RESTRICTED

FISCHER-TROPSCH UNIT AT LEIPZIG GAS WORKS.

Reported by

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on behalf of

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Introduction.

The Fischer-Tropsch plant at the gas works of Leipzig, Germany, was being installed for the purpose of enriching the town gas for the city of Leipzig and at the same time to yield much needed recoverable liquid and solid hydrocarbon products. It was the smallest unit that was considered economically operable for this purpose and was 75% complete at the time the area was occupied, the last of April 1945. The plant was of usual design for operation at low pressure on cobalt catalyst; in fact, the reactors had been removed from the Lutzkendorf plant (30/5.08).

Description of Plant.

A simplified flow diagram is attached as Figure 1, and photographs of the plant are presented on Figures 2,3 and 4. The feed gas, a mixture of water gas and coke oven gas, was supplied by the gas works and the residual gas from the plant was to be returned to the gas works for admixture with water and coke oven gas and used in the Leipzig gas supply. The gas quantities and compositions were intended to be as shown in Table I. Although an activated carbon plant was being installed for the recovery of propane and butane, it was stated that it was only for possible future use. Hence, the propane and butane would be present in the residual gas, and the town gas would therefore be somewhat richer in C_nH_m and have a higher BTU content.

The mixed feed gas, supplied at 2300 mm. H_g by a blower at the gas plant, was to pass through an activated carbon coarse-purification unit containing a total of five tons (350-380 kg/cu.m.) of activated carbon prepared and supplied by I.G.Farbenindustrie. The unit consisted of three vessels (approx. 7 ft.diameter x 10 ft. high, back center Figure 4), each vessel alternately on 40-minute periods of adsorption-purification, steaming, and cooling. During the adsorption-purification period, the vessel on stream was to operate at atmospheric temperature and have a normal pressure drop of 400 mm. of Hg. The activated carbon was to be reactivated by steaming at 150-160°C. (maximum temperature of 170-180°C, or permanent damage to the carbon results). The cycle was to be completed by drying and cool-

ing which was to be accomplished by recycling water-cooled residual gas over the activated carbon bed.

The gas then was to pass in parallel flow through a fine purification plant consisting of two units of three vessels each (approximately 8 ft. diameter x 8 ft. high, right, Figure 4), each vessel to contain 10 cu.m. of the usual iron oxide catalyst (total of 60 cu.m.). The gas was to be preheated sufficiently to maintain the temperature of this iron oxide catalyst at 250-300°C. This purification plant was expected to have a normal pressure drop of 500 mm. Hg.

The coarse and fine purification systems were stated to be oversize because it was anticipated that it might be necessary to use gas from the A.G.S.Werke, Böhlen (30/9.08) which was less pure than that from the Leipzig gas works.

The purified gas at 1200 mm. Hg. was then to pass in parallel flow into 4 units of 3 reactors per unit (each reactor approximately 16 ft. long, 6 ft. wide, 9 ft. high; see Figures 2 and 3). These were standard plate reactors (8 mm. spacing between 2 mm. fins) and were to operate at 185 to 200°C. and atmospheric pressure. Each reactor was to contain approximately 10 cu.m. of cobalt catalyst of 350 kg/cu.m. density which was to be supplied from the Lutzkendorf plant (30/5.08). Pressure drop through the catalyst bed was expected to be 500 mm. Hg. Boiler condensate from the gas works was to be used as the heat exchange medium for the ovens. It was to enter the lowest tubes and pass, by convection, upwardly through the remaining tube bundle. One steam accumulator was installed for each unit of 3 reactors (see Figure 3) for the recovery of the approximately 15-atmosphere steam, which was to be used either for the activated carbon regeneration or returned to the gas works.

The hot effluent from the reactors was then to pass into the bottom of a Raschig ring-packed water wash tower, (50 mm. pressure drop) the water and condensate to flow by gravity to separators and the wet gas was to be, either directly or through an activated carbon plant for recovery of propane and butane, returned to the gas plant. The two water-wash towers were approximately 50 ft. high and 4 ft. diameter, containing 6-2½ ft. beds of Raschig rings spaced at 1½-2 ft. intervals with intermediate distributors. The wash water (estimated 0.5% maximum acetic acid) with caustic, cooled in a spraytower and recycled.

The expected yield of liquid product was approximately 100 gms. per cu.m. consisting of 1/3 benzene, 1/3 medium oil and 1/3 wax. The liquid product (estimated at 500 T/Mo) was to be sent to Leuna or Lützkendorf for refining or further processing.

Personnel.

Ing. Bonnes, who was in charge of the installation of the plant for Lurgi, was interrogated on May 10, 1945, and served as a guide through the plant. The inspection and interrogation was by W.W. Odell, L.L. Hirst and W.A. Horne, and the photographs were taken by J.P.Jones.

W. A. Horne.
J. P. Jones.

TABLE I.

	Coke Oven Gas.	Water Gas.	Synthesis Gas.	Residual Gas.	City Gas.
Oven Gas	-	-	74,000	-	91,000
Water Gas	-	-	146,000	-	84,000
Residual Gas	-	-	-	-	110,000
Normal cu.m./day	165,000	230,000	220,000	110,000	285,000
CO_2	2.4	5.0	4.1	8.1	5.4
C_nH_m	1.2	-	0.4	1.0	0.8
O_2	0.4	-	0.1	-	0.1
CO	5.7	38.0	27.2	21.3	21.2
H_2	59.0	52.0	54.3	37.5	48.6
CH_4	27.8	0.3	9.6	23.6	18.1
N_2	3.5	4.7	4.3	8.5	5.8
Kcals/Nm^3	-	-	-	-	4000
Density, Kg/Nm^3	-	-	-	-	0.632