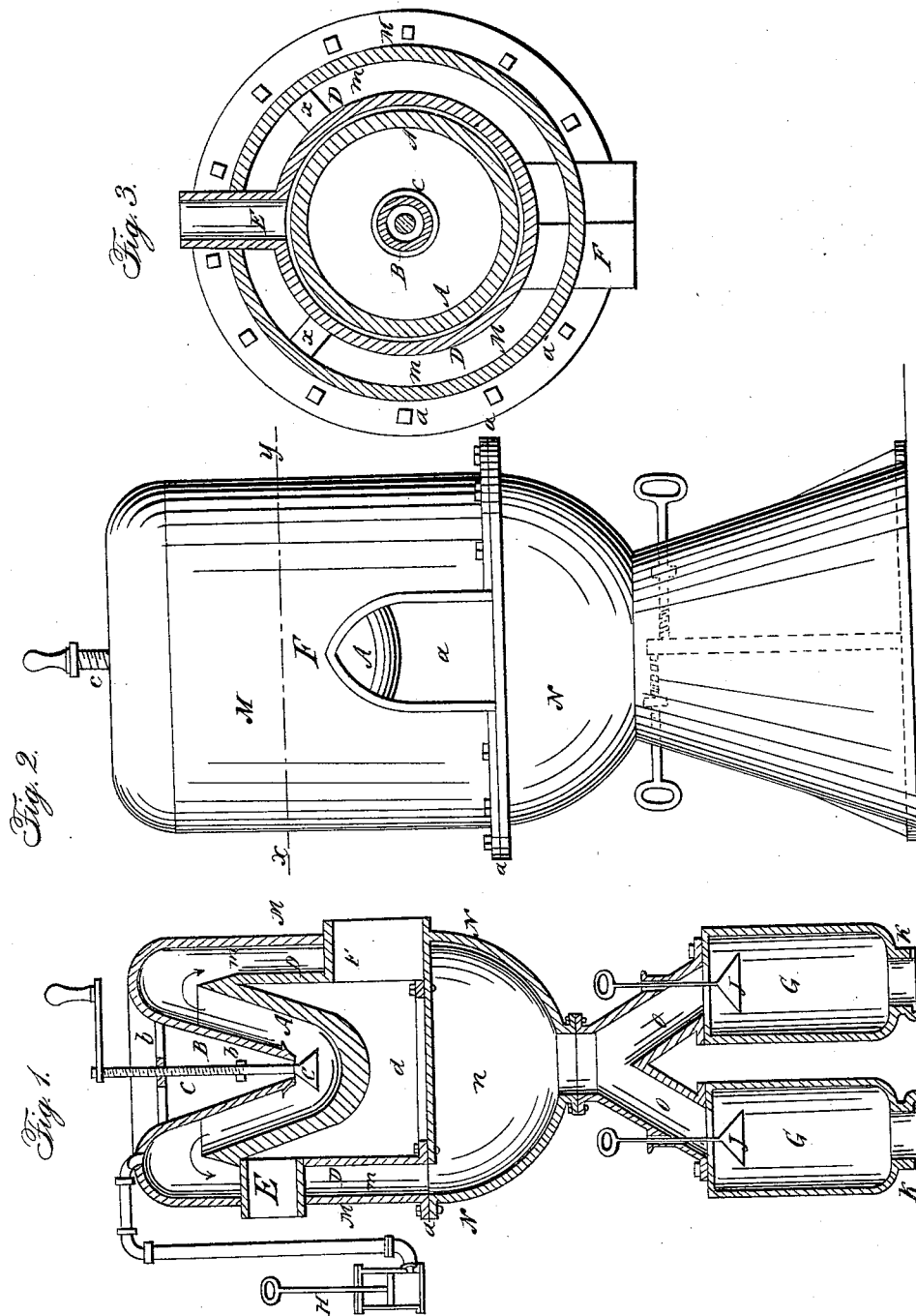


W. M. FULLER.  
Dry Amalgamator.

No. 53,805.

Patented Apr. 10, 1866.



Witnesses:

*Jos. L. Loombs*  
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# UNITED STATES PATENT OFFICE.

WILLARD MUNROE FULLER, OF CHICAGO, ILLINOIS.

