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U.S. STRATEGIC BOMBING SURVEY

APO 413

Interview No. 47

Subject: Officials of Ruhrchemie
Prof. Martin & Dr. Hagemann

Date of Interview: 5-9 June 1945

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INTERROGATION OF PROF. MARTIN.

1. Key personnel:

Prof. Martin is managing director of the Ruhrchemie.
Further key personnel include:
Dr. August Hagemann, technical director of Holten (at present in London with Prof. Martin)
Dr. Schuff, F.T. plant manager (chemist)
Ing. Newoling, F.T. plant manager (mechanical engineer)
Dr. Spanier, works manager of the nitric acid plant and at present temporarily in charge of the whole works.

The last 3 named persons are available at the plant and live in the company compound.
Mr. Asboth, in charge of construction of the nitrogen plant is now reported to be with his family in Grundlsee, near Aussee (Salzburg).

2. Records:

The evacuation addresses for the Ruhrchemie records are:

(a) Reelkirchen (between Paderborn and Dortmund).
All the F.T. synthesis and general records are there in charge of Dr. Rohe.
(b) Gebhardshagen near Salzgitter (near Braunschweig) at the Habelahwiese iron-ore mine, records of the nitrogen works. These are kept by Dr. Biederbeck, works manager of the Holten nitrogen plant.

3. Habelahwiese was the dispersal site for 2 units (cap. 50 T.N/Day) of the Holten ammonia plant. Furthermore, there is a small laboratory, the Holten laboratory facilities having been completely destroyed by air raids. The Habelahwiese laboratory is only small and set up for analytical purposes.

4. Prof. Martin stated that the laboratories of the Kaiser-Wilhelm-Institut in Mühlheim were still fully intact. Prof. Franz Fischer had severed his relations with the K.W.I. and, when last heard of, he was in Munich. Dr. Pichler was reported to be still at the K.W.I. laboratories.

5. Prof. Martin stated that the building of new Fischer or hydro plants had to be approved by the Reichsamt für Wirtschaftsausbau, organized at the beginning of 1938 under the leadership of Prof. Krauch. The initiative for making proposals for new plants rested with private industry.

In 1936 or 1937 the Mineralölbaugesellschaft was organized by the industry to assist those desiring to construct hydrogenation or synthesis plants. This company was under the leadership of Dr. Koppenberg (a Junkers man); Dr. Simath, formerly of the I.G., was in charge of construction.

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The stock of the company was owned by the I.G., Union Rheinische Braunkohle, Gelsenberg, Stinnes and Ruhrchemie (10 or 15 %). The capital was only nominal, originally 300,000 RM, later increased to 500,000 RM. The Ruhrchemie interests of the Board of the Mineralöl-Baugesellschaft were represented by Dr. Knepper, Chairman of the Ruhrchemie Aufsichtsrat.

6. The following is a summary of information Prof. Martin gave regarding F.T. plants in Europe. Prof. Martin stresses the fact these datas are given from memory and without the benefit of his records:

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Plant	Interest	Started operation	Type	No. of ovens	Capacity t/yr. Primary product (i.e. incl. C3 and C4)	Remarks
1. Holten	Ruhrchemie	(beginning 1936 (beginning 1939	L.P. M.P.	40-45 70	25,000 t/yr. 40,000 t/yr.)	
2. Homberg	Rheinpreussen	1937 extensions) later)	L.P. only	abt. 120	60,000 t/yr.	
3. Schwarzheide	Brabag	1936 constr. started main capacity started end 1938	L.P. only	abt. 350	210,000 t/yr.	
4. Wanne-Eickel	Krupp	abt. 1938 abt. 1939	L.P. M.P.	est. 80-90 3/4 est. abt 20 1/4	50,000 t/yr.	Had lot of trouble. M. part used treat unconverted gases from L.P. unit.
5. Dortmund	Hoesch	beginning 1939 (9 Ats.)	M.P. only	80-90	60,000 t/yr.	
6. Kamen, [illegible]	Essener Steinkohle	beginning 1939	L.P.	at least 150	70,000 t/yr.	best plant
7. Castrop-Rauxel	Gewerkschaft Victor	end 1937	L.P.	abt. 60	40,000 t/yr.	special oven construction for filling and discharging of catalyst.
8. Lützkendorf	Wintershall	never regular operation	L.P.	abt. 150	70,000 t/yr.	very poor pla
9. Deschowitz	Schaffgotts	beginning 1939	M.P.	80-90	50,000 t/yr.	special Pints ovens, later changed to normal Holten construction.
10. Harne	Kuhlmann	1938	L.P.	abt. 40	20,000 t/yr.	
11. Italy		project only	M.P. est.	110-120	50,000 t/yr.	

