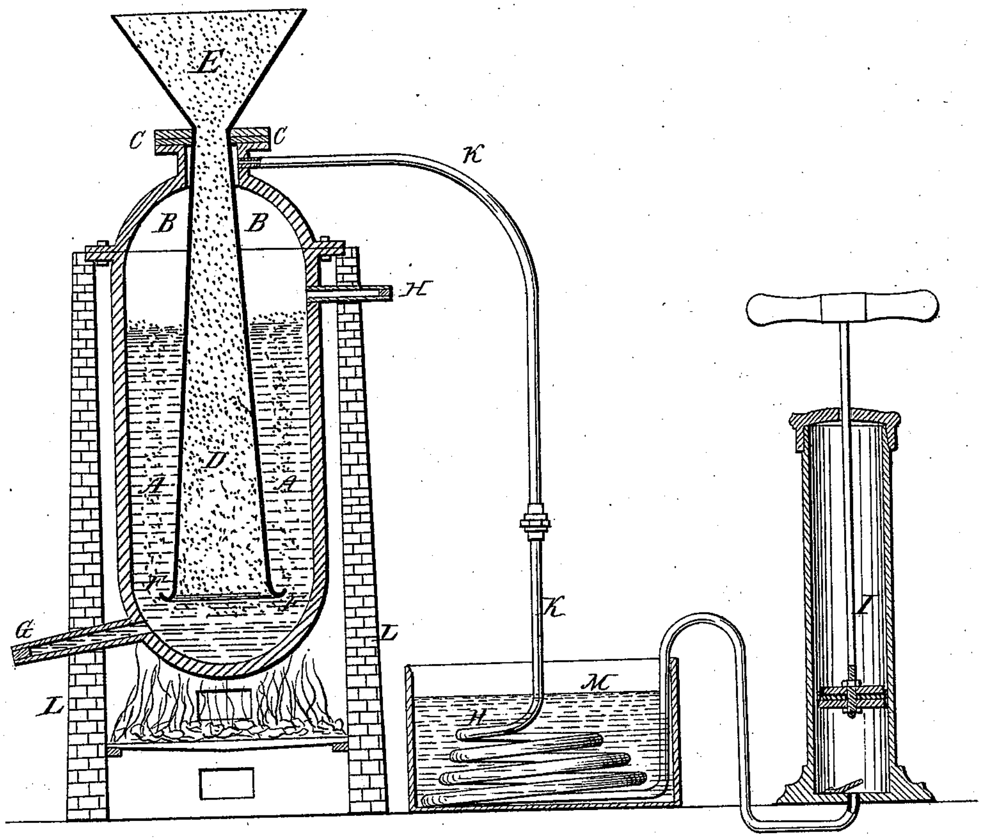
W. M. FULLER.

Dry Amalgamator.

No. 51,822. Patented Jan. 2, 1866.



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WILLARD MUNROE FULLER, OF CHICAGO, ILLINOIS.

IMPROVED APPARATUS FOR EXTRACTING GOLD AND SILVER FROM QUARTZ, &c.

Specification forming part of Letters Patent No. **51,822**, dated January 2, 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 Extracting Gold and other Metals from Quartz and other Substances; and I hereby declare that the following is a full, clear, and exact description of the same.

In the extraction of gold and silver from auriferous and argentiferous ores the reduction of the ore to a fine powder and the exposure of all the particles of gold and silver to the amalgamating or alloying action of mercury or melted lead are the principal operations. My invention relates to the latter, and has for its object the more perfect and intimate mixture of the powdered mass of auriferous or argentiferous quartz or ore with mercury or melted lead.

Heretofore the amalgamation of the quartz or reduced ore could only be effected by the imperfect, tedious, expensive process of stirring and mixing the mass, either as practiced by the Mexicans or by means of machinery. Numerous experiments, however, have led me to the discovery of the condition which I deem essential to obtain the best results, which is the introduction of the powdered quartz or ore under a column of mercury or heated lead in a diffused condition, so that the individual particles of gold or silver, on rising through the mass of mercury or lead, shall necessarily come in contact and infallibly form amalgam or alloy with the mercury or lead.

To carry this invention into effect I use a hermetically-closed vessel provided with a tube extending from the top downward to near the bottom of said vessel. With the latter I combine an air-pump, whereby the air in the vessel may be exhausted, thereby impelling the powdered ore or quartz to descend through the tube and discharge the same at the lower extremity of the tube in a diffused form, and cause it to rise around the said tube through the mass of mercury or lead, with which the particles of gold or silver form an amalgam or alloy. The earthy matter or quartz deprived of the gold will rise and collect on the surface of the lead or mercury, while the amalgam or alloy will sink to the bottom. Suitable discharge-pipes of the amalgam or alloy and of the quartz are provided, respectively, in the upper and lower part of the vessel.

