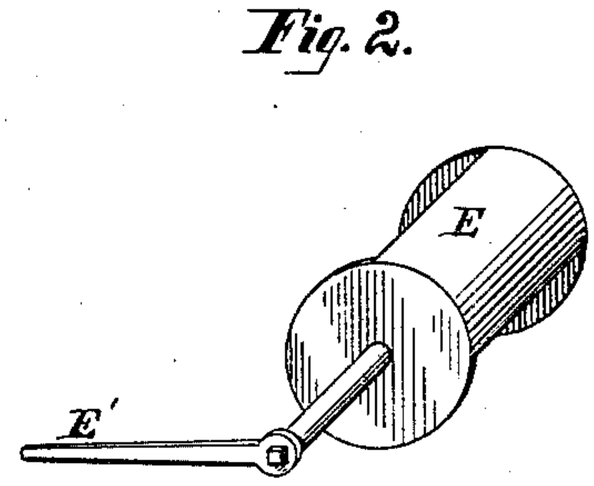
(No Model.) 2 Sheets—Sheet 1.

T. WALKER.

AMALGAMATOR.

No. 279,995. Patented June 26, 1883.

Fig. 2.



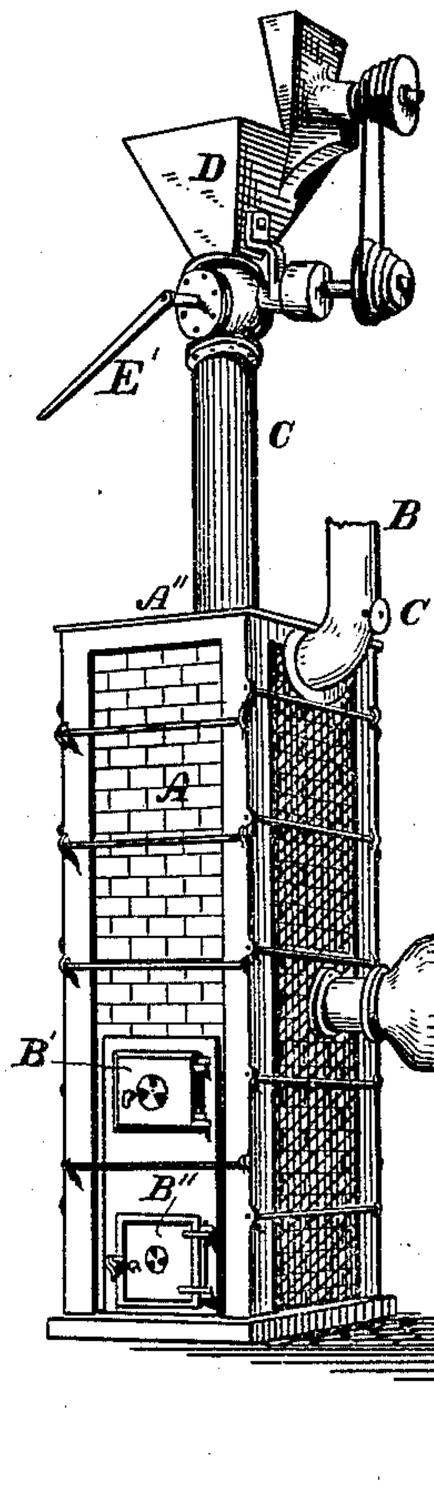
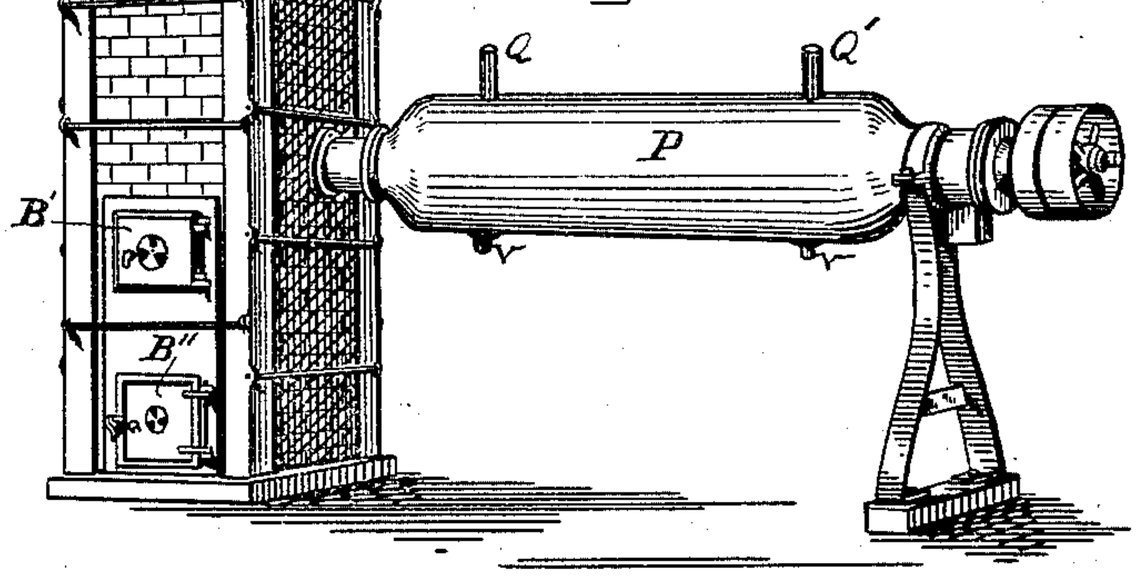


Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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AMALGAMATOR.

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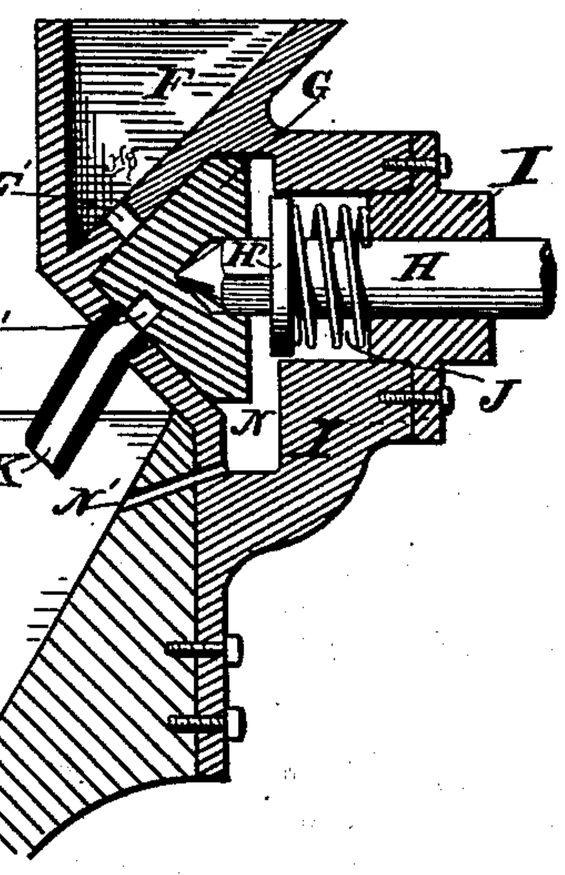
Fig. 4.



