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REEL 1

R E S T R I C T E D

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U.S. GOVERNMENT TECHNICAL OIL MISSION
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BAG 2168(4.03) - I.G., LUDWIGSHAFEN-OPPAU

Item 1

Letters sent to thirteen concerns referring to the organization of a committee for the investigation of the problem of gasification of bituminous coal without residue. Asks that thirteen concerns have information complete before June 25, 1939. Plan of the program is appended, divided in three sections on operation and yield data.

Item 2

Discusses the subject of producing "coronen". This is a synthetic process formerly done by various investigators and produced at a very high cost per gram. The method in this article tells how to produce it in rather large technical quantities. It gives the difficulties encountered in producing it, due to its tendency to crystallize. States that coronen itself although not of such great interest, its hydrogenated products are of great interest. Coronen boils at 525°C at 760 mm. All of the tests and solubilities are recorded. The article consists of 12 pages; it includes various formulae for coronen itself and of hydrogenated coronen.

Item 3

Follows cyclic aromatics from hydrogenation products. This article of 16 pages gives an idea of what can be obtained from high pressure hydrogenation, particularly from products of liquefaction of coal. There are many polycyclic aromatics contained in this material. Present in fairly large quantity is pyrene; also the hydrocarbon coronen. It is quite difficult to isolate the individual hydrocarbons from this mixture which are produced because of the small quantities in which they are present and the very complicated nature of the hydrocarbon mixture. It is thought that from this work considerable worthwhile information has been obtained on the mechanism of hydrogenation.

Item 4

Working up the C₂ to C₄ saturated hydrocarbons by the I. G. Farben processes in their hydrogenation plants. This is a very complete diagrammatic table showing the processes and routing of products, and indicates that they were able, by some of these processes, to make octane numbers as high as 96 or even iso-octane of 100 octane number. This is a worth-while chart to reproduce.

Item 5

It is a sump phase preheater at the Lutzkendorf plant. There is quite a discussion of the preheater, the way it's built and the temperatures at which it operated. As they had it set up it failed; therefore to overcome

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the difficulty, they put in much larger pumps to circulate the gases and by this device they were able to overcome their difficulties with the preheater as originally set up. This report consists of five pages and is accompanied by charts showing heat balances and the temperatures of the flue gases used in connection with control of the process; pressure drops through the preheater are a feature of the report.

Item 7

Deals with a 700 ats. pressure gas preheater.

Item 8

Dated February 17, 1943, is on the Lutzkendorf preheater.

Item 9

Is still on the sump phase preheater at Lutzkendorf.

Item 10

Item 10 Curves and analyses of the hydrogenation unit at Lutzkendorf. This is accompanied by very fine curves and shows analyses of gases taken at various points in the plant. The report is dated November 20, 1940.

Item 11

This report concerns the gas analyses in the sump phase hydrogenation at 700 ats.

Item 12

~~Cracking of high molecular weight paraffins.~~

Item 13

I. G. process for working up Fischer gas.

Item 14

Comparative calculations Lutzkendorf, January 24, 1941.

Item 15

Comparative calculations Lutzkendorf, December 2, 1940.

Item 16

Lutzkendorf plant.

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Item 17

On the influence of the carbon dioxide content in the synthesis gas on benzene yield, on the cobalt, thorium, magnesium contact.

Item 18

Fischer-synthesis, June 1941.

Item 19

Expected production of synthesis products from January to October 1942.

Item 20

Expected production of the synthesis November - December 1942.

Item 21

Heating gas distribution for May, 1944.

Item 22

Lutzkendorf cost of production calculations for the production of 9,000 cubic meters per hour of H_2 , 100% from water gas.

Item 23

Conditions for the production of 75,000 tons per year Fischer-Tropsch refinery products in connection with the working up of the residual gas.

Item 24 and 25

Have to do with the production of oxygen by fractionation of liquid air. ~~These are devoted entirely to matters of policy and are short letters. Nothing~~ much of interest in them even on this subject.

