

FILM STUDY GROUP

REPORT

T.O.M REEL NO. 57

Prepared by

THE ATLANTIC REFINING COMPANY

SCANNING OF REEL #57
(Orig. Ident. Reel 5C)

U.S. Government Technical Oil Mission
Bag 3520 - Target of Opportunity - Bad Sachsa

SECTION 12. (Continued from Reel 56) BUTANE DEHYDROGENATION
Frames 2 to 70.

Memo. Jan. 29, 1940 written by Rudorfer of the Leuna laboratory discussing an exchange of information on laboratory work.

Memo. Mar. 27, 1940. The general conditions were 500-550°, approximately 18% olefins in the product gas, 23% decomposition, a space velocity of 0.25 kg. nC₄H₁₀/liter catalyst/hour.

Memo. Jan. 1941 recounts experiments with activated clay in which isobutane was dehydrogenated with space velocity 1000, temperature 560°, concentration of about 28% iC₄H₁₀ in the product gas and decomposition equivalent to about 42%. Normal butane treated with catalyst 5530 at space velocity 1,000, temperature 530°, yields about 24% olefins with a total decomposition of approximately 30%. The same catalyst was employed on propane, giving a yield of about 22% C₃H₆ over a period of 8 hours. Semi-works experiments and the regeneration of catalyst are reported in this same memorandum.

Memo. Feb. 21, 1941 concerning activated clay (alumina) production. Two types of catalyst were to be made and consideration was given to the applications and requirements of such clays in dehydrogenation, hydroforming, and Tanol manufacture (splitting out of water from isobutyl alcohol), catalytic cracking, isomerization and hydrogenation.

Memo. Feb. 26, 1941 reports a further conference on the same subject.

A letter Mar. 4, 1941 transmits detailed requirements up to 1943 and discusses the equipment and facilities to meet these demands.

Memo. Mar. 17, 1941 reports a conference in Leuna Mar. 12, 1941. A generalised discussion - no technical details.

Memo. June, 1941 summarizes the development of normal butane dehydrogenation with Oppau catalyst.

Memo. July 7, 1941 and Oct. 2, 1941 relate to catalyst requirements for butane dehydrogenation in existing gasoline plants. The only material of interest appears on frame 41 which describes operating difficulty in the dehydro plant, caused by agglomeration and bridging of catalyst with consequent damage to reactor tubes.

Memo. Apr. 10, 1942 - frame 46, discloses that catalyst 3675 was produced from precipitated alumina and catalyst 5530 was made from commercial alumina. An added note says that this catalyst was made with alumina peptized with nitric acid, while the second catalyst was unpeptized. Both catalysts had been treated with 20% Cr₂O₃ and 2% K₂O.

Memo. Nov. 10, 1943 - frame 59, deals with the cost of dehydrogenation with fluid and fixed bed catalyst. A flow diagram is given for the fixed bed process.

SECTION 13. EXCHANGE OF INFORMATION ON HIGH PRESSURE POLYMERIZATION

An Oppau memo. Jan. 25, 1941 - frames 72 - 75, reporting conference between Uhde and I.G. on the subject of process heating, to determine whether emphasis should be placed upon intermediate heaters or upon reactor insulation.

SECTION 14. DEHYDROGENATION BY MEANS OF CHLORO-INTERMEDIATES

Correspondence, memoranda and reports largely originating in Louna and Ludwigshafen - frames 76 - 141.

Letter July 18, 1942 - frame 79, transmits a schematic flow diagram showing the use of dehydrogenation via chlorination to produce unsaturates for alkylation and manufacture of butadiene.

Report June 15, 1942 of a conference to compare production of butylene by chlorine dehydrogenation with catalytic dehydrogenation and attendant alkyl ether formation. Few technical details are given.

Memo. May 18, 1942 shows several pages of tabulated costs and utility requirements for making aviation fuel component in which the dehydro step is included.

Process for production of normal butylene

Record of Invention 13381, Apr. 15, 1942 - frame 117. A process for the production of nC_4H_8 by fractional distillation at elevated pressure. The example cites the use of an alloy steel tube at 550° through which is passed normal butylchloride at the rate of 500 grams per hour (the tube dimensions are 2 meters by 13 millimeters). The exit gases are completely liquified by cooling to -20° .

Letter June 2, 1942 is an extensive comparison of costs for the competing processes of catalytic dehydrogenation and chlorine dehydrogenation. Other memoranda of June 8, 1942 (frame 128), June 23, 1942 (frame 134), are largely discussions based upon calculated costs of processing, but merit review as reflecting many real or presumed necessary conditions of operation.

