(No Model.)

C. E. SEYMOUR.

MEANS FOR AND PROCESS OF SEPARATING METALS FROM ORES.

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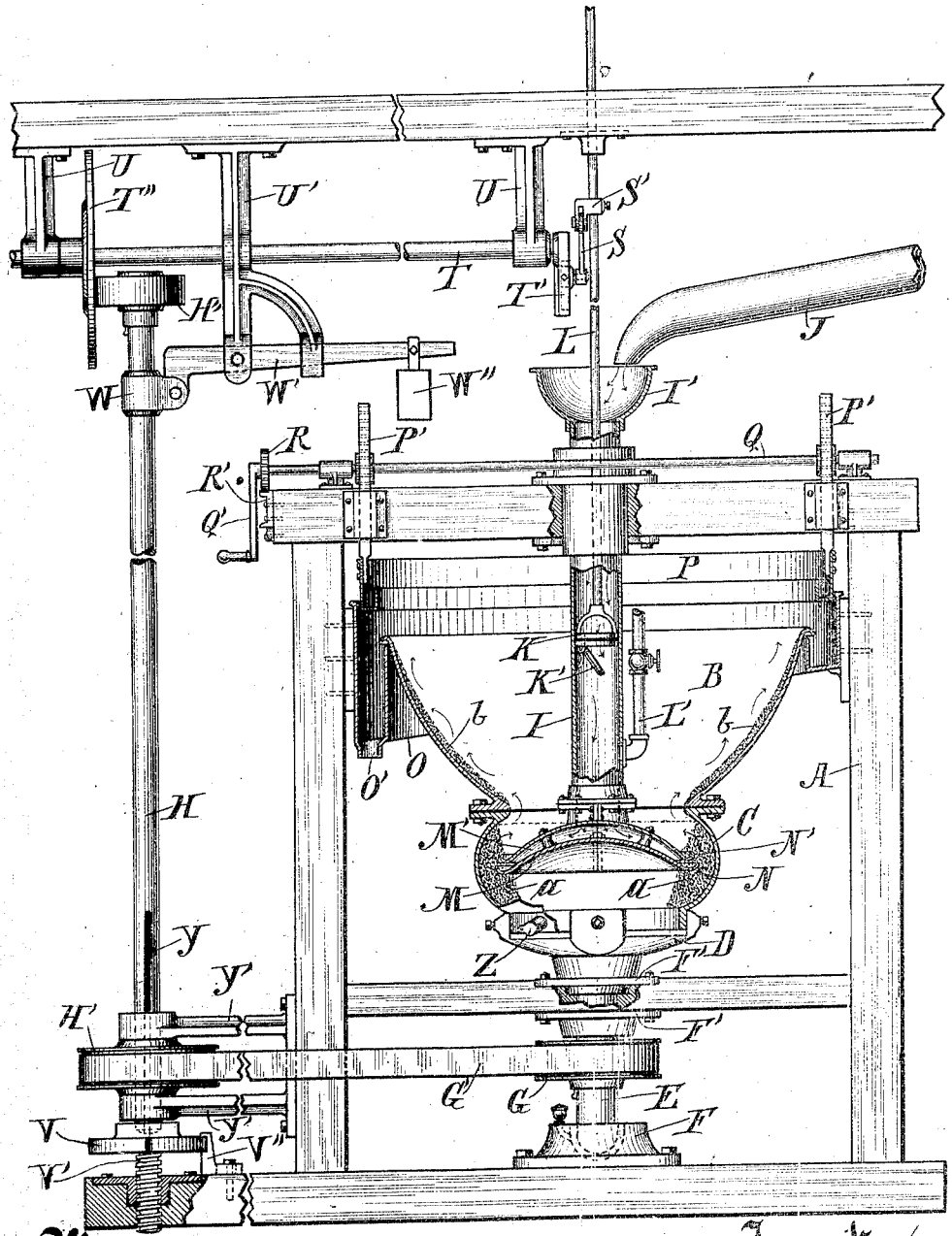

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MEANS FOR AND PROCESS OF SEPARATING METALS FROM ORES.

SPECIFICATION forming part of Letters Patent No. 489,101, dated January 3, 1893.

