

C O N F I D E N T I A L

GERMAN PETROLEUM INDUSTRY

HAMBURG DISTRICT

REPORT No.14

NORDDEUTSCHE MINERALÖLWERKE

PÖLITZ - STETTIN

Production of Synthetic Lubricating Oil

Interrogation of Dr. Hans Hartmann

*Reported By*

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*on behalf of the*

BRITISH MINISTRY OF FUEL & POWER

AND THE

U.S. TECHNICAL INDUSTRIAL INTELLIGENCE COMMITTEE

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FUELS AND LUBRICANTS

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE

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## I N T R O D U C T I O N

Dr. Hans Hartmann, Director of Norddeutsche Mineralölwerke, Pölitz near Stettin, was interrogated at his temporary residence, No. 2 Durer Strasse, Hamburg.

Dr. Hartmann fled from Pölitz just ahead of the entering Russian forces, taking with him a few documents which were later stolen from him while he was unconscious as the result of a bicycle accident. Hartmann was extremely cooperative and described in detail, from memory, the method used at Pölitz for making synthetic lubricating oil.

The plant started operation in February 1942 and had a normal capacity of 1500 tons per month, 375 B/D (42 U.S.Gal.) of aviation lubricating oil 110-120 V.I. The worst bombing raid occurred on May 29, 1944; the last on February 8, 1945, after which operations ceased. The plant can be restored to 20% of normal operating capacity in two weeks; eight or nine months will be required for complete restoration.

## SECTION I

a) Description of Process The process consists of two principal stages:

- (1) the cracking of paraffin wax for the production of liquid olefins, and
- (2) polymerization of the olefinic fraction with aluminum chloride and refining of the polymer thus produced with fine clay.

The preferred charging stock is

- (1) Fischer-Tropsch hard paraffin wax from Ruhrchemie, Schwarzheide, or Kamen-Dortmund, etc., boiling above 350°C.,
- (2) Paraffin wax from mineral oil, tar oils etc., also boiling above 350°C.,
- (3) Mixtures of (1) and (2) above.

The charging stock is first pumped through a preheater where the temperature is raised to 450-470°C., thence to the direct fired cracking section. Steam, equivalent to 5% by weight of the wax charge, is injected into the tubes of the cracking section to assist vaporization. The cracking section consists of 5 tube bundles, 240 tubes to the bundle. The tubes are silica-chrome steel, 3 m. long, 10 cm. i.d. 3 mm. wall thickness. Cracking is carried out at 490-510°C., at atmospheric pressure without a catalyst, with an average residence time of 25 seconds. Total capacity of the unit is 125 T/D. Average on stream time is 1500 hours, when charging Fischer-Tropsch wax. On straight paraffin wax from petroleum, the tubes require cleaning every 300-400 hours. No coking has been encountered in the preheater. The product from the cracking coil passes to a separator, the higher boiling uncracked wax from the bottom of the separator is recycled to the cracking coil, the vapors from the separator passing to a fractionator where the desired olefine fraction, 35 to 300°C., is removed as a bottoms, liquid cut. The light overhead from the fractionator equivalent to 26-28% by wt. of the wax charged, is made up as follows:

	<u>% by Wt.</u>
Methane, ethane, propane	40-45
Ethylene	19-20
Propylene	18-20
Butylene	18-20

The yield of the desired liquid olefine fraction, 35-300°C. boiling range, is 70-72% by weight. This material is 100% olefinic and has a iodine No. of 150. Sufficient methane and ethane are produced in the wax cracking operation to account for the yield of olefines obtained in the converted material. Loss and coke amount to 2% Conversion of the original wax charge is 35% per pass.

~~The liquid olefine fraction is pumped to~~  
the polymerising kettle, a 20 cu.m. capacity elliptical vessel of wrought iron with full-upon head and equipped with stirrers and cooling coils. The kettle is charged to 90% of capacity and 6% by weight of technical aluminum chloride added. Screened material with a particle size of 1-2.5 cm. and containing 1% of ferric chloride is used. The iron chloride impurity is not essential, according to Hartmann, but aluminum chloride of this quality is much cheaper than the sublimated grade.

During the polymerization reaction, the temperature is not allowed to exceed 60°C. At the end of 15-20 hours, the reaction is complete. The sour oil and sludge is then pumped to 50 cu.m. capacity settling tanks, 4 m. in diameter, and 4 m. high, also constructed of wrought iron. The sludge is settled 12 hours and drawn off to a mixing tank. The sludge is then diluted with 40% by volume of cutting oil (light gas oil), plus an amount of water equal in volume to the original sludge. The slurry is heated to 85°C. while stirring, and enough caustic soda is added to neutralize any free HCl. The neutralized slurry is then centrifuged, yielding a cylinder oil-gas oil mixture and water containing dissolved sodium chloride.

The oil stream is reduced with vacuum and steam to 300-320°C. flash, the gas oil and a small spindle oil cut are obtained at an overhead cut and a side stream from the flash tower respectively: the

bottoms "Zylinderöl", a high grade cylinder stock, require no further refining.

The settled sour oil from the primary settling tank is pumped to a separate mixing tank, diluted with 10-15% by volume of cutting oil, digested with an equal quantity of water, neutralized with caustic soda, and centrifuged, to give "Roh Motoren Öl" (diluted with gas oil) and water.

