2 Sheets—Sheet 1.

M. LAFLIN & S. ELLIOTT.

PROCESS AND APPARATUS FOR AMALGAMATING ORES.

No. 189,313. Patented April 10, 1877.

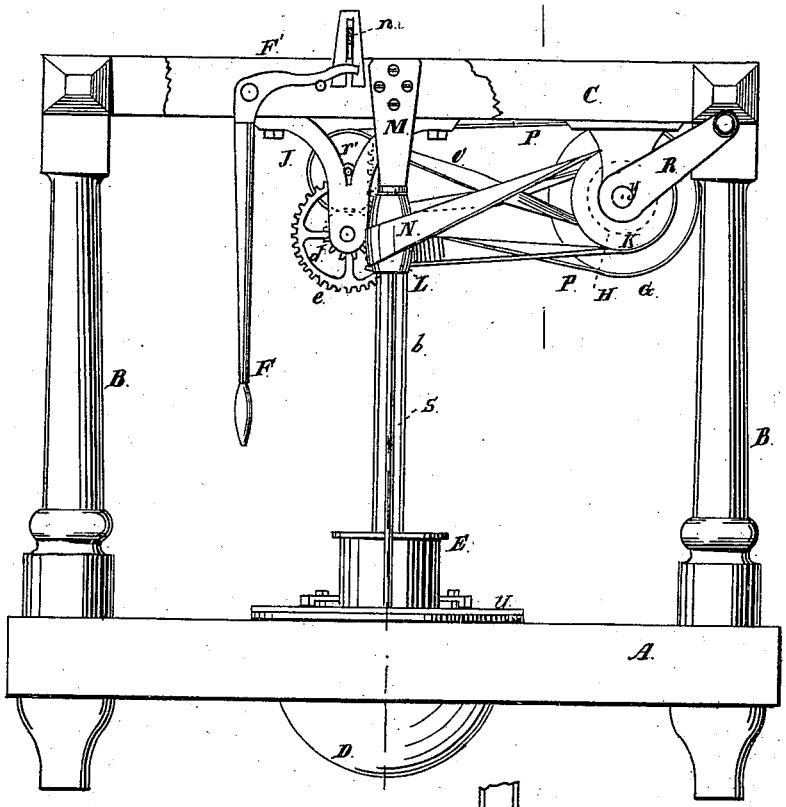

Fig. 1.

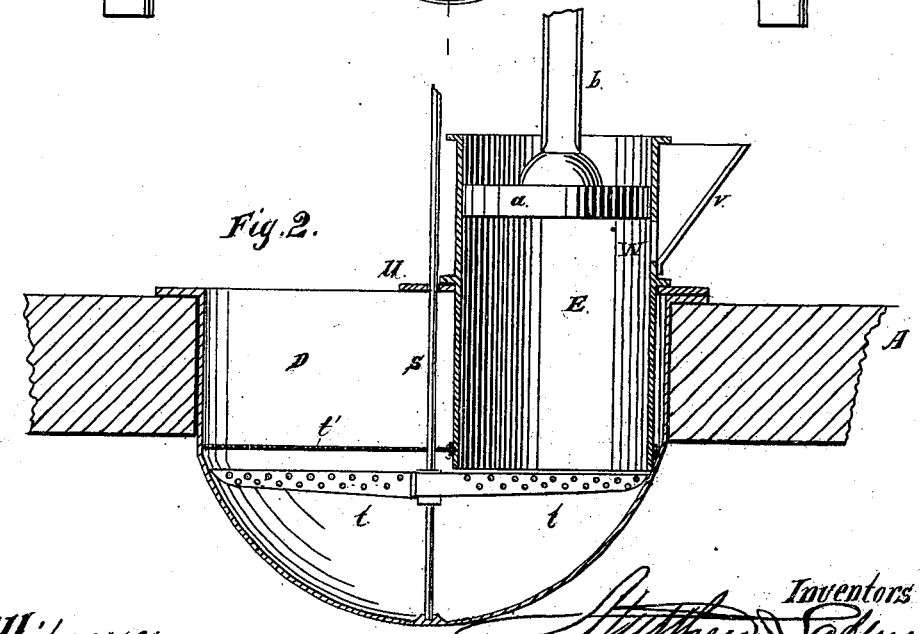

Fig. 2.

