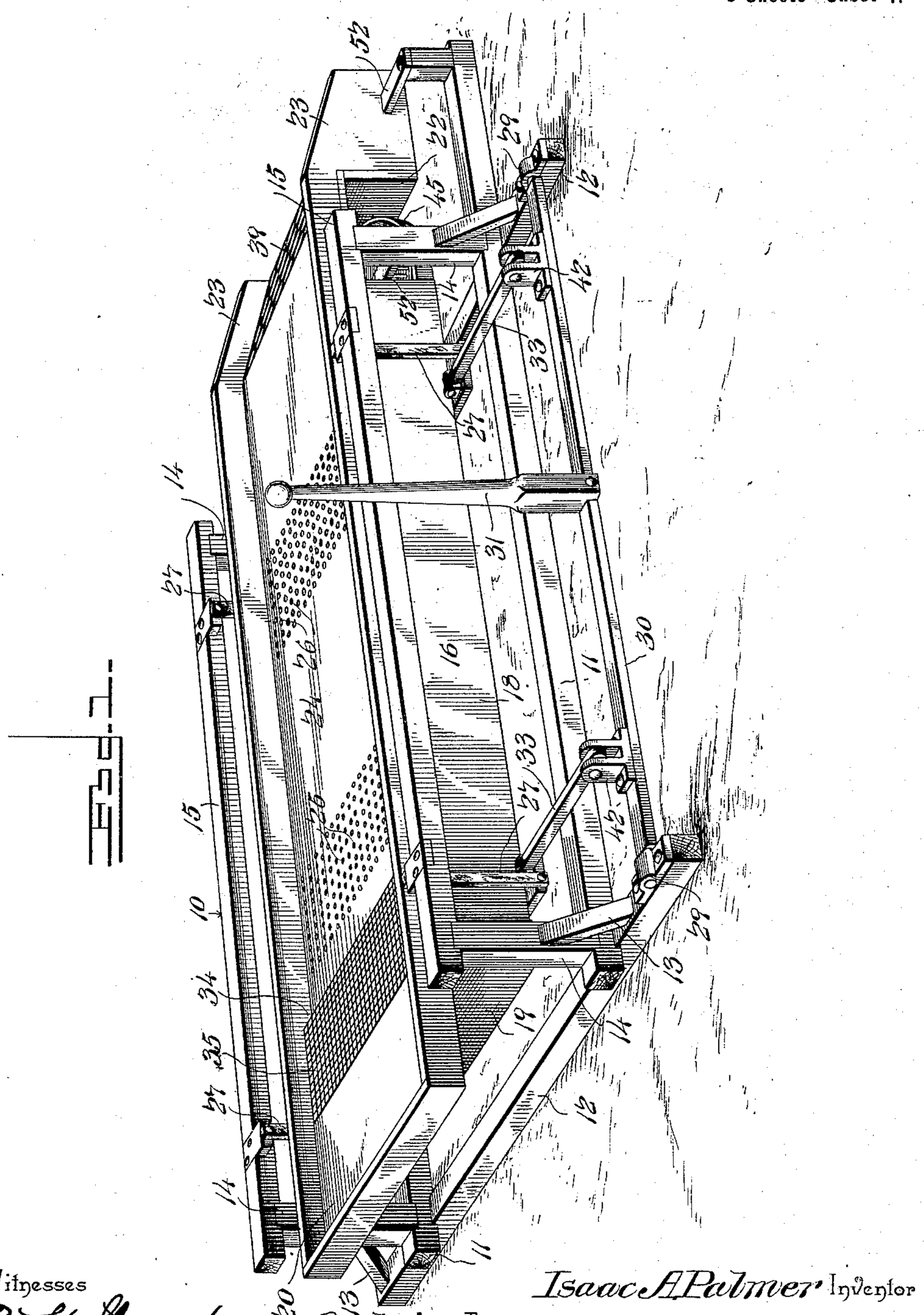
No. 639,089. Patented Dec. 12, 1899.

I. A. PALMER.

ORE SEPARATOR AND AMALGAMATOR.

(Application filed Apr. 12, 1899.)

(No Model.) 3 Sheets—Sheet 1.



Witnesses
E. F. Stewart.
H. B. Benedict

Isaac A. Palmer, Inventor
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3 Sheets—Sheet 2.

