

APPENDIX.

THE smelting experiments were carried out at Messrs. Thomas Summerson and Sons (Limited) Works at Darlington, in a 400 K.V.A. Snyder single-phase furnace. The power input to the furnace was 350/370 kilowatts, and was supplied at 140/150 volts and 2,500 amps. A tracing of the furnace is attached hereto [not printed].

The electrical measurements were made by means of two Board of Trade unit-meters, and checked by means of voltmeter, ammeter, and wattmeter, placed across the leads to the furnace. The readings of the two unit-meters were added together and multiplied by 1.25, the latter being the factor of the instruments. The instruments were read as nearly as possible every quarter of an hour throughout the run, and the average taken to check the Board of Trade meters. Graphite electrodes were used, and these were weighted at the commencement of the tests and again after the fourth heat at the end of the run. The consumption of electrodes was averaged over the whole run, and worked out at 51 lb. per ton of metal produced.

A sample was taken out of each bag of ore and each charge of lime and coke-dust. The samples were mixed together and analysed. The results of the analyses are as follows :—

	<i>Ironsand.</i>				Per Cent.
Ferric oxide	50.85
Ferrous oxide	25.39
Silica	5.07
Titanic acid	7.88
Alumina	3.43
Oxide of manganese	0.77
Lime	1.87
Magnesia	3.48
Phosphoric acid	0.586
Arsenic acid	Nil.
Sulphur	0.046
Oxide of copper	Trace.
Oxides of nickel and cobalt	0.045
Carbon dioxide	Nil.
Combined water	0.68
Moisture	0.08

100.177

Equivalent to—Metallic iron, 55.34 per cent. ; phosphorus, 0.256 per cent.

	<i>Lime.</i>				Per Cent.
Silica	1.18
Lime	78.00
Loss on ignition	19.21

	<i>Coke-dust.</i>				Per Cent.
Moisture	0.25
Ash	14.11
Volatile matter	0.93
Fixed carbon	84.96

100.00

Sulphur	0.83
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DETAILS OF SEPARATE HEATS.

As a result of two preliminary heats carried out in my presence it was found that the fluxing effect of the oxide of iron was very severe, and great care would be necessary in lining the furnace and thoroughly fritting the hearth.

During the first run the metal leaked down the side of the steel electrode and got into the water-jacket and caused a complete stoppage. The furnace was then carefully relined, and was ready on Friday, the 26th August. As this experiment was the ninth carried out altogether on New Zealand ironsands it was called heat 9. The furnace after relining was burnt in with coke for three hours, and the lining glazed by means of a wash heat of metal from a previous run.

In each heat 1,200 lb. of ironsands were treated, and were charged into the furnace in two portions at intervals of about one hour.

HEAT 9.

In this heat the composition of the two charges was as follows : Ironsand, 600 lb. ; coke-dust to pass $\frac{1}{2}$ in. mesh, 70 lb. ; coke-breeze, 40 lb. ; lime, 50 lb. The sand and coke-dust were mixed four times, the coke and lime then added and mixed again twice more.

A second similar charge was put in about an hour later. The reduction was completed in 3 hours 40 minutes, at which point the slag was run off, during which process 6 lb. of lime was added.

To recarburize the metal 40 lb. carburite (50 per cent. C.), and at periods 40 lb. coke-dust, were added, and recarburization was completed in $1\frac{1}{2}$ hours, during which period the furnace was on half-tap—i.e., only half the usual quantity of current was used.

At this point 77 lb. of ferro-silicon (24.8 per cent. silicon) was added, together with three shovels of slag-forming mixture consisting of 2 parts lime and 1 part silver sand. Later 3 shovels of slag-forming mixture and 4 lb. fluorspar was added, and the metal teemed after 6 hours total run.