Application filed November 30, 1891. Serial No. 413,457. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SEYMOUR, of Lake Geneva, in the county of Walworth and State of Wisconsin, have invented a new and useful Improvement in the Means for and Process of Separating Metals from Ores, of which the following is a description, reference being had to the accompanying drawing, which is a part of this specification.

The object of my invention is to provide improved mechanism for separating valuable minerals as gold and silver from pulverized metal-bearing ores in which they are contained, in and by putting the metal-laden ores by the aid of suitable mechanism into mercury and thereby by amalgamation making a substantially complete separation of the metals from the ores, and also at the same time to quite complete the separation by a further amalgamation and mechanical separation.

My improved mechanism and process are especially adapted for use in separating from their ores, those metals which are flaked or are so minutely pulverized as, when the ores are put into water, to float on or remain suspended in the water, and are liable to be lost when the metals are attempted to be separated from their ores by the means and processes heretofore in use.

In the accompanying drawing the figure is an elevation of my complete machine, arranged to illustrate the method of its use in the process of separating metals from their ores, portions of the mechanism being shown in section, and other parts being broken away for convenience of illustration.

A is a frame of suitable form and strength to support the operative mechanism. A revoluble bowl B open at its bottom, rests upon and opens into a spheroidal receptacle C. The walls of receptacle C are drawn inwardly or contracted at the top so that the circular aperture from the receptacle upwardly into the bowl is of conside able less diameter than the horizontal diameter of the medial part of the receptacle. This form of construction provides a cover for the medial outer annular part of the chamber of the receptacle, so that the mercury thrown against the side walls of the receptacle by centrifugal force in substantially the position shown by the granular shading, will not escape from the receptacle at the top into the bowl. The bowl and receptacle are preferably made independent of each other and are bolted together rigidly water tight. The bowl is preferably made of sheet copper, and the receptacle may be made of copper or other suitable material, glass being quite satisfactory therefor.

The receptacle C rests on a disk or head D rigid on the arbor E. The receptacle is secured detachably in its seat by means of set screws turning through lugs on the head D against the lower part of the receptacle. The arbor E rests upon and has its bearing in the pedestal F fixed on the frame, and also has bearings in the boxes F′ F′ also secured to the frame. A pulley G on the arbor E carries the belt G′, which runs on a pulley H′ on the shaft H which belt transmits rotary motion to the bowl B and receptacle C. A vertically disposed tube I supported rigidly in the frame and provided with a hopper I′ at its upper extremity extends downwardly into the receptacle C and is adapted to receive the pulp, conveniently through the pipe J in its upper end, and discharge it into the receptacle C. The pipe I is provided with a pump piston K having a downwardly opening valve K′ and a stem L which is adapted to force the pump downwardly in the tube or pump I. At the lower extremity of the tube I are two circular plates M M′ located opposite each other at a little distance apart, the upper plate being secured permanently to the pipe I and the lower plate being secured to the upper plate. These plates are preferably concavo-convex in form, the upper one M′ being provided with a central aperture through which the tube I discharges into the space or radial chamber between the two plates. The outer edges of the two plates are preferably slightly curved upwardly correspondingly as shown at N N′. These plates are within the receptacle C, their outer edges being substantially in a horizontal plane of the greater axis of the spheroid, and near the wall of the receptacle in the space occupied by the mercury when the receptacle is revolved rapidly with the mercury therein.

A somewhat deep annular trough O fixed to the frame surrounds the bowl B near its upper edge, and in such manner as to catch the overflow from the overturned lip or edge of the bowl. This trough O is provided with a discharging orifice O′. A second and smaller annular trough P is suspended on racks P′

movable endwise in bearings therefor on the frame, which racks are arranged to be raised and lowered by the rotation of a shaft Q having its bearings in boxes on the frame and provided with fixed pinions which mesh with the racks P'. The shaft Q is also provided with a crank handle Q' for rotating it and with a pinion rack R adapted to be caught by a bolt or latch R' sliding in ways therefor on the frame. By means of this latch and rack the shaft is locked and the trough is supported at any desired height within its line of vertical travel.

The piston stem or rod L has suitable bearings in the frame for its vertical movement and a rod S, pivoted in a collar S' adjustable on the stem, connects it to the adjustable wrist of a crank T' on the shaft T. The shaft T has its bearings in the hangers U U' fixed to a permanent support.