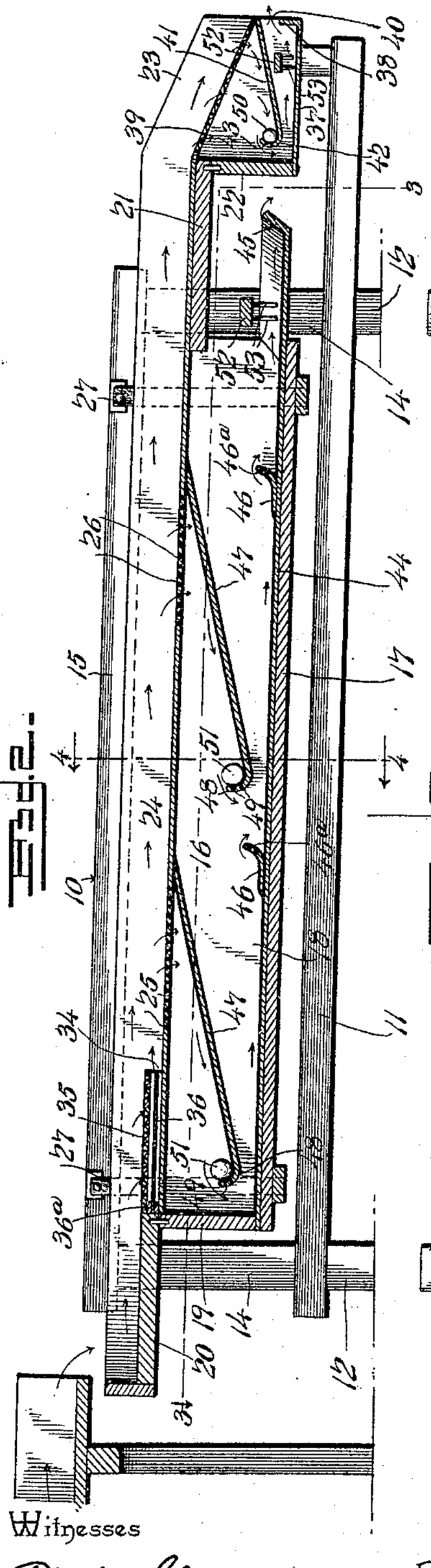

Fig. 2.

