2 Sheets—Sheet 1.

G. J. FIRMIN & T. A. D. FORSTER.

Apparatus for Amalgamating and Washing Ores.

No. 207,023. **Patented Aug. 13, 1878.**

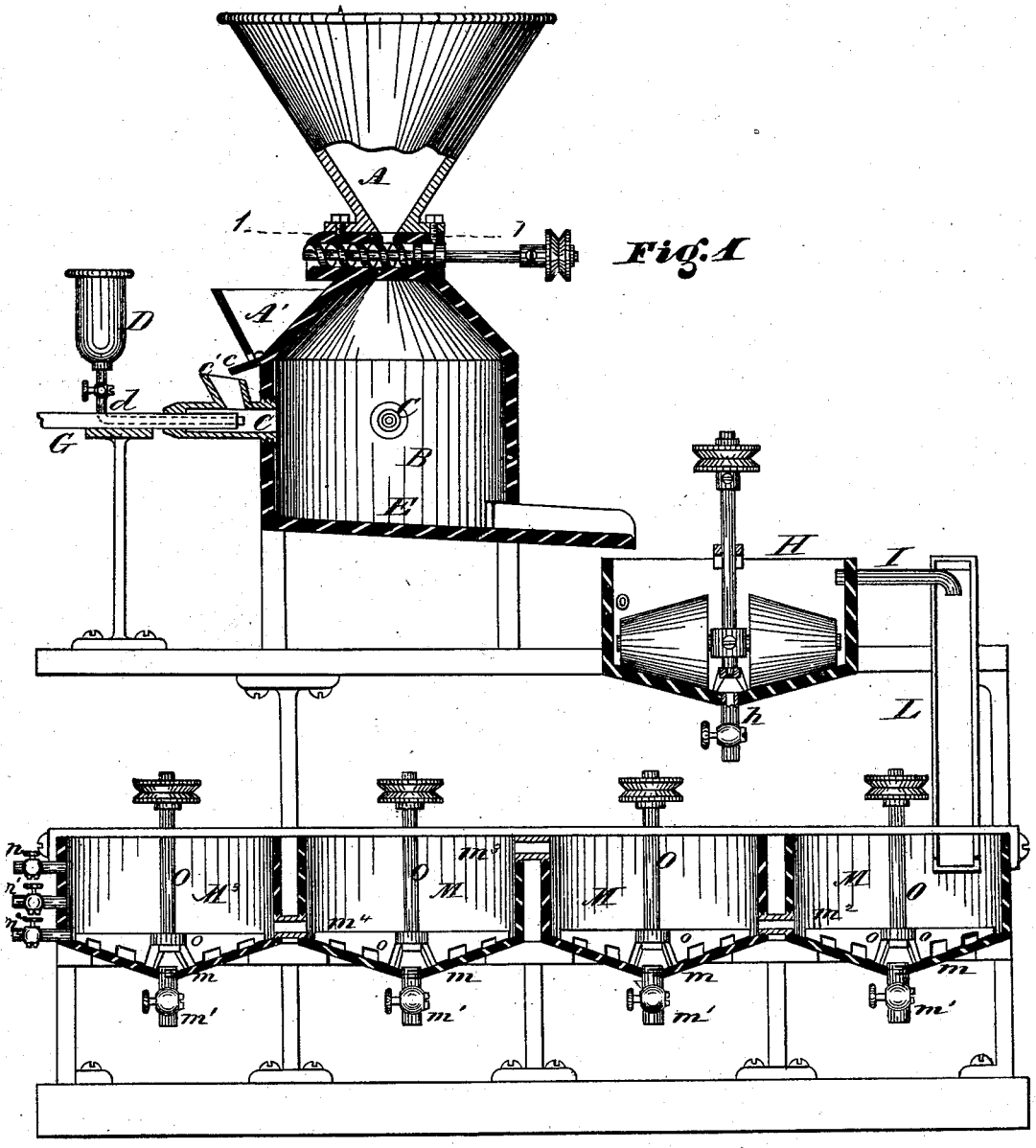

Fig. 1

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2 Sheets—Sheet 2.

