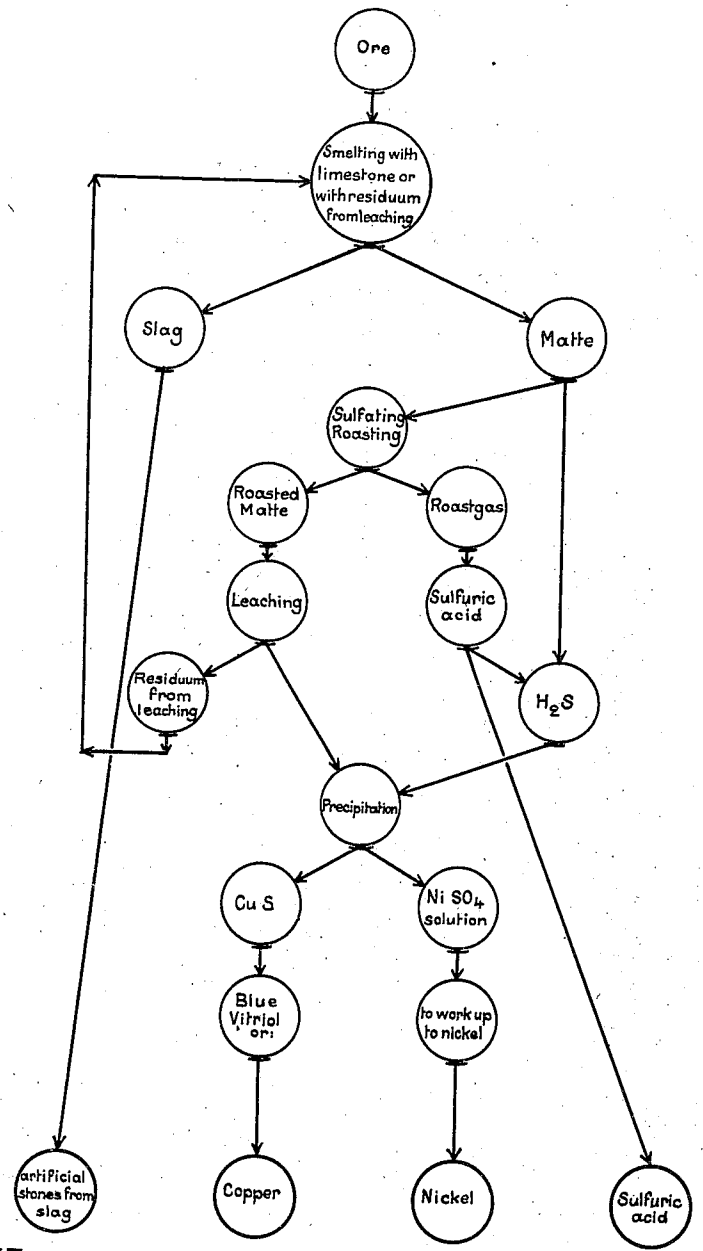
W. BORCHERS & H. PEDERSEN.

EXTRACTION OF COPPER AND NICKEL, PARTICULARLY FROM LOW GRADE ORES AND PRODUCTS.

APPLICATION FILED JUNE 5, 1912.

1,101,115. **Patented June 23, 1914.**



WITNESSES

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WILHELM BORCHERS, OF AACHEN, GERMANY, AND HARALD PEDERSEN, OF TRONDHJEM, NORWAY.

EXTRACTION OF COPPER AND NICKEL, PARTICULARLY FROM LOW-GRADE ORES AND PRODUCTS.

1,101,115. Specification of Letters Patent. Patented June 23, 1914.

Application filed June 5, 1912. Serial No. 701,859.

To all whom it may concern:

Be it known that we, Dr. WILHELM BORCHERS, professor, a subject of the German Emperor, and resident of 15 Ludwigsallee, Aachen, Germany, and HARALD PEDERSEN, engineer, a subject of the King of Norway, and resident of Trondhjem, Norway, have invented certain new and useful Improvements in the Extraction of Copper and Nickel, Particularly from Low-Grade Ores and Products; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the process described in our prior Letters Patent No. 1,043,291 of November 5th 1912 for the extraction of nickel and copper from ores or by-products containing the sulfids of these metals together with iron and copper by a combination of smelting, roasting, leaching and precipitating operations. It has now been found that this process can be appreciably simplified in its latter stages.

The present improved process is carried out in the following manner and as diagrammatically represented in the accompanying drawing:

The first operations:—

1. Smelting the ore,
2. Roasting to sulfates,
3. Leaching with acidulated water,
4. Utilizing the leaching residue in the ore smelting operation, remain as described in the specification of the said prior patent. The working principle of the main process, of first extracting the copper and nickel together from the ore, in a solution, thus remains as before. The succeeding stages are, however, varied as follows.

5. From the lye obtained from operation 3, the copper alone is precipitated as sulfid by means of sulfureted hydrogen; this latter can be obtained from a portion of the crude matte by means of sulfuric acid.

$$CuSO_4+H_2S=CuS+H_2SO_4.$$

6. The copper sulfid obtained in this way is filtered, dried and then converted by any known method into metallic copper or copper vitriol (blue vitriol), for instance by smelting it with copper oxid

$$CuS+2CuO=3Cu+SO_2,$$

or by oxidizing it

$$CuS+4O=CuSO_4.$$

7. The nickel sulfate solution is evaporated and allowed to cool and crystallize, yielding nickel sulfate and a mother liquor, which latter may be utilized in the leaching operation 3 or returned to the roasting operation 2.

