

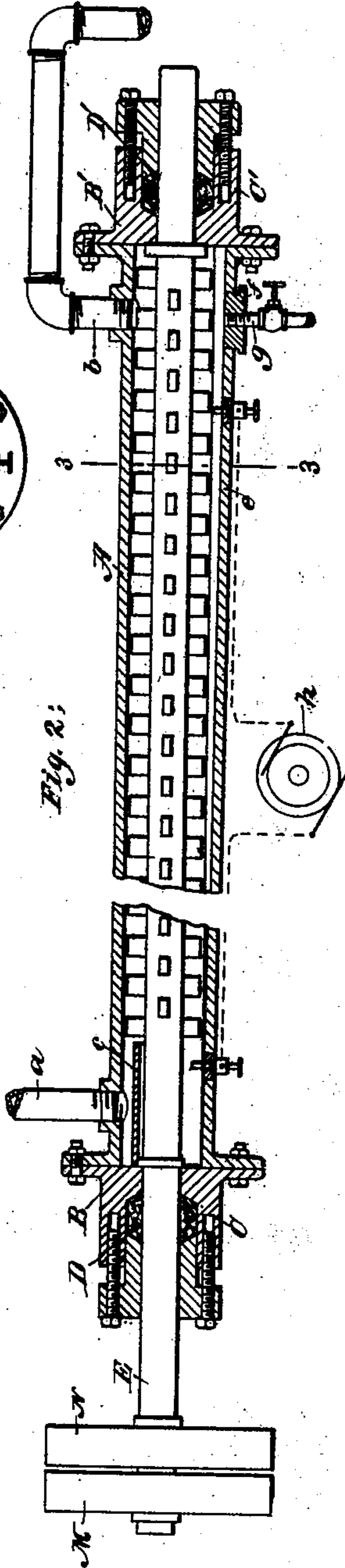
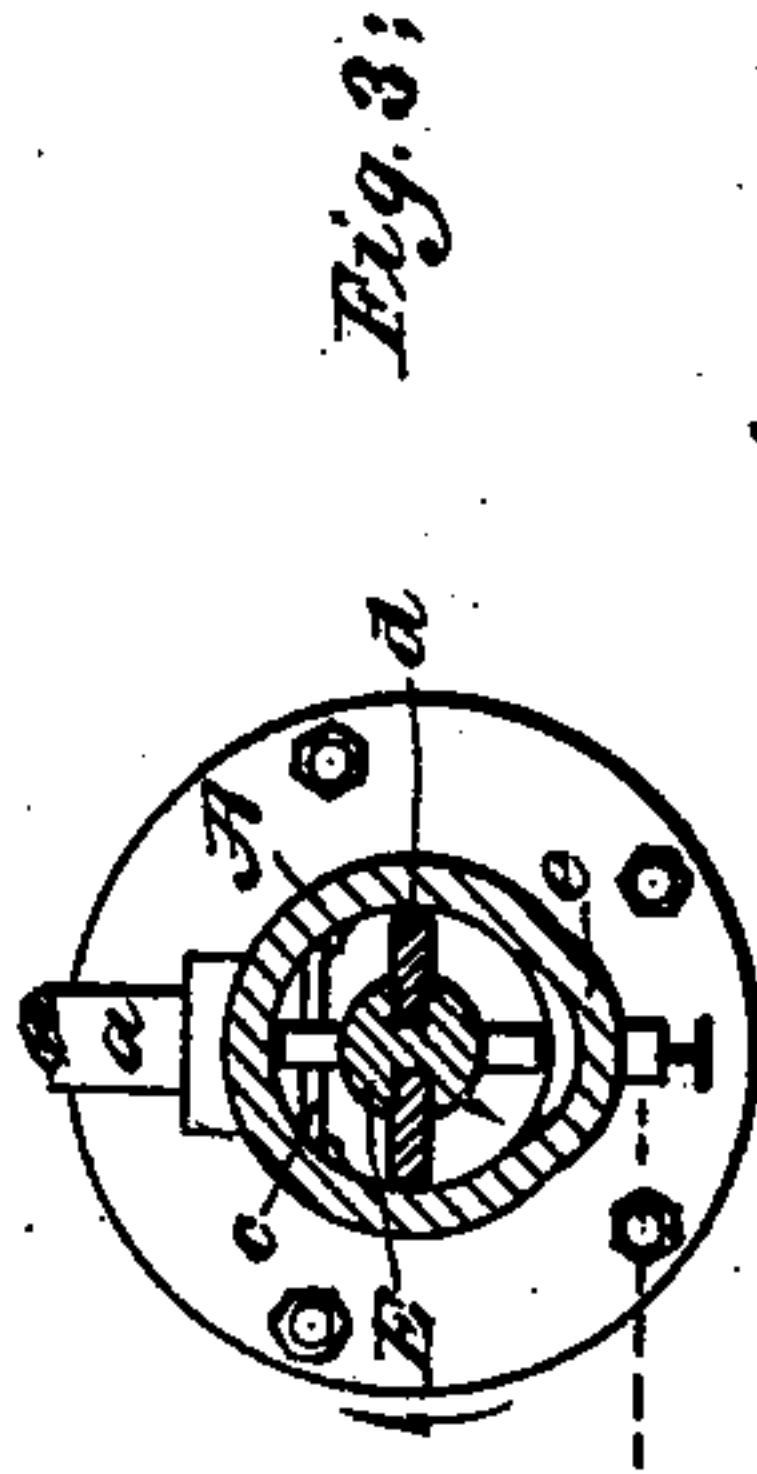