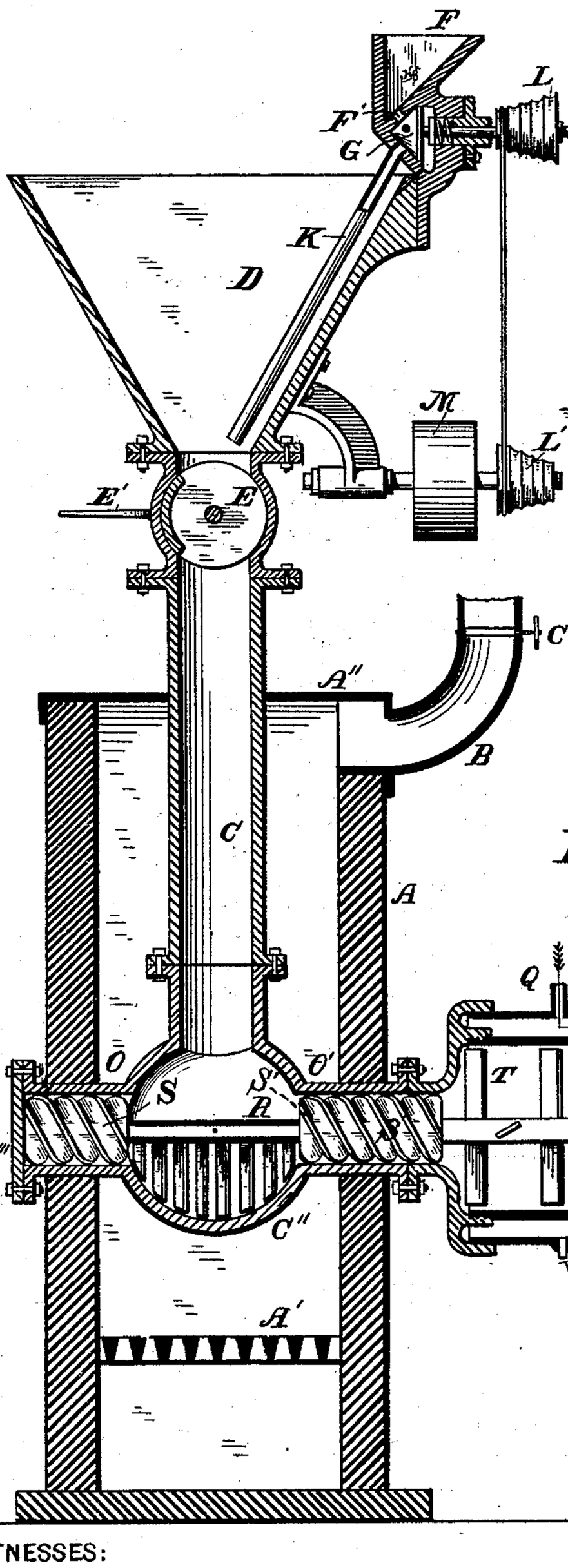


Fig. 3.

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UNITED STATES PATENT OFFICE.

THOMAS WALKER, OF PHILADELPHIA, PENNSYLVANIA.

AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 279,995, dated June 26, 1883.

Application filed April 10, 1883. (No model.)

To all whom it may concern:

Be it known that I, THOMAS WALKER, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented a new and useful Improvement in Gold and Silver Amalgamators; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the annexed drawings, making part hereof.

The nature of my invention will fully appear from the following specification and claims.

The object of my invention is to effectually amalgamate, automatically and continuously, gold and silver, whether they are in a metallic state in their native ores or made metallic artificially, and especially to save what is commonly called "flour gold," or gold very finely divided, whether free in the matrix or what is known as "gold sulphurets," by generating the vapors of mercury, saturating the properly-prepared ore containing the gold and silver with the vapors of mercury so generated, and condensing therein these vapors so generated.

In the drawings, in Sheet 1, Figure 1 is a perspective view of my apparatus; Fig. 2, a perspective view of the valve in the top of the retort, immediately below the hopper, to regulate or stop the flow of ore into the retort. In Sheet 2, Fig. 3 is a vertical sectional view of the whole apparatus shown in Fig. 1; Fig. 4, a detached vertical sectional view of the mercury basin or hopper, showing the means of feeding the mercury to the ore.

Similar letters in the various figures refer to like parts.

A, Fig. 1, is the furnace, inclosing part of the retort C; A′, (see Fig. 3, Sheet 2,) the grate-bars; B′, Fig. 1, Sheet 1, the coal and draft door; B″, the door covering the ash-hole; B, the flue or bottom of the chimney-stack, the draft in which is regulated by a damper, C′.

C is a tubular or cylindrical retort, part of which is inclosed within the heat-chamber of the furnace A, (see Fig. 3, Sheet 2,) the upper part of the retort projecting upward through the roof or cover A″ of the furnace.

D is the ore-hopper, set upon top of retort C.

E is a valve set in a cylindrically-shaped enlargement of the shell inclosing the space between the hopper D and the retort C. The valve E is of the form which will be left by cutting away a large part of the curved or convex shell of a hollow cylinder, the part of the convex shell remaining being of a width slightly greater than the diameter of the opening in the bottom of the hopper D. The axis or stem of the valve E passes at each end through the bolted covers of the cylindrically-shaped enlargement of the shell, and forms journals upon which the valve is turned or operated by means of the short lever E′. (See Figs. 1, 2, and 3.)

F is the mercury basin or hopper for providing a supply of mercury to the ore. An opening, F′, pierces the bottom of this hopper.

G is a cone-shaped block, provided with a pocket, G′, which block sets into a similarly-shaped recess beneath the hopper F. The pocket G′ in the block G is in such a position that when the block is turned around to a position the reverse of that shown in Fig. 4 the pocket will be flush with and beneath the opening F′, whereby as much mercury will flow through said opening into said pocket as the latter will hold.