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7. When questioned about the apparently rather substantial differences in the per oven capacities, Prof. Martin stated such capacity depends on the method of operation. The Kamen plant e.g. operated in 3 stages with a low (50%) in a second and third stage. This operation gives a high yield on synthesis gas (in Kamen 165 gr. Primary Product per nM^3 ideal gas), but a low output per oven (about 1.4 - 1.5 tons primary product per day).

The Rheinpreussen operation on the other hand was based on a high first stage conversion (70%) with a correspondingly lower yield (150 gr. per $n.M^3$ ideal gas, but with a higher output per oven (1.8 tons day).

Based on these figures and on Prof. Martin's statement that at least 10% of the ovens are always in repair, it may be concluded that the capacity of a low pressure Fischer oven of conventional design is about 450 to 550 tons of primary product (i.e. including C3 and C4) per oven per year.

Of the medium pressure plants Hoesch was the best one with a yield of 165 gr/M^3 ideal gas and an output of 1.7 tons of primary product per oven per day.

8. Prof. Martin admitted, no F.T. plant except the Essener plant had ever reached designed capacity. In the case of some of the older plants, e.g. Holten, this was at least partly due to poor design of the original ovens. Subsequent experience had improved the design. Furthermore, in the case of Holten and Rheinpreussen the operating conditions were often varied for experimental purposes or to carry out experiments for prospective licenses, and for best results it is very important that operating conditions be kept constant within a narrow margin.

In most cases, however, the poor results were due to trouble on the gas make side, e.g. the Wanne-Eickel plant manufactured its Water gas from anthracite L.T.C. coke. The gas made from this coke contained dust and some hydro-carbon gases resulting in Feinreinigung troubles and premature catalyst deterioration.

Schwarzheide also had trouble on the gas side. While the quality of the gas produced in the Schwarzheide Koppers units by the direct gasification of brown coal was satisfactory, these units fell far short of the designed capacity, since due to constantly changing temperature the Koppers chambers required continous repairs.

The difficulties with the Didier gas generators at Schwarzheide (which also were for the direct gasification of brown coal) were mainly of a mechanical nature, e.g. the bricklining of the air preheaters was attacked by the hot gas.

N.B. Since unsaturated hydrocarbons in synthetic gas prevent proper organic sulphur purification, several devices have been installed to remove these unsaturates. Kamen, for instance, has a Lurgi activated carbon plant before the Feinreinigung.

Dr. Löpmann of the Kamen-Essen plant was referred to by Prof. Martin as one of the best informed on how to get a F.T. plant operating satisfactorily.

Lützkendorf has been one of the worst plants and has never operated satisfactorily. The Schmalfeld generator in which raw brown coal was gasfied, did not completely crack the tar, i.e. the synthetic gas contained hydrocarbons and heavy sulphur compounds. Its capacity too fell far short of design.

I.G. sent their gas expert, Dr. Gloth, to help out, and attempts were made to condense the impurities, and an oil washing was installed before the final purification. The Lützkendorf plant has never produced more than at a rate of 30,000 tons primary product a year.

9. Prof. Martin, when asked why no new F.T. plants had been built during the war, whereas several new hydrogenation plants were constructed, gave the following reasons:

a) Coke (the preferred raw material for the synthesis gas) was short in supp[illegible] as it was badly needed by other war industries.

b) Interest in Germany was primarily in the manufacture of gasoline. In the F.T. process gasoline was not the main product, especially not in M.P. process, nor was its quality as good as that of hydrogasoline.

c) Appreciable quantities of LTC brown coal tar were being produced which was a very suitable raw material for hydrogenation.