G. J. FIRMIN & T. A. D. FORSTER.

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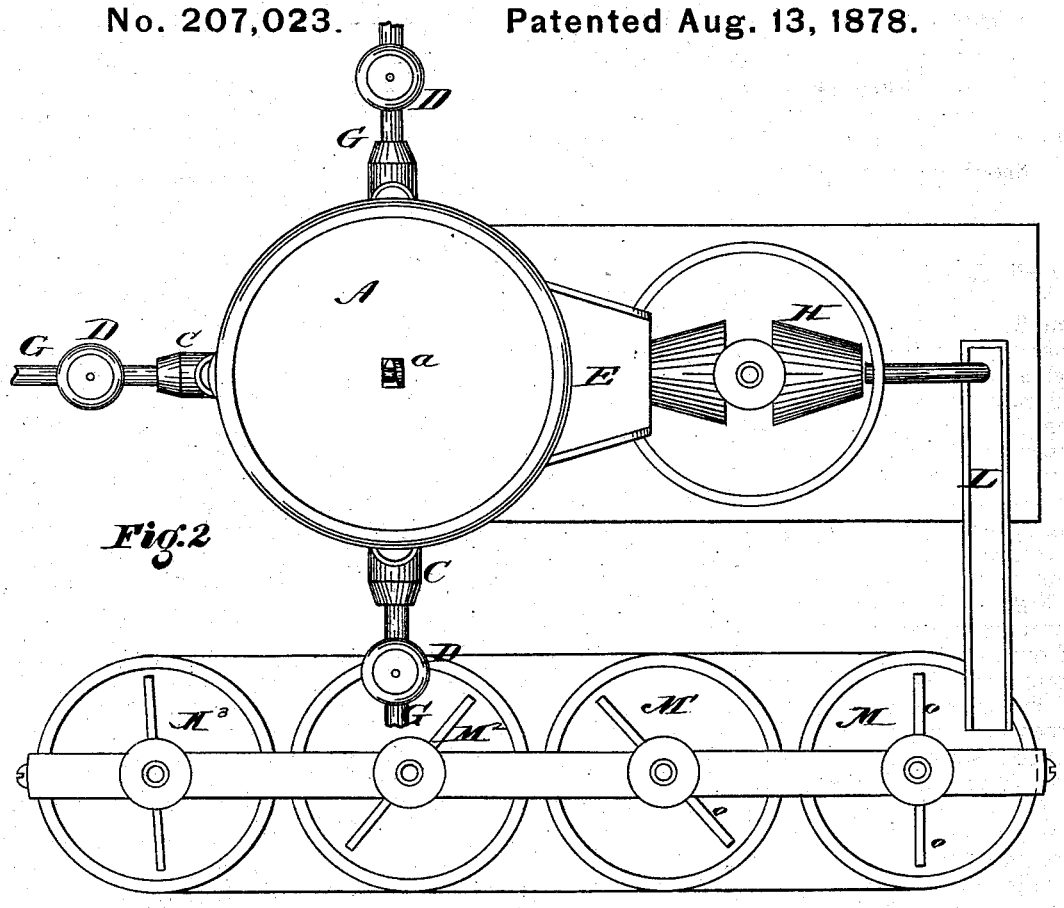

Fig. 2

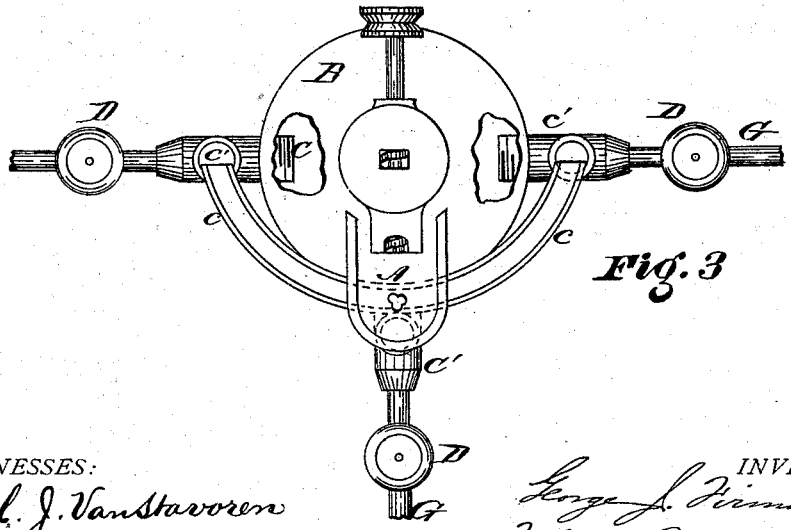

Fig. 3

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UNITED STATES PATENT OFFICE.

GEORGE J. FIRMIN AND THOMAS A. D. FORSTER, OF NORRISTOWN, PA.

IMPROVEMENT IN APPARATUS FOR AMALGAMATING AND WASHING ORES.

Specification forming part of Letters Patent No. **207,023**, dated August 13, 1878; application filed April 19, 1878.

To all whom it may concern:

Be it known that we, GEORGE J. FIRMIN and THOS. A. D. FORSTER, of Norristown, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Amalgamating and Washing Ores; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a longitudinal vertical section of our improved apparatus. Fig. 2 is a plan view of our apparatus, and Fig. 3 is a plan view of hopper and feed on the line 1 1, Fig. 1.

