Nitrogen in various combinations is an essential constituent of most fertilizers. Although an abundant supply of atmospheric nitrogen is readily available anywhere, it must be converted into a "fixed" form suitable for use as a fertilizer. The principal source of fixed nitrogen used in the manufacture of fertilizers is ammonia (82.2% N).

Although ammonia is an important general chemical, its major use is in the fertilizer industry. In 1960 over 75% of the ammonia produced in the USA was used in fertilizers. In 1963 production of ammonia in the USA was over 6.6 million tons, of which about 4.7 million tons were used in the fertilizer industry. World production in 1960 was about 13 million tons, with almost 11 million tons going into fertilizers. The greatest expansion period in the history of the ammonia industry will probably occur between 1963 and 1967.

During the past 25 years vast improvements have been made in the design of ammonia plants. Significant developments have been made in plant equipment, instrumentation, and catalysts. These improvements have substantially reduced the capital cost of new ammonia plants and have drastically reduced operating and maintenance costs.

1. HISTORY OF PROCESSES

Prior to World War I the principal sources of all fixed N were the natural deposits of sodium nitrate in Chile. In 1893 Sir William Crookes warned the British Association for the Advancement of Science of the limited life of the Chilean deposits. He emphasized the need to accelerate the search for a practical method for fixation of atmospheric N and pointed out the importance of a continuing supply of nitrogeneous fertilizers to world progress. His statements inspired the search for a practical process for N fixation.

Three industrial processes have been developed during the past 165 years for fixation of atmospheric N. These are: (i) the electric arc process...