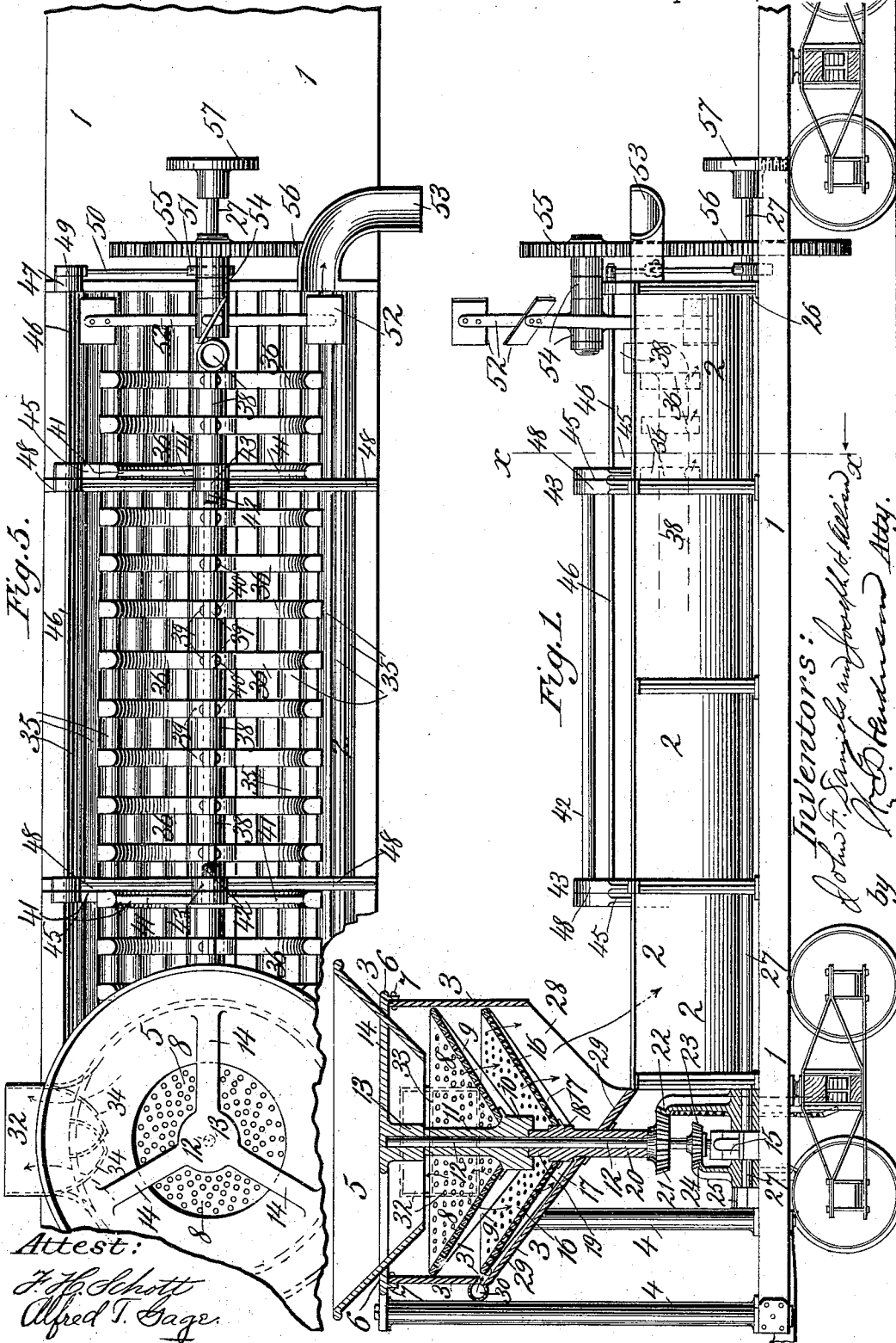


J. F. DANIELS & J. H. ALLISON.

AMALGAMATOR.

No. 538,099.

Patented Apr. 23, 1895.



(No Model.)

3 Sheets—Sheet 2.

J. F. DANIELS & J. H. ALLISON.
AMALGAMATOR.

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Fig. 2.

