

plant, three Holthoff-Wethey calcining furnaces, two briquetting plants, a good roast yard, assay office, water supply, etc.

At present almost all the Rossland ore is treated at the Canadian Smelting Works at Trail.

The Trail smelter is a combination copper-lead plant, with a lead-silver-gold refinery. If, as is planned, a copper converting plant be added, it will be one of the most self-contained copper-lead reduction plants on the continent. In addition to Rossland ores, it treats high-grade Boundary, Kamloops, Slocan, Lardreau and East Kootenay ores, together with some small amounts from the adjoining States. Besides ores and concentrates the works can handle mattes, bullion, cyanide, and mill products. The refined gold is sold to the United States assay office, pending the establishment of a mint in Canada. The greater part of the silver is disposed of in China. The lead, which is an exceptionally pure product, finds a market in Canada, China and Japan, and, to a limited extent, in Australia. Copper sulphate, which is produced as a by-product, is sold in the Northwest provinces. The copper matte is sold to refineries in the United States.

The plant is operated by electricity obtained from Bonnington Falls. It consists of copper and lead sampling mills, roast yard, two buildings with hand roasting furnaces, one with six Bruckner roasting cylinders, and one with two double-hearth mechanical roasting furnaces. The blast furnace building contains four rectangular copper furnaces with a capacity of about 1,500 tons of charge; a large furnace 22 ft. by 42 in., is being added to treat the high grade matte. There are also two lead furnaces and a third one is ordered. There are two briquetting machines, a well equipped blower-room, with motors and an auxiliary Corliss engine, a power and lighting plant, assay laboratory, machine and boiler shops, water supply, electric locomotives for handling the materials, etc. In all, there are forty buildings connected with the smelter, and in addition five belonging to the refinery.

The refinery is the first electrolytic lead refinery in the world. It contains a lead melting room with two 30-ton melting pots—one for the base bullion, which is cast into anodes, and one for the refined lead. There is a tank room with 180 tanks, in which the base lead of the anode is dissolved in an electrolyte of hydro-fluosilicic acid and lead fluosilicate, and deposited on the cathode, a thin, starting sheet of pure lead. This room has a capacity of 51 tons of refined lead per day. The slimes left from the anode go to the silver building, where they are melted in a reverberatory furnace to dore bars, and then parted with sulphuric acid and the silver is precipitated and cast into bars, .999 fine. The gold left in the parting kettles is melted into bars .995 fine. The solution of copper sulphate resulting from the precipitation of the silver goes to the copper sulphate building where it is crystallised.

The process of copper smelting as conducted in Northport and Trail differs but slightly. In the Trail smelter the present practice is to mix the crude ore

with limestone and coke and to smelt to a low grade matte; this is granulated, roasted in the mechanical furnaces and briquetted with 5 per cent of lime as a binder; the briquetted matte, together with certain ores, is re-smelted to a high grade matte, which is shipped to the refineries. For the initial smelt the charge is about 1,500 lb. Rossland ore, 500 lb. limestone and 275 lb. coke. The matte-fall is from 10 to 14 per cent, and the matte contains about:

6 to 8% Cu, 24% S, 50% FeO. The slag runs 42 to 44% SiO<sub>2</sub>, 17½% FeO, 17½% CaO, 15 to 16% Al<sub>2</sub>O<sub>3</sub>, 0.15 to 0.20 oz. Au, 0.01 to 0.04% Cu.

For the high grade smelt the charge is 1,000 lb. roasted and briquetted matte, 400 lb. of crude Rossland ore, 300 lb. heap-roasted Rossland ore, and 300 lb. siliceous ore. The matte-fall of about 8 per cent gives a matte of about 42 per cent copper and 16 to 20 oz. gold. The slag runs:

50.07% FeO, 38% SiO<sub>2</sub>, 4.7% CaO, 0.02 oz. Au, 0.1 oz. Ag, and 0.4% Cu.

This practice was adopted after experiments along the lines followed at Mount Lyell, Tennessee Copper Co., and other points, of concentrating first to a high grade matte, say 20 per cent, and then re-smelting with siliceous ore, low in sulphur, and, if possible, high in copper, by this means avoiding the danger of loss in granulation, and the costs of roasting and briquetting.

With the Rossland ores, which are so low in copper, high in gold (which prevents running too siliceous a slag), low in sulphur (which is in the form of pyrrhotite), and high in silica and alumina, it was found impracticable to run the low grade matte to a high without roasting, or to produce a high grade matte on the first concentration.

#### CONCENTRATION.

The problem of concentration has received considerable attention during the last three years, and five mills have been erected in or near the camp.

(a.) There is a large amount of ore in and about Rossland that is too low in grade for profitable handling even with the present low cost of smelting, but which, if some cheaper method of extracting the values were found, would greatly increase the output of the camp and help many properties that, under present conditions, do not promise immediate success. For such ores, concentration has been proposed.

(b.) In the operating mines the ore in a stope frequently becomes lower in value or spotty. This poorer material, which is broken down with the good ore and which may be too low grade to send to the smelter, amounts in some cases to a considerable tonnage.

(c.) The vein may contain poor material, which, if it could be made to pay costs of extraction, would be mined in the hopes of good grade material being encountered, for, in the same way as good material may suddenly become poor, this poorer material may suddenly become rich, and the mining of such matter would undoubtedly lead to the discovery of good pay shoots. It has been mainly for the purpose of meeting cases (b) and (c) that experiments have been