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RESTRICTED

A. G. SACHSISCHE WERKE
BOHLEN

Hollings (H)

RESTRICTED

COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE

RESTRICTED

A.G. SACHSISCHE WERKE
BOHLEN (NEAR LEIPZIG) GERMANY

Reported by

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on behalf of

British Ministry of Fuel and Power

and

U.S. Technical Industrial Intelligence Committee

17 August 1945

CIOS Target No. 30/4.05
Fuels and Lubricants

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division, SHAEF (Rear) APO 413

RESTRICTED

15 p. Illus.

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A.G. SÄCHSISCHE WERKE, BÖHLEN, (NEAR LEIPZIG), GERMANY.

Introduction.

This report deals with the low-temperature carbonization plant, the Lurgi high-pressure gasification plant, and the experimental high-pressure Fischer-Tropsch plant at the A.G. Sächsische Werke, Böhlen, near Leipzig. The information was obtained from Herr Böhm (in charge of the Sächsische Werke) and Herr Otto (the Works engineer) with assistance from Herr Rückes (a Lurgi engineer who had supervized the building of much of the plant). It was collected on May 4 to 13, 1945.

Lurgi Low-Temperature Carbonization Plant (Schwelerei).

Brown coal is delivered from the Böhlen Mine with 52% water. It is dried, when the moisture content of the finer material is reduced to about 15%, while that of the lumpy material is 25%.

The fine material is briquetted in a plunger press at 700 atm. without binder into 2½" cubes. The material has the following composition:

Combustibles	79%
Ash	11%
Water	10%
Total Sulphur	3.4%
Ashed Sulphur	1.4%
Combustible Sulphur	2.0%
Elementary Analysis	C 53.6, H 4.4, S 2.0, O 19.0
Ash	11
Water	10
Gross Calorific Value	5333
Net	5030 kcals per kg.

The carbonizing plant is of the standard "Lurgi" "Spülgas" design. It consists of 24 ovens arranged in two houses. The primary object is to produce tar for hydrogenation in the Brabag I plant adjoining. (30/4.05). The gas produced has a C.V. of 2000 kcals per cu.m. and is burned under the boilers. The coke produced is disposed of in 3 ways (1) sold, (2) used on the Winkler generators at Brabag, (3) milled and burned in the power house (the fourth largest in Germany).

The plant produces 25,000 tonnes of tar per month from 195,000 to 210,000 tons of briquettes, and also 1½ million cu.m. of gas per day of which a third is needed to heat the ovens.

The briquettes first pass through a drying zone, where they meet the circulated products of combustion from the burning of 60% of the gas used for heating. Conical distributors are used. The dried briquettes then pass down large pipes into the carbonizing zone, which is similarly heated by the combustion of gas. The carbonization temperature is 650°C maximum. The gas used for drying has been purified from H_2S in order to avoid corrosion, but that used in the carbonizing zone contains H_2S but is free from tar.

The gas produced is treated in a Cottrell precipitator, and benzine is recovered. There is no recovery of ammonia.

The coke obtained consists of 20% breeze, 50% peas, and 30% nuts. It is cooled in a rotary drier using nitrogen from the Linde plant, its temperature falling from 200 to 80°C. Cooling in nitrogen is necessary owing to the reactivity of the coke.

Yields per ton of dried brown coal briquettes are:-

Tar	130 kg.
Coke	450 kg.
Available Gas	300 cu.m. (sent to boilers).

Lurgi High-Pressure Gasification Plant.

In the handling of the briquettes which are carbonized in the low-temperature ovens, a considerable quantity of material is broken-off from the corners. These broken briquette pieces are gasified with oxygen and steam in the high-pressure plant, together with the larger lumps of the dried brown coal which are not suitable for briquetting. The usual size was stated to be from 3 to 10 mm. with a maximum of 20 mm. Fuel containing more than 8-10% of sizes below 2 mm. cannot be used.

The analysis of the broken briquette pieces is similar to that of the briquettes given in the description of the low-temperature ovens. The analysis of the lumps of dried brown coal is as follows:-

Combustibles	68%	
Ash	8%	
Water	24%	
Total Sulphur	2.8%	
Ashed Sulphur	1.2%	
Combustible Sulphur	1.6%	
Elementary Analysis	C 48.4, H 4.3, S 1.7,	
Ash	8	O 13.6,
Water	24	
Gross cal.value	4778	
Net	4400 kcals per kg.	