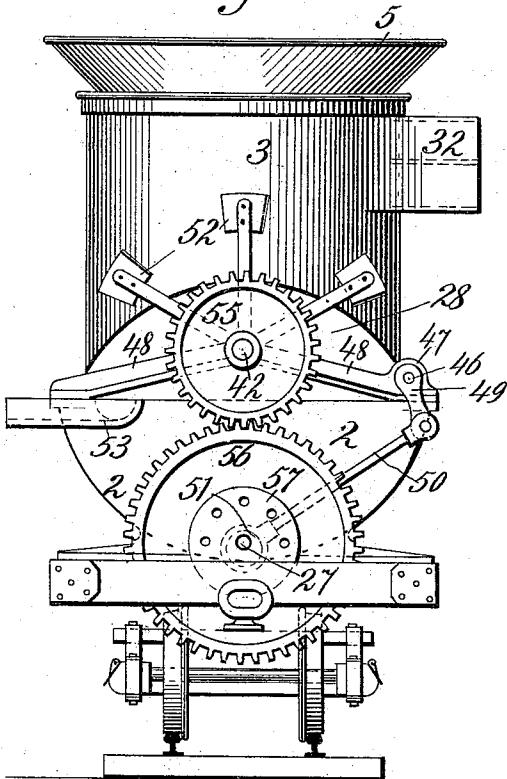


Fig. 3.

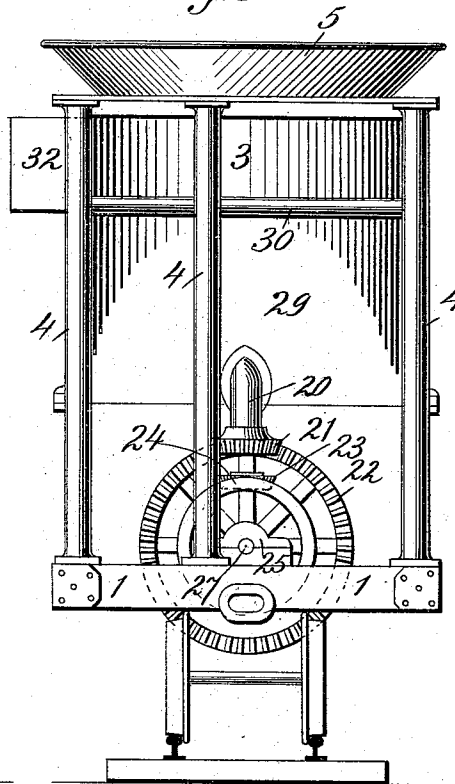
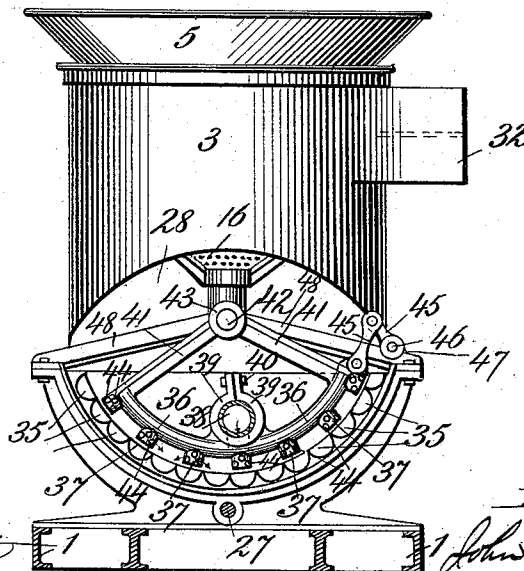


Fig. 4.



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Fig. 8.

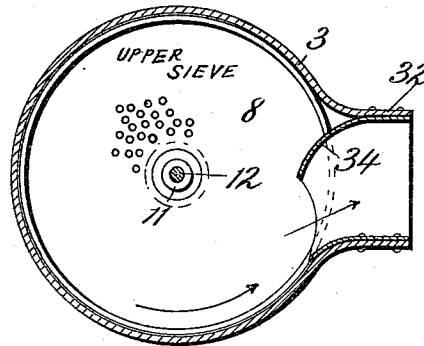


Fig. 6.

