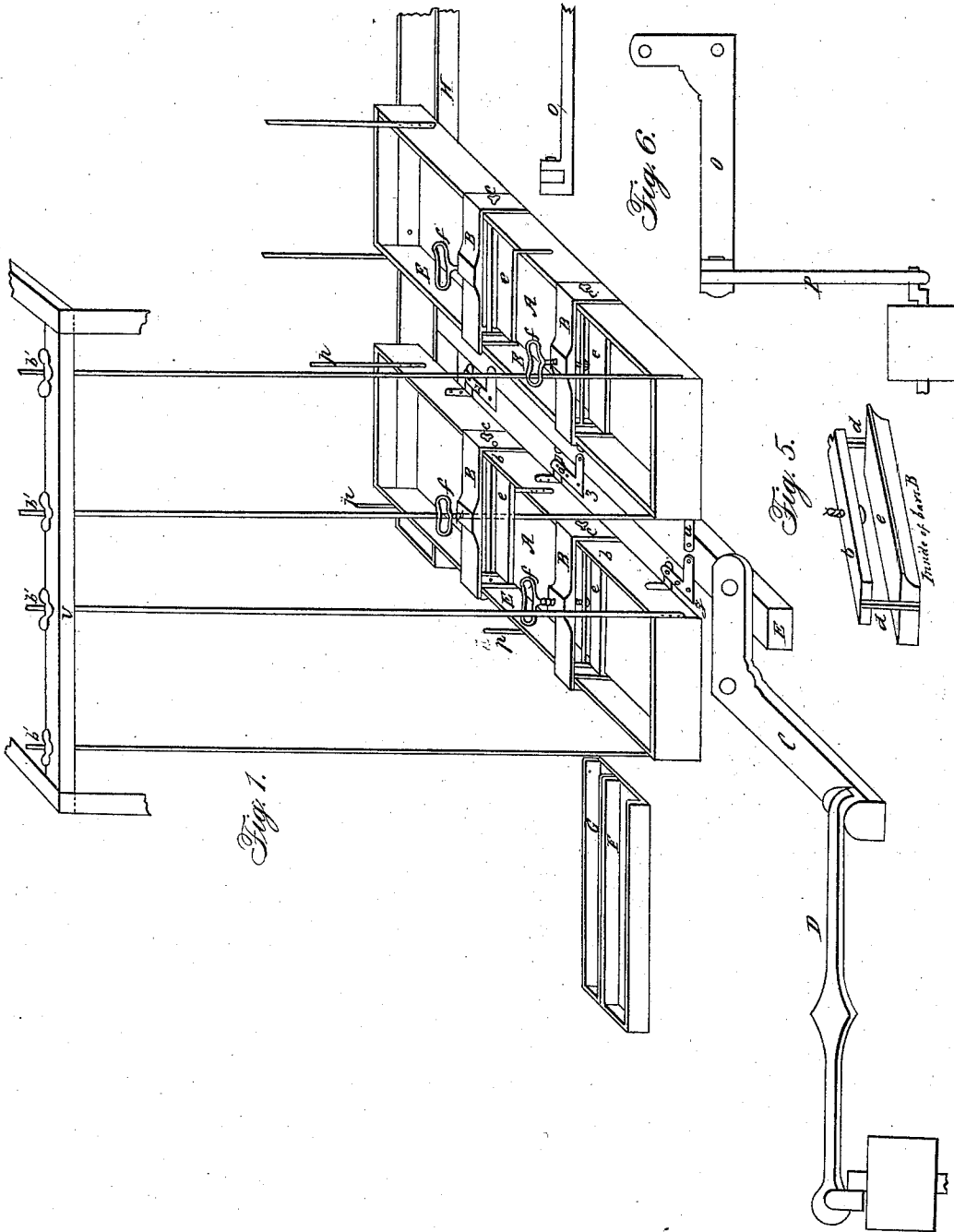


S. F. CHARLES.  
Ore Amalgamator.

No. 58,335

Patented Sept. 25, 1866.



