(No Model.) 3 Sheets—Sheet 1.

H. R. HANCOCK.

JIGGING MACHINERY FOR DRESSING ORES.

No. 540,659. Patented June 11, 1895.

Fig. 1.

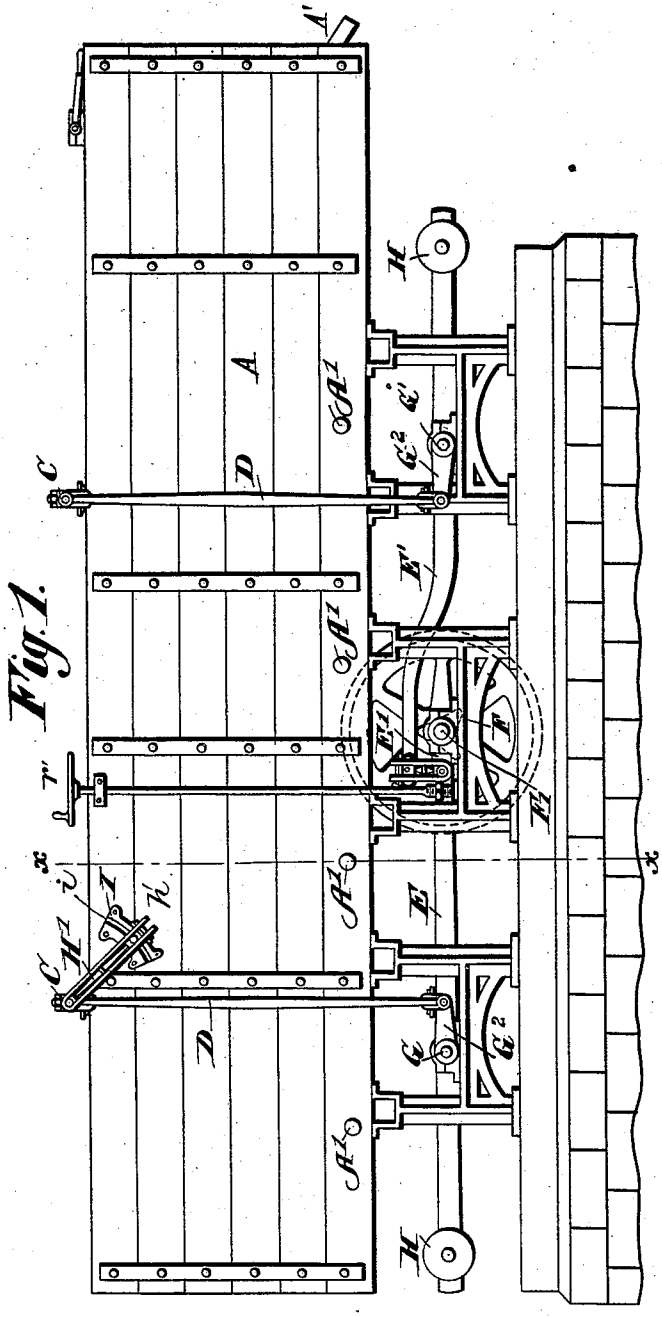
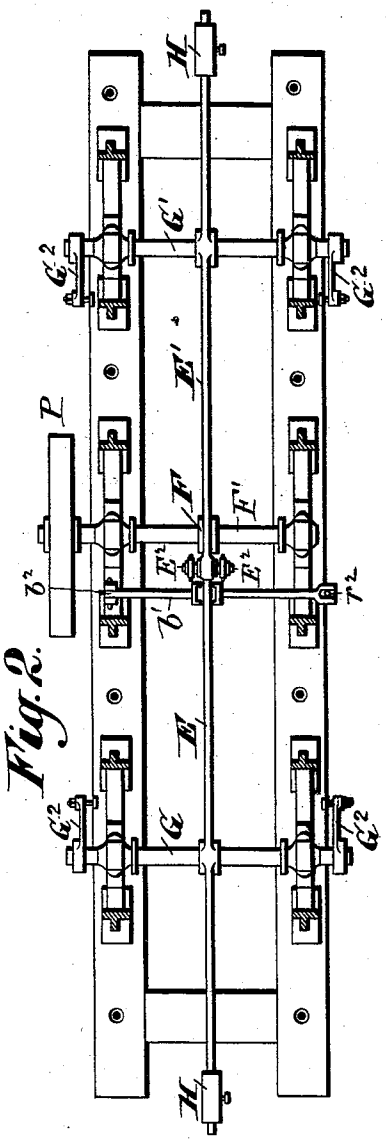


Fig. 2.



