UNITED STATES PATENT OFFICE.

EDGAR F. PRICE, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO ELECTRO METALLURGICAL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF WEST VIRGINIA.

PROCESS OF PRODUCING LOW-CARBON FERRO-ALLOYS.

No. 886,858. Specification of Letters Patent. Patented May 5, 1908.

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To all whom it may concern:

Be it known that I, EDGAR F. PRICE, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Processes of Producing Low-Carbon Ferro-Alloys, of which the following is a specification.

The value of the ferro-alloys commonly employed as a means of introducing chromium, vanadium and other metals into special steels, is largely dependent on a low carbon content, and methods of reduction involving the use of expensive metallic reducing agents, or giving low yields, are employed to produce these alloys.

The present process of producing low-carbon ferro-alloys comprises two stages. In the first stage, a high-carbon ferro-alloy, for example one of chromium, molybdenum, tungsten, titanium, vanadium or nickel, is cheaply produced by smelting a mixture of an ore of the alloying metal, an excess of carbon and a source of iron. The reduction may be effected in an ordinary electric furnace having a carbon lining and depending carbon electrodes.

In the second stage, the carbon is removed or reduced to a small percentage by electrically heating the molten alloy to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for the chromium or other alloyed metal, and then subjecting it for a limited period to the action of air or other oxidizing gas. In the ordinary Bessemer process of producing steel, the molten pig-iron containing a small amount of silicon or other highly-positive metal and carbon is subjected to the action of air at temperatures such that the affinity of oxygen for the silicon or other alloyed positive metal is greater than its affinity for carbon, so that the removal of the alloyed metal substantially precedes the removal of carbon. But when the temperature of a molten alloy of iron, a highly-positive metal and carbon, is raised to a definite point, dependent on the particular alloyed metal, a temperature above that employed in the Bessemer steel industry or usually produced by combustion but readily-obtainable in an electric furnace, the relative affinities of the alloyed metal and carbon toward oxygen change, the heat of combination of the carbon and oxygen becomes greater than the heat of combination of the alloyed metal and oxygen, and the carbon may then be largely or substantially eliminated by oxidation before any considerable percentage of the alloyed metal is removed.

In carrying out the second stage of the process, the high-carbon ferro-alloy is heated to the requisite temperature by supporting the body of the molten alloy in the form of a ring or closed loop, and making this body the secondary of a static transformer, the primary of which is fed with an alternating, pulsating or intermittent electric current. Either the entire mass of alloy to be decarburized may be comprised in this ring, or the ring may comprise an arc or loop of molten alloy the ends of which join the main mass. When the alloy is thus heated to the requisite high temperature, either in the reduction furnace or in a separate vessel, it is treated with air or other oxidizing gas, either forced through the alloy or caused to act upon its surface, as in the present art of bessemerizing pig-iron.

I claim:

1. The process of producing low-carbon ferro-alloys, which consists in first producing a ferro-alloy high in carbon, heating the product to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for the alloyed metal, by constituting a body of the molten alloy the secondary of a transformer and supplying electric current to the primary of said transformer, and subjecting the heated alloy to the action of an oxidizing gas.

2. The process of producing low-carbon ferro-alloys, which consists in electrically smelting a compound of the alloying metal, an excess of carbon and a source of iron, heating the product to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for the alloyed metal, by constituting a body of the molten alloy the secondary of a transformer and supplying electric current to the primary of said transformer, and subjecting the heated alloy to the action of an oxidizing gas.

3. The process of producing low-carbon ferrochromium, which consists in first producing ferrochromium high in carbon, heating the product to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for chromium,

by constituting a body of the molten alloy the secondary of a transformer and supplying electric current to the primary of said transformer, and subjecting the heated alloy to the action of an oxidizing gas.

4. The process of producing low-carbon ferrochromium, which consists in electrically smelting a compound of chromium, an excess of carbon and a source of iron, heating the product to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for chromium, by constituting a body of the molten alloy the secondary of a transformer and supplying electric current to the primary of said transformer, and subjecting the heated alloy to the action of an oxidizing gas.

In testimony whereof, I affix my signature in presence of two witnesses.

EDGAR F. PRICE.

Witnesses:
G. E. Cox,
I. R. Edmands.