A mixture of broken briquette pieces and dried coal lumps is usually gasified in the proportion of 1 to 2. However, it was stated that 100% broken pieces or 100% lumps could be used.

Oxygen is supplied by a Linde-Frankelplant. It consists of 4 units - 2 of 1000 cu.m. per hour and 2 of 2000 cu.m. per hour free oxygen capacity. The oxygen is of about 95% purity and is supplied to the generators, via compressors, at 23 atms. and 40°C. The installed power capacity of the oxygen plant is 4600 kw.

Steam is supplied from the adjacent power station and is superheated to 500°C by means of waste gas from the charging pouches and pressure water scrubbing plant before entering the generators.

The gasification plant has a capacity of 150 million cu.m. of towns gas per annum which is supplied at a pressure of 19 atms.to the grid supplying Leipzig and Magdeburg.The plant is in two parts, consisting of 5 older generators (1940) and 5 modern (1944) housed in one building. The modern generators differ from the older type in the design of the charging pouch, grate drive mechanism and arrangements for scraping the generator dome. Each generator is rated at 3000 cu.m. and normally operated at 2500 cu.m.per hour measured at N.T.P, the C.V. being 4200 kcals per cu.m., although wartime restrictions often reduced this to 3900. Attempts had been made to raise the C.V. to 4500, but this was not possible at the normal working pressure of 20 atms; it might be maintained at 25 atms.when methane synthesis would be promoted further.

The charging pouch on the modern generators consists of a chamber approximately 3 m. high by 1.6 m. diameter constructed of M.2 boiler steel. It is fitted with two valves, one at the top communicating with the overhead fuel bunker and 50 to 60 tons capacity, and one at the bottom leading to the generator. Both valves are manually operated. The method of charging is as follows:- the bottom valve is closed, and the gas in the pouch blown off to a holder from which it is drawn to burn in a steam super-heater; the top valve is opened. As this valve is lowered it permits a cylinder resting upon it to drop to an extent limited by lugs specifically provided for the purpose, leaving the coal from the bunker free to flow through the cylinder and the space between the bottom edge of the cylinder and the valve into the pouch. When the pouch is full the top valve is closed. In rising, the valve makes contact with the movable cylinder, thus shutting off the coal and leaving the contact surface of the valve clean. Gas is then let into the pouch from the generator and finally the bottom valve is opened. It takes 5 minutes to charge the pouch, and it was stated that only 2 men per shift are required on the charging stage of the new generators as compared with 5 men on the old generators. The 5 new generators started work 6 months ago. The total volume of gas blown off from the coal pouches is 5-7% of the total and is not included in the reported gas make.

Ventilators are fitted over the coal charging valves to remove any gas escaping and the coal bunkers are purged continuously with nitrogen from the air separation plant.

The top valve is composed of H 30.11 steel and seats against a rubber ring (Buna S) dovetailed into the top flange of the pouch. The normal life of the Buna ring is 3 months. The bottom valve has a hard ("Panzer") steel removable conical insert which seats against a chrome alloy of 60.11 steel sharp edged seating which is usually renewed after one year of service when the initial line contact has widened to from 7 to 8 mm. The free opening of both the top and bottom valves is 250 mm. diameter.

The pressure generator consists of a spherical ended cylinder 5 m. high by 3 m. external diameter. The internal diameter is 2.7 m. and the entire capacity is 35 cu.m. The cylindrical portion of the generator is brick-lined from the top to within 1 m. of the grate. It was stated that the bricks were dry set in contact with one another and with the steel and that no difficulty had ever been experienced with expansion; the brickwork in the older generators has lasted four years.

The generator is fully water-jacketed, the annular space being 120 to 150 mm. wide. The water jacket is connected to a steam drum and the small quantity of steam produced

(60 kg. per hour maximum) is led into the gas offtake. In this way the pressure inside the water jacket is maintained equal to the pressure inside the generator.

A skirt is provided around the coal inlet for the purpose of maintaining a gas space over the fuel bed. The skirt also serves as a support for a system of scrapers for the removal of pitch and carbon from the dome of the generator. These scrapers are electrically driven and are operated for 5 minutes every 2 hours. Inside the skirt is suspended a conical ring and beneath it a double cone whose combined purpose is to avoid segregation of the fuel and to equalize the pressure across the fuel bed.

Gasification is continuous, and the intervals between charging the pouches depend on the relative sizes of the pouch and generator. Actually the interval is 20 minutes with the old generators, and 35-45 minutes with the new generators. A generator can be started up from cold in 12 to 18 hours if fired with ash with a thin layer of coal on the top. Air is substituted for oxygen when starting up.

