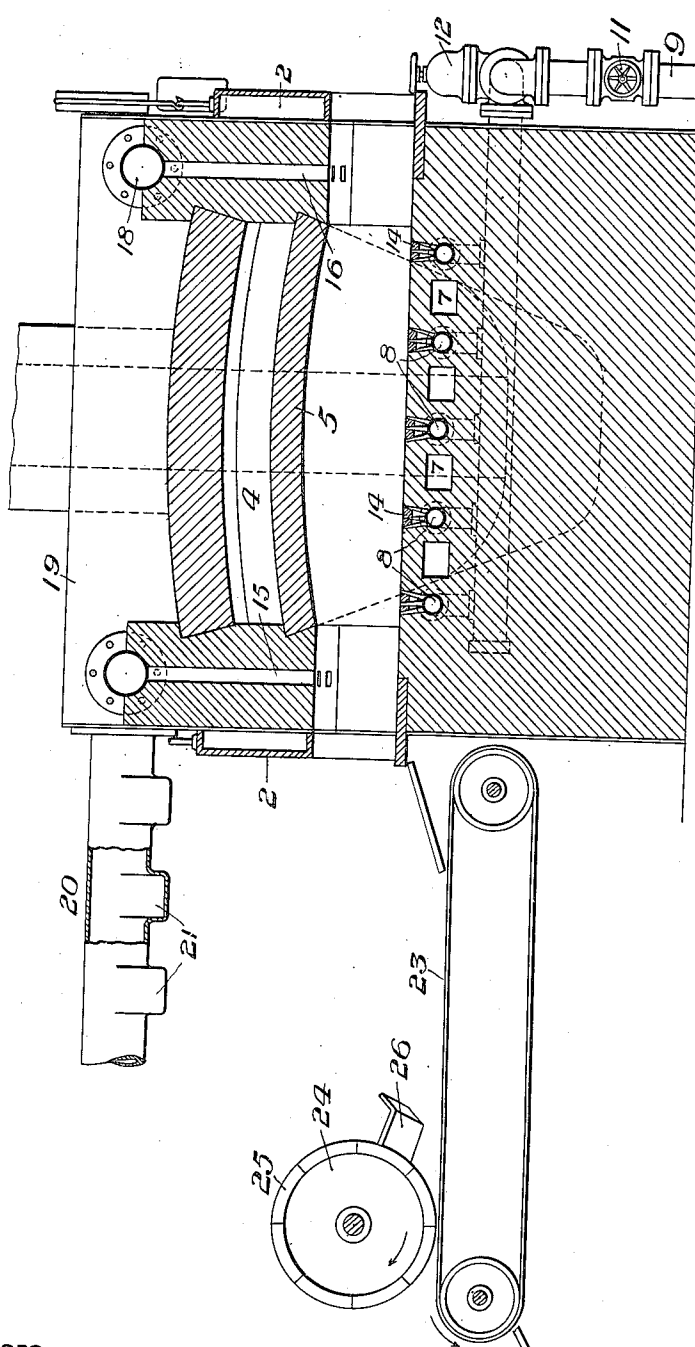


E. KERR.
TREATING ORES.
APPLICATION FILED FEB. 8, 1912.

1,032,007.

Patented July 9, 1912.



WITNESSES

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TREATING ORES.

1,032,007.

Specification of Letters Patent.

Patented July 9, 1912.

Application filed February 8, 1912. Serial No. 676,469.

To all whom it may concern:

Be it known that I, EDWARD KERR, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Treating Ores, of which improvements the following is a specification.

The invention described herein relates to certain improvements in the reduction of metalliferous ores and more particularly to the production of steel and iron direct from iron ore.

The invention is hereinafter more fully described and claimed.

In the accompanying drawing, forming a part of this specification, is shown a sectional elevation of a reducing furnace and also a mechanical separator adapted for use in the practice of my invention.

In the practice of my invention, I prefer to employ in carrying out a portion of my method a furnace substantially similar to that shown and described in application Ser. No. 676,468 filed by me February 8th, 1912.

