and is about the same thickness as that on the south side. This company use two Lamberton mills for pulverising the ore; but these mills are not suitable for grinding quartz—the wear-and-tear is far too great for the work done. The ore, as it comes from the mine, is taken and passed through a Blake's rock-breaker, where it is reduced to about a maximum of 1½in. diameter. It is then dried on kilns having an inclination of 1 in 1 and a series of small steps to prevent the ore from falling down before it is properly dried. After being thoroughly dried it is pulverised in the Lamberton mills, which have a crushing-capacity of about 1½ tons each in eight hours to such a fineness that the ore passes through a thirty-mesh grating. From this the ore is handed over to the Cassell Company to treat by their process.

Cassell Plant.

The only plant erected in the colony by the Cassell Company is at the Crown Company's crushing plant at Karangahake, where they treat the pulverised ore by their process. A description of the plant was given in my last report, so that there is no occasion to again refer to the details. On my visit to the company's works in December last the manager (Mr. McConnell) informed me that by the process from 85 to 93 per cent. of the bullion was extracted, and this has been borne out by the work done during last year, as will be shown hereafter in a statement giving the results of treating the Crown Company's ore. From all that can be seen or learnt respecting this process of treatment, it is by far the best that has yet been introduced into the colony for extracting a large percentage of the bullion from the ore at a moderate cost. At the same time it may be said that the minimum value of the ore sent for treatment must not have a less assay-value than £2 per ton, as the cost of drying the ore, pulverising, and leaching cannot be less with a good plant than about £1 3s. per ton, to which must be added the royalty which the company demands for the use of their patent, which is 10 per cent. on all ore up to a value of £8 per ton, and 15 per cent. on all ore over that value.

If this process be the means of extracting, say, 85 per cent. of the assay-value of the bullion in the ore, then a comparison might be made with ordinary crushing-batteries, which would give about 40 per cent. of the value of the bullion. Suppose the ore to have an assay-value of £2 per ton, then, by the Cassell process, £1 14s. would be recovered, at a cost of about £1 6s. 5d.—that is, including royalty—and by the other process the value of the bullion extracted would be 16s., which would be recovered at a cost not exceeding 8s. per ton. The profit by the former is 7s. 7d. per ton, while by the latter and more crude method, although only 40 per cent. of the bullion be saved, the profit is 8s. per ton, or 5d. per ton more than by the Cassell process. If ore containing an assay-value of £8 per ton were treated, the profit by the Cassell process would be £4 19s. 6d., and by the ordinary method £2 16s. It will therefore be seen that there is a limit to the low grade of ore that can be treated economically by the Cassell process, and for rich ores their process would enhance the value of the mines from which such ores are obtained.

In dealing with the question of using Cassell's process, there are several things to take into consideration—namely: (1.) That it cannot be economically used where the assay-value of the ore does not exceed £2 per ton. (2.) The royalty now asked by the company for the use of their process. (3.) The conditions under which the use of the process is offered by the Cassell Company in addition to paying royalty.

With regard to the latter, the conditions under which the Cassell Company wish to bind those who arrange to use their process is that all the cyanide of potassium must be purchased from them. This is a condition far more objectionable than the payment of a heavy royalty. At the present time, in introducing the process, it is to the advantage of the company to charge as little for cyanide of potassium as possible, in order to show that ores can be treated at a reasonable cost; but once the process is fully established, and different companies have erected plants to adopt it, the price of cyanide may rise to such an extent as to greatly increase the cost of treatment.

For moderately rich ores or ores of a complex nature, this process is well adapted and more economical than any other hitherto introduced, and it has the advantage of dissolving and precipitating gold and silver in one operation, which chlorination cannot effect, and, besides, the cost of chlorination greatly exceeds that of this process. Mr. J. S. MacArthur, who, in conjunction with Dr. Forrest, secured the patent rights for this colony, read a paper before the Society of Chemical Industry on the Cassell process, in which is given an interesting account of the action and use of cyanide of potassium in comparison with chlorination. The following extracts are from the paper:—

"An ore consisting of a complex mixture of silica and the various compounds of iron, copper, lead, zinc, antimony, arsenic, sulphur and gold, in the proportion of 10,000 parts of silica and sulphides to one part of gold, is much richer than the average auriferous ore, and the question is how can be best separated the one from the ten thousand. Under favourable circumstances the gold and the useful metals may be recovered by smelting, but these favourable circumstances, which are the proximity of the gold mine to coal, clay, limestone, and other fluxes, are quite exceptional, as auriferous reefs are generally found in primary formations. Chlorination: As no attempt is ever made to chlorinate gold-ores containing an appreciable quantity of lead, and where applicable is always troublesome and never cheap, when this question presented itself to Dr. Forrest and myself we tried to find some solvent which, unlike chlorine and mercury, would have a stronger affinity for gold than for sulphides, and we found that cyanide of potassium solved the problem.

"Our experiments were conducted first on a small scale, and on ores of all kinds and from mines in all parts of the world. The result of these small trials was so satisfactory that we gradually worked from less to more. . . . . The ore is ground to fine dust." [A thirty-mesh screen is used at the Crown Company's works at Karangahake.] "If instead of ore we are working tailings from the