10. Prof. Martin gave the following information regarding the working up of the Fischer primary product:

In Holten the product was distilled into 3 fractions - gasoline, diesel oil and paraffinous residue. The gasoline (200°C E.P.) was after a soda wash turned over to the Z.D. to be blended into motor gasoline. Holten sold about 10% of its Diesel oil fraction to the I.G., who used it for the manufacture of Mersol. (Rheinpreussen and Krupp also sold part of their Diesel oil fraction to the I.[illegible], for these purposes). However, most of the Diesel oil fraction (20-25% on Primary Product) is cracked and the olefines polymerised to yield about 46-50% wt. (calculated on Diesel oil) as a luboil.

The Diesel oil fraction and some low boiling point paraffins (the oils from the manufacture of paraffin wax from the parraffin residue) were cracked. In total an average of 700-800 t/month was so cracked. The C6 - C12 or 13 olefines produced were polymerised over Al.Chloride (a process licensed by the I.G.) to produce luboils. 3-4% of the lubs are spindle oils, about 97% Motor lub-quality, (Visc. 7°E. at 50°C, V.I. 100-105.

Holten was the only plant to work up Diesel oil to luboil. Rheinpreussen had some sort of a luboil plant, but Prof. Martin did not believe that they used any F.T. product in their luboil manufacture, and the Rheinpreussen luboils were low grade. No further details now.

Almost all the F.T. plants had cracking plants, but Prof. Martin stated that as far as he knew, Holten was the only plant that actually cracked F.T. product. The others used their cracking plants for distillation.

Some of the F.T. plants, particularly Schwarzheide, sent their paraffin to Witten/Ruhr, where Henkel had a paraffin oxydation plant of the Märkische Seifenindustrie),

Interrogation of Prof. Martin and Dr. Hagemann.

1. On dispersal and underground F.T. plants both Prof. Martin and Dr. Hagemann stated only to have knowledge of the Ruhrchemie projects. Both were convinced that underground F.T. plants were very dangerous in view of the danger of explosions etc., and did not believe them to be practical. They felt, however, the plants should be erected in narrow gorges with only certain parts of the critical equipment in caves. Ruhrchemie had planned such a plant in the Volmethal (Sauerland). The Holten Luboil plant was to be dispersed to Willengen. Prof. Martin also stated plans by Lurgi provided for 10 small F.T. plants as annexes to existing gas plants. These plants had a capacity of 5,000 to 12,000 tons primary product per year.

When further questioned on the subject M. and H. stated that the whole matter had been dealt with so secretly that they had no further information on it.

2. Regarding the effects of bombing on the F.T. plants both M. and H. stressed the fact that their information related primarily to Holten, although they believed experience in the other plants had been similar. As a result of the continuous air attacks the Holten plant has not been on stream again since Oct. 6th, 1944. Shutdowns as a result of air raids were in the beginning of no longer duration than 6-8 weeks, but after June 1944 the shutdown period was increased to 3-4 months. Regarding the rate of recovery of a plant Dr. Hagemann stated that it would come back on stream with a capacity of 30-40%, which in 3-4 days could be increased to 50-60% and after a week to about 90%. Bomb damage was predominantly (60-70%) to overhead piping.

Damage to water and gas mains and power lines caused also much interruption. A further vulnerable part of the plant were the gas holders, but with the necessary skilled labor it was possible to operate without gas holders. A more serious weak spot was however the "Fein-Reinigung".

Asked about instruments, damage to instruments had not been serious except in case of a direct hit. Ruhrchemie had always had sufficient spares to make up for damaged instruments, also it was felt that many instruments were not really essential for operating the plant, and at no time had damage to instruments been a factor in the loss of production.

The insulation of the ovens proved to offer considerable protection against fragment and the pumps and blowers had been well protected by concrete structures.

Loss of products stored had been very low, because no large stocks were allowed to accumulate, for instance Holten kept only a few hundred tons of gasoline in storage. Both gentlemen agreed that high explosives were worse than incendiary bombs and that a large number of small bombs created more damage than a small number of large bombs. Both gentlemen also agreed that the real bottleneck for effecting quick repairs was labor: the lack of a sufficient number of skilled artisans and other skilled labor.

3. Regarding the effect of the war on the labor force, Prof. Martin and Dr. Hagemann thought that the following rough figures for Holten were rather representative for the whole industry:

Pre-war Holten had a total number of employed of 3,000 men, of which 150 were college graduates and engineers, 1,000 skilled laborers and artisans, 600 in the general administration and 1,250 unskilled laborers.

