

quartz reefs. The gold may be in the quartz associated with other substances, such as sulphur, antimony, lead, and arsenic, which prevents a large percentage of it from being extracted by the ordinary process now adopted, thus rendering a valuable mine almost worthless.

GOLD—QUARTZ MINING.

The gold-saving appliances in Victoria are superior to those in use in New Zealand. The mining companies in the Sandhurst District have the best class of machinery in the colonies, but even it is nothing like perfect. The great wear and tear connected with stamping-batteries will always make it an expensive mode of extracting ores. From what I have recently read in the *Scientific Mining Journal*, published in San Francisco, the mode of treating gold-bearing quartz is superior to that in these colonies.

CRUSHING AURIFEROUS ORES.

In extracting the gold from quartz there are three principles involved: (1) To have a cheap and efficient method of crushing the stone; (2) to have a simple mode of concentrating the various minerals that are associated with gold; and (3) to have an appliance that will insure perfect amalgamation.

The most complete plants that I saw in Australia were those of the St. Mungo and the South St. Mungo Companies. A plan of the former is annexed (see Drawing No. 9). This plant consists of a crushing-battery of thirty heads of revolving stamps, weighing from 7cwt. to 8cwt. each, lifting from 8in. to 10in. and making 65 blows per minute. These stamps are arranged so that each ten heads can be started or stopped at will by having a counter shaft geared to the engine-shaft and running parallel with the cam-shafts; these are three in number, one shaft to every ten heads of stamps. The counter-shaft runs along on top of the horses on the side of the stamps next the feeding floor, and the cam-shafts at the side next the tables. On the counter-shaft there are spur wheels turned up to pitch line with saw-toothed clutches to take these wheels in and out of gear with those that are on the cam-shafts. The horses and standards of the battery are of an improved design. The horses do not project in front of the stamp-boxes, and therefore leave plenty of working room at the head of the riffle tables. The plummer-blocks for the cam-shafts are cast on the girder portion of the frames and also plummer-blocks for counter shafting.

The discs on the stamp shanks are known as "Watt's Patent." These as well as the cams are all steel-faced. The shoes of the stamps are of white hæmatite iron, and the false bottoms in the stamp box are wrought scrap iron, having the corners cut off. There are brackets fitted on the frames or standards of each battery to carry the water-pipes for supplying the stamp boxes with water, a jet of water falling down opposite to each stamp. At the discharging side of the battery there are cast-iron quicksilver wells attached to each stamp-box; similar wells are likewise at the lower end of the quicksilver and blanket tables. The quicksilver wells are covered with electro-plated copper plates of 12 B W gauge in thickness. The crushed material, after passing over the quicksilver tables, goes over the blanket tables and thence into one of Halley's concentrating tables, one of the latter being placed at the end of each blanket table coming from every five heads of stamps, and on those concentrating tables are collected all the pyrites and minerals of a greater density than the crushed sand. These tables work with small cams, which gives them a short jerking motion, having about three-quarters of an inch stroke and making about 140 strokes per minute. At the lower end of each table a strong steel spring is attached which brings the table quickly forward after the cam has pressed it back, thereby causing all the material of greater density than the sand to collect at the upper end, which is a little lower than the place where the sand is discharged. These tables are cleaned out at intervals according to the nature of the stuff; generally once in about two hours. The waste product coming from the end of the concentrating tables is carried by a shoot into a well in which a tailings force-pump is placed to lift the water and waste material to such a height as will enable them to be carried away in shoots to be further treated by cradling, and thence deposited some distance above the dam where the water is stored. The water then flows back to the dam and allowed to settle before it is again lifted to supply the battery. The whole of the machinery is driven by a 22-in. cylinder horizontal steam-engine, fitted with variable expansion gear and one of Tangye's governors. The manager of this battery states that the pyrites collected from the concentrating tables averages from 4oz. to 6oz. of gold per ton.

The saving of pyrites is one of the things that the quartz-mining community of New Zealand should direct its attention to. It will be seen by reference to the tables compiled from statistics, given me by Mr. R. H. Bland, the manager of the Port Phillip Company at Clunes, that the profits derived from the pyrites alone, during a period of seventeen years, amounted to about £4,000 per annum, and that the amount of pyrites in the quartz is only from 1½ to 2 per cent. This saving alone would make some of our mines pay liberal interest on the capital invested. The large amount of pyrites that is in some quartz reefs in New Zealand—for instance, the Invincible Company's mine, at the head of Lake Wakatipu—would pay large dividends to the shareholders, even should the gold obtained by the ordinary process of crushing only pay bare expenses. On my visit there in December last, the whole of the pyrites was running to waste; but I have recently learned that an arrangement has been entered into for three years for a party to work the tailings, the company to receive 15 per cent. of the gold saved as royalty. Professor Black, in one of his lectures he delivered on the goldfields, stated that he made an assay of pyrites from this company's mine, which gave at the rate of 11 oz. of gold per ton, so that by a small outlay this company might greatly enhance the profits. The gold contained in the pyrites cannot be saved by the ordinary process of amalgamation, inasmuch as it is coated with sulphur and arsenic, which prevents it from coming in contact with the quicksilver; even although this material may be ground up to a pulp, the sulphur will always carry off a large percentage of the