

# UNITED STATES PATENT OFFICE.

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## METHOD OF MAKING STEEL.

978,905.

Specification of Letters Patent. Patented Dec. 20, 1910.

No Drawing.

Application filed September 1, 1908. Serial No. 451,189.

*To all whom it may concern:*

Be it known that I, HORACE W. LASH, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Methods of Making Steel, of which the following is a full, clear, and exact description.

The object of the present invention is to produce an improved process of making steel.

More particularly my invention is directed to the making of steel in such manner as to utilize cast iron borings or turnings and finely divided oxid of iron.

The invention comprises the use of a smelting charge containing finely divided iron oxid and carbon with cast iron. Other useful material such as suitable fluxes and, preferably, oxid of manganese to the extent of 5 per cent. of the charge may be present. For the purpose of assisting in the smelting of this mixture I separately prepare a metallic iron product high in carbon and manganese and low in silicon, sulfur and phosphorus, which product I add to an amount approximating 40 to 60 per cent. by weight of the total charge, either in solid or molten condition, as convenience may dictate, to the furnace containing the smelting mixture above recited, but it is obviously preferable to add said product in the molten condition to avoid, as much as possible, loss in heat. This added metallic product I preferably make of cast iron borings or turnings, since these materials are cheap and may be treated in a manner which I have described in a pending application Serial No. 451,190, to produce the desired metallic product.

The details of preparing the iron product high in carbon and manganese, from cast iron borings, are not herein claimed, but may be briefly described as follows. These borings are preferably made up into a mixture, of which they constitute, for example, approximately 80 per cent. by weight, together with charcoal or coke dust, say to the amount of 15 per cent., and black oxid of manganese to the amount of about 5 per cent. This mixture having been thoroughly made in a grinding pan and put in proper condition for handling, is charged into a furnace in the usual way with an amount of limestone equaling 10 or 15 per cent. by weight of the total charge mixture. Upon being subjected to heat in the furnace a

product is obtained very high in manganese and in combined carbon with a reduced percentage of sulfur, silicon and phosphorus, each of which latter elements is ordinarily quite high in cast iron turnings or borings. The metallic product being, as stated, high in carbon and manganese, the combined carbon being between 3 and 4 per cent., and the manganese amounting to about 1 per cent. and having perhaps not more than  $\frac{1}{2}$  per cent. silicon, is admirably adapted for use with the above described charge in the smelting furnace. The added metal is both readily fusible and high in reducing agents, and not only serves, by reason of its ready fusion, in bringing the constituent parts of the smelting mixture in intimate contact with each other and in hastening the smelting reactions, but also assists in the reduction of the iron oxid present.

It will be found that the process described has the merit of being a rapid one, and, since the average percentage of silicon, sulfur and phosphorus in the charge is considerably reduced, there will be a corresponding reduction of the amount of slag over the bath, a feature of decided advantage in certain types of furnace. Further, under this process the reactions are kept under control and the process may be made continuous without any substantial addition in the way of expense, resulting in the production of a bath of metal readily refined into a high grade of steel, following the ordinary methods after the bath is obtained.

Having thus described my invention, I claim:—

1. The process which comprises subjecting to a smelting heat a charge mixture comprising finely divided iron oxid and carbon with cast iron together with iron having a high carbon and manganese content.

2. The process which comprises subjecting to a smelting heat a charge mixture of finely divided iron oxid, carbon, cast iron and black oxid of manganese together with an iron product high in carbon and manganese.

3. The process which comprises subjecting to a smelting heat a charge mixture containing iron oxid, carbon, cast iron and black oxid of manganese together with an iron product containing substantially 3 to 4 per cent. of combined carbon and substantially 1 per cent. manganese.



4. The process which comprises subject-  
ing to a smelting heat a charge mixture con-  
taining finely divided iron oxid, cast iron  
and carbon together with iron high in car-  
5 bon and manganese and relatively low in  
silicon.

5. The process which comprises subject-  
ing to a smelting heat a charge mixture com-  
prising finely divided iron oxid, cast iron,  
10 carbon and manganese oxid together with  
iron high in manganese and combined car-  
bon and low in silicon.

6. The process which comprises subject-  
ing to a smelting heat a charge mixture con-  
taining finely divided iron oxid, cast iron  
15 and carbon together with iron high in car-

bon and manganese and relatively low in  
silicon, phosphorus and sulfur.

7. The process which comprises subject-  
ing to a smelting heat a charge mixture 20  
comprising finely divided iron oxid, cast  
iron, carbon and manganese oxid together  
with iron high in manganese and combined  
carbon and low in silicon, phosphorus and  
sulfur. 25

In testimony whereof, I hereunto affix my  
signature in the presence of two witnesses.

HORACE W. LASH.

Witnesses:

J. M. WOODWARD,

H. R. SULLIVAN.