

by UOP. Process design of the fractionating and storage facilities as well as the mechanical design and construction of the entire unit was handled by Phillips.

The normal pentane feed for the Phillips unit is separated entirely from natural gasoline. A mixture of pentanes is fractionated to give a normal pentane feed of approximately 85 per cent purity.

The economics of design dictated the use of four parallel reactors. The advantage of operating at optimum efficiency, requiring close control of temperatures, led to the provision of individual heaters for each reactor.

After passing the reactor effluent through a high pressure separator, where the recycle hydrogen is removed for recompression, the

product is stabilised in a fractionating tower to remove the butanes and lower boiling materials.

After stabilisation, the stabiliser kettle product is fed to two deisopentanising towers operating in parallel. These towers produce 95 per isopentane overhead and approximately 85 per cent normal pentane as kettle product.

The operating performance of the Penex unit for isomerisation of normal pentane installed at Borger has justified the faith placed in this important new refining tool by the Phillips Petroleum Company. The plant start-up was smooth and design conversion and yields were quickly reached. This unit is in fact giving every indication of being a very economical and efficient process.

Synthesis of Hydrocyanic Acid

A NEW DEVELOPMENT OF THE ENDOTHERMIC PROCESS

The synthesis of hydrocyanic acid by the exothermic reaction between methane, ammonia and air—the Andrussow process—has been extensively developed during recent years (*Platinum Metals Rev.*, 1958, 2, 7-11). The energy requirements of this process are low, and it has proved to be a practicable commercial method, but the yield is comparatively poor and separation of hydrocyanic acid from the reaction products is difficult. A modified process has now been developed in Germany by Degussa in which the direct endothermic reaction between methane and ammonia is utilised and heat is supplied from an external source. This BMA process (*Blausäure aus Methan und Ammoniak*) has been described in a paper by F. Endter (*Chem.-Ing.-Techn.*, 1958, 30, (5), 305-310).

In a plant with a capacity of 100 tons per day, hydrocyanic acid is produced in 83 per cent yield based on ammonia, compared with 65 per cent for the Andrussow process and the concentration in the outlet gas is more than 20 per cent, the only other major constituent being hydrogen which is a valuable

by-product and easily separable from hydrocyanic acid.

The synthesis reaction occurs in sintered alumina tubes 2 metres long and 20 mm in external diameter, lined on their inner surface with a layer, 15 μ thick, of catalyst containing about 70 per cent platinum. This catalyst, which was specially developed for the process, suffered no apparent loss in activity in a test lasting nine months. The reaction between ammonia and methane, in the ratio 105 : 100, takes place at about 1200°C and the gases, on leaving the reaction chamber, are immediately cooled to below 300°C to prevent dissociation of the hydrocyanic acid. The unreacted ammonia is removed as ammonium sulphate by washing with sulphuric acid and the hydrocyanic acid is separated from the hydrogen by absorption in sodium hydroxide.

Some heat can be recovered from the effluent gas as process steam, but the need to supply heat for the endothermic reaction is the main item of cost, so that the process will be most economic where fuel gas is available cheaply.