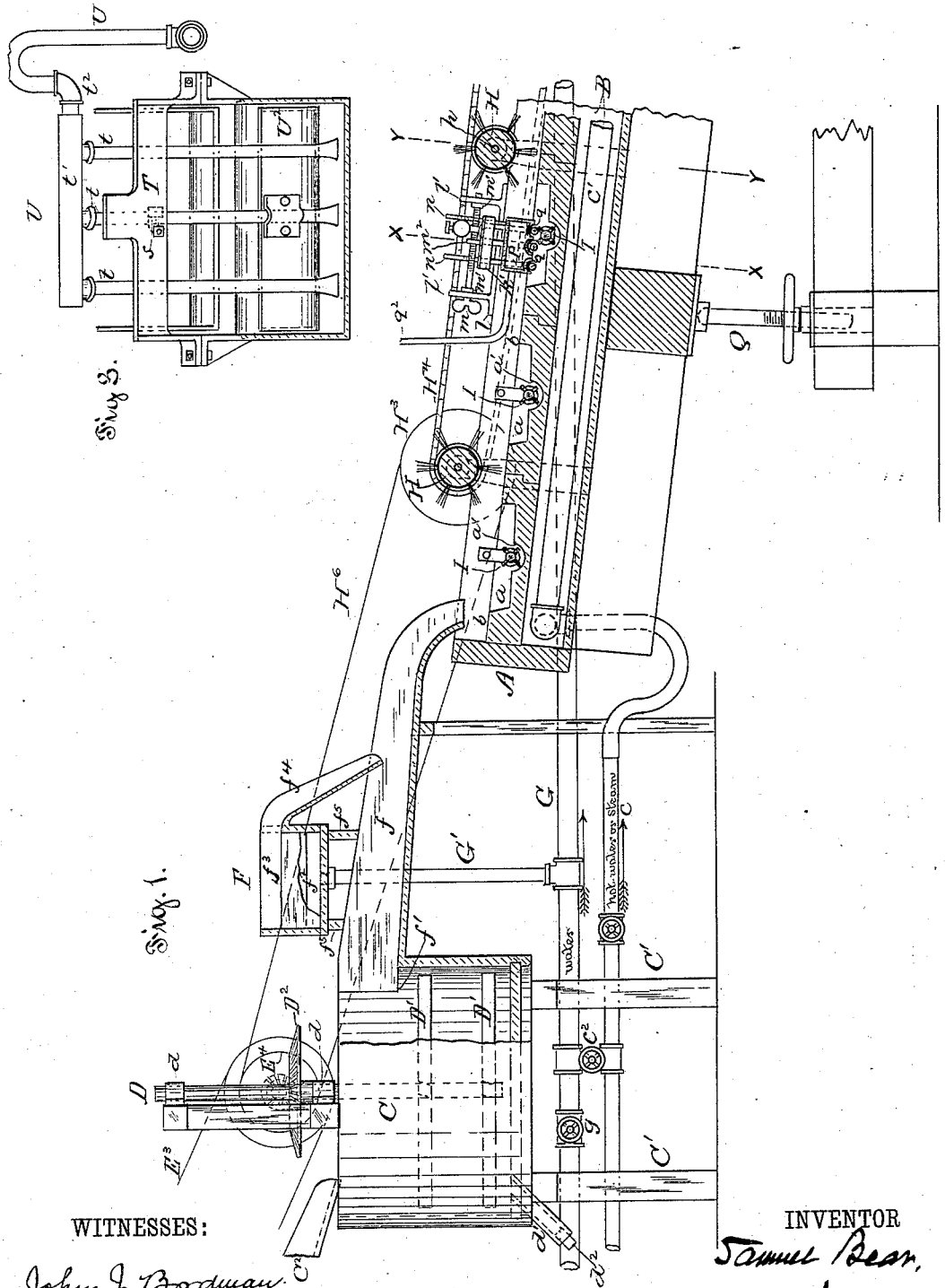
(No Model.) 3 Sheets—Sheet 1.

S. BEAR.

AMALGAMATING APPARATUS.

No. 307,082. Patented Oct. 28, 1884.



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(No Model.) 3 Sheets—Sheet 2.

