No. 696,452. Patented Apr. 1, 1902.

# E. J. KISS.

## AMALGAMATOR.

(Application filed June 27, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

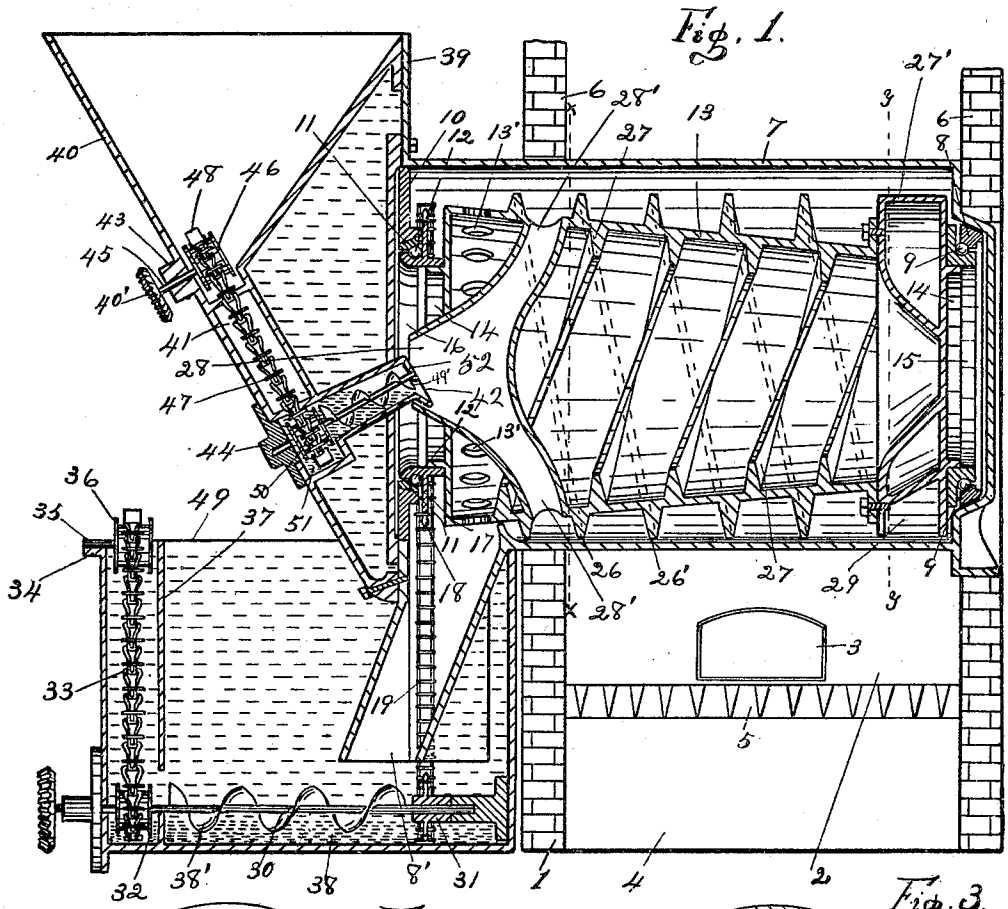



Fig. 2.

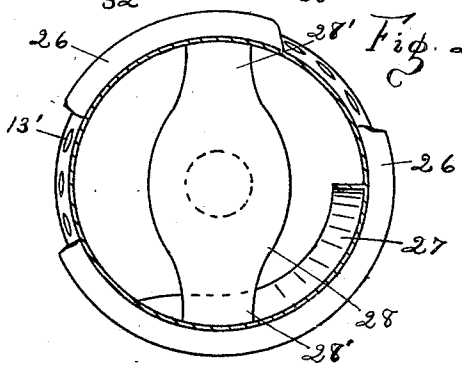
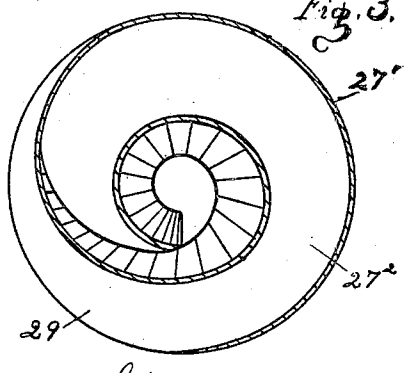



Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

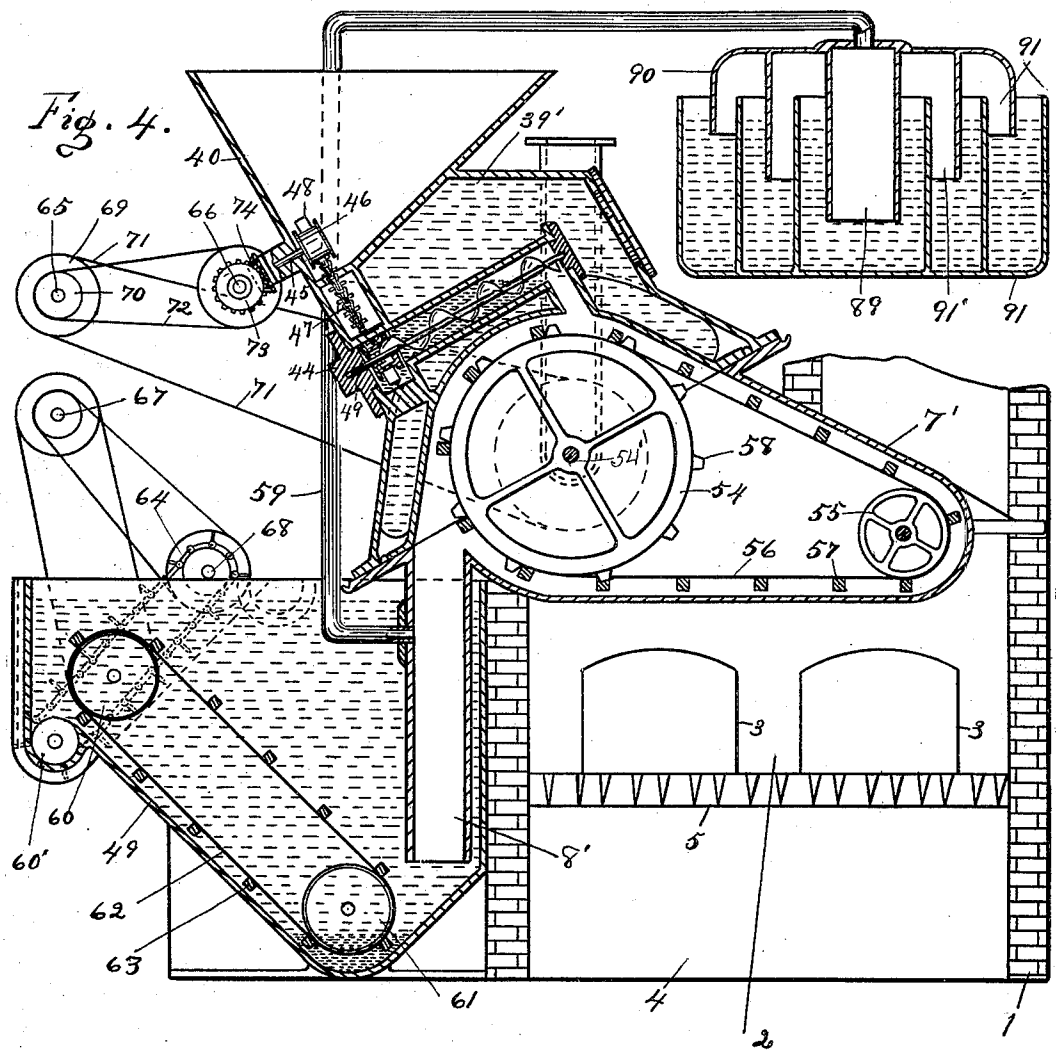


Fig. 9.

