W. R. MORSE.

SEPARATOR.

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1,049,257.

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Fig. 2.

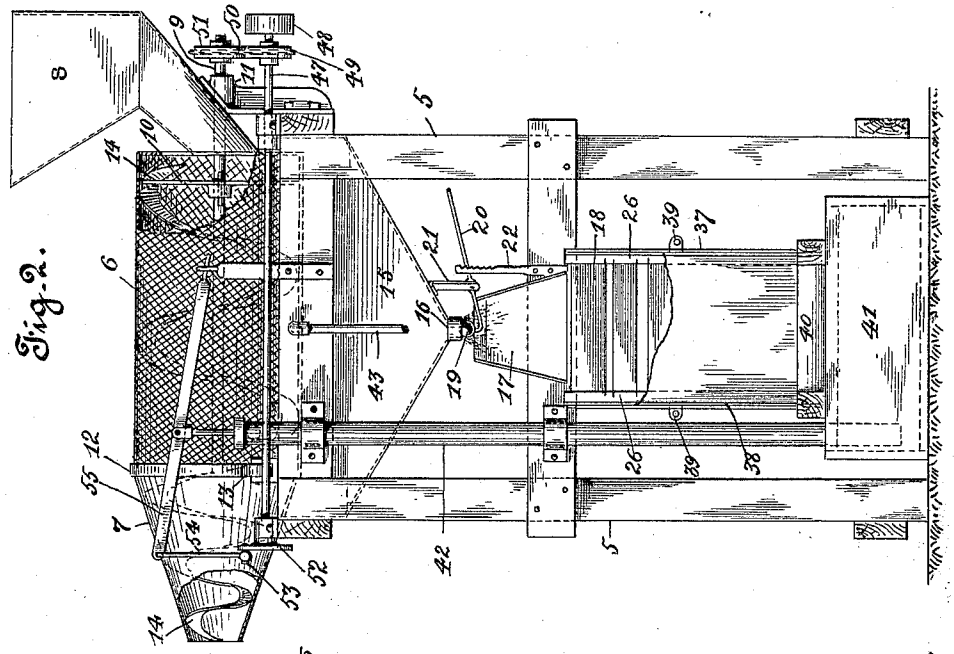


Fig. 1.

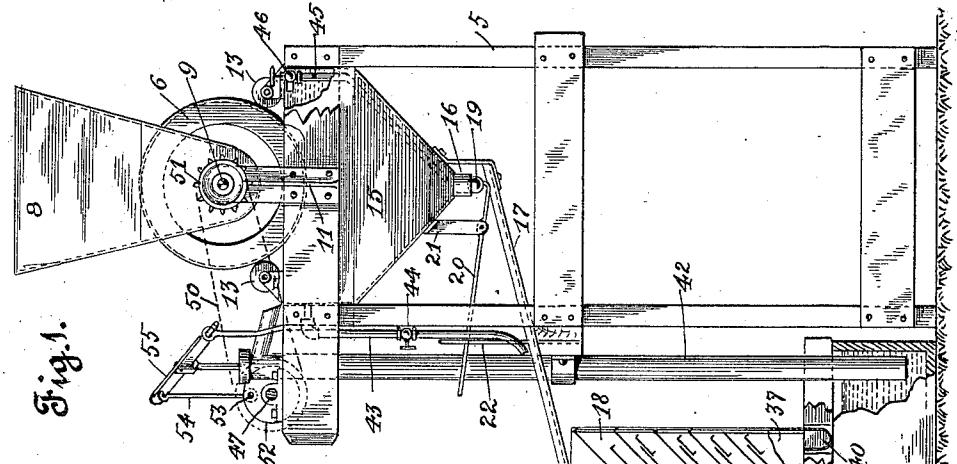


Fig. 3.

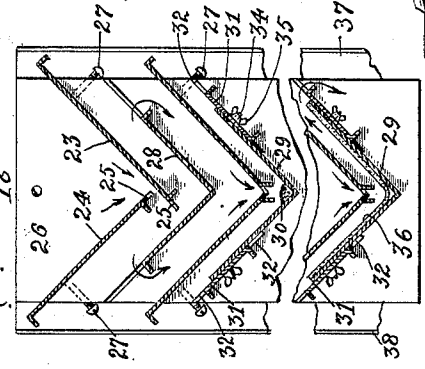
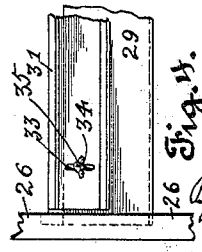


Fig. 4.



Witnesses.

Hattonteverds.

E. B. Austin.

Inventor,

William R. Morse,

By E. C. Orphaus

Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM R. MORSE, OF LOS ANGELES, CALIFORNIA.