Our improvements relate particularly to the invention for which Letters Patent of the United States, dated October 16, A. D. 1877, No. 196,212, were issued and granted to us, and have specially the following objects in view: first, the introduction into the amalgamating-chamber of two or more streams of mingled ore and mercury, said streams entering at different points in such manner that they will impinge upon one another, thereby effecting a more thorough mingling of the particles of ore and mercury than is effected when only a single stream is employed; second, to the provision of a series of settlers so constructed that the passage of the ore through them may be continuous, the operation of these settlers effecting, however, the collection of the mercury or amalgam, permitting the same to be drawn off separately from the tailings.

Referring to the accompanying drawing, A designates an ore-hopper, having a horizontal screw-feed, *a*, by means of which its contents are conveyed to a distributing-hopper, A′. B shows the amalgamating-chamber, which we have illustrated in the drawing as an upright cylindrical vessel with a conical top; but we do not mean thereby to limit ourselves to a vessel of this shape, as any other convenient and appropriate form may be adopted.

C C C represent tubes entering the vessel B at different points. Two or more of these tubes may be employed, and they may be arranged relatively to each other, as shown in the drawing, or in any other manner which will cause the blasts of mingled ore and mercury which they discharge into the amalgamating-chamber to impinge upon or come in contact with one another, so as to produce a mingling or commixture of such separate blasts.

D D are the mercury-cups, located on said tubes C C, and *d d* the mercury feed-pipes, the ore being conducted to said tubes C C from the distributing-hopper A′ by means of channels or gutters *c c*, and entering through openings *c′ c′*. The amalgamating-chamber B is bottomless, and beneath it is located an inclined chute, E, on which the ore and mercury fed into said chamber by means of a jet of steam, air, or other medium producing a blast, introduced through the pipes G G, fall, and are carried to the muller H. In the bottom of the muller is a port, *h*, through which the amalgam settling therein may be drawn off.

I is a pipe or conduit leading from the muller to a chute, L, located below the vessel B, and arranged to receive the water, ore, &c., falling from the muller, and conduct the same to the first of a series of settlers, M M^1 M^2 M^3. Each of these settlers consists of a cylindrical vessel having a conical bottom, *m*, with exit-port m^1 for drawing off the mercury and amalgam which settles therein. From the first settler, M, there leads to the second settler, M^1, a pipe or passage, m^2, located or communicating with said vessels near their bottoms. From the second settler, M^1, to the third, M^2, extends a pipe, m^3, located near the top of both said vessels. From the third settler, M^2, to the fourth, M^3, extends a pipe, m^4, located a short distance above the bottoms of said vessels, and from the vessel M^3 are bibb-cocks n n^1 n^2 at different altitudes. Each of the settlers has a vertical shaft, O, with radial arms and scrapers *o*, said shafts being designed and arranged to be rotated, so as to cause the scrapers *o o* to sweep over the bottoms of said vessels.

By means of the described construction and arrangement of the series of settlers the mass of ore, water, &c., is conducted from one vessel to another, entering at or near the top of one and discharging close to or at the bottom of such vessel, entering near or at the bottom of the next and leaving at or about the

top of the same, and so on. The effect of this is to produce a very thorough admixture of the mass, so as to bring any mercury and metal which may possibly have remained therein into intimate contact, thereby producing amalgamation.

A still further effect is that such of the ore and amalgam as has become so finely divided or atomized as to float on the surface of the water in the form of fine globules will, to a considerable extent, be caused to collect, so that it may be scooped off, or will settle on the bottoms of the settlers, where it may be drawn off through the ports.

We have shown a series of settlers consisting of four vessels; but we do not limit ourselves to that number, reserving the right to increase or diminish the same, preserving always, however, the described principle of construction and communication between the vessels, whether only two or a greater number be employed.

Beneficial results may be obtained by blasting ore alone through one or more of the tubes C, mercury being blown through the remaining tube or tubes.

What we claim as our invention is—

1. The combination, with an amalgamating-chamber, of two or more blast-tubes, C C, arranged relatively to each other, substantially as described, whereby the blasts which they discharge will impinge upon or come in contact with each other in said chamber, for the purpose set forth.

2. The settlers M M^1, provided with vertical shafts holding radial beaters, and having connecting-passage m^2 at or near their bottoms, the settler M^1 having an outlet at or near its top, substantially as shown and described.

3. The series of settlers M M^1 M^2 M^3, having connecting-passages alternately at or near their tops and bottoms to successively introduce the water, ore, &c., at the top and take it out at the bottom of said vessels, and then vice versa, said settlers being provided with vertical shafts having radial beaters, substantially as shown and described.

In testimony that we claim the foregoing we have hereunto set our hands this 12th day of April, 1878.

GEO. J. FIRMIN.
THOS. A. D. FORSTER.

Witnesses:
M. D. CONNOLLY,
CHAS. F. VAN HORN.