ISMA* Technical Meetings

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25-26 October 1949

*In 1986, the name of the International Superphosphate Manufacturers' Associations (ISMA) was changed to International Fertilizer Industry Association (IFA).

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NOTES ON THE GAILLARD PROCESS FOR THE MANUFACTURE OF SULPHURIC ACID,

by Union Française & Cies. Régionales Réunies de Fabriques d'Engrais & de Produits Chimiques. (May, 1949)

As from 1925 our firm "UNION FRANCAISE & CIES REGIONALES REUNIES DE FABRIQUES D'ENGRAIS & DE PRODUITS CHIMIQUES" has had to construct three sulphuric acid and superphosphate plants and in doing so has endeavoured to build them in accordance with conditions which at that time were most up-to-date.

For the manufacture of sulphuric acid they selected the GAILLARD process the installation of which had, at that time, only been approved in certain Spanish works. We thought it would be of interest, after a lapse of almost 25 years, to describe the results obtained.

DESCRIPTION OF THE PROCESS.

The GAILLARD process enables the manufacturer to obtain an appreciable increase in production per cubic metre and thus constitutes a great improvement on the standard process of sulphuric acid manufacture in lead chambers.

It consists, in principle, of cooling the interior of the apparatus by atomisation of cold 50° Bé acid sprayed on to the walls.

As with the standard plant, a GAILLARD plant comprises a Glover, Gay Lussac towers, whilst the chambers are replaced by empty cylindrical towers with lead walls of considerable height (about 18 metres) and 6 to 7 metres in diameter. (See attached diagram).

Atomisation of the cold acid is carried out by a turbo-disperser consisting of a vertical turbine placed below the roof in line with the axis of the tower and governed by means of a toothed-wheel or better still by direct connection with a vertical electric motor placed on top of the roof and protected from gases and acid sprays.

The acid is sprayed on to the walls in the form of a dense rain; one portion of the drops adheres to the wall and descends in a thin layer which completely covers and cools the lead. The other portion of the drops dispersed by the impact against the walls is divided into minute droplets which form a dense mist of acid, the cloudiness of which decreases from the wall to the centre.

Thus the following is attained:-

(1) the walls of lead are constantly protected and cooled by a layer of cold acid;

(2) a dense mist of dilute acid separates the lead wall from the hot nitrous gases of the central portion .....and provides the water required by the reactions;

(3) a central zone little sprayed and consequently hotter.

Method of acid production.

Thus the optimum conditions for the manufacture of sulphuric acid as described in treatises are realised.

The transformation of sulphurous acid into sulphuric acid takes place in two successive but independant phases:

(1) inside the hot zone, formation of nitrated sulphuric acid;

(2) towards the wall, hydration of nitrated acid and reduction of nitrous acid and formation of ordinary sulphuric acid. Everywhere oxidation of sulphurous anhydride takes place but the production of sulphuric acid proper can only take place in the neighbourhood of a wall wetted by a sufficiently weak acid.

The density of the acid produced must, therefore, increase from the wall to the centre, a fact which we have verified with one of our apparatus (1).

Check:	I D° Bé reduced to 15°			II D° Bé reduced to 15°		
	1st tower	2nd tower	3rd tower	1st t.	2nd t.	3rd t.
Placed against the wall	52.7	51.8	50.6	48.5	48.1	48
Placed at 1.1 metres from the wall	51.2	52.6	50.1	49.4	51.2	49.1
Placed at 2,30 metres from the wall	54.1	52.2	49.6	52.4	51.5	48.1
Placed in centre at 3.50 metres	57.1	53.8	49.7	56.7	52.4	48.4
Volume of cold acid atomised per hour	2.500 l.	2.500 l.	1.700 l.	2.600 l.	2.600 l.	1.800 l.

Acid which has passed through a cooler is used as cooling acid. Generally the acid of the last two towers, which is weaker and more nitrous is used for atomisation in the first tower and the acid of the first towers is used in the last.

The water necessary for the reaction is added to the cooling acid in the disperser when entering the turbo-disperser. Regulation is effected by means of a simple tap.

(1) Works at VOVES, 5th March, 1928 (approx. 40 tons - 3 towers of 7 metres in diameter and 18 metres in height.

All the complicated atomisation apparatus is eliminated.

Working of the plant.

The GAILLARD plant is very well balanced. As the temperature of each tower can be regulated at will, simply by operating the quantity of atomised cold acid, the plant is easy to run and to control.

This facility of regulation has enabled us to bring out the influence of the high temperature on the consumption of nitrous products.

When putting the first GAILLARD plant into operation at our works at ISSOUDUN, the temperature of the first tower reached 100 to 110° C; the consumption of nitrous products corresponded to 11/12 kgs of sodium nitrate (1) per ton of 53° Bé acid produced.

Merely by an increase in the circulation of cold acid in the first tower have we progressively reduced this temperature and noticed at each stage of decrease a corresponding falling-off in the consumption of nitrous products. At a temperature of 85° the waste of nitrous products had been reduced to 6 kgs per ton of acid with a production of 20 kgs per cubic metre.

