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APPARATUS FOR RECOVERING VALUABLE CONSTITUENTS FROM ORES.

APPLICATION FILED JAN. 17, 1910.

1,104,132. Patented July 21, 1914.

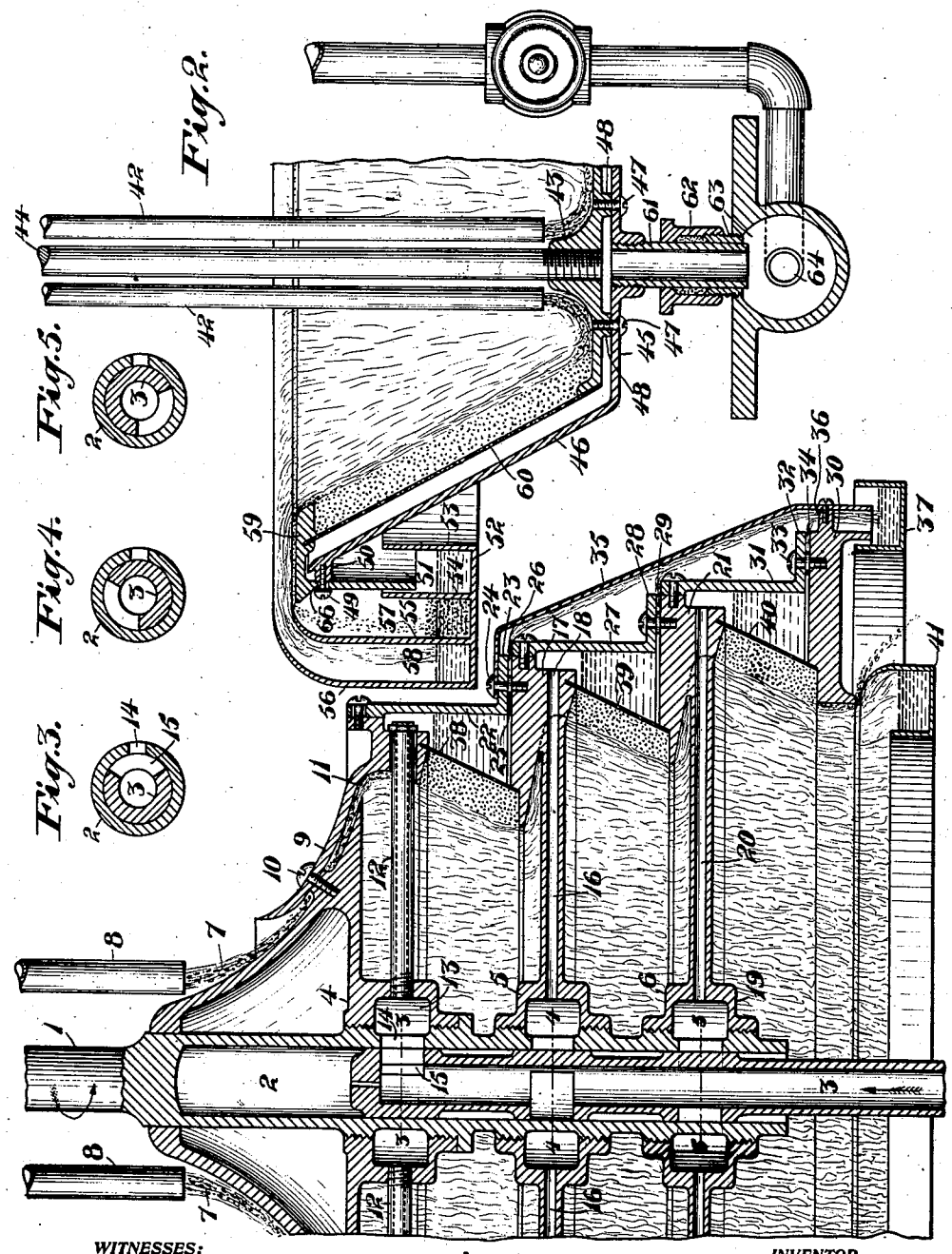


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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APPARATUS FOR RECOVERING VALUABLE CONSTITUENTS FROM ORES.

1,104,132. Specification of Letters Patent. Patented July 21, 1914.

Application filed January 17, 1910. Serial No. 538,409.

To all whom it may concern:

Be it known that I, FREDERICK H. PRENTISS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Apparatus for Recovering Valuable Constituents from Ores, of which the following is a specification.