The grate is slightly domed in form and is composed of three sections in each of which there is fitted a detachable portion which incorporates a plough arranged to direct the ash passing over the edge of the grate into a cylindrical space beneath the grate. A vertical vane attached to the grate shaft then scrapes the ash into an opening leading to the ash pouch. The diameter of the grate is 1.6 m., the center being 150 mm. above the circumference. The grate sections are preferably cast of 25% chrome steel and have a normal life of three years. The drive shaft of the grate is hollow to provide the inle t for the oxygen and steam mixture. The grate is driven electrically by a 4.5 kw motor through reduction gearing and a ratchet device. The shaft is packed with metal asbestos packing of square section with provision for lubrication. The grate and drive are supported from the generator shell.

The ash leaving the generator passes into the ash pouch through a valve which is exactly similar in construction to the bottom valve of the charging pouch except that its diameter is 300 mm. instead of 250 mm. The ash pouch is 3.0 m. high by 1.3 m. in diameter with a capacity of 3.5 cu.m. The base of the pouch is closed by means of a disc clamped by four swing bolts. A thin Klingerite packing ring set into the disc forms the actual joint and this is renewed after every three discharges. The pouch is steam-jacketed at appropriate points to permit cooling of the ash without condensation. The ash is discharged through a portable sieve into a water sluice at intervals of about 2 hours, the oxygen and steam released in the process of reducing the pressure being allowed to escape to atmosphere. Steam is used when building up the pressure again to working level.

There have been no difficulties with clinker formation except during periods of irregular operation and the ash discharged is normally very fine. During air raid periods irregularities in operation led to clinker difficulties necessitating four shut down periods in one year for each generator.

The grate is operated continuously and its speed of rotation is determined by the quantity and character of the ash. The ash zone normally extends 300 to 500 mm. above the grate. The temperature of the fuel bed and condition of the ash are controlled by the oxygen to steam ratio. The temperature in the reaction zone was stated to be 1050 to 1150°C. The minimum permissible melting point of the ash is 1100° and fuels containing up to 30% of ash may be used. The carbon content of the ash is from 5 to 6%.

It was stated that a generator can be operated for 250 consecutive days, which, however, include about 30 miscellaneous minor shut down periods totalling 90 hours. Total time lost for both major and minor repairs is of the order of 2000 hours per annum. Difficulties due to corrosion of parts of the plant by H_2S and oxygen at 20 atms have been experienced. Chrome steel containing up to 23% of chromium has proved to be resistant.

The gas leaving the generator at a temperature of about 300°C passes directly to a primary cooler, at the inlet to which it is sprayed with an excess of water. Several experimental designs of primary cooler have been used on the various generators with the object of eliminating troubles due to accumulation of dust. The general design in each case makes use of rapid changes in the direction of gas flow to precipitate tar and any dust. The tar is discharged through a trap and the water is recirculated through an indirect cooler to the sprays. The gas leaving the primary coolers at about 150°C and 20 atms is collected separately from each half of the house. Each stream then passes through two vertical water tube coolers when the temperature is reduced to 100°C. The gas then passes through a tar precipitator of the multi-baffle type and then through 3 water tube coolers to condense light oils. It is next washed with oil in a Raschig ring scrubber to recover benzole.

The cooling of the gas and removal of condensable products is followed by scrubbing under pressure with water to remove CO_2 and H_2S. The total gas is passed through 4 Raschig ring-packed towers arranged in parallel. The water is recirculated, being first delivered by high pressure pumps to the scrubbing towers and then, after absorbing CO_2 and H_2S, it is expanded to atmospheric pressure through turbines. Gases released from the water in this expansion process are separated and used for steam superheating. The water then flows down 4 towers, packed with boards on edge, where it is blown with air; this air containing H_2S is then passed to the bottom of the power house chimneys where H_2S and SO_2 react to give sulphur which is discharged to the atmosphere.

After water washing the gas passes to the Lux purifiers. The purifiers consist of two parallel sets, each of 4 boxes, of which 3 are used while one is being recharged with oxide. The working life of a charge is about 4 weeks. The boxes were built by Klonne, and are about 1.5 m. in diameter by 8 m. high, containing 5 trays each with 2 layers of oxide 16-18 inches deep, the gas flowing in parallel through the 10 layers in a box, although the 3 boxes of a stream are worked in series. The gas enters with 10-30 grm. of the H_2S per 100 cu.m. NTP and leaves with 0.1 grm. per 100 cu.m. (equivalent to 0.7 parts per million). It was stated that 20 tons of Lux were used per annum.