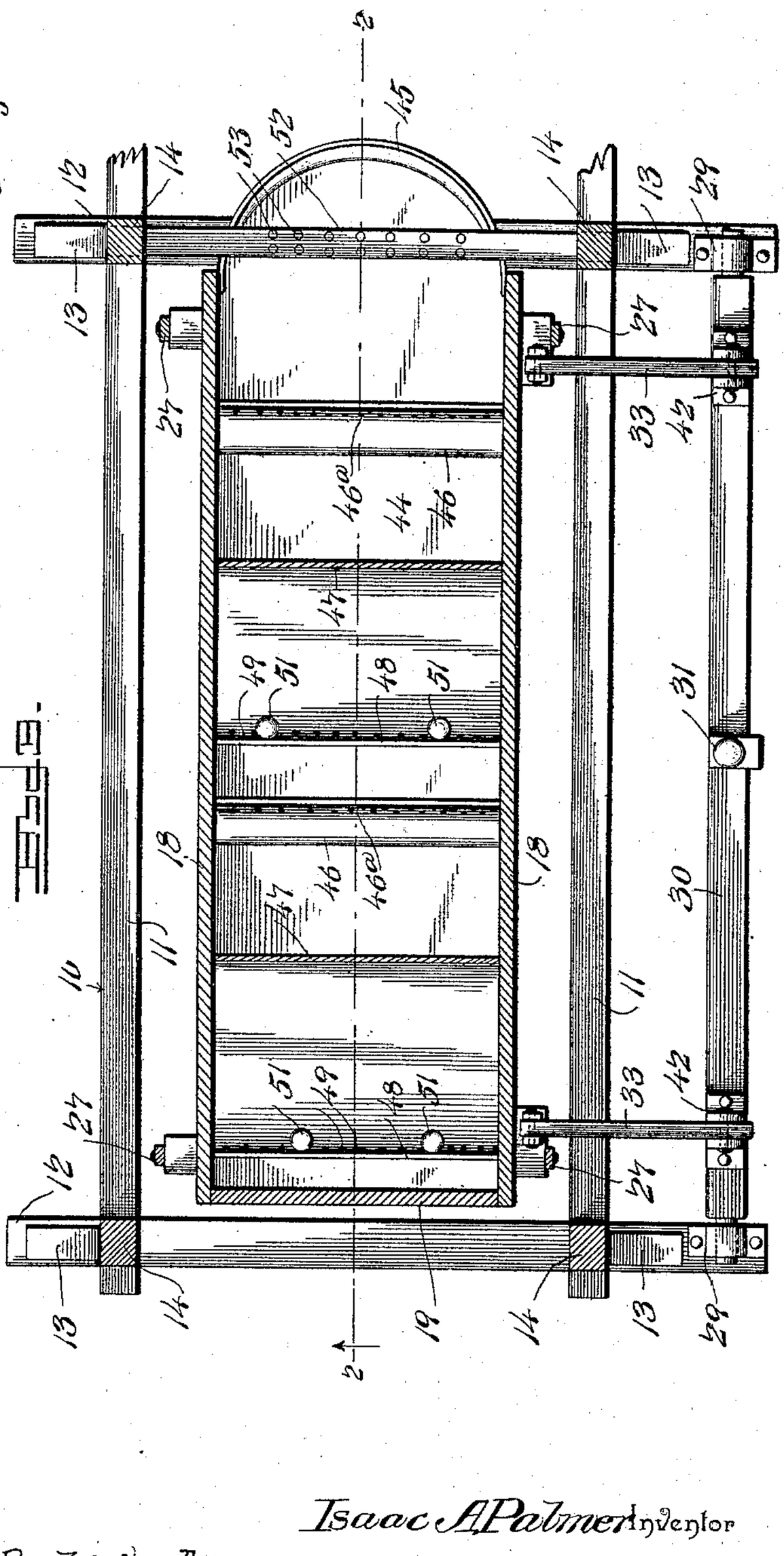

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

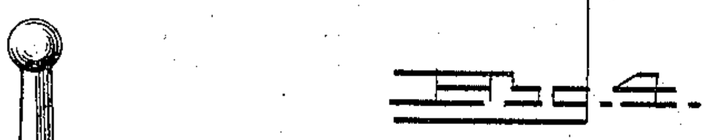
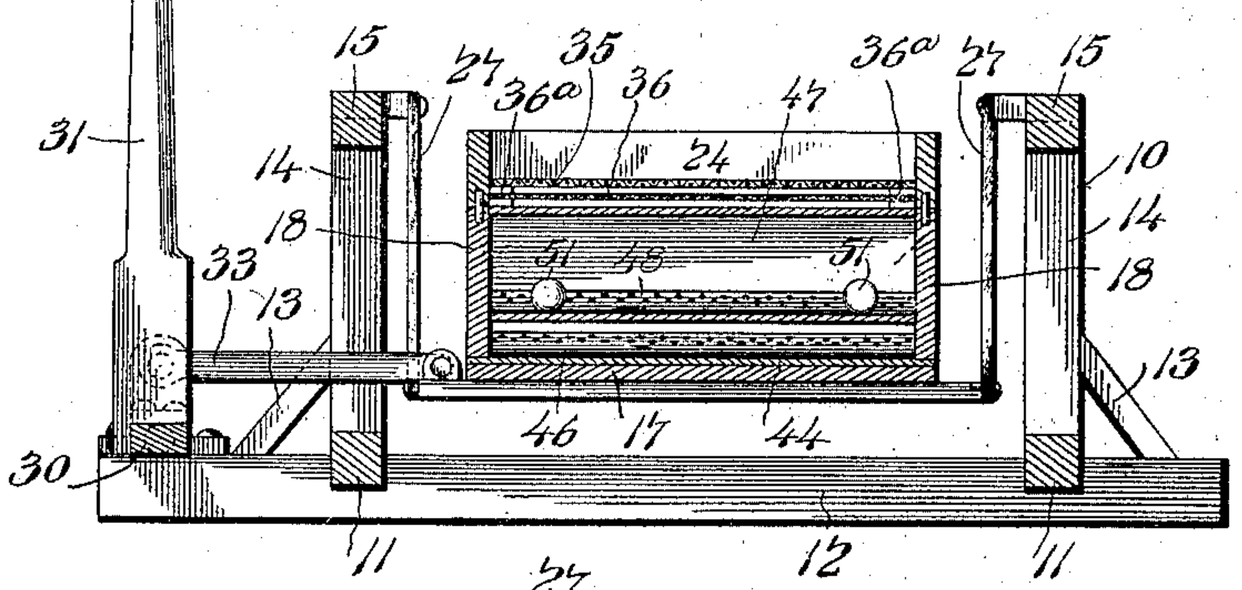


Fig. 4.