Chlorinating Isobutane

Patent Disclosure 13461, May 29, 1942 - frame 139. The patent claims are as follows:

Process for the production of chlorinated hydrocarbons by chlorinating saturated hydrocarbons in the liquid phase characterized in that the charge stock in liquid state under elevated pressure is mixed with liquid chlorine under such conditions that no chlorination results and the mixture in the liquid phase and at elevated pressure is submitted to the reaction.

The second and third claims are concerned with multiple points of mixing and reacting.

SECTION 15. LUBE OIL - NERAG

The material in this section is not considered of importance. It consists of correspondence Nov. 9, 1938 concerning paraffinic lubricating oil in Nerag (frame 143); a letter Oct. 3, 1942 dealing with propane deasphalting and solvent extraction (frame 148); a memo. Oct. 3, 1942 (frame 150) describing the processing and properties obtained in laboratory treatment to make an aviation motor oil; further summary of deasphalting tests given in memo. July 22, 1941 (frame 151) and memo. July 23, 1941 (frame 153). This latter memorandum includes extensive inspection data.

SECTION 16. ALKYLATION PLANT DESIGN AND MISCELLANEOUS DATA Frames 167 - 175.

A letter June 16, 1942 - frame 163, conveys summary of power and other utility requirements for a plant at Scholven.

Memo. Feb. 4, 1941 gives flow diagram and process description of an AT-244 plant comprising catalytic dehydrogenation of normal butane, sulphuric acid alkylation, and necessary distillation and stabilization equipment. The origin of this material is the construction firm Uhde, and from a notation it may be presumed that the intended location is Pölitz. None of the material in this section can be considered to have fundamental importance and apparently consists only of carbon copies directed to the Bad Sachsa offices.

SECTION 17. HUNGARY - AVIATION GASOLINE AND LUBE OIL

Letter May 6, 1943 - frames 177 - 182, discusses aviation gasoline and aviation lube oil requirements and means of meeting this both by utilization of Hungarian facilities and possibly supplementing this by export from Germany. It appears to be of little technical importance.

SECTION 1. THERMAL EFFICIENCY OF STEINKOHLE HYDROGENATION

Report Feb. 20, 1942 - frames 183 - 203, written by Wilde & Schappert. The calorific efficiency is expressed as the ratio of heat in the desired end products (naphtha and fuel gas) to the heat content in the coal being hydrogenated, coal consumed in the generation of hydrogen, coal consumed for power purposes, minus the incidental excess of Hygas made available. Each of the several components is carefully analyzed, and the authors conclude that the efficiency for aviation fuel is about 27%, while for motor gasoline the figure is about 29%. This section will be of interest to those concerned with the overall economics in the manufacture of German synthetic fuel derived by the hydrogenation of coal.

SECTION 2. INVESTIGATION ON CONCENTRATION OF LIGHT OLEFINS FROM GAS BY MEANS OF SELECTIVE SOLVENTS, PARTICULARLY SEPARATION OF NORMAL BUTYLENE FROM MIXTURES WITH BUTANE

Report by Stadelman - frames 204 - 289. Reviewer's note: the subject matter was discussed in the scanning of reel #30, probable date Jan. 1939.

SECTION 3. RECOVERY OF TAR AND COKE FROM COAL OF POOR COKING PROPERTIES BY BRIQUETTING WITH HYDROGENATION RESIDUE AND HYDROGENATED COAL FOLLOWED BY CARBONIZATION OF THE BRIQUETTES. GASIFICATION OF THE RESULTING COKE

Report from Ludwigshafen Dec. 30, 1940 - frames 290 - 324. Briquettes were made of a non-caking Upper Silesia coal and different hydrogenation products, and were then carbonised. Three different types of briquetting machines were used and four types of carbonization ovens. The conditions for briquetting, carbonisation and gasification are described in satisfactory detail.

SECTION 4. GASIFICATION RESEARCH IN HOLTEN WITH WEBER-CARBONIZATION BRIQUETTES

Report from Duisburg July 5, 1940 - frames 325 - 335. A generator with approximately 3.5 square meters cross section was employed. A typical cycle showed 50 seconds blast, 83 seconds up-run, 64 seconds down-run and dead time of 53 seconds for a total cycle of 250 seconds. The fuel charge was composed from four Upper Silesia coals, using sulphite liquor and clay as the binder material according to the Weber process. The descriptive text and accompanying data are in satisfactory detail, although the application of the information must bear in mind the particular equipment and fuel source employed.