Witnesses:
H. G. Dieterich
Henry Orth

Inventor:
Henry R. Hancock
by Henry Orth
Atty

(No Model.) 3 Sheets—Sheet 2.

H. R. HANCOCK.

JIGGING MACHINERY FOR DRESSING ORES.

No. 540,659. Patented June 11, 1895.

Fig. 3.

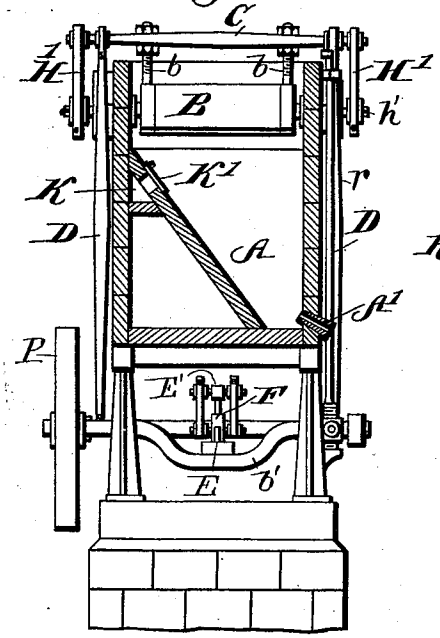


Fig. 6.

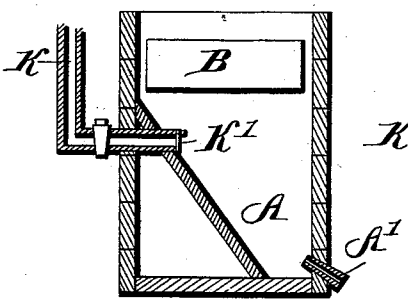


Fig. 7.

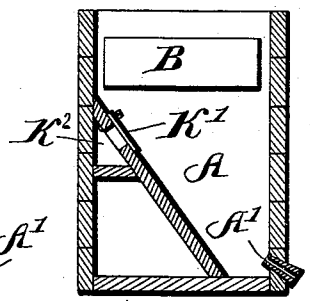


Fig. 9.

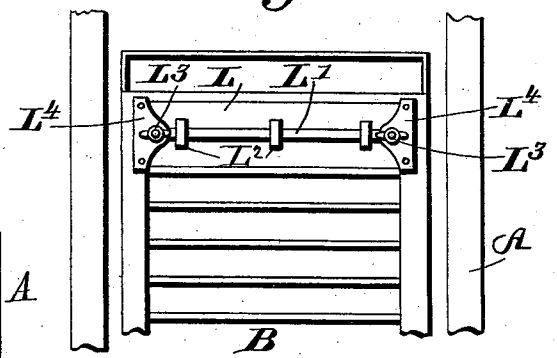


Fig. 8.

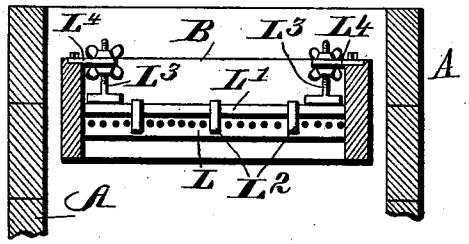
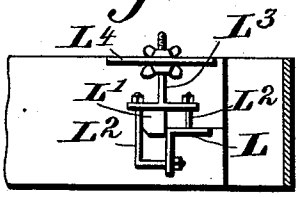


Fig. 10.



Witnesses:
H. G. Dieterich
Henry Orth

Inventor:
Henry R. Hancock.
By Henry Orth
Atty.

