

UNITED STATES PATENT OFFICE.

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METHOD OF MANUFACTURING MANGANESE STEEL.

SPECIFICATION forming part of Letters Patent No. 585,161, dated June 22, 1897.

Application filed January 9, 1895. Serial No. 534,332. (No specimens.)

To all whom it may concern:

Be it known that I, ROBERT A. HADFIELD, a subject of the Queen of Great Britain, residing at Sheffield, county of York, England, have invented an Improvement in Methods of Manufacturing Manganese Steel, of which the following description is a specification.

Manganese steel has hitherto been generally produced by making a heat of decarburized iron and mixing a quantity of it with a quantity of previously or simultaneously melted ferromanganese which has been weighed in the cold state before fusion. One objection to this method is the uncertainty as to the amount of ferromanganese actually added, for losses are especially liable to occur during the melting of the ferromanganese, owing to its cutting or slagging action upon the surrounding walls or by oxidation, and heats are also liable to vary considerably in weight. It follows, naturally, that no matter how carefully the ferromanganese is weighed when cold there is uncertainty as to how much is actually added when producing the manganese steel, which means liability of a more than desirable variation of both carbon and manganese.

My invention has for its object a method of making manganese steel wherein these objections are obviated, the manganese steel produced in accordance therewith being close to the composition sought, and substantially no waste of material is involved.

In accordance therewith my invention consists in the method of making manganese steel which comprises incorporating a determined weight of steel or decarburized iron with a quantity of ferromanganese weighed in a molten state, substantially as will be described.

Other features of my invention will be hereinafter described, and particularly pointed out in the claims.

Inasmuch as my hereinafter - described method may be carried out with a variety of apparatus, forming no part of my invention, I have not illustrated any apparatus, as the invention is readily understood without it.

In carrying out my invention a heat of ordinary steel is first prepared, usually preferably of mild temper—i. e., low in carbon, as it is usually desirable to keep the percent-

age of carbon to low limits. It is, however, wholly practicable and at times desirable to have a relatively large percentage of carbon in the manganese steel; but if this steel has more than 1.5 per cent. of carbon it will be less ductile and tough. The heat of steel may be made in any convenient manner, such as the Bessemer, open-hearth, basic, or other method, and it may be made either by first more or less completely decarburizing the charge and then making final deoxidizing and preferably slightly-carburizing additions, or by arresting the Bessemer, open-hearth, or other process when the charge has been sufficiently decarburized and purified to yield, without addition, metal of the composition desired for mixing with the ferromanganese. All of the heat, after weighing, or a determined quantity thereof divided out by weight is then incorporated with the necessary quantity by weight of molten eighty-per-cent. or other suitable ferromanganese, according to the percentage required in the product of manganese steel, pouring either material into the other, as may be most convenient, or both together into a third ladle or other vessel, the slag being separated during the pouring.

By my herein - described method exact weights both of ferromanganese and ordinary steel are obtained, resulting in great uniformity in the composition of the manganese steel so produced.

Pouring one of the two molten metals into the other insures thorough admixture, but, if desired, further stirring may be effected, and the product is then ready for pouring into molds for ingots or castings.

As an illustration of actual practice let us suppose that a quantity of eighty-per-cent. ferromanganese, weighing six hundred weights, one quarter, fourteen pounds, is held in a suitable ladle. Into it a weight of thirty-three hundred weights, two quarters, fourteen pounds of ordinary mild steel is poured, giving a total of forty hundred weights of manganese steel containing about thirteen per cent. manganese. It will be obvious that should there be any excess of ordinary steel remaining from the heat it can be used for ingots or castings of ordinary carbon steel in the usual way.

My invention is not restricted to any par-

ticular form of apparatus for carrying out the various steps, nor to any given proportions of ordinary steel and ferromanganese.

5 In speaking of "steel" I include decarburized iron, which, for the present purpose, is the equivalent of steel, and which may be used especially when it is desired that the resultant manganese steel shall have relatively little carbon.

10 In the foregoing specification and in the claims when speaking of "manganese steel" I refer to steel containing from two and one-half per cent. to thirty per cent. of manganese, such as described in United States Pat-
15 ents Nos. 303,150 and 303,151, dated August 5, 1884, and No. 342,868, dated June 1, 1886, granted to me.

I claim—

20 1. The herein-described method of making manganese steel, which consists in decarburizing a portion of iron, recarburizing to a sub-

stantially predetermined amount, and incorporating with a weight of the recarburized iron determined while molten a quantity of ferromanganese weighed after melting, sub- 25
stantially as described.

2. The herein-described method of making manganese steel, which consists in preparing a heat of steel, dividing out and weighing a portion thereof and casting the remainder as 30
carbon steel, and thereafter incorporating with the weighed portion of steel a melted and subsequently-weighed quantity of ferromanganese, substantially as described.

In testimony whereof I have signed my 35
name to this specification in the presence of two subscribing witnesses.

ROBERT A. HADFIELD.

Witnesses:

GEO. MOUNT,
MAURICE RAW.