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N. PETINOT

PROCESS FOR MANUFACTURING LOW CARBON ALLOY STEELS

Filed June 3, 1922

Fig. 1.

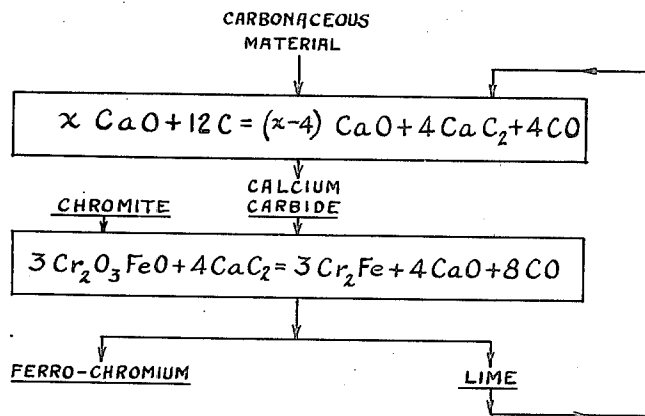


Fig. 2.

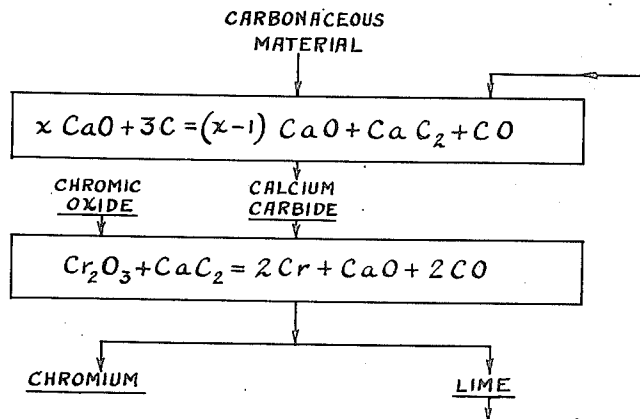
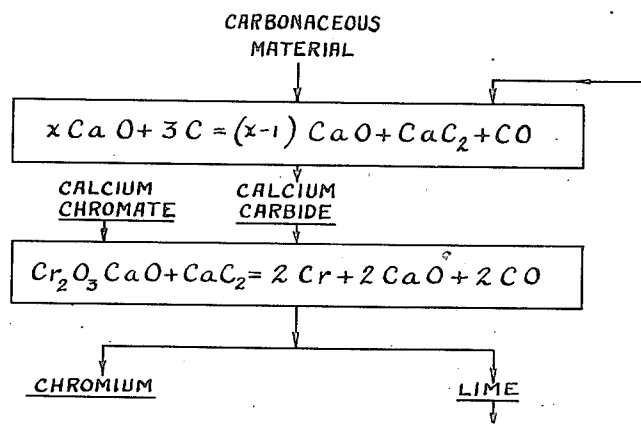


Fig. 3.



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UNITED STATES PATENT OFFICE.

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PROCESS FOR MANUFACTURING LOW-CARBON ALLOY STEELS.

Application filed June 3, 1922. Serial No. 565,649.

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 Process for Manufacturing Low-Carbon Alloy Steels, of which the following is a full, clear, and exact description.

This invention relates generally to the production of low carbon alloy steels such as chromium, tungsten, manganese, vanadium, and other alloy steels having a low carbon content (that is, steels containing from 0.05 per cent of carbon and more) by the process herein described in which an electric furnace is employed.

In making low carbon alloy steels in electric furnaces it has been the general practice of the art to first make a plain carbon steel low enough in sulphur and phosphorus to comply with the specifications for such elements and then to add enough of the ferro-alloy, whatever it may be, to bring up the content of the steel bath, as regards the alloying element, to the desired percentage.

It is well known that all ferro-alloys contain more or less carbon, and that this carbon will be taken up by the molten steel. In such practices of the art, therefore, it has been necessary to make allowance for the carbon introduced in this way, and, if an alloy steel low in carbon is required, it is exceedingly difficult and may even be impossible to do this, in any case, a very low carbon ferro-alloy must be used, and such ferro-alloys are costly.

By the use of my invention alloy steels of low carbon content (for example from 0.05 per cent of carbon and upwards) can be made without using low carbon ferro-alloys for the purpose of introducing the alloying substance.

A distinction should be made between the process herein described and those processes which have heretofore been employed for the purpose of making low carbon ferro-alloys in which calcium carbide is introduced as a reducing agent. The use of such reducing agent alone is not herein claimed.

In order to more graphically set forth the

process herein described, I have appended a single sheet of drawings, which clearly show the reactions which take place while my invention is being carried out. Referring to the drawings:

Fig. 1 shows the reactions which take place in my process when the chromite is used in combination with the carbonaceous material.