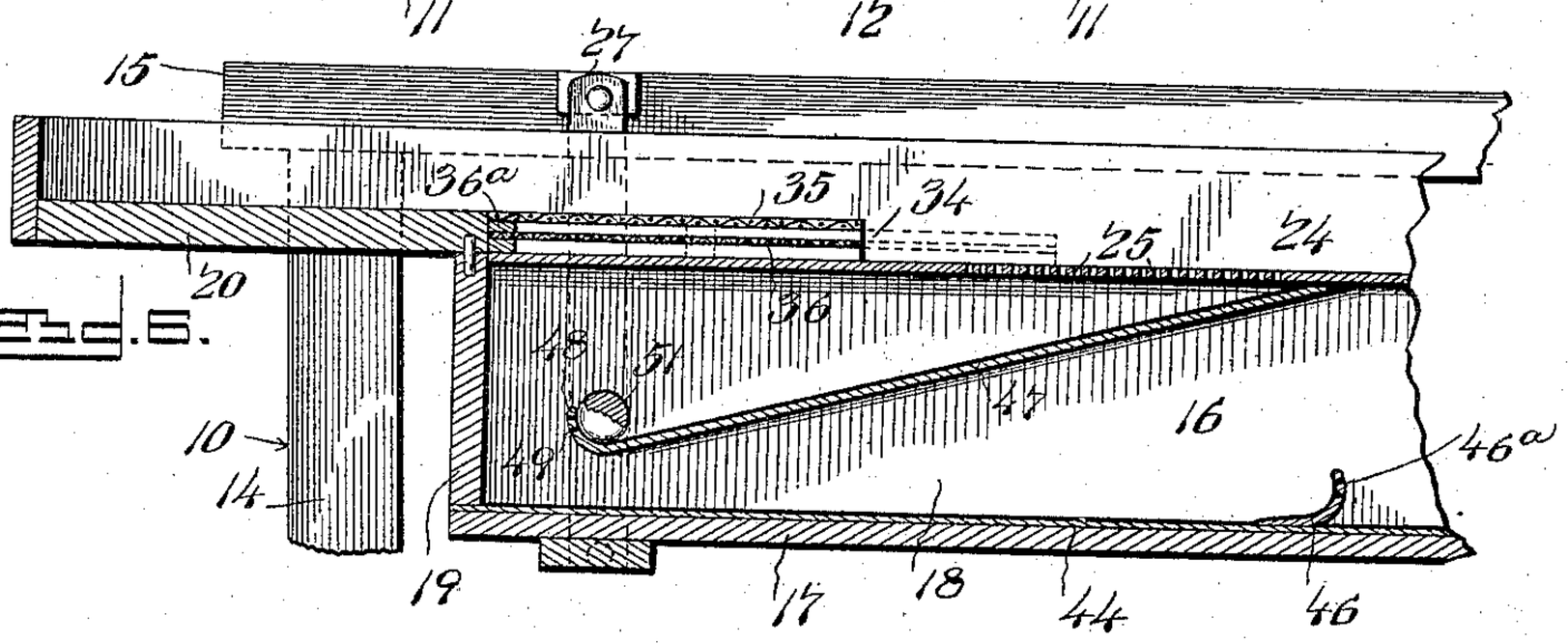


Fig. 5.

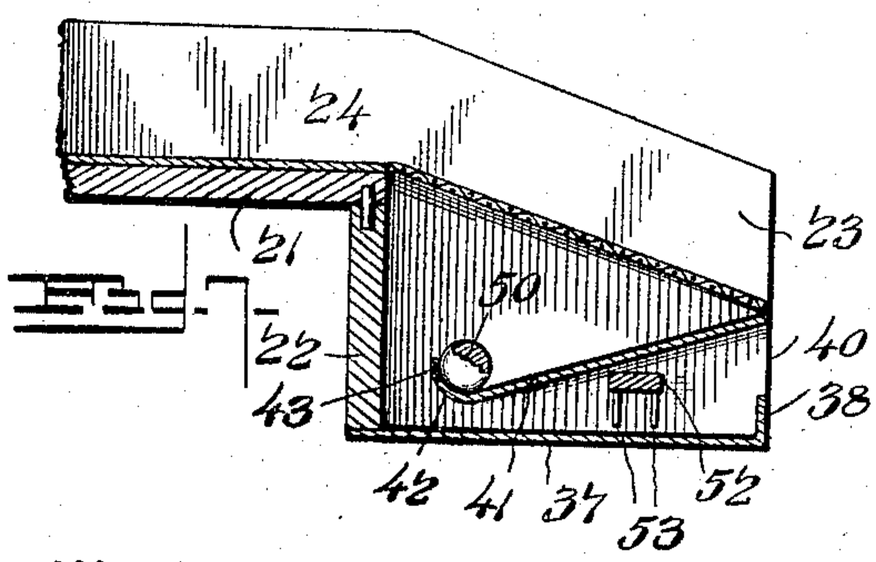


Fig. 7.

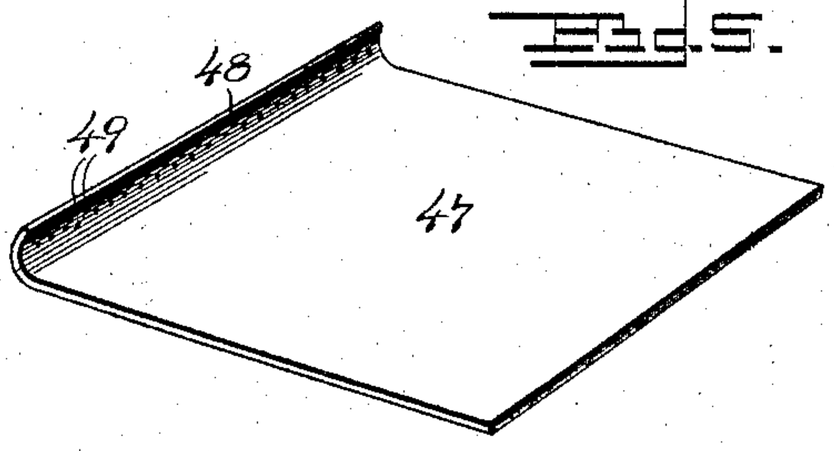


Fig. 6.

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UNITED STATES PATENT OFFICE.

ISAAC A. PALMER, OF SEATTLE, WASHINGTON.

ORE SEPARATOR AND AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 639,089, dated December 12, 1899.

