

UNITED STATES PATENT OFFICE.

PIERRE DEP. RICKETTS, OF NEW YORK, N. Y.

PROCESS OF SEPARATING METALLIC NICKEL.

SPECIFICATION forming part of Letters Patent No. 505,846, dated October 3, 1893.

Application filed April 20, 1892. Serial No. 429,925. (No specimens.)

To all whom it may concern:

Be it known that I, PIERRE DEPEYSTER RICKETTS, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Processes of Separating Nickel from Nickeliferous Bodies, of which the following is a specification.

My invention relates to an improvement in processes for separating metallic nickel, nickel salts or nickel oxides, from copper and other metals and the various impurities with which the nickeliferous bodies above named may be combined, and also for producing metallic nickel, oxides of nickel and salts of nickel, from nickel compounds or alloys.

The precise object of the invention is the production and separation of the aforesaid nickeliferous products, by electricity, from the alloys and other bodies containing nickel, and I accomplish this in the manner hereinafter described.

When nickeliferous bodies are dissolved in any convenient acid that will dissolve the same, so as to form a solution of the copper, nickel, and other metals contained therein, and alkalies, or sulphates of any alkaline base, or ammonia, or mixtures of such salts are added to the solution in such quantities as not to interfere with the acid reaction, the nickel contained in the solution will form double sulphates of nickel and the particular alkaline base present in the salt used. This salt is insoluble in the acid solution and is precipitated to the bottom. If now an electric current be passed through the solution from suitable terminals within the same, either before or after the addition of the alkaline reagents, the copper will be deposited upon the negative terminal and may be readily removed from the solution, while the insoluble nickel salts will be left as a precipitate at the bottom and may then be removed as they accumulate, and the nickel obtained from them in any convenient manner. In practice it will be found advisable to effect this separation as a continuous process, effecting the three steps above indicated in the same operation.

The various bodies containing nickel which

are to be subjected to the treatment, are in ordinary cases first prepared by smelting, bessemerizing, or otherwise concentrating or freeing from an excess of impurities, by treatment in any convenient form of furnace or receptacle, and are then rolled or otherwise formed into plates or other suitable forms. In the case of nickeliferous alloys, it is only necessary to form at once into suitable shapes.

The bath, as above indicated, is preferably composed of sulphuric acid, to which sulphate of ammonia, or any sulphate of an alkaline base, is added, either as such or by adding caustic alkali to the acid. The quantity of the caustic alkali or salt of the alkaline base employed to be added, will depend upon and vary with the character of these ingredients. It is essential, however, that the bath should be distinctively acid in its reaction, and not alkaline, and hence only such quantities of the alkalies or their salts should be added as will not interfere with the acid reaction of the bath.

The bath may be contained in any convenient form of vessel, and if desired, a convenient amount of water may be added preferably at a temperature slightly below its boiling point.

The electric current, for the removal of the copper, may be passed through the bath before or after the addition of the above mentioned reagents.

Where the nickeliferous bodies consist of plates of nickeliferous alloys, it will be found preferable to proceed in the following manner. The plates or other suitable forms, are first immersed in the bath formed as above indicated, and the current passed from the plates as anodes, through the bath, to one or more suitable cathodes also placed therein; such as copper plates, or other similar bodies. The electrolytic current will at once dissolve or disintegrate the anode composed of nickel compounds, or alloys, and the copper from the anode will at once be deposited on the cathode, while the nickel salts will be precipitated to the bottom of the bath, and being insoluble in the acid solution, will accumulate on the bottom. The iron and other

impurities generally present in the nickeliferous bodies, will dissolve or remain in solution, or will collect with the nickel compounds at the bottom of the bath.

5 The solution of the bath may be renewed from time to time by the addition of fresh acid and salts of alkaline bases, as may be necessary to maintain the bath acid in its reaction, and to dissolve fresh portions of nickel
10 and copper from the anode continually. The copper deposited on the cathode will also be removed from time to time as it accumulates, and be subsequently refined in any convenient manner, while the nickel salts are collected as sediment in the bottom of the bath,
15 and although insoluble in acid solution, may be dissolved in water and thus separated from any insoluble impurities, such as sulphur, contained therein. The solution is then evaporated to dryness and treated in a retort; so yielding up the ammoniacal compounds contained therein, in case ammonia salts are employed, which are then condensed and used for preparing the bath for new treatments.
25 The residuum left in the retort after distillation will, if the process be correctly carried out and a sufficient degree of heat employed, be found to consist of nearly commercially pure oxide of nickel together with
30 any fixed alkalies employed, such as soda or potash, which can then be reduced to metallic nickel in any convenient manner; as for example, by mixing it with carbonaceous material and heating in crucibles or furnaces adapted for the purpose.
35