By 1944 Holten employed about 6,500 people roughly as follows:
College graduates and engineers 150 (same as pre-war,) skilled laborers 1,300, administration etc., 600, general laborers 4,500. In addition, Gute Hoffnungshütte had continually a staff of a few hundred people in the Holten plant for repairs.

The increase was partly due to the lower efficiency of the workmen (two semi-skilled men or women were often used to do the work for which formerly one skilled man was used) and partly to cope with the continuous repair work. The above figures are for the whole of the Holten works, i.e. Nitrogen, F.T. etc., and are a rough estimate.

Prof. Martin thought that the labor requirements in the other F.T. plants could be taken to be roughly pro rata to the capacity. On this basis the Fischer synthesis industry in Germany employed about 30-40,000 people against a pre-war figure for a similar capacity of less than half this number.

4. Prof. Martin and Dr. Hagemann denied that area bombing had had any effect on the labor supply and thus interfered with production. However, such attacks on neighbourhood places sometimes resulted in water and power supply failures and to that extent they had affected plant production. Mostly such failures could be repaired in 2 or 3 days.

5. Prof. Martin and Dr. Hagemann felt it was impossible to say how many more man hours were required for construction and operation of dispersal or underground plants, since much depended on local conditions.

As a very rough estimate however, Prof. Martin believed that such plants would cost about 20% more than an ordinary plant and believed that this, as a rough approximation, might probably be taken to apply to labor too.

The cost of an F.T. plant including distillation and gas make (on basis coke), was estimated by Dr. Hagemann at RM 800/t primary product per year. This figure is based on pre-war conditions, at present probably 20-30% higher.
A rough split up of this figure is:

gas make from coke	20 %
synthesis proper	50 %
distillation, tank farm etc.	10 %
gas lines and piping	15 % or more
gas purification	5 %

The operating cost taking coke at 24 marks per ton was indicated to be RM 320 per ton of primary product including amortization. This figure is roughly made up as follows:

gas		RM 110.--
wages, salaries (others than employed in gas making)		" 30.--
Catalyst		" 20.--
repairs		" 50.--
Reinigungsmasse and Feinreinigungsmasse and other chemicals		" 20.--
water, power and steam		" 60.--
amortization		" 80.--
Total:		RM 370.--
credit for residual gas and steam:	about	" 50.--
Balance:		RM 320.--

6. Prof. Martin estimated the total capital invested in the F.T. industry in Germany at something of the order of 500 million RM.

7. Prof. Martin and Dr. Hagemann thought that about 40-50% of the F.T. capacity could be brought back into production without major new equipment.

8. Prof. Martin stated that at no time had there been a shortage of cobalt in Germany. The CO loss per regeneration was given 3C 3-4 % or 10-12% per year. Ruhrchemie had successfully reduced the cobalt content of an oven from 900 kg to 800 kg. Total stocks of cobalt metal in Germany were given by Prof. Martin to be 150 tons. Iron was a very good substitute, but could only be used in medium pressure plants. No industrial scale plant had been operating on iron, but a pilot plant (500-1,000 M³ gas per hour) worked satisfactorily.

9. Prof. Martin felt that the future of the F.T. process did not lie in the oil field. The gasoline was of poor quality and the Diesel oil while of good quality constituted only a small part of the product. However, he uses many promissing possibilities in the chemical field, e.g. the making of high melting point paraffins, from which by chlorination it is possible to make high alcohols, or which can be oxydized with NO_2 to high wax acids (C_{22} and higher). From such acids wax-like products of unknown possibilities can be manufactured. Also Prof. Martin thought it possible (Ruhrchemie had been experimenting along these lines) to produce a highly olefined product which can be used as a raw material either for producing luboil or for the manufacture of sulphonates and alcohols, etc.

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Another possibility for the Fischer process is the so-called Oxo synthesis, whereby CO and H_2 and loefines are reacted over a catalyst at 170-180°C., and 200 atmospheres pressure. The catalyst used in this synthesis is the same. Co catalyst and for the usual F.T. synthesis, but is in powdered form suspended in the liquid olefines.

From the production of the oxo process the aldehydes can be separated and used as raw materials for further chemical processing.