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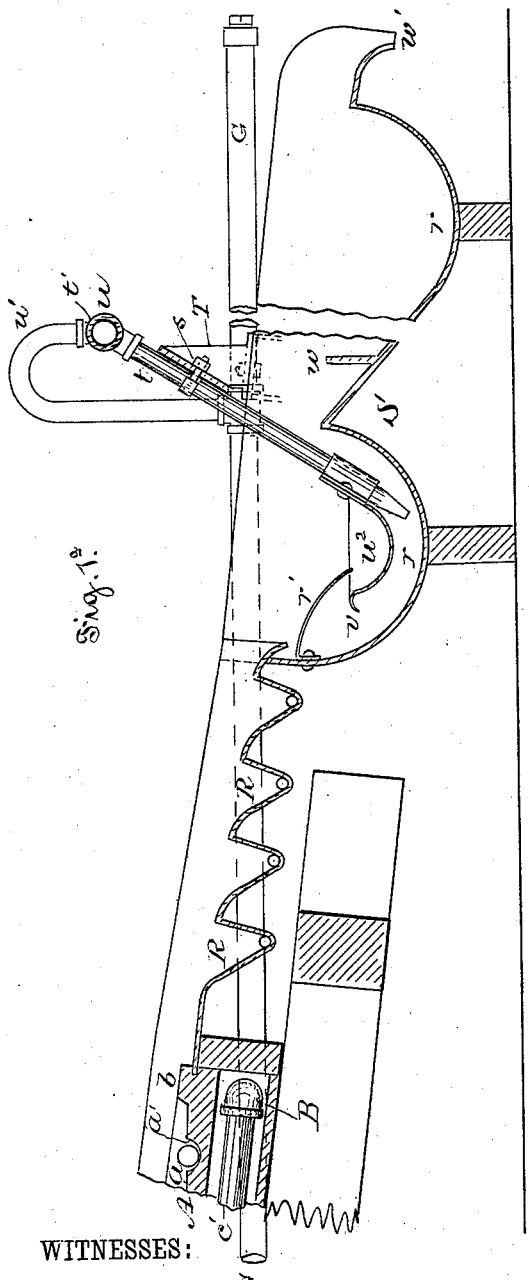

Fig. 1.

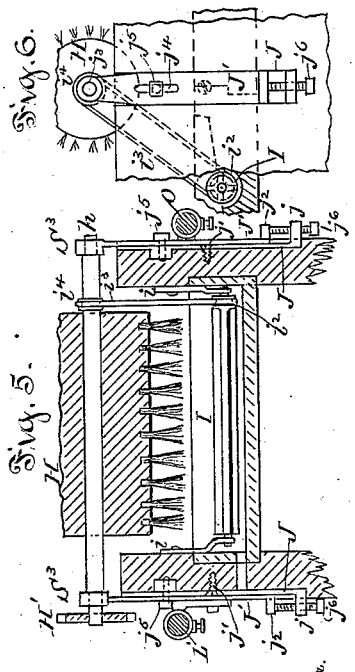

Fig. 5.

Fig. 6.

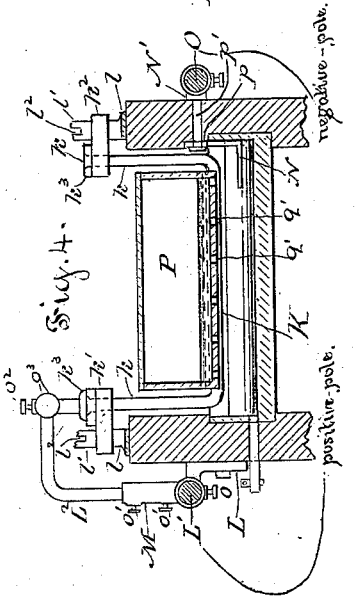

Fig. 4.

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(No Model.) 3 Sheets—Sheet 3.

