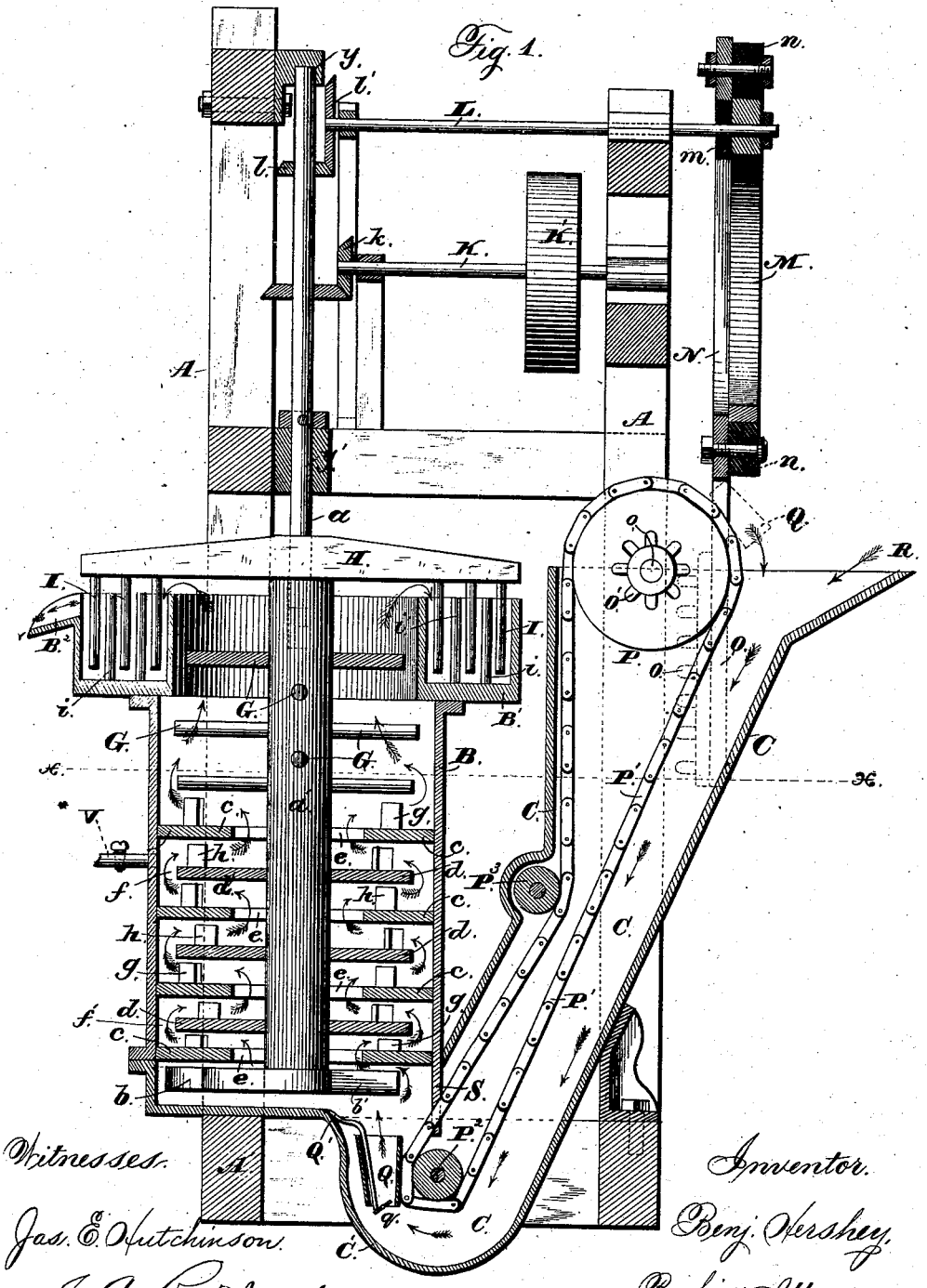
(No Model.) 2 Sheets—Sheet 1.

