ELECTROLYTIC REFINING OF ZINC

Notable progress in the metallurgy of zinc was made in 1915, and a number of plants designed for the treatment of zinc ores by leaching and electrolysis have been installed. Canadian companies are taking a prominent part in the development of the processes and three of the plants now in operation are in Canada. The Weedon Mining Company, which is operating a lead-zinc mine at Notre Dame des Anges, Quebec, has put into operation at Welland, Ont., a plant in which the Watts process is used. At Trail, B.C., the Consolidated Mining and Smelting Company of Canada has carried on much experimental work on electrolytic refining of zinc, and has produced spelter from Sullivan mine ore at the rate of 1,000 pounds per day. The results obtained were considered promising enough to warrant the construction of a larger plant. There is now being erected at Trail a plant designed for an output of twenty-five to thirty-five tons per day. At Silverton, B.C., the Standard Silver Lead Mining Company is using the French process of electrolytic production of zinc.

In view of these developments an article published in the January 1st issue of Metallurgical and Chemical Engineering if of special interest. The authors, D. A. Lyon, O. C. Ralston and J. F. Cullen, of the Department of Metallurgical Research, University of Utah, say:

"When the European war started there were three electrolytic zinc plants in Europe supposed to be operating on a commercial scale. All of these were on a small scale, and were producing zinc from by-products. At Winnington, Northwich, Cheshire, England, was the plant of Brunner, Mond & Co., which is an alkali works and which has been disposing of calcium chloride solution wastes by leaching zinc ores with them (with simultaneous action of carbon dioxide). This gave a zinc chloride solution from which the zinc was recovered by electrolysis, giving a spelter containing 99.96 per cent Zn., and producing chlorine gas which was absorbed to make bleaching powder. This process is one of those originally designed by Hoepfner, and was experimented on during the 90's in Germany, resulting in the installation of a like plant at Duisburg, Germany. Both of these plants have kept secret the exact details of the process by which they have been able to get good zinc deposits as their pure spelter has been for years at a premium of at least 1 cent above the ordinary market price. In 1914, a plant was built for treatment of zinc carbonate ores at Kristiania, Norway, under the direction of Borchgrevink, and another at Balestrand, Sogn, Norway, under the direction of E. A. Ashcroft, to treat flotation concentrates from Broken Hill. So far as we know, nothing has been heard of these plants since the war began.

"In the United States and Canada, however, a great deal of experimental work has been done on the leaching of zinc from ores with its subsequent electrolysis. Nearly all of this work has been sulphuric acid leaching followed by the electrolysis of the zinc sulphate solution. While all the various plants have this much in common, the details of the work vary at most of them by almost as many methods as there are plants.

"The Anaconda Copper Co. perhaps has gotten farther along with this work than have most of the other companies. They now have a 25-ton plant nearing completion. By a 25-ton plant is meant one that will produce 25 tons of metallic zinc per day. The Anaconda metallurgists regard this as only an experimental plant. Some splendid work has been done at Anaconda in their research work in connection with the development of the process which they are using and the publication of the details of this work by Mr. Laist and his associates will be keenly awaited by those interested in this line of work.

"As to the general outline of the processes employed at the various plants at Trail, B.C., and at Anaconda, the electrolytic liquor containing sulphuric acid, regenerated by electrolysis with insoluble anodes, is used for leaching the ore. The ore is a roasted complex sulphide of lead and zinc carrying silver, some gold (and some copper in the case of Anaconda). By the use of barely sufficient acid to dissolve the zinc, it is possible to get a solution of zinc sulphate carrying low amounts of the other constituents of the ore. This solution must be cleaned by the use of zinc oxide, lime or other cleaning agents, and is then electrolyzed. At most of the plants, lead anodes are used in the electrolytic tanks in order to regenerate sulphuric acid. The process as thus outlined is old, but the refinement of detail has been the feature of nearly every plant attempting to use it.

"At Murray, Utah, and Omaha, Neb., are small plants recovering zinc electrolytically. The one at Murray is following the practice as developed at Anaconda, with variations made necessary by local conditions. It is only an experimental plant and it is expected to produce about 2 tons of zinc per day. The Omaha plant is working on zinc oxide material from the refining of argentiferous lead by the Divine process, and is also in the nature of an experiment.

"Perhaps the most extensive research work on the leaching and electrical precipitation of zinc has been carried out on the ores of the Bully Hill mine, Shasta county, California. The process for the Bully Hill ore was worked out on the assumption that a good deposit of zinc cannot be obtained from a solution containing much sulphuric acid and the effort has been to neutralize the acid as fast as it is formed at the lead anodes. In treating the Bully Hill ore, lime is used to precipitate zinc hydroxide and calcium sulphate from the solution of the zinc sulphate. This precipitate is suspended in the zinc sulphate liquor of the electrolytic cell and as fast as sulphuric acid forms it is neutralized by the zinc hydrate.

"The Reed Zinc Co., whose plant is at Palo Alto, Cal., has operated on the bag house dust from the Kennett smelter of the U. S. Smelting, Refining and Mining Co. This is also an experimental plant designed to produce about a ton of zinc per day. Instead of a solid lead anode they use a sponge lead anode resembling the electrode used in a storage cell. As fast as sulphuric acid is formed at this anode it combines with the lead, forming lead sulphate. This lead sulphate can later be used to give up the acid by reversing the current, after placing the electrode in a sulphuric acid solution. The solution for electrolysis is prepared by dissolving zinc sulphate crystallized from the leaching liquor.

"At Silverton, B.C., the Standard Silver Lead Mining Co. is also experimenting with the production of electrolytic zinc by the French process. French was probably the first man to use manganese in the electrolysis of zinc sulphate solutions, although its beneficial effect has been noticed by other investigators. He found that it deposits as dioxide on the anode and can