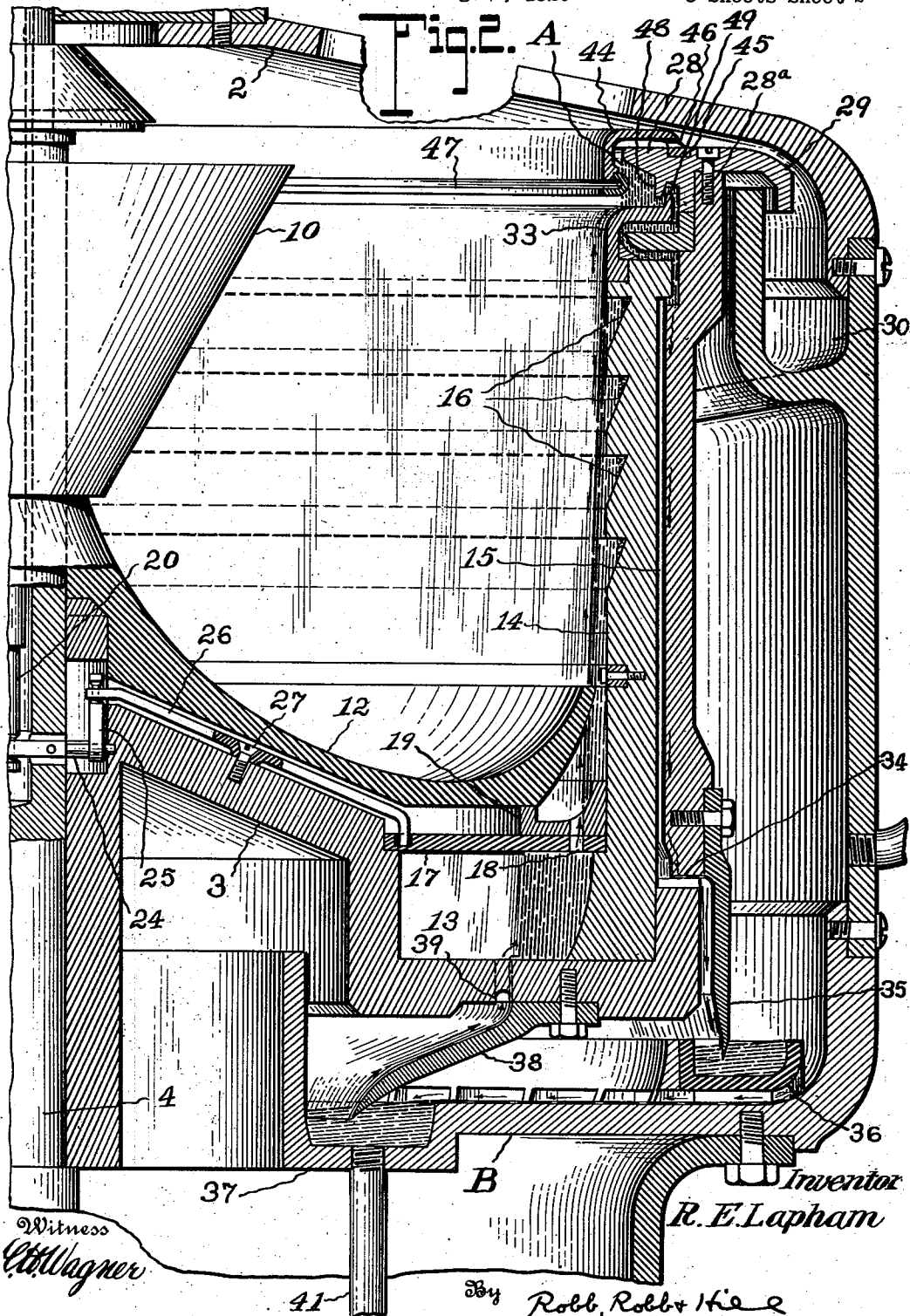
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Fig. 2. A