Item 26

On the same subject as 24 and 25.

Item 27

Has to do with the production of acetylene by the high temperature combustion of certain hydrocarbons with oxygen.

Item 28

Item 28 is a brief reference to setting up a Fischer-Tropsch unit in Italy and an acetylene producing process similar to Item 27.

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Item 29

Deals with the production of acetylene from methane.

Items 30 and 31

Also deal with the production of acetylene - no particular interest.

Items 31 and 32

Brief letters on the subject of acetylene production - of no particular interest.

Item 34

Has to do with the production of acetylene from natural gas and then the production of trichlorethylene from the acetylene.

Item 35

A letter dealing with the production of acetylene from methane.

Items 36 and 37

Also on this same general subject.

Items 38 and 39

Continue this general subject.

Item 40

Deals with an experimental plant for the concentration of acetylene.

Items 41, 42 and 43

Continue this same subject.

Item 44

A very brief letter showing the possibilities of producing various chemicals from methane.

Item 45

On gas production for one of the plants in Germany.

Item 46

A short letter on the production of methane or natural gas from mines.

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Item 47

A literature reference to *Angewandte Chemie*, November 7, 1922, No. 89, on the enrichment of methane from mine gases by E. Burrow and O. Schmidt.

Item 48

A continuation of the same article.

Item 49

A short letter on the production of synthetic nitrogen.

Item 50

A short letter dealing with the production of acetone at Heidebruck and Leuna from acetylene.

Items 51 and 52

Current correspondence dealing with the subject of acetone production and its purification.

Item 53

A government form sent out on the subject of the final purification of acetone pertinent to the Oppau plant for producing acetone.

Items 54 and 55

Very brief letters on the subject: one on acetone purification and the other on acetone production.

Item 56

Lists the acetone requirements and chemicals needed to produce the amount of acetone required at that time in Germany.

Item 57

A 4-page report with one table on the subject of producing methane by the Linde destructive distillation process. For the production of ethylene without producing gasoline and synthesis hydrogen. The object is to produce methane for fuel purposes.

Item 58

A process for the production of synthesis gases through the gasification of different kinds of coal. Four or five page article.

Item 59

A cost estimate pertinent to process of this type and labor requirements.

Item 60

Has to do with gas fractionating plant at Oppau, cost figures, etc.

Item 61

Gives the operating cost of a Fisher-Tropsch synthesis plant at Oppau, #648.

Item 62

Gives some technical data pertinent to the previously mentioned plant.

Item 63

Continues with the Fischer-Tropsch plant at Oppau. This gives the requirements in activated carbon.

Item 64

A brief letter which is of importance in that it mentions the use of an iron catalyst in the Fischer-Tropsch synthesis operating at 25 ats. pressure with an oil re-circulation process, giving the production of the plant at 5,000 tons per year, and a product distribution table.

Item 65

A 12-page report on development work of the Fischer-Tropsch process. It includes several processes, the hot gas recycle process, a new process operating in liquid phase, and also a discussion of the Synol process which makes mainly alcohols. This report should be translated completely.

Item 66

The synthesis of hydrocarbons using iron contact mass. This is a three-page article dated July 28, 1941, and appears to be quite interesting.

Item 67

A three-page description of a project for the utilization of waste gases from isobutylene production for use in Fischer-Tropsch plant.

Item 68

An article that describes the synthesis of hydrocarbons using iron catalysts. It is apparently a hot gas recycling process and gives in some detail the purification of the gas and motor operation.

Item 69

A continuation of the same subject, synthesis of hydrocarbons using iron contact mass. It seems to have considerable data in it from results which were discussed at a conference on this subject.

Item 70

Appears to be a duplicate of Item 69, both dated December 2, 1939.

Item 71

A series of short notes dealing with improvements and additions to the Ludwigshafen hydrocarbon synthesis plant on a four-year plan.

