

burnt by the waste heat while being fed into the furnace. I see no reason why this should not be used in the furnace making pig iron, and it would very greatly reduce the costs of the electrodes compared with ordinary carbon electrodes. If the Swedish type of high furnace were adopted the Soldenburg electrode could not be used, but the consumption of ordinary electrodes would only be about 20 lb. per ton, and a considerable saving would be effected. Great difficulty, however, has been found in using coke in this furnace, charcoal being necessary to obtain good results, which I assume is not available in New Zealand.

Carbon electrodes are costing at present in this country nearly 5d. per pound, but prices are falling, and in a year or two electrodes should be obtained at 4d. per pound in New Zealand. This is the price taken by Mr. Parry in estimating his costs for calcium-carbide manufacture. If these carbon electrodes had to be used the cost per ton of pig iron would be increased by 16s. 8d. per ton over the estimates given.

I understand that power can be produced in New Zealand at a very low figure—about £3 per horse-power per year—which is approximately equivalent to 1s. 10d. per unit; and to enable electric smelting of pig iron to have a reasonable chance of commercial success it will be necessary that it should be supplied at about this figure.

I have taken power at  $\frac{1}{10}$ d. per K.W.H., which is a very low figure, and possibly slightly lower than it can be produced at; but in starting a new industry of the kind in which power is such an important item of the total costs, unless it can be supplied at an extremely low figure there is little chance of commercial success.

The actual cost of a plant would depend very much on the site, and what had to be expended upon levelling, foundations, water-supply, the cost of building-materials, &c.; and until these are known and actual tenders obtained it is impossible to give more than a very approximate estimate, especially at the present time when prices are varying from week to week. On the assumption that the above general costs were normal, a two-furnace plant of the ferro-silicon type to produce about 10,000 tons of pig iron per annum, including furnaces, buildings, and all accessories, would cost about £50,000, and allowing £20,000 for working-capital a total capitalization of £70,000 would be necessary. The above would only cover actual cost of works plant ready for connecting up to power plant, but would not include cost of cables from the power plant to the works. If Swedish furnaces of the high type were adopted the cost would be somewhat increased for the same output—probably to the extent of £10,000.

In September the price of pig iron delivered at New Zealand ports was £11 9s. per ton, and on the lower estimated cost of £5 16s. 2d. per ton would show a profit of £5 12s. 10d. per ton of pig iron produced; but prices are at present abnormal, and during the next few years a very appreciable fall in prices may be expected. Pre-war the cost of pig iron delivered in New Zealand was about £4 15s. per ton, which is about £1 1s. per ton less than the estimated cost of production; and, although prices are not likely to fall to those ruling in 1914, pig iron in Europe can be bought at present at about £5 per ton, and it is probable it will be obtainable shortly at about £4 10s. Allowing for freight of about £2, this would mean that European pig iron could be delivered in New Zealand at about £6 10s. to £7 per ton, and consequently pig iron would have to be produced at about £5 10s. per ton to enable it to be sold at £6 10s. and a profit of £1 per ton to be made, assuming there was no protective duty. The costs of production should therefore not exceed £5 10s. per ton, which would give a profit of £10,000 on a total capitalization of £70,000, and be equivalent to a return of 14·3 per cent.

On the actual estimated cost of production—viz., £5 16s. 2d.—assuming selling-price were £6 10s., the profit would only be 13s. 10d. per ton, equivalent to £6,916 per annum on 10,000 tons of pig iron, which would yield 9·8 per cent. on £70,000.

Although pig iron in the near future may be purchasable at £4 10s. in Europe, the price is little if any above the cost of production, and consequently it is not likely to continue to be sold at this figure. So far as can be judged at present, pig iron will not be produced under £4 10s. per ton for a long time, and consequently cannot be sold at a reasonable profit under £5; and therefore the price delivered in New Zealand is more likely to approximate to £7 than £6 10s., which would leave a profit on the estimated costs of production of about £1 3s. 10d. per ton—equivalent to 17 per cent. on the total capital.

If it were decided to make steel, a special furnace would have to be used to which the molten metal from the pig-iron furnace could be transferred, and this might also be used for making steel direct from such scrap steel as is obtainable.

The production of steel would involve considerably more capital expenditure, as, apart from the cost of the furnace, either a steel-foundry, hammers, or a forging-press or small mill would have to be provided. Whether a small mill or forging-press, or hammers, should be installed would depend upon the class of finished steel for which there was the greatest demand, and would have to be decided after careful investigation.

Considerable quantities of small bars, bolts, and rods are imported into New Zealand, and a small bar and rod mill to roll these might be desirable.

Provided a market could be found for the pig iron, either in form of pig iron for sale to foundries or in the form of finished castings, I should strongly advise that no steel plant be erected, but the whole of the productions be confined to pig iron, at all events for the first year or so.

#### BLAST FURNACE v. ELECTRIC FURNACE.

Although it may be possible to make small quantities of pig iron and certain classes of finished steel products commercially in New Zealand in the electric furnace, the establishment of a large iron and steel industry will only be possible when either the home demand has greatly increased or it is possible to produce pig iron or finished steel at such a price that these can be exported at a profit. To justify the erection of modern furnaces and steel plant it would be necessary to have a market for not less than 150,000 tons of pig iron and steel a year.