H is a shaft set loosely into said block G by a square end terminating in a point, which point centers into a suitably-shaped recess in block G, this recess being of a shape corresponding to the square end of the shaft where the square end enters it. Said shaft end forms a carrier, which carries and at the same time rotates block G.

H′ is a tight collar set upon and near the inner end of shaft H, forming a recess or interspace between itself and the journal block or cap I, through which latter the shaft passes. Around the shaft, and between the collar H′ and the block I in this recess, is set a compressed spiral spring, J, which serves to press against the collar and force the shaft inward against the block G and hold the latter firmly against its seat and in place.

K is the mercury-tube, which terminates above in an orifice through the shell which supports the mercury-basin F, its terminus being located in a position directly opposite to that part of the block G which will insure its coincidence with the pocket G′ when the

block G is revolved to the position shown in Fig. 4. The lower end of this tube K terminates at a point immediately above the valve E in the lower part of the hopper D, or at a point where the ore while being treated is in active motion, in order that the mercury may not be fed into still or packed ore, and in order that the mercury may be equally distributed in the ore.

Upon the outer end of shaft H is located a cone-pulley, L. This pulley L is driven by a belt from the cone-pulley L′, which latter in its turn is driven by a pulley, M, located upon a suitable shaft, as will be seen by the views of these two cone-pulleys shown in Fig. 3. The speed of revolution of the shaft H, and consequently of the pocketed block G, can be regulated by shifting the belt to different-sized pulleys of the cones in the well-known manner.

A depression, N, beneath the space in which the block G is set, serves to collect any mercury which may leak from the hopper F or the pocket G′, and a small opening, N′, serves as an exit from the depression N, to permit the mercury so collected to escape into the hopper D, and consequently to the ore being treated. The retort C terminates below in a depression or pan, C″, which is lower than the plane of exit of the ore from the retort, and is designed to collect and hold the metallic mercury while it is being vaporized.

O O′ are two horizontal cylinders, one of which, O, pierces the wall of the furnace upon one side, and forms with its bolted head-plate O‴ a passage-way through which the interior of the retort can be reached for cleansing purposes when the delivery-screws are removed. The cylinder O′ forms an exit for the ore from the retort C to the cooling or condensing chamber P, which latter is formed of double-walled sides P′ P″, which two walls form a water-jacket around the chamber. The cool water enters the annular chamber between the walls by means of pipe Q, and after cooling the chamber the warmed water leaves by means of the outlet-pipe Q′. A horizontal square or polygonal shaft, R, passes from the outer head, R′, of the cooling or condensing chamber P to the opposite end of the cylinder O. In cylinder O a screw, S, filling the cylinder, is located on this shaft, and in the bottom of the retort C a single row of stirring-vanes is set upon this shaft by means of square eyes or holes through the ends of the vanes, the latter being of such length as will not preclude this vaned section from being pushed in through the cylinder O. A close screw, S′, is located upon said shaft in cylinder O′. This screw S′ is fitted so closely in the cylinder O′ that, while it turns freely therein, it will preclude the free flow of the heated ore through the cylinder-passage, and will regulate or, when its motion ceases, stop the same. At the same time, being packed between its threads by the mass of heated ore, it prevents the escape of any vapor or fumes from the retort C, and in the enlarged condensing-chamber P the vanes T T are set upon it, designed to stir up the ore, and at the same time deliver it through the outlet U. The vanes T are set at such an angle upon the shaft R that the tendency of their push against the ore is to drive it toward the opening U, as will be seen by the end views of these vanes shown in Fig. 3. The throw of screw S′ is also from the retort toward chamber P. That of screw S is toward the retort, which effectually prevents the accumulation of particles of ore in the chamber or cylinder O.

I have shown the retort C terminating in an enlarged bulb, which is a construction preferred by me in order to present the greatest amount of heating-surface to the fire beneath to vaporize the metallic mercury in the bulb. This mercury drip depression may be of various forms and shapes, and may be located at some other desired part of the retort. The object of its use is to catch the mercury before its passage with the ore away from the point or points where it can be heated and vaporized.

