solution appear clear. It is well to shake or stir solution more than once and warm before filtering, as there is a point in remperature of solution, and also quantity of H. S. at which arsenic is more readily precipitated, and if over gassed this point is more easily obtained by allowing solution to stand on a hot slab for some time before filtering. Even with great care, however, if arsenic is present in excess of copper some arsenic is likely to remain in solution, but this is gotten rid of by next operation. Filter on rapid brown or white paper, leaving precipitated sulphides on paper and wash thoroughly with five or six waters-hot water hastens the operation-allowing waters to pass into large greaker or flask with filtrate which will contain all the nickel and cobalt and iron, together with zinc and manganese if any present. As these two latter metals are rarely met with in association with ^{nickel} ores of commercial value. Although manganese is often found associated with with cobalt, we will act as though they were not present and treat with them later on, and proceed to separate the iron.

Boil filtrate until all Hy. S. is driven off, adding a little chlorate of potash to bring iron to a state of per oxide. If arsenic be not all precipitated by the last treatment, some will be seen to precipitate on boiling, and the balance will be precipitated with the iron as arsenate of iron. Proceed as follows:

Add slight excess of animonium hydrate, precipitating all the iron, then add hydrocloric acid at first rapidly and then drop until nearly all the iron is re-dissolved, leaving solution nearly neutral with just a trace of iron still precipitated, then add acetate of soda in excess and bring to a boil when all iron will be precipitated; filter into large breaker, wash once and redissolve iron, placing filter paper and contents in fiask with Hcl., dilute acording to amount of iron present, and re-precipitate in same manner; filter on another paper. test second filtrate with ammonium sulphide, and if containing any nickel add to first filtrate (washing thoroughly), if not it can be discarded. Where a large percentage of iron is present it is usual to find a little nickel and cobalt in first precipitate.

Warm filtrate, which by this time has become rather bulky, add one or two spots of ammonium hydrate, and pass strong current of Hy. S. through solution, which will precipitate nickel and cobalt as sulphide in a very short space of time, care being taken not to have a large excess of Hy. S. or ammonium ^{sulphide}, which will retain some of the nickel and cobalt in solution; allow precipitate to settle, and filter on white Swedish paper while hot, wash with water through which Hy. S. has been passed. This operation should be carried on quickly, keeping the nickel sulphide covered with solution, or gassed water until operation is finished, otherwise if precipitate is allowed to stand and become nearly dry before operation is finished some will pass through filter paper on adding ^{remainder.}

We have now on the filter paper nickel and cobalt sulphide together with zinc and manganese if any present; dry thoroughly; remove the filter from the funnel, and burn in platinum dish, thoroughly removing all organic matter from the paper. Brush the oxides now formed into a small breaker, add Hel. and one or two spots of Hnds. (to dissolve any sulphide still remaining) cleaning out the platinum dish by heating with Hel., which add to the main bulk -cover with watch glass and heat gently when all nickel and cobalt will be in solution. Precipitate the whole with caustic potash, add excess of acetic acid and then nitrate of potash; stir occasionally with glass rod and allow to stand for eight or ten hours covered with watch glass, when cobalt will be seen to precipitate and on addition of potassium nitrate will settle to the bottom. Decant the major portion of nickel off the precipitate cobalt, and filter on washed white paper, washing with two waters as gently as possible. Add excess caustic potash to nickel solution precipitating on the nickel, filter wash well. Now we have the two metals as precipitates, the nickel as oxide, the cobalt as double nitrate of cobalt and potash.

Although up to this point Fresenins and others employ practically the same method as the foregoing, the next operation I have never seen in print. It is as follows:

For Nickel.-Dissolve precipitate with dilute Hcl., dilute slightly, add slight excess of ammonia, which will precipitate any iron carried through mechanically or gathered during different operations; filter and wash thoroughly, care being taken to avoid bulky solution as concentrated as possible; add Hcl. to filtrate drop by drop until litmus paper is very slowly turned from blue to red (care being taken not to have an excess of acid which would render the next operation dangerous) and titrate with a standard solution of cyanide of potassium about one per cent strength, that is I c.c. of Kly solution-one per cent nickel, at first quickly until solution shows alkaline on testing with litmus paper, when a precipitate will be formed and then slowly until all the precipitate is dissolved, which finishes the operation.

Treat cobalt precipitate in the same manner.

The standard Kcy. solution used for titrating copper will do for the nickel and cobalt, the ratio being as follows: Ni. 100, Co. 0. 1053, Cu. 92.3, but it is well to check by standardizing solution with pure electra deposited metallic nickel; and for cobalt using chemically "prepared" oxide of cobalt (Co. 0) not the "black" oxide (Co. 2, O. 3).

This method of titrating is more accurate if properly manipulated than estimating the precipitated nickel as oxide, and check samples should not very more than 0.01 per cent. I-100 per cent. By this method nickel can be made in the absence of cobalt or if estimating together as nickel, in one day; if separately, requires a day and a-half, as cobalt must have time to settle.

In the event of zinc being present treat by one of the following methods:—

First—For alloy, volatilize zinc in charcoal lined crucible until constant.

Second—If an ore of nickel containing zinc in any quantity let the two proceed together, and a precipitating nickel with caustic potash a great deal of the zinc will be re-dissolved and thus got rid of; wash the nickel oxide well, dry, ignite reduce with carbon, and melt to metallic nickel, and the remaining zinc will be volatilized.

Third—In cases of small traces of zinc, titrate in the usual manner as hereinbefore described, add excess of cyanide of potassium and little ammonia, then add sulphide of sodium or ammonium and boil. Any zinc will be precipitated, as well as manganese.

A rich zinc ore is very unlikely to contain nickel, and if it does the nickel contained would be of practically no commercial value, unless recovered from retort residues after treatment of the ore for zinc.