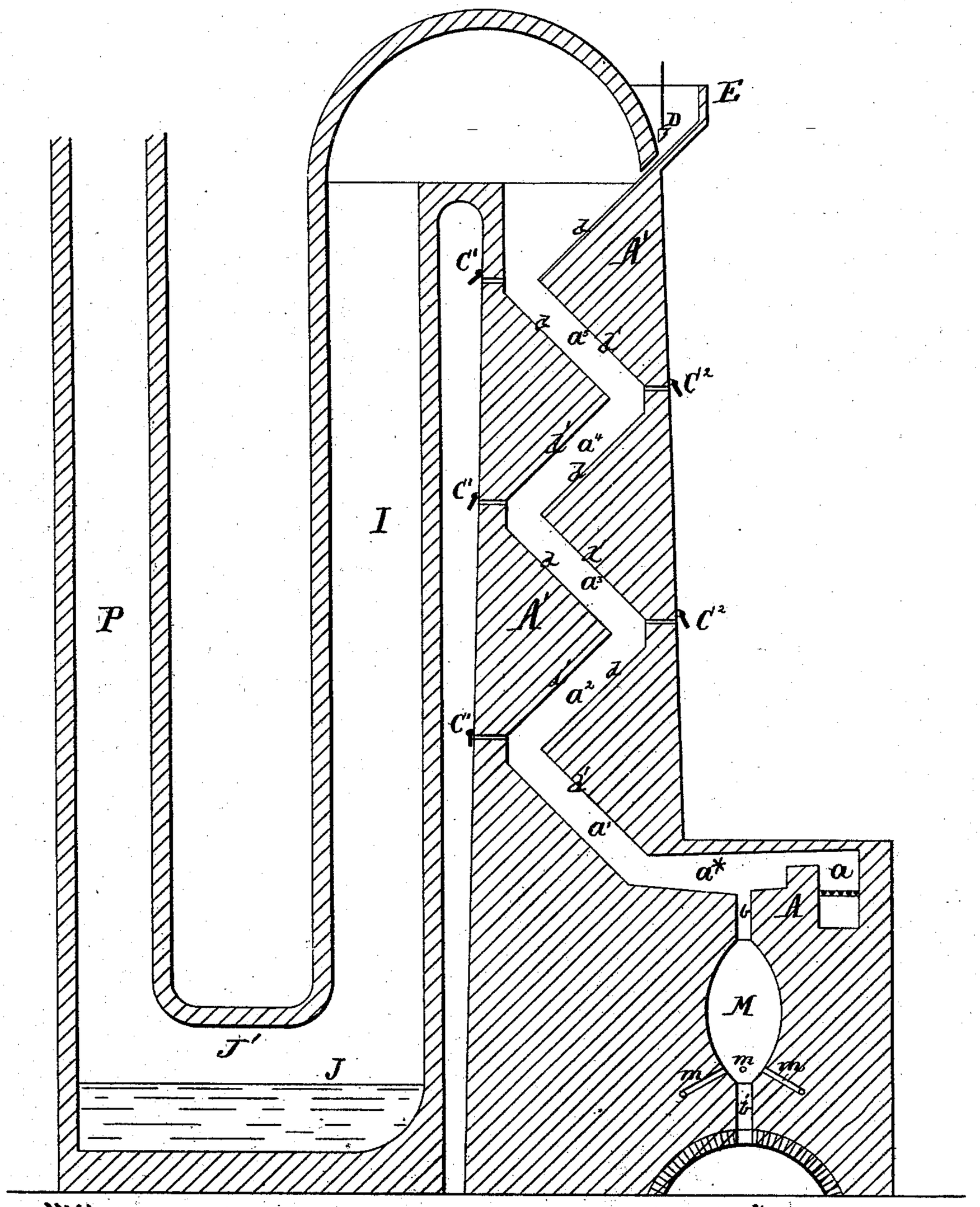
(Model.)

J. H. MORTON.

Furnace for Roasting and Reducing Ores.

No. 232,537. **Patented Sept. 21, 1880.**



Witnesses:
A. Henry Gentner
H. A. Johnstone.

Inventor:
John H. Morton
by his attorney
Thomas D. Stetson

UNITED STATES PATENT OFFICE.

JOHN H. MORTON, OF KEYPORT, NEW JERSEY.

FURNACE FOR ROASTING AND REDUCING ORES.

SPECIFICATION forming part of Letters Patent No. 232,537, dated September 21, 1880.

Application filed March 13, 1880. (Model.)

To all whom it may concern:

Be it known that I, JOHN H. MORTON, of Keyport, Monmouth county, in the State of New Jersey, have invented certain new and useful Improvements relating to Furnaces for Desulphurizing and Reducing Metals, of which the following is a specification.

My improvement is intended more particularly for reducing ores and earths containing gold, silver, and other valuable metals combined with sulphur. I believe it may be used, however, with success in treating base metals, as the several sulphurets of lead and ores of iron and copper.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawing forms a part of this specification, and represents a vertical section through the apparatus.