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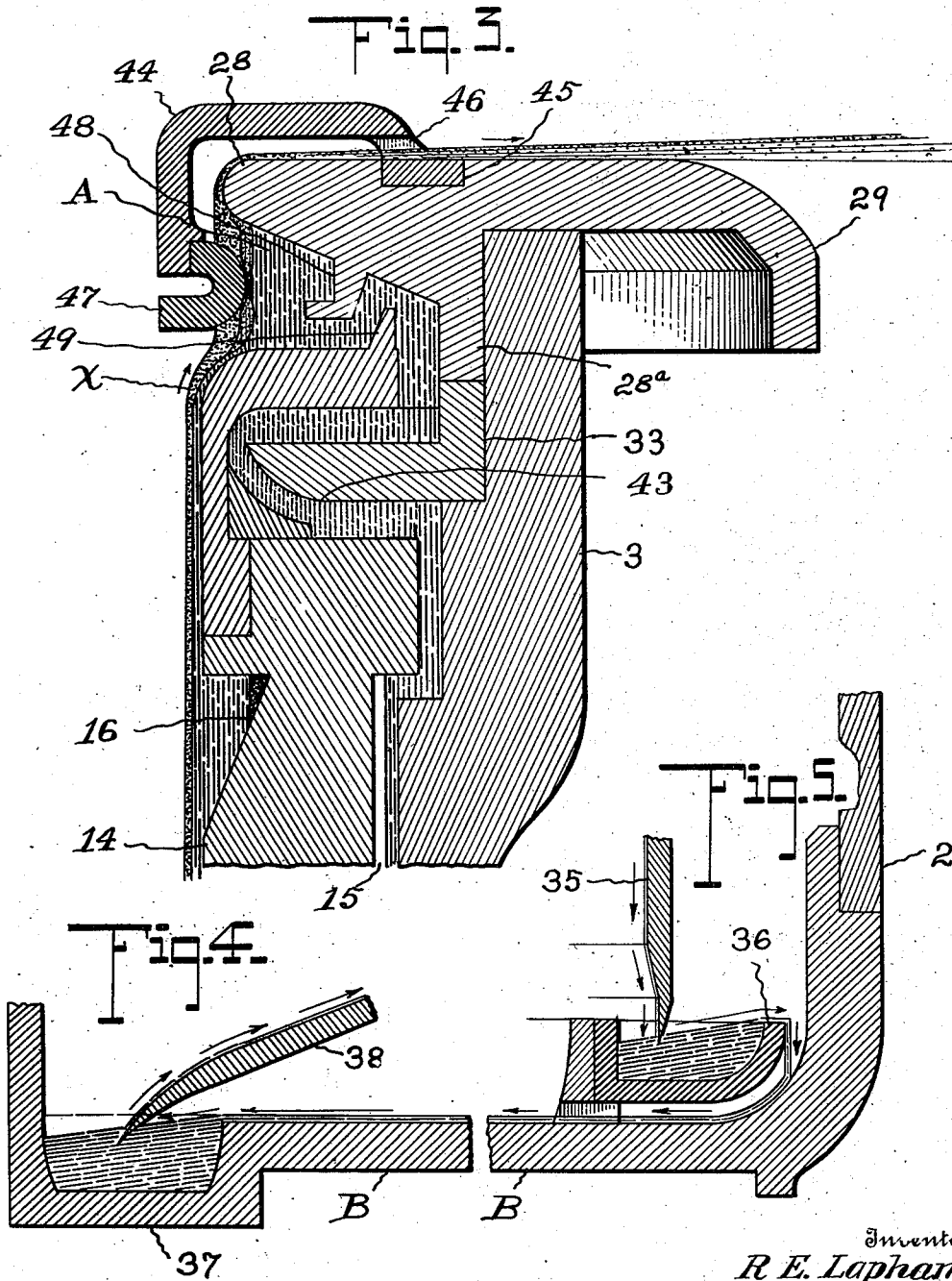
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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL SEPARATING MEANS.

Application filed August 7, 1920. Serial No. 401,883.

To all whom it may concern:

Be it known that I, RALPH E. LAPHAM, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Centrifugal Separating Means, of which the following is a specification.

The present invention relates to certain improvements in the construction of separating machines of that character which utilize centrifugal force for the separation of heavier values such as gold and platinum from auriferous and platiniferous sands, such sands being found in large quantities on the sea shore and even in inland places, and being commonly known as black sand.