8. The nickel sulfate obtained from operation 7 is completely dried and roasted until it decomposes into nickel oxid, sulfuric acid, and sulfur trioxid, which two latter may be returned to the roasting operation 2.

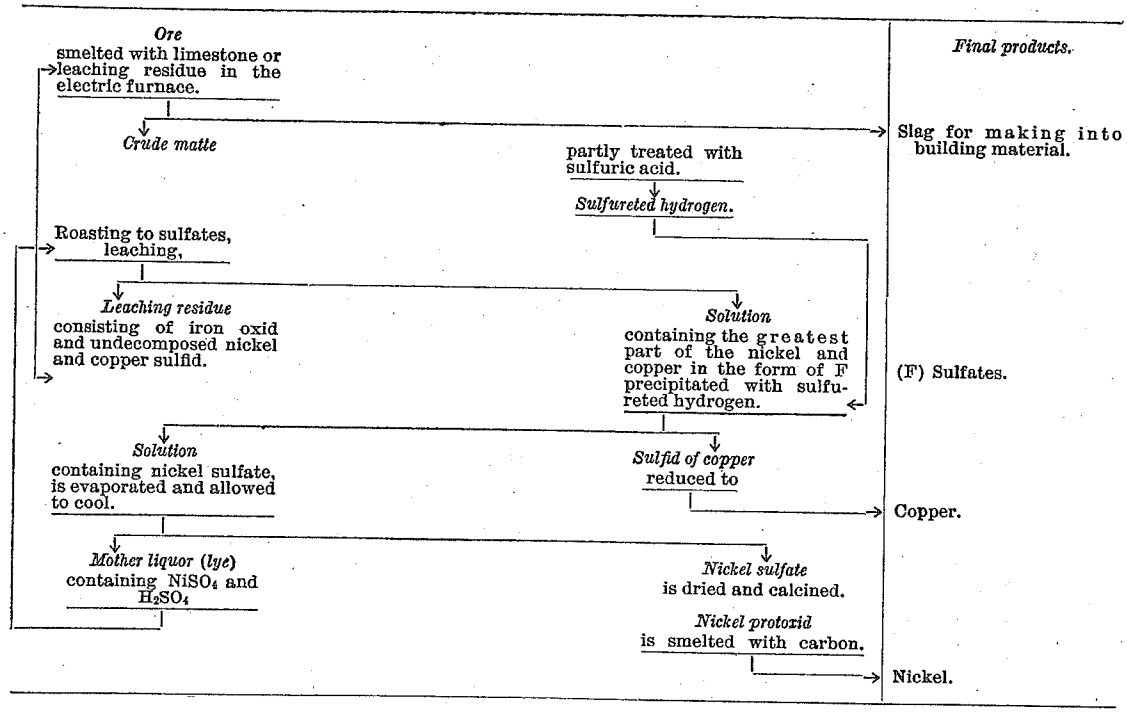
9. The nickel oxid obtained by the operation 8 is reduced to metallic nickel by smelting in the known manner, viz., by reduction with carbon and carbon monoxid in crucible-, muffle-, or electric-furnaces:

$$NiO+C=Ni+CO,$$
$$NiO+CO=Ni+CO_2.$$

The simplification of the process will become even clearer on comparing the following tabulation with the similar summarizing of the main process. By splitting up the nickel sulfate into protoxid, sulfuric acid and sulfur trioxid, instead of precipitating it by means of sulfids as in the process, described in the prior patent aforesaid, the preparation of the precipitating agent (sodium sulfid), the addition of the limestone flux, and the formation of a waste

product (gypsum) are avoided. Acid gases are, however, evolved, which accelerate the roasting operation 2, but which, however, increase the yield of sulfuric acid from this operation if it be desired to treat the waste gases for the manufacture of sulfuric acid.

Synopsis of the improved process.



Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The process for extracting nickel and copper from ores and the like containing sulfids, which comprises smelting the ore to a matte, roasting the matte, leaching the roasted material with acidulated water, precipitating from the resultant sulfate solution the copper by means of hydrogen sulfid, converting the precipitate into metallic copper, evaporating the residual nickel sulfate solution, roasting the dried nickel sulfate to convert the same into nickel oxid, and finally reducing the same to metallic nickel.

2. The process of separating copper and nickel from sulfate solutions of the same, which comprises precipitating the copper from said solution with hydrogen sulfid, separating the copper sulfid and reducing the same to metallic copper, evaporating the residual nickel sulfate solution, heating the residual nickel sulfate to convert the same into nickel oxid, and reducing said nickel oxid to metallic nickel.

3. The process for the extraction of nickel and copper from ores and the like containing sulfids which comprises forming from the said ores a solution of the sulfates of nickel and copper, precipitating and separating the copper as sulfid from the solution by means of sulfureted hydrogen, evaporating the nickel sulfate solution, roasting the resultant nickel sulfate to convert the same into nickel oxid, and finally smelting the nickel oxid to reduce the same to metallic nickel.

In testimony whereof we have affixed our signatures, in presence of witnesses.

DR. WILHELM BORCHERS.
HARALD PEDERSEN.

Witnesses:
KARL BOONEMANN,
KARL WAGENMANN,
JOHN SKREDDER,
JENS JENSEN.