**Witnesses:**

*L. L. Bond*  
*C. H. Hest.*

**Inventor:**

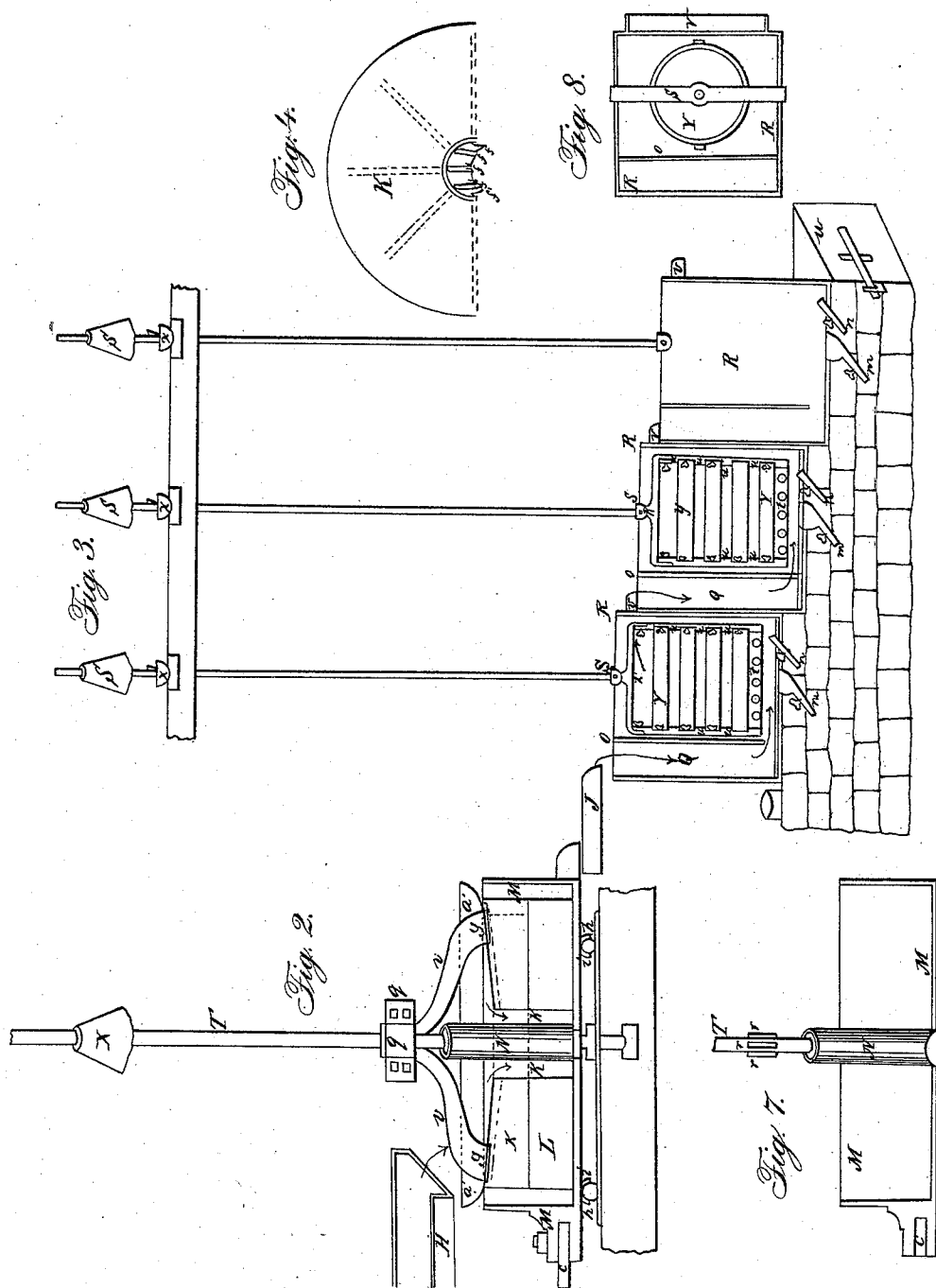
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2 Sheets—Sheet 2.

