No. 620,014. Patented Feb. 21, 1899.

O. BLACKET.

ORE CONCENTRATING MACHINE.

(Application filed Nov. 26, 1897.)

(No Model.) 2 Sheets—Sheet 1.

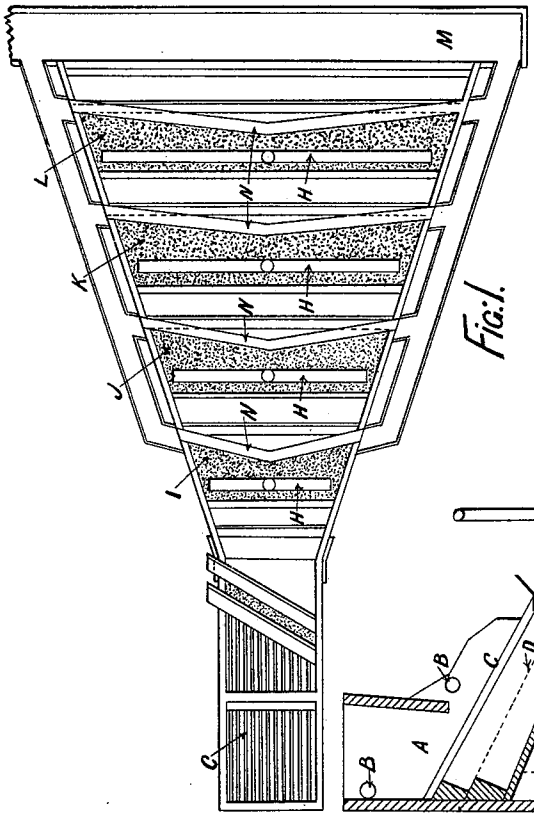


Fig. 1.

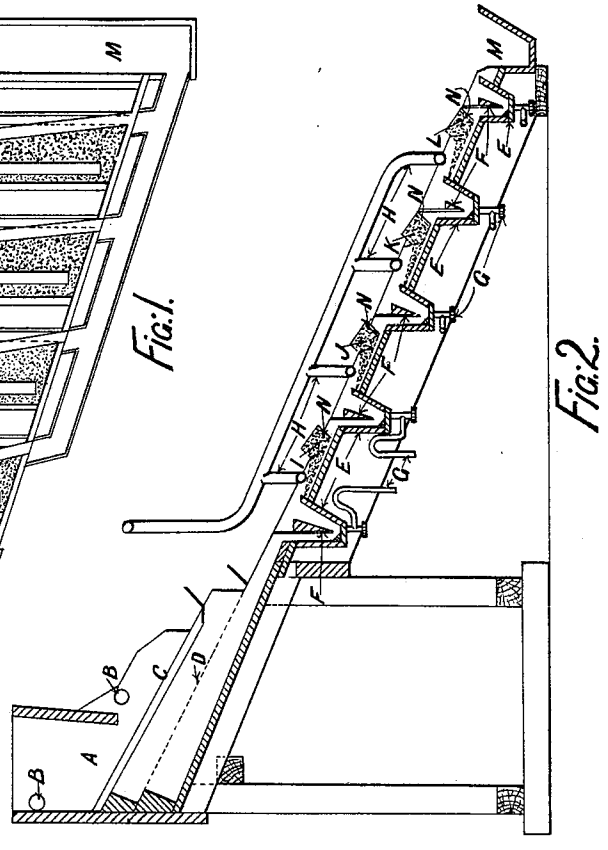


Fig. 2.

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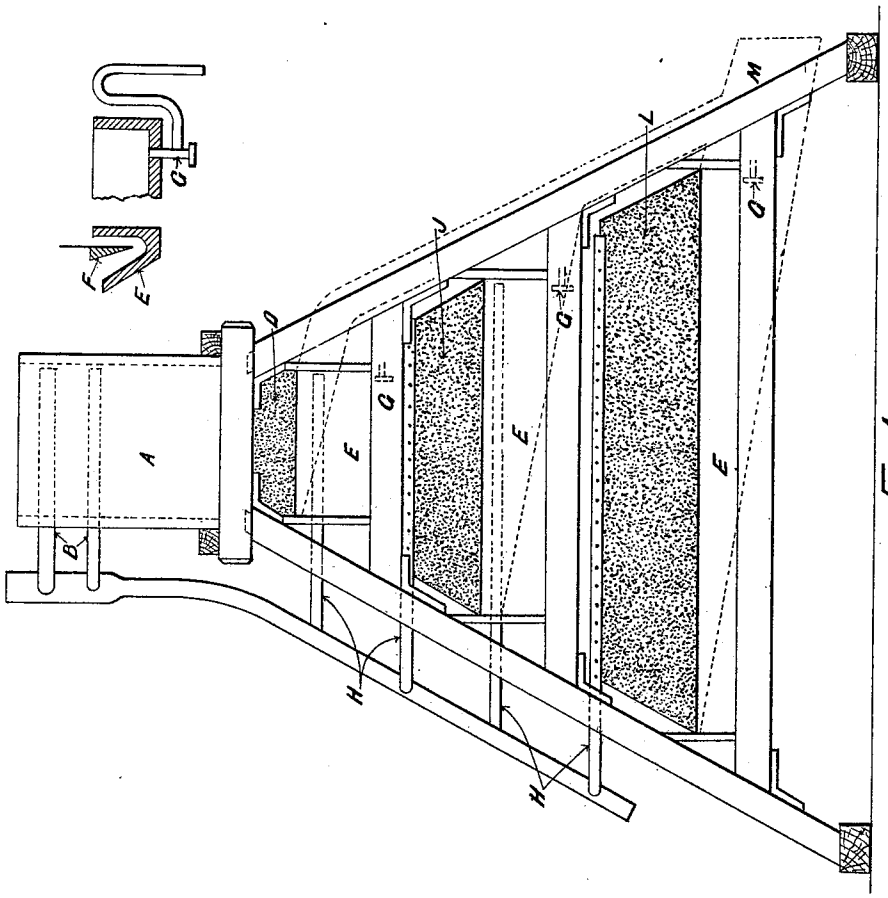


