INTERROGATION ON 2nd JANUARY, 1946

Dr. Bütefisch was interrogated by the following:-

Major K. Gordon)
Dr. R. Holroyd )
Dr. J. N. Perquin.
Mr. D. Morten )
Mr. D. A. C. Dewdney
Mr. A. R. M. Murray)
Mr. K. Stock )
Dr. F. A. Williams,

General Survey of Synthetic Oil Production in Germany.

Dr. Bütefisch was asked in the first place to give an outline of the production of synthetic oil in Germany. Dr. Bütefisch referred to the start of production in 1927 at Leuna with an output of 300,000 tons per annum at first, subsequently increased to 500,000. It was intended that half of the whole of the oil used in Germany should be synthetic. In 1934-1935 under the "Vierjahres Plan" there were started up additional plants in the following order:-

1. Böhlen
2. Magdeburg
3. Schwarzheide
4. Zeitz

Difficulties with the hydrogenation of black coal delayed the erection of plants for this purpose, but ultimately the treatment of black coal was commenced at Scholven and Gelsenberg. These were followed by the following synthetic oil plants Wesseling, Poelitz, Ruhrchemie, Hoesch and Essener Steinkohle.

Dr. Bütefisch gave figures indicating the rapid increase in the total production of oil from synthetic plants and natural petroleum during the war years from 4,300,000 tons in 1940 to the maximum attained of 7,100,000 in 1943. He was subsequently asked to prepare a table showing details of the various grades of oil produced throughout the war in Germany.

Dr. Bütefisch pointed out that of the 1943 production of oil the Fischer Tropsch process accounted for 430,000 tons as compared with the 3,400,000 tons produced by hydrogenation.

Poelitz had been the highest producer of iso-octane; Leuna had also contributed; Moosbierbaum had produced alkylate, DHD - benzine and also hydro-forming benzine.

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Natural petroleum was responsible for the greater part of the production of lubricating oils. Special synthetic lube oils were obtained from the polymerisation of olefins produced from Fischer-Tropsch wax, brown coal tar wax and petroleum wax and by the synthesis of the Ester oils. The total production of synthetic lubes was only some percent of the total lubricating oil, to which shale oil contributed a proportion. Plans had been made for the development of oil produced from the latter, but no great success had been achieved. The total production of shale oil for 1943 was 109,000 tons.

The Blechhammer hydrogenation plant was not finished and alkylate plants at various hydrogenation and Fischer Tropsch works were also unfinished. It seemed possible that these may not have been needed since the development towards the use of turbine engines called for a fuel more like diesel oil.

Blending of the aviation gasoline was carried out by the Luftwaffe; the plants supplied only base petrol. In the last year they had tried monomethyl aniline or ordinary aniline since the production of lead tetra-ethyl was doubtful.

Comparison of Fischer Tropsch and Hydrogenation Processes.

Asked why the hydrogenation process had developed to a much greater extent than the Fischer Tropsch, Dr. Bütefisch replied that the raw material requirements for the Fischer Tropsch process were appreciably higher than for hydrogenation. The Fischer Tropsch motor fuel was also too low in octane number, 40-45. The diesel oil was of course very good. Dr. Bütefisch was understood to say that the Fischer Tropsch oils were more expensive than hydrogenation oils both in capital and running costs, but he undertook to supply figures comparing the two processes. By and large he thought Fischer Tropsch oil was some 20% higher in cost than hydrogenation oil, and quoted figures of 32 pf. per kilo of oil by the Fischer Tropsch process as compared with 24-25 by the hydrogenation process. The isomerization of the straight chain paraffins in Fischer Tropsch product was not as easy as was thought at one time. In his view, the Fischer Tropsch should be regarded as a chemical process yielding pure hydrocarbons, and was therefore, one for the chemical rather that the fuel industry. He mentioned that some 80,000 tons per annum of Fischer Tropsch diesel oil was converted to soap by sulphonation; lubricating oil was made from the wax. He regarded the Oxo process as very interesting. The variation in the Fischer Tropsch products obtainable by choice of catalysts and conditions made the Fischer Tropsch process very flexible.

Hydrogenation on the other hand was mainly suitable for making benzine, diesel oil and fuel oil, but not for making chemicals. In connection with the hydrogenation of Upper Silesian coal, Dr. Bütefisch appeared not to think these were any more difficult to treat than Ruhr coals.