Referring to the drawing, A represents the masonry of what may be an ordinary reverberatory furnace, and A′ the masonry of a stack therefor. At or near the top of the stack provision is made for allowing the introduction of finely-crushed ore through a controlling-valve, D. Any ordinary means (not represented) may be provided for elevating the material and supplying it as required to the hopper E. The stack is peculiarly formed, having great breadth and containing a series of inclined reverberatory hearths. Care must be taken that the inclinations of the several hearths be sufficiently great to allow the material to flow slowly down toward the lower end of the hearth, where it descends to the next hearth. Opposite the lower end of each hearth an opening is made in the stack the full width of the hearth, controlled by a door or damper.

The whole or any part of the apparatus may be inclosed within a suitable roof. The fire-doors, grate, &c., with other various doors and appurtenances, may be of the ordinary construction.

The gases after passing through the inclined hearths or passages are conducted downward from the top of the stack A′, and after passing a greater or less distance over a water-surface, which will absorb the dust and a portion of the gases, they may rise again either by their own levity or aided by a fan or other ordinary device driven by an engine. (Not represented.) The down passsage for the gases is indicated by I, and the water-surface by J. The gases will ultimately be discharged through a flue, P, which may be of any height required.

To operate the device, the attendant opens and closes the valves C′ C², &c., as he finds by theory and practice shall be most expedient, according to the character of the ores or mixtures of ores which are treated.

The current of air drawn into the stack by suction at any one of the valves C′ C² by the draft of the chimney strikes upon the upper face of the reverberatory hearth opposite the valve, whence it is deflected upward through the ore.

The hearths have upper and lower faces, *d d′*, arranged in the form of a triangle, to prevent the loss of heat by keeping the flame constantly in direct contact with the descending ore, and also to prevent the formation of eddies in the air-current, which would be formed when straight inclined projecting pieces are arranged in the stack, which have heretofore been used.

The theory is to supply the ores in a comminuted condition, adapted to be quickly acted on, and to cause the granulated or fine particles to roll and otherwise tumble, so as to be presented in a great variety of positions. The current of hot products of combustion containing sulphurous gases is met at each turn of the flue by a fresh current of air, causing an immediate combustion of all the sulphurous vapors, thereby generating an intense heat. Further effects of such air-currents are to deflect the current of flame downward upon the floor of the opposite hearth and to aid in the oxidation of the ores. In other words, after the ore has passed its controlling-valve D and entered the series of reverberatory hearths it is subjected to a desulphurizing and oxidizing current of ascending flame. It is exposed to this current on a succession of highly-heated inclined surfaces, and under conditions of agitation of tumbling which is highly favorable to the complete burning out of the sulphur and the oxidation of the metal.

By effecting the desulphurization and the oxidation in combination with the reverberatory furnace *a**, below, I greatly economize the

heat and reduce the labor. No fuel is required on the inclined hearths a' a^2, &c., only the gases which are relatively waste from the reverberatory furnace a^*. The high temperature attained by the ore in the process of roasting is not diffused and lost, but is made a preparatory heating, to be immediately succeeded by the more intense heating in the chamber M.

M is a chamber lying below the hearth of the reverberatory furnace a^*, and communicating therewith by a narrow but sufficient passage to allow all the material which comes down through the tortuous desulphurizing-passages to be discharged into the chamber M at a high temperature.

The object of the chamber M and its connections is to deoxidize or chloridize the ores.

For the purpose of deoxidizing I provide a liberal supply of water-gas, produced either by carrying steam through a mass of red-hot charcoal or coke or coal. This gas is supplied at a high temperature through the passages *m* around the base of the chamber M.

The water-gas or hydrogen is presented at a high temperature to the ore in the absence of oxygen, except such oxygen as may be contained in the ore. The effect is to very thoroughly exhaust the previously finely-broken and desulphurized ore of its oxygen. The greater part of the oxygen is removed in the upper part of the chamber M, where, by its union with the hydrogen, it still further intensifies the heat. Whatever oxygen may remain in the ore meets in its descent a current of carbonic oxide or hydrogen under the most favorable conditions for union with the hydrogen or carbonic oxide.

In the operation care must be taken to guard the bottom opening, b', and all the passages to the chamber M against the access of air. To avoid this the deoxidized material may be discharged into any suitable car or water-tank.

I propose in some cases to introduce chlorine gas. Chlorine presented under these conditions, will, I believe, be peculiarly useful in chloridizing ores of silver and perhaps other ores, and purifying them from sulphur, phosphorus, arsenic, and other impurities. Ores or earth containing silver and gold may be simply desulphurized and passed down into the lower chamber, where a stream of chlorine gas is allowed to act upon the ores as long as may be found necessary. The ores are then passed out in separate charges.

I am aware that a series of reverberatory hearths forming a tortuous passage for ore, terminating at its lower end in a reverberatory passage leading to a cupola below, connected near its lower end with a fire-box, has heretofore been employed, and I therefore lay no claim, broadly, to such invention.

I claim as my invention—

The series of inclined reverberatory hearths a' a^2, forming a tortuous flue, in combination with the adjustable air-valves C' C^2, reverberatory furnace a^*, with its fire-box *a*, and the deoxidizing-chamber M, below said reverberatory furnace, with throat opening into the hearth thereof, and provided with gas blast-pipes *m*, as herein specified.

In testimony whereof I have hereunto set my name in presence of two subscribing witnesses.

JOHN H. MORTON.

Witnesses:

THOMAS D. STETSON,

H. A. JOHNSTONE.