To enable others to make and use my invention, I shall now describe an apparatus or machine constructed and arranged for operation in accordance with my said improvement.

Referring to the drawings, A is the amalgamating-vessel, or vessel in which the alloyage is effected. It is composed of an upright cast-iron cylinder closed at the bottom. On top the vessel A is closed by means of a cap, B, having a central opening or collar, C, through which passes the tube D, descending to near the bottom of the vessel, so as to leave a sufficient space between it and the bottom of the vessel for the collection of the amalgam or alloy formed. This tube is surmounted by a hopper, E, the conical outer surface of which tightly packs the joint of the tube with the collar. I prefer to give the tube a slightly conical shape—*i. e.*, making the same expanding toward its lower extremity, and to provide its edge with a flange, F, curved upwardly, to facilitate and properly direct the powdered quartz, in its ascending movement, up and through the mass of mercury or melted lead.

G is a discharge-pipe or vent for the removal, from the vessel A, of the amalgam formed. This pipe is kept plugged, by means of clay or otherwise, until the quantity of amalgam formed is such as to impede the operation, when the plug is removed; and H is another discharge-pipe for the removal from time to time of the exhausted quartz, or the quartz from which the gold shall have been extracted.

With the vessel A is connected an air-pump, I, by means of a pipe, K, in such manner that the air in the vessel may be exhausted by the operation of the pump.

When the apparatus is used with melted lead in lieu of mercury the vessel A is mounted in a furnace, L, and the pipe K is carried through a refrigerator, M—*i. e.*, a tank filled or supplied with a fresh stream of water, in order to protect the pump from the destructive effects of hot air.

The operation of the machine is as follows: The vessel A, if used with mercury, is filled up to a level somewhat below the discharge-pipe H, the discharge-pipe G having been previously securely plugged. The crushed and powdered ore is then entered until the tube D

and portion of the hopper is full. The discharge-pipe H being now also stopped, the pump is operated and the air exhausted, the effect of which will be the gradual descent of the powdered ore down the tube D. As the tube widens the particles of ore become more and more diffused, and at the mouth of the tube are drawn concentrically up and through the mercury surrounding the tube. While the powdered quartz or ore is thus drawn through the mass of mercury it becomes wholly divested of the gold or silver or other metal it may contain, by forming an amalgam, which is specifically heavier than the mercury and consequently sinks to the bottom, while the powdered quartz or ore, which is lighter, will rise to the surface of the mercury. The hopper, it will be understood, may be kept filled and the operation continued until the amalgam and quartz accumulated in the vessel require to be discharged.

If the apparatus be used in connection with melted lead the operation is precisely similar. Of course the lead in the vessel is melted by a fire built on the grate of the furnace, and the exhausted air is cooled before it is allowed to reach the pump, by passing the pipe K through a cooler, M, for the purpose provided.

I have described an apparatus constructed in accordance with my invention to illustrate the principle thereof, not meaning to restrict myself to the particular arrangement shown and described, as it is obvions that many modifications may be suggested and adopted without departure from my invention. Thus I contemplate, in case the ore is not entirely divested of the metal at one operation, to rework the quartz or ore that may come up to the surface of the mercury or lead—*i. e.*, discharge the same into the hopper of a second or reworking apparatus. Instead of an air-pump a blast of steam may be applied to exhaust the air in the vessel A.

Having now described my said invention, and the manner in which the same is or may be carried into effect, I shall state my claims as follows:

1. The method herein described of introducing, in a diffused condition, powdered auriferous or argentiferous ores under a column of mercury or heated lead, so that the individual particles of gold or silver, on rising through the mass of mercury or lead, shall necessarily come in contact and infallibly form an amalgam or alloy therewith, substantially as set forth.

2. The method herein described of forcing crushed and powdered auriferous or argentiferous ores down and up and through a body of mercury or melted lead, for the purpose of forming an amalgam or alloy therewith, by atmospheric pressure—that is to say, by exhausting the air in the vessel containing the mercury or melted lead, substantially as herein set forth.

3. An apparatus or machine for extracting goid or silver from auriferous and argentiferous ores, the same consisting of the following elements in combination: first, a closed amalgamating or alloying vessel, as described; second, a hopper and chute or tube discharging the ore at the bottom of the said vessel, as described; third, a device or machine for exhausting the air in said vessel, as described.

4. The employment, in combination with the amalgamating or alloying vessel, as described, of an expanding or trumpet-shaped chute or tube for conveying the powdered ore to near the bottom of the said vessel in a diffused state, substantially as herein set forth.

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

WILLARD MUNROE FULLER.

Witnesses:
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EDM. F. BROWN.