(No Model.) 2 Sheets—Sheet 1.

J. W. AYLSWORTH & A. C. PAYNE.

METHOD OF AND APPARATUS FOR EXTRACTING GOLD AND SILVER FROM THEIR ORES.

No. 481,683. Patented Aug. 30, 1892.

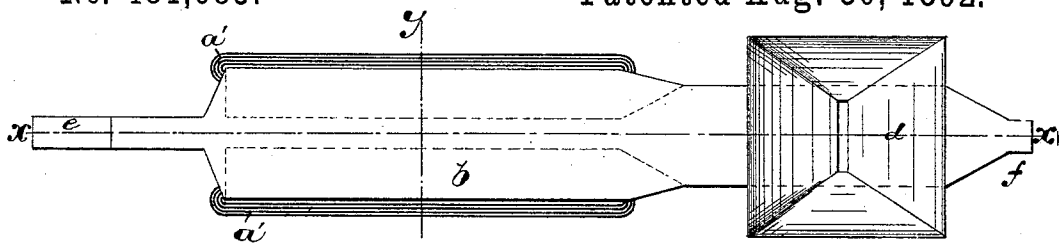

Fig. 1.

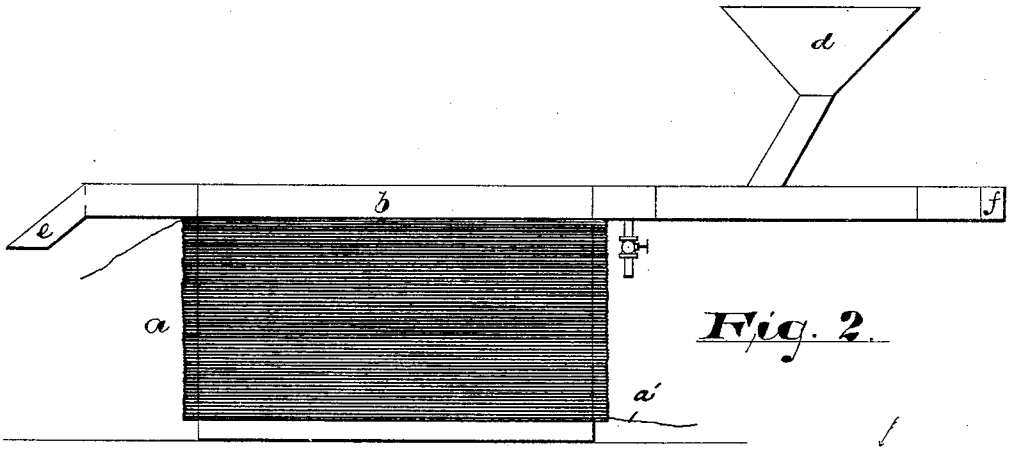

Fig. 2.

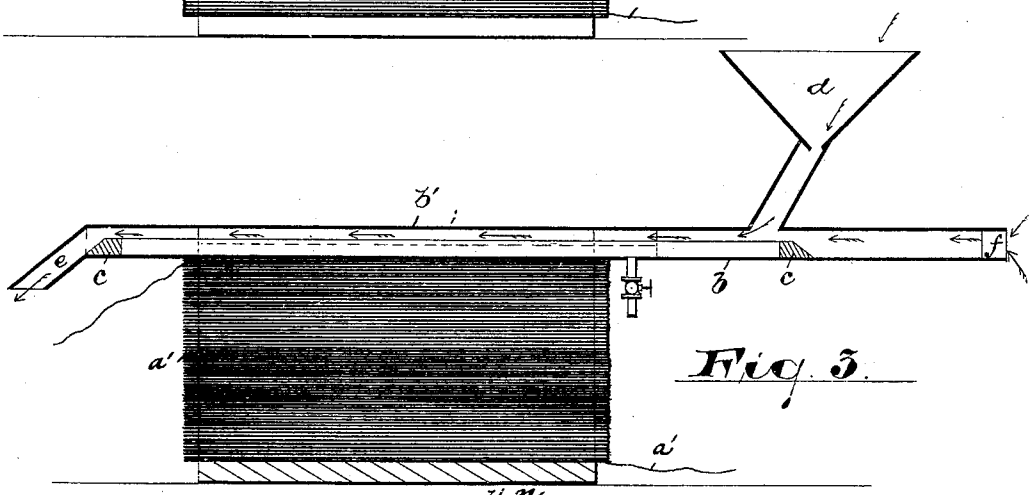

Fig. 3.