## IMPROVED AMALGAMATOR.

Specification forming part of Letters Patent No. 53,805, dated April 10, 1866.

*To all whom it may concern:*

Be it known that I, WILLARD MUNROE FULLER, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Extracting Gold and Silver from Quartz; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 represents a longitudinal vertical section of a machine constructed in accordance with my invention; Fig. 2, an elevation on an enlarged scale, with modified arrangement of receiving-boxes; and Fig. 3, a transverse section on the line *x y*, Fig. 2.

This invention relates to apparatus constructed in accordance with the improved method of extracting gold and silver from quartz by means of atmospheric pressure for which Letters Patent of the United States were issued to me on the 2d day of January, 1866. The practical application of my invention has led to the invention of important improvements in apparatus for applying the same, of which improvements the two most essential are, first, the means by which the machine is made continuous in its action, and, second, the method of preventing the quartz or tailings, after having passed through the melted lead, from banking up and collecting in the vessel, thus clogging and impeding the working of the machine; and my said improvements consist in constructing the apparatus so that the quartz or tailings, after passing up through the melted lead, may run off from every point on the circumference of the kettle, without obstruction or hinderance, into a receiving-chamber placed underneath the kettle, from whence it may be drawn off into receiver-boxes, which, by their alternate opening and closing, render the machine unintermittent in its operation.

To enable those skilled in the art to understand and use my invention, I will now proceed to describe its construction and operation by reference to the accompanying drawings.

M M is a cylinder, and N N a spherical shell or receiver, united by bolts or otherwise at the flanges *a*, and forming the outer shell or wall of the apparatus. The upper end of the cylinder M M is provided with a hopper, B, of the

shape of an inverted frustum of a cone, through which the ore is fed to the amalgamating-kettle. Within the chamber thus formed is placed the smaller cylinder D D, which supports the kettle A, as seen in the drawing. This cylinder is secured to the outer wall of the machine by braces X X, or in any other suitable manner. In order to render this part of the apparatus firmer and more solid, and to make the whole machine more perfectly air-tight, I cast the cylinder D and the kettle A in one piece. The chamber *d* within this cylindrical case forms the fire-chamber, which contains the fire by which the lead in the kettle is kept in a fused or melted state. It is provided with an arched or ogee-shaped door, F, and chimney E, which extend through the outer wall or cylinder, M M. At the points where the said chimney and door meet the outer wall the crevices between their frames and the wall or shell are tightly packed, in order to prevent the admission of air into the air-tight portion of the machine. The fire-chamber is shut off from all communication with the rest of the vessel, and can be opened freely at all times without interfering in the least with the working of the apparatus.

The space between the walls of the cylinders D D M M should be left open and unobstructed, except only at such parts as are needed in order to attach the inner cylinder to the outer one, as seen at *x x*, Fig. 3, and thus hold it in position. An annular chamber, *m m*, is thus formed between the walls of the fire-chamber and the outer shell, as shown more particularly in Fig. 3, into and through which the quartz or tailings may flow freely and without hinderance from all points on the circumference of the kettle. The importance of this chamber cannot be overestimated, as by its assistance the banking up and accumulating of the tailings in the kettle, upon the prevention of which the uninterrupted working of the apparatus mainly depends, is avoided.

The chamber *m* opens into the receiving-chamber *n*, which is that portion of the chamber formed by the outer wall below and underneath of the fire-chamber *d*.

The chamber *n*, by means of the ducts or pipes *o o*, is connected with other receiving chambers or boxes, G G, provided with conical valves J J adjusted vertically, which regulate

the flow of the quartz or tailings, and self-acting valves, K, opening from the outside, by means of which the boxes are closed. When the machine is in operation, and the air in the vessel is being exhausted by means of the air-pump H, it will be seen that if the valve *g* be open the atmospheric pressure will keep the valve K tightly closed, and, vice versa, if the valve *g* be shut and air allowed to enter the box atmospheric pressure will become equalized and the valve K will open automatically. This may be effected by connecting the valves J with air-cocks in the upper part of the boxes, so that the air-cocks will be opened by the closing of the valves J. By the alternate opening and closing of these valves the tailings may be made to run uninterruptedly, thus securing the continuous operation of the machine.

