J. Y. SMITH.

FURNACE FOR DRYING, SMELTING, AND DEOXIDIZING ORE.

No. 109,355. Patented Nov. 15, 1870.

Fig. 1

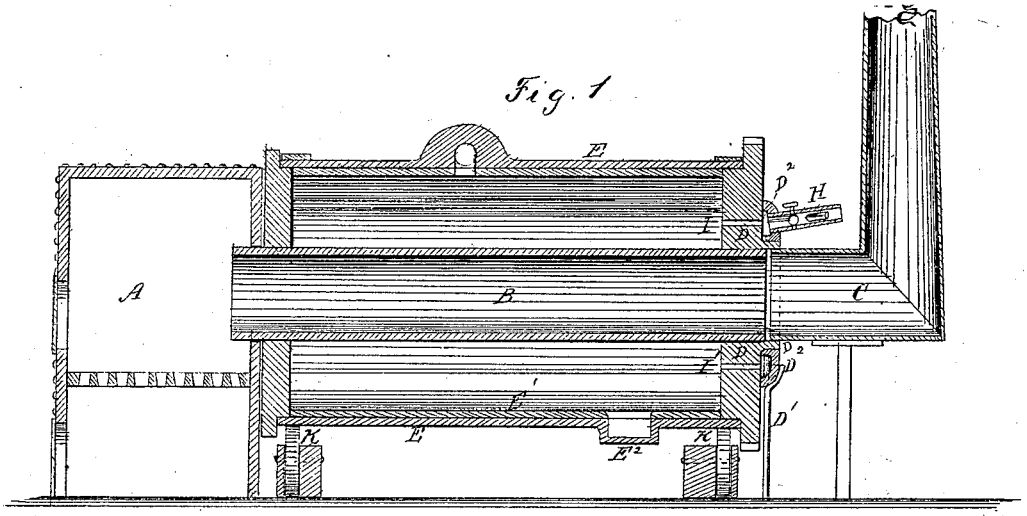


Fig. 2.

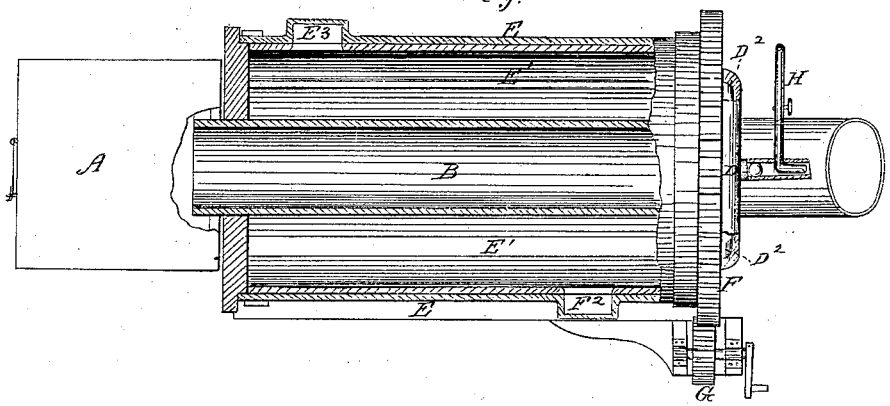
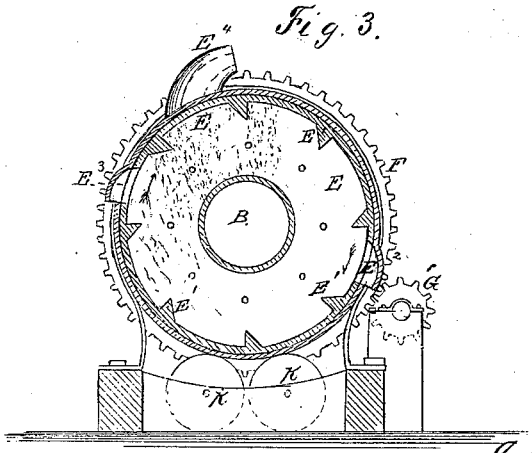


Fig. 3.



Witnesses

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JOHN Y. SMITH, OF PITTSBURG, PENNSYLVANIA.

Letters Patent No. 109,355, dated November 15, 1870.

IMPROVEMENT IN FURNACES AND PROCESSES FOR TREATING IRON AND OTHER ORES.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN Y. SMITH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain Improvements in Furnaces for Drying, Smelting, and Deoxidizing Ores; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawing making part of this specification, in which—

Figure 1 is a vertical longitudinal section.

Figure 2 is a plan view, partly in section, on a horizontal plane.

Figure 3 is a transverse vertical section.

My improvement relates to a revolving furnace for treating ores in various metallurgic operations, such as drying, smelting, desulphurization, deoxidation, &c., in which the ores may be subjected to the action of heat without being exposed to atmospheric influences, nor to the gaseous products of combustion.

In the annexed drawing—

A indicates a furnace in which the heat is generated by any suitable fuel, the draught and generated heat passing forward through the tubular tile B, which is made of fire-clay, the materials from which crucibles are constructed, or other suitable refractory material, having the requisite strength, and, at the same time, being thin enough to allow transmission of heat through the same.

