UNITED STATES PATENT OFFICE.

LUDWIG MOND, OF LONDON, ENGLAND.

PROCESS OF OBTAINING METALLIC NICKEL.

SPECIFICATION forming part of Letters Patent No. 455,228, dated June 30, 1891.

Application filed November 11, 1890. Serial No. 371,097. (Specimens.)

To all whom it may concern:

Be it known that I, LUDWIG MOND, a subject of the Queen of Great Britain, residing at Winnington Hall, Northwich, London, county of Chester, England, have invented a certain new and useful Improvement in the Process of Obtaining Metallic Nickel, of which the following is a specification.

This invention has for its object improvements in obtaining metallic nickel from nickel ores or other substances containing nickel, such as its oxides and salts or mixtures of these with other oxides, salts, or impurities, or from impure metallic nickel.

In treating ores which contain the nickel in combination with sulphur or arsenic or other elements of the same nature these ores have first to be treated so as to convert the nickel into oxide by the usual methods. After such treatment and in the case of all other ores or substances which contain the nickel in the form of an oxide or salt without such treatment, the oxide or salt is reduced to the metallic state in any convenient manner, such as by treating it with carbonic oxide or with hydrogen, or a hydrocarbon or a gaseous mixture containing these gases at a temperature of between 350° and 400° centigrade. In treating oxalates of nickel these may be heated by themselves to the temperature required for their complete decomposition. In this manner the metallic nickel is obtained in a very finely-divided state, particularly suitable for the subsequent operations. Substances containing metallic nickel obtained by other methods should be finely comminuted before proceeding with the extraction process hereinafter described. Any substance containing metallic nickel in a finely-divided state obtained in this or any other manner is treated at a temperature below 150° centigrade with carbonic oxide gas, which may be mixed with nitrogen, vapor of water, carbonic acid, hydrocarbons, and hydrogen, but should be free from oxygen or halogens. The nickel combines with the carbonic oxide and forms a readily volatile compound, called "nickel carbon oxide," which is easily carried off by the excess of the gas employed. This compound forms at all temperatures below 150° centigrade, even below 0° centigrade, and is very freely obtained at ordinary atmospheric temperature, but I prefer to work at about 50° centigrade.

The nickel carbon oxide is a colorless liquid of the composition $Ni\,C_4O_4$. It boils at 43° centigrade under ordinary atmospheric pressure and solidifies at −25°. Its specific gravity is 1.3185 at 17° centigrade. None of the impurities in the nickel or the oxide, not even the cobalt, are in the least acted upon by the carbonic oxide, but remain behind after the nickel has been volatilized. The treatment is preferably carried on in a chamber or cylinder revolving on a horizontal axis, or in one provided with a stirring or agitating device, whereby the pulverulent matter shall be freely and thoroughly exposed to the gas.

The mixture of the vapor of nickel carbon oxide with other gases so obtained is now passed through tubes or vessels, in which it is heated to about 180° centigrade, when the nickel carbon oxide is decomposed again into nickel and carbonic oxide. The nickel separates out in coherent metallic masses of great purity, more or less attached to the sides of the tubes or vessels in which the gas has been heated, and the carbonic oxide can be used over again to treat fresh masses of the reduced oxide. After some time the action of the finely-divided nickel upon carbonic oxides becomes less energetic. It is then heated up to 350° to 400° centigrade in a current of carbonic oxide or hydrogen and cooled down again to ordinary temperature, by which means its energy is restored.

In some cases it is preferable not to decompose the nickel carbon oxide at the time of manufacture. In such cases the gases containing it can be passed through refrigerating apparatus, if desired, under pressure, so as to hasten the condensation. The nickel carbon oxide then separates out as a liquid and can be bottled. The nickel can at any time be deposited from this liquid by heating the latter or its vapor.

I declare that what I claim is—

1. The process of separating metallic nickel from other substances, which consists in reducing the ores of nickel with gaseous fuel at from 350° to 400° centigrade and treating the reduced ore at a temperature below 150° centigrade with carbonic oxide, thus obtaining nickel-carbon oxide, and then depositing the.

nickel from this compound by heating it to about 180° centigrade.

2. The process of separating metallic nickel from other substances, which consists in heating oxalate of nickel out of contact with air or in a reducing atmosphere till reduction takes place, then treating the reduced nickel at a temperature below 150° centigrade with carbonic oxide, thus obtaining nickel-carbon oxide, and then depositing the nickel from this compound by heating to about 180° centigrade.

3. The process of separating metallic nickel from any other solid substances, except such as alter in constitution at the temperature used, which consists in treating such materials containing metallic nickel at a temperature below 150° centigrade, as described, with carbonic oxide, thus obtaining the nickel as a volatile compound, called "nickel-carbon oxide," and then depositing the nickel from this compound by heating to about 180° centigrade.

4. The process of obtaining nickel from nickel-carbon oxide, which consists in heating the same to about 180° centigrade, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LUDWIG MOND.

Witnesses:
WM. P. THOMPSON,
JOHN HAYES.