SEPARATOR.

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To all whom it may concern:

Be it known that I, WILLIAM R. MORSE, a citizen of the United States, residing in Los Angeles, county of Los Angeles, State of California, have invented new and useful Improvements in Separators, of which the following is a specification.

My invention relates to improvements in machines for separating precious metals from gravel or from pulp and the particular object thereof is to save particles of gold and other valuable metals heretofore lost by machines of this class.

Another object is to provide a compact, easily accessible and rapidly operable machine.

I accomplish these and other objects hereinafter to be referred to by, first, providing improvements in the construction and operation of the vat or tank that receives the concentrates, or finer gold-bearing material, from the usual revolving screen which is commonly employed to eliminate the coarser material. The bottom of my improved vat or tank has a three-fold purpose, namely; first, to utilize the force of gravity for the purpose of mixing with each other the contents of opposite sides of the vat so as to obtain uniformity of mixture; secondly, to cause the solid particles to roll and grind each other and thereby free the precious metals from the refuse to a large extent even before the separating process proper is begun; thirdly, to cause all of the matter in the vat to move to a single point where it may be kept in agitated suspension, suitably treated, tempered, diluted, or the consistency thereof changed step-by-step, or in successive small quantities and in the most economical manner at the very moment that it passes from the vat or tank to be subjected to the succeeding steps in the process, economy in the consumption of water being absolutely necessary in many mining places.

I further provide means for regulating and uniformly distributing the material after it leaves the vat or tank by providing a valve-controlled outlet from which the material issues in sprays, and making provision for further controlling the fluidity of the material at this point.

Furthermore, an improved amalgamator, riffle-box, or the like, is provided. This consists of a suitable casing provided with the usual safeguards against loss of precious metal. Within this casing plates are arranged in V-shaped sets or hopper-like formations having their adjacent edges spaced apart so as to form an outlet, or opening, between each such set, for the material. Beneath each of these openings I place a trough or vessel so that its sides extend to a point above the horizontal plane of such opening and in the bottom of this trough is placed the usual bed or pocket of quick silver. This trough is designed to contain fluid which serves as a resisting medium within which the outlet from between the plates is always submerged and it serves the purpose of momentarily checking the flow and giving the heavier, or precious, metals an opportunity to settle into the quick silver. Owing to the fact that sand, pulp or other auriferous material varies considerably in different mining localities I have made provision for varying the depth, density or resistance of the above-mentioned resistance medium so as to permit free escape of the refuse without permitting escape of the gold or precious metal. The water or fluid in the trough I call leverage water and its lifting force is determined by its depth and the depth of the trough from its edges to the outlet from between the plates determines the distance the material must flow upwardly from said outlet to said edges. The greater the distance of the upward flow the less will be its lifting force; that is, the momentum gained by the solid matter at the outlet between the plates will be gradually decreased upwardly until, in the case of the metals to be caught in the trough, it is entirely overcome before the edges of the trough are reached. A plurality of sets of plates and troughs are provided so as to not only obtain a variable resisting medium for each outlet or opening between each pair of plates, but variations of the resisting mediums relatively to each other, so as to insure the eventual capture of even the most minute particles of gold and particles which are disk or boat shaped and which therefore float more easily than the more ordinary grain form. By making a careful adjustment of the different sets of plates and troughs my improved machine is capable of catching even flour gold and taking gold out of clay, something which has heretofore been exceedingly difficult to accomplish.

Another particular object of my improvements is to separate the gold from the gravel or pulp by a gentle gravity process and

thereby avoid disturbing the mercury, or causing it to "flour" or disintegrate into small beads which are carried off and lost together with such gold as they may have collected. To obviate such difficulty it is necessary to effect the separation with the aid of a mild current such as is provided for in my improved apparatus, wherein the so called "skin of the quick" is not broken and the roll of mercury is permitted to lie still in the troughs after proper adjustments of the resisting mediums. By such adjustment and arrangement the necessity of providing such uncertain expedients as riffle plates interposed in the path of the current, is obviated.

My improvement is designed also as a testing apparatus from which the requirements in the way of a permanent arrangement for any given mining ground may be determined.

Figure 1 is an end elevation partly broken away of my improved separator. Fig. 2 is a side elevation partly broken away. Figs. 3 and 4 are enlarged details of certain of the parts.

