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THE NEW SULPHURIC ACID AND SUPERPHOSPHATE PLANTS IN HARJAVALTA (Finland).

by J. Lahmus (Rikkihappo-ja Superfosfaattitehtaat, O.Y. 14.6. 1949.

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The general situation caused by the war in the summer 1944 gave the impulse to build the newest sulphuric acid plant - the Harjavalta plant - in Finland. This was due to the fact that the Outokumpu copper smelter formerly situated in Imatra was evacuated to Western Finland - namely Harjavalta. The smelter gases which contained large amounts of SO_2 were recovered at Imatra as liquid SO_2. Due to the fact that the method employed was not enomomical and because it was decided to double the capacity of the smelter at its new site, Outokumpu Copper Co. and our Company (Rikkihappo-ja Superfosfaattitehtaat,O.Y.) agreed that we would build a plant to recover the SO_2 of the waste gases from the new smelter as sulphuric acid.

Electric smelting was employed until May, 1949, and the matting furnace was and still is the biggest in the world of its kind.

In spite of the fact, that the SO_2 gases from the matting furnace are weak and the gases from the Copper converters have an SO_2 content varying between 0 - 12% it was decided to build a contact plant.

The construction work of the sulphuric acid plant was started at the end of 1944, but due to the shortage of materials the first stage of the erection was not completed until August 1947. At this stage the capacity of the plant is 30,000 tons 93% H_2SO_4 annually and the plant is able to utilise about 40% of the sulphur content in the concentrates smelted.

The plant has, during all the time it has been in operation, worked according to our expectations, although the gas from the adjacent smelter has been intermittent and the SO_2 content has varied as mentioned.

The sulphuric acid plant is now being enlarged, as the Outokumpu Copper Co. made the decision in 1948 to abandon electric smelting because of the prohibitive prices of electric energy and adopted instead an entirely new metallurgical process, autogenous flash smelting, developed by Messrs. Ryselin and Bryk of the Outokumpu Copper Co. The principle of this patented invention is an autogenous flash smelting of the finely divided Copper concentrates and fluxes in suspension with air preheated by the hot waste gases from the furnace. The plant was started up in May, 1949, and is operating according to expectations.

The gases from the flash smelting furnace have been utilised since May, 1949, in our sulphuric acid plant.

We have calculated that the extension of our plant will be operating in September, 1949, when the flash smelting furnace is smelting at full capacity. At this stage the plant will produce 75,000 tons of 93% H_2SO_4 annually, which corresponds to the SO_2 amount in the waste gases from the smelter.

The equipment of the Harjavalta plant consist of the following main apparatus:

Gas cleaning.

The gases delivered from the electric matting furnace and the copper converters are passed through a dry Cotrell electric precipitator and the gases from the new smelter through a van Tongeren cyclone collector.

The order of the gas cleaning equipment at the sulphuric acid plant is as follows;- the first cooler-scrubber, the second scrubber, a wet Cotrell, the third scrubber, the second wet precipitator, altogether 3 scrubbers and 2 precipitators.

The first scrubber is empty, the other scrubbers are filled with Raschig rings. The scrubbers are covered with lead and made of acid-proof bricks. The precipitators are of the plate type.

Drying of gases.

There is one drying tower and the circulating acid carries normally 94 - 95% H_2SO_4. The design of the tower is normal being of steel plate and lined with acid resisting bricks and filled with Raschig rings.

The drying tower is followed by a dry "drop-tower"; this apparatus will not be included in the equipment of the enlarged plant.

Blowers.

A Zeta-Laval centrifugal blower is placed after the drying tower and delivers the gas after it has passed the glass-wool filter to the convertor equipment.

Convertor equipment.

The converter equipment is of Belgian make, Nouvelle Société Induschimie. The equipment for 100 tons daily which is now in use consist of two 50-ton units. The apparatus for the enlarged plant will be two 75-ton converters. The daily capacity of the plant will therefore be 250 tons.

At present, a vanadium catalyst made by a Swedish firm is used. After a run of nearly two years the efficiency of the converter it 98 - 98.2%. The catalyst for the new converters will be supplied by the same company as the convertor equipment.

Absorption.

There is one absorption tower of the same design as the drying tower. Oleum is, at present, not produced.

Coolers, pumps, etc.

The drying and absorption towers have cast-iron coolers located outdoors. All the pumps used are constructed and made in Finland, the scrubber pumps are of antimonial lead, the others of cast-iron.

All the necessary meters and instruments are centralised in the same control room. The dilution in the absorption tower is automatically effected in the way that a concentration meter automatically regulates the dilution valve. A great part of the pyrometers, gas content and acid concentration meters are self recording.

Two men per shift are needed and the enlarged plant will not require more men.

In addition to the sulphuric acid plant, a superphosphate plant has been built at Harjavalta. Construction work commenced at the end of 1946 and the plant was started up in February, 1949, again delayed by the shortage of material. Its capacity is 120,000 tons of superphosphate annually, the raw material being apatite from Kola.

In this connection I give only the following data about the equipment of the new superphosphate plant.

Raw phosphate is unloaded from railway vans with mechanical shovels to two pits from which a 5-ton clamshell crane takes the material to two storage silos. Their combined capacity is about 28,000 tons raw phosphate. The same clamshell crane is used for the transfer of the material to the feeding bins either from the storage silos or direct from the unloading pits.

The apparatus for the production of superphosphate is of the same type as that used in the other superphosphate plants in our country. It is entirely made in Finland, phosphate weighers and acid feeders are of the Nordengren type, the dens are developed from the original German Rema system. There are 4 dens with a capacity of 20 tons of superphosphate each. The production capacity is 40 tons of superphosphate per hour. The superphosphate is conveyed by a belt on to heaps at the end of the storage shed. Two overhead clamshell cranes with a span of 30 metres and lifting capacity of 5 tons are responsible for all the transport inside the storage building, which measures 60 by 90 metres. It is possible to heap superphosphate in 10 - 11 meter piles.

There are stationary bagging stations and the transfer of material to the feeding hoppers for the bagging machinery is effected by the aforementioned clamshells. The bagging stations are so placed that the bags slide direct by chute into the rail way vans. The superphosphate plant will reach ist full production capacity when the sulphuric acid plant has been enlarged.

Besides the Harjavalta plant our Company operates two older sulphuric acid plants, one in Lappeenranta (Willmanstrand), a contact plant (started up in 1922) and a Petersen tower plant (1927) and another in Kokkola, a contact plant (1945). The combined capacity of these plants is 60,000 tons annually. Finland's total production capacity will be about 135,000 tons annually.

In addition to the plants mentioned there are two other superphosphate plants the plant in Kotka (started up in 1922) and the plant in Kokkola (1945) with a combined capacity of 120,000 tons annually.

The total superphosphate production capacity in Finland is consequently 240,000 tons. As the main portion of superphosphate is made into Kotka phosphate which is best suited for Finnish soil, the total phosphoric acid fertiliser amounts to 300,000 tons annually which nowadays almost meets the present requirements of phosphoric acid fertilisers for the agriculture of Finland.

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FORMATION du SUPERPHOSPHATE