The hopper B is provided with a conical valve, C, worked by means of a shaft or screw-rod and crank *c* secured in bearings *b b*. By raising or lowering this valve the flow of ore into the kettle may be increased or diminished at pleasure.

The machine thus constructed is operated as follows: The kettle A is one-half or two-thirds filled with mercury, or preferably melted lead, and, the powdered ore having first been run into the hopper B, the air-pump H is put in motion. This exhausts the air in the vessel, and consequently the outside atmosphere, meeting with no resistance, forces the ore down through the hopper and into the lead, its flow being regulated by the valve C. As the ore is of less specific gravity than the liquid lead, it rises, but before it reaches the surface of the lead is denuded of all traces of gold and silver, which metals unite with the lead to form an amalgam. As soon as a quantity of quartz or tailings has risen sufficient to fill the kettle the tailings will run over the sides on every point of the circumference of the kettle, as indicated by the arrows in the drawings.

The annular chamber *m* is free from all obstructions, excepting the few braces or supports needed to hold up the inner cylinder, D D, and allows the tailings to pass uninterruptedly into the receiving-chamber *n*.

The door F and chimney E are arched or ogee-shaped, so that their surfaces act as deflectors, and do not retain the tailings. By this means all possibility of the quartz banking up or collecting in the kettle is precluded.

It has been ascertained by experiment that the quartz or tailings will not easily run off at a less inclination than forty-five degrees, and therefore all contrivances by which the tailings are drawn off at only one or two points within the area of the kettle are essentially defective, as the tailing will inevitably collect and bank up in a kettle thus constructed, rendering it necessary to constantly interrupt the working of the machine in order to remove the tailings.

This defect is obviated by the method above described of drawing off the tailings from all

points of the circumference of the kettle through an annular chamber surrounding the kettle into a receiving-chamber, whence it may be distributed to the different receiver-boxes.

To render the machine continuous in its operation the tailings are run off from the receiving-chamber *n* alternately into the receiving-boxes G and G'. Supposing it is wished to run the tailings into the receiver-box G, the valve J' is closed and the valve J opened, and the flow of the quartz is thus diverted from the box G' to G, while at the same time as the air in the box G is exhausted by the air-pump the valve K is kept tightly closed. Now, when the receiver-box G is sufficiently filled the flow of quartz is turned into the box G' by opening the valve J', while at the same time the valve J is closed. When this latter valve is closed by the means above described the atmospheric pressure is gradually removed from the self-acting valve K, which opens automatically and permits the tailings to escape from the receiver-boxes. It is evident that by the alternate filling and emptying of these receiver-boxes the tailings cannot accumulate in the receiving-chamber in sufficient quantities to interfere with the operation of the machine.

The surface of the valves fitted to the receiver-boxes should fit accurately, so as to prevent the entrance of air.

The surface of the valve C in the hopper should not be polished, but roughened, as the amalgam or alloy in the kettle formed by the lead, gold, or silver and sulphurets is a sticky substance which will adhere to any polished surface, and thus clog the machine.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In apparatus for extracting gold and silver from quartz, constructed substantially as herein described, surrounding the amalgamating-kettle with an annular chamber the central space of which shall form the fire-chamber of the apparatus, the said annular chamber being so arranged in relation to the kettle that the quartz or tailings may be drawn off simultaneously from all points of the circumference of the kettle, substantially as and for the purposes herein set forth.

2. In an apparatus as above described, connecting the said annular chamber with a receiving-chamber, into which the quartz or tailings flow, which said receiving-chamber may be organized for continuous or intermittent action, substantially as herein described.

3. In combination with the apparatus herein described, the valve placed in the feed or hopper, and constructed and arranged substantially as set forth, for regulating the flow of the ore into the kettle.

4. In apparatus constructed and operating as set forth, the combination and arrangement of valves whereby the automatic discharge of the tailings may be effected.

5. In apparatus constructed substantially as set forth, making the doors and flues which lead from the interior of the vessel to the outside thereof of an ogee shape—that is to say, with inclined surfaces to deflect the tailings and prevent the possibility of its accumulating and choking up the apparatus.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

WILLARD MUNROE FULLER.

Witnesses:

A. POLLOK,

EDM. F. BROWN.