(No Model.) 3 Sheets—Sheet 3.

H. R. HANCOCK.

JIGGING MACHINERY FOR DRESSING ORES.

No. 540,659. Patented June 11, 1895.

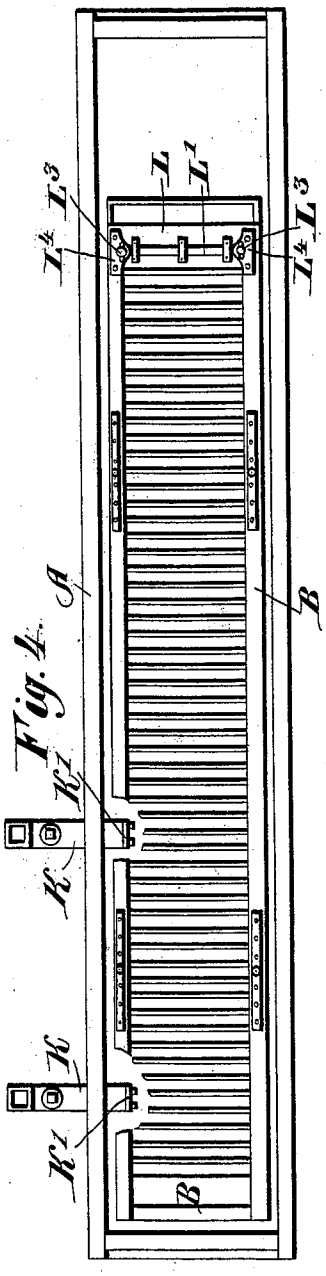


Fig. 4.

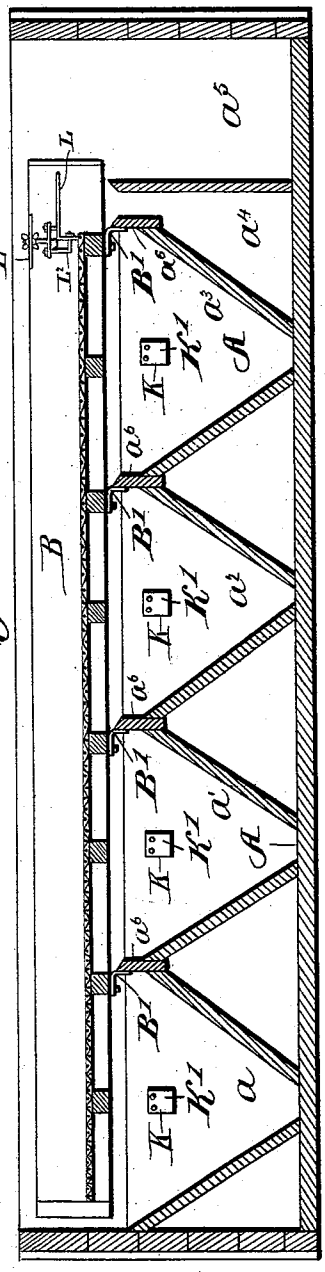


Fig. 5.

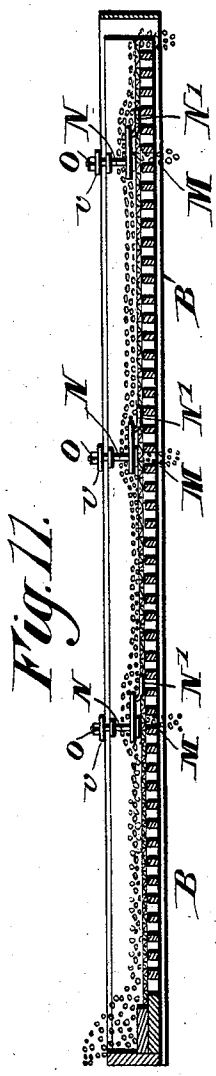


Fig. 7.

Witnesses:
H. G. Dieterich
Henry Orth

Inventor:
Henry R Hancock
by Henry Orth Atty

UNITED STATES PATENT OFFICE.

HENRY RICHARD HANCOCK, OF MOONTA MINES, SOUTH AUSTRALIA.

