(No Model.)

H. F. EDWARDS.

METHOD OF AND APPARATUS FOR AMALGAMATING ORES.

No. 518,543. Patented Apr. 17, 1894.

Fig. 1

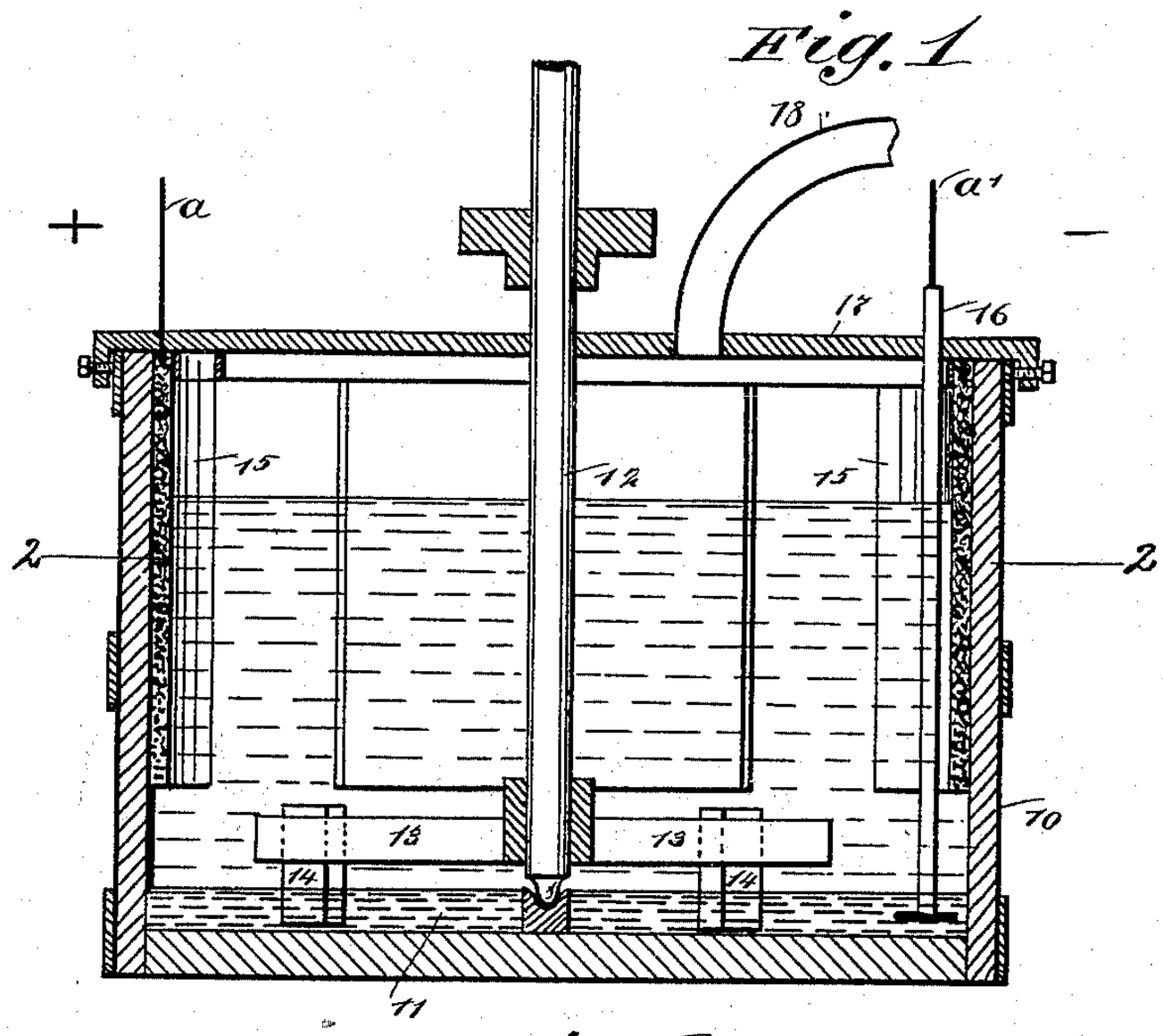
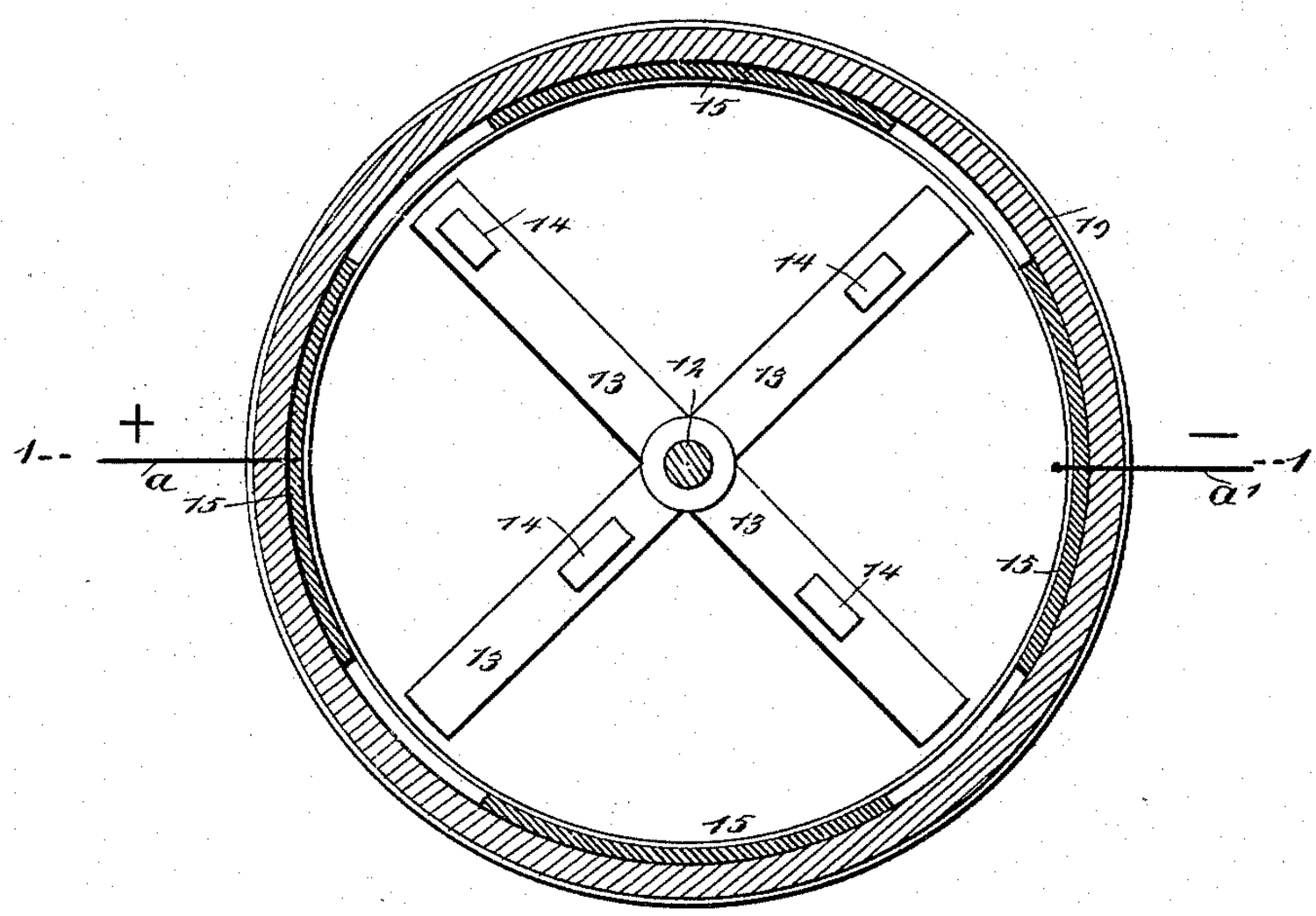