Among the objects of the invention is to provide for a smooth flow of the mercury or other mobile separating medium which is utilized to bring about the separation of the heavier values from the sand. One of the chief desiderata of a machine of this character is to obtain an efficient mercurial circuit which is automatic in its flow, and which will not permit the mercury to be disseminated or lost. Mercury, being a metal as well as a liquid, is capable of being floured or broken into many small globules if handled violently. Hence the mercury as it circulates through the machine must flow smoothly, especially since it is subjected to great centrifugal force, and if permitted to jump through space and impinge violently upon some solid portion of the machine would become broken up and floured. In other words, the mercury must be united continuously throughout its entire course of travel by a liquid mass of appreciable depth or flow over an amalgamated surface, and the flow must be smooth and unbroken. Acquiring of this result is an art involving delicate manipulation, and one of the objects of this invention has been to provide a construction which will insure such a flow of the mercury or mobile separating medium at all times and under all conditions when the machine is in operation.

A further object of the invention is to provide for conserving the supply of the mercury or mobile separating medium and prevent the escape thereof with the tailings. Owing to the high velocity at which the machine is driven when in operation the layer of sand which is superposed upon the mer-

cury is dense and there is a tendency to form a knife edge at the point where the mercury and sand finally separate. It has been found that globules of mercury are sometimes separated from the main body of the mercury by this knife edge, and the density of the sand wall prevents these particles of mercury from again reaching the main body of mercury, and this loss, which might be considerable at times, is prevented by the present construction.

With these and other objects in view, the invention consists in certain combinations, arrangements and associations of the parts, as will more fully appear as the description proceeds, the novel features thereof being pointed out in the appended claims.

For a full understanding of the invention reference is to be had to the following description and accompanying drawings, in which:—

Figure 1 is a vertical sectional view through a centrifugal separating machine which is constructed in accordance with the invention, the mercury or mobile separating medium being shown as filling the main supply reservoir and in the position assumed when the machine is at rest.

Figure 2 is an enlarged sectional view through one half of the rotating bowl and associated parts, showing the mercury circuit when the machine is in operation.

Figure 3 is an enlarged fragmentary sectional view of the upper edge of the rotating bowl, showing the mercury supply conserving device.

Figures 4 and 5 are enlarged sectional views through portions of the main mercury reservoir, showing the flanges which are carried by the rotating bowl and dip into the mercury to provide for the continuous circuit thereof, the surface of the mercury being illustrated in the position assumed when the machine is in operation.

Corresponding and like parts are referred to in the following description and indicated in all of the views of the drawings by like reference characters.

This invention is an improvement upon the centrifugal separating machines shown by my Patent No. 1,336,968 of April 13, 1920, and my co-pending application Serial No. 327,713, filed October 1, 1919. There are numerous structural details which are identical with what is shown by my prior patent,

and reference may be made thereto for an understanding of any details which are not pertinent to the present improvements and which will accordingly not be described in detail in the present application.

Specifically describing the present embodiment of the invention, the numeral 1 designates a base, and 2 a supporting frame or casing which is superposed upon the base and rigidly secured thereto. Rotatably mounted within the casing 2 is a bowl 3 which is adapted to be driven at a high rate of speed when the machine is in operation. A vertical shaft 4 to which the bowl is rigidly secured extends upwardly there-through at the axis of the bowl and is journaled at its upper end in a suitable bearing 5 at the top of the casing 2. The lower end of the shaft extends downwardly below the bowl and is journaled in a bearing 6 on the base 1. Surrounding the lower bearing 6 is a casing 7 which is formed with a neck upon which a drive pulley 8 is journaled. A helical spring 9 which surrounds the shaft 4 and has the respective ends thereof connected to the bowl and pulley provides a resilient connection between the two members so that there will be no sudden shocks or jars imparted to the bowl as it is rotated through the medium of power applied to the drive pulley.

A feed hopper 10 for the sand or gangue is located within the upper portion of the bowl at the center thereof, and a supply chute 11 extends upwardly from the feed hopper through an opening in the top of the casing 2. The gangue is discharged from the feed hopper upon a bottom member 12 which is arranged within the bowl and which has long sweeping curves so that the gangue circulates downwardly and outwardly upon the bottom and at the periphery thereof is deflected upwardly so that it will travel upwardly over the annular side wall of the bowl.

