

(No Model.)

I. L. ROBERTS.

PROCESS OF EXTRACTING METALS.

No. 284,063.

Patented Aug. 28, 1883.

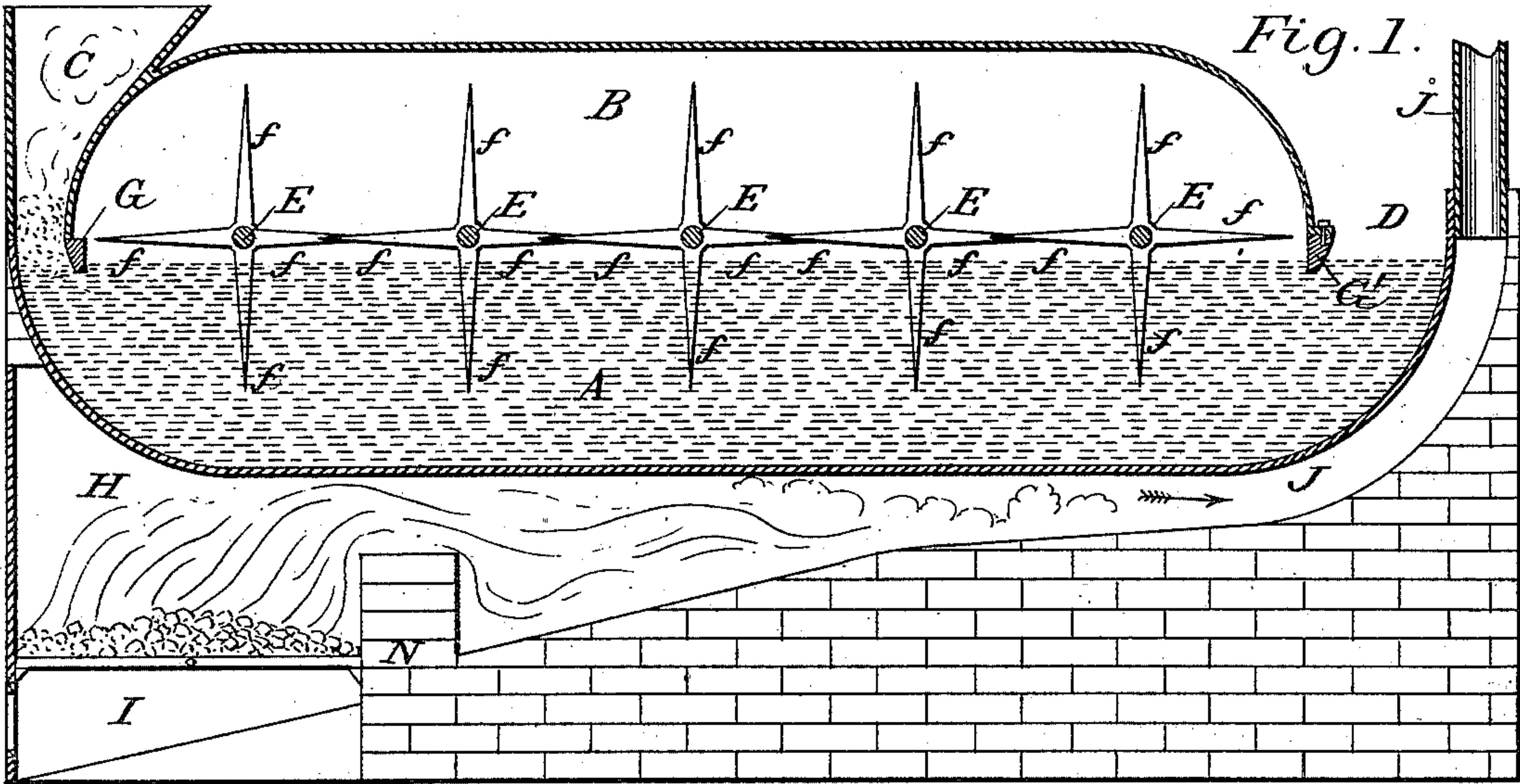
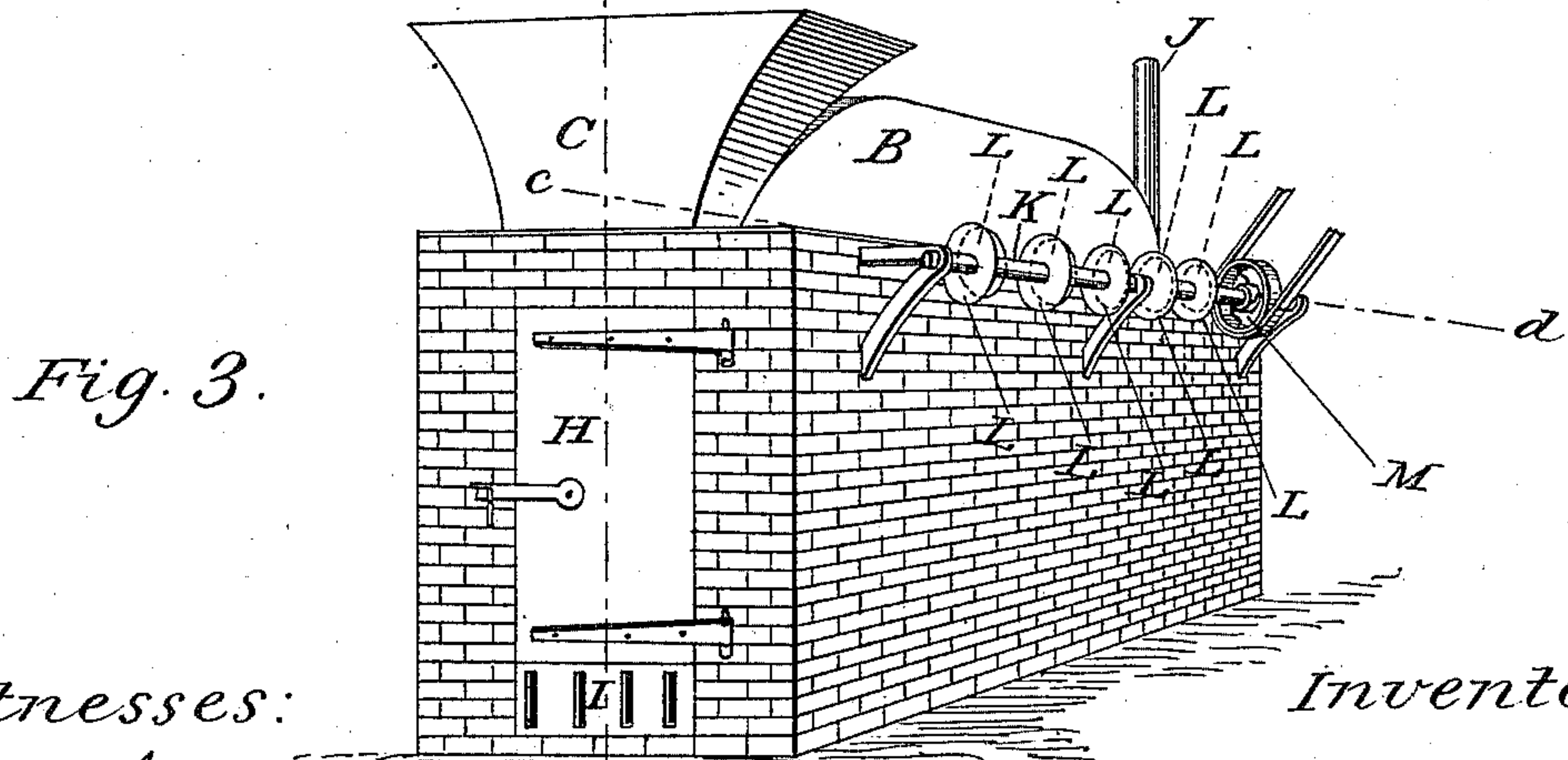
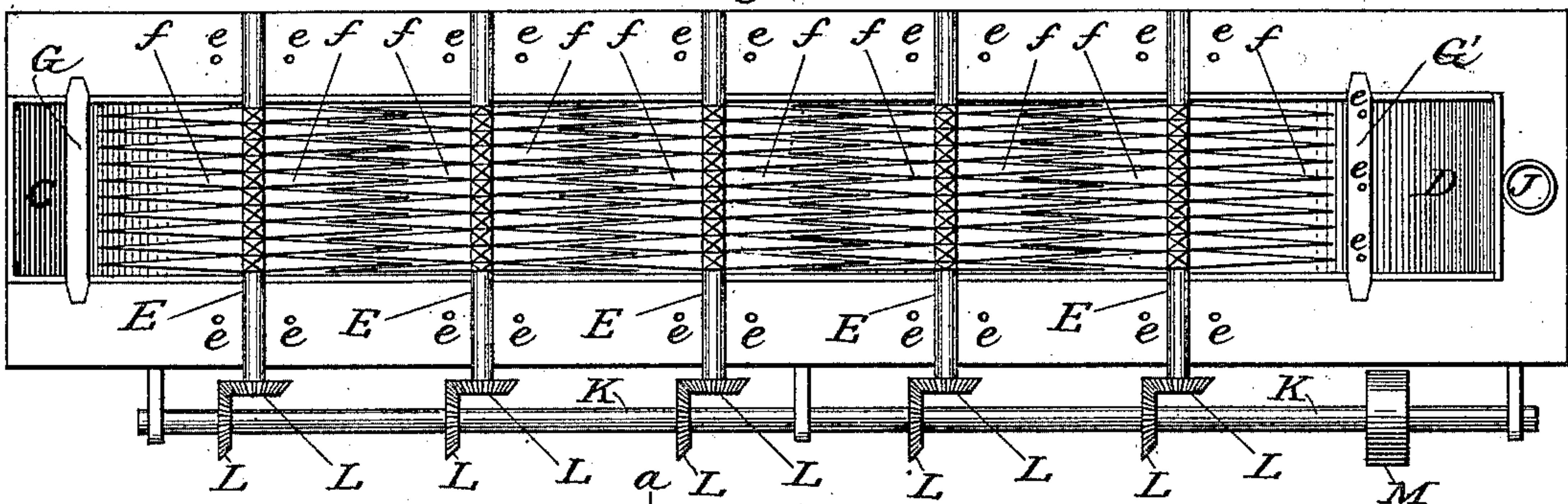