This facility of regulation enabled us to regulate in the same manner the identical apparatus of our plants at ISSOUDUN and VOVES. These two apparatus which could function simultaneously for more than a year with the same quality of pyrites, have given exactly the same figure of annual average: 4.56 kgs of sodium nitrate per ton of 53° Bé acid.

As far as production is concerned we obtain with these apparatus 20 to 26 kgs per cubic metre without difficulty:

40T/24 H. at VOVES and ISSOUDUN
80T/24 H. at MONDEVILLE.

The 40 ton-plant comprises 3 towers of 7 metres in diameter and 18 metres in height.

The 80 ton-plant comprises 6 towers of 6.30 metres in diameter and 18 metres in height.

The latter plant has been operating for several years with six towers in series, then, with the same results, with two groups of three towers in parallel, one or the other being readily eliminated from the circuit without any stoppage of the plant.

The latter arrangement gives great flexibility to the running of the plant, seeing that production can easily be reduced to 50% in one or two groups; it is, therefore, possible to produce 20 to 30 tons a day according to requirement.

These extremes of production have been attained without difficulty.

In addition, such an arrangement permits lengthy repairs of one of the two groups whilst still retaining half of the maximum production.

Space required and weight of apparatus.

The intensity of production per cubic metre makes it possible to use an apparatus of small dimensions with an economy in lead and buildings.

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(1) Originally, the nitrous products were introduced by the action of sulphurous gas on nitrate of soda placed in pans. This introduction is now carried out by circulating acid in the Glover.

The buildings of the 40 ton-plants at ISSOUDUN and VOVES comprise a Glover, two Gay Lussacs, 3 Gaillard towers, service tanks and coolers covering an area of 310 square metres - height 19 metres to the roof of the towers.

The buildings of the 80 ton-plant at MONDEVILLE comprise one Glover, two Gay Lussacs, 6 Gaillard towers, coolers and tanks covering an area of 600 square metres.

Those of the 60 ton-plant under construction require 500 square metres.

It is estimated that, with the same production capacity, the weight of lead to be used in a GAILLARD plant is a third less than that utilised in a standard chamber plant.

For these two reasons (decrease in space required and in weight of lead) the GAILLARD process is particularly advantageous from the point of view of initial expenditure.

Running expenses,

The motive power required is not great. The turbo-disperser is directly connected with an 1.4 H.P. electric motor which does not develop that power during normal operation.

The raising of the cold acid in a 40 ton-plant is fully assured by two piston pumps using altogether less than 4 H.P.

The maintenance of the turbo-dispersers is practically nil.

The wear and tear of the lead is on the whole the same as with the standard lead chamber.

Expenses in connection with labour are the same.

CONCLUSIONS,

The GAILLARD process has given results which we anticipated.

In view of the scarcity and the high price of lead, the advantage of this process from the point of view of saving in lead required for the construction, renders it, at present, very attractive.

As far as we are concerned we have not hesitated to retain this process for the replacement of a chamber plant destroyed by the war.

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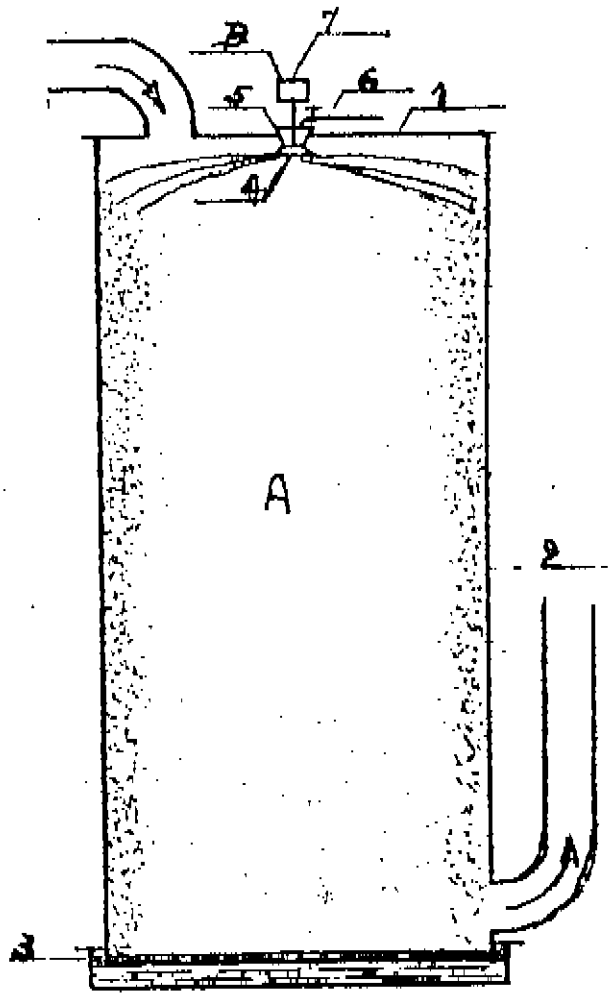
Schema d'une Tour de fabrication
Système E.A Gaillard Breveté S.G.D.G.



A Tour
1 Ciel _ 2 Parois _ 3 Cuvette
B _ Turbo
4 Turbine _ 5 Distributeur _ 6 Arrivée d'acide froid
7 Moteur à axe vertical _