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# UNITED STATES PATENT OFFICE.

S. FREDERICK CHARLES, OF DAHLONEGA, GEORGIA, ASSIGNOR TO HIMSELF  
AND S. J. RUSSELL.

## IMPROVED AMALGAMATOR.

Specification forming part of Letters Patent No. 58,335, dated September 25, 1836.

*To all whom it may concern:*

Be it known that I, S. FREDERICK CHARLES, of the town of Dahlonega, in the county of Lumpkin and State of Georgia, have invented certain new and useful Improvements in Separators and Amalgamators for Gold and other Precious Metals; and I do hereby declare that the following is a full, true, clear, and exact description thereof, reference being had to the accompanying drawings, of two sheets, making a part of this specification, in which—

Figure 1 is a perspective view of the panning-machine; Fig. 2, a vertical section of the grinding-mill. Fig. 3 is a vertical section of two, and a side view of one, of the sections of the amalgamator; Fig. 4, a perspective section of the upper runner, showing the openings of the channels; Fig. 5, a perspective view of a partition-bar of the panner with the top removed; Fig. 6, a plan view of the bent lever by which the lower grinder is given a reciprocating motion; Fig. 7, a vertical section of the shell incasing the grinders; Fig. 8, a top view of one section of the amalgamator.

Like letters refer to similar parts in all of the figures.

The nature and object of my invention consists in constructing and combining together a series of machines, each depending upon the other, so that in extracting gold from quartz-rock I am enabled to extract all of the gold, so as to save it, by a single operation, from the coarser grains to the most minute particles, and without reducing the apparent gold to an impalpable powder, and in important improvements in several parts of the machines, as follows: In suspending the panner and giving it a rapid oscillating movement; in providing the panner with removable and adjustable cross-bars; in forming a hopper partly in and of the upper grinder; in the method of connecting the upper grinder to the shaft; in providing the lower surface of the upper grinder with deep cavities or channels; in giving the lower grinder a reciprocating motion; in the attachment of rollers and a reciprocating arm to the shell of the grinding apparatus; in the arrangement of a series of amalgamators, each succeeding one being located a little lower than its immediate predecessor; in suspending in each a set of rotating amalgamating-pans;

in providing each with a partition, which causes all matter passing through to descend to the bottom; in rotating the amalgamating-pans in and through the whole mass without disturbing the mercury; and in providing the series of amalgamators with a flue running beneath them as a whole, to keep the water, particularly in winter, of an even temperature, the amalgamating process being facilitated by a slightly raised temperature.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

For pulverizing or crushing the quartz-rock I use any of the known forms of crushers or stamping-mills, or both, in connection with my improved apparatus, and connect the same as may be most convenient. The crushed quartz after leaving the crusher passes into the inlet-duct F, which is made of sufficient capacity to carry all the material. This duct or spout is cut off in the drawing before reaching the panner A'. From this duct the material is discharged into the panner A and A'. This panner is made in two divisions, suspended side by side, each being the counterpart of the other. A description of one will answer for both. The trough is made about twelve feet long, two feet wide, and eight inches deep, and is suspended from a beam, U, by the rods *p p*, entirely free from obstructions. It is made to vibrate rapidly by means of the bent levers *a a*, four or more of which are attached to the panner, at one end pivoted to the blocks or beams Z, and at the other end pivoted to the reciprocating pitman or bar E, which pitman is operated by a lever, C, similarly bent, and which is attached at the outer end by the rod D to the power by which the machinery is driven, so as to give the required motion.

The lower end of the panner is about one inch lower than the other end, so as to give the mass a slight current toward the trough or duct H, into which it is discharged. The incline is adjusted by the screws *b' b'*. It is also divided into transverse compartments by the bars B B, &c., which are in length, inside, equal to the width of the panner. They are made of cast-iron, and are eight inches high and about three inches wide. The top bar

projects over and turns downward, so as to form a sufficient bar for the thumb or set screw *c*, by which it is secured to the side of the panner. Arms also extend down, fitting the inner sides of the panner, which arms are provided with slots, in which the bars *b* and *e* are made to move up or down by the screw *f*.

