

perchloride which forms in the early part of the roasting goes off into the flues, while another part, giving off chlorine, is reduced to a protochloride, and this again loses the remaining chlorine by absorbing oxygen from iron-peroxide, which remains in the ore. Copper-protochloride gives off half its chlorine and forms dichloride, and volatilizes to some extent. Lead-sulphate requires a greater heat to convert it into chloride than can be used to preserve the better metals, so that it remains almost wholly unchanged: the chloride gives off some chlorine, and, absorbing oxygen, becomes oxychloride. Zinc is partly volatilized, but the oxide is quite stable. Antimony and arsenic form volatile chlorides as well as oxides, which to a great extent go into the flues and partly up the chimney. Gold at a very low heat forms a chloride, which decomposes at a higher temperature, and remains in a metallic state.

*Sifting the Ore.*—When the ore is sufficiently chloridised, which takes about eight hours to go through the whole process of roasting and chloridizing, the charge is raked out of the lower hearth and allowed to cool; afterwards it is put through a revolving screen with about two thousand meshes to the square inch. Any grit that passes over the screen is crushed along with the other ore, and again put through the furnace, while the dust that passes through the screen is now ready to be taken to the amalgamator.

*Amalgamation.*—The ore is now ground up in Wheeler's pans with quicksilver and heated water, which can be done by a jet of steam passing into the water and condensing. When the first charge is sufficiently amalgamated a cock is opened on the side of the pan, which is placed above the level of the quicksilver and amalgam, and the slime is run off into a chute and carried away to settling-basins, where the sediment, when settled, is afterwards taken out, and if proved by assay to contain either gold or silver is again passed through another Wheeler's pan and amalgamated; but if there is only a very small percentage left in the sediment it is thrown into the waste-product heap. As soon as there is a certain amount of amalgam in the pan a cock is opened at the bottom, and the quicksilver is strained through a thick canvas bag, which is made in the shape of an inverted cone. The strained quicksilver is again put into the pan, and the same process repeated, while the amalgam is now ready for retorting.

*Leaching or Lixiviation Process.*—Mr. G. W. Bull, at Karaka Creek, Thames, has been experimenting on the leaching of silver- and gold-bearing ores, and as far as his experiments have been conducted he has been successful in obtaining excellent results at a low cost of treatment. He first tried it on a small scale, with a common American bucket for a vat; but has now made a vat with which he can test a ton of ore, and thinks the whole cost of crushing, roasting, chloridizing, and leaching will not exceed £2 per ton, and probably will not be more than £1 10s. per ton. If this process can be carried out for the cost that Mr. Bull anticipates, and is successful in obtaining at least 90 per cent. of the metals, there is a great future for this district.

The roasting and chloridizing process have to be gone through, the same as I have before described, but when the ore is taken out of the furnace and is cool it is put into a vat with a solution of hyposulphide of calcium, or, better still, hyposulphide of sodium, which dissolves the silver and leaves the gold still remaining in a metallic state. The ore is placed in a wooden vat, made of rectangular form, having the sides sloping outwards. There is a glass or leaden tube fixed through the bottom, on which is placed an india-rubber tube. Inside the bottom there are a few strips of wood laid across to support a perforated false bottom, on which a filter is laid. The filter consists of, first, a layer of coarse pebbles, and next a layer of smaller ones, and each successive layer is finer than the other, till on the top it forms a layer of sand. This filter is in all about 5in. in depth. On the top of the filter is placed a coarse bag or cloth so as to keep the filter intact each time the vat is cleaned out; but the cloth must be of coarse open material, to allow water to pass through readily.

The vat is then filled with the chloridized ore to a depth of from 20in. to 2ft., and the solution of hyposulphide of calcium is put through the india-rubber tube fixed on the glass or leaden pipe which passes outwards through the bottom. The india-rubber is bent up to such a height that the solution passes through the filter on the false bottom, and upwards through the material to be operated on until the whole of the material is thoroughly saturated. It is then allowed to stand from five to eight hours, when all the silver will be dissolved. Afterwards water is put on top of the material in the vat, and the whole of the liquid is drained off into another vat, where the precipitating process takes place. The material in the vat is washed until the liquid shows no signs of silver being left. This is tested by using the precipitant for silver as the draining process is going on. When leaching of the silver is completed, the ore is removed from the vat and allowed to dry while a fresh charge is being manipulated and the same process gone through.

When the ore that was previously removed from the vat is sufficiently dry, it is again placed in the vat, and the chlorine-generator set at work. The gas is passed from the generator through a wash-bottle into the spaces between the false and main bottom of the vat. The lid which covers the top of the vat is now put on and made air-tight by having the joint luted with linseed-meal dough. There is a hole in the centre of the lid which is left open until the chlorine-gas has made its appearance on the surface of the ore. This can be easily ascertained by taking the cork out of an ammonia bottle, or dipping a glass rod in ammonia and holding it over the hole, when dense white fumes will arise if chlorine is present. As soon as its presence is detected the hole is closed up, and the ore is allowed to stand from thirty to forty hours in the vat to get properly chlorinated. Before removing the lid of the vat after the time allowed for chlorination the plug in the top of the cover should be taken out again, tested with a glass rod dipped in ammonia to see if chlorine is still present; if not, the chances are that a poor result will be obtained in leaching unless chlorination is repeated.

At this stage of the process the workmen employed have to be careful not to get suffocated with the chlorine gas. When the cover is taken off it will appear as a green vapour above the ore. They will have to retreat as fast as possible until this disappears. After the cover has been removed a stream of water should be admitted in the form of a fine spray. This is done by a revolving arm made of lin. gas-pipe, with fine holes perforated on the side, which causes the arm of the pipe to