Fig. 2



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METHOD OF AND APPARATUS FOR AMALGAMATING ORES.

SPECIFICATION forming part of Letters Patent No. 518,543, dated April 17, 1894.

Application filed March 17, 1893. Serial No. 466,498. (No model.)

To all whom it may concern:

Be it known that I, HUBERT F. EDWARDS, of Butte city, in the county of Silver Bow and State of Montana, have invented a new and Improved Method of and Apparatus for Amalgamating Ores, of which the following is a full, clear, and exact description.

My invention relates to improvements in a method of and apparatus for amalgamating ores and more especially precious ores such as gold and silver.

The object of my invention is to produce a simple and economical method of and apparatus for freeing and amalgamating gold or silver either from free milling or base ores.

To this end my invention consists in the method which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in both the views.

Figure 1 is a central cross section, on the line 1—1 in Fig. 2, of a form of agitator which is used or may be used in connection with my method; and Fig. 2 is a sectional plan of the agitator, on the line 2—2 of Fig. 1.

In carrying out my invention it is necessary to use a suitable agitator, and in the drawings I have shown an agitator adapted for the purpose, but any other suitable one may be employed without departing from the principle of the invention. As illustrated, a tank 10 which is preferably of wood, is employed, but the tank may be made of any suitable material, although it is better that the material be a poor conductor, to prevent the freed gold and silver from being plated upon its sides. In the bottom of the tank is a bath 11 of quicksilver, although other forms, as amalgamated plates may be used, and the crushed ore or pulp with which the tank is charged is kept stirred up by an agitator which also may be of any suitable construction. As shown in the drawings, the agitator comprises a central vertical revoluble shaft 12 which turns in suitable bearings and is arranged within the tank, this shaft having radial blades 13 carrying paddles 14 which extend downward. The liquid with which the tank is filled is adapted to connect with the positive pole of a battery, or other source of electricity, and to this end the tank is lined with carbon plates 15, or with similar plates of any non-decomposable material, and the plates are connected with the source of electrical supply by a wire *a*. The negative pole of the battery connects by a wire *a'* with the quicksilver in the tank bottom, the wire being led in through a suitable insulator 16. The tank is provided with a suitable cover 17 from which leads a pipe 18, and this is adapted to connect with a suitable condenser so that the vapors and gases from the tank, which are generated by the electric current and the consequent decomposition, may be condensed and used.

In carrying out the method, the tank is charged with crushed ore or pulp, and mixed with the pulp is some decomposing conducting chemical liquid or solution of some salt such, for instance, as an aqueous solution of cyanide of potassium, which at the time of its decomposition by means of an electric current, will liberate, in a nascent state, a chemical which is capable of re-acting on the metals united with the gold or silver and is capable of dissolving the precious metals themselves, the said solution being instantly decomposed by the electric current to liberate the free gold and silver. When the tank is charged as specified, the agitator is set in motion and a strong current of electricity is passed through the pulp which is kept stirred, as described, and the ores are rapidly decomposed. The particles of silver and gold are amalgamated with the quicksilver at the bottom of the tank and are thus charged negatively with electricity, as the quicksilver is connected with the negative pole of the battery as specified. If they become stirred up from the bottom they are positively charged by contact with the solution in the pulp and are then thrown back to the quicksilver so that the metal is all amalgamated and the quicksilver is not wasted.

By amalgamating metals in the manner described, I overcome the loss due to the flow-

ering of the quicksilver in the tank, as the negative current keeps the particles attracted to the bottom of the tank. I also avoid the loss of quicksilver due to the formation of calomel or other quicksilver salt. As soon as any quicksilver salt is formed it is immediately decomposed by means of the electric current, and the quicksilver is forced to the negative pole or plate of the tank or other form of pan or agitator. The reactions occurring in the solution are approximately as follows, in case oxidized gold or silver ores are treated, it being understood that the oxide is dissolved in the first place. $14KCN+(Ag\ or\ Au)+2FeO+29H_2O=2HCN+(Ag\ or\ Au)+2K_4Fe(CN)_6+25H_2O+6KHO=2CN(Ag\ or\ Au)+Fe_2(OH)_6+12HCN+14KHO+11H_2O+4H$. The various gaseous products are partly dissolved in the solution and partly escape therefrom. The potassium collects at the negative pole. The cyanogen united to the gold or silver is separated therefrom by the electric current and combines with hydrogen to form prussic acid, the main part of which goes off as gas. The final products are, gold or silver, and potassium, which are found at the negative pole; water, particles of mineral matter and hydroxide of iron, the latter being either partly in suspension or entirely in solution in the water. Various gases are also found in solution.

In amalgamating metals by this method, all the metals that are capable of being decomposed by means of an electric current from an aqueous solution are saved, and at the same time amalgamated with the quicksilver.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent—

1. The herein described method of amalgamating ores, which consists in reducing the same to pulp, charging the latter into a vessel and mixing it with a solution of cyanide of potassium in the presence of ferrous oxide, providing an amalgamating material in the bottom of the vessel, and passing an electric current through the pulp and the amalgamating material by connecting the latter with the negative pole and the solution with the positive pole, substantially as set forth.

2. An electrolytic tank, provided with electrodes secured to the sides thereof and insulated from the bottom of the tank, in combination with agitators adapted to move close to the bottom of the tank to agitate the mercury which is adapted to be placed in the tank, substantially as and for the purpose set forth.

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