The bars *b* and *e* are connected together by bolts *d*, which form the connecting projections that fit into the slots. The lower bar, *e*, has its lower surface grooved at the front edge, so as to form a circular cavity, as shown, when resting on the bottom of the panner. These bars are placed about one foot and six inches apart, and their number will depend upon the length of the panner.

The front end of the panner is lined with copper about three feet, and the copper is amalgamated with mercury, or furnished with as much as will adhere to the copper without being removed by the action of the machinery. The coarse and apparent gold is principally taken out by this panner, so far as the same is liberated by the action of the crusher; but the action of the crusher fails to liberate all of the apparent gold, and no part of the impalpable gold, which exists in all gold-bearing quartz, is liberated or saved by crushing and panning simply. I therefore run the tailings into the trough *H*, through which they are conducted to the grinders to be reground; and if more than one grinder is used I insert a partition into the trough or duct, so that the proper proportion will be carried to each.

These grinders are made of hard cast-iron or Franklinite iron. The grinders are about four feet and six inches in diameter, eight inches thick on the outside, and six inches on the inside, or at the hole *K*, so that the mass will run freely into the mill. The hole *K* through the center is about one foot in diameter.

The grinder is attached to the shaft *T* by means of the arms *v*, which are inserted into the runner by a dovetail joint, *g*, and are attached to the shaft by means of projections *r r* and the clamp or collar *q*. By this construction the mill can readily be taken apart for transportation or repairs. A rim or band, *a'*, is attached to the outer edge of this runner, so as to complete and hopper. The runner is rotated by means of the bevel or miter wheel *X*.

The lower surface of the runner is provided with a number of radiating channels or grooves, *j j*, which are about five inches deep, one and a half inch in width, and extend outward to within about three inches of the periphery. The lower runner is of the same diameter as the upper, and eight inches in thickness. It is perfectly plain, and rests in the case *M*. The case or tube is five feet in diameter and about sixteen inches deep, having a hollow shaft, *N*, cast in the center about four inches higher than the sides of the tube, which forms a shield to the shaft of the upper grinder. This hollow shaft is of sufficient internal diameter to allow the case and lower grinder to oscillate without interfering with the shaft of

the runner, as hereinafter described. To this case I also cast on the bottom sockets or shoes *i i*, in which the rollers *h h* are placed. These rollers *h* are about two inches in diameter, and extend across the bottom of the case. A reciprocating motion of about one and one-half inch is given to this case and the nether grinder by means of the bent lever *O* and rod *P*, connected with the driving-power.

The auriferous material, having passed through the mill and out of the bottom of the case *M* into the duct *J*, is passed into the amalgamator.

The amalgamator is made in twelve sections, and as they are all alike only one of the sections need be described. The shell or case *R* is made of cast-iron, and is lined with copper at the bottom. It is about two feet square and two feet deep. A movable partition is inserted about six inches from one end, and extends from the top to within about three inches of the bottom, allowing sufficient space for the material to pass under. Into the case is inserted a frame composed of two upright bars of about one inch by two inches, connected at the lower end by a perforated plate, *t*. This perforated plate is for the purpose of producing a gentle current, is about three inches wide and a quarter of an inch in thickness, and is connected at the top by the curved bar *Z*, to which is attached the shaft *W*. Into this frame are inserted four circular copper pans, *Y*, which are about three inches deep, and are supported by the ledges *u*, and are fastened by thumb-screws. This frame is suspended about three inches from the bottom of the case and supported by the conical collars *X*, and made to revolve about thirty revolutions per minute by means of the bevel-wheel *y*. Mercury is placed in the pans and bottom of the case to the depth of three-eighths of an inch. The water may be drawn off at the stop-cock *n*, and the mercury at the cock *M*. The amalgamators are placed in a row or line but not in the same plane, the second one being three inches lower than the first, and so on to the last, making the last one three feet lower than the first. The whole series is set on a brick or stone foundation, having a flue beneath them and a fire-place, the door of which is seen at *w*, the purpose of which is to keep the water moderately warm and insure the perfect working of the amalgamators in cold weather.