S. BEAR.

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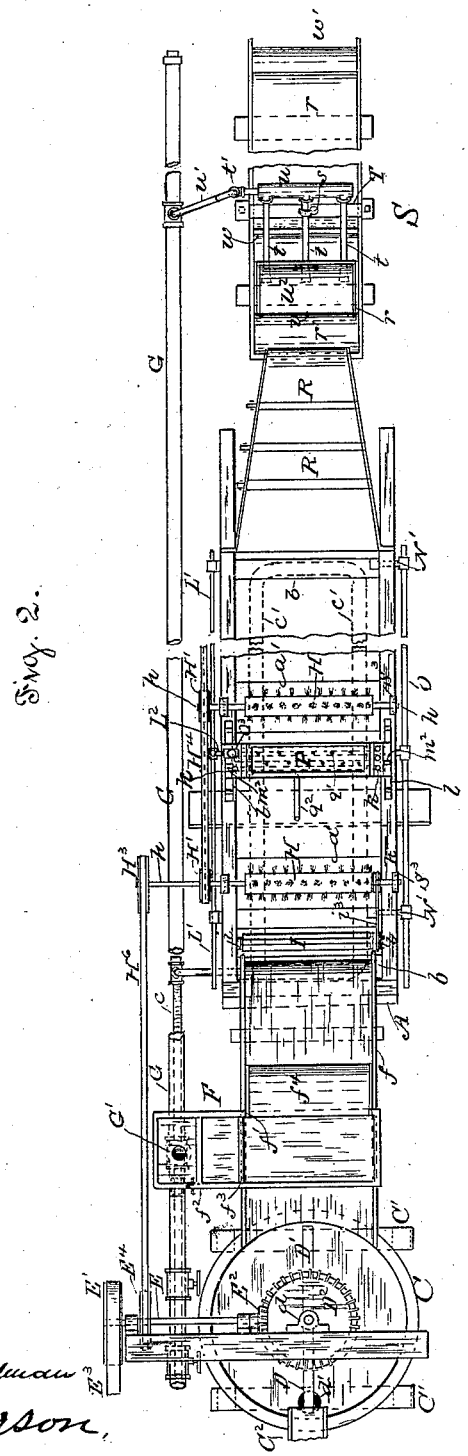

Fig. 2.

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AMALGAMATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 307,082, dated October 28, 1884.

Application filed February 20, 1884. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL BEAR, a citizen of the United States of North America, and a resident of Brooklyn, county of Kings, State of New York, have invented a new and useful Improvement in Amalgamating Apparatus, of which the following is a specification.

This invention is designed as an improvement on the amalgamating-table for which my application for Letters Patent of the United States was filed January 19, 1884.

The invention is intended to provide an improved apparatus for amalgamating gold and silver; and it consists of certain improvements in the construction or form of the table and its appurtenances, in substituting another material for those before used in devices of this class, and in combining with the table certain novel devices designed to facilitate and improve its operations, and to obtain better results therefrom, all of which will be hereinafter fully set forth.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figures 1 and 1ª are sectional side elevations of my improved apparatus with parts broken away to exhibit other parts. Fig. 2 is a reduced plan of the same. Fig. 3 is an enlarged end elevation of the injector. Fig. 4 is an enlarged cross-sectional elevation on line *x x*, Fig. 1. Fig. 5 is an enlarged cross-sectional elevation on line *y y*, Fig. 1. Fig. 6 is a side elevation of device shown in Fig. 5.

In the drawings, A represents my improved amalgamating-table lined with enameled iron, or constructed of iron and enameled on the inside with any well-known enameling compound that is designed to resist the action of acids, and that is at the same time a poor conductor of electricity. This table may be constructed of enameled iron in flanged sections, comprising one or more riffles bolted together, or may be constructed in one piece. Cavities *a* for containing mercury, and having in them central depressions, *a'*, for the accommodation of revolving stirrers, alternate with elevated riffles *b* throughout the length of the table.

Amalgamating-tables as ordinarily constructed and arranged cannot be effectively worked in winter in the majority of our mining districts for lack of suitable means or methods for preventing the chilling of the water and mercury used in the operation. To obviate this defect I construct and arrange under the bottom of the table A a chamber, B, the shell of which may be constructed of enameled iron, designed for containing hot water or steam applied through suitable pipes, *c c'*, for heating the bottom of said table, and the water and mercury thereupon when the device is in operation. This chamber B may be made to extend not only beneath the riffles, but also under the sluice-boxes that may be connected with the table.