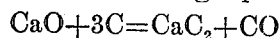
Fig. 2 shows the reactions which take place in carrying out my invention when the chromic oxide is employed in combination with the carbonaceous material.

Fig. 3 shows the reactions which take place when calcium chromate is employed in combination with the carbonaceous material in carrying out my invention.

For the purpose of specifically describing my invention I will illustrate it as applied to the manufacture of chromium steel. This illustration will serve to fully disclose my invention, and any one skilled in metallurgy will be able to apply my invention to other alloy steels than chromium steel.

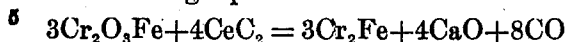
One of the objects of my invention has been to simplify the present methods of the art; to reduce the cost of manufacture of low carbon ferro-alloys; and to do away with using low carbon ferro-alloys for introducing the alloying substance.

In carrying out my invention I make a bath of iron with a low carbon content in a basic lined furnace of the arc type. This may be easily accomplished by melting cold scrap in the furnace or transferring hot metal into the furnace from a basic open hearth furnace. Then I add burnt lime to the bath, so as to form a slag on it and on top of this I spread a layer of carbonaceous material, in a powdered form, such as anthracite coal, coke, petroleum coke, or carbon electrodes. When this mixture is subjected to the high temperature of the arc, the carbonaceous material reacts with some of the lime thereby forming calcium carbide according to the following equation:



If this reaction has taken place I add in small quantities at a time chromite (viz

iron chromate) until the calcium carbide present is substantially exhausted in forming ferro-chromium and lime according to the following equation:



The ferro-chromium thus formed is taken up by the steel and then a fresh layer of carbonaceous material is spread on the slag.

The cycle of operation of steps just described is then repeated as often as necessary until the alloyed steel of the desired composition is obtained.

Fig. 1 of the drawings illustrates the cycle of steps and the chemical reactions which take place when my process is carried out in the manner just above described.

Instead of using chromite for supplying the chromium, chromic oxide may be used and in that event the cycle of operations and the chemical reactions which take place differ from those already described in the particulars clearly and graphically shown in Fig. 2 of the accompanying drawings.

As a substitute for the chromite used in the process illustrated in Fig. 1 of the drawings, chromate of lime may be substituted for supplying the chromium. When chromate of lime is thus used the cycle of operation and the chemical reactions which then take place are clearly and graphically shown in Fig. 3 of the accompanying drawings.

From the foregoing descriptions and the accompanying drawings it will be clear to any one skilled in metallurgy how my invention can be applied in the manufacture of any alloy steels of low carbon content.

Having thus described my invention what I claim is:

1. A process of producing low carbon alloy steels which consists in electrically heating a lime slag containing a calcium carbide and a refractory oxide or compound in contact with the bath of molten iron, and regenerating the calcium carbide by the addition of a carbonaceous material.

2. A process of producing low carbon alloy steels, which consists in electrically heating a lime slag containing a calcium carbide in contact with a bath of molten iron, adding thereto a refractory oxide or com-

pound, and regenerating the calcium carbide by the addition of a carbonaceous material.

3. A process of making low carbon alloy steels which consists in electrically heating a lime slag in contact with a bath of molten iron adding thereto a carbonaceous material to produce calcium carbide, adding a refractory oxide or compound until the calcium carbide is exhausted regenerating the calcium carbide by adding carbonaceous material and then adding a refractory oxide or compound.

4. A process of producing low carbon alloy steels comprising the formation of a bath of iron having a low carbon content in a basic lined furnace of the arc type, then adding burnt lime to the bath so as to form a lime slag, then spreading a layer of carbonaceous material in powder form thereon, then adding a refractory oxide, and then adding carbonaceous material to regenerate the calcium carbide as required.

5. A process of producing low carbon alloy steels comprising the formation of a bath of iron having a low carbon content in a basic lined furnace of the arc type, then adding burnt lime to the bath so as to form a lime slag, then spreading a layer of carbonaceous material in powdered form thereon, then adding in small quantities at a time iron chromate.

6. A process of producing low carbon alloy steels comprising the formation of a bath of iron having a low carbon content in a basic lined furnace of the arc type, then adding burnt lime to the bath so as to form a lime slag, then spreading a layer of carbonaceous material in powdered form thereon, then adding in small quantities at a time chromic oxide.

7. A process of producing low carbon alloy steels comprising the formation of a bath of iron having a low carbon content in a basic lined furnace of the arc type, then adding burnt lime to the bath so as to form a lime slag, then spreading a layer of carbonaceous material in powdered form thereon, then adding in small quantities at a time chromite of lime.

In testimony whereof, I have hereunto signed my name.

NAPOLEON PETINOT.