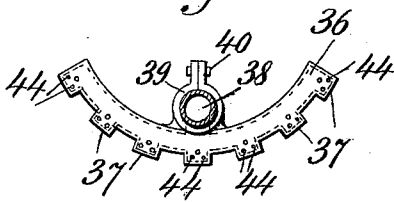


Fig. 11.

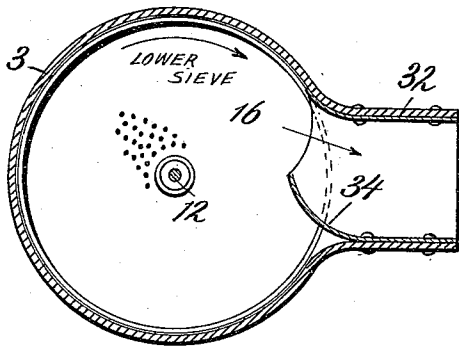


Fig. 7.

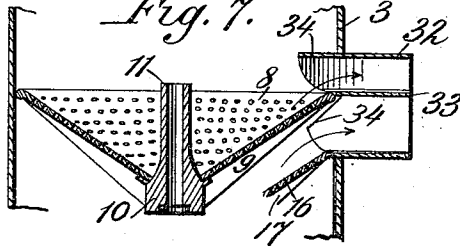


Fig. 9.

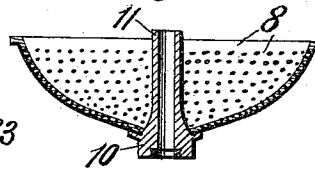


Fig. 12.

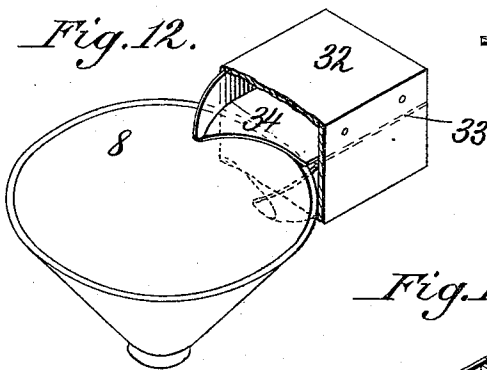
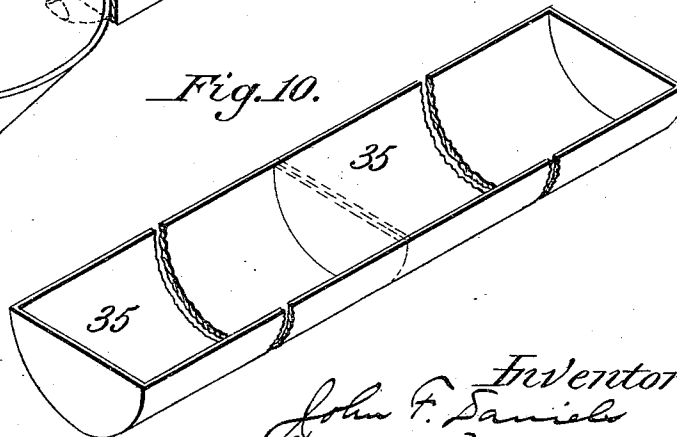


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOHN F. DANIELS AND JOSEPH H. ALLISON, OF DENVER, COLORADO.

AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 538,099, dated April 23, 1895.

Application filed June 23, 1893. Serial No. 478,659. (No model.)

To all whom it may concern:

Be it known that we, JOHN F. DANIELS and JOSEPH H. ALLISON, citizens of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Amalgamators; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

Our invention relates to amalgamators designed more especially for gold placer mining on a large scale.

It has for its object to provide suitable means for separating the larger material from the smaller material.

It has further for its object to provide improved means whereby the particles adhering to a shelf or apron may be washed therefrom.

It has further for its object to provide improved means for agitating the water containing the gold, sand, and other particles, for the purpose of better separating the precious metal from the foreign matters.

It has further for its object to provide means for supplying water to the agitator for the purpose of more effectually washing the material and keeping up a flow of water.

It has further for its object to provide improved means for holding the mercury to receive and retain the precious metal separated from the foreign matter.