JIGGING MACHINERY FOR DRESSING ORES.

SPECIFICATION forming part of Letters Patent No. 540,659, dated June 11, 1895.

Application filed December 27, 1893. Serial No. 494,920. (No model.) Patented in New South Wales August 10, 1891, No. 3,173; in South Australia August 12, 1891, No. 2,010; in Victoria August 12, 1891, No. 8,953; in Queensland August 15, 1891, No. 1,822, and in Tasmania August 18, 1893, No. 1,191/10.

To all whom it may concern:

Be it known that I, HENRY RICHARD HANCOCK, mine superintendent, a subject of the Queen of Great Britain, residing at Moonta Mines, in the Province of South Australia, have invented certain new and useful Improvements in Jigging Machinery for Dressing Ores, (for which I have obtained patents in the following countries, to wit: South Australia, No. 2,010, dated August 12, 1891; in Victoria, No. 8,953, dated August 12, 1891; in New South Wales, No. 3,173, dated August 10, 1891; in Queensland, No. 1,822, dated August 15, 1891, and in Tasmania, No. 1,191/10, dated August 18, 1893;) and I do hereby declare the following to be a full, clear, and exact specification 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 letters of reference marked thereon, which form a part of this specification.

My invention has relation to ore washers, separators or concentrators, and it has for its object the provision of means whereby the separation or concentration is effected more rapidly and more thoroughly than in machines of this class as heretofore constructed.

As is well known, the separation of ores as practiced in jigging machines, whether the screen is immersed in water or not, is dependent upon the difference in the specific gravity of the ore and gangue, and in order to more effectually carry out the separation it has been proposed to impart to an immersed screen a compound reciprocating motion, *i. e.*, a rising and falling motion in addition to its jigging or horizontal reciprocating motion, for the purpose of forcing the water through the mesh of the screen during its descending motion and thereby displacing and separating the ore thereon to allow the heavier particles to more readily separate from the lighter gangue and subside and at the same time to lift the lighter material to the surface of the ore. One of the main objects of my invention is to facilitate this displacement or scattering to a greater or less extent of the material on the screen, as I have found that the mere rising and falling motion of the latter is in many cases insufficient to effectually displace or disperse the material. This I attain by causing an intermittent flow or rush of a considerable volume of water to the hutch or vessel below the screen, such inflow being controlled by the rising and falling motion of said screen, in such manner that the inflow will take place during the rising movement, and is stopped by the falling movement of the screen, causing a corresponding rush of water through the meshes of such screen whereby the material is more effectually separated or dispersed.

In the accompanying drawings, illustrating my invention, Figure 1 is an elevation of an ore washer, separator, or concentrator, illustrating the mechanism for imparting to the screen a compound reciprocating motion, Fig. 2 being an under side view of the hutch or tank, illustrating a portion of said mechanism in plan. Fig. 3 is a transverse sectional view taken about on line *x x* of Fig. 1, looking toward the right. Fig. 4 is a top plan view of the hutch and its screen, the latter being partly broken away to show the water-inlets and having its screen-cloth removed. Fig. 5 is a longitudinal vertical section of the hutch and its screen, illustrating principally the arrangement of the hutch-compartments relatively to the varying fineness of mesh of the screen-sections, the means for admitting water to the hutch below the screen, and the means for preventing the passage of the water from one compartment to the other. Figs. 6 and 7 are vertical transverse sectional views of the hutch and its screen, illustrating the means of admitting water to the hutch-compartments below the screen and a modification thereof, respectively. Figs. 8 and 9 are part plan and part vertical transverse sections of the hutch and screen, illustrating means for separating the heavier dredgy particles,—*i. e.*, particles that contain a percentage of metal and have been carried to the tail end of the screen with the gangue—Fig. 10 illustrating such means in side elevation; and Fig. 11 is a longitudinal section, partly in elevation, of a screen particularly adapted for separating or washing coarse ores.

