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METHOD OF DEOXIDIZING OPEN-HEARTH-STEEL BATHS.

No Drawing. Application filed February 11, 1924. Serial No. 692,177.

To all whom it may concern:

Be it known that we, NAPOLEON PETINOT and JOHN McCONNELL, citizens of the United States of America, and residents, respectively, of the city, county, and State of New York, and the city of Canton, county of Stark, and State of Ohio, have invented a new and useful Method of Deoxidizing Open-Hearth-Steel Baths, of which the following is a full, clear, and exact description.

Our invention relates generally to a method of deoxidizing open hearth steel baths, and more particularly to such a method, when employed with an alloy of aluminum, silicon, and iron.

Those familiar with the art of making steel by the open hearth practice know that the steel bath is kept oxidized not only by the oxidizing atmosphere of the furnace, but also by the addition of iron oxide. This is done to help cut down the carbon in the initial charge to the proper amount desired.

It is well known that if steel is poured from a bath having such a degree of oxidation as just described, the product will be valueless. It has, therefore, been necessary to deoxidize the steel by adding ferro silicon or aluminum to the ladle after the furnace has been tapped.

The most useful and efficient deoxidizer known is aluminum, but on account of its low specific gravity, it will float in the bath, and thus will not be thoroughly diffused therein. Therefore, aluminum has been heretofore only useful as a deoxidizer, when added to the ladle. If it is added to the bath, it will only react on the impurities contained in the slag.

In carrying out our invention, we employ an alloy, such as that described in the copending patent application of Napoleon Petinot for a deoxidizer for open hearth steel baths and a method for making the same, filed January 30, 1924, and given Serial No. 689,565. An alloy, such as described in the said copending Petinot application, being cast in shaped form, should be sufficiently large so as to sink under the slag in the open hearth steel bath. The alloy may be added to the bath at any time when it is desired to deoxidize it. When such an addition is made and a sufficient quantity of the deoxidizer has been added it will be noticed that the bath instead of being agitated will lie quietly. If kept too long in the bath, however, it will reoxidize on account of the oxidizing atmosphere of the furnace. Preferably we employ a deoxidizer having a low silicon content and being composed of from 5% to 20% of aluminum; from 5% to 15% of silicon; from .50% to 3% of carbon and the balance iron, such deoxidizer being cast in a shaped form as above stated.

The reactions, which occur when the new deoxidizing aluminum and silicon alloy is employed, whereby the various oxides of iron, manganese, and the like are reduced, are as follows:

$$Si+2FeO=SiO_2+2Fe.$$
$$2Al+3FeO=Al_2O_3+3Fe.$$

Thus when my new deoxidizing element is in solution with the steel, the oxides of silicon, aluminum, and the like will rise to the slag at the top of the molten bath, and will combine with it, as will be plainly evident to the operator carrying out the method. If a plain carbon steel is thus made, a deoxidizing metal can then be tapped into the ladle.

When an alloy steel is desired, such as chromium, chrome vanadium, and the like, alloying elements such as ferrochromium, ferrovanadium and the like may be added to the charge immediately after the addition of the deoxidizer above described.

One of the very important advantages resulting from the practice of our invention will be that when the bath deoxidizes by means of the addition of the deoxidizer above described, the alloying element (such as chromium, for example,) during its melting, will be uniformly distributed through and be intermingled with the bath and will be protected, so that a much better yield of that element will be obtained.

Obviously some excess of the special deoxidizer of the said Petinot application may be and in some cases should be added to the bath after the addition of the ferrochrome or other ferro-alloys, so as to avoid any possible reoxidization.

While we have described our invention as carried out in its preferred form, it is obvious that some modifications thereof may be made without departing from the spirit of our invention or the scope of the appended claim, and we do not, therefore, wish to be limited to the preferred form herein described.

Having thus described our invention what we claim is:

A method of deoxidizing open hearth alloy steel baths comprising the addition into the molten bath of a sufficient quantity of an alloy of aluminum, silicon, and iron, such alloy being low in silicon and cast in a shaped form for the deoxidization of the steel, then adding a sufficient quantity of the metal or metals to be desired in the finished product in the form of a ferro of such metal or metals so as to produce the desired alloy content in the product, a sufficient amount of such deoxidizer being added to reduce the various oxides present in the bath and avoid any possible reoxidization of the same, whereby a greater yield will be effected and the cost of making alloy steel products will be reduced.

In testimony whereof, we have hereunto signed our names.

NAPOLEON PETINOT.
JOHN McCONNELL.