It has further for its object to provide an amalgamator possessing improved features in construction and in combination for the more expeditious and efficient separation of the precious metal from the foreign matters, all as hereinafter particularly described and illustrated in the accompanying drawings.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, the invention consists in the construction, and also in the combination of parts hereinafter particularly described and then sought to be specifically defined by the claims, reference being had to the accompanying drawings forming a part hereof, in which—

Figure 1 is a side elevation of the amalga-

mator, with parts in vertical section. Fig. 2 is an end view looking from the rear of the amalgamator. Fig. 3 is an end view looking from the front of the amalgamator. Fig. 4 is a cross section on the line $x-x$ of Fig. 1 looking from the rear of the amalgamator. Fig. 5 is a plan view of the amalgamator. Fig. 6 is a detail view of one of the agitators. Fig. 7 is a vertical section through the top sieve. Fig. 8 is a plan view of the same partly in section. Fig. 9 is a vertical section through a modified form of sieve. Fig. 10 is a perspective of one of the mercury receptacles with a portion broken away. Fig. 11 is a horizontal section through the casing showing the lower side in plan. Fig. 12 is a perspective of upper side and a portion of the discharge outlet of the casing or shell.

In the drawings the numeral 1 designates a platform car of any approved construction and designed to support the amalgamator and move the same from place to place as desired. This platform sustains the amalgamator pan 2 which is preferably a trough of semi-circular form and made of any suitable metal and appropriately braced and stayed to rest firmly upon the platform. At the forward end of this amalgamator there is located a casing or shell 3 supported by any suitable number of upright standards 4 resting upon the platform of the car. At the upper end of this casing or shell is a hopper 5 preferably formed with a flange 6 which fits around the outside of the casing or shell so as to receive bolts 7 to securely hold the hopper to the shell or casing. Within the casing or shell 3, beneath the hopper 5, there is supported a screen 8 which is illustrated as of conical form but which may be of a basket form as shown in Fig. 9, and which is preferably formed of perforated metal of one half inch mesh and which may be braced by ribs 9 on its exterior. This screen is connected in any suitable way to a hub 10 from which there extends a sleeve 11, through which hub and sleeve passes a vertical shaft 12 having its upper end bearing in a hub 13 sustained by arms 14 extending from the interior of the hopper and its lower end bearing in a box 15. The hub 10 or sleeve 11 is keyed or otherwise secured to the shaft 12 so that the sieve 8 will revolve with said shaft.

Beneath the sieve 8 and within the shell or

casing 3 there is supported a second sieve 16 which may be of a conical or a basket form and which is preferably formed of perforated metal of one eighth inch mesh, and which may be braced by ribs 17 formed on the exterior thereof. The sieve 16 is connected in any suitable way to the hub 18 which has an upward extension or sleeve 19 preferably entering a recess formed in the base of the hub 10 and also with the sleeve 20 extending downwardly, through which hub and sleeve the vertical shaft 12 will pass so that said shaft will turn therein and the sieve 16 may revolve around said shaft.

The sleeve 19 and the sleeve 11 serve to protect the shaft 12 from the material in the two sieves 8 and 16. On the lower end of the sleeve 20 there is a pinion 21 which meshes with a gear wheel 22, and to the shaft 12 there is keyed or otherwise secured a pinion 23 which meshes with a gear wheel 24, the hubs of the gears 22 and 24 being secured to the main shaft 27 journaled in the boxes 25 and 26 mounted on the platform 1. Under the construction described the sieves 8 and 16 are revolved in opposite directions to each other and as the lower sieve 16 will have its material distributed more evenly over its surface than will the sieve 8 and will consequently be more evenly balanced, it will be run at a higher rate of speed than the sieve 8. The sieves however may be caused to revolve in the same direction. The lower portion of the shell or casing 3 is formed with a spout or mouth 28 over the forward end of the amalgamator pan 2 for the delivery of the material that may pass through the two sieves 8 and 16, and beneath the sieve 16 there is located an inclined shelf or apron 29 over which will be directed a stream of water for the purpose of washing from the apron into the amalgamator pan particles of gold that may settle thereon after passing through the sieves above.

