

The blast for the furnace is produced from either a Root's or Baker's blower, either of which is vastly superior to the ordinary fan-blasts, as they produce a greater blast, while the power required to drive them is considerably less. A continual stream of cold water is forced into the water-jacket at several points around its bottom, and the heated water is discharged by pipes leading from its top. The great advantage of the water-jacket is that, as soon as the slag begins to melt, it forms a coating or crust on the steel plates, thereby preventing them from being burnt by the fierce heat, the slag acting as a lining of fire-brick. The principle of the furnace having now been described, the next thing is to describe the mode of operation in treating the ore.

The ore is brought down from the paddock where it is stacked, and put through the pulverizer, or stone-breaker, which breaks it in pieces of about 1 in. in diameter. After this it is taken to the mixing-floor and mixed with lime, iron, and silica, in order to make it run freely in the furnace. When there is not a sufficient quantity of galena in the ore, it is forced through a molten lead bath, so as to distribute the lead among it in small particles. The fuel used here for smelting is charcoal, but coke would be preferable if it could be obtained at a reasonable price. There is an opening in the brick portion of the furnace, on a level with the mixing-floor, through which to feed the furnace. The fire being kindled and the blast in motion, the mixed ore is fed into the furnace, having a layer of charcoal and ore together, and so on. The furnace is kept going night and day by three shifts of men.

As mentioned before, there is an opening at the bottom of the blast-furnace, through which to draw off the slag. This opening is closed up with clay, and the clay is tapped with an iron bar when the slag is sufficiently melted. The slag is run into iron-pots, which are fixed on two-wheeled hand-trolleys and are run away as soon as they are full, and the molten slag is then allowed to stand in the pots for a short time to cool sufficiently without running, before it is emptied. Portions of it are afterwards broken up and taken again to the mixing-floor to mix with the ore. As soon as the well or bath at the bottom of the furnace is filled with molten lead and metal it is taken out of the side well in ladles, and run into bars ready for the refining furnace. Care has to be taken not to allow the molten metals to get above the level of the top of the well, and so on the process continues. This furnace is capable of smelting from 20 tons to 25 tons per day, according to the character of the ore that is treated.

The Probert furnace is made on the same principle as the Pacific, only, as already stated, it is made in several segments, and instead of the water-jacket being closed at the top it is open, thus allowing the steam that is generated by the heating of the water in the jacket to escape freely. The furnace that is erected here is circular in form, but the new furnaces that are now being made by the Mort's Dock Company, at Sydney, are oval-shaped, like the Pacific. The reason for this is that, in a large circular furnace the tuyeres for the blast have to project beyond the inner edge of the furnace, and thus becomes more liable to get burnt and damaged. There is likewise a slight difference in the circular iron flue, which, in this patent, projects horizontally from the top of the furnace into the chimney, having condensing-chambers or recesses and down-casts to collect the oxides, which goes away in fumes. This flue differs from the flues in the new furnaces which the Mort's Dock Company are constructing, the flues in the new furnaces being below the opening where the ore and charcoal are fed from the mixing-floor. A plan of the improved furnace is annexed. (See Drawing No. 8.)

The lead well or bath at the bottom of the furnace is capable of holding about five tons of molten metal, and the quantity of ore that the furnace is capable of smelting was expected to be 60 tons per day. However, Mr. Hurley informed me that 25 tons was as much as it had averaged since it had been at work.

It may be well to state that in order to establish the superiority of this furnace Messrs. La Monte and Kahlo entered into an agreement with this company to erect one of their furnaces and work it for three months continuously, giving a guarantee that it would smelt 60 tons of ore per day and save 90 per cent. of metals found by assay, before being paid for it. They have, therefore, an independent manager, Mr. Stearns, from America, who is conducting the smelting and refining operations, and if the results are equal to the guarantee, at the end of the period agreed on the company will take over the whole plant. I subsequently learned that the furnace has given every satisfaction, with the exception that it does not smelt the quantity of ore as guaranteed; but this was owing to the water-jacket being too short; but they were supplying a longer one of the same length as all their new furnaces are now made, and there is every reason to believe that when this new jacket is fixed and other improvements made, it will do the work guaranteed. I was likewise informed that this process gave about from 95 to 96 per cent. of the metals as per assay, which is satisfactory. The cost of the La Monte furnaces, ready to attach all connection with blast- and water-pipes, in Sydney is about £750 for a furnace that will smelt 25 tons of ore per day, and £950 for one that will smelt 45 tons; but if the whole of the machinery be included for the latter sized furnace it will cost from £4,000 to £5,000.

The refining works consist of reverberatory furnaces, in which are placed large cupels, having cast-iron skeleton frames filled up with bone-dust. The bars of metal from the smelting-furnace are put into the cupels and roasted until all the lead and base metals are oxidized, and nothing but the precious metal left. The fumes from these furnaces pass through a flue, where a small jet of steam is inserted at the junction with the chimney, which condenses the fumes and causes the lead to be deposited in the bottom of the chimney as litharge. When sufficient roasting has been done, which takes about four hours to oxidize all the base metals, there is a hole bored with a brace and bit from below into the bottom of the bone-dust cupel until nearly through. Afterwards a trolley with moulds placed on the top is run in below the cupel, and the hole, partly bored, is then tapped with a rod punch, and the precious metal run into ingots fit for market.

The minimum cost of the smelting process up to the time I visited these works was a trifle over £2 per ton with the Probert furnace, and between £2 and £3 with the Pacific. It must, however,