Witnesses:
Heinrich L. Briesen.
A. V. Bond

Inventors
Matthew Laflin
Sterling Elliott.

2 Sheets—Sheet 2

M. LAFLIN & S. ELLIOTT.

PROCESS AND APPARATUS FOR AMALGAMATING ORES.

No. 189,313. Patented April 10, 1877.

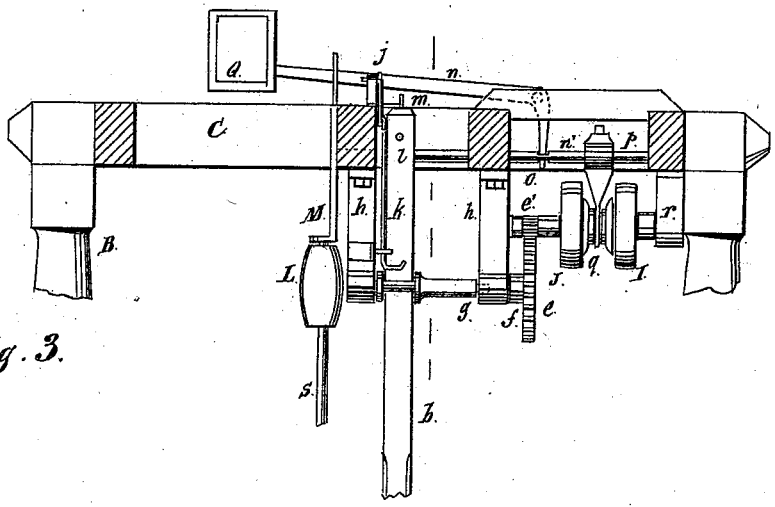

Fig. 3.

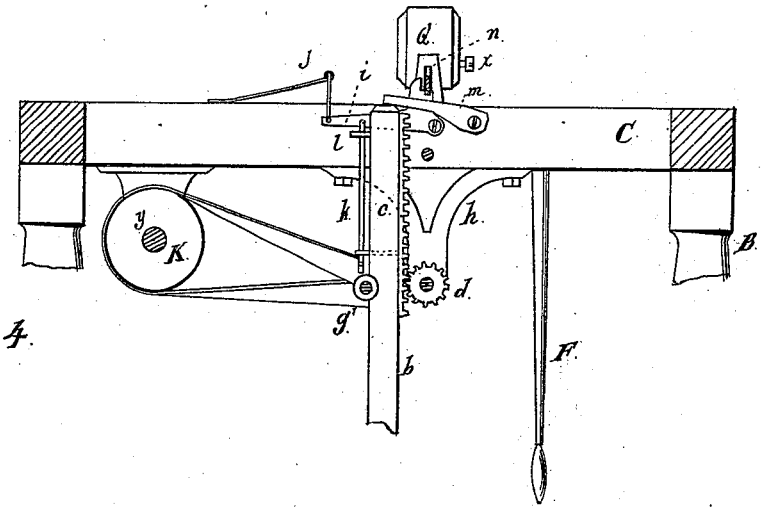

Fig. 4.

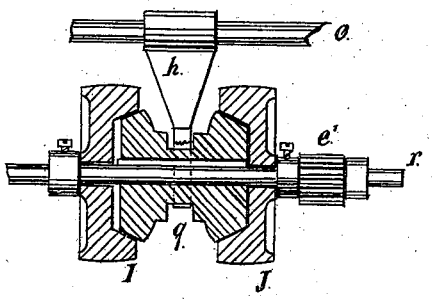

Fig. 5.

Witnesses:
O. W. Bond
Heinrich L. Brunn.

Inventors:
Matthew Laflin
Sterling Elliott
per West & Bond
attys.

UNITED STATES PATENT OFFICE.

MATTHEW LAFLIN AND STERLING ELLIOTT, OF CHICAGO, ILLINOIS; SAID ELLIOTT ASSIGNOR TO SAID LAFLIN.

IMPROVEMENT IN PROCESSES AND APPARATUS FOR AMALGAMATING ORES.

Specification forming part of Letters Patent No. **189,313**, dated April 10, 1877; application filed August 17, 1876.