Fig. 2.



Witnesses:

H. B. Crossett.

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UNITED STATES PATENT OFFICE.

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PROCESS OF EXTRACTING METALS.

SPECIFICATION forming part of Letters Patent No. 284,063, dated August 28, 1883.

Application filed November 17, 1882. (No model.)

To all whom it may concern:

Be it known that I, ISAIAH L. ROBERTS, a citizen of the United States, residing at Jacksonville, in the State of Florida, have invented an Improved Process of Extracting Metals having an Affinity for Lead; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it ap-
10 pertains to make and use the same.

It is well known that mercury, which at ordinary temperatures is a liquid metal, has a great affinity for gold and silver, and that when they are exhibited to it they form an amalgam with
15 it, and are withdrawn from their ores wherever immediate contact can be established between such metal and the baser one. A like amalgamation also takes place when a baser metal is by the application of heat reduced to
20 a liquid state and contact established between it and either or both of the precious metals; but when pulverized ore is passed into such liquid there is such cohesion between the particles of such ore that they will form masses,
25 balls, or nodules, the outer portions of which alone are affected by the attraction of such baser metal sufficiently to cause their separation from the ore, and only a partial amalgamation is thereby effected.

30 The objects of my invention are to bring about such a contact between the fine particles of pulverized ores containing metals, except iron and nickel and molten lead, which has such affinity for them, and thus produce a
35 cheaper and more thorough amalgamation of the same than has heretofore been found practicable, from which amalgam such metals may be readily extracted by the ordinary known processes of metallurgy. Such baser metal I
40 designate, for the purposes of explanation, the "receiving metal."

Another object of my invention is to carry on such process in presence of the least quantity of oxygen, and thus diminish the waste
45 of such receiving metal by oxidation; and to these ends my invention consists in two processes which are carried on simultaneously. The one is the presentation to the receiving metal of the fine particles of ore containing
50 metals, excepting iron and nickel, so as to bring every particle as far as possible into con-

tact with such receiving metal by means of a mechanical device or machine acting at or near the surface of the lead, as well as beneath it, and the other is the supplying of some material, as pulverized charcoal, which I prefer on
55 account of its cheapness, to absorb the oxygen, together with the practical exclusion of any additional quantity of oxygen than that contained in the machine and in the ore as it is
60 fed into the machine, thus reducing the waste of the receiving metal by oxidation to the lowest degree practicable.

I attain these objects and effects by the process above referred to, and more particularly
65 set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the entire machine, made in the plane of the dotted lines
70 *a* and *b*, Fig. 3. Fig. 2 is a horizontal section of the same in the plane indicated by the dotted lines *c d* in Fig. 3, showing the manner in which the teeth are arranged upon the shafts
75 in the interior of the machine, and showing how the power is applied. Fig. 3 is an elevation in perspective of the same machine, showing the bevel-gearing attached to it and with the cover upon it as constructed for use.

Similar letters refer to similar parts throughout the several views.
80

A is a tank containing molten lead. B is the upper portion or cover of such tank. C is the opening left in the tank A for the feeding of the ore. D is the exit for the ore after treatment. E E are the axles on which teeth
85 *f f* are attached. G G' are hanging bars projecting downward and into the receiving metal to support the cover and to exclude air; H, furnace; I, ash-pit; J, exit of the gas of combustion; K, shaft on which are beveled or
90 other gearing; L, beveled gearing; M, pulley for communicating power to such gearing; N, furnace-bridge; O, bars for supporting fuel.

