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International Fertilizer Industry Association - Secretariat: 28 rue Marbeuf - 75008 Paris - France
Tel. +33 1 53 93 05 00 - Fax +33 1 53 93 05 45/47 - ifa@fertilizer.org - www.fertilizer.org

THE INTERNATIONAL
SUPERPHOSPHATE MANUFACTURERS' ASSOCIATION

AGRICULTURAL COMMITTEE
130, BOULEVARD HAUSSMANN
PARIS (8e)
TEL. BALZAC 87-25

SECRETARY:
R. M. COLLINS

CENTRAL OFFICE
32 OLD QUEEN STREET
LONDON, S.W.1
TEL. WHitehall 7262.

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IMPROVEMENTS IN THE MANUFACTURE OF PHOSPHORIC ACID BY THE WET PROCESS.

by Compagnie de Saint-Gobain and Union Chimique Belge.
(11th May 1949)

General Remarks.

In view of the demand for higher grade superphosphates (..3 or 20% water-soluble P_2O_5), manufacturers, who cannot secure supplies of 75% phosphate, are compelled to utilise phosphoric acid in order to obtain these grades.

In the past, a plant producing 10 tons of P_2O_5 a day covered an area of several hundreds of square metres. Thanks to an increasingly thorough knowledge of the mechanism of phosphoric acid manufacture (especially the work done by Nordengren, Sokolowsky, Sanfourche, Campwell and Cants) and to the appearance on the market of corrosion resisting material, important improvements have been made in the manufacture which have in turn permitted the evolution of an entirely continuous process.

The continuous process allows a considerable reduction in the dimensions of the apparatus, eliminates the formation of froth during the breaking down and ensures an increased output.

Apparatus for distribution.

The feeding of acid and phosphate should be regulated within at least 2%. The acid is fed by means of a bucket wheel turning at a speed which can be regulated according to requirement or by a level which can be altered. In our opinion, this device is superior to a small calibrated pipe. Accuracy is of the order of 1%.

As far as the phosphate is concerned, the weigher is by far superior to any volumetric apparatus; we would recommend a weighing scale where the flow of phosphate is controlled by the beam connected with a valve regulating the feed or by variation of the speed of the suction apparatus of the weighing scale. The accuracy of this apparatus is 1 to 2%. A controlling device by gauge and weighing is indispensable in order to ensure a satisfactory working of the feeds.

Problem of Froth.

During the breaking down of phosphate, froth is produced. In the case of the batch process froth is plentiful and requires a special apparatus for keeping it down or the use of expensive anti-froth substances (silica, fish oil.). We have evolved an apparatus for breaking down which ensures the disappearance of froth as and when it is formed.

Conditions of Breaking Down.

Two conditions have to be fulfilled: the avoidance of coating of the phosphate particles so that solubilisation should be effected rapidly and the formation of sulphate crystals easy to separate and wash.

These conditions are fulfilled in the continuous process and and can practically only occur in the latter or at the end of manufacture, in the batch process; the content of SO_4 ions in the liquid phase of the reaction mass should be between 10 and 30 grammes/litre. In the batch process this content is, of necessity, much higher at the beginning of the reaction. The continuous process in itself is not sufficient to ensure these conditions; different methods may be employed, in particular, the re-cycling of the slurry, but it is preferable to operate with parallel vats or still better with a vat of sufficient dimensions in order to ensure an increased attack of the phosphate (95% minimum) corresponding to a decreased acid content of 20 grammes/litre. We are using a special vat corresponding to 1.3 cubic metres per ton of Gafsa phosphate, treated per hour. These conditions allow an increased degree of attack without a previous wet crushing of the phosphate. These results have been obtained with 75% crude Morocco phosphate of the following fineness: 90% through screen 20, 56% through screen 80 and 30% through screen 100. The vat was equipped with anti-froth agitators, its capacity was 6 cubic metres, and it was fed at the rate of 2.5 tons of Morocco phosphate per hour (corresponding to about 20 tons of P_2O_5 a day). The extent of the attack amounted to 97%, the temperature being 80°C.

Filtration.

The above conditions facilitate filtration of the crystals. The crystals were 75 microns long and 25 microns wide. It is essential that the slurry should be in a good physical condition in order to produce an acid of sufficient purity for the manufacture of certain secondary products of phosphoric acid. It contains, as a matter of fact, Ca and SO_4 ions in suspension. Crystallisation is necessary before filtration.

For filtration we have chosen the Landskrona belt-filter which is well known and which operates without difficulty.

Industrial Installation.

The largest filters allow a production of 20 tons of P_2O_5 per day. In order to reduce operation costs to a minimum it is therefore advisable to build units capable of this tonnage. For a plant of that size approximately 2.5 tons of phosphate should be treated per hour and 45 tons of H_2SO_4 should be used per day. For the breaking down a vat, measuring 2 metres in diameter and 2 metres in height, equipped with an anti-froth device, should be adequate, crystallisation being carried out in a vat 3 metres in diameter and 3 metres high. If extraction of the acid issuing from the vacuum filter is effected by barometric column and if the pumping of the reaction mass is to be avoided, a shed 18 metres high will be required. However, as nowadays the problem of pumping is solved satisfactorily, it is possible to reduce the height of the shed to 13 metres. Finally, if suction pumps are at the disposal of the manufacturer, the height of the shed may be reduced to 10 metres. Its area will be of the order of only 150 square metres.
