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SEPARATION OF NICKEL FROM COBALT
CONTAINING SOLUTIONS

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This invention relates to the separation of nickel from cobalt containing solutions.

According to one feature of the present invention, a solution containing Co and Ni is subjected to electrolysis with a mercury cathode.

If other metals are present, such as Cu, Cd, Zn, which have a cathodic potential lower than that of the Co under the operating conditions, such metals are also deposited preferentially, carrying with them a certain amount of Co which varies according to the initial ratio of Co to Ni plus all the said other metals of the solution.

The electrolysis is advantageously carried out with controlled cathodic potential and density of cathodic current. The lower the concentration in Ni and in the said other metals of the Co solution, the lower is the density used for the electrolysis.

The electrolysis may be advantageously carried out stepwise, the current density of each step being adapted to the concentration in the solution of Ni and other metals of lower cathodic potential than that of Co. The lower the said concentration, the lower is the density required.

The cathode may consist of a layer of mercury placed at the bottom of the electrolytic cell. It is also possible to use any arrangement increasing the surface of the cathode per unit of weight of mercury, for instance rotating discs partially immersed in liquid mercury.

The mercury containing the deposited metals may be withdrawn during the electrolysis and replaced by fresh mercury, either continuously or periodically.

The original solution is preferably, but not necessarily, of high concentration (for instance 50 grams of metals per liter) and contains the Co, Ni and the other metals previously mentioned in the form of soluble salts, such as sulfates, the anion of which does not produce harmful secondary reactions.

The presence of cations capable of reacting with metallic mercury, is preferably avoided.

The electrolyte and the mercury are preferably maintained in motion.

At the lower ratios of Ni plus the said other metals relatively to Co, the temperature is maintained above 50° C.

The solution to be treated is preferably maintained acid; its acidity may vary within wide limits.

Use may be made either of an insoluble anode, such as Pb or graphite, or of a soluble anode, containing Co and possibly Ni and/or other other metals. In the latter case it may be neces-

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sary to separate the anodic and cathodic compartments by means of a diaphragm.

The elimination of the said metals from the cobalt solution may be carried out more or less completely, at will; as to Ni for instance, a ratio Ni/Co of 0.05/100 or less may be obtained.

The extraction of the deposited metals from the mercury cathode may advantageously be carried out electrolytically by using the said mercury as the anode, the mercury being thus regenerated.

The said extraction of Ni, Co and the said other metals may be carried out selectively with controlled anodic potential. It is possible to extract successively Ni with a little amount of Co which has been carried over and then the remaining Co, without redeposition of the metals at the cathode by maintaining conditions which are favourable to a lowering of the potential of deposition of hydrogen, that is facilitating the evolution of hydrogen, for instance by the use of a copper cathode which has been coppered by electrolysis so as to have a rough surface.

The anode of amalgam may be placed at the bottom of the electrolytic cell. It is also possible to use any arrangement increasing the surface of the anode, such as rotating discs partially immersed in liquid mercury.

The mercury, freed from the metals deposited thereon, may be withdrawn and replaced by the amalgam to be treated, either in a continuous or in an intermittent manner.

It is also possible to extract separately the metals of the amalgam by passing the latter through a succession of cells, each of which works with an anodic potential and with a current density at the anode which are adapted to the separation of a given metal.

The electrolyte and the upper layer of the amalgam are maintained in motion.

The temperature is preferably maintained above 75° C.

Use may be made as the electrolyte, of an acid solution, such as normal H₂SO₄.

Examples

1. A solution containing 0.6 gr. Ni and 30 gr. Co per liter (that is a ratio Ni/Co=2/100), as sulfates with a pH=3, is electrolysed with a mercury cathode and an argentiferous lead anode (5% Ag). The electrolyte is maintained at 65° C. and is continuously stirred as well as the cathodic mercury. The cathodic current density being maintained at 27A/m², the ratio Ni/Co in the solution is brought down to 0.2/100. The electrolysis being afterwards continued with the same

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current density, the ratio Ni/Co in the solution becomes 0.02/100.

The amount of Co deposited together with the Ni corresponds to 3 parts Co per 1 part Ni when the ratio Ni/Co is brought down to 0.2/100, and to 6.5 parts Co per 1 part Ni when the ratio Ni/Co is brought down to 0.02/100 from 2/100.

2. The recovery of Ni and Co from an amalgam containing 0.11% Ni and 0.09% Co is carried out electrolytically at 75° C. with continuous stirring, by using the amalgam as the anode, and a N-sulfuric acid solution as the electrolyte. The anodic current density is maintained at 12.5 A/m.² during the first step of the electrolysis, during which the major part of the Ni is extracted with only 2 parts of Co for 100 parts of Ni. After removal of the obtained Ni solution and the removal of the electrolyte, the Co is extracted practically free from Ni, with an anodic current density increased to 45 A/m.².

I claim:

1. In a process for the separation of nickel from aqueous solutions of acid reaction containing cobalt and nickel in the form of soluble salts whose anions do not produce harmful secondary reactions, the steps which comprise heating the said solution to above 50° C., electrolyzing the heated solution with a mercury cathode while controlling the cathodic current density to deposit nickel with very little cobalt on the mercury cathode to form an amalgam, and separating the amalgam from the solution containing the major part of the cobalt.

2. In a process for the separation of nickel from an aqueous solution of acid reaction containing cobalt and nickel in the form of soluble salts whose anions do not produce harmful secondary reactions, the steps which comprise heating the said solution to about 65° C., electrolyzing the heated solution with a mercury cathode while controlling the cathodic current density to de-

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posit nickel with very little cobalt on the mercury cathode to form an amalgam, and separating the amalgam from the solution containing the major part of the cobalt.

3. In a process for the separation of nickel from aqueous sulfate solution of cobalt and nickel of a pH of about 3, heating the said cobalt-containing solution to about 65° C., electrolyzing the heated solution with a mercury cathode while controlling the cathodic current density to deposit practically the entire amount of nickel contained in the solution with very little cobalt on the mercury cathode to form an amalgam, and separating the amalgam from the solution containing most of the cobalt.

4. The process as claimed in claim 3 followed by electrolyzing the mercury amalgam by employing it as an anode in an electrolyte at a temperature of about 75° C., while controlling the anodic potential and the current density to separate the nickel from the mercury amalgam.

5. A process as claimed in claim 3, in which the electrolyte and the mercury are maintained in motion.

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