SECTION 5. PRODUCTION OF SOLID COKE & FUEL OIL BY THE CARBONIZATION OF BRIQUETTES MADE FROM POORLY CAKING COAL BY ADDITION OF HYDROGENATED COAL OR HYDROGENATION RESIDUES

Report Oct. 8, 1940 - frames 336 - 360. This report from Ludwigshafen written by Bähr describes experiments in which weakly coking coals from Upper Silesia were briquetted. Bituminous materials as binders included hydrogenation residues from pitch or the material designated as hydrogenated coal containing about 4% ash. The briquettes when carbonized in an oven of the Krupp or Lurgi type gave a hard lump coke and a fuel oil (retort tar). The description and data are satisfactory; calculations and discussions of possible application constitute a part of this report.

Investigations on the behavior of briquettes during carbonisation in moving and stationary state - frames 361 - 367. This report is undated and may be a supplement to the previously named report by Bähr. The film is imperfect in many places, but it is observed that incomplete correlation of laboratory data and the behavior of the briquette during retorting was obtained.

SECTION 6. CALCULATION OF THE DIFFERENT CARBONIZATION PROCESSES ON THE BASIS OF THE LURGI SPÜLGAS REPORT

Report Dec. 31, 1942 - frames 368 - 402, appears to have been written by Bähr. This report goes into extensive calculations on the relative economics for the coking of coal from the Oheim Mine. The several processes include the Lurgi carrier gas retort; the hot surface steel ovens of Krupp-Lurgi and Brennstoff Technik and the ceramic ovens made by Otto and Company, Didier and Koppers. An annual throughput of one million tons of dry coal is assumed.

The difficulty of translating German investment and operating costs to comparable American figures is recognized; however the data possesses value as showing necessary utility requirements, and if this information is correlated with parallel processes available to United States industry, it may serve as a guidepost.

SECTION 7. PRODUCTION OF BRIQUETTING MATERIAL FROM UNHYDROGENATED COAL OR THROUGH WORKING UP OF HYDROGENATION RESIDUES WITH ESPECIAL REFERENCE TO COMBINATION OF HYDROGENATION AND COKING

Report from Ludwigshafen, Dec. 23, 1942 - frames 403 - 451. The processes for the production of briquetted materials from the so-called hydrogenated coal (Anko) have been described. These employ the mixing of tar with the material to be briquetted, and then retort the briquettes to yield a fuel suitable for water gas generation.

The hydrogenation of coal can be combined with the process for hydrogenating retort tar, especially that remaining after topping of middle oil, so that the heavy tar can be ground with the coal, and the resulting coal paste is hydrogenated to make middle oil and hydrogenated coal, the latter of which is used for briquetting purposes.

By the use of these hydrogenation products, particularly the hydrogenated coal as briquetting material it is possible to employ non-caking coal through the route of briquetting and retorting to obtain a high quality coke with properties similar to high temperature coke which may be used in Pintsch generators for the production of water gas or in blast furnaces.

This report, unlike others of the same series, goes into great detail both in the presentation of data and the calculation of economics. It will be recognized the information is of limited importance because of the conclusions being based upon German fuels and by-products.

SECTION 8. CARBONIZATION OF BRIQUETTES MADE FROM MIXTURES OF HYDROGENATION PRODUCTS OR BITUMEN AND STEINKOHL FOR THE PREPARATION OF RETORT COKE

Report Feb. 5, May 10, 1940 - frames 452 - 526, written by Bähr. For the production of retortable briquettes from Steinkohl and hydroproducts, especially hydrogenation residues or primary bitumen, the chemical and physical properties of the coal as well as the hydrobitumen are of great significance. An extensive investigation has been undertaken to arrive at favorable conditions and admixture of the charge stocks as well as their best employment. Steinkohlen in admixture with about 10 to 20% hydrobitumen can be consolidated; coke fines or non-caking coal such as anthracite, gas coal, may be made to yield a retort coke in which the individual briquettes are not fused together.

Richer coal, on the contrary, upon addition of bituminous briquetting material when retorted exhibits strong foaming or fusion to produce a consolidated coke structure. The addition of 5 to 15% of a Braunkohl or a low volatile Steinkohl when admixed with rich coal gives briquette material of good retorting properties. A criterion for the selection of coals is the oxygen content. For the production of retort briquettes, coal with 1.0 to 2.5% O₂ and from 8 - 12 or more percent O₂ is favorable. Coals with 3.5 to 6% O₂ are very poor and will find limited use, coals with 6 to 8% O₂ are somewhat better, but they, too will be limited.

