

sulphuric acid, manganese, salt, and water. The proportion is given further on. In order to thoroughly understand the process it will be necessary to consult the annexed plan, Drawing No. 3, which is a plan and section of the United Pyrites Company's works at Sandhurst. The whole process of chlorination was described to me by the manager, Mr. Edwards, who is likewise part proprietor. The plans are as follows: Drawing No. 3 comprises a vat 10ft. in diameter, 2ft. 10in. high on the sides, made of wood 2½in. in thickness (kauri pine preferred). The inside must be coated with Stockholm tar and pitch, and put on while hot, or it may be coated with asphaltum cement. A false bottom, made of wood and perforated with holes, is laid on strips 1in. thick, which forms a chamber or recess between the main and false bottom. The holes B and C come between the main and false bottom, and the hole C is fitted with a lead cock to draw off the water. The hole at B receives the lead pipe E leading from the wash-bottle F, which is a Winchester quart bottle with the bottom cut out, and this bottle also covers the end of the lead pipe H leading to the earthenware generator I. The end of the pipe E, as shown on plan, is about 4in. out of the water that is contained in an earthenware dish, in which the Winchester quart bottle is placed, and the end of the pipe H is 2in. under the water, so that the gas passing from the generator through the pipe H passes through the water, and is washed and freed from hydrochloric acid before passing through pipe E leading into the vat. The gas coming out of the pipe into the chamber or recess, between the false, and main bottom, is distributed all over the bottom of the vat, and rises through the filter-beds K and the roasted ore. The filter-bed is formed of first a layer of broken quartz about the size of walnuts, next a layer of smaller size, then a layer of small gravel, and on the top a covering of quartz-sand, making altogether a thickness of about 5in. On the top of this filter-bed the roasted ore is sifted after being damped, but care must be taken not to make it too wet, only in such a state as a handful may squeeze into a ball that will stand gentle handling, and the vat is then filled to within 5in. or 6in. of the top. The vat having been filled with ore, which is about from 5 to 6 tons, the generator is next set to work. This is done by putting 35lb. of manganese, 50lb. of common salt, 85lb. of sulphuric acid, and 50lb. or 5 gallons of water into the generator, which is a large earthenware jar having a capacity capable of holding from 20 to 25 gallons. After a short time four bottles of acid are added. The gas should come up pretty briskly, which will be indicated by the wash bottle F, and if this does not take place the contents of the generator should be stirred and more acid added, and heat applied to the generator, either by having it placed on a hot sand-bath with fire under it, or by having the generator placed in a tub of water heated by a jet of steam from the boiler that supplies steam for the engine which drives the other machinery. When the gas rises to the top of the ore in the vat, the cover is then put down and made air tight, which is done with a linseed meal joint. There is a hole in the top of the cover that is left open until the gas smells strong through it, after which it is corked up, and the generator kept at work for fifteen to sixteen hours. At the end of that time, if circumstances have been favourable, the cork in the cover is removed, and a little ammonia on a cork held over the hole, which will indicate whether the ore has been chlorinated successfully or not by the ammonia giving off white fumes. If there is sufficient gas it may remain eight hours longer, then remove the cover and run water on the top of the chlorinated ore until the vat is filled; this process is done by an inverted T gas-pipe having a joint at the end of the vertical and centre of the horizontal pipe. The horizontal pipe is almost the same length as the diameter of the vat, having small holes on the sides. The holes on either side of the centre being opposite to each other, this gives the horizontal pipe a revolving motion like a turbine water-wheel when the water is turned on, and it distributes the water in a regular shower equally all over the surface of the vat. When the gas or air bubbles cease to rise on the surface of the water, the cock C is opened, and the chloride of gold solution is then drawn off into twenty earthenware jugs or pans holding thirty gallons each, or into a vat of equal capacity, into which is added, to precipitate the gold, a little hydrochloride acid, and half a gallon of strong sulphate of iron in each jug or pan; but more sulphate of iron must be added if the jug or pan, on being filled, should lose its dark colour. The water should be tested as it is drawn off by taking a glass tumbler, and adding to the water or solution a few drops of hydrochloric acid, and afterwards some sulphate of iron; if there is gold in the solution it will turn dark, and thus be tested until no colour can be obtained. The solution should stand in the pots or pans ten or twelve hours, and when the gold has been precipitated, the clear water is then drawn off by a lead syphon, after which, the bottoms of the pots or pans should be washed out into another pot, and left to settle until the water is clear, after which the water is then syphoned off, and the gold powder collected and put into filter-papers. After the water is filtered off the powder is dried, the papers are burnt, and the powder put into a clay crucible with a little nitre and borax, and smelted.

ROASTING OR CALCINING THE ORE.

Drawing No. 3, Fig. 1, shows the plan, Fig. 2 the elevation, and Fig. 3 the cross-sections of a reverberatory furnace, as used by the United Pyrites Company at Sandhurst. The length from the bridge A to the entrance of the flue B is 46ft., and the width, inside measurement, is 7ft. 6in., with 18in. brickwork, as shown on Fig. 1. The height inside the furnace is 14in. from the hearth to the rise of the arch, and there are ten working openings, each about 6in. high by 10in. long, on each side of the furnace, 4ft. apart from centre to centre. The furnace is built on an incline from close to the bridge adjoining the fireplace to the flue, leading into the chimney at the opposite end, of 2½in. to the foot, which Mr. Edwards informed me was suitable to the class of pyrites he had to deal with; but, if the pyrites were pulverized very fine, and well concentrated, 1½in. to the foot would be sufficient. At the lower end of the incline there is a fire-box, D, the same length as the inside width of the furnace, 22in. in width, supported by a strong masonry wall at the lower end of furnace or side of the fireplace, as shown on drawing. The fire-box is filled with cast-iron grate-bars, suitable for burning wood, and the sides of the furnace are bound with wrought-iron straps, as shown, having bolts passing through the furnace top and bottom. On the top end of the furnace there is a place, marked E, which is built up to hold from three to four tons of raw