The water is supplied through a pipe or passage way 30 which will communicate in any suitable way with the source of water supply and deliver the water through an opening 31 in the side of the shell or casing at or adjacent to the upper end of the inclined shelf or apron 29 so that it will flow over said shelf or apron for the purposes stated. The shell or case 3 is provided with an outlet 32 adjacent to the peripheries of the two screens 8 and 16 for the exit of the coarser material that may be thrown out of and away from said screens by centrifugal force in their revolution, said outlet 32 being provided with the horizontal partition 33 to keep separate the material thrown out from one sieve from that thrown out from the other sieve. This is desirable so that in the event of nuggets of gold being thrown out from the foreign material from the sieve the nuggets may be directed to a rifle and be saved. For the purpose of deflecting the coarser material that may rise to the periphery of the two sieves and thus cause

it to pass directly into the outlet 32, there are arranged next to the outlet and projecting to a greater or less extent into the space above the periphery of the sieves, shoes or deflectors or dividers 34, preferably formed of hardened steel and arranged as indicated in the drawings, whereby the material will be directed to and through the outlet 32.

The interior of the amalgamator pan 2 is provided with a series of amalgam plates or mercury receivers 35 preferably made of copper and silver plated and then plated with quicksilver. These plates or reservoirs are preferably formed semi-circular in cross section and are preferably arranged to extend lengthwise of the amalgamator pan. They are arranged side by side and each one is preferably independent of the other so that any one or more can be removed as desired or they can be removed each one at a time when the gold collected therein is to be removed therefrom. When constructed and arranged as described they may be said to constitute a lining for the amalgamator pan composed of a series of removable plates or reservoirs. Each one of these reservoirs is closed at opposite ends so as to form the semi-circular trough and each one may be made in a single piece from end to end but it is preferred to form each one of a series of sections so that instead of removing the whole trough of the entire length of the amalgamator pan, the sections composing the entire length of the trough may be taken out separately thus facilitating the removal of the amalgam plates or reservoirs. In such event it will be understood of course that each section has its two ends closed so that the precious metal will be held in each section of the trough.

While it is preferred to have each one of the amalgam plates or reservoirs independent of the others so that one can be removed at a time it is obvious that two or more of them may be connected together and thus be removed in sections of that kind without departing from the spirit of this feature of the invention.

We have indicated in Fig. 10 of the drawings by the transverse dotted lines the form of the mercury trough or amalgam plate formed in its length of a series of sections, each having its opposite ends closed, the dotted lines indicating the closed ends of the trough.

Within the amalgamating pan is arranged a series of oscillating agitators designated by the numeral 36. These agitators are preferably made segmental in form and hollow and provided with a series of projections or blades likewise hollow and are suspended in any suitable manner that will permit oscillation. The preferred construction is to connect the series of agitators by means of the shaft 38, each segment being formed with a collar 39 adapted to pass around said shaft and to be clamped thereto by means of a bolt 40, and then to connect two or more of said segments

by means of arms 41 to a shaft or journal 42, the hubs 43 of said arms turning loosely on said shaft, that is, preferably so, although if they should be secured rigidly to the shaft and the shaft made to turn the same would be within the spirit of our invention. It is designed that the shaft 38 shall be of tubular form so as to constitute it a water pipe for the passage of water from a source of supply under considerable pressure for the purpose of delivering the water to the hollow segments composing the agitators in order that it may be forced into the amalgamator pan and thus supply it with water for the purpose of washing the sand and other foreign matter from the gold in the pan. The water is delivered into the pan through perforations formed in the agitators on the side toward the rear of the pan so that the water will be projected in the direction that the material travels through the pan thereby promoting the flow and movement of the material from the forward to the rear end of the pan. The perforations, designated by the numeral 44, are preferably formed in the projections or paddles 37 of the agitators although they might be elsewhere placed without departing from the spirit of the invention. By the construction described the water and the gold and the sand in the pan, are kept in a state of constant agitation, and the sand is carried along toward the tail end of the pan while the gold is deposited and collected by the mercury of the reservoirs or amalgam plates, the sand being delivered from the tail end of the pan, and assisted in its delivery by the rotation of paddles hereinafter described, which paddles also assist in keeping up a strong current or flow of the water from the forward toward the tail end of the pan. The oscillatory motion is imparted to the agitators through cranks 45 connected with certain of the agitators and with a shaft 46 journaled in suitable boxes 47 which may form a part of the transverse supports 48 which sustain the shaft 42. The shaft 46 receives its motion through a crank 49 and a rod 50 connecting it with an eccentric 51 on the main driving shaft 27. At the tail end of the amalgamator pan 2 there is a paddle wheel 52 which has its blades set at an angle as shown and which works in the pan so as to assist the flow and agitation of the water and which serves also to lift the sand which settles at the tail end of the pan so that it will discharge through the spout 53. The shaft of the paddle wheel is journaled in a suitable box 54, and is provided with a gear wheel 55 which derives its motion from a gear wheel 56 mounted on the main shaft 27 which derives motion from a suitable source of power transmitted to the coupling 57 mounted on the main shaft 27.

