(b) In Hydrochloric Acid Extract from Acetic Acid Residue.

Silica,			7·47
Oxide of lead,	0·01		
Oxide of copper,	0·272		0·93
Oxide of cobalt,	0·25		
Oxide of nickel,	0·40		
Manganous oxide,			19·39 : 35·5 = 0·546
Loose oxygen,			3·95 : 8 = 0·494
Lime,			1·33
Magnesia,			1·42
Alkalies (R_2O),			0·34
Alumina,			3·03
Ferric oxide,			16·20

(c) In Sulphuric Acid Extract from Hydrochloric Acid Residue.

Alumina and ferric oxide,	1·62
Silica,	0·83

(d) Ultimate Residue.

Silicates and Silica,	14·91
	98·18

Special Experiments on the State of Oxidation of the Manganese.

The loose oxygen reported above had been determined in two ways, viz., firstly by Bunsen's method: distilling with hydrochloric acid, and titrating the iodine equivalent of the chlorine liberated by means of thiosulphate—chemically pure iodine serving as a standard; and secondly, by Fresenius and Will's method: digestion of the substance with dilute sulphuric and oxalic acids, collecting the carbonic acid liberated in a tared potash bulb and soda-lime tube, and determining the increase of weight shown by the absorption apparatus. In the latter case the carbonic acid of the carbonates was determined in a separate portion of substance, setting it free by means of a mixed solution of ferrous chloride and hydrochloric acid and weighing it as above. In order to see whether the second method is affected by the presence in the substance of ferrous oxide (as Bunsen's undoubtedly is), a quantity of a pure "peroxide" of manganese was made by heating pure nitrate first to about 200° C., then to redness, and the percentage of loose oxygen in this preparation determined according to Fresenius and Will; first in the usual manner and then after addition to the substance of a known weight of artificial ferroso-ferric oxide (Fe_3O_4) prepared in the wet way from ferrous sulphate.

The results were as follows:—

Percentage of Loose Oxygen found.

By the oxalic acid method,	7·99	8·13
By the same in presence of Fe_3O_4,[1]	7·98	

Hence the presence of ferrous oxide does not sensibly affect the oxalic acid method, which at the same time showed me that the substance of the manganese nodules analysed could not have contained much ferrous oxide. In fact the 3·95 per cent. of loose oxygen reported in the summary were deduced from the following determinations:—

Oxygen found by oxalic acid,	4·02 = 0·502 × "O"
Oxygen found by iodine method,	3·88 = 0·485 × "O"
Difference,	0·017 × "O"
Manganous oxide found,	19·39 = 0·546 × MnO

The difference (0·017 × "O"), if not simply due to observational errrors, would correspond to $0·017 \times Fe_2O_3 = 0·017 \times 72 = 1·22$ per cent. of ferrous oxide = 1·36 per cent. of ferric oxide, leaving 16·2 − 1·36 = 14·84 of

[1] MnO . O = 0·6454 grm.; Fe_3O_4 = 0·18 grm., CO_2 obtained = 0·2832 grm. = 7·98 per cent. of oxygen.