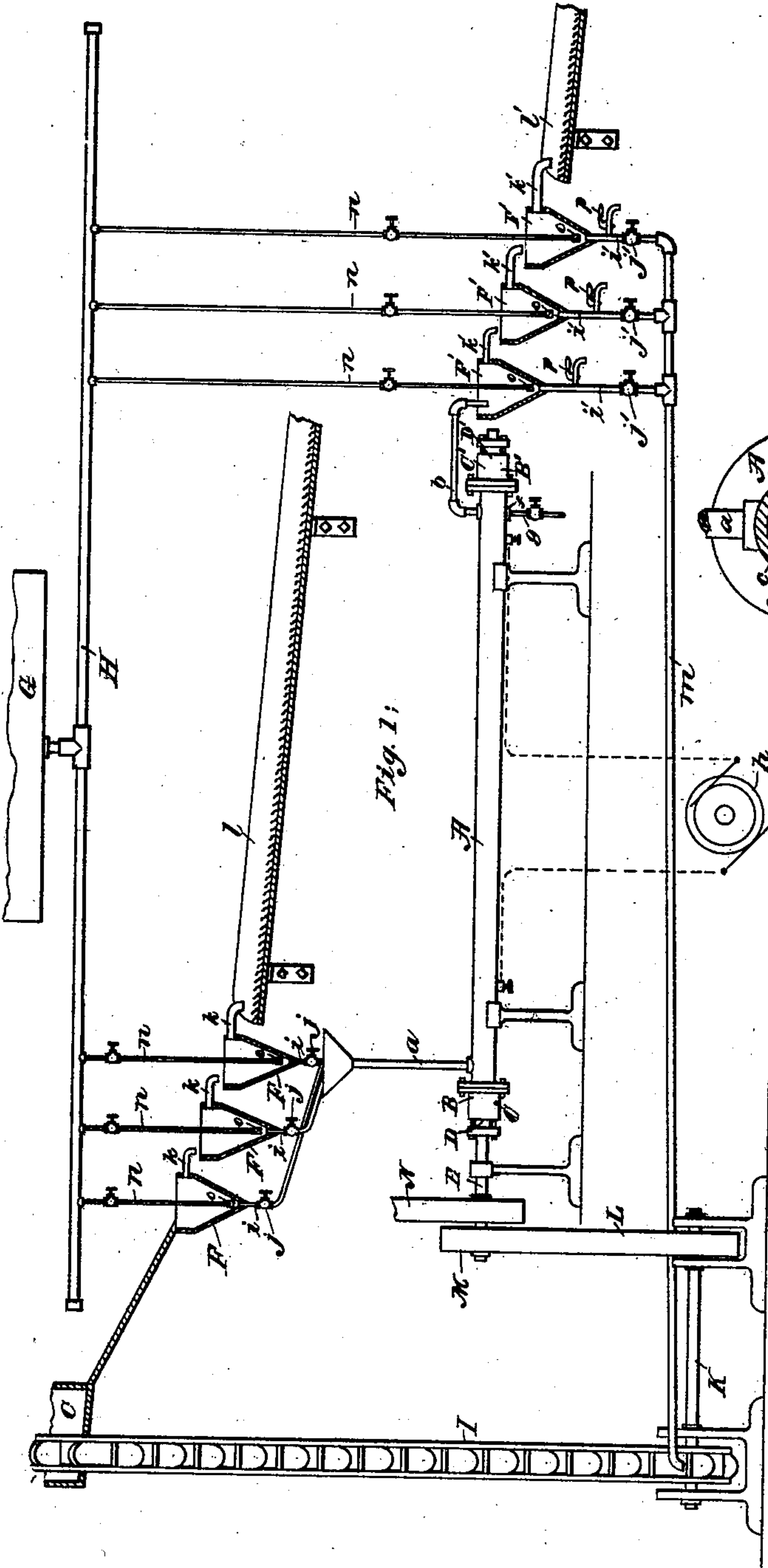
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Patented Aug. 26, 1902.