The operation is as follows: The ore, after being roasted or properly prepared, is fed in a continuous stream into the hopper D. The pulley M is started at the same time, and the metallic mercury will then run into the mass of moving ore in retort C and down into the pan C″. The furnace-fire will then operate to heat the ore and to vaporize the metallic mercury in pan C″, which, rising, thoroughly saturates the ore and becomes united with the noble metals therein. Any vapors of mercury rising still higher will be cooled and condensed by the incoming cool ore. Meanwhile the shaft R, operated by a pulley upon its outer end, will continue revolving and delivering the ore from the retort C to the condensing or cooling-chamber P, and thence through the delivery-outlet U. The object of the cooling-chamber P is to condense the vapors of mercury in the ore before the latter is discharged through the outlet U. The operation is continuous. It will be observed that with the exception of valve E, designed only to close the retort when the operation is over, there are no obstructions in the interior of the retort to militate against the free and continuous operation of the amalgamator. The thorough union of the vapors of mercury and the noble metals is effected in the retort C. As the vapors rise from the pan C″ they pass through the hot ore, and what escapes or is not taken up rises until it meets the incoming moving mass of cool ore near the top of retort C. The cool ore condenses the vapors, and the metallic mercury thus formed passes with the supply from the hopper or basin F down to the basin or pan C″, where it is again vaporized and driven up with the new supply into the ore being treated, the operation being continued indefinitely. The entire mass of ore treated is thus thoroughly and completely saturated with the vapors of mercury continuously, so that no particles of

the noble metals can by any possibility escape being recovered. The heat from the furnace is communicated to the moving ore in the lower part of the retort to such a degree as to so heat the ore for a certain space in said retort as will permit the rising vapors to pass through and thoroughly saturate the mass of heated ore. When the operation of the apparatus has reached a point when it is desirable to cease, the valve E is closed in the manner indicated in the above description. The edge of the valve, coming into contact with the ore, cuts through the moving mass and shuts off the further entrance of the same. The ore thus left in the retort continues descending, and is discharged by screw S′ and vanes T. As this ore descends it is heated, and as it descends it will leave a gradually-increasing unoccupied space in the top of the retort C, between the top of its own body and the closed valve E. This unoccupied space will thus be receiving the vapors of mercury arising from depression C″, and no cold ore will be entering to condense said vapors. Their escape, however, is prevented by the closed valve E and the cold ore in hopper D above the valve, which latter will condense any escaping vapors, and when the ore is all removed and the retort cools the vapors will be condensed by the lowering of the temperature. If, on the other hand, the furnace-fire is kept up, the vapors will remain confined in the retort by the valve E, and prevented from rising and escaping by the cold ore in the hopper D, which cold ore will condense what vapors do pass through the valve, and when the valve is again opened to permit the entrance of the cold ore the operation will go on as before. When the operation is thus checked, the belt is thrown off or shifted from the pulley M to check the feed of metallic mercury from the basin F. Any vapors which may pass through the screw S′ will be condensed in the chamber P.

It will be observed that the packing of the ore between the screw-threads of screw S′ will prevent the escape of the vapors of mercury through said screw to the chamber P.

Various modifications of the form and arrangement of my retort and its auxiliary parts may be adopted, and steam, hot air, and other devices may be used for heating the retort, as well as cold air, &c., may be used for cooling the chamber P.

V V are two short nozzles to be furnished with cocks to empty the contents of the annular chamber contained between the outer and inner shell of the chamber P.

I am aware that amalgamators in which the retort was furnished with valves to enable the operator to treat detached or separate batches of ore have been used before and described in printed publications. The batch being handled was, however, stationary, and in this condition was treated with the vapors of mercury. As one batch was finished it was removed and another batch let down, to be in its turn similarly treated. I am also aware that other amalgamators have been described in printed publications, wherein the ore was treated while in a continuously-moving mass with the vapors of mercury; but these vapors passed out of the retort with the moving mass and were condensed in a separate condensing-chamber; also, that still other amalgamators have been so described wherein the ore was while in a moving mass treated with the vapors of mercury which were generated in a vessel separate and apart from the retort in which the ore was being treated, and in which separate vessel the amalgam was gradually collected, and the operation was then terminated to remove the amalgam from this vessel, thus constituting an amalgamator in which an intermittent action only was possible. It is my object to utilize some parts of old processes and unite them in one new method or process possessing distinctive and new features. I treat my ore in a continuously-moving mass in the retort with the vapors of mercury, the mercury being vaporized, and the excess of mercurial vapor again condensed continuously directly in the moving stream of ore, vaporized in the heated ore, and recondensed in the incoming mass of cool ore before the latter reaches the point where it is heated, and the amalgam passes directly through and out of the apparatus with the tailings. I am thus enabled to sustain the operation continuously, no stoppage of the same being necessary for any cause. The ore-hopper is kept constantly filled with ore to be treated.