10. Prof. Martin gave the following very rough figures for capital cost of the Holten plant:

Luboil plant cracking about (incl. V&C dist. laboratory)	RM 5 - 6 million
N_2 plant	RM 30-40 million
Cat.-plant (incl. money spent on research)	RM 12 million
Oxo plant	RM 11 million
Holten total	RM 100-110 million.

11. Prof. Martin stated that Dr. Biermann was the Werkschutz leiter at Holten

12. Prof. Martin stated that as far as payment of wages were concerned foreign laborers in all respects were treated in the same way as the German laborers.

13. When questioned concerning R.C. contributions to the Nazi Party, Prof, Martin stated they only contributed the amounts levied on the industry as from about 1937. The amounts in question were only small and amounted to only RM 15-20,000 per year for R.C.

14. Prof. Martin did not know what was meant by the term "Freiheitskrieg ". He claimed he did not recollect using it.

9 June 1945

Interrogation of Herr August Hagemann of Ruhr Chemie

Dr. Hagemann stated that he worked with Professor Martin as an assistant works manager and was in charge of the Fischer Tropsch plant and laboratory. Questions prepared by Team No. 35 and attached to Mr. Roethli's letter of May 26th to the writer were used as a basis for the interrogation. A few questions were omitted. The following answers were obtained:

A (a) The air raids were the cause of the final cessation of plant operations. The frequency of the raids, every 4 - 6 weeks, finally made it useless to carry out the repair work. The repair required after each raid was more than could be handled in the time available before the next raid occurred.

(b) Production stopped on October 6. Thereafter some small additional effort was made to repair the plant but it was clear that nothing further could be done.

(c) Hagemann unable to answer this question. Normal production was about 3000 tons per month during the period May to June 1944 before the heavy attacks occurred.

(d) The Fischer product charged to the cracking unit of synthetic lube oil plant consisted of 2 cuts., the first boiling from 220 - 320° C., and the second boiling from 320° C., and up. The latter, however, was pressed to remove hard wax before cracking. The two streams were mixed and constituted (about 3500 tons per year total) feed to the crackin unit.

(e) The lube plant capacity was about 1200 -1400 tons per year of finished lube. However, a second plant for aviation lube with a capacity for 1000 tons per month was planned. Several critical parts of the plant, however, had been made good for 200 tons per month. A brief flow sheet attached shows the lube oil operations.

B (a) All products with the exception of wax were shipped away from the plant in tank cars. The hard wax was packaged and shipped in box cars.

(b) A pilot plant was under construction for catalytic cracking of Fischer gasoline. It consisted of fixed bed reactors using clay catalyst (clay from Bavaria). A C4 and C5 fraction was fractionated from the cracked product, polmerized with phosphoric acid catalyst and then hydrogenated to form a material which was almost the equivalent of iso octane. The yield of final product was 55 % based on feed. Hageman stated the Luftwaffe had not approved the use of catalytic cracked Fischer Tropsch gasoline as such in aviation gasoline. Hageman was not in position to give further description of process.

(c) This process was developed by the Ruhr Chemie.

(d) No trouble was experienced in transporting products from the plant. The transportation system in the Ruhr was always capable of taking away products. (This, of course, applies only until October 1944 when the plant shut down).

C Hagemann described plans to install small ovens in gas plants stating the capacity of the ovens was 1.5 to 2 tons per day. He felt that this project was of no great importance. The dispersal of the big plants on a large scale was not undertaken, but a plan was being followed to build Fischer plants alongside of vertical cliffs with installations of some of the more important equipment in shafts nearby. He was very dubious about the possibilities of underground plants in general for the Fischer synthesis, since such equipment is never absolutely tight and there is great danger of explosion. 40 to 50 air changes per hour are needed and this would cause considerable draft for the workers.

(a) The planned production was changed considerably. At one time a progress for 10,000 tons per month in 3 to 4 plants was considered.

D Hagemann not asked this question.

E (a) In general, Ruhr Chemie produced half of their steam requirements. The other half they brought in from the grid system. However, an expansion in the power plants had been planned to handle the additonal plants being constructed: the cat cracking plant, the lube oil plant and the plant making toluol from normal heptana.

(b) Hagemann did not know the answers.

F (a) Ruhr Chemie did not own its own since, but was a partner in the community of interests which produced coal in the Ruhr.