The bitumens should have a softening point above 60°; hydrobitumens with lower softening points must be processed for further removal of oil. With increasing asphalt content, the briquettes are stronger and are more suitable for use in moving bed retorts.

Temperature is the most important variable in briquetting. This should be as high or somewhat higher than the softening point of the briquetting material. Briquetting pressure of 200 to 400 kg/sq.cm. is sufficient; a higher pressure has little or no effect on the coke structure.

The structure of the retort coke should indicate fusion but the individual briquettes should not be coked together. In this respect the charge coal is of great importance. Particle size of the compressed coal as far as possible will be below 2 mm. and very little less than 0.02 mm. To lessen the tendency of individual briquettes to agglomerate they should be dusted with pulverized braunkohl or steinkohl as soon as prepared.

To evaluate the retortability of briquettes in moving layers, a method was developed in which the briquette is impressed upon by a weighted needle and the penetration is measured at several temperatures. The value of a binder seems to be roughly proportional to the difference in temperatures between the softening point and the drop point. For hydrobitumens, these differences are of the order of 40° or higher.

Under conditions of application it is important that the bitumens added carry with it a large amount of oil. It was established that the oil losses rise with increasing asphalt content so that when working with residue it is necessary to use a hydrogenation residue low in asphalt, as for example, topped slurry residues. Research was carried on with Upper Silesia coal and topped slurry residues from Scholven. The resulting retort coke had an abrasion resistance of above 90% and had three times as great activity as high temperature coke, from which it was concluded that this retort coke is particularly suitable for gasification and for blast furnace use.

SECTION 9. STEAM REQUIREMENTS OF CO CONVERSION PLANT

Oppau, Oct. 24, 1942, written by Markert - frames 528 - 589. The work in question is concerned with the thermal investigation of presently known processes, and compares conversion under pressure (28 atmospheres) with conversion at approximately one atmosphere. Two groups of experiments were performed; in one, water was used as the heat carrier for exchange between contact gas and fresh gas, while in the other series, heat exchange was performed in tubular equipment. The term fresh gas is the charge material rich in CO; contact gas is the product or effluent from the catalyst mass in which CO in the presence of water vapor is converted to CO₂ and H₂.

A number of conditions in which the alternative employment of direct cooling, the use of conventional heat exchangers, the recycling of condensate, and the degree of cooling in the several pieces of equipment is analyzed. While it is apparent that the conclusions are drawn upon the use of specific equipment, the reviewer believes that the report merits examination by those concerned with the general process of CO elimination from water gas. Although there is no original data given, the report is illustrated by numerous diagrams and graphs presumably based upon the investigator's data.

(b) ALKYLATION REPORT

SECTION 10. STATUS OF ALKYLATION WORK UP TO MAR. 23, 1940

Report from Ludwigshafen, Aug. 1, 1940, written by Corr - frames 590-618. As the result of investigation upon the alkylation of isobutane with normal or isobutylene by means of concentrated sulphuric acid, the most favorable operating conditions were established as:

- 1 - Isobutane-olefin ratio of 5:1.
- 2 - A large excess of acid, as for example, an acid-hydrocarbon ratio of 4:1.
- 3 - Rejection of acid at about 90%.
- 4 - Intensive mixing of the reacting components in which the isobutane is preferably pre-emulsified with the sulphuric acid, and then this emulsion is mixed with the diluted olefins.
- 5 - Reaction temperature of -2° for iC_4H_8 , 10° for nC_4H_8 , and about 30° for C_3H_6 .
- 6 - Reaction time of 1 - 2 minutes.

The alkylate yield and quality is shown below:

	<u>iC_4H_8</u>	<u>nC_4H_8</u>
Alkylate yield on olefin reacted, wt. %	196	194
Aviation gasoline to $329^{\circ}F.$, wt. %	74	84
Octane No., motor method	90	89
" " , + TEL (4.5 cc/gal.?)	102	102

There is a literature and patent survey extending principally through 1939. It is interesting to note that at this early date the equivalent of supercharged engine ratings were being attained. There is nothing in this report novel to American refiners.