B. HERSHEY.

ORE AMALGAMATOR.

No. 260,682 Patented July 4, 1882.

Fig. 1.



Witnesses.

Jas. E. Hutchinson.

J. A. Rutherford

Inventor.

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By his Attorney.

James L. Norris.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

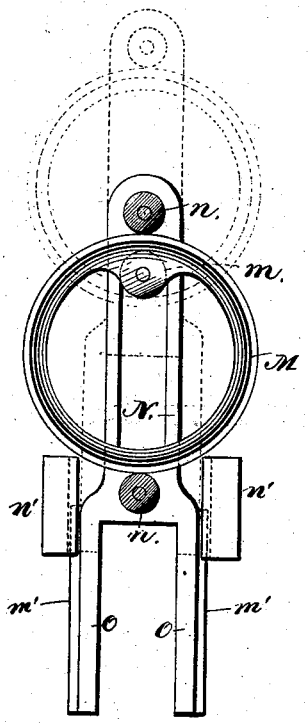


Fig. 3.

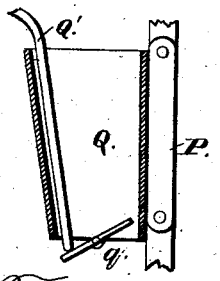


Fig. 4.

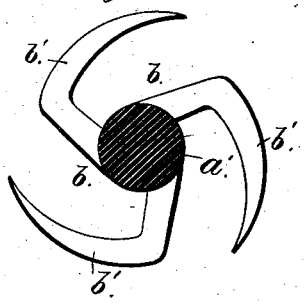


Fig. 5.

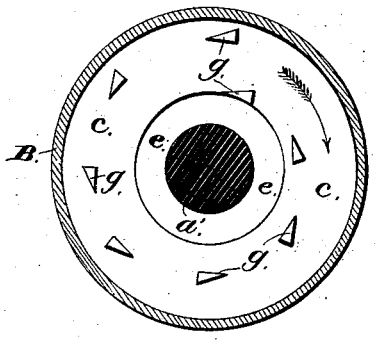
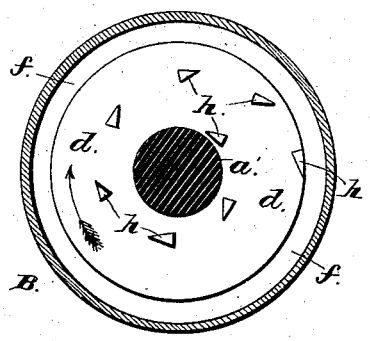


Fig. 6.



Witnesses.
Jas. E. Hutchinson.
J. A. Rutherford

Inventor.
Benj. Hershey.
By his Attorney,
James L. Norris.

UNITED STATES PATENT OFFICE.

BENJAMIN HERSHEY, OF ERIE, ASSIGNOR OF THREE-FOURTHS TO CHARLES HITCHCOCK, JOSEPH A. EGE, AND BENJAMIN THORNTON, ALL OF BRADFORD, PENNSYLVANIA.

ORE-AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 260,682, dated July 4, 1882.

Application filed February 25, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN HERSHEY, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented new and useful Improvements in Ore-Amalgamators, of which the following is a specification.

In the improved amalgamator hereinafter described the mercury employed greatly exceeds the quantity of gangue treated at any one time. The gangue may be either wet or dry, and may be either crushed quartz, sand, gravel, or concentrates. The material or gangue is treated within the mass of mercury, and the gangue is prevented from rapidly escaping and is not discharged until it has been thoroughly operated upon.

I am aware that amalgamators have been made in which some of the features above mentioned have been approached; but it will be found upon examination that, while they contain elements tending in the directions above named, there is a want of completeness of devices and operation which is necessary to reach the best results.

The present invention consists in certain improved organizations and manner of operating, which will be fully set forth and claimed hereinafter.

