

UNITED STATES PATENT OFFICE.

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INGOT.

940,785.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, ROBERT B. CARNAHAN, Jr., a citizen of the United States, residing at Middletown, Butler county, Ohio, have invented certain new and useful Improvements in Ingots, of which the following is a specification.

It has been found that in substituting for knobbled and puddled iron an iron obtained by treating molten metal, which means the substitution of economical and certain processes for costly and erratic ones, certain sacrifices in the quality of the metal were often involved, that is to say, while one composition of the new metal might be superior to the old metal in some respect, and while some other composition of the new metal might be superior in some other respect, no composition of the new metal has proven itself superior to the old metal and other new metals in all desired respects.

My invention provides an iron having in an exceptionally high degree the quality of malleability, that is to say, the facility with which it may be rolled and forged, and the quality of ductility, and the quality of rolling into sheets free from blisters, and the quality of galvanizing in a superior manner, and the quality of resisting corrosion in the highest degree, and the quality of yielding a particularly smooth surface under the action of rolls, and the quality of working at low heat so as to avoid the scaling of surfaces, these qualities greatly reducing the percentage of waste.

My invention consists of a rolling mill or bloomery ingot characterized by a deoxidized and degasified slagless body crystalline in structure and containing at least 99.80 per cent of iron and containing not over .14 per cent. of sulfur, phosphorus, carbon, manganese and silicon taken in the aggregate, and containing not over .05 per cent. of oxygen, the oxygen to be determined by the method of Ledebur.

The improved ingots may be made by refining a charge of pig-iron or cast iron or molten iron in a basic open-hearth furnace by means of limestone to reduce sulfur and phosphorus, and iron ore or agitation or both to reduce carbon and manganese the refining operation being so prolonged and at

such high heat (from one to four hours more time than is employed in making high grade soft steel, and at an ultimate refining temperature of at least 2850 deg. F.), that by bath test, the bath will contain not over .14 per cent. of sulfur, phosphorus, carbon, manganese and silicon taken in the aggregate. For the best results it is desirable and practicable to reduce this aggregate to less than half the percentage named, and to have neither carbon nor manganese to exceed .02 per cent. The refined metal is to be poured into ingot molds while still at high temperature, and while still molten it is to be deoxidized and degasified to such extent that the resulting product will contain not over .05 per cent. of oxygen as determined by the method of Ledebur, and preferably considerably below this. The deoxidation and degasification may be very satisfactorily accomplished by the employment of aluminum in the molten metal, say two and one-half pounds per ton. If done in the furnace it is recommended that aluminum pig-iron be used. Aluminum may be economized by partially deoxidizing the bath by employing pig-iron, say two to eight per cent. of the charge. The degasifying and deoxidizing agents must, of course, not be such as to lessen the above mentioned purity of the ultimate product. In tapping the metal the slag floats off and the product is thus freed from it.

Among the various methods for oxygen determination that of Ledebur has been chosen on account of its superior reliability and accuracy, and is herein mentioned as a standard in view of the differing results arrived at by various methods.

I claim:—

Improved rolling mill and bloomery ingots characterized by a deoxidized and degasified slagless body crystalline in structure and containing at least 99.80 per cent. of iron, and containing not over .14 per cent. of sulfur, phosphorus, carbon, manganese and silicon taken in the aggregate, and containing not over .05 per cent. of oxygen.

ROBERT B. CARNAHAN, JR.

Witnesses:

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