Fig. 4.

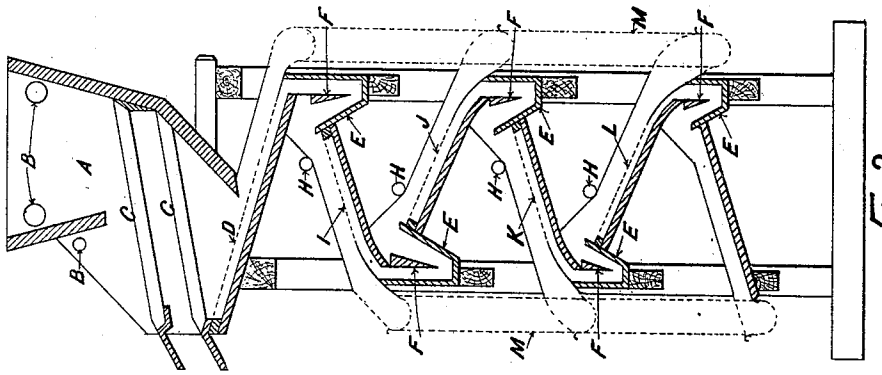


Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

OWEN BLACKET, OF SYDNEY, NEW SOUTH WALES.

ORE-CONCENTRATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 620,014, dated February 21, 1899.

Application filed November 26, 1897. Serial No. 659,881. (No model.)

To all whom it may concern:

Be it known that I, OWEN BLACKET, engineer, a subject of the Queen of Great Britain, residing at Sydney, in the British Colony of New South Wales, have invented new and useful Improvements in Ore-Concentrating Machines, (for which Letters Patent have been granted as follows: New South Wales, No. 7,206, dated January 18, 1897; New Zealand, No. 9,483, dated May 1, 1897; Queensland, No. 3,844, dated April 22, 1897; South Australia, No. 3,621, dated April 26, 1897; Tasmania, No. 1,885, dated July 12, 1897; Victoria, No. 14,116, dated April 22, 1897, and Western Australia, No. 1,619, dated May 4, 1897,) of which the following is a specification.

My invention relates to improvements in ore-concentrating machines for the saving of flour, fine, and float gold or other materials on the sluice-box system, in which screens remove the stones, gravel, and sand passing through and riffle-boxes catch and hold the gold or other materials. Such machines can be made either with a diagonal continuous incline, as in an ordinary sluice-box, or diagonally zigzag, with the riffle-boxes and screens placed one above the other; but in order that this invention may be clearly understood reference will now be made to the drawings herewith, in which—

Figures 1 and 2 are a plan and a longitudinal sectional elevation, respectively, of a diagonal ore-concentrating machine, Figs. 3 and 4 being similar views, respectively, of a zigzag ore-concentrating machine constructed according to these improvements.

The hopper A receives the material to be washed, while pipe or nozzle B supplies the water. The grizzly C removes large stones, while coarse screen D removes the small ones.

E are riffle-boxes to save the heavy material, in each of which is a deflector F to make the material under treatment pass downward to the bottom of riffle-box and then upward to the next screen. As shown most clearly in Figs. 2 and 3, each of said riffle-boxes E is trough-shaped, having its upper side or wall or the side or wall nearest the hopper arranged vertically, while the lower side or wall is inclined upwardly and away from the vertical upper or front wall. The deflector F is preferably made wedge-shaped in cross-section to correspond to the shape of the riffle-box. By these means the material to be separated is caused to drop vertically into the riffle, whereby the heavier material is precipitated to the bottom thereof, while the lighter material is carried up gently over the inclined lower wall of the riffle and out of the latter.

Draw-off pipes G are for cleaning out the concentrates, which are led to a handy receptacle or to an inclosure or safe. Jets of water from pipe or nozzle H flow over the screens I J K L to help wash away the refuse, while said screens remove the sand after the material leaves the boxes, while chutes M and N carry away the tailings to waste.