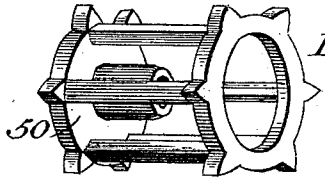


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Fig. 5.

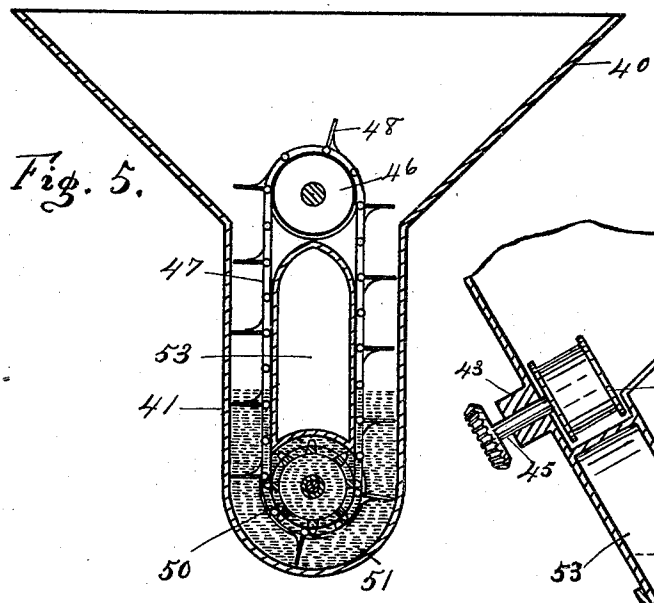



Fig. 6.

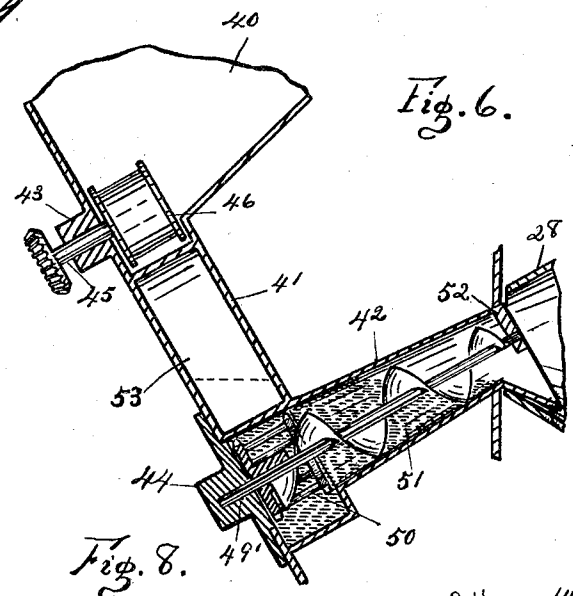
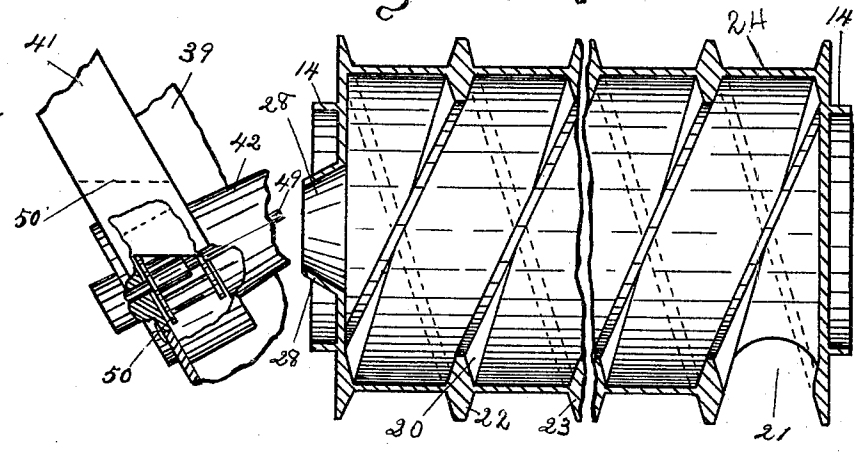



Fig. 8.

Fig. 7.

