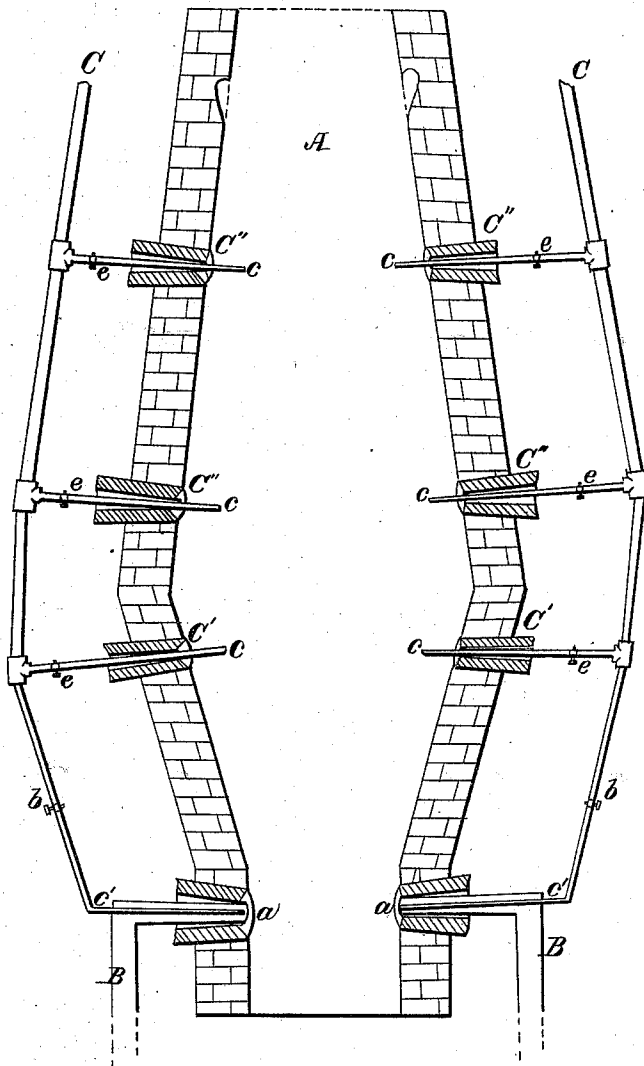


A. HAMAR.
Blast Furnace.

No. 81,775.

Patented Sept. 1, 1868.



Witnesses
Jos. S. Peyton,
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ALEXANDER HAMAR, OF NEW YORK, N. Y.

Letters Patent No. 81,775, dated September 1, 1868.

IMPROVEMENT IN MAKING 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, ALEXANDER HAMAR, of the city, county, and State of New York, have invented a new and useful Process for Making Iron, of which the following is a full, clear, and exact description.

It is the object of my invention to make iron suitable for conversion into steel by the use of anthracite coal as fuel and hot air as blast.

This has been attempted before, but has, so far as I am advised, been unsuccessful, owing to the difficulties of removing the impurities of the iron, which difficulty my process obviates.

The improvements herein claimed consist—

First, in a novel method of introducing jets of steam, superheated steam, or hydrogen into the boshes and stack of a blast-furnace, at different heights above the ordinary blast-tuyeres, whereby a continuous supply of fresh hydrogen is imparted to the charge in its descent.

Second, in a novel method of extending the pipes which supply the jets of hydrogen into the furnace beyond its lining.

In the accompanying drawing, which makes part of this specification, I have shown a vertical central section through a blast-furnace, to which my improvements are applied.

The furnace, A, may be of any well-known form and construction. The hot-air blast is introduced into the furnace through the blast-pipes B and tuyeres *a*. Steam, superheated steam, or hydrogen may be introduced into the furnace with the blast, if desired, through pipes *c'*, provided with suitable regulating-valves or stop-cocks *b*.

Steam, superheated steam, or hydrogen is supplied from a suitable generator, and conducted around the furnace by pipes C, from which it is led into the stack and boshes by branch-pipes *c*, provided with suitable regulating-valves, *e*, and with tuyeres C' C'', of approved construction. The pipes *c*, by preference, are made to project into the furnace about eighteen inches beyond its inner wall, in order to inject the hydrogen more effectually into the charge. But the amount of projection may be varied to suit different constructions of furnace. These intruding pipes must of course be made of material refractory enough to resist the heat of the charge.

In the drawings, I have shown three sets of pipes above the ordinary blast-pipe, viz, one in the boshes and two in the stack, but a greater or less number may be used with good effect, according to the quality of the ore and of the fuel being worked, the number being increased for impure ores, and *vice versa*. I prefer, however, to put in three or four sets of tuyeres, and to use as many of them as may be expedient. The jets of steam or hydrogen might be introduced directly through apertures in the wall, without the use of tuyeres, with good effect, but I prefer to use tuyeres, as they protect the walls from injury.

The furnace is fed in the usual way, by adding successive charges of ore and fuel at the top of the furnace, which gradually descends as the portions below are melted. In ordinary furnaces all the blast enters below the boshes, consequently by the time it encounters the fresh charge near the top of the stack it has become so mingled with the products of combustion as to have little effect upon the fresh charge, beyond heating it.

In my process, on the contrary, when the charge descends to the upper set of tuyeres, fresh jets of steam, superheated steam, or hydrogen are thrown in through the pipes *c*, which partially desulphurize the ores and fuel, which are partially reduced before encountering the next jet, which removes still more of their impurities, and this process is repeated at each set of tuyeres, until the iron is almost entirely purified.

By preference, I employ nearly pure hydrogen, but, with some ore, steam or superheated steam, when applied periodically, will produce beneficial results.

It is obvious that my furnace would work successfully with other kinds of coal than anthracite.

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

1. The method, herein described, of introducing steam, superheated steam, or hydrogen into the boshes of a blast-furnace above the ordinary blast-tuyeres, for the purpose set forth.

2. The method, herein described, of introducing steam, superheated steam, or hydrogen into the stack of a blast-furnace, for the purpose set forth.

3. The method, herein described, of producing iron, suitable for conversion into steel, by the use of anthracite and a hot blast, in combination with the introduction of hydrogen or superheated steam into the furnace at different elevations.

4. The combination, substantially as set forth, with a blast-furnace, of tuyeres, arranged at different levels in the boshes and stack, for the purpose set forth.

5. The combination, substantially as set forth, with the furnace, of the jet-pipes intruding into the interior of the boshes and stack, as and for the purpose set forth.

In testimony whereof, I have hereunto subscribed my name.

A. HAMAR.

Witnesses:

TH. PRATT POTTS,

Jos. I. PEYTON.