(c) AVIATION GASOLINE

SECTION 11. AVIATION GASOLINES AND THEIR PRODUCTION

Article by Matthias Pier of Ludwigshafen in publication of unknown name or date, but likely the period 1941, frames 618 - 647. The material is a generalized discussion of sources and methods for producing aviation fuel which have their counterparts in American industry with few exceptions. Among these is the use of methanol synthesis for the production of isobutyl alcohol which is then dehydrogenated to iC_4H_8 . This latter hydrocarbon may be polymerized and hydrogenated, or may be employed in alkylation. By-products of the isobutyl alcohol synthesis are large quantities of methanol and of higher alcohols which may in part be hydrogenated to light naphtha with an octane number of 79. Synthesis of unsaturated hydrocarbons directly from CO and H_2 were developed. Extensive development work was done upon high octane substances such as ethers and ketones. The non-linear octane blending value of aromatics was appreciated, and dimethyl benzene appeared to have been a commonly employed component of aviation fuel.

It was pointed out that naphthonic fuel made from Steinkohl had a higher supercharge rating than isoparaffinic light gasoline made from higher alcohols, although the base octane of the two naphthas was the same as determined by the motor method, and the lead susceptibility of the naphthonic gasoline was less than that of the naphtha of alcoholic source.

Benzol can be reacted with C_2H_4 and C_3H_6 to form diethyl benzene and ethyl propyl benzene. Diethyl benzene was said to be in extensive production as an aviation fuel component. The DHD process for making aromatics was commented upon. (This process has been described in great detail by other reviewers) It is inferred that at the time of writing, leaded aviation fuel had an octane number of 87, and that 90% of German aviation gasoline was derived from hydrogenation plants. The discussions following the presentation of Pier's paper indicate that the Germans were fully aware of possible disadvantages resulting from the use of lead in large quantities in their gasoline, and that they gave early consideration to means for raising the effectiveness of aviation fuel by redesign of engine parts.

SECTION 12. AROMATIC FUELS

Undated publication of Matthias Pier, presumably an address delivered before a technical meeting about 1941, frames 648 - 676. This report is concerned primarily with the physical properties of aromatics and their behavior in test motors and aviation engines. The discussion and the subsequent comments from the audience do not reveal novel data nor thinking which differs appreciably from American sources.

BAG 1677 - TARGET 30/4.10 - SECTION 1. UNION RHEINISCHE BRAUNKOHLE
KRAFTSTOFF A.G. - WESSELING PLANT

Log books 1942 - 1944. Entries as a running record chiefly of occurrences causing disturbance to plant production. The record ends July 18-19, 1944, when a large scale air raid was made upon this plant. A notation of July 26, 1944 enumerates specific damage, and estimated the time to place the plant in operation again (2-3 months).

~~This section will not be found to be of importance, and in fact has little significance unless the log book is studied in conjunction with a flow diagram of the plant. There is no specific mention as to the type of operation primarily concerned, but the reviewer believes the installation was an extensive coal hydrogenation plant, together with necessary purification and refining equipment. (frames 681 - 770)~~

SECTION 2. OBSERVER'S REPORT ON THE PRODUCTION OF A CHAMBER ONE METER DIAMETER BY 1.8 METERS LENGTH

Report dated Essen Oct. 21, 1940 - frames 772 - 823, describes a reaction chamber whose walls consist of multiple layers forming concentric cylinders. The vessel was to be resistant to the attack of hydrogen at 300-350° and 300 atmospheres. A feature of the vessel was to employ a layer of screen between the innermost cylinder and the next concentric wall. Any hydrogen which might diffuse through the first cylinder would be removed before attacking the steel of the next outward layer by sweeping the gas through this screen base and into escape vents. The description of fabrication, testing, and assembly of the components of this reaction chamber is exceptionally detailed. The analyses, acceptance sheets and shop drawings are adequate. It will be of interest to learn the subsequent history of this product of Krupp when placed in service by Union Rheinische Braunkohlen Kraftstoff A.G.

SECTION 3. OPERATING RESULTS FOR 1943

Tabulated monthly and annual figures for the Hesselung plant of Union Rheinische Braunkohlen Kraftstoff, beginning on frames 824 - 927. This is a systematic presentation in which the amount and character of charge stock is described; the utility and chemical requirements for each of the process steps is given; inspections of the products have been noted to an extent that it should be possible to follow the operating history of this plant when the data is used in conjunction with a reliable plant process flow sheet for that period.