A necessary adjunct to an amalgamating-table, an important part of a complete amalgamating apparatus, consists of a device for mixing the ore and water together and delivering them upon the table. My improved device for accomplishing this consists of a cylindrical mixing-tank, C, supported on a suitable frame, C'. A vertical shaft, D, carrying stirrers D', is held centrally suspended in the mixer C in journal-boxes *d*, which are fixed on the frame C', and on said shaft D is keyed a horizontal bevel-gear, D^2.

On the extremes of a horizontal shaft, E, suitably journaled on frame C', are secured, respectively, a pulley, E', and a bevel-gear, E^2. Through a belt, E^3, motion from a suitable source is transmitted to the pulley E', and through the bevel-gear E^2, that gears with the bevel-gear D^2 to the stirrer-shaft D.

In the bottom of the mixer C is inserted a pipe, *d'*, provided with plug or cock d^2 for drawing off the mixer contents when desired. A chute, C^2, is designed to deliver ore and water to the mixer C. One side of said mixer C is cut down, as shown at *f'*, Fig. 1, and at this point a spout, *f*, is fixed, through which the ore and water that have been agitated and thoroughly mixed by the stirrers D' are discharged upon the head of the table A. A water-tank, F, is fixed on suitable supports, f^5, over and across the mixer-spout *f*, and said tank F is provided with vertical diaphragms f^2 f^3, the former of which extends from about the top of said tank to near the bottom thereof, leaving a space beneath it, and the latter of which reaches from the bottom of said tank

to near the top thereof, so that the water entering from the water-pipe G into one end of said tank is forced to pass first beneath the diaphragm f^2 and then up over the diaphragm f^3 into the main body of said tank F, whence it flows in a gentle and unagitated current through a spout, f^4, into the spout f of the mixer C and aids in conveying the ore therein to the table A. The water-pipe G, provided with suitable valve, g, and with a branch, G′, that enters the bottom of the tank F, is designed to supply to the latter a sufficient supplementary amount of water for the proper treatment of the ore and for carrying it over the amalgamating-table A, and through the sluice-boxes and amalgam-collector. A valved pipe-connection, c^2, between the pipe c and the water-pipe G, is designed to convey steam or hot water into the pipe G and its connections whenever desired, for the purpose of heating the water used in the amalgamating process.

Another portion of my improved apparatus consists of vertically-adjustable revolving brushes H, for distributing the ore under treatment more evenly over the table and for preventing its accumulation at any point; and at however slight an inclination the table may be adjusted, even if it be level, these brushes will operate to move the ore and water from one end to the other thereof over the mercury. These brushes H may be located one over each riffle of the table, or over alternate riffles, as may be desired. Each brush H is provided with a shaft, h, on one end of which is a sprocket-wheel, H′. The shaft of the first brush of the series, as shown in Fig. 2, is prolonged, and has on its extreme end a pulley, H^3, from which a belt, H^6, passes over a pulley, E^4, on the shaft E, and transmits motion to the first brush, and motion is transmitted to the other brushes by a chain, H^4, that passes over the sprocket-wheels H′. On the opposite sides of the table A plates J, with terminal offsets or lugs j, are secured by screws j'. Standards J′, having lugs j^2 on their lower ends, and journal-boxes j^3 on their upper ends, and having vertical slots j^4, are held on and against these plates J by screw-bolts j^5, that pass through said slots. Adjusting-screws j^6 pass up through the lugs on plates J into the lugs on standards J′, so that on loosening the bolts j^5 and turning the screw j^6 the standards J′, and thereby the brushes H, can be raised or lowered at will, be adjusted according to the inclination of the table A, and to the depth of ore thereon.

Another device which constitutes a portion of my improved amalgamating apparatus consists of longitudinally-grooved rollers I, one of which is suspended in a horizontal position from hangers i, that are fixed on the inside of the table sides, in the mercury in each depression a', for the purpose of keeping, by its revolutions, the said mercury in constant agitation, and its surface thereby bright and active for amalgamating. Each roller-shaft is provided with a pulley, i^2, and motion is transmitted thereto by a belt, i^3, passing over said pulley and over a pulley, i^4, on a revolving brush-shaft, as shown.