P. A. KNAPPE.
AMALGAMATOR.

(Application filed Mar. 8, 1902.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 707,972, dated August 26, 1902.

Application filed March 8, 1902. Serial No. 97,232. (No model.)

To all whom it may concern:

Be it known that I, PAUL A. KNAPPE, a citizen of the United States, residing at Grantville, in the county of Coweta and State of Georgia, have invented an Improvement in Amalgamators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to the amalgamation of metals wherein separation of the metal is effected by intermingling a mixture of comminuted ore and water with a quantity of free mercury. A very thorough intermingling of the mercury and ore is obviously requisite to obtain satisfactory results by this means. A thorough mixing, however, is usually accompanied by a loss of a considerable percentage of the mercury and amalgam, which passes off in small particles with the tailings or gangue. It is also very difficult to prevent the loss of many fine particles of metal with the gangue, particularly when the ore has been ground to a high degree of fineness, without subjecting the same to repeated intermixture with mercury.

The object of my invention is to provide a simple means for amalgamation which shall permit the attainment of a high commercial efficiency.

My invention will be best understood by reference to a specific means for carrying it into effect, while its scope will be particularly pointed out in the appended claims.

Referring to the accompanying drawings, Figure 1 is a side elevation, partly in section, of my improved amalgamator. Fig. 2 is a broken central sectional view of the amalgamating-chamber with its attached parts, and Fig. 3 is a cross-sectional view of the amalgamator-chamber on the line 33 of Fig. 2.

A is an amalgamator-tube, suitably supported in a horizontal position and preferably formed, as shown, with flanged ends. The tube is closed at its ends by heads B B', bolted to flanges and providing glands C C' for the stuffing-boxes D D', forming therewith bearings for the shaft E. An inlet-pipe *a* enters the initial end of the cylinder, preferably at the top, and an outlet or discharge

pipe *b* is provided at the outlet end thereof, likewise located preferably near the top. A shield or baffle-plate *c*, which may be formed of metal or other suitable material, is removably fitted into grooves in the wall of the cylinder A, immediately beneath the said inlet-pipe. A series of radial mixing-arms *d* is carried by the shaft E throughout the length of the tube A, except where they would conflict with the shield *c*. These are screwed or otherwise suitably attached to the shaft E and are adapted to be revolved within the chamber A with but slight clearance. These are shown in staggered sets of two and are suitably dimensioned and disposed with relation to the space in the chamber A to cause thorough intermingling of the mercury and the pulp.

As a convenient means for draining the amalgamator, but forming no essential feature thereof, I have shown a trough-like depression *e*, formed in the under wall of the tube and increasing in depth toward the latter end thereof. This is best shown by Fig. 2 and the cross-section in Fig. 4. At the outlet end of the tube and near the deepest part of the depression is cast a boss, into which is screwed the plug *f*, carrying the drain-pipe *g*, controlled by a valve, through which the mercury may be removed at suitable intervals.