SECTION 4. SPECIFICATIONS AND ANALYTICAL METHODS APPLYING TO PETROLEUM PRODUCTS AT HESSELUNG

Material presumably taken from the file of Eltz (the chemist at the Union Rheinische plant?) - frames 928 - 965. Items appearing in this section are noted below:

- Specification for marine diesel oil (929)
- Evaporation residue for non-volatile materials (933)
- Determination of water soluble materials and other substances in fuel (934)
- Iodine number according to Hanns (935)
- Ethylene bromide content (936)
- FOXA analysis (937)
- Aniline point (939)
- ~~Specifications for domestic aviation fuel, 41-811 (943)~~
- Specifications for fuel, Oct. 19, 1943 (949)
- Observations on test procedure for aviation fuel. These are presented as a printed report by Reusmer (957).

The material in this section does not appear to be important.

SECTION 5. SPECIFICATIONS OF THE GERMAN AIR FORCE HIGH COMMAND RELATING TO AVIATION GASOLINES ET-811, SEPT. 1944

—Relaxed specifications were permitted on the premise that higher yields of fuel would be attained - frames 966 - 968.

SECTION 6. ANALYSES OF INTERMEDIATES AND PRODUCTS IN THE HYDROGENATION OF BRAUNCOLE, ETC. AT WESSELING, 1943-1944. Frames 969 - 980.

—This material does not appear to be important, and in most cases is presented as isolated analyses whose bearing on the general operation of this plant is unknown.

SECTION 7. FLOW DIAGRAM OF GAS RECIRCULATING PUMPING SYSTEM IN THE S (SUAP?) PHASE AT 700 ATMOSPHERES

Drawing 15673 dated Oct. 12, 1944, frame 981, shows pump lines and valve arrangements for a portion of the system. It will be of little value unless text is found to explain the purpose of the indicated changes and operating conditions.

SECTION 8. DIAGRAMMATIC FLOW SHEET OF BRAUNCOLE HYDROGENATION PLANT AT WESSELING

This diagram is wholly pictorial without any insertion of operating conditions and has not been complicated by indication of probable recycling. It provides a good generalised picture of the overall operation embodying hydrogen production, coal treatment and hydrogenation, and the fractionation of the liquid products in conventional equipment. Frames 986 - 988.

**SECTION 9. DIAGRAMMATIC FLOW SHEET OF THE PINTSCH-HILLEBRAND WATER GAS PLANT AT WESSELING
Frame 989**

Two pictorial process flow diagrams clearly indicate the principal operating steps without revealing actual temperatures, pressures and quantities involved. The diagrams bear the numbers BGH 0370 and 0412.

SECTION 10. OPERATING RESULTS WITH THE NEW INITIAL HYDRO-
GENATION CATALYST AT PÖLITZ AS OF OCT. 12, 1942

Frame 1002 - the Ludwigshafen office of I.G. writes to Union Rheinische at Wesseling that their opinion, based upon operating results at Pölitz, is that naphtha formation in the initial hydrogenation step, using the new catalyst 7846 is less than with catalyst 5058. There seems to be no advantage in replacing the customary catalyst 5058. The film is indistinct in many places. The subject matter is not considered important.

SECTION 11. OPERATING RESULTS WITH NEW PREHYDROGENATION CATALYST
AT THE SCHOLVEN AND LEUNA PLANTS AS OF JULY 27, 1942

Frame 1016 transmits to Union certain information available to I.G. as in section 10 the information does not appear to be of high importance. It appears, however, that the new catalyst was available in two forms - 7846 contains molybdenum while 7846W incorporates wolfram as the active substance. Data transmitted from Scholven May 21, 1942, frame 1029, reports in greater detail on the hydrogenation of mineral oil than the other correspondence. At this point there remains reasonable doubt upon the relative superiority of the several catalysts available.

SECTION 12. TEST METHODS FOR FUEL

A circular notice, Jan. 20, 1941, frame 1038, advised the members of the industry group that the Zentral Büro für Mineralöl has issued a revision of fuel test methods. It transmits a copy of test methods with appropriate comments.

The copy of the inspection test methods is dated Nov. 1940, frame 1039. The material is divided into two portions - fuel for use with carburetors, and fuel for use in diesel motors. Under the first heading appears: color and other appearances, odor, specific gravity, sulfonation number, dimethyl sulphate number, tetraethyl lead content, vapor pressure, research octane number, freezing point, water content, residue on evaporation, storage stability and gum formation, iodine number, acidity, corrosion, analytical distillation. Fuels intended for service in diesel motors were subject to the following tests: color and other appearances, odor, specific gravity, viscosity at 20°, first appearance of wax separation, setting point, filterability, flash point, lower heating value, neutralisation number, corrosion, ash content, Conradson carbon test, hard asphalt, total residue, aniline point, cetane number, boiling point analysis and total sulphur.

(This ends scanning of Reel #57)