The bottom member 12 is spaced from the bottom of the bowl, and an annular mercury reservoir 13 is provided under this bottom member or plate 12. An annular wall member 14 is fitted within the bowl 3 and rigidly secured in position therein, the lower edge of the wall member being shown as extending downwardly into the mercury reservoir 13, and said wall member being spaced from the bowl as indicated at 15 to provide a return circuit for the mercury after it has been caused to flow upwardly over the inner surface of the wall. The said inner surface of the wall is provided with the usual annular pockets 16 which are preferably V shaped in cross section, and in which the heavier values which pass through the film of mercury and are thereby separated from the sand collect.

The upward flow of the mercury over the annular wall 14 from the reservoir 13 is

preferably controlled by some kind of a valve mechanism. The valve construction provided for this purpose may be similar to that shown in my above identified co-pending application, including a rotary valve plate 17 provided with openings 18 which are adapted to be moved into and out of registry with corresponding openings in a channel member 19 which is arranged between the periphery of the bottom plate 12 and the wall 14. The adjustment of this valve may be accomplished by means of a shaft 20 which is arranged within the tubular upper end of the main shaft 4 and has its upper end in a threaded engagement, as at 21, with a fixed plate 22. A handle 23 is fitted upon the upper end of the shaft 20 and provides a means for rotating the same to impart a bodily up and down longitudinal movement to the shaft. The lower end of the shaft 20 is formed with a reduced portion which engages the forked end of a lever 24 which is pivoted at an intermediate point in its length. The other end of this lever 24 engages a bell crank lever 25 which is in turn connected to a shifting lever 26, said lever being arranged under the bottom plate 12 and pivotally connected at 27 to the bottom of the bowl. The outer end of the shifting lever 26 engages the valve plate 17, and it will be obvious that with this construction the said valve plate can be rotated to bring the openings 18 thereof into or out of registry with the openings of the channel member 19 and thereby regulate the upward circulation or flow of the mercury from the reservoir 13.

An overflow rim 28 is secured to the upper edge of the bowl 3 and projects inwardly within the bowl the exact distance necessary to determine the thickness of the layer of sand which is permitted to accumulate on the surface of the mercury as the sand circulates upwardly within the bowl. This overflow rim 28 is formed with an outward extension 29 which has the periphery thereof deflected or curved downwardly over the inner wall of the discharge launder 30, the outlet for the said launder being indicated at 31. The overflow rim is formed with a flange 28^a which extends downwardly into the bowl and engages the vertical flange of an angle iron ring 32 which is fitted within a seat at the top of the bowl. The overflow rim 28 and angle iron ring 32 thus cooperate with each other to provide an annular mercury receiving pocket A. When the mercury reaches the top of the wall 14 it is carried into this pocket by an angle iron guide ring 33 which is secured to the upper edge of the bowl, one flange of the ring extending into the pocket. There is a substantially quiescent body of mercury in the pocket A and the upwardly flowing film of mercury flows smoothly from the wall 14

into this body of mercury without any violence or undue agitation. The depth of the mercury which is permitted to collect within this annular mercury pocket A before it overflows into the return circuit 15 is determined by the amount the flange of the ring 32 projects into the bowl. The projection of this flange into the bowl is slightly less than the projection of the overflow rim 28 so that the substantially vertical face of the mercury in the pocket A will never reach the edge of the overflow rim 28 and permit the mercury to overflow with the tailings, but will cause the mercury to first overflow the flange 32 and then enter the return circuit 15 between the wall member 14 and the bowl. This is substantially as described and shown in my above identified co-pending application.