If desired, the solution of ammoniacal nickel salts obtained from dissolving in water the precipitate formed by the electrolytic action of the electric current, may be purified
40 by recrystallization, for the production of nickel salts for electroplating purposes; or they may be treated electrolytically for the production of metallic nickel, by any of the ordinary electrolytic methods.

45 The invention is not necessarily limited to the use of a bath of sulphuric acid, for the reason that any acid may be employed that will unite with the ammonia, soda or potash, to form an insoluble double salt of nickel and the alkaline base. Nor is the invention
50 necessarily limited to the use of sulphates of ammonia or the alkaline bases; for caustic alkalies and any other salts of the alkalies may be employed, that will unite with the acid in the bath to form a salt, which, in the
55 presence of nickel, will form an insoluble double sulphate of nickel and the alkaline base present therein.

I claim as my invention—

60 1. The method of separating nickel from the other metals salts of metals, and impurities combined therewith in nickeliferous bodies, consisting in purifying and concentrating when necessary; in forming the purified mass into suitable plates or shapes; in
65 immersing the plates or shapes in acids in

adding thereto sulphates of alkaline bases or other similar reagents in such quantities as not to interfere with the acid reaction, thereby forming a bath of such composition as to
70 dissolve the copper and nickel and retain the former in solution and form with the latter insoluble salts; in causing an electric current to traverse the bath from the nickeliferous body as anode, to a suitable cathode placed
75 therein, whereby the copper is deposited upon the cathode and the insoluble nickel salts precipitated to the bottom, and in separating the precipitated salts and subjecting them to further treatment.
80

2. The method of separating nickel from the other metals, salts of metals and impurities combined therewith in nickeliferous bodies, by immersing the same in acids in adding thereto sulphates of alkaline bases or
85 other similar reagents in such quantities as not to interfere with the acid reaction, thereby forming a bath of such composition as to dissolve the copper and nickel and retain the former in solution and form with the latter
90 insoluble salts; and in causing an electric current to traverse the bath from the nickeliferous body as an anode to a suitable cathode placed therein, whereby the copper is deposited upon the cathode, and the insoluble
95 nickel precipitated upon the bottom of the bath.

3. The method of separating nickel from the other metals, salts of metals and impurities combined therewith in nickeliferous
100 bodies, consisting in immersing the same in adding thereto sulphate of ammonia or other similar ammoniacal salts in such quantities as not to interfere with the acid reaction, thereby forming a bath of such composition as to
105 dissolve the copper and nickel and retain the former in solution and form with the latter insoluble salts; in causing an electric current to traverse the bath continuously from the nickeliferous body as anode, to a suitable
110 cathode placed therein, whereby the copper is deposited upon the cathode and the nickel salts are precipitated to the bottom of the bath; in collecting the precipitated salts, and dissolving the same in water, separating the
115 insoluble impurities contained therein; evaporating the solution to dryness and heating the residue in a retort, whereby the ammoniacal products are collected and condensed for further use, and the nickel residue refined
120 in any convenient manner.

4. The method of separating nickel from copper and other metals and impurities contained in nickeliferous bodies, consisting in
125 immersing the same in sulphuric acid in adding thereto sulphates of alkaline bases or other similar reagents in such quantities as not to interfere with the acid reaction, thereby forming a bath of such composition as to
130 dissolve the copper and nickel and retain the former in solution, and form with the latter insoluble salts; and in causing an electric current

to traverse the bath from the nickeliferous
body as anode, to a suitable cathode placed
therein, whereby the copper is deposited in
metallic form upon the cathode and the
5 nickel compounds are separated in the form
of salts at once available for nickel plating
purposes.

In testimony that I claim the foregoing as

my invention, I have signed my name, in pres-
ence of two witnesses, this 19th day of April, 10
1892.

PIERRE DEP. RICKETTS,

Witnesses:

WILLARD PARKER BUTLER,
EDWIN T. RICE, JR.