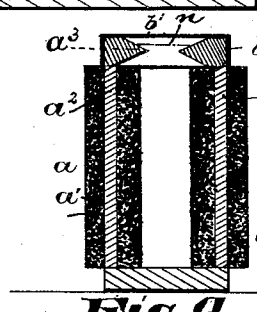

Fig. 4.

Witnesses
Oscar A. Michel
E. Igler

Inventors:
Jonas W. Aylsworth,
Arthur C. Payne,
By Drake & Co., Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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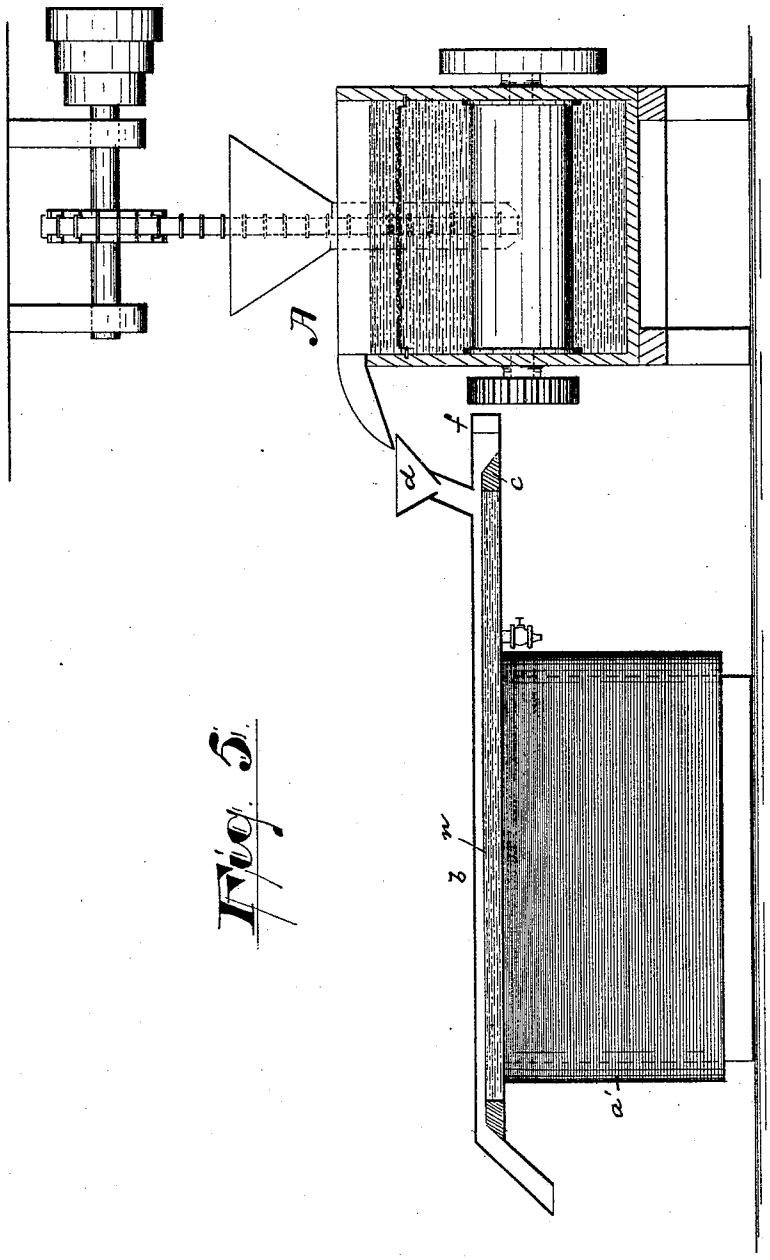

Fig. 5.

Witnesses

Oscar A. Michel

John A. Wiedersheim

Inventors:

Jonas W. Aylsworth,

Arthur C. Payne,

By Dyrenforth & Co. Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JONAS W. AYLSWORTH, OF ORANGE, AND ARTHUR C. PAYNE, OF ELIZABETH, NEW JERSEY.

METHOD OF AND APPARATUS FOR EXTRACTING GOLD AND SILVER FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 481,683, dated August 30, 1892.

Application filed July 3, 1891. Serial No. 398,444. (No model.)