Application filed April 12, 1899. Serial No. 712,775. (No model.)

To all whom it may concern:

Be it known that I, ISAAC A. PALMER, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented a new and useful Ore Separator and Amalgamator, of which the following is a specification.

This invention relates to ore separators and amalgamators of that class wherein wet ore in a pulpy condition is treated to effect the separation by screening of the gravel and coarse sand or dirt from the fine black sand and small particles of gold, such as flake or flour gold.

One of the difficulties heretofore encountered in saving gold by the placer-mining process and appliances resides in the interference of the fine black sand with the amalgamation of the fine particles of gold. I have constructed my machine with aprons and riffles which are carried by a laterally shaking or vibrating box, and these elements are arranged to permit of the free escape of the black sand, while allowing the uninterrupted amalgamation of the fine particles of gold by said aprons and the riffles.

The primary purpose of the present invention is to provide an apparatus especially designed for the collection of the extremely fine particles of or the flake or flour gold which, under the familiar process of treatment, is allowed to escape with the water, sand, and gravel, whereby the efficiency of the apparatus is promoted and its capacity for collecting fine gold is increased.

A further object of the invention is to provide an apparatus in which the washings of coarse gravel, sand, and dirt are subjected to a panning operation before their escape from the machine, thus saving the fine particles of gold which would have a tendency to be carried off with the gravel and dirt that is separated from the fine sand and gold at the initial stage of treatment of the gangue or gold-bearing soil.

With these ends in view the invention consists in the novel combinations of elements and in the construction and arrangement of parts, which will be hereinafter fully described and claimed.

To enable others to understand the invention, I have illustrated the preferred embodiment thereof in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a perspective view of an ore separator and amalgamator. Fig. 2 is a vertical longitudinal sectional elevation on the plane indicated by the dotted line 2 2 of Fig. 3. Fig. 3 is a horizontal sectional plan view illustrating the amalgamator-pan, the plane of the section being indicated by the dotted line 3 3 of Fig. 2. Fig. 4 is a vertical transverse section on the line 4 4 of Fig. 2. Fig. 5 is an enlarged detail perspective view of one of the riffles. Fig. 6 is an enlarged detail sectional view of a portion of the grizzly, showing the primary coarse screen and the fine amalgamator-screen at the fall situated at the head of the grizzly. Fig. 7 is an enlarged detail section through the tailings-receptacle of the shaking-box.

Like numerals of reference denote like and corresponding parts in each of the several figures of the drawings.

The frame 10 of the improved machine consists of the longitudinal base-sills 11, the cross-sills 12, the struts or braces 13, the posts 14, and the longitudinal carrying-rails 15. All these parts are joined solidly together in any suitable way to present a substantial rigid structure, and the rails 15 are arranged in horizontal elevated positions on the posts 14 for the purpose of suspending the vibrating box by which all of the operating devices are carried. The shaking-box 16 is arranged within this supporting-frame 10, and the width of said box is less than that of the frame for the purpose of hanging the box within the frame to enable a transverse shaking or vibrating motion to be imparted thereto. This shaking-box exceeds in length the supporting-frame within which it is suspended, and the box is thus adapted to receive the gangue beyond one end of the frame and to discharge the gravel, dirt, and sand beyond the opposite extremity of the frame. This box consists of the bottom 17, the sides 18, and the vertical end wall 19 adjacent to the receiving end of said box. This receiving end of the box is provided with a horizontal headboard 20, which lies at right angles to and extends beyond the end wall 19, and said headboard is firmly secured to the sides and end

of the box, whereby the ore may be deposited upon the head-board to be fed to the grizzly. At the discharge end of the box the sides 18 thereof are cut away to provide the extensions 23, and to the vertical edges of these extensions there is secured the vertical board 22, while the foot-board 21 is secured to the sides in a horizontal plane below the head-board 20. The foot-board 21 and the vertical board 22 lie at right angles to each other adjacent to the delivery end of the box, and this vertical board 22 and the extensions 23 of the sides assist in forming a tailings-box, to be presently described, in which the tailings are deposited for treatment before their final discharge from the machine.

The grizzly 24 consists of a metallic plate or sheet which is secured firmly to the upper part of the shaking-box. This grizzly is secured to the box for its end at the head of the box to lie below the head-board 20, while the opposite end of the grizzly rests upon the foot-board 21, said grizzly being united to the sides, the head-board, and the foot-board of the box to secure water-tight joints between the parts. The grizzly is provided with groups of perforations at points intermediate of its length, and in the embodiment of the invention represented by the drawings I have shown two of such groups of perforations and indicated the same by the reference-numerals 25 26. The group of perforations 25 is formed in the grizzly near the head-board thereof, while the other group of perforations 26 is contiguous to the foot-board, thus leaving the grizzly imperforate in the intervals or sections between such perforations.