The ore whether containing iron or other metals to be treated is charged into the chamber or muffle, the depth of the charge being dependent on the degree of fineness of the ore, *i. e.*, whether it is in the form of lumps or a fine powder. As stated in the application referred to, the muffle is externally heated by products of combustion passing through the flues 4 and 7. After the ore has been charged, the doors 2 are sealed by luting or in any other suitable manner adapted to prevent the escape of gases from the muffle.

The charge is first uniformly heated to a suitable temperature which will vary somewhat with the nature of the ore being treated. In experiments which have been made the best results have been attained at temperatures varying from five to seven hundred degrees Fahrenheit, especially when treating iron ores. It is probable however that in treating some ores a temperature as low as four hundred degrees Fahrenheit will give good results while other and more refractory ores a temperature higher than seven hundred *e. g.* about eight or nine hundred degrees Fahrenheit may be required. It is believed however that a temperature ranging from about five hundred and fifty to six hundred degrees Fahrenheit will give very good results in nearly all cases. After

the charge has become uniformly heated, steam, preferably superheated, and highly heated air are forced alternately into the charge, so as to come into intimate contact with all parts.

The order of introduction of the air and steam may be varied, it being preferred to subject ore high in phosphorus to the action first of air and then of steam, both of which are preferably heated to about the temperature of the ore.

A convenient means of forcing the steam and air through the ore consists of a series of comparatively large tubes 8 arranged in the bottom of the muffle the flues 7 preferably alternating with the tubes 8, so that the steam and air will be heated while flowing through the tubes. If preferred, any other suitable means known in the art may be employed for heating the steam and air.

The tubes 8 are provided with a number of nozzles 13 whereby the steam and air are directed through openings in the bottom of the muffle into the charge. The tubes 8 are connected to pipes 9 and 10 leading to suitable sources of supply and provided with controlling valves 11 and 12. The gases formed or generated escape through flues 15 and 16 and pipes 17 and 18 into the shell 19, from which they flow through the passages 20, in which they may be condensed and treated. As shown, the passage is provided with pockets or rooms 21 into which the condensed portions will be deposited according to their specific gravities and relative condensability.

By the alternating action of the steam and air on the heated ores, the latter are reduced to a fine powdery condition, and the vaporizable constituents will be segregated and pass out of the muffle through the flues 15 and 16.

The treated charge is removed from the muffle and the metallic elements are mechanically separated by any suitable means from the non-metallic portions of the treated charge. A convenient means for effecting such mechanical separation when treating ores naturally magnetic or which are rendered magnetic by the treatment described consists of any suitable construction of magnetic separator diagrammatically indicated. The charge from the muffle is placed on a traveling belt 23 by which the charge is carried under a revolving drum 24, provided with magnets 25, which may be permanent

or electric. When permanent magnets are employed, the metallic particles adhering thereto will be removed by a suitable scraper and in the case of the electro-magnets the current will be interrupted at a certain point in the rotation of the drum, thus permitting the adhering metal to drop off into the chute or trough 26. When thus separated from the solid foreign matter, the metal is in a finely divided state and is melted preferably in a closed crucible to prevent loss of the finely divided material while bringing it into a commercial form. In treating finely divided iron, pulverized carbon and other ingredients or elements desired in the finished material are mingled with the iron in suitable proportions, with a suitable binder as molasses, etc., and pressed into blocks which are then melted in a crucible or furnace.

It will be understood that to prevent loss of the finely divided material when treating other metals than iron they may be briqueted and melted in any suitable furnace, or melted in a closed crucible without briqueting as before stated.

I claim herein as my invention:

1. The method herein described which

consists in heating ore to not less than four hundred degrees Fahrenheit, and then forcing heated steam and air alternately into contact with the heated charge.

2. The method herein described which consists in heating ore, and then forcing heated steam and air in the order mentioned into contact with the heated charge.

3. The method herein described which consists in heating ore, forcing heated steam and air alternately into contact with the heated charge and mechanically separating the metal portion of the charge from other solid elements thereof.

4. The method herein described which consists in heating iron ore, forcing heated steam and air alternately into contact with the heated charge, mechanically separating the reduced iron from other solid ingredients, mixing the metal with carbon, and melting the same.

In testimony whereof, I have hereunto set my hand.

EDWARD KERR.

Witnesses:

ALICE A. TRILL,
THOMAS JOYCE.