As a further improvement, I construct the adjustable anode K, one of which is designed to be suspended in the water above the mercury used in the operation, over each cavity a, of several copper tubes or rods k, that are bent in the form of a stirrup and are held parallel to and apart from each other by the insertion of their ends up through blocks or lugs k' k^2, of wood or other suitable material, and through copper plates k^3, that overlie said blocks. The devices for adjusting these anodes K are similar to those shown and described in my previous application for a patent above alluded to, and consist of a bed-plate, l, secured on a side of the table A, from which rise two standards, l', provided with vertical slots l^2. A horizontal screw, m, provided with collars m', passing through a screw-threaded nut, m^2, projecting upward from block k', has its ends resting in these slots l^2, so that by turning said screw m the connected anode K may be laterally adjusted, the opposite lug, k^2, of said anode K at the same time being entered in a vertical slot of a standard, l', that is fixed on the opposite side of the table-frame. Vertical adjustment of an anode, K, is effected by means of upright screws $n\,n$, that pass down through the lug k', and have their points in contact with the plate l, the slots l^2 permitting this vertical adjustment. Brackets L, fixed on a side of the table A, support the copper rod L′, which extends alongside the table, and is designed to be connected with the positive pole of the battery or other source of electricity used when operating this device. In posts M, that are held on the rod L′ by binding-screws o, the lower ends of the branch rods L^2 are held by screws o', the other ends of said rods L^2 being held by screws o^2 in posts o^3, that are set on the plates k^3, so that the positive electric current shall pass into anodes K, as set forth. The angle-plates N serve as negative poles or cathodes of the battery or other source of electricity connected with the device, and each plate N consists of a copper plate bent at right angles and having in its vertical leg a slot, p, through which is passed into a branch rod, N′, a brass or copper screw-bolt, p', that holds said plate in position, as shown, so that by turning said bolt p' the said plate N may be loosened in position and be elevated or depressed in the mercury that is in the cavities a, and by withdrawing said bolt p' the plate N may be easily removed to be cleaned to have the amalgam that may have adhered to it scraped off. The negative electric current is conveyed from the battery or other source of electricity through a copper rod, O, that is held in the eyes of the branch rods N′, which enter through a side of the table A, and are connected with the plates N by bolts p', as set forth, so that the negative current shall pass into said plates N.

In order to render the water used in the

process a better conductor of electricity by the introduction therein of an acid, I construct an acid-box, P, of hard rubber or other suitable material, made, preferably, rectangular in shape, with grooves q in its bottom, and provided with bottom discharge-perforations, q'. This box P is designed to be closed, as shown in Figs. 1 and 4, and to be provided with a connecting-tube, q^2, for the introduction therein of the acid. One of these boxes is designed to be placed on each anode K, the box-grooves q fitting over and upon the anode-rods k, so that the box is held in place.

When the amalgamating process is in operation, strong or dilute acid, as the case may be, is introduced into each box P through tube q^2 from some suitable receptacle, which acid, dripping through the perforations q' gradually into the water beneath as it flows between the anodes and mercury, acidulates the water at the desired points where the action of the electric current should be most active.

Q represents the screw for adjusting the inclination of the table A, to adapt it for working light or heavy ores.

At the lower end of the table A, and designed to be connected therewith, are arranged a series of V-shaped troughs, R R, designed for receiving the discharge from the table A, and collecting the particles of gold, silver, and mercury therein.

At the lower or overflow end of the series of troughs R R, I arrange my improved mercury and amalgam collector S, which is designed to catch and retain the minutest particles of the mercury and amalgam that may escape from the troughs above. This collector S consists of a series of connected deep semicircular basins, r, as shown in Fig. 1^a, set on about the same inclination as the table A and troughs R R.

In the first of the basins R is fixed an apron, r', extending across the same, and designed to receive the discharged material from the troughs R.

Fixed across the upper edge of the collector S is a standard, T, having an inclined face, on which is secured, by a strap-bolt, s, a water-injector, U, that consists of several vertical pipes, t, having their lower or discharge ends somewhat flattened or fan-shaped, as shown in Fig. 3, and having their upper ends all entered at right angles into a horizontal pipe, t', which is closed at one end. This injector U is connected with a water-supply pipe, U', by a branch pipe, t^2, as shown.