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# UNITED STATES PATENT OFFICE.

ERNEST J. KISS, OF FORT WAYNE, INDIANA.

## AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 696,452, dated April 1, 1902.

Application filed June 27, 1901. Serial No. 66,195. (No model.)

*To all whom it may concern:*

Be it known that I, ERNEST J. KISS, a citizen of the United States, residing at Fort Wayne, in the county of Allen, in the State of Indiana, have invented certain new and useful Improvements in Amalgamators; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in amalgamators for use in the recovery of amalgamable metals from their ores.

The object of my present improvement is to provide an improved apparatus for mercurializing refractory ores.

My invention consists of a fixed retort arranged over the combustion-chamber of a suitable furnace, a cylindrical agitator rotatably mounted in said retort, improved means for feeding the ore to the agitator and for subjecting the amalgamable metals to the mercury-fumes, improved means for sealing the mercury-fumes in the said retort during the operation of mercurializing the ore therein, and means for conducting the ore from the retort to a water-sealed amalgamating cooling-tank, and means for discharging the mercurialized ore therefrom.

The principal novel features of my present invention are the construction of the inclosed revoluble agitator, whereby it is adapted for thoroughly exposing the ores to the mercury-fumes in the said retort, and the means for sealing the mercury-fumes in the retort during the amalgamating process.

In the accompanying drawings, illustrating my invention, similar reference-numerals indicate like parts throughout the several views, in which—

Figure 1 is a vertical central section of the preferred form of my improvement, showing the relative arrangement of the operative parts. Fig. 2 is a cross-section of the agitator taken on the line $x\,x$ of Fig. 1 looking to the left, showing another view of the bifurcated inlet-opening to the heated retort. Fig. 3 is a cross-section of the agitator taken on the line $y\,y$ of Fig. 1 looking to the right. Fig. 4 is a vertical section of a modified form of my invention, showing a modified form of agitator. Fig. 5 is an enlarged front detail view of the carrier-chain which feeds the ore from the hopper to the coöperating conveyer, the hopper and inclosed casing being shown in vertical section. Fig. 6 is an enlarged detail of the said conveyer, showing its relative arrangement with wheels on which the said carrier-chain is mounted. Fig. 7 is an enlarged detail of the lower end of said inclosing casing, showing the bottom line of the mercury seal as horizontal. Fig. 8 is a longitudinal central section of another form of the cylindrical agitator, showing the inner peripheral spiral flange. Fig. 9 is an enlarged detail of the lower wheel for the carrier-chain 47.

Referring now particularly to Fig. 1, the furnace 1 has a suitable combustion-chamber 2, having a door 3, the chamber 2 being separated from the ash-pit 4 by the grate-bars 5. In the upper portion of the walls 6 and directly over the combustion-chamber is mounted the cylindrical retort 7, closed at both ends, as shown, and provided upon the inner face of its outer end with a removable fixed collar 8, whose inner face has an annular groove adapted to admit and contain the balls 9. To the opposite inner face of the said retort 7 is fixed a ring 10, adjacent to whose inner face is arranged a second ring 11, having upon its lower face an annular groove adapted to admit the balls 12. The retort 7 has at one end a pendent chute 8′, which extends downward into the water-tank 49, forming a water seal to prevent the escape of the mercury-fumes of the retort through said chute. The pressure of the said fumes will of course keep the said chute free of water in use. This chute at its lower end is divided into two parts, one of which is for the driving-chain for the revoluble agitator about to be described. In the said retort 7 is rotatably mounted my improved cylindrical agitator 13, which has upon its outer perimeter the spiral flanges 26 and 26′ of proper dimensions and adapted to feed the ore forward upon its entrance to the retort and has a series of internal peripheral spiral flanges 27, adapted to feed the ore back through the interior of the cylinder in the manner hereinafter described.