A total of 25 special centrifuges are used with vertically rotating bowls of nickel-chrome alloy, operating at 4500 RPM. The centrifuge shell is mild steel. The oil stream from the centrifuges is also reduced with vacuum and steam (10-60 mm. absolute pressure and 5% by wt. of steam; the cutting oil recovered and pumped to storage for re-use; a small spindle oil cut obtained and the bottoms, minimum 300°C. flash, clay treated, using 2% by wt. of "Frankouit", a decolorizing clay similar to Floridin. Clay treatment is carried out at 95°C. for 2 hours. The clay is removed by means of standard filter presses. The filtered oil is shipped to blending plants for admixture with an equal volume of solvent refined lubricating oil and reserved for use in aircraft engines.

b) Yields Ultimate yields, based on the wax charged to the cracking unit, are as follows:

Aviation Blending Oil	45%
Cylinder Oil	10%
Gas Oil a.	15%
Fuel Gas	28%
Loss	2%

- a. Does not include recycle gas oil used as a cutting oil to facilitate sludge separation.

Typical tests of Pölitz production plus the inspection of a blend of equal parts of Pölitz Aviation Blending Oil and a Duo-Sol refined oil, are shown in the following table:-

(see next page)

<u>Description</u>	1.	2.	3.	4. a.
	"Zylinderöl" (High Flash Cylinder Stock)	Aviation Blending Oil	Duo-Sol Refined Lub.Oil	Aviation Engine Lub.Oil
Properties				
Sp.Gr.: 70°C.	0.879	0.840	0.890	0.875
Viscosity, Engler: Deg.				
50°C.	68.4	42.0	7.0	17.0
100°C.	7.86	5.93	1.84	2.96
Viscosity Index	108	120	98	110
Polhoehe	1.7	1.54	1.9	1.7
Flash: °C.	315	310	225	240
Fire: °C.	355	350	260	280
Cold Test: °C.	-31	-29	-18	-25
Color (German Method)	Green	100	30	90
Neutralization No.	0.14	0.03	0.03	0.03
Saponification No.	0.47	0.10	0.11	0.10
Iodine No.	-	20	-	23
Carbon Residue: %	2.0	0.31	0.16	0.23
Ash: %	0.03	0.001	-	-
Evaporation Loss: %				
250°C.	1.64	2.3	-	-

a.

A blend of equal parts of Pölitz Aviation Blending Oil and the Duo-Sol refined mineral oil shown in column 3.



### Miscellaneous

Fischer-Tropsch wax is the preferred charging stock. Petroleum waxes, containing some oil, yield aromatics on cracking; these subsequently raise the carbon residue, darken the color and lower the viscosity index of the finished lubricating oil.

Corrosion problems have been very minor at Pölitz. Caustic soda is used, where required, to neutralize any free HCl.

The fuel gas from the Norddeutsche Mineralölwerke was shipped to Hydrierwerke, also at Pölitz. In return, utilities were furnished by Hydrierwerke.

~~Normally 300 men are employed. 120 of these are skilled Germans, the balance Frenchman and Poles.~~

After the severe bombing raid on May 29, 1944, production dropped from 1500 tons per month to 800 tons per month, for the period June 1, 1944 to February 8, 1945.

Hartmann avers that synthetic lubricating oil produced by the polymerization of ethylene is superior to that made by wax cracking; the engine performances of the ethylene oil showing less tendency to stick the piston rings in the BWW oil test engine.

The plant is now in Russian hands.

Conclusions

The Politz process for making synthetic lubricating oil is similar to the Shell process, neither of which can compete economically with mineral oils prepared from crude oil. Both processes can probably be modified to produce lubricating oil of 140 V.I., which may be valuable for special uses, providing Fischer-Tropsch wax, or similar material, is available for charging stock.

Date of Interrogation &  
Names of Party

16th May, 1945.

Mr. E.H. Boomer (Can.)  
Mr. V. Haensel (U.S.)  
Mr. Paul K. Kuhne (U.S.)

SECTION 2. Norddeutsche Mineralöl Werke Documents, Pölitz,  
(Germany).

Target No: Opportunity Target examined in Shellhause, Hamburg.  
20 May, 1945.

C.I.O.S. Trip 203, Group 3, Item 30.

Norddeutsche Mineralöl Werke shipped several boxes of documents to Deutsche Amerikanische Petroleum Gesellschaft, Standardhaus, Hamburg, in advance of the entry of the Russian Army into the Pölitz-Settin area. The documents were found among the D.A.P.G. files transferred to Shellhause on occupancy of Standardhause by the Military Government of Hamburg. The boxes were opened and the documents examined.

The documents comprised the essential working papers and historical records of the plant covering construction, operation, maintenance, supplies and sales, finance and administration. Certain technical documents were selected and forwarded to S.H.A.E.F. and C.I.O.S. Secretariat for further study.

These documents may be described as follows:-

1. Plans and flow sheets of the synthetic lubricating oil plant.
2. Flowsheets of a dewaxing plant.
3. Data on the properties of the waxes used as raw material and of the products of the plant and data on operating procedure and difficulties.
4. A proposal by Lurgi giving essential details of a plant using both gaseous and liquid olefins in the production of lubricants.

The documents selected are adequate to the design and operation of a synthetic lubricating oil plant based upon the cracking of paraffin wax. The information obtained by interrogation of Dr. Hartmann, the Director, was confirmed by the documents.

Among the documents was a detailed list of equipment, including railroad car numbers, that has been shipped from the plant to the Hamburg area in advance apparently of the Russian entry to Pölitz. This list was turned over to the Military Government of Hamburg for attention and tracing.

(Sgd.) E. H. BOOMER.