In the accompanying drawings, Figure 1 is a vertical section; Fig. 2, a detail view of the mechanism for operating the feeding devices. Fig. 3 is a detail view of the feeding-cup, showing the hinged or pivoted bottom and the fixed rod for operating it. Fig. 4 is a plan view of the spider for working the gangue centrally in the amalgamator. Fig. 5 is a plan view of one of the stationary plates or disks within the amalgamator-cylinder, and Fig. 6 a similar view of one of the revolving plates or disks within the amalgamating-cylinder.

A suitable frame, A A, supports the working mechanism and the amalgamating-cylinder B, to the bottom and sides of which cylinder the feed-pipe C is attached. A vertical shaft, a', revolves within the amalgamating-cylinder B, and is preferably made of large diameter, so as to occupy the central space of the cylinder, where the circles of revolution are of small diameter, and where the work done would be trifling, as will be set forth. A vertical shaft, a, turns in bearings y y' in the frame and carries at its lower end the larger shaft, a', which is suspended from it by means of a suitable connection. A spider or casting, b, (shown in Fig. 4,) is secured upon the lower end of the shaft a', and is provided with the curved arms or fingers b', which gather the gangue toward the shaft as it is delivered to the amalgamating-cylinder. A circular plate or disk, c, is secured within the cylinder B, just above the spider b. The central aperture of the disk is of such size as to leave an annular opening, e, around the shaft a', which passes through said central aperture. A circular plate or disk, d, is secured to the shaft a' and revolves with it, and is of such diameter as to leave an annular space, f', between it and the walls of the cylinder B. Any number of such disks d and c may be arranged alternately, as seen in Fig. 1. These disks are preferably arranged, as shown, with gradually-increasing space between them, for a purpose to be mentioned hereinafter.

Angular lugs g, Fig. 5, are arranged on the upper face of the plates c, and are so disposed, as seen in the drawings, that the material being operated upon will be directed by them outwardly toward the annular opening f. Similar lugs, h, on the upper faces of the revolving plates or disks d serve to direct the material inward to the central annular openings, e. Any suitable number of lugs properly disposed may be employed. The height of the lugs on the different plates increases as the spaces between the plates increase.

Agitating or stirring rods G pass through and are attached to the shaft a', and project radially from it above the series of disks c d. The top B′ of the cylinder B is enlarged, as shown in the drawings, such enlargement serving as a settler in which to separate and retain any particles of mercury or amalgam that may be carried up by the material being treated. A cross-piece, H, attached to the shaft a at its union with the shaft a', carries downwardly-projecting teeth I, which thoroughly stir the stuff that may be in the enlargement B′ for the purpose of saving any amalgam or mercury and to facilitate the discharge of the

gangue at the spout B^2. Teeth *i* project up from the bottom of the enlargement B′, being placed at suitable intervals, and assist the operation above described, serving as checks and breakers to the mass of stuff that is being carried around by the teeth I.

A horizontal shaft, K, turning in bearings in the frame, carries a bevel-pinion, *k*, which gears with a corresponding pinion on the shaft *a*, and is driven by a belt-pulley, *k′*, motion being thus imparted to the shafts *a* and *a′*. A bevel-wheel, *l*, on the shaft *a* above the mechanism just described gears with a corresponding bevel-wheel, *l′*, on a shaft, L, turning in suitable bearings in the frame. The shaft L passes through a slotted slide, N, and carries at its outer end an eccentric, M, which works between the two rollers *n n* on the slotted slide. *m* is a loose collar on the shaft L, which fits in and fills the width of the slot in the slide N. It will thus be seen that by the rotation of the shaft L the slide N is reciprocated vertically. Two racks, O O, carried at the lower end of the slide N, gear with pinions O′ O′ on the ends of a shaft, *o*, mounted in suitable bearings. Thus by the reciprocation of the slide an intermittent rotation in reverse directions is imparted to the shaft *o* for a purpose to be explained.

As a means for guiding the slide N in its vertical movements the outer edge of each rack O may be provided with a rib or spline, *m′*, arranged to move in a grooved guideway, *n′*, as shown in Fig. 2. I have not deemed it essential to show the guideways in Fig. 1, as, obviously, various means for guiding the slide can employed.