We have described with particularity the construction and also the arrangement of the several parts entering into the formation of the amalgamator and while it is believed that such construction and arrangement involve many features of novelty and such features

of novelty are intended to be covered herein still we do not confine ourselves to the exact details and arrangement as shown as it is obvious that various changes may be made therein without departing from the spirit of the invention.

It will be observed that the lower portion of the hopper 5 projects into the shell 3 below the top thereof and over the top screen 8, thus forming a depending flange designated by the numeral 58 which will constitute a hood that will deflect or hold down the material thrown by centrifugal force from the top peripheral edge of the sieve when employed in connection with the portion of the shell or case 3 which projects above the top peripheral edge of the sieve. In other words this flange 58 or deflecting hood, in connection with the wall of the shell lying in proximity to the peripheral edge of the sieve and extending upward above that edge, forms a sort of channel or way into which the material thrown centrifugally from the peripheral edge of the sieve will travel until it reaches the discharge outlet in the wall of the shell. This is an important feature in a machine of this character where the sieves are revolved at a high rate of speed so as to effect the separation of the material or ores. It will also be observed that one of the conical sieves fits down inside of the other sieve which brings the peripheral edge of the inner sieve above the edge of the other sieve, and as the wall of the shell 3 extends above the top edge of the lower sieve, the material thrown centrifugally from the edge of the lower sieve will be confined by said wall and the lower surface of the upper sieve toward its peripheral edge, in which confined space or channel the material will travel until it reaches the outlet in the shell. In effect the upper portion of the top sieve will constitute a deflecting hood above the lower sieve which will serve practically the purpose of the flange or deflecting hood 58 to the top sieve.

This amalgamator is adapted for placer mining on a large scale, it having the capacity to handle from one thousand to three thousand yards of earth in ten hours. In actual operation there will be employed a railroad steam shovel or excavator mounted on one car to which will be coupled the platform car carrying the amalgamator or both may be mounted on the same car. On the rear end of the car carrying the amalgamator there will be an engine to furnish power for the amalgamator, and a boiler may also be placed on the car to connect with the engine; or steam to run the amalgamator may be taken from the excavator boiler. The pumping plant employed will consist of a steam boiler, engine and pump of sufficient capacity to furnish say at least a thousand gallons of water per minute at a pressure of say not less than sixty pounds to the square inch. As these several parts however do not involve invention and being merely accessories that may be employed for

operating the amalgamator constituting the invention said parts need not be and therefore are not illustrated but we merely refer to them to indicate what may be employed in connection with the amalgamator in the actual operation of the same on a large scale.

