

ing are not hindrance in making other lead products, as litharge, red lead, etc.

It will not pay to carry the lead to water power and back, nor will it pay to bring current across wooded mountains amidst the vicissitudes of winter. Vancouver has coal near at hand, cheaply laid down on any of her extensive salt water frontages; coke ovens are constantly at work; wood, girdled and killed by fire, standing up as far as eye can reach around the city in hundreds of thousands of tons, on slopes to salt water navigation, can be had for the labour of getting. In this abundance of cheap fuel lies the certainty of cheap power on any desired scale, not through steam, but by producing "water gas" by the improved and now assured European methods to operate gas engines of large cylinder. By these engines the largest powers can be developed with great economy at a cost for power not exceeding one-fifth of that by steam, and by a cost of plant not one half of the corresponding steam plant. There is also developing petroleum of good quality which must find its way to Vancouver at low price. Engines are now making using gas from crude petroleum, from a small generator alongside the engine which give one horsepower per hour by consuming one-ninth of a gallon of petroleum—value, three cents a gallon. These engines may be seen in constant use; they are made from four horsepower to 125, set in pairs with a centre fly-wheel, giving 250 horsepower, very steady for running dynamos. By the best European gas generators, any quality of fuel can be consumed. They are uncostly to build, are not large, and anywhere that fuel is cheap, large powers are easily provided and attended. This arrangement for power removes the difficulty attending all electric work in Vancouver or generally in B. C. where it may be said that there is a combination of much to refine, little refined, and power to refine at very low cost—assuring to capital a steady unceasing income.

But refining goes after ore reduction. Ore must be made to pay reducing expenses. The conditions attached to lead mining in B. C. are very disjointed. Figure on 20 per cent. lead ores—leave silver out of mind. The present London value of lead contained in this ore is nearly \$10, and this has to pay \$11 smelting charge, and freight to market. Take ore of 45 per cent. content of lead. The lead is worth at London price \$22.30. The smelting charge on this is \$16. Balance, \$6.30. This sum has to bear the cost of concentrating and its loss of silver in slimes; and the freight to market. To refine this gives the miner all the silver contained, to get which costs him in refining (900 lbs. at \$12 a ton) \$5.40, leaving him 90 cents per 900 lbs. of metallic lead production. Not a fat trade! The Government will add \$15 on the lead per ton smelted, and \$4 per ton on the lead refined—until the appropriations are exhausted. The taxpayer has to bear this bolstering up of business. It is a poor grovelling way. A better should be in work before the term of the bounties becomes exhausted.

The first step of the better way undoubtedly is to concentrate the ores as rich as they will bear with little loss. Take now the money—result from lead ore concentrated to 65 per cent.—which is equal volumes of galena (mixed with a little zinc in the ore and little iron) and of gangue of 2 1-2 sp. gr. The lead in this concentrate is worth \$31.18. The smelting charge is \$16. The balance is \$15.18 for the lead, in place of \$6.30, showing that it is more costly to melt off gangue than to concentrate it off. The extra concentrating is merely arrangement, not cost, for the same work done. Concentrating is therefore the first step to advance in. Wet concentrating will always carry off rich slimes. It has been computed that in the silver-copper ores of Montana 20 per cent. of the values are carried off by water as slimes, which are many times richer than the concentrates left behind. By dry concentration every particle of this is saved, through using the lighter menstruum, air, in place of heavy water. Thus 90 to 95 per cent. of the whole values of mineral can be saved. And further, although the crushing and its necessary power is the same in all cases, the dry concentrators are not one-fourth of the cost of wet, and any mechanic can so construct it that the ore may be taken from the ore dump, and passed without handling until it is roasted ore ready for the smelter, which will now be described.

The cost of lead smelting as practised on this continent is excessive. Lead can be smelted more cheaply than copper is put into rich matte. Every British engineer from Europe knows the old Scotch or Cumberland hearth for lead: its low cost of building, its uncostly working for a small scale of operators. Less than \$500 has built many a one. To work the same principle of smelting on the large scale, a tower roaster getting through about 40 tons a day has to be used. With this adjunct the cheapness of the Scotch hearth in working has been imitated, aided by the electric current, forming a furnace not dissimilar to that employed for many years past in smelting aluminum at Pittsburg, Pa., and at various places in Europe, but with a very moderate current, smelting a large volume of rich concentrates of lead; 100 tons to 400 tons of such concentrates is easily reduced to metal, and having roasting towers of proportionate capacity. The economy is great. Zinc contained in the ore is not wasted, but recovered in chambers as fumes from the roasters. Silver and gold are taken up by the lead. The slag is clean, except at times a little sulphate of lead, which easily unites with slags. The cost of plant is not one-third of the American smelter. The cost of labour is considerably less. The cost of current is the greatest item, but is not more than that of fuel unusually employed. The roaster requires little other fuel than the sulphur of the ore. The totally new work of this age necessitates cheap power for electric current, which is shown above to be within the grasp of every individual mine. None of the processes need a gigantic scale of working, but can be built up from small uncostly beginnings, doing the work with no other freights or handlings except for finished metal.