When questioned about the operation of the Blechhammer hydrogenation plant to produce an excess of distillate heavy oil at a very high throughput, some three times the normal, Dr. Bütefisch said that it was desired to obtain fuel oil - a material which under normal conditions it would not be worth while producing by hydrogenation. Consideration appeared not to have been given to the use of any liquid phase stage to treat this heavy oil for conversion into middle oil.

Methyl Alcohol for Motor Purposes.

Dr. Bütefisch referred to experiments which had been carried out using fuels containing methyl alcohol. He referred to the difficulty with water tolerance and to the fact that the total consumption of an engine using a fuel containing 15% of alcohol was no higher than with the petrol alone.

Methyl alcohol was not used as a fuel during the war because it was wanted for other purposes. It was pointed out to Dr. Bütefisch that methyl alcohol plants were cheaper than hydrogenation plants, but Dr. Bütefisch said that the gas consumption involved in the production of the alcohol were much the same as by the other synthetic methods.

High Octane Number Fuels.

Dr. Bütefisch said that octanes were being made pre-war at Leuna and Poelitz. In the former case isobutanol was the starting material.

Production of aviation spirit at the start of the war was low because the Luftwaffe up to 1938 was not worried about high octane numbers; they were prepared to blend with benzol. When the Luftwaffe demanded higher octane numbers as a result of pressure from engine designers, iso-octane was made from isobutanol. The hydrogenation petrol had an octane number of 78-79 and with iso-octane or alkylate addition, numbers of 102-104 were achieved. All the aviation gasolene came from black coal. The cost of iso-octane from isobutanol was said to be 80-90 pf. per kilo. In 1941 isobutane was dehydrogenated to isobutene, polymerised to iso-octene and hydrogenated. Later isobutene and butane were alkylated. There was, however, difficulty with supplying the isobutene. Leuna was the first to make alkylate.

With regard to the D.H.D. plants built at several works but not put into operation, it was said that this delay was due to the influence of the development work being carried out on turbine engines, coupled with the use of aniline which showed that it was not necessary to have D.H.D. petrol, and in addition the loss of production of 20% resulting from the D.H.D. processes was serious with the declining output from the synthetic plants. It was pointed out to Dr. Bütefisch that alkylate plants were still being increased at the end of the

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war, but he inferred that there was insufficient co-operation between engine designers and the Luftwaffe.

Dr. Bütefisch was in agreement with the statement made to him that the aromatic content in the D.H.D. petrol from black coal was too high for utilisation by any engine which was in existence. Junkers were also of this opinion.

High lead content in the fuel had no injurious effect on valves when using aniline.

Jet Engine Fuel.

Dr. Bütefisch said the supply of jet engine fuel was a simple problem but the Germans had made it complicated. A pour point of - 20°C was necessary to avoid blockage of the fuel lines. Actually the fuel consisted of black coal middle oil from the sump phase, which had been put through the gas phase at 320-330°C and was mixed with heavy spirit.

The products from both the T.T.H. and M.T.H. processes at Zeitz could be used for gas turbines. These two processes serve to give paraffins and lubes, although the lube oil was not good. There was no incentive to make diesel oil since the return was only 16 pf. as compared with 32 pf. for spirit.

Catalytic Cracking.

Dr. Bütefisch said it had been proposed to erect in Hamburg in pre-war days a plant for the catalytic cracking of petroleum oil combined with hydrogenation. At the end of the war there were proposals to use petroleum oil fractions or middle oil from hydrogenation to make motor fuels with a silica fixed bed catalyst. silica fixed bed catalyst

Lube Oil Production.

Dr. Bütefisch admitted that insufficient dewaxing and solvent refining equipment was available in Germany to make good lubricating oils. The wax was needed and it was intended to erect more plant. The ethylene synthetic oils and S.S. oils helped to overcome the difficulties with cold in Russia. Poelitz made use of Fischer-Tropsch wax for producing synthetic oil, whereas Ruhrchemie appear not to have been successful. He thought that the matter may have some patent difficulties. The synthetic Ester lubricating oils were prepared by blending the ester from adipic acid and isobutanol with ethylene synthetic lubricating oil. The quality of the blend could be varied by varying the proportions of the mixture. Special lubricating oils were used for the Panzers.

✓ Fischer Tropsch iron fixed bed