In operation, the material is emptied from the shovel or excavator into the hopper of the amalgamator and from thence it passes into the revolving screen below. In this screen the material is carried around by the rotation of the screen, and the coarser particles that fail to pass through the meshes of the screen are, by the centrifugal action of the screen, carried to the periphery thereof and ejected into the upper compartment of the outlet, being guided in their movement by the deflector placed therein, and they are expelled with such force through this outlet that they are delivered a distance from the amalgamator into a receptacle or at the point at which it is desired to deliver the same. The finer particles passing through the upper screen fall into the lower screen which revolves in an opposite direction (although it may revolve in the same direction) from that of the upper screen and by the force imparted by the revolution of the upper screen are impelled into and against the surface of the lower screen with such force or impact that the material is forced through the meshes of that screen, the coarser particles which fail to pass through being ejected by centrifugal force from the periphery of the screen into the lower compartment of the outlet into which they are guided by the deflector placed therein, and from this outlet they are impelled by the force given to them by the screen to a riffle (not shown) so that any nuggets of gold that may be ejected with the coarser material may be saved. The particles however which pass through the lower screen drop through the opening in the shell into the amalgamator pan, some of the particles dropping onto the inclined shelf or apron from which they are washed by the water admitted through the inlet at the upper end thereof. These particles washed from the shelf, and the particles which pass directly from the sieve, are both delivered into the forward end of the amalgamator pan where they are subjected to agitation in the water which fills the pan, the agitation being produced by the oscillations of the agitators and by the force of water ejected through the openings in the agitators so that the material composed mainly of the gold and sand is subjected to a constant movement and rolling action in the water which causes a separation of the gold from the foreign matter, the gold being collected in the mercury reservoirs or plates covering the bottom of the amalgamator pan while the sand is carried by the current of water to the tail end of the pan from which point it is delivered outside of the pan through the spout, the delivery being facilitated and assisted by the revolution of the paddle wheel at that end of the pan. The gold and the sand after pass-

ing through the two sieves enter the amalgamator pan comparatively free from all foreign matter and in a state of disintegration so that the material is in the best condition to be subjected to a most thorough agitation caused by the oscillation of the agitators which cause a tumbling or rolling of the material from side to side of the amalgamator pan while it is carried forward by the current established by the jets of water issuing from the perforations of the agitators in the direction of the tail end of this pan so that before the sand reaches the tail end of the pan the gold has been separated therefrom and collected in the mercury plates or reservoirs while the sand is caused to settle at the tail end and is removed therefrom by the flow of water and by the rotation of the paddle wheel, practically freed from all particles of the precious metal.

The advantages and merits of an amalgamator of this construction will be apparent to the skilled in the art and in view of its capacity to operate upon a large scale and to most effectually separate the gold from the foreign matter it constitutes an amalgamator especially adapted for placer mining on a large scale.

Having described our invention and set forth its merits, what we claim is—

1. In an amalgamator, the combination with the upright revoluble shaft carrying the inverted conical sieve presenting upwardly and outwardly flaring walls, of the shell or case surrounding said sieve and extending above its top peripheral edge and formed with an outlet adjacent to the periphery of the sieve, and a deflector or divider adjacent to said outlet and the top peripheral edge of the sieve and projecting over said top edge to guide the material thrown from the top edge of the sieve by centrifugal force into said outlet, substantially as and for the purposes described.

2. In an amalgamator, the combination of the two revoluble concave sieves fitting one within the other, each presenting upwardly and outwardly flaring walls, a shell or case surrounding said sieves and extending above the top peripheral edge of both sieves in proximity to said edges and formed with an outlet covering the peripheries of the two sieves, a partition arranged in said outlet to form it into two divisions and keep separate the material thrown from the periphery of the two sieves, and a divider or deflector to each outlet and projecting over the top edge of each sieve to direct into the outlet the material thrown centrifugally from the sieve substantially as and for the purposes described.

3. In an amalgamator, the combination of the revoluble concave sieve presenting an upwardly and outwardly flaring wall, the shell or case surrounding said sieve and extending above the top peripheral edge of the sieve and formed with an opening for the outlet of material thrown by centrifugal force from the top edge of the sieve, and a flange extending downwardly inside of the shell above the sieve

to form a deflecting hood for the material thrown centrifugally from the peripheral edge of the sieve, substantially as and for the purposes described.

4. In an amalgamator, the combination of the two revoluble concave sieves each presenting an upwardly and outwardly flaring wall and fitting one inside the other, with the top peripheral edge of the upper sieve above the top edge of the other, the shell or case surrounding said sieves, and extending above the top peripheral edge of both sieves and formed with an outlet for the material thrown centrifugally from the peripheral edges of the sieves, and a flange extending downwardly inside of the shell above the upper sieve to form a deflecting hood for the material thrown from the periphery of the sieve, substantially as and for the purposes described.

5. In an amalgamator, the combination of the case or shell, a concave sieve arranged in said shell and connected with the shaft passing through the same, a second concave sieve arranged below the first named sieve and supported by a sleeve encircling the shaft of the first sieve and passing through the shell or case, and means applied to said shaft and sleeve respectively for revolving both sieves, substantially as and for the purposes described.

