

Since in 1891, the price of sulphate of ammonia was only £10 17s. 6d., i.e., at a time when the sulphate produce from by-product coke ovens did not exceed 5,000 tons per annum, the extensive growth of the by-product coke oven, coupled with other sulphate recovery works (the gas industry, blast furnace and producer gas processes), can hardly be said to have threatened the value of the main by-product. The answer to the apparent paradox is the growing appreciation and demand for sulphate of ammonia as a fertilizer for cereals, sugar, and vine growing, all three important articles of food. With the food supply at stake there is little chance of this product from coal being put in the background. The only danger would be a cheaper fertilizer, and this is not forthcoming. Certainly there is the possibility for atmospheric nitrate (i.e., nitric acid electrically produced from the atmosphere and combined with lime), but given this possibility, and its production is not great except with very cheap power, there is room for the two products, in the consideration of the world's food supply.

As regards tar and benzol, the other products obtained from by-product coke ovens, there has again been an upward recent tendency. Tar has risen from 16s. to 21s. per ton, and benzol (90 per cent.) from 6d. to 9d. and 10d. This again, the writer would suggest, is due to fresh fields and pastures new. Tar has found an outlet for road dressings, and benzol has developed as a motor spirit, the result being a shortage for the old outlets, which have had to bid against the new usages. In fact, the by-products process depends for its future developments, as do all other processes on fresh applications for its products, and to this end the writer offers to the meeting the following considerations:—

The future of the by-product coking process lies (1) in the development of the process itself, (2) in the application of the process.

Developments in the Process Itself.

Recent years have brought forth many improvements which have helped to establish the process. Flue arrangements have been perfected, whereby regular heating of large coking chambers is produced, the result being even carbonization with minimum repairs to oven lining. It is safe to say that with a modern design of heating flues coupled with the choice of a first-class siliceous firebrick, the minimum life of a by-product coke oven lining may be taken at four years, and the chance of serious breakdown in this direction such as have occurred in the past, may no longer be considered.

The growing possibilities of coke oven gas as a source of towns' illumination, power generation, furnace heating and the like, have furthermore led coke oven inventors and designers to perfect regenerative systems of oven heating whereby the process has been resolved into a highly developed heat economizer, so that where 60 per cent. of the gas evolved was required by waste heat processes for oven heating, an equivalent quantity is now available for any desired extraneous purpose.

Before proceeding, it may be of interest to you to see the design of a by-product coke oven, which is now being erected by the Otto Hilgenstock Coke Oven Company, at Skinningrove, which in the writer's opinion embodies the modern drift of coke oven design. From the illustration you will see that in the first place the gas is admitted to alternate sections of flues, not from a common gas flue or duct, but by independent burners

which are accessible and interchangeable from the outside. By this means there can be no mis-direction of the heating gas, and the temperature of the oven walls remains even throughout. In the second place, since the products of combustion, having passed up one section of flues, are drawn down the adjacent flues, as much heat is transferred to carbonization duty as possible. There is, furthermore, the advantage that the products of combustion, instead of collecting in a common flue at the top of the oven wall, thereby tending to overheat the oven crown, are immediately withdrawn, and superheating of the crown is minimized. The regenerators, which are 15 feet deep, are tall and narrow, and no opportunity is afforded the gases to cut across corners, which is the case with squat regenerators. Finally, you will observe that the depth of the carbonizing chamber is considerably higher than the depth of the flue chambers. Most of you who are in coke-oven practice, will admit that the crown of all coke ovens gets too hot by radiation from the mass of hot coke during the latter stages of carbonization, an effect which is harmful, since it produces breakdown of gases, tars, benzol, and ammonia. By increasing the depth of coal beyond the flue depth, the aforesaid radiant heat will be absorbed in the upper thickness of coal, which, of course, will be carbonized, resulting in a greater all round output of coke, gas, and by-products per oven with no further expenditure of heating gas, and at the same time giving a cool crown with greater yields per ton.

The writer believes that, as regards the design of the carbonizing chamber itself, very little remains to be accomplished, except that where the consideration of coke oven gas for any use is of moment, the chambers might be heated by producer gas (regenerated if need be) instead of by coke oven gas as at the present time. Such method of heating was suggested by the writer at the Dublin meeting of the Institution of Gas Engineers in 1907, and would open up, by employment in modern mechanical producers, the large quantities of refuse small coal which are still thrown to waste, or left in the pits, in many parts of this country. The writer is informed that at one plant in Westphalia, a coke oven battery is already heated by producer gas from refuse coal, and suggests that there are many cases in Great Britain, the need for coke oven gas being urgent, where this method of heating would tend to national economy. When all is said and done, it is only the method employed for heating towns' gas retorts throughout past generations.

The writer has suggested that the design of construction of coke oven carbonizing chambers has nearly reached its zenith in the type of oven just described, but the chemical aspect of the process offers a far more extensive territory for development and economy. The last two years may be truly said to have marked an epoch in carbonization practice, since inventors have been driven from the worked-out field of oven design to investigate economies and developments in dealing with the gaseous products resulting from their ovens as carbonization chambers pure and simple. The writer refers, of course, in the first instance to the attempts which have been made to recover sulphate of ammonia direct on the gas main, without having recourse to the usual method of condensation of ammonia liquor, and the subsequent distillation of the latter in the manufacture of ammonium sulphate. To students of coke oven economy, it has always appeared wasteful to cool down from the gases the aqueous vapours containing