The object of the present invention is to provide an improved apparatus for recovering from ores their valuable mineral constituents by the combined actions of centrifugal force, and that of an opposing current of a fluid, preferably water, and preferably an intermittent or pulsating current.

In the accompanying drawings, Figure 1 is a broken vertical section of one form of my improved apparatus, in which the tailings are discharged at the bottom; Fig. 2 is a similar view in which the tailings are discharged at the top; Figs. 3, 4 and 5 are sections on the lines 3—3, 4—4, 5—5, respectively, in Fig. 1.

Referring to the drawings, and particularly to that form of the apparatus shown in Fig. 1, 1 indicates a shaft to which rotation is imparted by any suitable means, not shown. The lower portion of said shaft is hollow, as shown at 2, and passing upwardly into said hollow shaft is a stationary water-supply pipe 3. Screwed upon said hollow shaft are sections 4, 5 and 6 of a rotor. The uppermost section 4 is formed with a surface of revolution which is of a general bell-shaped form but widened at the bottom. Upon this surface the pulp 7 is discharged from pulp-supply pipes 8. Said pulp flows over the surface of said section 4, and between said surface and the inner surface of a shell 9, which, by means of a ring of screws 10, is secured to the rotor section 4, the shapes of said rotor section and shell being such as to provide a space therebetween of substantially uniform thickness. Through this space the pulp flows by gravity, its speed being accelerated by centrifugal action, and presses against an inner curved surface 11 of said shell 9. Said shell 9 is additionally secured to the upper rotor section 4 by pipes 12, which pass through the shell and connect at their inner ends with an annular water passage 13 open to the interior of the pipe 3 by an opening 14 through the rotary shaft 1, which opening 14, during part of the rotation of said shaft, connects through an opening 15 with the interior of the water supply pipe 3.

The second rotor section 5 comprises a hub portion screwed upon the rotary shaft, conduits 16 leading radially therefrom, and a rim portion 17 formed integral with said conduits and perforated, as shown at 18 to form continuations of the conduits. The lowermost rotor section 6 is, in like manner formed of a hub portion 19, radial conduits 20, and a rim portion 21. Connecting the shell 9 with the rim portion 7 is a cylindrical wall 22, having a flanged portion 23 secured by screws 24 to the rim portion 17, but spaced therefrom a short distance by washers 25 to form a passageway 26 to permit the valuable material to pass therebetween. In like manner the rim portion 17 is secured to the rim portion 21 by a wall 27 having a flange portion 28 spaced from the rim portion 21 to form a passageway 29, and, in like manner, the rim portion 21 is secured to a ring 30 by a wall 31 having a flange 32 secured by screws 33 to said ring, and spaced therefrom to form a passageway 34. A casing 35 secured at the top of the flanged portion 23, and at the bottom to studs 36 formed on the outer edge of the ring 30 furnishes a closure for the above mentioned parts, the discharge from within said closure being into a hutch launder 37.

Between the shell 9 and the rim portion 17 extends a conical screen 38, sloping inwardly downward. A screen 39 is similarly arranged between the rim portion 17 and the rim portion 21 and a third screen 40 is similarly arranged between the rim 21 and the ring 30. A clear water launder 41 is arranged immediately beneath the inner edge of the ring 30. These screens are preferably arranged so that each is of finer mesh than the one above it, corresponding to the variations in diameter of said screens and the consequent increase in centrifugal force thereagainst. Thus, if the diameters of the respective screens are to each other in the proportions of 2, 3, and 4, the screen meshes will be 20, 30, 40, or 40, 60, 80, according to the fineness of the pulp under treatment.

The method of using the apparatus will

readily be understood from the foregoing description.

The shaft having been set in rotation, and the pulp discharged from the pipes 8, said pulp is, by centrifugal force, directed against the first of the above described screens, where it meets resistance from the pressure of the water between said screen and the wall 22. This pressure is sufficient to wash inward the gangue and light material, on which the centrifugal action has the least effect, but the heavy material is forced through the screen against the pressure of the water. This action is repeated at the successive screens until finally all of the valuable material has been passed through the screens while the gangue and worthless material falls off the inside of the ring 30. This worthless material will by centrifugal force divide into two streams, the heavier material passing outside the upper edge of the outer wall of the clear water launder, while the clear water falls into said launder, by which it is led to a storage tank, from which it can be pumped back for re-use. It will have been observed that, by reason of the fact that the water chambers between the screens 38, 39, 40, and the walls 22, 27, 31, are each in communication with the water supply during part only of a complete revolution of the rotary shaft, the water pressure which opposes the centrifugal action is a pulsating or intermittent pressure, the arrangement being such that each chamber in turn receives the increase in pressure.