6. In an amalgamator, the combination with the shell or case and a revoluble concave sieve therein, of an inclined shelf or apron arranged beneath said sieve, and means for supplying water at the upper end of said shelf or apron, substantially as and for the purposes described.

7. In an amalgamator, the combination with an amalgamator pan, of mechanism for grading auriferous material and feeding finer particles to the amalgamator pan, said mechanism consisting of a shell or case having an outlet for material thrown from the periphery of a sieve and another for delivery to the pan of material passing through the sieve, said shell extending above the top peripheral edge of the sieve, an upright perforated open concave sieve having its top peripheral edge contiguous to one of the outlets in the shell to permit material in the sieve to be centrifugally ejected from it and through said outlet, an upright shaft for supporting said sieve, and means for rotating said sieve to cause the coarser material thereon to be moved from its lower portion to its upper edge and centrifugally thrown through the outlet in the shell at the top peripheral edge of the sieve while the finer particles will pass through the sieve and be discharged at the lower portion of the shell into the amalgamator pan, substantially as and for the purposes described.

8. In an amalgamator, the combination with an amalgamator pan, of a series of agitators provided with liquid channels having apertures facing the tail end of the amalgamator pan to direct the liquid from the channels in the direction of the tail end of the amalga-

mator pan, substantially as and for the purposes described.

9. In an amalgamator, the combination with an amalgamator pan, of a series of agitators and projections or blades thereon, both the agitators and said projections being formed with liquid passages and the projections with apertures for the escape of the liquid, substantially as and for the purposes described.

10. In an amalgamator, the combination with an amalgamator pan, of a series of segmental agitators having liquid passages and extending transversely of the pan, and the liquid supply pipe extending transversely of the agitators and lengthwise of the pan and having said agitators secured thereto between their ends and communicating therewith, substantially as and for the purposes described.

11. In an amalgamator, the combination with an amalgamator pan, of a series of curved agitators formed with liquid passages, and extending in the direction of their length transversely of the said pan, a liquid supply pipe extending lengthwise of the pan and transversely to the agitators and having said agitators connected thereto between their ends, a shaft sustaining said agitators and the liquid supply pipe in a manner to permit an oscillatory movement thereof, and means for oscillating the agitators, substantially as and for the purposes described.

12. In an amalgamator, the combination with a shell or case containing revoluble screens and an amalgamator pan, of oscillatory agitators in said amalgamator pan, a revoluble shaft having connections with said agitators, to transmit an oscillatory motion thereto, a main drive shaft, connecting mechanism between said drive shaft and the screens in said case or shell to revolve the screens, and connecting mechanism between the same main drive shaft and the revoluble shaft having connection with the oscillatory agitators, whereby said screens are revolved and the agitators oscillated from the main drive shaft, substantially as and for the purposes described.

13. In an amalgamator, the combination with the amalgamator pan, of a series of oscillatory agitators in said pan formed with liquid passages having discharge orifices opening toward the tail end of the pan for the delivery of water into the pan in the direction of the tail end thereof, and a paddle wheel at the tail end of the amalgamator pan for assisting in the agitation of the contents of the pan and in the delivery from the pan of the sand and other material carried to the tail end of the pan by the flow of water in the pan, substantially as and for the purposes described.

14. In an amalgamator, an amalgamator pan having a segmental interior formed of a series of separately removable semi-circular amalgam plates or mercury reservoirs arranged side by side, substantially as and for the purposes described.

15. In an amalgamator, an amalgamator pan

having a lining formed of a series of separately removable semi-circular trough shaped amalgam plates or mercury reservoirs closed at opposite ends and applied to the pan on the inside thereof along the bottom and sides to form a segmental interior to the pan, substantially as and for the purposes described.

16. In an amalgamator, an amalgamator pan having a lining formed of a series of semi-circular trough shaped amalgam plates or reservoirs arranged side by side inside the pan to form a segmental interior to the pan, and separable lengthwise of the pan, said plates or re-

ceptacles being also transversely separable and each section closed at opposite ends so that each length of the plates can be removed in sections, substantially as and for the purposes described.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN F. DANIELS.
JOSEPH H. ALLISON.

Witnesses:

I. B. PERKINS,
W. F. MASON.