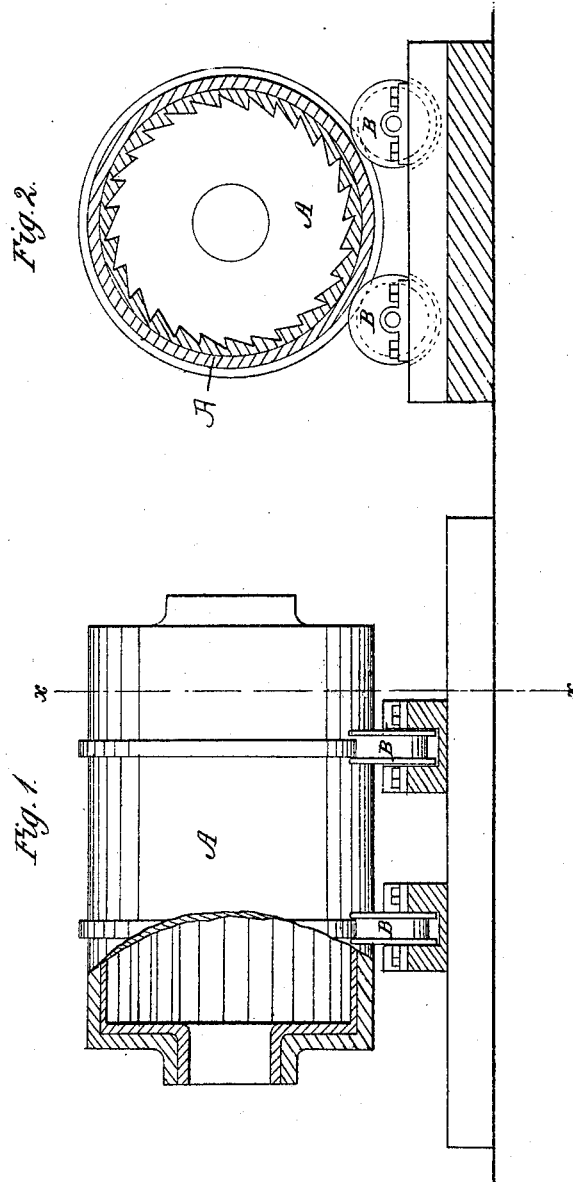


J. F. ALLEN.  
REFINING IRON, REDUCING ORES, &c.

No. 112,003.

Patented Feb. 21, 1871.



Witnesses  
*A. W. Almqvist*  
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per *Mumford* atty

# UNITED STATES PATENT OFFICE.

JOHN F. ALLEN, OF TREMONT, NEW YORK.

## IMPROVEMENT IN REFINING IRON, REDUCING ORES, &c.

Specification forming part of Letters Patent No. **112,003**, dated February 21, 1871.

*To all whom it may concern:*

Be it known that I, JOHN F. ALLEN, of Tremont, in the county of Westchester and State of New York, have invented a new and useful Improvement in Refining Iron, Reducing Ores, &c.; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had, to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side view, partly in section, of an apparatus by means of which my invention is carried into practical effect. Fig. 2 is a vertical cross-section of the same.

Similar letters of reference indicate corresponding parts.

My invention has for its object to improve and extend the process described in Letters Patent No. 76,581, issued to me April 14, 1868, so as to make it more effective in operation and more extended in scope, enabling it to be applied to the reduction of ores; and it consists in passing the molten iron in the form of a shower or spray through pulverized alkaline earths or oxides of iron, whether with or without the addition of pulverized char or anthracite coal, as hereinafter more fully described.

A is a cylinder lined with fire-brick or other suitable material, and revolved or rocked upon its axis and supported by wheels or rollers B, placed beneath it, or by bearings in which its hollow journals revolve. The interior surface of the cylinder A has cavities or corrugations formed upon it, as shown.

In carrying my invention into practical effect a quantity of molten carburet of iron or cast-iron is introduced into the cylinder A, and while the machine is in motion pulverized alkaline earths or oxides of iron are thrown upon the surface of the mass of molten iron in the lower part of the cylinder A. As the cylinder is revolved the molten metal will be carried up by and with the ascending side of said cylinder, and will fall down in a shower or spray upon and through the pulverized material floating upon the mass of molten metal, and through the gases in the upper part of

said cylinder developed from the said material. At the same time the pulverized material will be carried down by the descending side of the cylinder beneath the surface of the molten metal, and, escaping from the cavities in said cylinder, will rise through said molten metal, thus causing a thorough intermingling of the molten metal and the pulverized material with each other.

When it is desired to produce malleable iron or semi-steel for the rolls, enough molten metal is run into the machine to fill the cylinder A part way to the central opening. The machine is set in motion, and one of the end openings is connected with the chimney or other draft-flue for the purpose of conducting away the waste gases. Through the other end opening pulverized earths or oxides of iron are introduced to float upon the surface of the molten iron. As the molten metal and the pulverized material become intermingled in the manner hereinbefore described, the oxygen of the material is liberated, combines with the carbon of the molten iron, and is carried off in the form of carbonic-acid gas, leaving the iron of the oxide and the molten iron in a malleable state by the combustion of the carbon from the said molten iron.

When the reduction of ores into carburet of iron, cast-steel, or high steel is desired, the cylinder A is filled with molten metal nearly to its central openings, and as it is revolved or rocked pulverized peroxide of iron mixed with pulverized carbon—such as charcoal or anthracite coal—is introduced upon the surface of the molten metal, and as the operation is continued, and as the shower or spray of molten metal falls upon and becomes intermingled with the pulverized materials, the oxygen from the ore reacts upon the carbon, causing a most vivid combustion, by which the temperature of the molten metal is maintained, and as the quantity is increased the metal is allowed, after the slag which floats upon its surface has been removed, to flow off at the end of the machine into suitable molds. In this way the reduction of the ore may be made continuous, the quantity of fuel required will be much less than when the ore is re-

duced in a cupola-furnace, and at the same time a superior quality of metal will be produced.

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

Passing molten metal in the form of a shower or spray through pulverized alkaline earths or oxides of iron, either with or without the admixture of pulverized carbon, such as charcoal

or anthracite coal, substantially as herein shown and described, and for the purpose set forth.

The above specification of my invention signed by me this 16th day of September, 1869.

JOHN F. ALLEN.

Witnesses:

GEO. W. MABEE,

JAMES T. GRAHAM.