In the drawings 5 is the frame of the machine in the upper portion of which is mounted the revoluble screen 6 having the discharge end 7 thereof tapered, and open as best shown in Fig. 2. The other end of the screen is also open and will be called the feed end of the screen. A feed hopper 8 opens into the feed end of the screen. A shaft 9 extends longitudinally through the center of the screen to the tapered part and is connected to the periphery by spiders one of which 10 is shown in Fig. 2. This shaft is revolubly mounted in bearings 11 secured to the frame. The screen is provided at the junction of the main body with the tapered or discharge end with an anuular reinforcing ring 12, which engages supporting pulleys 13 which are mounted in bearings secured to the frame at that end of the screen. In the interior of the screen are the spiral conveyers 14 which cause the material that is too large to pass through the mesh of the screen to travel through the screen as it is revolved and be discharged therefrom. The screen is so mounted that a portion thereof projects into the washing tank 15 as shown by dotted lines in Figs. 1 and 2. The bottom of the washing tank has convergent sides or slopes at an angle sufficiently acute to carry the material passing through the screen into the tank to a central discharge pipe 16, at which the fluidity or consistency of the material may be conveniently and properly varied and from which the material passing through the washing tank is discharged upon a chute 17, down which it passes into the separator or amalgamator 18, which will be fully described hereafter. The sides of this chute 17 diverge from the receiving to the discharge end of the chute so as to spread out the flow into the amalgamator, and said chute is open and accessibly arranged so that the operator may observe the character of the mixture and its fluidity and control the mixture and the volume of its flow so as to secure the best possible results after it has entered the amalgamator.

A valve 19 controls the flow of the material through the discharge pipe 16. This valve is preferably made of rubber and is suitably secured upon the end of lever 20, which lever is pivoted in bearings 21 secured upon the bottom of the washing tank. A toothed detent bar 22 adjustably engages lever 20 so that the opening through the discharge pipe 16 from the washing tank can be controlled as desired. The amalgamator consists of baffle plates 23 and 24 in the top portion thereof which are preferably set at right angles to each other. The ends of these baffle plates project into grooves 25 in the end timbers 26 which are preferably constructed of wood and bolted together. Screws 27 are provided to hold the baffle plates in their adjusted positions. By moving the baffle plates upwardly a larger opening is provided between the lower ends of the baffle plates without changing their angles of inclination or the incline of the path over which the material must flow. Immediately below the opening between the upper pair of baffle plates I provide a V-shaped baffle trough 28, the sides of which are preferably shorter than the baffle plates. Below the baffle trough I provide another pair of baffle plates, and below these baffle plates are V-shaped amalgamator troughs 29, in the lower portion of which troughs I place mercury 30 to catch the gold as it is passing through the amalgamator or concentrator. For the purpose of varying the depth of each of these troughs, or the force of resistance or leverage of the liquid mass therein, the sides of these amalgamator troughs are provided with adjusting plates 31 or wings at their upper edges, which have the ends thereof in grooves 32 in the end timbers and are also provided with slots 33 therein through which bolts 34 pass. These bolts are counter-sunk and secured in the sides of the amalgamator trough and are provided with wing nuts 35 to hold the plates 31 in their adjusted positions. There are as many amalgamator troughs as may be desired in order to catch the free gold. There are as many baffle plates as there are amalgamator troughs. In some cases there is free gold in the gravel which is coated so that it will not amalgamate in the mercury. In such cases I line a portion of the amalgamator troughs with carpet or other fabric provided with a nap in which the gold will settle. In the drawings the lower trough is shown lined

with fabric, but in practice I prefer to line the upper troughs with the fabric. In some cases all of the troughs would be lined with fabric. I provide the sides of the amalgamator with covers 37 and 38 which are provided with ears 39 through which the hasp of a padlock may be placed to lock the covers upon the amalgamator. One of these covers is preferably provided at the bottom thereof with an upturned end forming a U-shaped trough 40, and when it is desired to remove the mercury from the amalgamator it will be tipped down on that side provided with the trough until the mercury runs out of the amalgamator troughs and down into the trough at the bottom of the cover, from which it would be collected in a suitable receptacle when the cover is removed.

The material that is passed over the lowest amalgamator trough falls into a receiving tank 41 from which the water may be pumped by a pump 42 and run back into the washing tank where it is used over again. The gangue will be shoveled out or otherwise removed from the receiving tank. Opening from near the top of the washing tank is a tempering pipe 43 which will lead a sufficient quantity of water from the washing tank and deliver it upon chute 17 to produce the required fluidity in the material passing down upon the chute to cause the same to pass through the amalgamator with the desired speed. This pipe may be provided with a valve 44 to regulate the quantity of water flowing therethrough. Within the tank is a starting pipe 45 which has a valve 46 on the top thereof and runs down and terminates adjacent to the discharge pipe of the washing tank. This pipe furnishes a quantity of comparatively clear water into the discharge pipe of the washing tank to prevent the material clogging at such point.

47 is the operating shaft provided with power pulley 48 to which power is applied from any suitable source. The operating shaft is provided with a sprocket wheel 49 which is connected by chain 50 with sprocket wheel 51 mounted on shaft 9, thereby providing means for rotating the screen when power is applied to the driving shaft. On the other end of the operating shaft is a disk 52 which carries a crank pin 53. This crank pin is connected by pitman 54 to walking beam 55 which operates pump 42.

