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METHOD OF MAKING CHROME STEEL HAVING VARIOUS CARBON CONTENTS.

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To all whom it may concern:

Be it known that I, NAPOLEON PETINOT, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented a certain new and useful Method of Making Chrome Steel Having Various Carbon Contents, of which the following is a full, clear, and exact description.

My invention relates generally to the production of chrome steel, and more particularly it relates to the manufacture of chrome steel grades having such carbon contents as may be desired, particularly as carried out by means of the basic open hearth processes.

The general practice in making alloy steel, which is familiar to those skilled in the art of making steel by means of the open hearth process, is as follows:

A charge of pig iron and iron scrap is made in such proportion that when the bath is melted, the carbon content in it will be from about one per cent to 1.50%. To this charge is added limestone, and iron ore. Then the metal of the charge is held in the furnace, and the carbon is gradually oxidized on account of the oxidizing atmosphere existing there. Usually there is a slight silicon content in the bath, which comes from the pig iron or from the scrap, and this usually varies from .75% to 1.25%. Such slight silicon content is oxidized first so that there is no silicon present in the molten bath, and the bath is an oxidized bath.

It is further recognized by the art that any addition of ferrochrome made in lump form will become oxidized during the time it is melting and being diffused through the molten bath thereby creating a loss in chromium of from 10% to 40%. The extent of this loss depends on the degree of heat existing in the molten bath, or more generally speaking, it depends on the amount of iron oxide contained in it.

It is the principal object of my invention to provide a process, which will substantially prevent such loss of chromium, and at the same time provide an inexpensive and efficient method of making the chrome steel of any desired grade and of any desired carbon content.

Other advantages than those above set forth will be apparent to those skilled in the art of making steel by means of the open hearth process.

In carrying out my invention, I follow the initial step of the previous practices of the art, and prepare a charge of pig iron and iron scrap in such proportion that when the bath is melted, the proper amount of carbon desired will be present. I then make an addition to the bath of ferrosilicon of the grade known in the trade as "Bessemer ferrosilicon", having a silicon content varying from 10% to 20%. This ferrosilicon is cast in shape form in a permanent mold as described in United States Letters Patent No. 1,274,360, issued to me July 30, 1918. Sufficient ferrosilicon must be added to the bath to deoxidize it, and in practice, I have found that from one pound to two pounds of silicon added as ferrosilicon is necessary to accomplish this end. When sufficient silicon has thus been added that fact will be apparent since then the bath will lay quiet instead of boiling.

Since the atmosphere is oxidizing, if the bath is kept as such for a long time, the silicon addition will not only deoxidize the bath but the bath of carbon steel will eventually reoxidize. This deoxidation will take place according to the equation

$$Si+2FeO=SiO^2+2Fe.$$

In other words the oxide of iron will again be found in the bath.

As soon as the addition of from 10% to 20% ferrosilicon, which is cast in a shape mold (ordinarily in a chill mold), has been made I start to add ferrochrome, such material being in broken pieces and preheated if necessary. It will take from ten minutes to forty minutes for the ferrochrome to become thoroughly diffused through the bath.

The addition of the silicon not only deoxidizes the bath but inasmuch as it has been added in excessive quantities, it will prevent any possible reoxidation. The lump ferrochrome which floats in the bath will first become mushy; then it will melt, but it will not oxidize for the reason that the silicon has more affinity for oxygen or oxide, and consequently will oxidize first. It is for this reason that the excessive amount of ferrosilicon is necessary.

The addition of the ferrosilicon with the content of from 10% to 20% will protect

the chromium from oxidation thus giving a better yield. This is the great advantage of my invention. Obviously, as soon as the chromium is melted other additions of ferro alloys such as ferromanganese may be made as desired either into the furnace or to the ladle and then the heat is tapped.

In practicing my process, I add enough silicon not only to deoxidize the bath but also to protect from oxidation the addition of chromium. The condition that enough silicon has been added to thoroughly deoxidize the bath is easily recognized since when that has been done the bath then lays quiet or is "dead".

In practice I usually add ferrochrome from five minutes to fifteen minutes after the 10% to 20% ferrosilicon addition has been made, and I do not thereafter let any action come back in the bath until the heat is tapped.

Having thus described my invention, what I claim is:

1. A process of the character described comprising the addition to a bath composed of pig iron and iron scrap having the desired carbon content of sufficient ferrosilicon having a silicon content of from 10% to 20% to kill all boiling action in the furnace and then add ferrochrome to the bath.

2. A process of the character described comprising the addition to a bath composed of pig iron and iron scrap having the desired carbon content of sufficient ferrosilicon having a silicon content of from 10% to 20% to deoxidize the bath and also to protect from oxidation the added chromium, then adding the desired amount of ferrochrome.

3. A process of the character described comprising the addition to a bath composed of pig iron and iron scrap having the desired carbon content of sufficient ferrosilicon having a silicon content of from 10% to 20% to deoxidize the bath and also to protect from oxidation the added chromium, then adding the desired amount of ferrochrome, then after the chromium is melted adding other ferro alloys as desired, and then tapping the heat.

In testimony whereof, I have hereunto signed my name.

NAPOLEON PETINOT.