To all whom it may concern:

Be it known that we, JONAS W. AYLSWORTH, residing at Orange, in the county of Essex, and ARTHUR C. PAYNE, residing at Elizabeth, in the county of Union, State of New Jersey, citizens of the United States, have invented certain new and useful Improvements in the Method of and Apparatus for Extracting Gold and Silver from their 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The object of this invention is to secure the extraction of the precious metals from their ground ores or and more particularly to save from the gangue what might otherwise pass off therewith after the amalgamating process is effected.

The invention consists in the process of extracting precious metal from its ore and in the arrangements and combinations of parts, substantially as will be hereinafter set forth, and finally embodied in the clauses of the claim.

Referring to the accompanying drawings, in which like letters indicate corresponding parts in each of the several figures, Figure 1 is a plan of the improved device. Fig. 2 is a side elevation of the same. Fig. 3 is a sectional view taken on line x, Fig. 1; and Fig. 4 is another section taken at right angles to the first on line y, Fig. 1. Fig. 5 is a sectional view showing the relation of the magnetic separator to an amalgamator, from which it is adapted to receive the comminuted ore.

In the drawings, a indicates a strong electro-magnet. a' are the wires connecting with means for generating an electric current in any ordinary manner, and a^2 are the pole-pieces, which extend up into a shallow pan or receptacle b and are there provided with knife-edges a^3, as shown in Fig. 4. The said pan is inclosed at the top, as at b', and within the pan the projecting pole-pieces and end pieces c form a shallow chamber for the mercury or amalgamating composition, hereinafter referred to. At one end of the pan the same receives a hopper d, by means of which certain gangue which has passed through an amalgamating process, described in a contemporaneous application, Serial No. 398,443, filed July 3, 1891, and which will be again referred to hereinafter, is led into the pan from the amalgamator A or other supply mechanism or storage-chamber prior to being forced over the mercury in said pan, as hereinafter described. At the same end of the pan at the extremity the said pan is connected with a blower, by means of which the fine gangue is forced over the mercury in close contiguity with the surface thereof. At the opposite end of the pan the same is provided with a chute e, by means of which the dust and gangue from which the metal has been extracted is carried to a distance from the machine.

The process of separation is conducted substantially as follows: The comminuted gangue carrying the auriferous particles is first passed through a body of magnetic amalgam or an amalgam of iron and mercury in relatively small quantities and the gold or precious metal is extracted therefrom, but a small percentage of the said magnetic amalgam is taken up by the gangue, because of the rapidity of the operations of the process or otherwise, and is carried therewith into the device herein described more particularly.

To prepare the magnetic amalgam, mercury is placed in a suitable vessel, and over this is poured a concentrated solution of ferrous sulphate—say one pound of mercury to two quarts of the solution. An iron electrode is then placed into the sulphate solution, and both the mercury and the iron are connected by wires to a convenient source of electricity of from two to twenty volts potential, so that the current shall pass from the iron through the solution to the mercury and thereby cause a deposit of iron, which is absorbed and combined with said mercury. The operation is continued until the mercury has become thick or pasty, in which condition it will contain about ten parts of iron to one hundred of mercury. The mass thus obtained is diluted with mercury to make it perfectly fluid; but it still retains a proper degree of magnetic susceptibility. The comminuted gangue carrying the

globules of magnetic amalgam is received from the amalgamator into the hopper *d*, and from thence it is fed to the pan to a point therein over the body of quicksilver or mercury lying between the pole-pieces of the magnet, which extend longitudinally from end to end of the pan. As the gangue strikes this mercury it encounters the blast from the blower entering at *f*, and is carried by said blast through the inclosing box over the surface of mercury and between the pole-pieces and out at *e*. From the point where the gangue encounters the blast to the magnet the action is simply one of distribution. The blast scatters the gangue and the larger globules of amalgam tend to remain on the surface of the mercury; but on account of the dust covering the surface of these globules they will not enter into the body of the mercury until they accumulate in some weight, when they sink and are absorbed. The dust and finer particles are carried by the blast through the low passage in the box or pan *b*, over the surface of the mercury and between the pole-pieces. Here the globules of magnetic amalgam are attracted to the poles and are drawn down into the mercury, because the line of greatest magnetic force is below the surface, as will be understood upon examination of Fig. 4, where *n* indicates the upper surface of the body of mercury.

