DESCHENES REFINERY OF THE BRITISH AMERICA NICKEL CORPORATION.

Note: The order followed in the description of the plant is, in a general way, that of the materials in process of treatment. The order in which the different departments will be visited is, however, that of the paragraph numbers, which also indicate where the corresponding groups will start.

9. Cementation: Granulated matte from Nickelton smelter of B.A.N.C. (Ni 53, Cu 28, S 18, Fe 0.25) is screened through 10 mesh and sent to cementation tanks for precipitation of Cu from Ni electrolyte. Foul solution (Ni 48 g.p.l., Cu 2) passed through series of tanks until clean (Ni 50 g.p.l., Cu 0.001), then to heat interchange, head tank and electrolytic deposition tanks. Cemented matte (Ni 44, Cu 38) from cementation tanks to roasters.

2. Roasting: In two 8-hearth Wedge roasters, 22 ft. 6 in. diam., oil-fired, capacity 15-20 tons each. Roasted matte screened, oversize crushed and returned to roasters, fines (S 1 - 2) fall hot into launder through which leaching solution conveys them to leaching tanks.

3. Leaching: Carried out in six lead-lined tanks 22 x 18 x 5 ft., with filter bottoms, capacity 90-100 tons matte each. Leaching solution (30 g.p.l., Cu, 80 H_2SO_4) enters with roasted matte feed. Circulated till easily soluble Cu removed from matte, then sent through clarifying cone to head tank and electrolytic deposition tanks. Leached matte given two washes, excavated and sent to anode-making department.

4. Cu Deposition: Electrolysis in 18 "nests" of six-lead-lined tanks each. Solution (Cu 50 g.p.l., H_2SO_4 50) is fed to the first of a series of three tanks in cascade, going down a shield to the bottom and overflowing from the top of each tank to prevent segregation. Overflow from third tank of series is leaching solution. Each tank has eight cathodes (pure Cu, from starting-sheet section) and nine lead anodes. Current density 15-25 amps. per sq.ft. Satisfactory voltage is 2.2 per tank. Cathodes removed when weighing 125-150 lb. each, washed and sent to Rennerfelt furnace to be melted into ingots.

Part of the leaching solution (spent electrolyte) is continuously removed and electrolyzed in tanks with slow circulation to remove practically all copper. Then sent to evaporators followed by tanks for the crystallization of $NiSO_4.7H_2O$. This is to remove Ni from Cu electrolyte. Mother liquor, high in acid, returned to leaching system.

1. Anode Furnaces: Leached matte excavated and sent to anode plant, where mixed with limestone, sandstone and coke to produce slag of 6-10 Ni, 3 Fe, 40 SiO_2, 35 CaO. Two-anode resistance furnaces of type developed in Norway, using three-phase current at 30-70 volts. Voltage regulation by changing connection on high tension side of transformer. Total power may vary between 400 and 1600 kw. Each furnace has three vertical carbon electrodes 24" in diam. Partly used electrodes connected to new ones by carbon nipples 18" long and 12" diam. Charge fed from top through hoppers on each side of electrodes. Anode metal and slag tapped intermittently into brick-lined tilting ladle from which metal is poured into open cast-iron molds which pass on cars in front of furnaces. Metal contains about 68 Ni, 26 Cu, 0.25 Fe.

8. Ni Deposition: In lead-lined tanks placed in pairs, not in cascade, each containing 36 anodes and 35 cathodes. Latter are iron plates 24" x 36". Anodes suspended in bags to catch slimes, cathodes in bags (Hybinette patent) consisting of wooden frames with treated canvas on each side, acting as diaphragms. Cathodes spaced 8" c. to c. They are painted with graphite to assist in stripping. Current density about 8.5 amps. per sq.ft. Voltage about three. Pure Ni electrolyte from cementation tanks (9) fed to cathode bags through rubber tubes from lead header at a rate to maintain a head over level in anode compartment of 1-1.5 in. This is to prevent anolyte containing Cu from coming in contact with cathodes and so contaminating Ni. Anolyte sent to heat interchange where warmed by solution from cementation tanks, then goes through the cementation tanks (9) for purification, and finally passes through heat interchange again to cool it before its return to the electrolytic tanks as catholyte. There is no accumulation of harmful impurities, therefore no discarding of solutions. Ni sheets stripped from cathodes about every 10 days, when they weigh some 30 lb. each. Washed in hot dilute sulphuric acid and cut into small squares for shipment.

5. Steam Plant: Two B. & W.boilers of 500 h.p. each, equipped with B. & W. chain grate stokers. Slack coal conveyed from track hopper outside building to pivoted bucket conveyor, which delivers it to suspended hoppers, from which it is drawn to stokers. Same conveyor removes ashes to bins. Boilers average 8.1 lb. water evaporated per pound coal, operating at part capacity.

6. Heating Plant: While plant is shut down much surplus electrical energy used to heat various buildings. Done in two ways. (1) Iron pipes 2" to 5" diam. conduct current directly to Cu tank-house and Ni tank-house, acting both as conductors and resistors. Use 3-phase current at 75 volts for about 1400 kw. (2) Office buildings heated by steam generated by electrical power in steel tank 10 x 40 ft. Tank contains three 4-inch iron pipes 38 ft. long, set 1" apart. Uses 3-phase current at 80-330 volts, or 300-1100 kw. To start, a little soda was added to water used as resistor, but none now necessary. Only precaution is that 1/3 to 1/2 of solution in tank be retained when partly emptied every two weeks. Steam at five lb. simply passes into pipes of former heating system.

7. Sus-Station: Power supplied from Ottawa at 11,000 volts over two independent 3-phase lines. Equipment in main substation consists of five sets of three multiple transformers, each set supplying a Westinghouse synchronous booster converter, and one transformer stepping down to 2200 volts for distribution around plant to five other sets of transformers supplying motors at 550 volts and lights at 110. Four of the converters supply four electrolytic tank circuits with up to 4000 amps. each, at 50-290 volts, one is kept in reserve. In the main sub-station is also an emergency generator of 1250 k.v.a. capacity, driven by a steam turbine. This is arranged to synchronize with the incoming power, so that it may be run in parallel with the other machines.

--oOo--

Flow-Sheet, British America Nickel Refinery

(Note: Numbers refer to paragraphs in the description)