(b) About 4000 to 5000 tons per month of ammonia (expressed as pure "5") were reduced by the Cagale process using local Oven gas.

(c) The ammonia was used to make nitric acid, ammonium nitrate and calcium ammonium nitrate. About 1000 tonsper month of ammonium nitrate were needed.

G (a) Hagemann did not know the answers.

(b) The ammonia data were reported to the Ruhr Nitrogen Producers Syndicate, which in turn reported to the main Stickstroff Syndicate. The oil production data were reported to ARSYN at Essen and from there to Berlin.

(c) The Betriebsobman was a Herr Keiping.

(d) No Ruhr Chemie directors or key men were connected with any organization controlling or planning production.

(e) Von Asboth was Ruhr Chemie technical director nominated to assist Geilenberg on synthesic plants. He was nominated as the Werks Beauftragter for Ruhr Chemie Plants. Feist was loaned to Wintershall at Lutzkendorf. His location not known.

(f) Dr. Tramm, director of the laboratory took a position with the firm "Otto". He is on friendly terms with the Ruhr Chemie. Alberts left Ruhr Chemie to take a better position with Gewertschaft Viktor.

H The development of the iron catalyst was mainly difficult in that an attempt was made to use it in the present reactors. It had to work; therefore, at temperatures not exceeding 225° C. (in the medium pressure reactors). Ruhr Chemie, Brabag, Rheinpreussen, Lurgi and the Kaiser Wilhelm Institute all developed satisfactory iron catalysts. The use of these iron catalysts in the plant only required some strengthening of the steam boiler. The iron catalyst was never used in large scale plants.

Hagemann pointed out that some cobalt (or iron) always stayed in the reactors and that if a shift had been made to iron, a difficulty would have been experienced on shifting back to cobalt.

(c) About 30 to 40% of the catalyst plant could be made operable without any major repairs. About 50 to 60% of the Fischer plant capacity could also be realised without the addition of any major equiptment.

(d) Hagemann estimated that cobalt supplies are equivalent to 1-1½ years operation.

(e) Ruhr Chemie had a partnership of 50% in the Lutzkendorf catalyst plant and had no participation in the plant at Ruhland.

I (a) In addition to FLAK, barrage balloons were used for a while but appeared to be of no value in protecting the plant. Camouflage had to be used on the Luftwaffe, but was of no great value because wood was used at first and caused fires. In the oxo plant, tanks were protected by concrete walls plus dirt. The damage appeared to be greater than normal for this type of protection. Brick walls made from loose brick were found to be very good for reducing blast. Due to the use of bunkers, very low loss of life was experienced. He did not know of any decoy plants. Smoke was used also.

(b) Repair work after air raids was done by Geilenberg, who provided the additional help. This worked out well at first, but later only a small fraction of the assistance required could be secured.

(c) The Todt organization supplied about 1000 men for repair work.

(d) Soldiers were only used for some clean up jobs.

(e) About 100 -120 guns were in the flak batteries.

(f) Some plant personnel were called out to man the antiaircraft batteries. These men worked both day and night.

(g) Hagemann does not know the answer.

(h) Quite a bit of the protection around the plant was done by Ruhr Chemie personnel.

J (a) Ruhr Chemie did not deliver Gatsch to Witten and he did not know where their Gatsch was obtained. The name of the company was Deutscher Fettsaure A. G.

(b) Not asked.

(c) Knows of only one Fischer plant in Japan.

(d) Does not know the location.

(e) Hageman estimated the following personnel:

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150 per day at Lube Oil Plant
500 to 600 per day at Gasoline Plant
300 per day at Catalyst Plant
600 per day at Ammonia Plant

All of these were skilled. No technical men included.

L (a) About 20,000 KW ere produced in the Ruhr Chemie power plants.

(b) It was planned to produce 18,000 tons per year of tuluol from normal heptane. However, the plant was not finished. The main interest in the process was to improve the octane number of Fischer product. The process consists of using a chrome-alumina catalyst at 520° C., 70 -73% yield, of toluol from heptane was obtained.

(c) Rubo is the code name for the toluol plant.

M Of the ammonia nitrate produced, about 300 -600 tons per month were used for munitions.

N Ruhr Chemie's experience was that absenteeism was not serious.

(b) The morale was not particularly high, but the people continued to work.