The up-take C connects with the end of the tile B being attached to the collar D which surrounds the end of the said tile. The tile B revolves with the cylinder, but the collar D is stationary, and supported upon a standard, D^1. It is constructed with an annular chamber, D^2, formed in it between it and the head of the cylinder, for a purpose to be hereinafter explained.

E is the cylinder, which is intended to contain the ore. It is supported upon friction-wheels K K, and has a spur-gearing on its periphery, as shown at F, geared into the pinion G, which derives motion from any suitable power. It is, however, apparent that many other devices may be adopted for communicating a rotary motion to the cylinder E, and it may be suspended upon bearings other than the wheels K, if preferred.

The cylinder is closed at the ends by heads, which are cast-iron, and lined by suitable refractory materials, such as are now used in analogous cases. The periphery of the cylinder is formed by slabs of cast-iron firmly joined and bolted together, and lined with a similar refractory material.

On the inner face and extending longitudinally, I propose also to construct ribs E^1, to carry up particles of ore with the revolution of the cylinder, and discharge them through the heated chamber and against the surface of the highly-heated tile B. For using the cylinder in drying ores, I propose to construct inclined openings at E^2 E^3, the mouths projecting beyond the surface of the cylinder, and so arranged that the pulverized ore, being placed in a receptacle below the cylinder, will be taken up by one of these openings as the cylinder revolves and discharges, after passing through the cylinder from the other.

Another opening, at E^4, is intended for charging the cylinder with ore. It should be closed by a door or cap.

I I are openings through the head of the cylinder, through which gases evolved by the action of heat upon the ores, may be drawn off into the annular chamber D^2 formed in the collar D, and thence into the uptake.

The steam-jet H is designed to produce a vacuum in the pipe connecting the up-take with the chamber D^2, the action of the steam-draught being regulated in the ordinary manner by a stop-cock.

The process of treating ores used in connection with this apparatus is as follows:

The ore, in regular charges, is introduced into the revolving cylinder E, and the openings closed. The heat applied to the tile B raises the temperature of the chamber to whatever may be necessary for deoxidizing, desulphurizing, or smelting the ore. As the products of combustion do not mingle with the ores within the cylinder, they may be manipulated at will without the intervention of foreign and injurious influences. The ores may be mingled with such fluxes or other materials as may be of service in working such chemical changes as may be desired, and for their carbonization to whatever degree may be required for producing that quality of iron or steel which may be desired. The force of the steam-jet H acting upon the gases and air contained in the cylinder, may be made to produce so nearly a vacuum that no chemical effects impairing the quality of the product will be produced by agencies operating independently of the will of the operator.

In producing a metallic sponge within the chamber, I propose to inject pulverized glass or other equivalent material, for the purpose of coating the surface of the particles forming the sponge with a vitreous and air-proof coating whenever the sponge has reached such a condition that further changes in its quantities of oxygen, carbon, or other ingredients is not desired. When the metallic sponge has been thus protected, it may be removed to an open hearth, and treated in a reverberatory furnace without injurious effect from the flame, though I prefer in such case to construct a guard over the bridge wall, to protect, measurably, the sponge on the hearth from direct contact with the gaseous products of combustion.

It is apparent that the furnace herein described may be readily adapted for use in the desulphurization of the ores of precious metals. The operation being carried on in a partial vacuum, and the gases immediately drawn away by the suction caused by the steam-jet, it is evident that favorable results may be produced, and the operation be economically conducted, as there need be no loss from the evaporation and carrying off of any portion of the precious metal.

I am aware that revolving puddling-furnaces have been heretofore used in which the flame was discharged into and through the revolving furnace, and I have myself patented a furnace in which the ores might be treated without coming in contact with the gaseous products of combustion. I do not therefore claim, broadly, either of these features; but my invention is distinguished from all others in this, that I employ a revolving furnace, so constructed that the ores are not allowed to come in contact with the gaseous products of combustion.

I am also aware that glass and its constituents have been used for coating the particles of ore, but my process is distinguished from this, that I first treat the ores in a furnace where they do not come in contact with the products of combustion, and when brought to the proper stage I protect the particles against further chemical change by injecting glass or other equivalent material into the furnace to coat the metallic sponge, and then withdraw it from the furnace, and treat it in a reverberatory furnace.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A revolving furnace, E, through which the heat is conducted through the tubular tile B, so that the ores when under treatment are not subjected to the action of the gaseous products of combustion.

2. A revolving furnace, E, constructed with a tubular tile, B, chamber, D^2, and steam-jet in pipe H, substantially as and for the purpose set forth.

3. The revolving furnace E, when constructed with openings E^2 E^3, arranged to operate substantially as and for the purpose set forth.

4. The arrangement of the furnace A, revolving furnace E, with tubular tile B and up-take C in relation to one another, substantially as set forth.

5. The process for preparing and treating metallic sponge by subjecting the ore to treatment for decarbonization, desulphurization, or deoxidation in a close furnace without being brought into contact with the gaseous products of combustion, and then protecting it from further change by coating it with a vitreous material injected into the said furnace, and the subsequent removal and reduction of the metallic sponge so formed in a reverberatory furnace, substantially in the manner set forth.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN Y. SMITH.

Witnesses:
R. MASON,
B. EDW. J. EILS.