The inclined feed-spout C is attached to and communicates at the bottom with the cylinder B. The shaft *o* may have its bearings in the top of the spout C. This shaft carries a sprocket or chain pulley, P, on which an endless chain, P′, travels, the chain passing around a similar pulley, P^2, at the bottom of the feed-spout. The lower end of the spout C passes under the bottom of the cylinder B by a curve, as shown at C′, and within the center of the curve is the lower chain-pulley, P^2. The endless chain passes over the pulleys P P^2, as mentioned, and against a tension or deflecting pulley, P^3, journaled in the spout. A feed-cup, Q, is fastened to and carried by the chain P′, so that in its downward passage its mouth will be turned down.

The eccentric M, slide N, and feed-cup Q are so placed in relation to their movements that when the eccentric is at the end of its upstroke the feed-cup Q will be in the position shown above the top of the feed-spout, while at the end of the downstroke it will lie in the curve C′ with its mouth uppermost by having passed around the chain-pulley P^2.

Q′ is a rod fastened to the inner face of the curve C′, and is so placed that by the time the feed-cup comes to its lower rest the end of the rod Q′ will have opened the valve-bottom *q* of the feed-cup Q, for the purposes explained hereinafter.

R is an enlargement of the upper end of the pipe C, which serves as a feed-spout. The cylinder B is extended downward at S, so as to form a downward extension, curtain, or wall at this point, which serves as a partition to direct the gangue discharged from the feed-cup Q up into the cylinder instead of permitting it to return back up the feed-spout.

The operation is as follows: Having filled the cylinder B and spout C with mercury to such an extent that when the proper quantity of stuff is passing through the apparatus the mercury-level will be somewhat above the upper plate, *c*, in the cylinder, as shown by dotted lines *x x* in Fig. 1, motion is imparted to the entire machine from the pulley *k′*. The material to be operated upon is introduced at the point R and falls and rests upon the surface of the mercury in the spout. When the feed-cup Q is carried down by the endless chain it will carry down with it such stuff as comes within the area of its open mouth and carry it through the mercury and around the lower chain-pulley, P^2. It will be seen that the mouth of the feed-cup is now uppermost. The gold-bearing material, being lighter than the mercury, would naturally float; but owing to the inferior mobility of the particles of mercury they will not permeate the mass of material in the cup. The material will not readily leave the cup without assistance. To this end the cup is provided with a pivoted bottom, and the rod Q′ is so placed that as the cup comes nearly to a rest the rod will be forced through the contents of the cup and trip its bottom, as seen in the drawings. As the walls of the cup taper outward toward its mouth, the buoyancy of its contents will allow the contents to be displaced by the heavier mercury and rise upward. The motion of the eccentric will, after a short rest at the dead-point, cause the cup to retrace its course for another charge.

By reference to Fig. 1 it will readily be seen that the discharged contents of the cup will rest under the bottom of the lower plate, *c*, and back of and against the curtain S. Here they would accumulate and clog the machine were it not for the work done by the spider *b*. By reference to Fig. 4 it will be seen that this has curved arms and as these are turned in the direction of the motion of the shaft *a′* they will, as a result of such shape and motion, work the material they come in contact with toward the central opening, *e*, in the lower plate, *c*. Here the revolving motion of the shaft *a* will prevent any packing of the material, while the buoyancy of the latter will cause it to rise through the annular opening (shown at *e*, Fig. 1) and again rest against the under side of the first plate, *d*, Fig. 1. Here it would accumulate but for the action of the lugs *g* on the upper side of the plate *c*, which lugs are so arranged with regard to their positions and the angle of their faces that as the plate *d* carries the stuff around

against its lower face and brings it in contact with the lugs it is spirally and radially carried to the outer annular opening, *f*, where it will rise and rest against the under side of the second plate, *c*.