At the bottom of the bowl the return circuit 15 communicates with ports 34 which extend outwardly to the exterior of the bowl and lead to the base of a flange 35 which extends downwardly in a spaced relation to the bowl and terminates in an edge which projects into a trough 36 forming a part of a main mercury reservoir B which is arranged under the periphery of the bowl and is formed in connection with the main casing 2. The trough 36 is slightly elevated from the bottom of the reservoir so that mercury can flow under the same, and the inner portion of the reservoir is provided with an annular depression 37 into which the edge of a second flange 38 of the bowl projects. This inner flange 38 is arranged at an inclination and at the base of the flange ports 39 are provided in the bottom of the bowl which lead to the reservoir 13. A gage 40 is in communication with the depression 37 of the reservoir through a pipe 41 and shows the level of the mercury within the reservoir at this point. A drain opening at the bottom of the gage is provided for withdrawing the mercury from the reservoir when desired, the said drain opening being normally closed by means of a plug 42.

The annular wall member 14 is preferably formed of copper or a composition comprising practically 90% copper and 10% tin. Similarly, the circulation flanges 35 and 38 of the bowl are preferably formed of some material such as copper for which mercury has an affinity, and may be electro-silver plated to provide for a most efficient amalgamation of the mercury with the metal. The mercury thus has what may be termed an amalgamated contact with these members and can flow over them in a very thin film. It will be understood, however, that the recovery of the metal values is not due to amalgamation, but is entirely the result of the centrifugal action of the machine, the metal values which it is desired to recover

having a greater specific gravity than the mercury and passing through the same into the grooves 16, while the sand or gangue has a less specific gravity than that of mercury and circulates upwardly along the surface of the mercury film, being finally discharged into the discharge launder 30. In the operation of the machine the sand or material to be treated is deposited in the feed hopper 10 and permitted to be fed into the bowl as the latter is rapidly rotated. The rotation of the bowl causes the mercury which may have collected in the reservoir 13 of the bowl to flow upwardly over the inner face of the annular wall 14 in a thin film which has an amalgamated contact therewith. The sand or gangue circulates downwardly and outwardly over the curved walls of the bottom member 12 and is deflected upwardly at the periphery of the said member so as to flow upwardly over the mercury film in engagement therewith. The centrifugal force produced by the rapid rotation of the bowl has the effect of magnifying or increasing the relative weights of the materials in the well known manner, and a most effective separating action is thereby obtained. The gold and platinum particles, being heavier than the mercury, will pass through the film of mercury and collect in the pockets 16, while the gangue which is lighter than the mercury will circulate upwardly over the inner surface thereof. The mercury circuit induced by the rotation of the bowl is illustrated by Fig. 2 of the drawings. At the top of the annular separating wall 14 the flowing film of mercury travels over the guide ring 33 and becomes merged in the substantially quiescent body of mercury in the pocket A. The sand and gangue will continue to circulate upwardly over the surface of the mercury in the pocket A, and when the thickness of sand which may have accumulated upon the mercury is sufficient will pass over the overflow rim 25 and enter the discharge launder 30. As the mercury collects in the pocket A and the vertical wall thereof tends to move inwardly toward the axis of the bowl, the mercury will overflow the flange or ring 32 and be directed through a passage 43 into the return passage 15 which is provided between the bowl 3 and the separating wall member 14. This is indicated more clearly by Fig. 3.

At the lower end of the return passage 15 the mercury passes outwardly through the ports 34 into amalgamated engagement with the annular flange 35. The lower edge of this flange dips slightly into the mercury in the trough 36 and the frictional engagement of the mercury with the flange will cause the mercury in the trough to rotate as the bowl is rotated. However, the rotation of the body of mercury within the

trough 36 will act centrifugally thereon and cause the mercury to overflow the outer wall of the trough. At the same time the surface of the mercury within the trough will become inclined, as indicated by Figures 2 and 5, with the result that the edge of the flange 35 will not dip so deeply therein and will not have as great a frictional engagement with the mercury. It is desired that the edge of the flange shall dip as little as possible into the mercury when the machine is in operation, although it is necessary for the flange to touch the mercury in order that there may be a smooth and uninterrupted downward flow of the mercury along the inner face of the flange 35 and into the mercury in the reservoir.

