

# United States Patent Office.

JOHN Y. SMITH, OF PITTSBURG, PENNSYLVANIA.

Letters Patent No. 104,220, dated June 14, 1870; antedated June 3, 1870.

## IMPROVED PROCESS FOR PURIFYING AND REDUCING MAGNETIC ORES OF IRON.

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 an Improved Process for Reducing the Pulverized Magnetic Ores of Iron in the manufacture of cast-iron, wrought iron, and steel.

The following description will enable persons skilled in the art to reduce my improved process to practice.

What are known as sand ores of iron are found in large quantities in various localities, and their use for conversion has been impossible in ordinary blast furnaces, (except in small quantities,) while in their native state, both by reason of the difficulty of removing foreign impurities with which they are mingled, and by reason of the lightness of the particles, which causes them to be carried away by the force of the blast, or burned by the intensity of the heat.

To obviate these difficulties, they have sometimes been concreted into blocks or lumps, and then subjected to treatment. But this concretion into masses is expensive, and subject also to the further expense of reducing masses so agglomerated that the heat has not ready access to the particles.

These ores are commonly black oxide of iron, and highly magnetic, and, as found in the beds in which they are deposited, are mingled with sand or other impurities, which require to be removed.

Other magnetic ores may be used, which are reduced to a powdered or granulated state, or non-magnetic ores, by familiar processes, may be converted into magnetic ores, and powdered or reduced to a granular form.

It is apparent that any ores in this condition may be used as well as native sand ores.

This part of the process I propose to accomplish by means of magnets, which, acting upon the magnetic particles, hold them while a blast of air or stream of water removes the foreign matter upon which the magnetic force does not act.

A machine for that purpose is fully set forth in the specification and drawings in another application filed herewith, to which reference is herein made, and which need not be fully set forth herein.

Other machines, for the same purpose, employing magnets differently arranged, have been patented in this country and in England.

Among others I will refer to the American patent to François A. H. La Rue and Chas. E. Panet, dated January 26, 1869, and the English patent to Chas. A. B. Chenot, or 1854, numbered 658, as more or less perfectly performing the purpose desired, viz: The separation of the particles of iron ore from the foreign substances mingled therewith.

In this patent I do not desire to confine my claims to the use of any particular machine for the purpose

of separation, but include the use of particles of magnetic iron ore separated by any known magnetic machine.

The second part of my process relates to the reduction of the ores thus obtained.

To avoid the difficulties already stated as attending the treatment of such ores in ordinary furnaces, I use a crucible furnace, in which the ore may be reduced by the action of heat applied to the exterior surface of the crucible, and transmitted through the crucible to the ore placed within the same. By this means the particles of ore are not exposed to the current of the blast, and the heat may be so regulated as not to burn them.

I have shown in another specification, herewith filed, a crucible furnace especially adapted to this use, and to that specification and the accompanying drawings I herein make reference for a more full understanding thereof.

I do not, however, propose to confine myself in this patent to the use of any particular furnace, claiming my process wherever a crucible is used, in a furnace, for the reduction of magnetic ores, reduced to sand-like particles, and separated from foreign substances by the use of magnets.

I, however, regard the furnace invented by myself, as set forth in said specification, as being the best known mode of reducing said granulated ores, because in that furnace I provide for the proper "medication" of the ores by mixing them with such known substances as are employed by persons skilled in the art of manufacturing iron and steel, for their proper fluxing, and the carbonization thereof to the extent necessary for producing iron or steel of a certain required property.

This part of the process is carried on in retorts placed across the chamber, through which the waste heat ascends in its passage from the combustion-chamber to the stack; and the ores thus prepared are then to be passed from the retorts to the crucible through an air-chamber above the crucible, into which the gaseous products of combustion cannot enter, so that the entire process of treating and smelting the ore is conducted without contact with said gaseous products, whereby I am able to accomplish definite results, as no uncertain quantities need enter into the operation to disturb the result. In this furnace the molten metal and slag are drawn from the crucible by tapping the same in the same manner as in ordinary cupola furnaces.

Having fully explained my improved process for reducing pulverized magnetic ores of iron,

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

1. The process for reducing such ores by first sep-

arating the magnetic ores from foreign impurities, by the action of a magnetic-machine, and subsequently smelting said ores so separated in a crucible-furnace, substantially as set forth.

2. Such a process consisting in first separating the magnetic ores from foreign substances by the action of a magnetic-machine, and afterward treating said ores in a furnace, in which they may be medicated, roasted, and reduced, without coming into contact with

the gaseous products of combustion evolved in heating the furnace, substantially as set forth.

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

JOHN Y. SMITH.

Witnesses:

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