In using my machinery I avoid roasting the quartz for the following reasons: First, auriferous quartz is often mixed with pyrites, and if roasted develops sulphurous matter, which in contact with water is exceedingly injurious to machinery constructed of iron; second, by roasting quartz a great waste of gold is unavoidable.

The operation of my improved machinery is as follows: (All miners object to grinding the coarser or apparent gold into a powder with the quartz.) The quartz, after being crushed in water by any of the known methods, passes from the crusher through the duct

F into both divisions, A and A', of the panner, which has a vibrating motion of about two hundred alternations per minute, which motion is communicated to the water without accelerating the current. The vibrating motion communicated to the fluid matter causes the gold, by its greater specific gravity, to be precipitated to the bottom, the finer gold adhering to the amalgamated copper, the coarser gold lodging against and under the curved bars. The gold can be taken out at will, without stopping the machinery, by stopping the flow of ground quartz from one of the pans at a time, and letting on a small stream of clear water through the duct *g*, and allowing it to run a few seconds, washing out portions of the remaining sand. The front bar is then gradually raised by means of the screw *f*, releasing the gold lodged against it. The next bar is treated in like manner, and so on to the last. The gold is then received in a vessel. The bars are then replaced, and the process repeated on the other pan, and so on, alternately, as often as may be desired. By this process a continuous saving of all free gold is performed. Thence I pass the tailings through the duct H into the mill or grinding apparatus, where it is reground to an impalpable matter.

The operation is very much facilitated by giving the lower grinder an oscillating motion in connection with the rotary motion of the upper grinder. It also prevents the gold from being ground in a leaf-like form, and thus prevents it from floating upon the surface of the water.

The ground mass passes through the duct J into the first amalgamator behind the partition, and is forced to pass below the bottom of the partition, coming in contact with the mercury in the bottom of the case, and rises up around and over the pans in the revolving frame, and passes out the spout V into the next amalgamator, where it descends and rises, as before, and so on through the series of amalgamators, when it is allowed to pass off. By this process, the material coming repeatedly in contact with the mercury, all the gold will be absorbed. The bulk of the gold will be found in the three first amalgamators. The gold need not be removed from the remaining ones oftener than once in three or six months.

By this process of amalgamation the greatest saving of the precious metal is effected. I also avoid stirring or agitating the mercury with any hard substance, as agitation will

cause it to lose its cohesion, and it will float off with the water, and also greatly weaken its affinity for gold.

The panning process is also useful in placer or hydraulic mining, as a large mass can be panned as thoroughly and effectively as can be done by hand.

It is apparent that many of the parts, details, and relative positions of the parts will require changes in some respects to suit the position or locality in which the apparatus is placed and the construction of the power by which it is driven, which changes any good mechanic will be able to make.

The machinery should be so geared that the upper grinder should make about two hundred revolutions, the lower grinder about thirty oscillating motions, the panning-machine about two hundred vibrations, and the amalgamator-pans about thirty revolutions, per minute.

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

1. The so combining a panning-machine, a regrinding-machine, and an amalgamator that the gold shall be thoroughly extracted by the continuous and connected action of all of them, substantially as set forth.

2. The adjustable partition B, constructed and operated substantially as and for the purposes set forth.

3. The deep radiating channels *j* in the lower surface of the grinder K.

4. The combination of an upper revolving grinder with an oscillating lower one, constructed and operating substantially as specified.

5. The case or shell M of the grinders, in combination with the rollers *i* and the reciprocating arm or lever O.

6. The amalgamator R, constructed so as to form one large and one narrow compartment by the insertion of the removable and adjustable partition *o*, substantially as specified.

7. The revolving frame provided with amalgamating-pans suspended below the surface of the auriferous mass, constructed and operating substantially as and for the purposes specified.

8. The location of the flue below the series of amalgamators, substantially as and for the purposes specified.

S. FREDERICK CHARLES.

Witnesses:

L. L. BOND,

A. G. GOODRIDGE.