Heretofore a screw similar to that which I denominate S′ has been used to discharge the tailings and amalgam from the retort; but this screw has been loose-fitting and simply served as a conductor or carrier. In my device, in the cylinder O′ the screw S′ fits snugly, whereby a stuffing-box (practically) is formed between the retort and the cooling-chamber, which checks the exit of mercurial vapors into the cooling-chamber from the retort.

Heretofore, while screws somewhat similar to screw S′ have been used to remove the ore from the retort, there has been no provision made for preventing the escape of vapors with the ore. The distinction between my present device and others in this respect is that I form a packed passage-way by making the screw S′ close-fitting in the surrounding walls. It is free enough to turn, but too close to permit the escape of vapors. The stirring-vanes T T operate better than a screw to bring all the particles of the ore into contact with the walls of the cooling-chamber, for while the vanes stir the mass up and dash it about, the screw-conveyer carries it in a spiral column through the cooler, the outer particles only of which column come into actual contact with the walls of the cooler.

What I claim as new is—

1. In the amalgamation of metals, the pro-

cess of treating the ore in a continuously-moving mass with the vapors of the mercury or amalgamating agent, continuously vaporizing the latter in the body of the retort containing the ore being treated, continuously recondensing the residuary surplus of vapor within the said retort by means of the incoming mass of cool ore before the latter reaches the point where it is heated, and continuously passing the mass of tailings and amalgam out of the apparatus, whereby the operation may be carried on without interruption, substantially as set forth.

2. In an amalgamator, the combination of the retort C, ore-hopper D, set above and feeding to the upper end of the same, the said retort being plain and free from obstructions within, to permit a continuous flow of ore down and through the retort, the lower part of the latter being set in a heat chamber or space, the upper part projecting up through the top of said heat-chamber, so as to remain cool, whereby the descending ore at and near the top of the retort will be cool to condense the mercurial vapors, and will be gradually heated as it descends, whereby the mercury may be vaporized below, substantially as described.

3. In an amalgamator, the process of continuously feeding ore to the retort, the retort being kept constantly full with a moving mass of ore, and continuously discharging the same from the latter, whereby the ore is kept in constant motion, and vaporizing mercury in said retort, to saturate the mass of ore to amalgamate the precious metals contained in the same, and condensing the residuary vapor above by the cooling effect of the incoming mass of fresh ore, and preventing the escape of any vapors with the mass being discharged by condensing the same in a cooling-chamber, P, connected with the retort, substantially as described.

4. In an amalgamator, the ore-hopper D and mercury-supply basin F, provided with an automatic regulating mercury-feed mechanism, F′ G L H, to supply the desired quantity of mercury to the ore moving down in the retort C, substantially as described.

5. In an amalgamator, the ore-hopper D and mercury-supply basin F, provided with an automatic regulating mercury-feed mechanism, F′ G L H, to supply the desired quantity of mercury to the ore moving down in the retort C and tube K in said hopper D, to carry the mercury to the moving mass of ore, substantially as described.

6. In combination with an amalgamator having a hopper, D, and retort C, the valve E, having a curved face, as shown, of the form of a longitudinal part of the convex surface of a hollow cylinder, to cut through and regulate the supply of ore from the hopper set within a cylindrical enlargement or shell between the hopper D and retort C, so that the valves, when open, will turn into said enlargement, so as to offer no obstruction to the moving mass of ore, substantially as described.

7. In an amalgamator, the combination of the retort C and cooling-chamber P, and, located between the said retort and said chamber, the passage-way or cylinder O′, provided with the close-fitting discharge-screw S′, to check the too rapid discharge of the heated ore into cooling-chamber P, substantially as described.

8. In an amalgamator, the combination of retort C and cooling-chamber P, provided with stirring and delivering vanes T T, set at an angle, as shown, to drive the mass of ore to the outlet, and by separating and stirring the mass bring all the particles into contact with the cooling-walls, substantially as described.

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