

UNITED STATES PATENT OFFICE.

EUGENE A. BYRNES, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO ELECTRO METALLURGICAL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF WEST VIRGINIA.

PROCESS OF PRODUCING LOW-CARBON NICKEL ALLOYS.

1,059,709.

Specification of Letters Patent.

Patented Apr. 22, 1913.

No Drawing.

Application filed July 1, 1908. Serial No. 441,341.

To all whom it may concern:

Be it known that I, EUGENE A. BYRNES, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Processes of Producing Low-Carbon Nickel Alloys, of which the following is a specification.

According to the present invention, the production of low-carbon nickel alloys, specifically ferrochromium containing nickel and $\frac{1}{2}$ to 2% of carbon, is effected by a process comprising two stages. In the first stage, a product relatively high in carbon is made, for example the crude ferrochromium commonly produced by electrically smelting a mixture of chromite, carbon and a flux, containing from 5 to 10% of carbon. The high-carbon product is then subjected to the action of an oxid of nickel, while heated to such temperature as to effect a reaction between its contained carbon and the nickel oxid, whereby the carbon is oxidized and eliminated, the reduced nickel alloying with the decarburized metal.

The temperature required for the reduction of nickel oxid is considerably lower than that required for chromium oxid, and lower than that for iron oxids, as shown by the following figures: Heat evolved on the oxidation of 1 kilo of Ni to $\text{NiO}_2=1051$ Cal. Heat evolved on the oxidation of 1 kilo of Fe to $\text{FeO}=1173$ Cal. Heat evolved on the oxidation of 1 kilo of Fe to $\text{Fe}_2\text{O}_3=1746$ Cal. Heat evolved on the oxidation of 1 kilo of Cr to $\text{Cr}_2\text{O}_3=3000$ (?) Cal. (See *Metalurgical Calculations*, by Richards, Vol. 2, pages 326 and 327). The process can therefore be carried out at temperatures lower than that required to produce the crude ferro-chromium.

The process may be carried out either by stirring nickel oxid into a molten body of the high-carbon metal or alloy; feeding nickel oxid into a bath of inert slag, for ex-

ample calcium aluminate, supported by the molten crude metal or alloy; running the molten crude metal or alloy into a vessel containing nickel oxid; passing or percolating a stream of the crude metal or alloy through a granular body of nickel oxid; or melting a mixture of the broken crude metal or alloy and nickel oxid.

The small percentage of nickel remaining in the product, corresponding to the amount of carbon removed, is desirable in many cases, especially for the production of special steels containing chromium and nickel.

I claim:

1. The process of producing low-carbon nickel alloys, which consists in reacting on a high-carbon metal or alloy with nickel oxid, by feeding nickel oxid into a bath of slag supported on the molten metal or alloy.

2. The process of producing low-carbon ferrochromium containing nickel, which consists in reacting on high-carbon ferrochromium with nickel oxid, at a temperature lower than the reduction-temperature of chromium oxid.

3. The process of producing low-carbon ferrochromium containing nickel, which consists in reacting on high-carbon ferrochromium with nickel oxid, by feeding nickel oxid into a bath of slag supported on the molten ferrochromium.

4. The process of producing low-carbon ferrochromium containing nickel, which consists in reacting on high-carbon ferrochromium with nickel oxid, by feeding nickel oxid into a bath of calcium aluminate slag supported on the molten ferrochromium.

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

EUGENE A. BYRNES.

Witnesses:

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