Item 72

A short note in regard to the use of the by-products of the Ludwigshafen synthesis plant.

Item 73

A priority request in connection with obtaining steel for the Ludwigshafen synthesis plant.

(No. 74 and No. 75 later in this film.)

Item 76

Covers tests carried out for methane formation out of water gas. This report dated July 19, 1940, gives considerable detail including composition of the catalyst and seems a quite complete article

Item 77

A short tabulation showing distribution of sulphur in a Winkler type gas generator used in synthesis.

Item 78

Consists of methods for determining acetylene in gases from synthesis plants. The two-page article should probably be translated.

Item 79

Probably worthless. It looks like a lot of figures that have been written over.

Item 80

A production program and shows the production of tonnage per month of benzine from hydrogenation plants, the Fischer-Tropsch primary process products, lubricating oil, crude oil charge, and synthesis gas.

Item 81

Refers to the alkylate acid plant at Lutzkendorf. It apparently is a presentation of how the plant has been operating in considerable detail and asks for or presents the personnel necessary to operate the plant. There seems to be considerable operating data included with the claims made for the way the plant has been running.

Item 82

A series of three reports. Shows what could be gained by cooperation between the Merseburg plant and between the Lutzkendorf at Winterschall and the Ammonia Werke Merseburg. It gives in considerable detail the difficulties they are having from an operating and engineering point of view in these two plants, and the means of overcoming them, if this cooperation is undertaken.

Item 83

Is a plan for expansion in the Lutzkendorf works. Page 7 contains a description of the alkylate acid unit at this plant pertinent to the Fischer-Tropsch unit. On page 12 there is a beginning of a section dealing with the operating and technical control of the various operations in this plant. There are a number of figures showing the equipment and the changes in equipment by the proposals of this report; also a flow diagram of the plant pertinent to the Schwalfeldt Winterschall works. It is a very long report and would probably be one that should be gone over carefully by those interested in the subject of Fischer-Tropsch.

Item 85

A forecast of the possibilities as to how far they might go at the Winterschall Lutzkendorf plant in building up production.

Items 86-89 (inclusive)

Gives the details of these forecasts on production.

Item 90

Continues the forecast and deals with the energy and gas requirements.

Item 91

Deals with building a reserve turbine for the plant.

Item 92

Gives further details in connection with the Turbo generator.

Item 93

Has to deal with the alkylation acid plant built at Lutzkendorf by Bramag Company. It points out errors in construction and bad workmanship.

Item 94

A portion of Item 93.

Item 95

An estimate of the cost of the various proposed changes in the Lutzkendorf plant.

Items 96-99

Are some more of the same type of figures on the Lutzkendorf plant.

Item 100

Is hardly legible.

Items 101-104 (inclusive)

Deals with the high-pressure hydrogenation plant at Lutzkendorf. A section of this is devoted to the hydrogenation requirements, in considerable detail, also, to the power requirements.

Item 105

Seems to be a sheet from the notebook of somebody. Does not have any particular bearing on the rest of the film at this point.

Items 106-108 (inclusive)

Deals with closing down the Fischer plant and bringing in hydrogen from Leuna to the Lutzkendorf hydrogenation unit.

Item 108

Deals with the cost of carrying out of this transaction.

Item 109-110

They report a conference which was held between the Lutzkendorf and Leuna plants.

Item 111

Is a schedule for bringing various synthesis units into operation.

Item 112

Is a very short letter. Deals with electrical requirements at the Lutzkendorf plant.

Items 113-114

Apparently deals with this same subject.

Item 115

Has to do with the selling of vacuum still residues and lubricating oil from the storage at Lutzkendorf.

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Item 116-117

Deals with a conference held at which they discussed the competence of those directing the Winterschall.

Item 118

Deals with plans for bringing up the production of primary products of the Fischer-Tropsch plant to a 95,000 tons per year.