I have shown the amalgamator troughs V-shaped and so arranged that the material passing through the amalgamator will overflow both sides, but if desired they could be so arranged that the material would flow over only one side, but I consider the arrangement shown in the drawings the better arrangement as it gives more capacity. If desired the amalgamator troughs could commence directly below the first set of baffle plates.

In the operation of my device the washing tank would be filled with water and the valve at the bottom of the discharge pipe closed. Gravel containing free gold or other amalgamating metal to be separated therefrom would be fed into the feed hopper and power would be applied to the operating shaft to rotate the screen at the desired rate of speed. As the screen is rotated the rock or other material that is too coarse to pass through the mesh of the screen will be worked out of the discharge end thereof by the screw conveyer, but as it passes through the screen it will be subjected to the action of the water so as to remove all fine material therefrom, which drops upon the bottom of the washing tank and the particles of solid matter slide, roll and grind against each other down to the discharge outlet of the vat or tank. As soon as a sufficient quantity of material has collected in the bottom of the washing tank the valve on the discharge pipe thereof is opened a sufficient distance to permit the desired flow of material out of the washing tank. This material passes down the chute which spreads it evenly into the amalgamator. It is caused, first, to pass between the baffle plates forming the top set and into the baffle trough, from which it flows onto the next pair of baffle plates and between this second pair of baffle plates into the first amalgamator trough. The use of the baffle trough is to thoroughly liquefy the material. A portion of the gold will be taken up by the mercury in this trough and a portion will pass over the sides of the first trough down upon the set of baffle plates below, thence into the second amalgamator trough where most of the gold passing over the first trough is caught.

I have found in practice that a very small quantity of gold will be caught in the third amalgamator trough, but for safety I prefer to provide one or two additional troughs with mercury in them, and in some cases to provide two or three additional amalgamator troughs lined with fabric at the top or bottom of the machine to catch such gold as will not amalgamate with the mercury. While I have shown the baffle plates and the sides of the amalgamator troughs at an angle of 45 degrees I do not desire to limit myself to such angle, but I have found such angle very satisfactory in practice. The angle of the baffle plates and sides of the amalgamator trough and the distances between the lower ends of the baffle plates and the height of the sides of the amalgamator troughs should be such that the material flowing therethrough will flow with sufficient velocity to carry the black sand always found in gravel

in placer mining over the sides of the amalgamator troughs and yet not with sufficient velocity to cause the mercury to flour and pass over the sides of the amalgamator troughs with the other material. This velocity can be regulated by the distance apart between the lower edges of each set of baffle plates and also by the height of the sides of the amalgamator troughs. Where there is an abundance of water the pump could be omitted.

Having described my invention what I claim is:

1. In a separator of the class described, the combination of a pair of reversely inclined plates having an opening therebetween, means for varying the size of said opening without varying the inclination of said plates, a trough adapted to contain a fluid body arranged to submerge said opening, and means for varying the depth or resistance of said body.

2. In a separator of the class described, the combination of a plurality of pairs of reversely inclined baffle plates spaced apart to form outlets, means for varying the sizes of said outlets without varying the inclinations of said plates, means for submerging said outlets in fluid resistance bodies, and means for varying the resistance of each of said bodies relative to each other and relative to each of said outlets.

3. In a separator of the class described, the combination with an amalgamator case, of a pair of plates arranged in substantially V-shaped formation having an outlet opening at the apex thereof, a trough within which said opening is placed, said trough adapted to contain a body of water that will submerge said opening, and means for varying the depth of said body of water for the purpose of varying its lifting force as set forth.

4. The combination with a separator of the class described, of a series of pairs of plates, the plates of each pair arranged at an angle with relation to each other and spaced apart to form an outlet at the apex of said angle, means for submerging each of said outlets in a body of water for each outlet and thereby providing a resistance medium for each of said outlets, means for varying the force of such resistance at each individual outlet, and means for varying such resistance mediums relatively to each other.

5. In a separator of the character described herein, an amalgamator comprising a plurality of pairs of reversely inclined plates and a plurality of amalgamator troughs, said plates and amalgamator troughs being arranged to alternate so that the material passing through the amalgamator will pass around the lowest portions of the plates and the highest portions of the amalgamator troughs, and means for varying the depths of said amalgamator troughs and thereby the distance that material must travel from said lowest to said highest portions.

In witness that I claim the foregoing I have hereunto subscribed my name this 14th day of March, 1908.

WILLIAM R. MORSE.

Witnesses:
G. E. HARPHAM,
S. B. AUSTIN.

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