This agitator is slightly conical, as shown, and the said external flanges 26 and 26′ are of a proper height to barely clear the bottom of the said retort as the agitator revolves. Each end of the said agitator is provided with an annular flange 14. On the outer face of the said flange 14 on the forward end of the agitator is fixed a ring 15, having upon its outer face an annular groove adapted to admit the said balls 9. On the other flange 14 is fixed the annular plate 16, whose outer face has an annular groove for the balls 12. The upper face of this plate 16 has an upright flange 17, provided upon its perimeter with a series of sprocket-teeth 18, adapted to carry the endless actuating sprocket-chain 19.

The rear or larger end of the agitator 13 has a series of peripheral outlet-openings 13′, through which the ore is fed into the said chute 8′. The inlet-chute 28 has its inlet-opening protruding from the said rear end and in concentric relation therewith and has two radial branches 28′ in opposite arrangement, through which the ore is alternately discharged upon the bottom of the retort, after which it is fed forward by the said flanges 26 and 26′. On the forward and smaller end of the said agitator is rigidly fixed a cylindrical casing 27′, open on its inner face and having a spiral inlet-chute $27^2$, into the mouth 29 of which the ore is fed by the said flanges 26 and 26′, and as the agitator is rotated the ore thus fed into the said casing 27′ passes the spiral chute $27^2$ and discharges centrally into the agitator 13, after which it is fed rearwardly by the said internal flanges 27 to its discharge through the said openings 13′ into the chute 8′. Adjacent to the forward end of the said retort is arranged an upright tank 49, which is kept filled with water in use and into which the ore from the retort is discharged through the said chute 8′. At a suitable point at or near the bottom of said tank is rotatably mounted a spiral-bladed conveyer-shaft 30, carrying on one end a fixed sprocket-wheel 31, on which the said sprocket-chain 19 is mounted. On the other end of the shaft 30 is fixed a sprocket-wheel 32, on which is mounted the endless conveyer-chain 33. At a proper point on the outer face of the said tank 49 is arranged a lug 34, in which is fixed a short shaft 35, on whose inner extended end is loosely mounted a sprocket-wheel 36, on which the chain 33 is also mounted. By means of this chain 33 the ore is discharged from the said tank. A vertical partition 37 in parallel relation with the adjacent side of the tank keeps all floating particles of mercury from escaping. On the outer protruding end of the said shaft 30 is rigidly mounted a sprocket-wheel or gear 30′, which is connected to any suitable source of power. In the bottom of said tank 49 is arranged a body of mercury 38, into which the spiral blade 38′ of the said shaft 30 dips at each revolution thereof. On the front face of the said retort 7 is arranged a second upright water-tank 39 of irregular form, to which in turn is fixed the hopper 40, having a pendent inclined chute 41, which intersects with a second inclined chute 42, whose inner end discharges into the said opening 28 of the agitator, as shown in Fig. 1. In a suitable lug 43 in the outer face of the said hopper is fixed the short shaft 45, carrying on its inner end the fixed chain-wheel 46, on which is mounted the endless chain 47, provided with the projecting metal blades 48. On the outer end of this shaft 45 is a fixed bevel gear-wheel 40′, which can be connected to any suitable source of power. In a suitable bearing 44 is loosely mounted the outer end of the spiral-bladed conveyer-shaft 49′, carrying near its outer end a chain-wheel 50, on which is mounted the said chain 47, which is arranged in the said chute 41. The other end of this conveyer is loosely mounted in a proper supporting-bracket 52. This conveyer 49′ is concentrically arranged in the said chute 42 and feeds the ore forward into the interior of the agitator through the opening 28. This chute 42 contains a body of mercury 51, which so fills the said chute in use as to prevent the escape of any mercury-fumes from the interior of the said retort. The chute 41 has a closed chamber 53, Figs. 5 and 6, which in itself serves no purpose, but whose sides form the inner walls of the chute 41 and prevent the clogging of the same in use.

As shown in Figs. 6, 7, and 9, the pin-wheel 50 is open and has its inner end formed of spokework, whereby the mercury body 51 occupies the space within the wheel and the ore passes freely through the same into the chute 42. This body of mercury 51 is preferably maintained in the chute 41 approximately up to the dotted line 50′ in Fig. 7, thereby securely sealing the said retort against the escape of the mercury-fumes.