To all whom it may concern:

Be it known that we, MATTHEW LAFLIN and STERLING ELLIOTT, of the city of Chicago, Cook county, State of Illinois, have invented new and useful Improvements in Amalgamators, of which the following is a full description, reference being had to the accompanying drawings, in which—

Figure 1 is an end view with one of the upper timbers partly broken away; Fig. 2, a vertical section of a kettle and feeding-cylinder; Fig. 3, a vertical longitudinal section of the upper part; Fig. 4, a vertical cross-section of the upper part; Fig. 5, a detail of the clutch.

My invention relates to a process and apparatus for amalgamating gold and silver bearing ores with molten lead, the nature of which will more fully appear on referring to the accompanying description and drawings.

In the drawings, A represents the base upon which the kettle is supported; B C, the posts and upper frame-work; D, the kettle; E, the feeding-cylinder; F, the hand-lever; G H I J K L, pulley-wheels; M, the upper support for the stirrer-shaft; N O P, the belts; Q, the weight; R, the crank; *a*, the piston-head or plunger; *b*, the piston-stem or pitman; *c*, the rack; *d*, the pinion; *e e'*, the gear-wheel and pinion; *f*, the shaft; *g*, the guide-shaft for keeping the stem *b* in position; *h*, the hangers for supporting the shafts *f g*; *i*, the lever or catch for holding up the weight Q; *j*, the spring; *k*, the rod attached to the lever *i*, and provided with a hook at its lower end; *l*, the pin on the back of the piston-stem *b* for releasing the weight; *m*, the stop for limiting the ascent of the piston; *n n'*, the bent lever for operating the clutch; *o*, the sliding bar for supporting the clutch-fork; *p*, the clutch-fork; *q*, the double-acting clutch; *r*, the shaft; *s*, the stirrer-shaft; *t*, the wings or arms of the stirrer; *t'*, the sieve-diaphragm; *u*, the plate supporting the cylinder E; *v*, the hopper; *w*, the hopper-opening; *x*, the set-screw for adjusting the weight; *y*, the shaft.

The kettle D is preferably made four feet in diameter and two and a half feet deep, with a round bottom. This kettle D is supported upon the base A, which base, in practice, will be made of iron, brick, or other masonry, to which the upper frame-work will be suitably attached, and below which a suitable furnace for melting the lead will be applied. This kettle is partly covered on one side by a plate or metal frame, *u*, upon which the cylinder E is supported.

The cylinder E is made of metal, and is left open at both ends, as shown. It is so located that its lower end will be as near the bottom of the kettle D as is practicable, the approach to the bottom being determined somewhat by the form of the kettle. For convenience in feeding the pulverized ore into this cylinder, the hopper *v* is placed on one side, which hopper, in practice, will be provided with a gate at the opening *w*, to prevent filling of the cylinder after the piston has passed below the opening.

The piston-head *a* is made to nearly or quite fit the interior of the cylinder, and is operated by a stem or pitman, *b*, which extends to the upper part of the frame-work, and at its upper end is provided with a rack for raising and lowering it. Extending across the kettle, and just above the stirrer-arms *t*, a sieve-diaphragm, *t'*, is fixed, which serves to retard and subdivide the ore rising through the bath, and, in conjunction with the stirrer-arms, subjects it to a sort of rubbing action that promotes amalgamation. The sieve does not pass below the lower end of the cylinder E; for if it did so, the proper feeding of the ore into the kettle would be seriously obstructed.

The shaft *y*, as shown, is operated by the crank R; but, in practice, it will be driven by power. This shaft is provided with three pulley-wheels, G, H, and K. The wheel K, by means of the belt N and pulley-wheel L, drives the stirrer. This arrangement, if desired, may be substituted by gear-wheels. The wheels H and J, with the belt O, cause the piston to descend, while the wheels G I, with the belt P, cause it to ascend.

The wheels I J, with the clutch *q*, are constructed as shown at Fig. 5, the clutch being attached to the shaft *r* by means of a groove and feather, in the usual manner. The clutch-fork *p* is attached to the shaft *o*, which is operated by the bent lever *n*. The lever *n* is

operated in one direction by the weight Q, and in the other by the hand-lever F.