The iron tank A, with suitable flanges for support, and provided with suitable means for
95 attaching the cover B, rests over or is constructed upon an ordinary furnace, H, supplied with fire-bars O, ash-box I, bridge N, and flue J. Such tank is of sufficient depth to allow the reflex current of the metal within it to
100 establish itself beyond the reach of the teeth *f f*. It is provided with a flanged cover, B,

which is secured to the flanges of the tank A and to the bars G G' with suitable intermediate air-tight packing and bolts or nuts, so as to exclude the air when such receiving metal rises above the lower surfaces of such bars. The tank A, with its cover B and bars G G', forms a chamber in which the process is effected. Within such chamber revolve the shafts E, carrying the teeth, blades, or meshes, or other comminuting mechanism. When teeth are used, such shafts should be placed sufficiently near together so that the teeth on each shaft shall pass through the spaces between the teeth upon adjacent shafts. Whatever device is used for disintegrating or comminuting, it must be so arranged that as it moves it shall displace the matter with which it comes in contact and overcome its cohesion, resubmerging the nodules that float to the surface and repeatedly separating each mass until it is divided into its ultimate particles. Such comminuting device, in addition to its disintegrating action, should impart a movement to the submerged particles from the point at which such submergence commences at one end of such chamber to and beyond the bar G' at the other end, where they may emerge. Air is prevented from entering this chamber by maintaining the lower surface of the bars in and below the surface of the molten lead, excepting such as may be carried in with the pulverized ore as it is fed in through the feed C. The rotation of the shafts E E is effected by means of the bevel-gearing L L, operated by the common shaft K, carried by a pulley, M, by which the power is supplied.

In order to carry my invention into effect, I place lead in the tank A in sufficient quantity that when liquefied it shall fill the tank A sufficiently above the lower surface of the hanging bars G G' to prevent the access of air into the chamber. I also introduce with it a small quantity of powdered charcoal, sufficient, when it shall become hot, to eliminate the oxygen contained in the chamber by the formation of carbonic acid and carbonic oxide. I prefer charcoal for this purpose, though any other matter may be substituted which presents a greater affinity for oxygen than the receiving metal employed in the amalgamating process. I apply heat to the tank when the receiving metal has become fluid by the heat of the furnace. I apply the power and cause the shafts E E to revolve and introduce the pulverized ore through the feed C, and cause it to descend by gravitation or pressure when necessary, so that it shall be submerged in the receiving metal, and pass into the tank A below the bar G, where it will have a tendency to rise by reason of its lesser specific gravity, and will be caught by the teeth *ff* as they turn upon the rotating shaft E, and be carried forward farther into the tank A, and the mass separated into smaller masses.

These smaller masses, rising, meet the descending teeth on each succeeding shaft, where a like effect is produced until the original mass is entirely disintegrated and the cohesion of its parts destroyed, and the receiving metal brought into intimate contact with and united to the metal operated upon and the desired amalgam attained, leaving the remaining waste portions to be carried forward by the current established by the rotation of the teeth *ff* beyond the bar G', where they come to the surface and may be removed.

During the operation of feeding the ore, I introduce charcoal or some deoxidizing agent continuously or from time to time, in order to maintain the chamber as free from oxygen as possible.

For a receiving metal I prefer to employ lead, on account of its affinity, cheapness, and point of fusion. When the receiving metal has become sufficiently charged with the extracted metal, it may be drawn off or removed from the tank, and is then ready for the succeeding ordinary processes of metallurgy for separating such metals, which do not form a part of my process.

I prefer the device I have described, because it operates at or near the surface as well as beneath; but I do not wish to confine myself to this one device, but any other device may be used which will perform a like office.

I am aware that molten lead has been used for the purpose of extracting by affinity gold and silver from their ores; and, also, that such ores have been submitted to agitation by means of rotating rods, spiral screws, and perforated diaphragms, and also to grinding while entirely submerged, either in water, heated mercury, or molten lead, all such action taking place within the receiving metal, and not at or near the surface; and that a cover or covers have been used for the purpose of excluding the air from the lead to prevent oxidation. I therefore disclaim each of said uses or operations in the modes in which they have been heretofore applied; but I secure a less wasteful use of lead and the ores by treating them at and near the surface as well as beneath it and under the comminuting devices in a deoxidized atmosphere; and I furnish repeated opportunity for the escape of the occluded gases which surround the submerged nodules and cause their cohesion, and by repeated percussion and submergence by the mechanical means I have indicated I effect a more complete disintegration than has been effected by any of the modes heretofore applied; and I eliminate the oxygen from the vessel in which the operations are conducted by introducing a deoxidizing agent, which forms carbonic acid or carbonic oxide under the influence of the heat of such vessel.

What I claim, therefore, as my invention,

and for which I desire that Letters Patent may be granted to me, is—

5 The process of extracting metals having an affinity for lead from their pulverized dust, ores, or grits, which consists in comminuting or disintegrating them in molten lead, and at or near its surface, and in a deoxidized atmos-

phere, in a closed vessel, all substantially as described.

ISAIAH L. ROBERTS.

Witnesses:

WILLARD L. CANDEE,
MARCUS WALKER.