A source *h* of electric current is shown suitably connected with the interior of the chamber A, preferably through insulating-plugs, to cause the passage of a current through the contents thereof.

C is an initial ore-receptacle adapted to feed the ore to the first of a series of sizers F F F, having successively lower levels. These sizers are shown suitably located to drain into the inlet of the amalgamator through pipes *i i i* at a point elevated above the outlet thereof to cause a steady progress of the pulp therethrough under the pressure of the superimposed pulp in the inlet-pipe. The amount of flow through these pipes may be regulated by valves *j j j*. Overflow-pipes *k k k* are provided for the sizers to carry the waste from one to the other, and thus throughout the series, the overflow-pipe from the last sizer leading to a blanket-sludge, (typified at

l in the drawings.) The discharge-pipe of the amalgamator leads to a second series of similar sizers F' F' F', provided with similar overflow-pipes k' k' k' and drain-pipes i' i' i', the latter 5 being provided with valves j' j' j' and draw-off cocks p p p and leading to the return-pipe m. The overflow from the last sizer leads to another similar blanket-sluice l', the end only of which is shown in the drawings.

10 An elevated water-tank G or other suitable source distributes water to the sizers through the main feed-pipe H, which is shown with depending valve-controlled branches n n n, extending downward into the individual sizer-

15 tanks of both sets. The ends of these branch pipes are preferably provided with perforated tips o o o. An inclined return-pipe m leads from the last sizer F' to the bucket elevator or conveying means I, by which the returned

20 materials may be elevated to the initial ore-receptacle C. This elevator is conveniently driven through the shaft K, the belt L, and driving-pulley M on the shaft E, power being supplied to the latter from any suitable

25 source through the pulley N.

My invention is carried out by the described apparatus in the following manner: The ore is conveyed by any suitable means to the initial receptacle C. Here it is joined,

30 as will afterward appear, by the discharge from the bucket elevator, and the mixture passes into the first sizer F. The water-jets from the pipes n serve to agitate and dilute the mass, so that the heavier particles gravi-

35 tate to the bottom of the sizer and are conveyed by the pipe i to the inlet-hopper of the amalgamator. The lighter particles pass off at the overflow and are subject to a second settling or concentrating process in the sec-

40 ond sizer. From here the overflow may be carried to a third sizer, and so on, as many sizers being employed as may be found desirable to extract all the concentrated por-

45 tions of the ore. As a means for securing such concentrates as escape from the last sizer I preferably cause the overflow therefrom to pass over the blanket-sluice l'. This blanket-sluice may be taken up and washed to remove the mineral held by it as often as

50 circumstances may demand. It is evident that any means which will afford a suitable concentration of the mixture and a separation of the lighter particles therefrom may be employed in place of the specific means I

55 have shown. To any device equivalent or similar to the series of sizers shown I have applied the generic term of "concentrator." The concentrated ore or pulp is passed to the amalgamator through the inlet-pipe a and on

60 entering the chamber is prevented from coming into immediate contact with the mercury and flouing the latter by the shield c. While conveyed through the amalgamator under the pressure of the superimposed pulp it is sub-

65 ject to the steady action of the mixing-arms, which enforce a thorough intermingling of the mercury and the pulp and an amalgamation

of the metal carried thereby. The lighter gangue or tailings which escapes from the amalgamating-chambers through the pipe b 70 carries with it numerous small globules of mercury and amalgam, as well as particles of unamalgamated precious metal. For the separation of these substances I pass the tailings through a second concentrator, (repre- 75 sented by the series of sizers F' F' F'.) In construction and function this concentrator is similar to that already described. The heavier particles of mercury and amalgam and the finer particles of precious metal, as 80 well as the "concentrates" or bits of refractory metal unsusceptible to amalgamation, gravitate to the bottoms of the several sizers. These tend to pass through the pipes i' i' i' to the return-pipe m, by which they are deliv- 85 ered to the bucket elevator, the latter conveying them to the initial ore-receptacle C. By adjusting the valves j' j' j' this flow may be regulated, if desired, to include only the comparatively fine particles of mercury, 90 amalgam, and metal, leaving the coarser concentrates to be withdrawn from the sizers through the draw-off cocks p p p at suitable intervals. The bucket elevator or conveyer 95 may be constantly operated and, with the sizers and circulating-pipes described, affords a continually-repeated circulation of the unamalgamated metals through the amalgamator until they undergo the desired amalga-