In operation, the kettle D is filled with molten lead up to six or eight inches from the top; and in order to prevent oxidation of the lead while melting or heating, it is covered with pulverized charcoal to a suitable depth to prevent the contact of the air. The piston is then elevated, and the cylinder E is charged with the previously-pulverized ores, or ores reduced to an impalpable powder, which, in order to insure the proper working of the machine, should be dry and heated. When suitably filled the hand-lever F is pressed inward, which lifts, by means of its bent arm F, the lever *n* and its weight Q. This movement brings the clutch *q* in contact with the pulley-wheel J, which operates through intervening mechanism to depress the plunger and force the ore to be amalgamated down into the kettle from sixteen to twenty-four inches, more or less, beneath the surface of the molten lead. The stirrers or arms *t* take the material as it passes below the bottom of the cylinder E, and distribute it through the kettle or bath, so as to bring all of the material in contact with the molten lead. As the lighter ore and tailings rise to the top of the lead-bath they are compelled to pass through the sieve-diaphragm, which is of such fineness as to effect their minute subdivision, and thus secure the intimate contact of the lead with every portion of valuable ore. By the conjoint operation of the sieve and the stirrer-arms, the dissemination of the ore, and its consequent amalgamation, are insured in a very efficient manner. In order to prevent the ores from banking against the stirrer-arms, they may be provided with small holes, as shown, or with slits.

An important feature of my process is the heating of the ore preliminary to its introduction into the feeding-cylinder. If the ore were fed into the kettle in a cold state, on coming in contact with the molten lead, violent ebullition or sputtering would occur, which tends to throw off portions of the lead-bath in its more or less enriched condition, with evident loss to the operator. Since this wasteful sputtering results entirely from difference in temperature between the ore and the lead, it is clear that the higher the former is heated, so as to approximate in temperature to that of the molten lead, the less danger there will be of loss from this cause.

When the piston has reached its lowest point of descent, it should be about two inches above the bottom of the cylinder, so as to leave a covering of pulverized ores on the lead in the cylinder, to prevent oxidation when lifting the plunger. The pin *l* engages with the hook on the lower end of the rod K, which pulls down the end of the lever *i*, when the weight Q falls and shifts the clutch *q* into the wheel I. This reverses the movement, when the piston *a b* ascends until the top of the piston-stem strikes against the pivoted bar *m*, which partly lifts the lever *n*, so as to relieve the friction of the clutch *q*, and also so as to lock against the lever *n*, and prevent the further ascent of the piston. It remains in this position until the cylinder is again filled, when, by pressing against the hand-lever F, the weighted lever *n* is again elevated, and, when lifted, the spring *j* returns the bent arm or lever *i*, so as to catch under and support the weighted lever until it is thrown out by the pin *l* and rod K, as before.

By a change in the diameter of the wheels on the shaft *y*, the ascent of the piston is made much more rapid than its descent, which should be measurably slow, in order to insure a thorough contact of all of the ores with the molten lead.

It will be advisable to cover the top of the plunger with a sufficient depth of charcoal, or other suitable material, so as to prevent the oxidation of the lead which may flow over the plunger while it is below the top of the bath in operation. A sufficient depth of tailings should be left on the surface of the lead in the kettle to prevent the contact of air to oxidize the lead.

The ore may be heated upon a suitable pan, under which the heat and smoke from the furnace pass on their way to the chimney.

The stirrers *t* may be made either reciprocating, oscillating, or in any convenient way, according to the situation of the cylinder E; but the rotary is the most practical.

What we claim as new, and desire to secure by Letters Patent, is—

1. The cylinder E and piston or plunger *a*, located within the kettle D, and in combination therewith, substantially as specified.

2. The cylinder E, piston *a*, and kettle D, with or without sieve *t'*, in combination with a stirrer operating between the lower end of the cylinder and the bottom of the kettle, substantially as and for the purpose set forth.

3. The combination of the rack *c*, pinion *d*, and stem or shaft *b*, with the catch-lever *i*, rod *k*, and pin *l*, substantially as described.

4. The combination of the stem *b* with the bar *m* and lever *n*, for stopping the action of the piston while the cylinder is being filled, substantially as specified.

5. The process of amalgamating gold and silver bearing ores, which consists in forcing the pulverized ore at regular intervals, and in a heated condition, as described, into a bath of molten lead, and permitting it to rise freely to the surface of said bath during constant stirring and dissemination, substantially as and for the purpose set forth.

MATTHEW LAFLIN.
STERLING ELLIOTT.

Witnesses:
O. W. BOND,
L. L. BOND.