No. 859,572. PATENTED JULY 9, 1907.

S. McDONALD.

METHOD OF PRODUCING PIG IRON AND STEEL.

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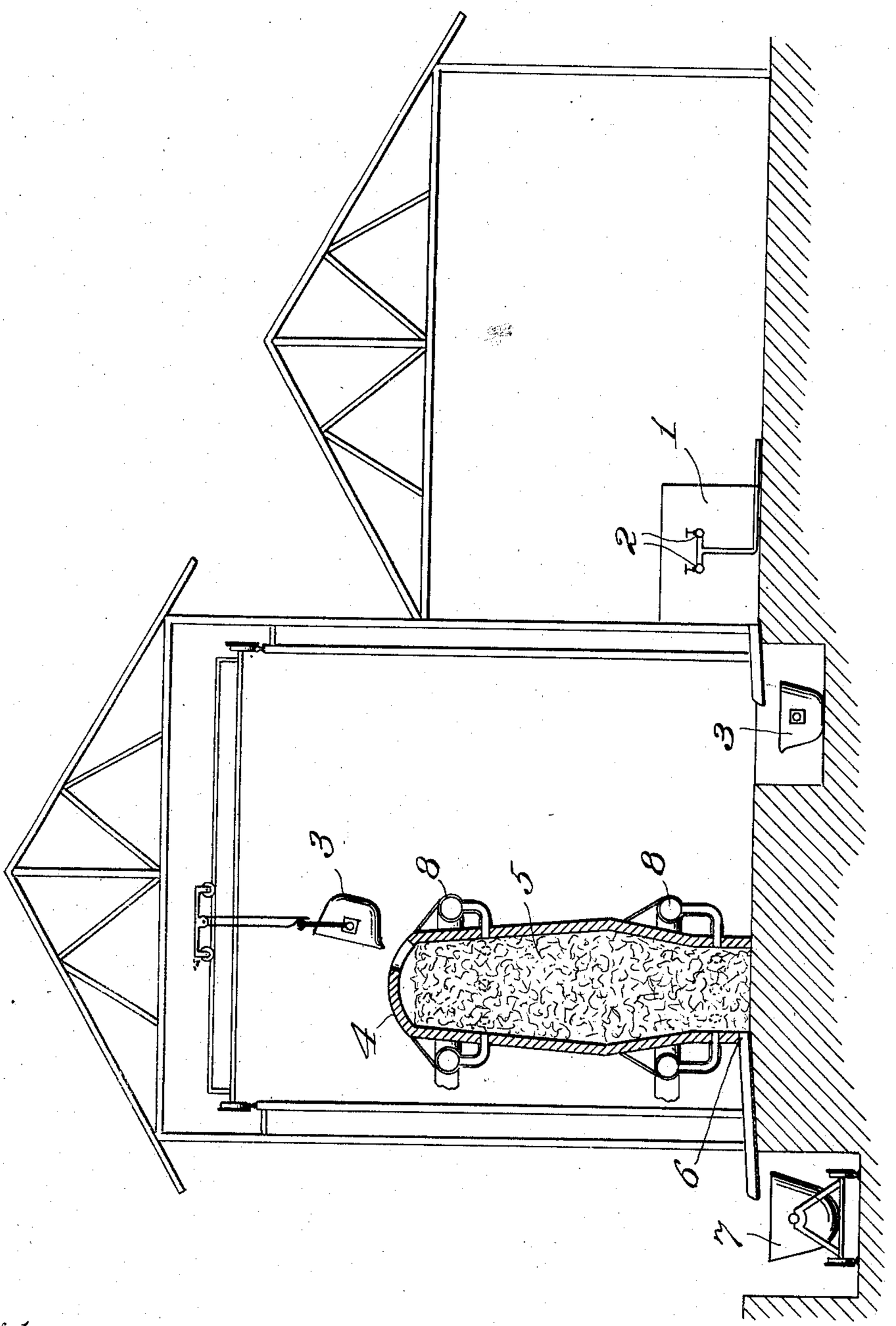

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UNITED STATES PATENT OFFICE.

SAMUEL McDONALD, OF LOS ANGELES, CALIFORNIA.

METHOD OF PRODUCING PIG-IRON AND STEEL.

No. 859,572. Specification of Letters Patent. Patented July 9, 1907.

Application filed March 13, 1906. Serial No. 305,789.

To all whom it may concern:

Be it known that I, SAMUEL McDONALD, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Method of Producing Pig-Iron and Steel, of which the following is a specification.

This invention relates to the treatment of oxid iron ores.