The mercury which is thus caused to overflow the trough 36 of the reservoir B circulates under the trough and accumulates in the annular depression 37 into which the inner circulation flange 38 projects. The body of mercury in this annular depression 37 will also rotate to a certain extent with the bowl, owing to the frictional engagement between the mercury and the flange. The surface of the mercury in the annular depression 37 will thus assume an inclination, as indicated by Figures 2 and 4. It will be noted that the inner circulation flange 38 is inclined inwardly and downwardly and the portion of the mercury which overlies the edge of the flange will have a considerable frictional engagement with the flange and be caused to rotate therewith. This rotation of the mercury results in a centrifugal force which is sufficient to cause the mercury to flow upwardly along the face of the flange and pass through the ports 39 into the reservoir 13 at the bottom of the bowl. As previously stated these flanges are formed of copper or some metal with which mercury has an affinity so that the mercury is in an amalgamated engagement with the flanges, and a smooth even flow of the mercury over the flanges and in a thin film is thus brought about. The mercury is thus caused to circulate continuously around the mercury circuit when the bowl is rotated, and there is a smooth even flow of the mercury at all points of the circuit so that there is no possibility of the mercury becoming broken up or floured by being brought violently into contact with some surface.

In the operation of machines of this character it has been found that under certain conditions there will be a loss of the mercury, since portions thereof will become separated from the main body of the mercury and be discharged with the tailings. This is due very largely to the fact that the sand which accumulates on the surface of the mercury in the pocket A has a comparatively sharp edge at the lower portion

thereof, as indicated at X on Figure 3. The rapid rotation of the bowl results in a centrifugal action which causes this sand wall to be dense and stiff. The sharp edge at X thus tends at times to cut or separate portions of the mercury from the film thereof which is passing around the guide ring 32 into the pocket A. Any particles of mercury which may be separated at this point would pass upwardly over the sand accumulation, and the density of this accumulation is such that it is impossible for the mercury to penetrate through the same to reach the body of mercury in the pocket A. I have accordingly found it desirable to make provision for recovering or preventing the loss of such particles of mercury. For this purpose an annulus 44 is carried by the overflow rim 28, being rigidly secured thereto at 45. This annulus 44 has a substantially L shaped cross section and overhangs the overflow rim, being provided at its point of connection thereto with outlets 46 through which the tailings escape. The overhanging portion of the annulus 44 is provided with a ring 47 which has a substantially U shaped formation, the curved portion of the ring being arranged to project inwardly toward the surface of the mercury in the pocket A and into substantial engagement therewith. This ring 47 thus projects into the body of sand or gangue which accumulates upon the surface of the mercury before passing over the overflow flange. The sand or gangue must pass under this ring 47 in a thin film or layer before it is finally discharged. Any particles of mercury which might be severed by the sharp edge at X and separated from the main body of the mercury will also pass under ring 47, and the layer or thickness of the sand under the ring is so thin that the mercury will readily penetrate through the same and become merged in the large body of mercury in the pocket A. The supply of mercury will thus be conserved and loss thereof reduced to a minimum. Furthermore, the discharge of the tailings under the upper flange of the annulus 44 and through the passages 46, caused by centrifugal force, will tend to produce a partial vacuum within the annulus 44, and this partial vacuum will assist the overflow of the sand.

The overflow rim 28 is shown as provided with a baffle flange 48, and a cooperating baffle flange 49 is provided at the free edge of the mercury guide ring 33. These baffle flanges provide a barrier or trap for any sand working in along the line between the upper member and the body of mercury, and also prevent sand from being washed down the return space 15 when washing down the machine to clean the same. The baffle flange 48 is preferably L shaped, as indi-

cated, to provide in a more effective manner for catching the sand.

The mercury in its upward movement over the wall 14, caused by the pressure 5 generated in the reservoir 13, assumes a variable curve due to the combined action of gravity and centrifugal force, and will approach and depart from the perpendicular in direct proportion to the force produced, 10 gravity remaining constant. The mercury in its downward movement through the narrow return space 15, which is of increasing diameter, will assume a film of varying thickness decreasing slightly in depth at the 15 lower part of the channel due to the action of the combined forces of gravity and centrifugal force. The rate of flow of the mercurial circuit depends upon the amount issuing through the valve controlled ports at the bottom of the bowl. At a given speed 20 of the bowl, but with various rates of flow, the inclination, curvature, and thickness of mercury on the separating wall 14 remain constant. At a high rate of flow the inner 25 surface of the film of mercury travels upwardly faster, giving a greater capacity of sand while the mercury in the outer channels travels downwardly faster, giving a greater capacity for the mercury. The mercurial circuit throughout the moving parts 30 of the machine gradually increases radially, that is, the circuit through which the mercury passes increases in diameter in the direction of flow of the liquid, terminating in the largest diameter at the lower edge of 35 the flange 35.