Item 119

A short letter of February 9, 1940, for building up the Fischer-Tropsch plants.

Item 120

A continuation of the same general subject.

Item 121

A sheet from somebody's notebook giving certain references, the pertinency not shown.

Items 122-123

Apparently identical. They deal with the assistance counted on from the Leuna works.

Item 124

A table showing the requirements of hydrogen and oxygen (of oxygen and steam) required for the operation of the Winkler generator.

Item 125

Is the original handwritten manuscript from which Table 124 was prepared, apparently.

Items 126-127

Concerned with the ways to heat boilers at the Winterschall plant.

Item 128

A handwritten sheet very difficult to decipher.

Items 129-133 (inclusive)

Seems to be a duplicate of an earlier set of items and deals with assistance desired by the Merseburg plant from the Lutzendorf Winterschall unit.

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Items 134-192 (inclusive)

Apparently duplicates of Items which we have already discussed.

Item 193

A report of a gas experiment carried out with pictorial Flow in a Ramag briquette generator. It is a fairly complete article with tabulations of data.

Item 194

Deals with the starting up of the hydrogen plant at Lutzkendorf, August, 1940. Item 194 includes not only the production of hydrogen, but also methane. The article has very good charts showing the analysis of the gas produced, the design of the plant, etc.

Item 195

A description concerned with the starting up of the hydrogenation plant at Winterschall and pertinent to the hydrogen which was formerly at Bohlén.

Item 196

A report dealing with the inspection of the hydrogen plant at Lutzkendorf written about June 10, 1940. The report shows in great detail by items the condition of the plant at the time it was inspected.

Item 197

Consists of a preliminary report concerning the testing of a methanizing contact mass with the gas before and after carbon dioxide was in the hydrogen plant.

Item 198

Curves—showing the carbon monoxide and the carbon dioxide content in the gas after the CO₂ washing at the hydrogen plant from October, 1941 to January, 1942.

Item 199

Has to do with the composition of a wash gas entering the unit where the process is carried out with BS contact mass.

Item 200

Has to do with the behavior of the BS catalyst. Shows the properties of the catalyst and its behavior under certain conditions. Pertains to the Chemichewerke at Essen.

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Item 201

Concerned with testing of the methanizing catalyst from the Lutzkendorf plant which shows the activity tests of the nickel catalyst and gives analysis of the gases.

Item 202

A memorandum concerned with the methanizing unit and circulation at Lutzkendorf dated June 26, 1940.

Item 74

A pictorial diagram showing Fischer-Tropsch plant at Lutzkendorf. Shows the lubricating oil plant and the hydrogenation plant.

Item 75

Also pictorial diagrams, looks as though they were for advertising purposes for Winterschall at Lutzkendorf. This also shows the Fischer-Tropsch plant crude oil lubricating works and the hydrogenation unit slightly different from 74.

Part 4 Gas Purification:

The first report covers tests of the syntheses gas producer 3B with the ratching off of the producer gas prior to the drying tube. This test was dated July 15, 1942. The report carries several tables including the analyses of the circulating and producer gases and also of the synthesized gases. The second report of Winterschall dated January 12, 1943, has to do with the final purification of the gas during the manufacture of synthetic motor fuel. There are about five pages of this report, all pertaining to the aforementioned subject.

Item 33:

A monthly report for July, 1940, on the alkylate acid plant at Lutzkendorf dated August 7, 1940. It gives the log of the operation of the plant at this period. This report is about four pages, covers all the discussion of the various points of operation of this unit. The report was a copy of seven tables and tabulations of data having to do with the gas figures and other operating conditions and materials handled in the plant during this period.