Similar letters of reference indicate like

parts wherever such may occur in the above described figures of drawings, and in these, A, indicates the trough or hutch divided by transverse partitions into any suitable number of compartments, a, a', a^2, a^3, a^4, a^5, Fig. 5. The compartments a to a^3 receive the dressed ore, the compartment a^4 the dredgy material or vein stuff, namely, such materiel as still contains a percentage of metal, while the compartment a^5 receives the gangue or tailings, each of said compartments being provided with a suitable tap hole A' near the bottom thereof that is normally closed by a plug, or the discharge of the contents from the compartments may be effected and controlled in any other desired manner.

Within the upper portion of the hutch is located a screen B of varying mesh, the finer being at the head and the coarser at the tail, said screen preferably increasing in coarseness for each successive compartment a to a^3. The screen receives a compound reciprocating movement, *i. e.*, a reciprocating movement in horizontal and in vertical planes, through the medium of the following instrumentalities.

The screen B has secured thereto near its opposite ends hanger rods b b, that in turn are secured to cross rods or bars C, whose opposite ends are secured to one end of vertical supporting rods D, which latter are pivotally connected with crank or radial arms G^2 respectively secured to shafts G, G', mounted in suitable bearings below and transversely of the hutch, Figs. 1 and 2. To each of the shafts G, G', is secured a lever E and E' respectively, the inner ends of which are coupled together in any suitable manner, as by links E^2, Figs. 1 and 2, while their outer ends are provided with a weight H adjustable lengthwise of the levers and adapted to counterbalance the screen, or approximately so. It is obvious that when the levers E and E' are vibrated on their fulcrum shafts G, G', the screen B will receive a vertical reciprocating motion through the medium of the crank arms G^2 and the supporting rods D. Now, in order that said screen may also receive a horizontal reciprocating motion, I secure to the cross bars C at one or both ends an oblique rod or link H', provided at its outer end with a set screw or bolt h' that takes into a segmental groove i in a sector plate I bolted to the side or sides of the hutch A, Fig. 1, and whereby the amplitude of the horizontal reciprocation of the screen B can be adjusted. It is obvious that when the screen rises or falls the link or links H' will cause it to move in a horizontal plane in one or the other direction, said screen receiving therefore, a compound jigging motion.

The levers E and E' are vibrated by means of a cam or tappet wheel F secured to a shaft F' and acting upon the proximate end of lever E, said shaft F' receiving motion from any suitable prime motor, a belt pulley P being shown for the purpose. The amplitude of the vibration of the levers E E' is controllable within certain limits by means of a cross bar b', Figs. 2 and 3, hinged at one end b^2 to the supporting frame of the hutch, and has its other end connected to one end of an adjusting rod r screwed into a nut r^2 pivoted in a fork at the end of said cross bar b', the upper end of rod r revolving in a suitable bearing and carrying a hand wheel r'. The cross bar b' lies below lever E and supports the same, so that when the rod r is revolved in one or the other direction the cross bar is lifted or lowered, thereby varying the amplitude of the vibrations of both levers E, E', as will be readily understood.

The described mechanism for imparting a compound jigging motion to the screen is an improvement upon a mechanism for similar purposes shown in Letters Patent granted to me in England in 1872, No. 2,051. In the latter patent I have shown two pairs of levers arranged on one side of and below the hutch, both pairs of levers, as well as the levers of a pair being linked together. In the mechanism described I am enabled to employ but two levers, and these are arranged underneath the hutch, consequently entirely out of the way, the entire mechanism being materially simplified and the power more uniformly distributed.

In practice I preferably form the compartments a to a^3 of the hutch A with converging end walls as shown, for the purpose of facilitating the discharge of material therefrom, or said compartments may be hopper-shaped. The end walls of the compartments are secured at their upper ends to transverse strips a^6, Fig. 5, and to prevent the passage of water from one compartment to the other I attach to the under side of cross bars of the screen frame and extending clear across the screen, flaps or aprons B' of a suitable flexible material, as rubber, that bear against the cross strips a^6 and perform the function of flap valves, said cross strips extending close to the screen bottom when the screen is in its lowest possible position, said screen fitting the sides of the hutch as closely as can be done without interfering with its movements.