The upper edges of the lower inclined walls of the riffle-boxes preferably project slightly above the floor or bottom of the sluice-box to cause the material to be fairly deposited onto the upper sides of the screens I J K L.

In operation the material to be concentrated is brought to head of machine, where it is emptied into hopper A, into which a stream of water is flowing from pipe or nozzle B. The coarse stones are separated by the grizzly C, getting a second wash as they pass out under the hopper down the grizzly to chute M to waste. The sand and small stones after passing through the grizzly C are screened by a coarse screen, the gravel passing out of box by chutes N and M to waste after the wash-dirt has been screened. The finer material passes down to bottom of riffle-box E, and by the upward flow of water the lighter material is carried up out of the first box E and over another and finer screen, which catches coarse sand and delivers it into a second chute N to waste, while the finer materials fall into a second box E, where the process of separation is carried a further stage. The same process is repeated over a third, fourth, or fifth screen and box, the number of screens and boxes being arranged according to the fineness of the material to be separated and retained, the last upward flow from the last box E taking away only the finest sand.

The riffle-boxes and screens are wider at the tail or discharge end than at the head or feed in the diagonal machine, and the top riffle-boxes and screens are narrower than the

bottom in the vertical machine. The velocity of the water is thus reduced, so that the current which will lift coarse sand in first riffle-box is only able to lift fine sand in the last. By the screening out of coarse sand and under the natural law of sinking velocities in water the metal or heavy material is deposited in first riffle-box with any black or heavy sand of equal weight though larger volume, the size of metal and sand diminishing in each succeeding box, the screens taking away the coarse and lighter sand every time it is washed over from the box. Each jet of water from pipes or nozzles H gives a further impetus to the material washed upward over and from the riffle-box, so moving it along the screen to the discharge-chute.

The pipe G is fitted to the base of each box, by which the concentrates can be drawn off and, if desired, carried to an inclosure or safe. The working of the machine is thus continuous, and the cleaning out of the boxes may be effected without ceasing its operation.

The stones and sand when delivered from the boxes are carried by the chutes M to another chute N across the end of the machine, so that the full water-supply can be utilized for getting rid of the tailings.

The extent of space under the deflectors F in the riffle-boxes E and the areas into which the deflector divides the box may be altered to suit the velocity of water required to scour the material, and the outer lips of the boxes are also adjustable to regulate the amount of material to be passed out of the box.

The process of concentration carried out according to my invention is based upon the difference of specific gravities of materials to be treated, two substances of equal size, but of unequal weight, having different sinking velocities through water. A sphere of gold settles one hundred inches, while a sphere of quartz of the same diameter sinks thirty inches in water, from which it can be understood that equal sinking particles of different specific gravity have different volumes, the volumes of the heavier materials being less than the lighter, and it is found that the sinking velocity of quartz (eleven-sixteenths diameter) and gold (one-sixteenth diameter) are the same. Therefore if a current of water carries these over a one-fourth-inch screen the one-sixteenth gold passes through to the bottom of box, while the eleven-sixteenths quartz and all between eleven-sixteenths and one-fourth inch is removed by the screen. The boxes and screens are wider at the discharge end than at the feed end, so that the velocity of the water is reduced, and the current which will lift coarse sand in the first box is only able to lift fine sand in the last. Assuming that the water is flowing at the rate of fifty inches a minute and that the gold settles one hundred inches a minute, the current will not be able to wash the gold upward and away, but if the quartz of equal diameter can only sink thirty inches a minute it must be carried away at the rate of twenty inches a minute. By the screening out of the coarse sand and under the natural law of sinking velocities in water the metal or heavy material is deposited in the first box with any coarser sand or gravel, the size of metal and sand diminishing in each succeeding box, the screens taking away the coarse and lighter sand as it is washed over from the box. Jets of water wash across the ends of the screens and carry the sand to the chute. At the bottom of each box is a pipe, by means of which the concentrates can be drawn off. The working of the machine is thus continuous, and the cleaning out of the boxes can be done without stopping the machine.

The working of the machine is purely by the flow of water, and as there are not any moving parts nothing can get out of order. The only attention required is a constant and steady stream of water and equal feeding of material to be washed.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

In an ore-concentrator, the combination with a downwardly-inclined sluice-box, of transverse riffle-boxes arranged at intervals in the sluice-box, screens arranged transversely between the riffle-boxes, each screen being arranged to receive the overflow from the riffle-box immediately in advance, and means for flowing water down the sluice-box, each riffle-box being narrower and deeper than the riffle-box immediately below and each screen being narrower and coarser than the screen next below, the arrangement being such that the velocity of the upward flow of water decreases in each succeeding riffle-box to suit the varying sizes of the screens, substantially as described.

Dated this 21st day of October, 1897.

OWEN BLACKET.

Witnesses:

FRED WALSH,

PERCY NEWELL.