The next item is the monthly report for August, 1940, of the alkylate plant at Lutzkendorf, dated September 9, 1940. There is a monthly report for September, 1940, from this same plant. The same type report for October, 1940, follows, covered the same unit at the same plant. There is given a final report for the alkylation acid unit at Lutzkendorf which points out the corrosive difficulties and other operating problems that they ran into. The last few reports deal with the "alkacid" (which we do not exactly understand). There is apparently in the final report a short statement of those repairs and changes that have not yet been made up to November 1940, in connection with the alkacid plant at Lutzkendorf. There is a flow diagram or diagrammatic sketch

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of the alkacid plant at Winterschall, Lutzkendorf. There follows a list showing what should still be done to this plant based on its condition at the end of November, 1940.

The next article based on a conference at which was discussed the licensing of the alkacid process, probably of Lutzkendorf, to the Ruhrchemie for the production of benzene by the Fischer process. The meeting with the Ruhrchemie representatives, was held on the twenty-eighth of September, 1935, at Lutzkendorf. (We are of the opinion that the expression "alkacid plant" means merely a plant composed of two steps, one acid and one alkali, and that the previously mentioned alkylate or alkacid plant really means an alkali acid plant as it is used in connection with gas production). Gas purification consists of nine pages and goes into considerable detail of the application of the alkacid process to the Fischer process.

The next item which is dated March 20, 1940, is a report covering tests for the conversion of organic sulphur E_2S by the incomplete conversion under pressure of CO-containing gases. The report consists of six pages with curves and two attachments which show the effect on catalysis life and the effect of the degree of the conversion of CO_2 to CO and involves a report on the solubility of carbon dioxide, sulphur dioxide, and H_2S in organic liquids dated September 1, 1938, at Oppau. Six pages followed by twelve pages of data.

Part 5 Dehydrogenation

There follows a report on dehydrogenation by means of chlorine starting with isobutane and going to tanol.

Item 207

A flow diagram of the process starting with isobutane and ending with iso-octane, using chlorine, hydrogen, and in one stage, a vessel where there is treatment with iron chloride with mechanical stirring. The plant was apparently at the I. G. Farben plant at Lutzkendorf.

Items 207-211

Pertain to a unit in the I. G. Farben plant. The report is dated early in 1943 and covers an alkylation unit of which a flow diagram is provided and a forecast is made of yields which seem to be on a full commercial scale. This article, we believe, should be translated.

Item 212

Dated September 21, 1942, has to do with the planning of the plant shown in items 207-211.

Items 212-247 Inclusive

Deals with first, an experimental unit of the butane-tanol type alkylation to be built at Hydebreck and second, a commercial unit to be built for the Upper Silesian hydrogenation works.

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They were to be built along the line of the process of the I. G. Farben. There is considerable detail in this article on the products to be made, costs, yields, the entire set-up should be translated.

Item 248

Deals with the financing and setting up of the hydrogenation works at Blechhammer in Upper Silesia.

The first portion dated September 28, 1944, deals with supplies of methane and ethane for this type of plant.

Item 249

A note from the director of the Upper Silesian plant dated October 29, 1944, stating that they were not now in a position to carry out the supplying of the methane and ethane for this plant.

Item 250-254

Still deals with the subject of the Blechhammer unit, partly on the enlargement of their butane unit and somewhat with their difficulties in supplying methane and ethane to Hydobreck.

Item 254-257

Relates to this same general subject.

There follows a great number of items, mostly inter-company correspondence between Blechhammer and Hydobreck. They have to do with the supplying methane and ethane, and enlarging the butane separating unit at one of these two plants.

Perhaps this whole section amounting to some sixty or seventy items should be looked through, but they do not appear to be worth complete translations.

The next item is an amendment to an original patent I-74279 IBD/120 process for the preparation of dichlorobutane and butylene mixture. The amendments dated October 22, 1943. There follows also a second office action dated November 1, 1943, applicable to patent application filing. Data or filing information I-74649 IBD/120 entitled "Process for the Preparation of Alkacid Dichloro-Hydrocarbons".