Into each compartment, a to a^3 opens a port normally closed by a flexible or flap valve K' opening inwardly or into the hutch for the intermittent admission of water to the said compartments. This port may be formed in a side wall of the hutch A and connected to a suitable head of water, or it may be the outlet of a conduit, K, Figs. 5 and 6, that projects into the compartment, or it may be a port formed in a conduit K^2 extending along one of the side walls of the hutch within the same, Fig. 7, suitable means being provided to control the flow of water to the several ports, so that the pressure on opposite sides of the flap valves K will be such that when the hutch A is supplied with the necessary quantity of

water and the screen is at rest, the valves K′ will be held to their seats by the pressure within the compartments.

By means of the described arrangement whenever the screen rises suction is produced, thereby reducing the pressure upon the outer face of the valves K, causing them to open under the pressure of the water behind them, so that at each upward movement of the screen there is an inrush of a comparatively large body of water into each of the compartments, and inasmuch as there is but little space between the screen and hutch walls and as no water can pass over the cross partitions below the screen, the water is caused to flow through the screen meshes with an increased force when the screen descends, the valves K′ being closed as soon as the pressure within the compartments due to the downward movement of the screen has increased sufficiently. By the means described the water is caused to rush through the screen meshes with a greater force than if said screen were reciprocated in a quiescent body of water. This rush of water through the screen not only lifts the lighter material, but it scatters or disperses the whole layer of material, thus admitting of the heavier particles to more readily subside and pass through the meshes of the screen or move from one screen section to the other. This operation is materially facilitated by imparting to the screen a reciprocating motion in a horizontal plane, that imparts to the material successive short advancing movements from the head toward the tail of the screen, and it is clear that if these short step by step advancing movements are imparted to the material while the screen is descending, the said material will be in a state of motion while the water is rushing upward, whereby the passage of the water through the screen and material is greatly facilitated, which would not be the case if the screen were to receive a rising and falling motion only, as such motion would tend to pack the material on the screen during its rising motion and a much greater pressure of the water would be required to admit of its passing therethrough, and in this case it would become necessary to provide means for preventing any of the water from escaping along the sides and ends of the screen.

In order to prevent the dredgy material from passing over the tail of the screen with the gangue or tailings, I provide means for separating the former from the latter, shown more particularly in Figs. 4, 8, 9 and 10, and they consist of an angle plate L that extends from side to side of the screen and has in its vertical wall perforations of such size as to allow the smaller dredgy material to pass through, the lower edge of said vertical wall resting on the screen bottom. The plate L is connected with an angle plate L′, the vertical wall of which is adapted to more or less cover the perforations l' in plate L, the two plates being adjustably connected by means of screw bolts L^2 and nuts, while said plate L′ is secured to hanger rods L^3, the upper end of which passes through a supporting plate L^4 on each side of the screen frame, Figs. 8 and 9, so that by removal of the nuts on said rods L^3 and by suitably dropping the plate L′, the device can be entirely removed from the tail of the screen. The dredgy material—that is to say, that portion of the ore which contains a small percentage of metal and requires further dressing before such metal can be extracted and is consequently heavier than the vein stuff or tailings that contains no metal, such dredgy material accumulating on the screen in front of the separator plate L′, the heavier dredgy material passing through the perforations in plate L′, while the lighter vein stuff passes over said plate and falls into compartment a^4 of the hutch, while the tailings fall into compartment a^5, said tailings being forced over plate L′ by the jigging motion of the screen, the horizontal portion of angle plate L extending back over the tail end of the screen sufficiently to cover the narrow inlet to compartment a^4 for the dredgy material, so that the tailings passing over said plate will drop into compartment a^5 provided therefor.