About the lower end of one of the pipes t is secured a bowl, U^2, having an overhanging lip, as shown at v, and extending all across the basin r. The injector U being fixed in place, as shown, the bowl U^2 is thereby held beneath the lower edge of the apron r', so that the water, ore, and mercury flowing over the latter shall fall into said bowl. The nozzles of the injector-pipes t are made fan-shaped, that they may deliver the injected water more equally or evenly across the basin r, and they extend below the bowl U^2 to near the bottom of said basin. In the second basin of the series a riffle, w, extends across, and the extreme discharge end of the basin series is contracted, as shown at w', Fig. 1^a, for the purpose of retarding to some degree the flow of material therefrom, so that the mercury and amalgam may have more time to subside.

Each basin r may be supplied with an injector, U, and bowl U^2, if desired, and aprons r' and riffles w, as above indicated, may be placed in one or more of the basins.

When the amalgamating process is in operation, the ore yields up most of its gold and silver to the mercury in the table A; but by the action of the stirring-rollers I and the passage of the ore and water over the baths of mercury some of the mercury and of the amalgam that has been formed is floured or reduced to minute particles, which are carried by the moving current of ore and water into the series of troughs, R, where most of the escaping amalgam and mercury, and also of the gold and silver, which has escaped the action of the amalgamating-table, is deposited by gravity and retained by the mercury in said troughs. The moving current of ore and water, still carrying, possibly, a small percentage of gold, silver, mercury, and amalgam, then discharges upon the apron r' of the amalgam-collector S and falls into the bowl U^2, which is designed to be submerged in water during the operation of the device. The particles of amalgam, mercury, and precious metals from their superior gravity tend to settle to the bottom of the bowl U^2, and to remain there while the residual gangue discharges over the lip of the said bowl into the bottom of the basin below. The injector U is all this time in operation discharging water under suitable pressure into the bottom of the basin r, at such an angle that the residual gangue is violently agitated and prevented from lodging in the basin, and the particles of mercury and amalgam therein, if there be any, are washed clean and bright. The current then flows to the next succeeding basin, and, impinging against the riffle w, creates eddies, in which most of the remaining particles of mercury and amalgam will settle, and thence the current flows through the last basin that is designed to retain the last remaining particles of mercury and amalgam and discharges at the mouth thereof.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with an amalgamating-table, of an ore and water mixing tank provided with a discharge-opening and with suitable stirrers, and mechanism for operating the same, and of a supplementary tank for containing a supply of water, said supplementary tank being provided with vertical diaphragms, all constructed and arranged substantially as set forth.

2. In an amalgamating apparatus, a tank, F, located between the mixing-tank and amalga-

mating-table, and provided with diaphragms f^2 f^3, spout f^4, and water and steam pipe connections, all arranged substantially as and for the purposes as set forth.

3. The combination, with brushes H and brush-shafts h, of plates J, provided with lugs j, and slotted standards J′, provided with lugs j^2 and journal-boxes j^3, screw-bolts j^5, and adjusting-screws j^6, substantially as herein shown and described.

4. In an amalgamating apparatus, the combination, with the amalgamating-table, of longitudinally-grooved rollers and vertically-adjustable revolving brushes, substantially as and for the purposes set forth.

5. In an amalgamating apparatus, an adjustable anode constructed substantially as herein shown and described, consisting of copper tubes or rods bent in stirrup form, with their ends passing up through lugs and overlying copper plates, as set forth.

6. The combination, with an anode, K, of an acid-box, P, substantially as herein shown and described, said box being supported by said anode, as set forth.

7. The combination, with the amalgamating-table A and trough series R, of the amalgam-collector S, provided with apron r' and riffles w, substantially as herein shown and described.

8. The combination, with the water-injector U, of a bowl, U^2, substantially as herein shown and described.

9. The combination, with the amalgam-collector S, of inclined standard T, bolt s, water-injector U, water-supply pipe U′, and bowl U^2, all arranged and operating substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 16th day of February, 1884.

SAMUEL BEAR.

Witnesses:
JACOB J. STORER,
JOHN J. BORDMAN.