In Fig. 8 is shown, partly broken away and in longitudinal central section, a modified form of the agitator in which the bifurcated inlet-chute 28 and the cylindrical attachment 27′ is omitted. In this modified form the ore is fed into the interior of the agitator first through the central opening 28 and is discharged upon the bottom of the retort through the opening 29′.

In Fig. 4 is shown another modified form of my invention, in which the agitator consists of two rotatable cylinders 54 and 55 of unequal diameters, on which is mounted an endless belt 56, provided upon its outer face with a series of fixed transverse strips 57, so spaced thereon as to successively engage the peripheral teeth 58 on the said wheel 54. This belt 56 is of a sufficient width to practically fill out the space between the opposite sides of the inclosing retort 7′.

The water-chamber 39′ in Fig. 4 is also modified in form, though, as before, it is interposed so far as possible between the body

of mercury 51 in the chute 42 and the walls of the heated retort to prevent any waste of the said mercury by evaporation.

In one side of the discharge-chute 8′ of the retort-chamber, at a proper point below the water-line, is fixed the lower end of an upwardly-extended discharge-pipe 59, whose upper end discharges into an independent mercury-condenser formed of two cylindrical castings 90 and 91 in concentric arrangement, the upper one 90 fitting within the other, as shown, thereby forming a series of annular chambers 90′ and 91′ and a central chamber 89, in which the water is displaced by the mercury-fumes. The mercury thus condensed and collected can readily be conducted back to the hopper 40.

In Fig. 4 is shown a modified form of means for discharging the ore from the water-tank 49, consisting of two drums 60 and 61, carrying an endless belt 62, provided upon its outer face with a series of strips 63, fixed thereon and adapted to dip into said bed of mercury 38 and to carry the ore upward to where it is discharged upon the spiral screw conveyer 60′, of the same form and construction as the conveyer 51. As this conveyer 60′ feeds the ore forward it is taken up by the conveyer-chain 64 and carried to its discharge. Fig. 4 also shows well-understood means for actuating the rotatable agitator and the various chain, belt, and spiral conveyers above described and consists of the revoluble shafts 65, 66, 67, and 68, supported in suitable bearings. (Not shown.) The shaft 65 carries the fixed pulleys 69 and 70, on which are mounted the belts 71 and 72, respectively, the former running to a pulley on the opposite end of the shaft 54′, carrying the cylinder 54, and the latter to a pulley on one end of the shaft 66, which carries on its other end a bevel-gear 73, in operative relation with a second bevel-gear 74 on the outer end of the shaft 45.

The operation of my improvement thus described is, briefly stated, as follows: Referring first to the preferred form shown in Fig. 1, when the pulverized ore is fed into the hopper 40 it will be received by the carrier-chain 47 and carried downward at a uniform rate through the said chute 41 to the lower end of the said intersecting chute 42, through which it is next fed forward into the opening 28 of the rotatable agitator by means of the spiral conveyer 49′ and in so doing each particle of ore is dragged through the mercury body 51. This body of mercury is properly replenished in any suitable manner from the top of the hopper. The ore thus fed through the said mercury seal 51 passes into the bifurcated chute 28 and thence downward through the lower one of said branch chutes 28′ upon the bottom of the retort, after which it is fed forward by the external peripheral flanges of the rotatable agitator and is then taken up by the mouth 29 of the spiral cylinder 27′, from which it is fed into the interior of the agitator, and is then fed rearwardly to the discharge-openings 13′ by means of the said internal flanges 27. As the interior of both the retort 7 and the hollow agitator 13 are highly heated from the furnace 1, they will be filled with mercury-fumes generated from the mercury floating in with the ore, as it is thus thoroughly agitated in its passage through the rotating agitator. These mercury-fumes, as is well known, are necessary in the successful treatment of refractory ores, and it is of the highest importance to prevent their escape, and thus cause a loss of mercury. This I accomplish in my present improvement by sealing perfectly both the inlet-opening to the said retort and the outlet therefrom, the former by the mercury-bed 51 in the chute 42 and the latter by the body of water in the tank 49. As the ore is fed forward by the two spiral flanges 26 and 26′ it is discharged through the chute 8′ into the water-tank 49, in which it is dragged through the body of mercury 38 and then fed forward to the carrier-chain 33, by which it is carried upward to its discharge from said tank. When that form of agitator 24 shown in Fig. 8 is used the ore is fed through the same by the inner spiral flanges 20 to the discharge-opening 21, through which it is discharged upon the bottom of the retort after which it is fed rearwardly by the external flanges 22 and 23 to the chute 8′.