In the washing, separation, or concentration of coarser ores or vein stuff I prefer to employ a screen of the construction shown in Fig. 11, in which are provided transverse openings M leading to a compartment below the same, and above each opening is arranged a plate N, the tail end of which is provided with a flap or apron N′ of flexible material, as rubber, that trails on the screen. The plate N is suspended from rods O that pass through holes in a plate *o* which extends from side to side of and is secured to the screen frame, the rods being adjustably held to the supporting plate *o* by means of suitable nuts, so that the plates can be adjusted closer to or farther from the screen bottom according to the degree of coarseness. The finer material will, of course, pass through the meshes of the screen section having the finest mesh, while the next grade instead of being forwarded directly onto the succeeding screen section and caused to pass through the meshes thereof, will be moved under the plate N and pass through opening M, while the next coarser material that cannot pass under said plate will be moved over the same and onto the succeeding screen section of coarser mesh and so on to the tail of the screen, where the gangue is finally discharged, the aprons N′ preventing the material from being moved by the jigging motion under the plates N after having passed the same. In this manner coarser ores can be nicely graded or prepared for further treatment.

From the above description, the operation of my improved ore washer, separator or concentrator will be readily understood.

I do not desire to claim broadly a screen having a compound reciprocating motion, as

this is shown in Letters Patent granted to me in England in 1872, under No. 2,051, but

What I do claim, and desire to secure by Letters Patent, is—

1. In an ore washer, separator, or concentrator, a vessel provided with one or more valved water inlet ports, and a screen movable within the vessel, the movements of said screen adapted to open and close said valves, for the purposes set forth.

2. In an ore washer, separator, or concentrator, a vessel adapted to contain a body of water and provided with one or more valved water inlet ports, and a screen adapted to alternately rise and fall within the body of water and thereby alternately open and close the valves of said inlet port or ports, for the purpose set forth.

3. In an ore washer, separator, or concentrator, a vessel adapted to contain a body of water and provided with one or more valved water inlet ports and a screen above said port or ports adapted to alternately rise and fall and reciprocate in a horizontal plane and to alternately open and close the valve or valves for the aforesaid port or ports in its rising and falling movements, for the purposes set forth.

4. In an ore washer, separator, or concentrator, a vessel adapted to contain a body of water, said vessel divided into a plurality of compartments each provided with a valved water inlet port, and a screen of variable mesh extending over said compartments and adapted to alternately rise and fall and thereby open and close the valves for the aforesaid inlet ports, for the purpose set forth.

5. In an ore washer, separator, or concentrator, a vessel adapted to contain a body of water, said vessel divided into a plurality of compartments each provided with a valved water inlet port, and a screen of variable mesh extending over said compartments and adapted to alternately rise and fall and thereby open and close the valves for the aforesaid inlet ports, and means for preventing the water from passing from one compartment to the other immediately below the screen, for the purpose set forth.

6. In an ore washer, separator, or concentrator, a vessel adapted to contain a body of water, a screen contained therein, two rock shafts, as G, G′, provided with radial arms or cranks from which said screen is supported, a rock lever on each of said shafts the proximate ends of which are coupled together, a movable counter-weight on the free end of each lever, and a revoluble cam or armed wheel adapted to engage one of said levers, whereby a rising and falling motion is imparted to the screen, and means for imparting to said screen a reciprocating motion in a horizontal plane, for the purpose set forth.

7. The combination with a jigger screen provided with a transverse slot, of an adjustable plate arranged to form a passage between it and the slotted portion of the screen, and a flexible apron for closing one end of such passage, substantially as and for the purpose set forth.

8. The combination with a jigger screen provided with a screen bottom composed of a plurality of sections the mesh whereof increases in size in the successive sections, and with a transverse opening between each two sections, of adjustable plates arranged to form open ended passages between them and the said openings, and a flexible apron connected with each of said plates and adapted to close one end of the passage formed thereby, substantially as and for the purpose set forth.

9. In combination, a vessel adapted to contain a body of water, divided into a plurality of compartments, and with a valved water inlet for each of said compartments, and a screen adapted to reciprocate in vertical and horizontal planes within the body of water and to open and close the water inlet valves by its vertically reciprocating motion, said screen provided with a screening bottom composed of sections of different mesh, and with a transverse opening between each two such sections, of an intercepting device for each of said openings adapted to intercept material of given size and guide the same to the opening without interfering with the passage of coarser material over such opening, for the purpose set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

HENRY RICHARD HANCOCK.

Witnesses:

FINBARR PATRICK SHIEK,

HERBERT HUBBER.