

UNITED STATES PATENT OFFICE.

PLIMMON H. DUDLEY, OF NEW YORK, N. Y.

MANUFACTURE OF STEEL.

1,009,707.

Specification of Letters Patent.

Patented Nov. 21, 1911.

No Drawing.

Application filed January 22, 1910. Serial No. 539,596.

To all whom it may concern:

Be it known that I, PLIMMON H. DUDLEY, a citizen of the United States, and resident of the borough of Manhattan, in the city and State of New York, have invented a new and useful Manufacture of Steel, of which the following is a specification.

My invention relates to the manufacture of steel, particularly steel of high grades, for rails and ties, the object being to eliminate or reduce the slags and oxids to a greater degree than has hitherto been done in ordinary practice.

It has heretofore been the Bessemer practice to recarburize the bath of molten metal and forthwith to proceed to teem the ingots. The result has been that products, for example silicates of iron and manganese and oxids detrimental to the homogeneity and toughness of the steel, have remained therein and serious accidents have resulted therefrom.

I have found in practice that if, after the incorporation of the spiegeleisen, the molten bath is held in the converter for two, three or more minutes, according to the size of the bath, to allow the chemical reactions to take place, the slag resulting therefrom will separate, rise and escape from the steel to such an extent that the further cleansing of the bath by ferro titanium to remove more traces of oxids and nitrogen can be accomplished by the use of about one-tenth of the amount of ferro titanium heretofore required for steel of corresponding quality.

My present invention consists in producing a bath of prepared metal, introducing the recarburizing elements therein, allowing the bath to remain undisturbed a predetermined length of time and subsequently, before teeming the ingots, introducing a subsidiary de-oxidizing agent.

My invention further consists in producing a bath of prepared metal, introducing the recarburizing elements therein, allowing the bath to remain undisturbed a predetermined length of time, pouring the bath into the teeming ladle, and introducing a subsidiary de-oxidizing agent in the ladle underneath the poured slag and then teeming the ingots.

In carrying the process into practical effect, the bath of prepared metal may be recarburized in the well known Bessemer converter or other furnace, and after the com-

pletion of adding the ordinary or usual recarburizers, the bath is held undisturbed for preferably two and one-half minutes as a minimum time before pouring into the teeming ladle. The subsidiary de-oxidizing agent, which may consist of ferro titanium, may be thrown into the teeming ladle as the metal is being poured from the converter into the ladle and the metal with the de-oxidizing agent therein, is held in the ladle three or more minutes for the slag from the subsidiary de-oxidizer to rise and escape from the steel.

It is important that the subsidiary de-oxidizing agent should be introduced into the steel after the usual recarburizing agents have had their effect and the slag therefrom has risen, in order that it may have an immediate effect upon the molten steel freed to a considerable extent from the oxids, and it is also important that it be introduced in a position beneath the slag which has risen, in order that it may operate upon the steel proper rather than upon the slag.

The particular manner of introducing the ferro titanium in the teeming ladle may consist of simply shoveling it into the bottom of the ladle as pouring begins or any other feasible way may be resorted to, and hence I do not wish to limit the process to this particular manner of introducing it. When the heats are recarburized in an "intermediate ladle" instead of in the converter, the bath or charge should be held at least three minutes after the introduction of the spiegeleisen (recarburizer), before pouring into the teeming ladle. The ferro titanium is introduced in the teeming ladle in such proportions as may be required to produce the desired result, the amount ranging from one-tenth of one per cent. to five tenths of one per cent. of a ten per cent. alloy or its equivalent as compared with one to four per cent. hitherto required where the process has been conducted without the delay after the introduction of the spiegeleisen, and the ferro titanium has been added with the other recarburizers.

In the open hearth process, either acid or basic, the bath of metal produced by melting and reducing, is allowed to rest a sufficient period of time to complete the chemical reactions as shown by tests made at suitable intervals, for instance, ten minutes or more before being transferred to the teeming

ladle, and ferro titanium is introduced beneath the slag in the teeming ladle in any feasible manner.

What I claim is:—

- 5 1. In the manufacture of steel, producing a bath of blown metal, introducing spiegel-eisen, allowing the bath to rest a prescribed period of time, and introducing a subsidiary de-oxidizing agent before teeming the ingots.
- 10 2. In the manufacture of steel, producing a bath, of metal, allowing the bath to rest a suitable period of time for the slag to rise, transferring the bath into the teeming ladle and introducing ferro titanium in the metal
- 15 in the teeming ladle beneath the transferred slag.
3. In the manufacture of steel, producing a bath of blown metal, recarburizing the bath, allowing the bath to rest a prescribed
- 20 period of time, pouring the metal, and introducing a subsidiary de-oxidizing agent at the time of pouring and subsequently teeming the ingot.
- 25 4. In the manufacture of steel, producing a bath of blown metal, recarburizing the

bath, allowing the bath to rest a prescribed period of time, pouring the metal into the teeming ladle and introducing a de-oxidizing agent in the teeming ladle beneath the slag of the poured metal.

5. In the manufacture of steel, producing a bath of blown metal, recarburizing the bath, allowing the bath to rest a prescribed period of time, pouring the bath into the teeming ladle, introducing ferro titanium in 35 the metal in the teeming ladle beneath the poured slag, the quantity of ferro titanium being from one-tenth of one per cent. to five-tenths of one per cent. of a ten per cent. alloy or its equivalent to serve as a subsidi- 40 ary de-oxidizing or cleansing agent.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this 20th day of January 1910.

PLIMMON H. DUDLEY.

Witnesses:

F. GEORGE BARRY,
HENRY THIEME.