

UNITED STATES PATENT OFFICE.

NIVEN McCONNELL, OF MUNHALL, PENNSYLVANIA, ASSIGNOR TO THE
CARNEGIE STEEL COMPANY, LIMITED, OF PENNSYLVANIA.

METHOD OF MANUFACTURING ALLOYS OF IRON OR STEEL WITH NICKEL.

SPECIFICATION forming part of Letters Patent No. 537,544, dated April 16, 1895.

Application filed March 9, 1894. Serial No. 503,009. (No specimens.)

To all whom it may concern:

Be it known that I, NIVEN McCONNELL, of Munhall, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Alloys of Iron or Steel with Nickel, of which the following is a full, clear, and exact description.

My improvement in the manufacture of alloys of iron or steel with nickel consists in an improved method of introducing the nickel ore into the fused metal (iron or steel) with which it is to be alloyed, when the nickel oxide is to be reduced to a metallic condition in the presence of the fused steel or of the iron undergoing treatment for conversion into steel.

In Letters Patent of the United States No. 476,913, dated June 14, 1892, for an invention of Ezra F. Wood for an improvement in the process of manufacturing alloys of iron or steel with nickel, a process is described in which the oxide of nickel (either natural ore or "prepared nickel oxide") is ground to powder and mixed with a suitable quantity of pulverized charcoal, coke dust or similar form of carbon, (as a reducing agent,) and is then formed into masses, preferably in the shape of bricks, by mixing the pulverized nickel oxide and dry carbonaceous matter with a binding material such as tar, or silicate of soda.

The object of forming the carbonaceous matter and nickel oxide into a brick or solid mass as described, is to preserve the mixture of the carbon and keep them while thus intimately associated, immersed in the melted metal with which the nickel is to be alloyed, because the carbon being so much lighter in specific gravity than either the nickel oxide or the melted metal, the carbon and nickel would become separated and the carbon would combine with the iron or steel, and the necessary reduction of the nickel oxide would be either entirely prevented or only imperfectly secured.

I have discovered a method by which the reduction of the nickel oxide by carbon can be readily effected in the presence of the molten iron or steel without the necessity of forming the mixed carbon and oxide into a solid mass with binding material, or inclosing them

in a fusible envelope and it is this improvement in the process of forming alloys of nickel with iron, steel and other metals which constitutes the present invention.

The oxide of nickel which I use may be either the natural oxide, or what is known in commerce as the "prepared nickel oxide," (which is much richer in nickel and freer from foreign contamination than the ordinary natural nickel oxide) containing usually about ninety-six per cent. of nickel oxide and four per cent. of iron and impurities and the oxide yielding about seventy-five per cent. of metallic nickel.

I shall describe my process as carried on with the prepared nickel oxide, premising, however, that if a natural oxide of nickel is used it will require a larger proportion of the oxide with a given charge of iron or steel to obtain the desired percentage of nickel in the resulting alloy. I shall also describe my process as carried on in connection with the open-hearth process of manufacture of steel, the application of my improvement to the manufacture of iron, by any of the well-known processes of refining crude pig metal, or to the Bessemer process, being so obvious as not to need any special statement.

The prepared nickel oxide being ground, is intimately mixed with pulverized carbonaceous matter, preferably coke dust, both of them either more or less wet, or entirely free from moisture as may be preferred in the proportion of about one-fifth part, by weight, of carbonaceous matter and four-fifths of nickel oxide. I need hardly repeat that the relative amounts of carbonaceous matter and oxide of nickel to be used will depend on the richness of the ore in nickel. To these I add iron or steel borings or turnings in about the proportion of an equal quantity, by weight, of the mixture of carbon and oxide and of the borings or turnings. These are well mixed together and are placed on the hearth of the furnace, previously heated in the usual manner; and the pig metal is then charged on to the hearth on top of the charge of nickel oxide, carbon and turnings, the presence of the unmelted pig metal preventing the dissipation of the oxide and carbon, the pig metal as it melts gradually mingling with the nickel

charge, the nickel oxide being reduced to a metallic condition and mixed with the melted iron or steel during the conduct of the open-hearth process, which is otherwise conducted in the usual manner.

The advantage of my process as above described, besides dispensing with the preliminary step of forming nickel and carbon bricks as heretofore practiced, saves waste of nickel oxide to a considerable degree, which would otherwise ensue either by chemical reaction, or by the mechanical removal of the pulverized nickel oxide by means of the gas current in the furnace.

By the means described I secure the more ready reduction of the oxide of nickel in the presence of the metal with which the nickel is to be alloyed.

In case it is desired to treat the iron for the manufacture of steel by the crucible process, or by the pneumatic process in a Bessemer converter, the mixture of nickel oxide, solid carbon and iron or steel borings or turnings is to be placed in the crucible or Bessemer converter, as the case may be, before the metallic iron is charged therein, and the respective processes are then carried on in the usual manner.

The desired percentage of nickel to be contained in the resulting alloy (nickel steel or nickel iron) is obtained by adding the requisite amount of nickel oxide, reference being had to the richness of the ore, and an allow-

ance of about ten per cent. being made for necessary waste.

The usual decarburizing and recarburizing of the iron in the manufacture of steel are carried on at the same time and in the usual manner without interfering with the admixture of the nickel therewith.

Having thus described my improvement, I do not claim, nor do I use in my process, any method of forming the pulverized oxide and carbon into a solid mass with plastic material and pressure, nor inclosing these materials in a fusible envelope, it being the purpose of my invention to simplify the process by dispensing with such steps; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

The method of alloying nickel with iron or steel, consisting in mixing with oxide of nickel, carbonaceous reducing matter and iron or steel borings or turnings, charging the loose mixture into a furnace, charging iron or steel upon the mixture, and applying sufficient heat to cause the reduction of the oxide and its alloying with the iron or steel; substantially as described.

In testimony whereof I have hereunto set my hand.

NIVEN McCONNELL.

Witnesses:

H. H. HERVEY,
W. H. CORBETT.