

handling our coal, which at present is lowered to No. 6 level on the old shaft, and hoisted up the new shaft to surface.

"No. 5 level has been drifted 30 ft. east, and a crosscut put in 100 ft. to try and tap the Union body of ore. On the western end we have drifted 245 ft., to connect with a pass from the Progress battery level, through which we hope to be able to bring filling. Besides this a crosscut 420 ft. has been driven, in order to connect with new shaft. This is not yet complete. Also a winze put down 100 ft., and two intermediate drifts, the combined length of which is 183 ft.

"No. 6 Level: A raise has been put up 150 ft. on the eastern end, and 20 ft. of drifting on the south-east.

No. 7 drive east has been advanced 404 ft.—crosscutting, 53 ft.; and further drifting, 95 ft. On the western end 90 ft. of drifting, and on No. 7 Progress level 100 ft., has been completed, besides a winze down 74 ft. from No. 7, to insure good ventilation for No. 8 level. This winze will be down before the crosscut from the shaft is out to the reef.

"The shaft has also been sunk a further distance of 75 ft., and is now down to No. 8 level. We shall sink about 10 ft. below No. 8, there cut the station and place the chamber timber in position, and resume sinking to No. 9 level as speedily as possible. Average rate of sinking, 15 ft. per week, besides hoisting sufficient quartz for both mills.

"Machinery: A description of the machinery used in hoisting at shaft B appears in the annual report of 1898 issued by the Mines Department, since which date there is no alteration to report in the equipment. The machinery is giving entire satisfaction, and will handle a much larger output than it is now required to do. At the present time whilst sinking the whole output from this shaft is hoisted through the west compartment, the eastern cage being in constant attendance on the sinkers. The hoist used at shaft A is a 30-horse power Hornsby undertype geared engine, with two hoisting-drums.

"*The Forty-stamp Battery.*—The forty-stamp battery, by Fraser and Chalmers, has been running nearly continuously since last May, crushing 29,642 tons. Power for the mill is supplied from a 6 ft. Pelton, driven by an effective head of 168 ft. The crushers, which are two in number, by Blake, 9 in. by 15 in., are driven by a 3 ft. Pelton, whilst the Frue vanners are driven by another of the same size. The average speed of the mill is eighty-one drops of 8½ in. per minute. Screening of various sizes has been used experimentally, with the result that 20- to 25-mesh gives the greatest satisfaction. Value of forty-stamp mill, vanners, crushers, and mill-shed, £12,000.

"The Frue vanners, sixteen in number, have been constantly running in conjunction with the new mill, and giving good results. The percentage of concentrates extracted by the vanners is about 1.35 per cent. of the rock crushed, of an average value of 5 oz. 6 dwt. per ton. The value of the concentrates, of course, varies nearly inversely as the amount made, but by extracting from 1.3 per cent. to 1.5 per cent. we obtain the greatest value. On making very thorough investigations, it has been proved beyond doubt that owing to the nature of the quartz a large proportion of the concentrates are in such a fine state that it is impossible to retain them on the vanners. The fineness is not caused entirely by the crushing, but is partially due to the natural state in which the concentrates exist in the quartz, being in places only a stain or thin coating.

"The old twenty-stamp mill has crushed 8,363 tons of quartz during the last twelve months. The cost of milling and concentration by the new mill is 2s. 3.86d. The cost of milling only by the old twenty-stamp mill is 4s. 0.59d. per ton.

"*Chlorination.*—This plant started regular work during the latter part of December. Since the commencement 344.5 tons have been treated, yielding 1,271 oz. 14 dwt. 8 gr. bullion; value, £5,315 15s. 10d. Value of plant, £1,600. The furnace is of the reverberatory type, 80 ft. by 14 ft., all on the same elevation, without a drop on to the finishing-hearth, as is often the case. The cooling-floor is on the same ground-level as the furnace. The three treatment-vats, 9 ft. diameter by 3 ft. deep, are on a slightly lower elevation, to facilitate the filling. These tanks have filter-bottoms so arranged that the gas distributes itself evenly over the whole area, and ascends through the charge under treatment. The precipitating- and settling-vats are placed on a lower elevation still, so that the solution gravitates down from the treatment-vats. The whole works are enclosed in a building 142 ft. by 40 ft.

"The green concentrates obtained either from the Frue vanners or canvas plant are run on the top of the furnace next to the smoke-stack end, and dumped there in small charges to dry, when a certain amount of sawdust is added and intimately mixed. This charge is fed into the furnace through an opening in the top, and forms then part of a stock pile always kept in a cooler part of the furnace. From this pile the working-charge is drawn and constantly ravelled forward towards the hotter part of the furnace. The functions of the cooler part of the furnace—that is, where the stock pile lies—is in the first place to dry the pile; but it also acts as a condenser, and any metallic gold which may become volatilised in the vicinity of the flame is, in the act of passing this pile, redeposited in the cooler metallic particles. The working-charge, after being extracted from the pile, is ravelled forward, and the applied heat very soon induces the whole mass to ignite.

"If the concentrates themselves contain a large percentage of sulphur they scarcely require the applied heat to start the combustion. When in this stage the sulphur, antimony, and arsenic are being driven off, a large percentage of which is deposited in the dust chambers and flues. The working-charge during this time is gradually being drawn towards the finishing-hearth, over which the flame plays. When all sparking is finished the charge is roasted dead, and is then drawn from the furnace. Meanwhile another charge has been following up the first one all the way, and is placed on the finishing-hearth when the previous one is withdrawn. The object of roasting the ore before chlorinating is to expel the sulphur, arsenic, and antimony, and to oxidize the metals left behind, so as to leave nothing which can combine with the chlorine when subsequently treated with it in aqueous solution except metallic gold. From a chemical point of view a rough explanation of what probably takes place during the roasting is this: When the charge gets into such a position in the furnace that it begins to ignite the first effect is to distil off sulphur,