

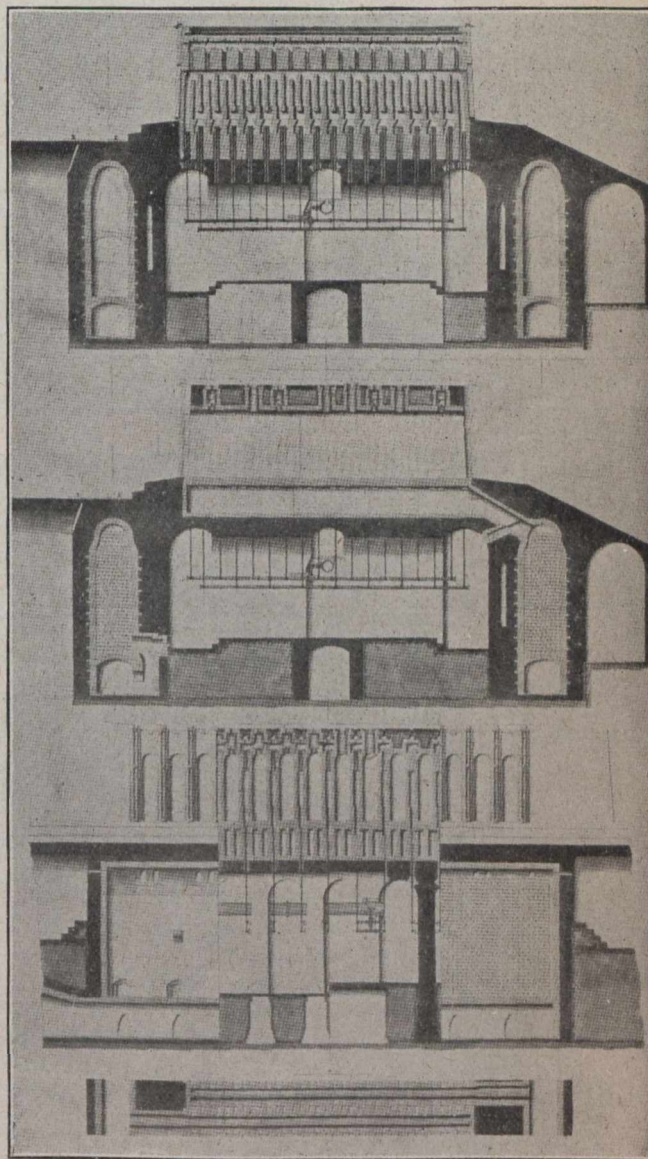
ammonia, forming part of the distillation products of coke ovens, and afterwards to reheat these aqueous products to recover ammonia or ammonium sulphate. Such procedure was the reverse of fuel economy, and accordingly Brunck, in 1903, sought to pass the hot uncondensed tarry gases from his coke ovens direct through sulphuric acid. Brunck's aim was ethically right in seeking to conserve the heat contained in the hot gases from the ovens for the manufacture of ammonium sulphate, but unfortunately his object was barred, in so much as the acid became tarry and dirty sulphate was the result. Furthermore, the tarry products exerted a reducing action on the sulphuric acid, and the sulphurous acid gas produced corroded his gas mains. The entire process therefore became unworkable.

The next attempt at direct sulphate recovery was made by Koppers. This inventor avoided Brunck's method of attempting to treat the hot gases, and decided to cool out his tars in the usual manner before the sulphuric acid washing. The vessel containing sulphuric acid or saturator, as it is called, is inserted as a scrubber, through which the tar-free gases are passed, thus eliminating the chances of loss of ammonia which might occur with liquor or water washing in the usual type of scrubber. The liquors which have condensed in the process of tar removal (containing with wet coal about 80 per cent. of the ammonia) are heated with steam in an ordinary ammonia still, the ammonia and steam from which are passed into the saturator on the gas main. In order to avoid condensation within his saturator, Koppers preheats his gases after tar removal, by passing them before entering the saturator through a "reheater" or "heat exchanger," through which is passed the hot gases travelling from the ovens to the condensing plant. By his invention, Koppers avoids using the scrubbing water ordinarily employed, thus reducing the amount of liquor requiring to be treated by the ammonia still, and therefore, the amount of river polluting effluent which is of serious moment in some parts of the country. Koppers' salt is of good colour and contains a minimum amount of tarry matters.

The most important development in the treatment of coke oven gases and in the recovery of tar and sulphate, is that devised by Dr. Hilgenstock of the Otto Company. The inventor reverts to Brunck's original aim, but instead of passing tarry gases into sulphuric acid, he primarily removes the tar from the hot gases by passage through a tar spray, the temperature of which is so regulated as to completely remove the tars without effecting condensation of the greater bulk of ammonia liquor. From the spray, the gases containing the liquors in steam form, together with the ammonia, are passed directly into sulphuric acid, where the ammonia is caught and precipitated as ammonium sulphate. The gases leaving the saturator are free from ammonia, but still contain the liquors as steam, which is carried on to the ovens and boilers and thus dispensed with.

In the event of the gases being required for benzol recovery, gas engine use, or towns' lighting, the Otto Company employs a fractional method of condensation, whereby the greater portion of the liquor containing very little  $H_2S$ , etc., is precipitated immediately below the dew-point. The remainder of the liquor obtained by completion of the cooling is similar to ordinary spent liquor without, however, containing any lime; its amount is so small that it can be mixed off with the coke slacking water.

The next three diagrams and photographs of models will show the extent of these recent simplifications in the recovery treatment of coke oven gases. It will be seen from the illustrations that Otto's new process dispenses with condensers and water for the same, liquor circulating pumps, liquor cellars and stores, ammonia stills and superheaters, lime mixer, lime pump, settling tanks for spent liquor and drains therefrom, steam connections and boiler power, thereby effecting a big economy in ground space. The working costs are reduced by abolition of steam and lime in sulphate making, and trouble in dealing with spent liquor. Finally, all chances of loss of ammonia are reduced to a minimum, since the free or volatile ammonia never leaves



Regenerative Coke Oven

the gas main, and losses by circulation and in the distillation process are avoided.

Several points have been suggested against the Otto method of recovery from the hot gases. In the first place it has been stated, that the temperature of the gases, and the reaction heat produced by the ammonia and sulphuric acid in the saturator, was insufficient to prevent condensation in the latter, and that external steam had to be supplied to avoid such condensation.