The shaft H is driven by means of a wheel H'' on the shaft H, which bears frictionally against a disk T'' on the shaft T. The shaft H has a bearing and is supported at its lower end in the step V which is adjustable vertically by means of the screw V' rigid thereto turning into a suitable nut therefor fixed in the frame. A dog V'' sliding on the frame engages the step V releasably in suitable recesses therefor, and locks it in position revolubly. A collar W fitted about the shaft H so that the shaft is movable therein, is pivoted on one arm of the lever W' which is pivoted medially in the hanger U' and is provided with a weight W'' adjustable on its other arm. The pulley H' is splined on the shaft H by means of a tongue in the pulley that enters a longitudinal groove Y in the shaft H and the pulley is retained constantly in the plane of the belt G' by the bracket arms Y' Y' fixed on the frame and terminating in collars about the shaft H respectively above and below the pulley H'.

The method of using my improved machine and the process of separating metals from ores with the machine are substantially as follows: A supply of mercury (quicksilver) *a*, is placed free in the receptacle C and the bowl B is preferably washed or surfaced with mercury. The bowl and receptacle are then put into rapid rotation which causes the mercury in the receptacle by centrifugal action to rise to the laterally enlarged part of the receptacle, and form an annular ring about and covering the edges of the plates M and M' as shown in cross section in the drawing. A supply of pulp (wet ores) is delivered to the tube or pump I through the hopper I' conveniently by means of the conducting pipe J, and the pulp is by the action of the piston forced in a practically continuous stream between the plates M and M' into and through the mercury about and covering the edges of the plates, the water and the lighter portion of the gangue rising through the mercury into the bowl B, while the metal in the ores will mostly amalgamate with the mercury, and a portion of the heavier gangue or metal laden ores will settle through the mercury in the bottom of the receptacle C. The water and lighter gangue will by centrifugal action under the rapid revolution of the bowl, rise in the bowl and flow over the edge into the trough O, from which it is discharged by gravity through the orifice O'. The quicksilver-coated surface of the copper bowl, is adapted to catch and hold by amalgamation any free metal that may have escaped from the free mercury in the receptacle C, and a certain amount of the heavier particles of the lighter ore that has escaped from and risen above the receptacle, is liable to gather on the sides of the bowl as shown at *b b*. These metal-laden ores that settle on the sides of the bowl are removed therefrom and caught by shutting off the supply of pulp while the bowl is still rotating, lowering the trough P into the trough O and lowering the shaft H so that its wheel H'' gears with the disk T'' nearer its periphery thereby greatly increasing the speed of rotation of the bowl which, by centrifugal action, will lift this mineral laden ore *b*, out of the bowl discharging it into the trough P, from which it may be removed in any convenient manner. When the mercury in the receptacle C has become dull or loaded by amalgamation with mineral, the revolution of the receptacle is stopped and the amalgam is removed therefrom in any suitable way, as by drawing it off through the gate Z or by dipping it out with a ladle, or the receptacle C may be unfastened both from the supporting head D and from the bowl B, and may be removed from the machine with its contents, and a duplicate receptacle properly supplied with free mercury put in its place. This work of removing and replacing a receptacle can be done in a comparatively short time so that but little time will be lost in making the change.

In using this machine in low temperatures of the atmosphere, and also for separating certain ores, it is desirable to raise the temperature of the pulp, and for that purpose I connect a steam pipe L' to the pump I, by which steam may be discharged into the pulp in the pump, thereby raising its temperature sufficiently to be acted upon quickly and satisfactorily as it passes through the mercury.

It will be apparent to a skilled mechanic that the adjustable step V provided with and supported on the screw V', is adapted for raising and lowering the shaft H, whereby its friction gear H'' is put into contact with the disk T'' nearer to or farther from its shaft T, thus reducing or increasing the speed of the revolution of the bowl B as desired, under the uniform revolution of the shaft T. Also that the weight W'' on the lever W' is adapted to hold the wheel H'' constantly but yieldingly in engagement with the disk T''.

What I claim as my invention and desire to secure by Letters Patent is:

1. The combination with a spheroidal mer-

cury-holding receptacle having a contracted and partially closed top mounted on a revoluble shaft, of an upwardly outwardly flaring bowl mounted on and opening at its bottom into the spheroidal receptacle, substantially as described.