(c) The female German workers were not good and could only be used in the laboratory and not in plant operations.

(d) The Russian female workers were quite satisfactory.

Further Interrogation of Herr August Hagemann

HE bombs created the main damage. In Hagemanns' opinion many little bombs were worse than the equivalent weight of large bombs, due mainly to the fact that in the Ruhr Chemie plants, pipe lines were easily damaged. The main damage appeared to be above ground but damage to electric cables underground required the next longest amount of time for repair. No difference was noted between English and American bombs.

Pipe lines, building, and gas holders suffered the main damage. However, they did plan to run without gas holders using a recycle gas system, which would be cut in through a water seal when the gas holders were used. The gas purification plants, which are large low pressure tanks were quite vulnerable and much repair work was required, but they were not difficult to repair. The reactors were not easily damaged, the insulation protecting them from splinters.

The most vulnerable part of the plant was originally the gas holders, but with the use of the recycle system, mentioned above, the gas purification system appeared the most vulnerable.

The time of recovery is quite variable. In June 1944 a mine hit the Fein Reiniguns plant. Six weeks were required for repair. In general, the heavy attacks which came later would have required 3-4 months repair time. After the plant came on stream, the recovery was fairly rapid and 50% capacity was reached within 2-3 days.

The most critical items were iron sheets; they had plenty of repair parts. Repair materials were obtained rapidly in June 1944 through Geilenberg. Later this became more difficult. Later however, labor was more critical than materials in making repairs.

Through the period January 1938 to March 1945, no Japanese technical men were trained at the Ruhr Chemie plant. Furthermore, no Japanese visitors were present during the period of heavy air raids. It was mentioned that the Ruhr Chemie lube oil process had been given to the Japs. He doubted if the Japs had obtained German experience on protection of equipment in Fischer Plants, also that they probably did not know about German dispersal plans.

Maximum production of product from a Fischer oven is 2 tons per day with the normal range being 1.2 to 2.0 Plenty of ovens were available and it was felt more important to get a high yield based on gas than high output per oven. For example, Esne Steinkohle obtained 150 grams liquid product and 165 grams product with C_3 plus C_4 per Cbm of pure Co and hydrogen. The middle pressure ovens gave about the same production per oven.

The cobalt content of the catalyst was reduced about 10% from about 1 tons to about 900 kiles. No appreciable change was noted.

Hagemann stated that the reason no new Fischer plants were built during the war was that they were unable to make aviation gasoline by the Fischer process at first. Later they found out how to do this by cat cracking, but the I. G. Farben people in Government Offices were not sympathetic. In addition, Ruhr Chemie's main interest was in the use of the process for chemicals.

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

Middle pressure reactors were used by Hoesch, Schaffsgott, Krupp (3rd stage) and Ruhr Chemie (about 2/3 of the plant).

In general about 40% of the production from Ruhr Chemie plants is gasoline, 30 to 40% diesel fuel, and the rest fatty acids. Ruhr Chemie, however, made 1400 tons per year of lube oil and delivered only 800-900 tons per year of diesel for diesel aviation engines.

a-The main difficulty at Lutzkendorf was the gas production process. Resins in the gas were deposited on the gas purification catalyst and as a result the sulphur content of the synthesis was higher than normal. This sulphur inactivated the Fischer catalyst after a short time. An activated charcoal plant was being built to remove the resin forming material.

b-At Schwarzheide there was also trouble at first with the gas production plants. Didier and Koppers fixed up the plants, at their own expense. After this, the operation was satisfactory.

c-Regarding actual production at Ruhr Chemie, he stated that they wanted to reach 75,000-80,000 tons/year (about 90,000 tons including C3 and C4). No additional expansion was planned. They actually did reach in the best month about 60,000 tons (without C3 or C4). Due to the fact that they had to make a number of experiments in their ovens (they were licensors) their ovens did get out of mechanical order (with warping of the buffle plates) and they were never able to do as well as they should.

When asked as to what improvements might have been made in bombing, it was pointed out that attacks before July were not serious. They were able to run with reserve sections of the plant, while repairs were made in others. Later, during the heavy attacks however, so many places were damaged that they were unable to cope with them. He had no constructive suggestion as to how to improve the bombings. The results of bombing in the ammonia plant seemed to be about the same as in the Fischer Tropsch plant.