The next item seems to be a report on the subject of butano-butadiene plant at the Hydobreck works. It is a flow diagram of the plant sketch layout, also the material requirements. The question is raised as to the extent of air protection needed. The date of this report seems to be around February, 1944, and on back to earlier dates. There is a flow diagram entitled dichlorobutane cracking where dichlorobutane enters the process and the end production is butadiene. There is also a flow diagram for the process of chlorinating butane with dichlorobutane, starting with butane and ending up with the dichlorobutane.

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There follows an article with the date of March 18, 1945, taken from "Fortune" magazine on the subject of synthetic rubber in America.

There follow several short articles on the production of normal butane from natural gas.

There is quite a table giving a comparison of the plant costs in energy and material required for processes for producing butadiene. Among the processes are the four butane processes, the spirit process and the four-stage process. There follows a couple of short reports dealing with the relative advantages of the processes for making butadiene, preparing or making it from alcohol or making it by the Oppau butane chlorination process.

Now come two pages of a report marked January 1, 1943. It covers a discussion that was held on processes for making normal butane and for producing butadiene by certain processes. Since there are only two pages of this report and they seem quite pertinent to the four processes, we believe these should be translated. For purposes of identification, this was a conference of December 28, 1942.

This short report is followed by a table or flow diagram giving yields and the details and figures of raw materials required on one of the butadiene processes. The table with all of the detailed information is apparently the process for using the olefin-containing gas mixtures and hydrochloric acid to produce this hydrocarbon.

A report signed by Habelman on the Oppau or butane process for producing butadiene, probably produced during the discussion at the above-mentioned conference, dated December 4, 1942.

A flow diagram, P-282, showing this process. A second flow diagram or rather a material balance, is shown, No. 283, applicable to this same Oppau process for making butadiene. There is considerable discussion and a lot of figures presented showing the production of certain required ingredients for this plant which had come from Rumania, particularly the Astra plant. In our opinion, this entire section of the film starting with the conference comparing the four different methods for making butadiene should be translated.

Two flow diagrams on the purification of butadiene. There are charts showing the details of pieces of equipment and a flow diagram showing the final polymerization to produce the synthetic rubber.

A symposium on the synthetic rubber held in 1937.

A sheet containing three flow diagrams, (1) where propane is dehydrogenated and then put through a process ending up with isopropylether (2) iso and normal butane mixture is dehydrogenated and processed ending up by polymerization and hydrogenation to produce tanol, and (3) normal butane dehydrogenated and put through a process to produce pure butadiene. There is a wire and a number of sheets relating to the synthesis of triptane. The statement was made in the wire that this German firm would shortly be in a position to produce triptane on a commercial scale.

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Part 6 DED Process.

The first report under this section covers a visit to inspect the alkylate motor fuel plant at Hydabrock. There is a detailed analysis of the various catalysts used in this process for this purpose. Most of this report deals with catalysts used and gives methods for testing them and gives their composition. This report looks as though it should be translated completely.

Following this report there is a final summary sheet giving the methods for producing activated clay for this purpose at Oppau, Leuna, and Hydabrock plants. This seems to be quite interesting and vital. It is our opinion that this entire section dealing with the catalysts on DED should be translated.

Part 7 - OXO Process.

The first report is entitled "Conversion of a synthetic oil into OXO alcohols. We recommend that this entire Part 7 should be translated.

Part 8 - Synthetic Lubricating Oils.

The entire part 8 on lubricating oils should be translated.

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Item 203

A report of a visit to the plant at Schwarzheide, July 6, 1940. The report consists of six pages. It starts out with a brief summary, deals with the prospective difficulties in operation and other problems which will arise.

Item 204

A report on a conference at which they discussed the production of gas and the synthesis process in late 1943.

Item 205

A calculation showing the expected production from the synthesis plant at Lutzkendorf in 1942.

Item 206

Gives the composition of gases and products produced by using many coals and gasified coals and semi-cokes during operation. It is interesting because it shows the use of Japanese semi-cokes during this operation.

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