In the modified form (shown in Fig. 4) the ore instead of being circular upon the interior of the retort 7′ is circulated and brought into contact with amalgamating mercury-fumes of the containing-retort by means of the endless belt 56 and is then discharged, as before, into the water-tank 49 through the chute 8′, from whence it can be discharged in a variety of ways.

The provision of the pipe 59 and the independent condenser formed of the castings 90 and 91 enables the operation to save all the mercury-fumes that would have a tendency to escape through the chute 8′.

It is thus seen that in the use of my improvement every particle of amalgamable metal is subjected to the mercury-fumes in the retort, evenly heated, and thoroughly agitated and mixed therein, whereby all the amalgamated particles of gold and silver will be eventually collected in the body of mercury in the water-tank 49, in which the heated ore is also collected and saved, while at the same time the entrance to the retort and its contained agitator is perfectly sealed against the escape of the mercury-fumes by the said mercury body in the inlet or feed chute 42.

Having thus described my invention and the manner of employing the same, what I desire to secure by Letters Patent is—

1. An amalgamating apparatus consisting of a retort arranged over a suitable furnace; a rotatable agitator mounted in said retort; means for feeding the ore into the said retort; an inlet-chute adapted to contain a body

of mercury to form a seal to prevent the escape of mercury-fumes from the retort and a water seal closing the outlet of said retort, and in which the mercury-fumes of the said retort are condensed and the amalgamated particles of precious metal are collected.

2. In an amalgamated apparatus a cylindrical agitator revolubly mounted in a closed containing-retort; means for heating said retort; a mercury seal arranged in the inlet to the retort; means for feeding the ore-pulp through said seal into the agitator; means for circulating the ore within the retort; and a water seal closing the outlet of said retort against the escape of mercury-fumes therefrom.

3. In an amalgamating apparatus a fixed retort; a cylindrical agitator rotatably mounted in said retort adapted to receive the ore and subject it to the mercury-fumes of the retort; a mercury seal closing the inlet of said retort; and a water seal closing the outlet of said retort.

4. In an amalgamating apparatus the combination of a retort; means for heating the same; and an inlet-chute adapted to contain a body of mercury to seal the same against the escape of mercury-fumes from the retort.

5. In an amalgamator, a retort; means for heating the said retort; an inlet-chute adapted to contain a body of mercury to seal the same against the escape of mercury-fumes from the retort; and an ore-conveyer arranged in said chute.

6. In an amalgamator a retort, a rotatable agitator arranged within the retort and consisting of a hollow cylinder having oppositely-directed inner and outer peripheral spiral feeding-flanges as described, a bifurcated inlet-chute within one end thereof adapted to direct the ore to the bottom of the said inclosing retort, the other end of the said cylinder being provided with a means for receiving ore as it is fed forward on the bottom of the retort and for conducting it to the interior of said cylinder, all substantially as described.

7. The combination in an amalgamator of a mercury seal through which the ore is fed; means for feeding the ore through said seal into a retort; an inclosed retort discharging into a water seal; a rotatable agitator mounted in said retort adapted to feed the ore forward along the heated bottom of the retort, and to pick up the ore at its forward end and impart to the same a spiral circulation in the interior thereof before discharging it at the rear end thereof.

Signed by me at Fort Wayne, county of Allen, and State of Indiana, this 24th day of June, A. D. 1901.

ERNEST J. KISS.

Witnesses:
ADELAIDE KEARNS,
AUGUSTA VIBERG.