The total pressure loss in the whole cooling and purifying plant is 1 atm. so that the finished gas enters the grid at about 19 atms.

During the visits, several references were made to experiments with Silesian hard coal. It appeared quite clearly that these experiments had been conducted for a short period only and that optimum conditions had not been established. On two occasions Böhm stated that troubles due to sticking and clinkering in the generator and to dust blockage in the primary cooler had been experienced during these experiments.

In operation, there are 3 men and 1 technician per shift in the control room, which contains a panel for each generator, on which are mounted a CO_2 recorder, steam and oxygen flow meters, a pressure recorder, and a 5-point temperature indicator. There are 4 men per shift on the ash-pouch stage, and 1 man for coal elevating.

The total number of men assigned to the plant, including those on the Linde oxygen plant, is 200. This excludes boiler men and power house attendants.

The oxygen consumption is 0.145 cu.m. per cu.m. of purified gas, and the steam consumption 1.47 kg. The overall power consumption for production of oxygen, including power for compression to 23 atms is 1.1-1.2 kw.H. per N cu.m. and the cost 2.2 pf. per cu.m. including capital charges. The total power consumption for gas manufacture, including oxygen production, is 0.22 kw.H per N cu.m. of purified gas. The power for oxygen production, excluding compression, 0.9 to 1.0 kwH per N cu.m., is high because the turbo-compressors are inefficient. It was hoped, by fitting new rotors, to reduce the power compressed to 0.8 kwH per N cu.m. of oxygen.

Based on costs of fuel at 6.50 mk. per ton, water at 6 pf. per cu.m., power at 1.1 pf. per kwH, labor at 0.4 pf. per cu.m. of gas, maintenance cost at 0.4 pf. per cu.m. of gas and oxygen at 2.2 pf. per cu.m., the total cost of gas is 3.8 pf./cu.m. After deducting a by-product credit of 1.4 pf. per cu.m. the net cost is 2.4 pf. per cu.m.

It was emphasized by both Böhm and Otto that the whole gasification plant operated smoothly and satisfactorily, and was a most successful unit.

Working results for the month of January 1945 were as follows:-

Gas made (measured at 0°C, 760 mm)	12.366 million cu.m.
Tar	1,101 tonnes
Benzole	474 tonnes
Maximum daily gas production	476,190 cu.m.
Mean daily gas production	399,892 cu.m.
Mean generator output per hour	2,300-2,500 cu.m.
Coal used	19,600 tonnes
Coal used, water and ash free	13,329 tonnes
Oxygen used	1.799 million cu.m.
Oxygen used per cu.m. purified gas	0.145 cu.m.
Steam used in generator	18,183 tonnes
Steam used in generator per cu.m.gas	1.47 kg.
Total steam used	24,096 tonnes
Total steam used per cu.m. gas	1.94 kg.
Power consumption	3.402 million kWh.
Power consumption per cu.m.purified gas	0.274 kWh.
Water used	247 thousand cu.m.
Water used per cu.m. purified gas	20 liters

Gas analysis, average for the month:-

	Crude Gas.	Purified Gas.
CO_2 % by volume	32.1	9.1
H_2S	1.6	0.0
C_nH_m	0.7	0.6
O_2	0.2	0.2
CO	12.1	16.7
H_2	37.5	52.3
CH_4	14.5	20.0
N_2	1.3	1.1
Gross calorific value Kcals per cu.m.	3090	4048
Density (air=1)	0.753	0.499

Gas Yield 632 cu.m. NTP per tonne of dried coal.
= 929 cu.m. NTP per tonne of dry,ash-free coal.

Note the low C.V. which was ascribed to air raid interruption.

The documents secured appear to cover the structural details of the plant for gasification, and include instructions to employees on the method of operation, daily and monthly reports of operation for several years and analyses of the estimated and realized costs of construction.

A sketch of the older type of gas generator is attached as Figure I.

H. HOLLINGS
G. V. HOPTON
L. L. NEWMAN

Experimental Fischer-Tropsch Unit.

This pilot plant was installed by Lurgi Gesellschaft für Wärmetechnik, originally to study the "detoxification" (carbon monoxide removal) of the town gas produced by the Lurgi high pressure gas generators. Information on this plant was first picked up from Lurgi personnel in Frankfurt A.M, and data obtained at the plant, as to its capacity and yield, checked the information obtained at Frankfurt.