100 mation. It also permits the recovery and restoration to the amalgamator-chamber of all free particles of mercury and amalgam carried off in the gangue. As a means to sustain the activity of the mercury and prevent its "sickening" I have found it advan- 105 tageous to employ a source of electricity suitably connected with the interior of the amalgamating-chamber to cause a passage of the electric current through the contents thereof. This may be accomplished as indicated; but 110 I am not limited to any particular arrangement in this respect. In practice I have found an alternating current or one subject to repeated reversals highly efficacious, and in the drawings I have conventionally shown 115 an alternating-current source, although I am not limited to any particular kind of current for this purpose.

The form of amalgamator-tube described I have found particularly efficient in practice 120 for causing a thorough intermingling of the pulp and the mercury without danger of "flouing" the latter. Any known means may be substituted therefor. I have also found it advantageous to cause the pulp to pass 125 through the amalgamator under pressure, and the elevated position of the metal ore-receptacle, sizers, and feed-hopper is merely selected as a simple and practical means of affording the requisite pressure in the amal- 130 gamator for this purpose. It is not necessary that this construction should be followed or that any particular means for obtaining pressure should be employed, nor is my inven-

tion to be restricted to the employment of any pressure in this connection. The bucket elevator is merely shown as illustrative of any practical means for conveying the concentrates to a position where they may be returned to the amalgamator-chamber.

The structure shown and described is submitted for illustrative purposes only and as well adapted in practice to carry out my invention. My invention is not limited, however, to the specific means shown, but may take the form of a variety of embodiments.

I claim—

1. The combination with an amalgamator, having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, of a concentrator for extracting the heavier particles from the gangue, and conveying means to conduct said heavier particles again into the amalgamator near the initial end thereof.

2. The combination with an amalgamator having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, of a concentrator for extracting the heavier particles from the gangue and conveying means to conduct said heavier particles again into the amalgamator through said pulp-inlet.

3. The combination with an amalgamator having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, of a concentrator for extracting the heavier particles from the gangue, conveying means to conduct said heavier particles to the ingoing pulp, and a concentrator to concentrate the ingoing pulp and heavier particles.

4. The combination of an amalgamator, a concentrator interposed between the pulp-feeder and said amalgamator, and a second concentrator to receive the gangue therefrom, and having a concentrates-discharge to said first concentrator.

5. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, means to cause the passage of the pulp therethrough under pressure, a concentrator for extracting the heavier particles from the gangue and conveying means to conduct said heavier particles again into the amalgamator near the initial end thereof.

6. The combination of an amalgamator, having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, means to cause the passage of the pulp through the mercury un-

der pressure, a concentrator for extracting the heavier particles from the gangue, and conveying means to conduct said heavier particles again into the amalgamator through said pulp-inlet.

7. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet and an outlet for the gangue, means to cause the passage of the pulp through the mercury under pressure, a concentrator, for extracting the heavier particles from the gangue, conveying means to conduct said heavier particles to the ingoing pulp, and a concentrator to concentrate the ingoing pulp and heavier particles.

8. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a concentrator to extract the heavier particles from the gangue, conveying means to return the heavier particles again to said amalgamator near the initial end thereof and means to cause the passage of an electric current through the contents of said amalgamator.

9. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a pulp-inlet elevated thereabove and in free communication therewith, a concentrator for the gangue from said amalgamator and conveying means to conduct the heavier particles from said concentrator to the pulp-inlet.

10. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a concentrator for extracting the heavier particles from the gangue, means for returning said heavier particles to the amalgamator to maintain a repeated circulation of the unamalgamated metal therethrough, and means for withdrawing from such circulation those particles which are unsusceptible to amalgamation.

11. The combination of an amalgamator having means therein for forcibly intermingling the pulp and mercury, a concentrator to receive the gangue therefrom, and communication between said concentrator and an inlet to said amalgamator to permit the passage of the heavier particles from said concentrator again into said amalgamator.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL A. KNAPPE.

Witnesses:

THOMAS B. BOOTH,
EVERETT S. EMERY.