The box is suspended within the frame 10 by the hangers or links 27, each of which has one end connected with the frame, while its other end is attached to the shaking-box 16. It is immaterial whether these hangers are made of straps or metal; but in the cheap portable class of machines I prefer to use leather straps which are well oiled, while in other kinds of machines metallic bars or links may be pivoted to the frame and the box to allow the latter to vibrate or shake transversely within the frame.

The embodiment of the invention represented by the accompanying drawings embraces hand appliances for shaking the suspended box, and in this type of operating mechanism I employ a horizontal rock-shaft 30, which is arranged longitudinally of the machine at one side of the shaking-box, and the ends of this rock-shaft are journaled in proper bearings 29, which are secured to extended ends of the cross-sills 12, as shown by Figs. 1 and 3. This rock-shaft has an upright hand-lever 31 secured firmly thereto, and on opposite sides of this hand-lever short posts 42 are secured firmly to the rock-shaft 30. These posts extend upwardly from the rock-shaft, and to their upper ends are pivotally attached the links or pitmen 33, which are connected to the shaking-box on one side thereof for the purpose of communicating the motion of the rock-shaft and the posts to the box 16.

An imperforate section of the grizzly is provided between the first group of perforations 25 and the head-board 20, and this end of the grizzly is secured to the under side of the head-board for the purpose of forming the drop or fall 34 at the head of the grizzly. This drop or fall accommodates a coarse heavy separator-screen 35 and an amalgamated fine screen 36, and both of the screens are arranged over the imperforate section of the grizzly between the head-board 20 and the perforations 25 in the grizzly. The coarse heavy screen 35 is secured to the sides of the box in a position to lie flush with the upper surface of the head-board 20, and said coarse screen should be properly supported, so that it will not settle in the middle thereof when loaded with gravel or sand. The fine amalgamator-screen 36 is made of fine copper wire-netting having from eight hundred to one thousand meshes to the square inch, and this netting is well cleaned with acid and is charged with pure mercury to give an amalgamating-surface thereto. The fine amalgamator-screen is secured to a light frame of wood 36^a, and this screen 36 is arranged beneath the coarse separator-screen 35 midway between the latter and the imperforate section of the grizzly, so as to leave a space between the amalgamator-screen 36 and the separator-screen 35 and also between the imperforate section of the grizzly and the amalgamator-screen, whereby the last-named screen can be adjusted beneath or removed at will from the coarse heavy screen. The coarse screen 35 will carry out the coarse gravel and other material, while the water and fine pulp will descend through the meshes of the screen 35 to and upon the fine amalgamator-screen 36, and the fine gold which comes in contact with the screen 36 will be caught and amalgamated with the mercury film thereon. The water, the fine black sand, and other fine waste material which does not amalgamate with the mercury film of the screen 36 will pass through the minute meshes of said screen 36, and thus the material is treated at the point of its reception in the machine to collect a part of the fine gold.

At the discharge end of the vibrating box I provide a tailings-receptacle. This receptacle is formed in part by the extensions 23 of the sides 18 and the vertical board 22 of the box 16, and the receptacle is completed by fastening a copper plate 37 to the extensions 23 and the board 22, the joints between the parts being made water-tight to retain the fine materials. This copper plate has its inner surface coated with quicksilver as an amalgamating agent, and at the delivery end of the tailings-receptacle this plate is formed with a vertical flange 38.

At the lower end of the shaking-box I provide an inclined screen 39, which is secured

vided with a curved riffle 48, the latter being provided with a plurality of perforations 49 and having the upper concave face thereof coated with a suitable amalgam. In each of the riffles there is provided a series of two or more collector-balls 51, which are loosely arranged in the riffles to travel back and forth therein, and each collector-ball has its spherical surface covered with a mercury film to constitute an amalgamating-surface. In the practical construction of my machine I prefer to make each apron and the riffle of copper and to coat the surface thereof with quicksilver; but it is understood, however, that the apron may be made of other materials—such as iron, wood, burlap, blanket, tin, carpet, or any other suitable material—in which event the riffle must be made of copper plate, curved and perforated, as described, and having the amalgam film on the concave face thereof, said riffle being attached to the lower end of the apron in order to separate the black sand from the gold.

It will be observed that each riffle is perforated for the purpose of discharging the black sand through such perforations, while the fine gold is designed to be caught by and amalgamated with the mercury film of the riffle. In the absence of the perforations in the riffles the black sand would have a tendency to fill the riffles completely and would pack solidly in the riffles, so that the fine gold would escape.

I provide the shaking-box and the tailings-receptacle with agitator-bars 52, which are suitably secured in horizontal positions above the amalgam films on the pan 44 and the plate-like bottom 37 of the tailings-receptacle, and each of these agitator-bars is provided with a series of stirrers or agitators 53, which are secured firmly to the bars and have their free ends contiguous to the bottom of the pan 44 and the plate 37 of said tailings-receptacle. The agitators serve to stir up the black sand in the collector-pan of the tailings-receptacle, so that the sand cannot become packed and cause the gold to escape over the rim of the pan or the flange of the tailings-receptacle.

