UNITED STATES PATENT OFFICE.

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PROCESS OF RECOVERING NICKEL AND COPPER FROM ORES AND MATTES.

947,791 Specification of Letters Patent. Patented Feb. 1, 1910.

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To all whom it may concern:

Be it known that I, ADOLPHE CHALAS, a citizen of the French Republic, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Recovering Nickel and Copper from Ores and Mattes, of which the following is a specification.

This invention is a two-stage process of recovering nickel and copper as oxids, especially from nickel-copper-iron sulfid ores, such as are found in Canada, by first producing anodes of nickel-copper and then electrolytically parting the alloy by a cyclic operation.

In the first stage of the process, the nickel-copper matte from pyrrhotite smelting is bessemerized to slag off the iron and to concentrate the nickel-copper contents to about 80%. The resulting rich matte is then roasted to convert it into oxids of nickel and copper, which are finally reduced, with production of an alloy of nickel and copper. The reduction may be effected in a coke, gas, or preferably an electric furnace. The resulting nickel-copper alloy is then cast into anodes.

In the second stage of the process, the nickel-copper anodes are placed in an electrolytic cell, No. 1, having sheet cathodes of nickel, copper or iron, and containing as an electrolyte an aqueous solution of an alkali-metal salt, for example sodium chlorid. The anodic and cathodic solutions are separated by a diaphragm. As electrolysis proceeds, nickel and copper are dissolved from the anodes as chlorids, while a sodium hydroxid solution is produced at the cathode. During electrolysis, the solution is continuously circulated from the anodic compartment of the cell through a filter, No. 1, containing a body of precipitated nickelous (cuprous) hydroxid, which reacts upon the dissolved copper chlorid with production of dissolved nickel chlorid and precipitation of copper hydroxid. The solution, thus freed from copper and containing an additional amount of nickel equivalent to the removed copper, is mixed with the alkali solution which continuously flows from the cathodic compartment of the cell. These two solutions when mixed react with the production of pure nickelous hydroxid, which precipitates, and sodium chlorid brine. The brine, carrying the precipitate in suspension, is circulated through a filter, No. 2, which retains the pure nickelous hydroxid, the clear solution being returned to the cell to regenerate the electrolyte. When the nickel hydroxid in filter No. 1 has been completely dissolved and replaced by precipitated copper hydroxid, the stream of electrolyte from the anodic compartment of cell No. 1 is diverted to a filter, No. 3, which has been filled with fresh precipitated nickelous (cuprous) hydroxid, and the first filter is emptied, cleaned and refilled. When filter No. 2 has been filled with pure nickel hydroxid, it is also replaced by another and is emptied and cleaned for subsequent use. The pure copper hydroxid from filter No. 1 and the pure nickel hydroxid fom filter No. 2 may be merely dried or calcined to give pure copper and nickel oxids.

The nickelous (cuprous) hydroxid used in filter No. 1 for the precipitation of copper is produced by directly mixing the anodic and cathodic solutions flowing from an electrolytic cell No. 2, identical with cell No. 1, so that nickel and copper hydroxids precipitate together. The brine, carrying the precipitate in suspension, is circulated through a filter, No. 3, which retains the mixed hydroxids, the clear solution being returned to cell No. 2 to regenerate the electrolyte. The nickelous hydroxid in the mixed precipitate, alone, enters into reaction with the anodic solution drawn from cell No. 1.

Commercially, five filters or sets of filters are preferably employed, which are worked in rotation: Filter No. 1 containing nickel-copper hydroxid is used in the second stage of the process, while filter No. 2 is being filled with nickel hydroxid free from copper, and filter No. 3 is being filled with nickel-copper hydroxid. Filter No. 3 is then substituted for filter No. 1, an empty filter, No. 4, is used to replace No. 2, and the last filter, No. 5, is filled with nickel-copper hydroxid in sequence with No. 3, the process being cyclic and the reagents continuously regenerated.

I claim:

1. The process of treating nickel-copper ores, which consists in smelting the ore and producing nickel-copper anodes, electrolytically dissolving the anodes, and continuously precipitating the dissolved copper by circulating the nickel-copper solution from the electrolytic cell in contact with a nickeliferous reagent.

2. The process of treating nickel-copper ores, which consists in smelting the ore and producing nickel-copper anodes, electrolytically dissolving the anodes in a diaphragm cell containing a solution of an alkali-metal salt, continuously precipitating the dissolved copper by circulating the anodic nickel-copper solution from the cell in contact with a nickeliferous reagent, and mixing the purified anodic nickel solution and the cathodic alkali solution thereby precipitating the nickel.

3. The cyclic process of parting nickel and copper, which consists in electrolytically dissolving nickel-copper anodes, continuously precipitating the dissolved copper by circulating the nickel-copper solution from the electrolytic cell in contact with a body of nickel-copper hydroxids, electrolytically dissolving other nickel-copper anodes in a diaphragm cell containing a solution of an alkali-metal salt, mixing the anodic nickel-copper and cathodic alkali solutions from said second cell thereby precipitating the dissolved nickel and copper as hydroxids, and employing the body of mixed hydroxids as the precipitating agent for the copper in the solution from the first cell.

4. The cyclic process of parting nickel and copper, which consists in electrolytically dissolving nickel-copper anodes in a diaphragm cell containing a solution of an alkali-metal salt, continuously precipitating the dissolved copper by circulating the anodic nickel-copper solution from the cell in contact with a body of nickel-copper hydroxids, mixing the purified anodic nickel solution and the cathodic alkali solution thereby precipitating the nickel, electrolytically dissolving other nickel-copper anodes in a second diaphragm cell containing a solution of an alkali-metal salt, mixing the anodic nickel-copper and cathodic alkali solutions from said second cell thereby precipitating the dissolved nickel and copper as hydroxids, and employing the body of mixed hydroxids as the precipitating agent for the copper in the solution from the first cell.

5. The cyclic process of parting nickel and copper, which consists in electrolytically dissolving nickel-copper anodes in a diaphragm cell containing a solution of an alkali-metal chlorid, continuously precipitating the dissolved copper by circulating the anodic nickel-copper solution from the cell through a filter containing a body of nickel-copper hydroxids, mixing the purified anodic nickel solution and the cathodic alkali solution thereby precipitating the nickel as hydroxid, separating the nickel hydroxid from the mixed solutions by a second filter, electrolytically dissolving other nickel-copper anodes in a second diaphragm cell containing a solution of an alkali-metal chlorid, mixing the anodic nickel-copper and cathodic alkali solutions from said second cell thereby precipitating the dissolved nickel and copper as hydroxids, separating the nickel-copper hydroxids from the mixed solutions by a third filter, replacing the first filter when filled with copper hydroxid by the third filter, replacing the second filter when filled with nickel hydroxid by a fourth empty filter, and filling a fifth filter with nickel-copper hydroxid to replace the third filter.

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

ADOLPHE CHALAS.

Witnesses:
N. P. LEONARD,
E. DANIELS.