2. The combination with a spheroidal mercury-holding receptacle having a contracted and partially closed top mounted detachably concentrically on a revoluble shaft, of an upwardly outwardly flaring bowl mounted detachably on and opening through its bottom into the spheroidal receptacle, substantially as described.

3. The combination with a revoluble amalgam receptacle, spheroidal in form and having a contracted and partially closed top, of a tube leading into the receptacle, and plates at the bottom of the tube opposite the larger medial part of the receptacle arranged to discharge pulp from the tube between them radially into the outer portion of the larger medial part of the receptacle, substantially as described.

4. The combination with a revoluble spheroidal receptacle in which mercury is by centrifugal action held against the sides of the receptacle, of means for forcing pulp into the mercury consisting of a tube leading into the receptacle and discharging by radial passages, a piston in the tube arranged to force pulp through the tube into and through the mercury in the receptacle and means for reciprocating the piston, substantially as described.

5. The combination with a revoluble mercury-holding receptacle, of a flaring copper bowl mounted thereon opening into the receptacle, and a quicksilver coat on the inner surface of the copper bowl, substantially as described.

6. The combination with a spheroidal mercury-holding receptacle mounted on a revoluble arbor so as to revolve about its shorter axis, of a pulp discharging tube leading into the receptacle and concavo-convex plates secured to the end of the tube located at a little distance apart and having correspondingly upturned edges between which plates the pulp is discharged radially substantially opposite the plane of the greater axis of the spheroidal receptacle, substantially as described.

7. The combination with a revoluble ore-separating bowl, of an annular trough suspended normally slightly above the bowl, and means substantially as described on which the bowl is suspended and whereby it is adapted to be lowered below and about the edge of the bowl so as to catch the discharge therefrom.

8. The combination with a revoluble ore-separating bowl, of a comparatively wide and deep annular trough located about the bowl at its edge, and a second annular trough normally suspended above the bowl and arranged to be lowered about the bowl into the first mentioned trough in such manner as to catch the overflow therefrom, substantially as described.

9. The combination with a revoluble spheroidal amalgam receptacle, adapted by its rapid revolution to carry under centrifugal action a supply of mercury in annular form against the inner surface at its greatest diameter, of a fixed supply pipe leading into the receptacle, disk plates secured rigidly at a little distance apart to the pipe forming a radial discharge passage from the pipe, which disks are located substantially opposite to the greatest diameter of the receptacle and project nearly to the sides thereof and into the space occupied by the mercury when the receptacle is revolved rapidly, whereby, the edges of the plates being in the mercury, the mercury is agitated as it moves about the plates by contact therewith, and means as a force pump in the pipe for forcing the pulp into the revolving and agitated mercury, substantially as described.

10. The combination with the arbor of a revolving ore receptacle, of an endwise adjustable shaft belted to and driven by the receptacle arbor, a pulp feeding pump, a shaft provided with a crank connected to the pump's piston, a disk on the latter shaft and a wheel on the adjustable shaft bearing frictionally against the disk, whereby the pump is operated from the receptacle-revolving mechanism and its motion is regulated as desired, substantially as described.

11. The combination with the arbor of a revolving ore receptacle, of an endwise adjustable shaft belted to and driven by the receptacle arbor, an adjustable step in which the adjustable shaft has its bearing, a pulp feeding pump, a shaft provided with a crank connected to the pump's piston, a disk on the latter shaft and a wheel on the adjustable shaft bearing frictionally against the disk, and a weight-actuated lever arm bearing against the adjustable shaft adapted to hold the wheel on the adjustable shaft yieldingly in contact with the disk on the other shaft, substantially as described.

12. The process of separating the heavier parts of ores from the lighter parts consisting in rotating mercury in and with a revolving receptacle whereby by centrifugal action the mercury is disposed in annular form about the sides of the receptacle, and forcing crude pulverized ores in a substantially continuous supply into the revolving mercury whereby by the specific gravity and agitation of the mercury and the ores therein the heavier parts of the ores are separated from the lighter parts, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES E. SEYMOUR.

Witnesses:
JOSIAH BARFIELD,
CHAS. F. CASE.