In concentrating a galena ore crushed to 80 mesh, all of the galena, including the finest slimes, should be recovered as a hutch product of practically pure galena through the 20 mesh screen, while the tailings should not show more than a trace of lead. On a 60 mesh screen using pulp of 200 mesh, all of the galena should be recovered as a hutch product of practically pure galena while the tailings should not show more than a trace of lead, and all quartz coarser than 18 or 20 mesh should be discharged as tailings. Similar statements may be made of ores of gold, copper, zinc, mercury, and the like.

The height of the passages 26, 29, 34, may be regulated by the screws, so that only the least amount of water may be discharged with the hutch product that is actually required for the removal of the valuable particles of high specific gravity. With a galena quartz ore crushed to 70 mesh, the greatest particles of galena that would go into the hutch would be about 20 mesh the interstitial space between the particles forming the bed of the jig, or body of ore resting against the screen, not permitting the passage of anything coarser. The pulsating current flowing inwardly through the screen, and through the material forming the bed of the jig, would carry off all particles of quartz finer than 70 mesh and discharge them as worthless tailings.

In the form of the appartus shown in Fig. 2, the pulp is discharged by pipes 42 on to the top of a spreader 43 secured to, and suspended from, a rotating shaft 44, the bottom 45 of a vessel 46 being secured to the spreader by means of screws 47 through bosses 48 formed on the spreader 43. To the upper edge of the vessel is secured by screws 49 to lugs 50 on said edge, a rim 51, said rim depending into the first or inner section of a combination launder, said launder having four annular walls 53, 54, 55, 56, forming a hutch launder 52, a tailings discharge launder 57 and a clear water launder 58. Between an annular horizontal flange 59 of said rim and the outer edge of the spreader is secured a conical screen 60, said flange extending inwardly past its point of connection to said screen a sufficient distance to insure a bed of ore of sufficient thickness being pressed against said screen by centrifugal action. To the middle of the bottom of said vessel is secured a hollow shaft 61 which depends into a stuffing box 62 secured upon an outlet mouth 63 of a pipe 64 which is connected to a pressure tank so as to furnish pressure water. This water flows from said pipe through said hollow shaft, through the space between the bottom of the vessel and the spreader, then through the space between the conical wall of the vessel and the screen, and out through the narrow space between the upper edge of the vessel and the under side of the flange of the rim 51. The screws 49 which secure the rim to the lugs 50 pass through vertical slots 66 in the rim 51, thus permitting of the rim being adjusted vertically before being fixedly secured to the vessel by means of said screws.

By centrifugal action, the pulp is pressed against the rotating screen, and by this force alone all of the solid particles of the pulp are deposited in a layer along the surface of said screen. By suitable contrivances not here shown, the pressure of the water in the pipe 64, and also in the space between the vessel and the screen, is a pulsating or intermittent pressure. Owing, however, to the pulsating or intermittent current of water passing inwardly through the screen, the lighter particles or gangue are swept back and are discharged by the overflow of the stream of water above the horizontal flange of the rim. The tailings discharged are caught beneath the curved edge of the wall 55 and pass into the tailings launder, while the clear water passes over said edge and falls into the clear water launder.

While for the sake of clearness, I have, in the description of my invention, spoken of water as the carrier of the pulverized ore,

I do not limit myself to the use of this fluid, since any suitable liquid may be employed, or even a gas, such as common air.

I claim:—

A rotatable vessel having an inverted-cone-shaped screen concentric with the axis of rotation and permanently secured to, and within, the wall of the vessel to form with said screen a closed annular space said screen being of a mesh adapted to permit passage therethrough of the particles to be separated, a layer of material resting upon the screen and forming a jig bed, means for forcing a stream of water into said closed space between said wall and screen and through the material forming the jig bed, whereby the worthless gangue is washed out from said jig bed, means adapted to discharge from the annular chamber between the screen and the vessel, and means for rendering the pressure of said stream through said screen pulsating, whereby the centrifugal force forces the fine particles of high specific gravity through the screen.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FREDERICK H. PRENTISS.

Witnesses:
G. C. DE WOLFE,
C. C. BAKER.