The main object of the invention is to enable one to produce pig iron and steel direct from ore by a minimum consumption of coke or other form of solid carbon. Also to produce a much higher grade of steel than heretofore.

In common blast-furnace practice, the coke usually contains about one per cent of sulfur, and inasmuch as it requires a ton of coke to produce a ton of pig iron, practically from 3 to 5 percent of the sulfur in the coke is taken up by the iron.

An advantage to be gained by my process is the omission of such sulfur from the product, thereby producing a finer quality of steel. With this process, the amount of coke required as compared with that required by former processes, would be about as 1 to 6, a tenth of a ton of coke being sufficient to produce as much steel by this process as a ton of coke would produce by former processes.

One of the advantages of this invention is to produce refined iron from ore by the use of oil or gas in localities where coke or other suitable solid carbon is not readily available or of comparatively high price.

The invention is applicable to reduction of other ores.

I will now describe my newly-invented process, reference being had to the accompanying drawing which illustrates apparatus by means of which the process may be performed.

In the drawing, 1 is a smelting furnace of any suitable character in which the oxid ore will be first fused by means of oil or gas burners 2, and the molten product will be discharged into a ladle 3 of any suitable size and dimensions by which it will be carried to the top of refining furnace 4 filled with coke or any other form of solid carbon which is first ignited and brought to a high state of incandescence, namely to a temperature of 2700° or more Fahrenheit and is kept incandescent at that temperature through out the process.

The molten product from the smelting furnace 1 will be turned into the top of the refining furnace 4 on top of the charge of incandescent solid carbon 5 therein and allowed to percolate down through the mass of such carbon until it reaches the outlet 6 where it will be discharged into any suitable vessel, as the ladle 7.

The incandescence of carbon in the furnace may be initiated by means of fire from an air and gas or liquid fuel blast 8 which may be used again from time to time to maintain such incandescence after it has thus been initiated in case the charges of molten ore may not be passed through the furnace with sufficient frequency thereafter to maintain the incandescence therein; but in ordinary practice, after the mass of coke or hard coal, or other hard carbon in the refining furnace 4, has been brought to a state of incandescence by means of the fire blast the charges of molten ore will be passed through the refining furnace with sufficient frequency to maintain the incandescence without the further use of the air or fuel blast.

The highly heated incandescent solid carbon acts upon the molten ore to deoxidize the same and produce a superior quality of steel or refined iron in case the ore treated is iron ore.

The amount of carbon consumed in the refining furnace for a ton of refined iron or steel will be about one-tenth of that consumed in the ordinary blast furnace process, and therefore the amount of sulfur taken up by the iron will be reduced in the same proportion.

The refining furnace should be of a height sufficient to maintain the melted ore in contact with the incandescent carbon for such a period as may be necessary to completely deoxidize the ore; a depth of forty feet, more or less, for the incandescent charge will be found appropriate under ordinary conditions.

It is to be understood that the furnaces will preferably be lined with basic or acid lining in the usual way of lining furnaces for purpose of durability.

By using a fire from fluid fuel for the preliminary fusing of the ore the introduction of sulfur into the product may be largely avoided and the process of producing the refined product greatly cheapened.

By the method above described it is made possible to pass the iron through a sufficient quantity of carbon to effect the desired result and without any freezing of the molten metal inside the carbon mass.

By providing the incandescent carbon mass and passing the liquid metal through it, the objects aimed at can be secured.

Since the temperature necessary to maintain the steel or iron in a fluid state while it passes through the forty feet more or less of carbonaceous solids, is evidently very great,—namely, from 2700° to 3000° Fahrenheit, in the case of steel,—it is absolutely necessary that the carbon shall be ignited and brought to a state of incandescence before molten material, from which the refined iron and steel or other metal is to be produced, is poured into the refining furnace. When the carbon has been brought to such state of incandescence as to allow the molten material to pass from the top to the bottom, the molten material may be poured in and the same will remain fluid until drawn off at the

outlet 6 in the usual manner of drawing off charges of iron or steel from blast or reverberatory furnaces.

What I claim is:—

The method of producing pig iron or steel from oxid iron ore, which consists in first igniting and bringing to a state of incandescence at a temperature of 2700° or more Fahrenheit a mass of coke or other hard solid carbon, then fusing such ore by means of fire from fluid fuel, then pouring the fused material onto said incandescent mass, and allowing the same to pass through said mass, said temperature of said mass being maintained throughout the process.

In testimony whereof, I have hereunto set my hand at Los Angeles, California this 7th day of March 1906.

SAMUEL McDONALD.

In presence of—

JAMES R. TOWNSEND,

JULIA TOWNSEND.