While I have illustrated and described one particular embodiment of the invention, it will be understood that many changes can 40 be made in the details of construction without departing in any manner from the spirit of the invention or the scope of the appended claims.

Having thus described the invention, what 45 I claim as new and desire to secure by Letters Patent is:—

1. A centrifugal separating machine of the character described including a rotating 50 bowl provided with a wall over which the separating medium and pulp flow, a stationary reservoir for the separating medium, and an annular circulation flange carried by the bowl and projecting into the separating 55 medium, said flange being formed of a material for which the separating medium has an affinity and over which it flows in an amalgamated engagement.

2. A centrifugal separating machine including a rotating bowl provided with a wall 60 over which the separating medium and pulp flow in one direction and also with a return passage for the separating medium, a stationary reservoir for the separating medium, and a pair of circulation flanges carried by 65 the bowl and projecting into the separating

medium in the stationary reservoir to provide for the feed and return of the separating medium.

3. A centrifugal separating machine of the character described including a rotating 70 bowl provided with a wall over which the mercury and pulp flow, a stationary mercury reservoir, and annular feed and return flanges carried by the bowl and projecting into the mercury of the stationary reservoir, 75 said flanges being formed of a material for which the mercury has an affinity and over which it will flow in an amalgamated engagement and the feed flange being constructed to utilize the motion thereof to induce a passage of the mercury from the 80 reservoir to the bowl.

4. A centrifugal separating machine including a rotating bowl provided with an interior annular wall over which the separating 85 medium and pulp flow in one direction, the exterior of the bowl being provided with a return passage along which the separating medium flows in the opposite direction, a stationary reservoir for the separating 90 medium, and concentric annular circulating flanges carried by the bowl and projecting into the separating medium in the stationary reservoir so as to provide for the feed and return of the separating medium. 95

5. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, 100 a stationary reservoir for the separating medium, and a pair of circular flanges carried by the bowl and projecting into the separating medium in the stationary reservoir to provide for the feed and return of the separating 105 medium, the feed flange having an inclined edge portion which is arranged so that the separating medium will be centrifugally forced along the flange of the bowl as the separating medium upon the 110 edge of the flange is caused to rotate by frictional engagement therewith.

6. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, 115 a stationary reservoir for the separating medium, and means including circulation flanges carried by the bowl for producing a continuous circuit of the separating medium between the bowl and the stationary reservoir and over the said annular wall of the bowl, the said stationary reservoir being provided with independent trough portions for the circulation flanges. 120

7. A centrifugal separating machine of the character described including a rotating 125 bowl provided with an annular wall over which the separating medium and pulp flow, a stationary reservoir for the separating medium, and means including a pair of annular 130

circulation flanges carried by the bowl for producing a continuous circuit of the separating medium between the bowl and the stationary reservoir and over the said wall of the bowl, the stationary reservoir being provided with separate annular troughs for the circulation flanges and the trough for the return flange being at a higher elevation than the trough for the feed flange so that the separating medium returned to the reservoir from the bowl will be first received in the trough at a higher elevation and then overflow said trough and flow by gravity into the trough at a lower elevation.

8. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, a stationary reservoir for the separating medium arranged under the rotating bowl, and means including annular feed and return circulation flanges carried by the bowl and projecting into the stationary reservoir for producing a continuous circulation of the separating medium back and forth between the bowl and the reservoir and over the beforementioned wall of the bowl, the stationary reservoir being provided with independent annular trough portions for the circulation flanges and the return flange projecting into the trough at a higher elevation so that the separating medium returned to the reservoir will be first received within the higher trough and after overflowing the same flow by gravity into the lower trough provided for the feed flange, said feed flange having an inclined edge portion which is arranged so that as the separating medium rotates by frictional engagement therewith the centrifugal force produced will drive the separating medium over the flange to the bowl.

9. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the mercury and pulp flow, a stationary mercury reservoir, and a circulation flange carried by the bowl and projecting into the stationary reservoir, said flange being formed of a metal for which mercury has an affinity and over which the mercury will flow in an amalgamated engagement.

10. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the mercury and pulp flow, a stationary mercury reservoir, and annular feed and circulation flanges carried by the bowl and projecting into the stationary reservoir to convey the mercury back and forth between the reservoir and the bowl, said flanges being formed of metal for which mercury has an affinity and over which it will flow in an amalgamated contact, the feed flange being inclined and arranged so that the mercury in

the reservoir which is engaged thereby and caused to rotate by frictional engagement therewith will be driven along the flange to the bowl by the centrifugal force thereby produced.

11. A centrifugal separating machine of the character described including a rotating bowl provided at the bottom thereof with a reservoir and also with an annular wall over which the separating medium flows upwardly from the reservoir, a return passage being provided for the separating medium after it has circulated over the annular wall, a main stationary reservoir for the separating medium under the bowl, and means utilizing the centrifugal force produced by the rotation of the bowl to convey the separating medium from the fixed reservoir to the reservoir of the bowl and from the return passage of the bowl to the stationary reservoir.

12. A centrifugal separating machine of the character described including a rotating bowl provided at the bottom thereof with a reservoir and also provided with an annular wall over which the separating medium flows from the reservoir, a return passage being provided for receiving the separating medium after it has circulated over the annular wall, a main stationary reservoir for the separating medium under the bowl, and annular feed and return, circulation flanges carried by the bowl and projecting into the stationary reservoir, the return flange having the base thereof adjacent the return passage of the bowl and the feed flange supplying the separating medium from the stationary reservoir to the reservoir of the bowl and being inclined so that the separating medium frictionally engaged by the edge of the flange and caused to rotate therewith will be forced over the flange by the centrifugal force thereby produced.

13. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, a return passage being provided for the separating medium while the gangue overflows the bowl, and means for catching any particles of the separating medium which may have become separated from the body thereof and deflecting them back into the main body of the separating medium.

14. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, a return passage being provided for the separating medium while the gangue overflows the bowl, and means including a baffle ring between which and the bowl the gangue flows, said baffle ring projecting into the gangue at a point in advance of the overflow thereof for directing any portions of

the separating medium which may have become separated from the body thereof through the gangue so that they can reach the before-mentioned return passage.

5 15. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, a return passage being provided for the separating medium while the gangue overflows the bowl, an annular body of the separating medium being maintained adjacent the edge of the annular wall and over the surface of which the gangue passes prior to being discharged, and an annular ring member between which and the said body of separating medium the gangue flows, said annular ring member being arranged to project into the gangue which is upon this body of the separating medium so that the gangue must pass between the ring and the body of separating medium which may have become mixed with the gangue will be deflected into engagement with the annular body of separating medium and prevented from loss.

10 16. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, an overflow rim upon the bowl, a return passage being provided for the separating medium while the gangue is discharged over the said overflow rim, an annular body of the separating medium being maintained adjacent the overflow rim and carried by the bowl, an annulus carried by the bowl, and a ring carried by the annulus and arranged to project into the gangue

passing over the annular body of separating medium so that the gangue will pass between the said ring and body of separating medium in a thin film and any particles of the separating medium which may have become mixed with the gangue will be deflected back to the body of separating medium and thereby recovered.

17. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, an overflow rim for the bowl, a return passage being provided for the separating medium while the gangue is discharged over the overflow rim, a guide ring for the separating medium at the edge of the annular wall, and cooperating baffle flanges carried by the overflow rim and guide ring and providing a tortuous path for the separating medium as it flows to the return passage.

18. A centrifugal separating machine of the character described including a rotating bowl provided with an annular wall over which the separating medium and pulp flow, an overflow rim upon the bowl, a return passage being provided for the separating medium while the gangue is discharged over the overflow rim, an annular body of the separating medium being maintained in contact with the overflow rim, and a baffle flange carried by the overflow-rim and projecting into the said body of separating medium to provide a tortuous path for the separating medium as it flows to the return passage.

In testimony whereof I affix my signature.
RALPH E. LAPHAM.