By reference to Fig. 6 it will be seen that the positions and faces of the lugs on the plates *d* are so arranged that by virtue of the rotary motion of the plates they will work the stuff inward toward the central opening, *e*. Here the process of the two first plates is repeated, and so on until the material passes through all the series of plates and finally floats on the top of the body of mercury above the line *x x*. The accumulation above this point is constantly and gently agitated by the rods G and the teeth I and *i* until it at last overflows through the spout B^2. This stirring and agitation is for the purpose of settling and holding any amalgam or mercury that may have been carried upward by the mass.

There may be cases in which it may be of advantage in the case of dry amalgamation (and possibly also in the wet process) to dilute the mass for better settling. In this case a current of water may be admitted under some of the upper plates, as shown at the pipe V, Fig. 1. By reference to Fig. 1 it will be seen that the relative distance between the plates gradually increases from the bottom of the cylinder upward. This arrangement is for the purpose of clearance, for which reason the lugs on each succeeding plate upward are larger than the next lower ones, and in so far their working capacity is increased.

It will be seen that it will be impossible to clog the machine, except by overflowing, and as this is constantly under supervision and control the clogging danger is reduced to a minimum.

The plates or disks *c* are so provided with fastenings that they can be readily taken from their places. The disks or plates *d* are similarly provided for easy removal from the shaft *a'*.

When it is desired to collect the amalgam in the machine the joint between the shafts *a* and *a'* is to be uncoupled and the shaft *a* removed from its bearings, together with the rake-head H. After removing the agitator-pins *g* and whatever stuff may be on the top of the mercury, the latter is to be drawn off from the bottom of the curve C', which may have a suitable cock, into some suitable vessel. The plates *d* and *c* can now be removed one by one and any amalgam adhering to them cleared off. When all the plates are out the shaft *a'* and spider *b* may in like manner be removed and the amalgam in the cylinder collected, to be afterward treated in the usual manner.

It will be observed that the material being treated is in its passage through the machine caused to move in a tortuous, zigzag, or spiral direction through the mercury, which fully exposes it to the mercury and treats it in the most perfect manner. The material being delivered at intervals in comparatively small quantities relatively to the body of the mercury, each charge or delivery is fully and completely exposed to its action and the amalgamation accomplished in the most perfect manner.

Many of the mere details of the apparatus described may of course be varied without departing from the spirit of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of the amalgamating-cylinder, the feed-spout communicating with its bottom, feed devices arranged within the spout, mechanism for causing the feed devices to traverse the spout, the upright shaft, the annular stationary and revolving plates, and the spider at the bottom of the cylinder, composed of radial arms, substantially as described.

2. The combination of the amalgamating-cylinder, the feed-spout communicating with its bottom, feed mechanism, the curtain S, the upright shaft, the revolving spider composed of radial arms, and the plates *c d* within the cylinder, substantially as described.

3. The combination of the amalgamating-cylinder, the feed-spout communicating with its bottom, the upright shaft, and the stationary and revolving plates provided with angular lugs, substantially as described.

4. The combination of the amalgamating-cylinder, the feed-spout communicating with its bottom, a belt or chain provided with a cup, and devices for reciprocating the belt or chain, substantially as described.

5. The combination of the amalgamating-cylinder, the feed-spout communicating with its bottom, the belt or chain provided with a cup having a pivoted bottom, mechanism for causing the chain to intermittently move in reverse directions, and a trip-rod, Q, substantially as described.

6. The combination of the shaft L, its eccentric, the slotted slide provided with racks, the shaft *o*, the pinions thereon, the pulley on the shaft, and the belt or chain, substantially as described.

7. The combination of the spout C, the pulleys P P', the endless belt or chain provided with a cup, the shaft *o*, its pinions, the slide and rack, and mechanism for reciprocating the same, substantially as described.

8. The combination of the amalgamating-cylinder, the stationary plates *c*, provided with lugs *g*, the upright shaft, and the plates *d*, attached thereto and provided with lugs *h*, the respective lugs gradually increasing in length from the lower to the upper plate, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

BENJAMIN HERSHEY.

Witnesses:
ALBERT H. NORRIS,
JAMES A. RUTHERFORD.