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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
OFFICE OF SYNTHETIC LIQUID FUEL
LOUISIANA, MISSOURI

1139

T-411

TOM Reel 44, Frames 1140 - 1142

W. M. Sternberg
Oct. 20, 1947

Linde Kismaschinen A. G.
Division of Liquefaction of Gases, Höllriegelakreut near Munich.

Sept. 9, 1936

To Ruhrbenzin A. G.
Oberhausen -- Holten

REMOVAL OF CARBON DIOXIDE BY REFRIGERATION

We refer to the discussion of your Professor Martin with Dr. Richard Linde on August 6, with regard to the process for removal by refrigeration of carbon dioxide proposed in our letter of July 22, 1936. Dr. Martin has expressed the opinion that the process is satisfactory with respect to energy consumption and installation costs for the preliminary purification of the synthesis gas, and that you would therefore be interested in a semicommercial test of the process. We are ready to conduct such experiments, and are ready to inform you of the costs of setting up such tests.

If the results of small scale tests are to be permitted to decide with certainty on operation of large scale installations, the size of the small scale thruput must be 1,000 - 1,600 m³ (/hr) of raw gas (14% CO₂, 56% H₂, 30% CO). In that case, we can use parts of the Oberhausen installation, namely 2 regenerators and 1 blower, which will reduce the costs of the experimental installation by about RM 12,000. Two regenerators, connections, the pipe line and a compressor (for about 1,600 m³ of raw gas, 2 atm. pressure) and an expansion turbine will have to be added. Our costs for the additions to the installation, including the construction costs will amount to about RM 50,000, and the total costs for the experimental installation will be RM. 62,000.

The installation will operate as described in our letter of July 22, 1936. It will permit us to use all foundations of the experimental installation for the actual operating units with proper regards to safety and the cost of the installation, and permit you to test the suitability of the purified gases for the gasoline synthesis. The experimental unit for the purification of 1,600 m³ of gas will use about

100 kw of power. This is a higher figure than quoted in our previous letter because we will use compressors and blowers of larger capacity in our experimental installation, and will therefore have to estimate their efficiency considerably lower than for a full size installation. Furthermore we do not take into account the credit for the energy of the expansion turbine, nor the energy content of the purified gases which leave the equipment with an excess pressure of 0.2 - 0.3 atm. We have further taken into consideration in our estimate of energy requirements, that a smaller installation would naturally operate with greater specific losses of cold than a large installation.

The gas losses during the purging of the regenerators with air must be taken into consideration when evaluating the operations. These losses will amount to about 2 - 3% of the gas to be purified, an amount which will affect adversely the operating costs given in our letter of 7/22/36. The installation will be operated by two men supplied by you. We will first use desulfurized gas for the purification, on which we must demonstrate the carbon dioxide removal and the final sulfur elimination. Our ability to handle raw gas containing the whole of the hydrogen sulfide in the installation will depend on the degree of perfection with which hydrogen sulfide can be eliminated with the purging air. We propose to study this problem jointly.

The knowledge of the presence of oxides of nitrogen and of heavy hydrocarbons is important in judging the applicability of the process, because their presence will produce conditions favoring the formation of nitro compounds during the cooling in the regenerators. We wish to request you to inform us whether your previous experiments have furnished any information on this subject. If none is available, we will consider it essential that you should establish their presence by suitable experiments, and do so before arriving at any decision on proceeding with the experiments. The tests should also include the dust and iron carbonyl contents of the gas.

(The rest of the letter discusses the financing of the test, the personnel furnished by the Linde Co. and the patent rights to any inventions made; considered unimportant.)