It will be understood that my machine may be made of various sizes, from the small hand-power machine up to machines of large capacity. It is my purpose to manufacture machines which will be large and strong enough for use at the lower end or dump of flumes of large capacity employed in hydraulic mining for the purpose of saving a large amount of fine gold that escapes in the ordinary process of hydraulic mining. In this adaptation of the invention the machine must be stronger and heavier throughout all its working parts, including a strong framework, strong screens of heavy sheet-iron or perforated cast-iron adapted to carry off the heavy gravel and boulder, and all bearings and connections must be of substantial metal. It is evident that power mechanisms for shaking the box may be substituted for the hand-power mechanism. It will also be understood that in machines of large capacity the number of riffles and aprons may be increased, and this increase in the number of riffles may be effected on the aprons individually on the collector-pan 44 and in the tailings-receptacle.

From the foregoing description it will be noted that the grizzly, the tailings-box, and the screens at the head of the grizzly are all supported by the framework attached to the swinging box, which is suspended in the framework, and all of said devices are removable at will from the machine without affecting the lower box thereof in order to remove and replace the aprons and riffles when it becomes necessary to clean up and remove the amalgam and gold from the machine. The frame for the grizzly is constructed, preferably, of wood, and the grizzly, the tailings-box, and the screens are attached to said frame for removal therewith. The sides of the grizzly-frame should be directly over the main box below it, and they may be connected to said box by dowels or otherwise, as shown by dotted lines in Figs. 2 and 4. Although I have described that the grizzly is perforated at intervals, I may use a plate with perforations throughout its width and length when one machine is used for treating certain kinds of material.

Changes in the form, proportion, size, and the minor details of construction within the scope of the appended claims may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

What I claim is—

1. In an ore separator and amalgamator, a suspended box provided with a grizzly perforated at intervals throughout its length, a collector-pan fixed to the box below the grizzly and provided with perforated riffles, a series of aprons within the box, below the perforated sections of the grizzly, and each having a perforated riffle in staggered relation to the riffles on the collector-pan, a primary screen at the head of the grizzly, a tailings-receptacle at the delivery end of the box and provided with an inclined apron and a riffle, and a discharge-screen extending from the grizzly over the tailings-receptacle, substantially as described.

2. In an ore separator and amalgamator, a shaking-box provided with a grizzly and with a tailings-receptacle, a collector-pan attached to said box below the grizzly, a series of inclined aprons secured within the box and the tailings-receptacle thereof, and the curved perforated riffles at the lower discharge ends of said aprons and having the amalgamated balls or spheres confined loosely therein, substantially as described.

3. In an ore separator and amalgamator, a shaking-box provided with a series of riffles, each having its concave face coated with an amalgam film, each riffle being further pro-

firmly between the sides of the box and has its upper edge arranged flush with the tail end of the grizzly. This screen inclines downwardly from the grizzly, and its lower edge terminates above the vertical flange 38 of the plate-bottom 37 to the tailings-receptacle, thus forming an overflow discharge-opening 40 from the tailings-receptacle and below the lower edge of the screen 39. This screen is thus arranged over the tailings-receptacle in a position to discharge the coarse materials and gravel which may travel through the box upon the grizzly, and the fine sand and particles of gold contained therein are free to pass through the meshes of the screen 39, so as to lodge within the tailings-receptacle. An inclined apron 41 is secured firmly in place within the tailings-receptacle below the screen 39, and this apron 41 assumes a position within the tailings-receptacle inclined reversely to the inclination of the screen 39. This apron may consist of a copper plate having its upper surface coated with an amalgam film, and said apron extends from a line near the discharge end of the screen, across the tailings-receptacle, and terminates above the bottom or plate of said tailings-receptacle contiguous to the vertical board 22. The inclined apron is thus arranged relatively to the screen 39 to receive the fine materials and gold which may pass therethrough, and this apron is provided at its free edge with an upwardly-curved riffle 42. This riffle may be formed on the apron 41 by bending or curving the lower edge thereof, or the riffle may consist of a copper plate suitably attached to the lower edge of the apron. The riffle has its inner concaved face coated with an amalgam film, and it is provided with a plurality of perforations 43, which permit the fine materials, such as sand, to pass through the riffle, while the fine particles of gold will become amalgamated with the mercury film on the concave face of the riffle. The riffle supports a series of two or more amalgamator-balls 50, which are loosely placed in the riffle, to be confined therein by the curvature of its plate, and these balls consist of a suitable metal having their spherical surfaces covered with a mercury film. The balls are placed loosely in the curved riffle, and they are free to travel or move therein when the box 16 is agitated sidewise.