While we have described a dry method of forcing the gangue containing magnetic amalgam into contiguity to the electro-magnet we may employ a method in which water is the motive force without departing from the invention. Nevertheless the process is more especially adapted to the extraction of precious metals from the dry ores, and by means of the amalgamating-machine in the said contemporaneous application, by means of which the comminuted ore is conveyed to the machine particularly described herein in small quantities but continuously. Again, we may vary the relation of the magnet and receptacle for the mercury and change the construction of both from that shown without departing from the invention, the essential feature of the process being the passing of the gangue carrying the fine globules of precious amalgam through a strong magnetic field, thereby attracting the amalgam and separating the particles susceptible to magnetic influence and allowing the non-magnetic portions to pass off from the machine.

In the use of an amalgam of iron and mercury the iron is found to play an important part in the operation of amalgamation, with the precious metal itself increasing the amalgamating power of the mercury, and it is found to be desirable to add iron amalgam to the body of the amalgamating fluid from time to time, in order to secure the desired degree of magnetic susceptibility in the fine particles of amalgam that are carried into the machine to be separated from the gangue when passing through the magnetic field. The non-magnetic dust is not attracted and passes on out at the opening *e*. The mercury as it becomes charged with magnetic amalgam is removed and fresh metal is supplied. While it is found that the wedge-shaped pole-pieces are preferable, yet we do not wish to limit ourselves to that construction and the mechanisms may be otherwise varied without departing from the invention.

Having thus described the invention, what we claim as new is—

1. The process of extracting precious metal from its ore, which consists in subjecting the ore to the amalgamating action of a magnetic mercurial amalgam, and then passing said ore through a magnetic field and extracting the remaining amalgam, substantially as set forth.

2. The process of extracting precious metal from its ore, which consists in passing the ore containing said precious metal into close association with a magnetic composition and combining the said precious metal therewith, and then forcing the particles of precious metal combined with said composition through a magnetic field and attracting the magnetic particles therefrom, substantially as set forth.

3. The process of extracting precious metal from its ore, which consists in subjecting the ore to the action of an amalgam of mercury and iron, and after separating said ore from the body of said amalgam subjecting the same to the action of a magnet and attracting the remaining particles of said amalgam, substantially as set forth.

4. The process of separating magnetic amalgam from comminuted gangue, which consists in forcing said gangue through a magnetic field and over a surface of mercury, substantially as set forth.

5. The process of separating magnetic amalgam from comminuted gangue, which consists in forcing the dry gangue by pneumatic power over a surface of mercury arranged in a magnetic field, substantially as set forth.

6. The process of separating magnetic amalgam from its gangue, which consists in attracting said magnetic amalgam toward a body of fluid metal, substantially as set forth.

7. The process of separating precious metal from its ore, which consists in passing said ore into a magnetic body of mercury amalgam, the ore being relatively smaller in quantity than the said mercury, and allowing said ore to rise to the surface of said amalgam, then passing said ore over a magnetic field adjacent to a body of liquid metal and attracting particles of amalgam toward and into said body of liquid metal, substantially as set forth.

8. The process of extracting precious metal from comminuted ore, which consists in subjecting said ore to the action of an amalgam containing particles in suspension, such as iron, susceptible to magnetic attraction, substantially as set forth.

9. The combination, with a magnet and a

pan or receptacle for mercury, of a blower or other means for forcing the ore over said mercury and through the field of said magnet, substantially as set forth.

10. The combination, with a pan or receptacle for mercury, of a magnet having its pole-pieces in said pan, and means for supplying the pan with comminuted ore, and pneumatic means for forcing said ore in a dry state over said mercury, substantially as set forth.

11. The combination, with a closed pan having the longitudinal edges of the pole-pieces a^2 within the same, of a body of mercury within said pan covering the line of greatest magnetic force and means for forcing the dry ore through said pan, substantially as set forth.

12. In combination, a closed pan, a magnet *a*, having pole-pieces in said pan, said pole-pieces having knife-edges, a body of mercury covering said edges, an outlet-opening *e* from the pan, a hopper *d* at the opposite end, and an inlet-opening *f* for pneumatic force, all said parts being arranged and combined substantially as and for the purposes set forth.

In testimony that we claim the foregoing we have hereunto set our hands this 29th day of June, 1891.

J. W. AYLSWORTH.
ARTHUR C. PAYNE.

Witnesses:
OLIVER DRAKE,
OSCAR A. MICHEL.