The inclined screen 39 at the tail of the grizzly carries off the coarse gravel and other waste materials, and all of the fine pulp and other gold-bearing materials in the tailings will pass through the meshes of this screen 39 to lodge upon the apron 41. These fine materials traverse the apron toward the riffle. They are deposited on the amalgamated bottom plate of the tailings-receptacle, and the sand and other refuse are discharged through the overflow-opening 40 at the rear end of the tailings-receptacle. It will be understood that the apron, the riffle, and the bottom or pan of the tailings-receptacle are to be made of copper, well cleaned and charged with mercury. All the gravel and the gold-bearing material that may have traversed the perforated main screen or grizzly and arrived at the tailings-screen 39 is thoroughly washed, and the coarse materials will pass over the screen 39, while the fine material will lodge within the tailings-receptacle. The apron, riffle, and bottom of the tailings-receptacle being provided with amalgamator-surfaces compels the fine gold to come in contact with the mercury to be amalgamated therewith. One of the important features of this tailings-receptacle and of the machine generally is that there is very little waste of water, because the water will pass either through the grizzly or through the tailings-screen 39. It is well known that water, wherever it may flow, will carry with it the fine flake or flour gold, and by compelling the water to pass through my machine and by screening off the coarse gravel and other waste materials the water will carry the fine gold to the devices provided for its amalgamation, while the coarse waste material is discharged in a comparatively dry condition.

At the lower side or bottom of the swinging box I provide a collecting-pan 44, which is secured firmly to the sides and the end board 19 of said box, the joints being water-tight between the box and the pan to prevent the waste of water and the materials. At the lower end of this pan 44 is provided a raised segmental flange or rim 45, which gradually merges into a perpendicular at each side where the rim is secured to the box. This bottom pan 44 is of copper plate, having its upper surface coated with mercury, and the oscillating or vibrating sidewise motion of the box causes the water and the pulp contained within the pan to whirl from the sides thereof as it comes in contact with the curved rim, thereby forming small eddies in the moving liquid mass and precipitating the fine gold to the amalgamated surfaces of the pan, whereby the gold is caught and retained in the pan. The pan is provided at intervals of its length with transversely-arranged curved and perforated riffles 46, and near the tail end of the pan a series of discharge-openings 46ª is provided in the bottom of the pan within the raised flange or rim thereof.

Beneath the grizzly 24, which is carried by the shaking-box, I provide a series of inclined aprons 47. These aprons are secured within the box between the pan 44 and the grizzly 24, and the aprons are arranged below the perforated sections 25 26 of the grizzly, whereby the fine materials which pass through the openings in the grizzly are adapted to lodge upon the aprons 47. The aprons are joined with the grizzly at lines below the groups of perforations therein, and these aprons are inclined in a direction toward the vertical end 19 at the head of the box. The aprons terminate a suitable distance above the collector-pan 44, and each apron is pro-

vided with a plurality of perforations in its bottom, and an amalgamated collector-ball confined loosely in each curved riffle, substantially as and for the purpose set forth.

4. In an ore separator and amalgamator, a shaking-box provided with a perforated grizzly, a series of aprons supported below the perforations in said grizzly and each inclined reversely to the course of the ore as it traverses the grizzly, a series of amalgamated riffles at the free edges of said aprons, each riffle provided in its bottom with a plurality of sand-escape perforations, and collector-balls confined in said curved riffles, substantially as described.

5. An ore separator and amalgamator comprising a shaking-box, a perforated grizzly attached to said box, means for imparting lateral shaking motion to said box, a collector-pan carried by the box and disposed longitudinally of and below said grizzly, a series of aprons within said box, between the grizzly and the collector-pan, and inclined downwardly from the grizzly toward the head of the box to terminate above the bottom of said pan, a perforated and amalgamated riffle at the free edge of each apron, and a collector-ball confined in each riffle and movable freely in a direction transversely across the box on the vibration thereof, substantially as described.

6. An ore separator and amalgamator comprising a shaking-box provided with a grizzly, a tailings-receptacle carried by said box at its delivery end and having an amalgamated bottom terminating in a vertical flange, a screen inclined from the grizzly and extending over said flange of the tailings-receptacle to form overflow-openings between the lower edge of said screen and the flange, and an apron disposed within the tailings-receptacle below the screen and inclined toward the head of said receptacle, said apron provided at its free edge with a perforated riffle, substantially as described.

7. An ore separator and amalgamator comprising a shaking-box provided with a grizzly, a tailings-receptacle carried by said box, an inclined separator-screen attached to said tailings-receptacle, an apron supported in the tailings-receptacle below said screen and inclined reversely thereto, a curved perforated riffle at the free lower edge of said apron, and a collector-ball confined loosely in said riffle, substantially as described.

8. An ore separator and amalgamator comprising a shaking-box provided with a grizzly, a collector-pan secured to said box below the grizzly and provided with a raised curved rim at its delivery end, a series of riffles fixed to the bottom of the collector-pan, a series of aprons supported in the box between the grizzly and the collector-pan and inclined from said grizzly toward the head of the pan, a series of riffles at the free edges of the aprons and arranged alternately with the riffles on the bottom of the collector-pan, each riffle having the perforations and an amalgam film, and an agitator supported within said box above the collector-pan therein, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ISAAC A. PALMER.

Witnesses:
RALPH SIMON,
H. LEWIS.