The gas from the generator was water-washed to reduce the carbon dioxide content, purified in an activated carbon absorber and an iron oxide contactor, then passed downflow at 18 atms. and approximately 250°C. over a precipitated iron catalyst (Fischer-Tropsch). After condensation of the wax and oil and abdorption of the benzine the residual gas still contained 7-8% carbon monoxide, which was not considered sufficient "detoxification", and in the interest of war economy operation was shifted to the study and the production of hydrocarbons. No data or experimental results were available for either operation and the plant personnel could not be located. It was stated, by personnel of the A.G. Sächsische Werke who were interrogated, that the unit was never operated satisfactorily and had made only a few short runs on the hydrocarbon synthesis with iron catalyst, and that it was planned to conduct investigations on the use of cobalt catalysts. The yield of liquid and solid product was shown to be only 40 gms/cu.m. on a schematic drawing of the plant which was among the official documents collected.

The flow diagram is shown schematically on the attached Figure II, and a photograph of the plant is presented as Figure III. The Lurgi gas (C.V. of 4200 kcals. per cu.m.) at a rate of 1600 normal cubic meters per hour, which has been water-washed to remove CO_2 (see the Table, page 8), is first passed through an activated carbon coarse purification plant at atmospheric temperature for removal of resinous constituents. This plant consists of two vessels approximately 2 ft. in diameter by 12 ft. high; one carbon absorber is on stream while the other is being regenerated with steam. The gas, after preheating to about 220 to 280°C., then passed in parallel through an iron oxide-organic sulfur removal stage consisting of two vessels, each about 2 ft. in diameter by 12 ft. high.

After this final purification the gas, at approximately 250°C. and 18 atm pressure, passed downflow through a reactor, which was within a horizontal cylindrical pressure shell (See Figure III). It was not possible to investigate the internal construction of this reactor, but one group of investigators was told that it was as shown in a dimensioned drawing dated 5 November 1940, picked up in a near-by place of temporary storage (See Document Bag 3500, #25, Microfilm Series A, Reel 12). This shows a horizontal cylinder 4620 mm. long and about 3300 mm. in diameter containing a conventional atmospheric-pressure Fischer-Tropsch reactor with 630 water-steam coils passing horizontally through a multitude of thin vertical plates, between which the catalyst was placed. This reactor was 3000 mm. long and about 1760 mm. square, contained about 6 cu.m. of catalyst, and could be withdrawn from the cylinder. (However, a different investigator was told that the reactor contained a withdrawable bundle of finned tubes, and that difficulties were experienced because the fins failed to register). The effluent from the reactor went to a hard wax trap and thence to a dilute sodium hydroxide wash where soft wax was condensed and withdrawn. The gas was then further cooled in a water spray tower where the middle oil was condensed. The benzine was adsorbed in an activated carbon plant which consisted of two vessels about 2 ft. in diameter by 12 ft. high, one of the carbon adsorbers being on stream while the other was being regenerated with steam. No propene or butane was recovered from the vent gas, which was produced at a rate of 1200 normal cubic meters per hour with a C.V. of 4300 kcals per cu.m. The pressure drop through the plant was about one atmosphere.

The unit was apparently manually operated for no control instruments were found at the plant site. The control laboratory contained equipment for Orsat analysis, simple distillation, acidity, and iodine number determinations. A sample of the iron catalyst was found in this laboratory and has been submitted for activity tests. The production was shown to be approximately 1500 kg per day and the product distribution was about as follows:

Hard Wax	25-30%	Middle Oil	10-30%
Soft Wax	20-30%	Benzine	25-30%

Among the documents collected were a schematic flow sheet (which is the basis for Figure II) and the above-mentioned dimensioned drawing of the contact vessel. The plant had been operated under the direction of two Lurgi engineers, a Dr. Gross and a Mr. Will, of Frankfurt-am-Main, who were said to have disappeared with all the records shortly before the occupation by American troops.

W. A. Horne
E. Spivey

ADDENDUM.

On May 8th a visit was paid to this plant by Dr. J. G. King, Mr. H. Bardgett and Mr. E. Spivey, following their investigation of the Metallgesellschaft/Lurgi Target 30/6.08.

The technical details collected during the visit have all been embodied in the main target report but the following should be placed on record:-

Managing Director Boehm, and Engineer Otto, were questioned on the subject of drawings of the Lurgi H.P. Generator and ancilliary plant but stated that they had no drawings of any kind although in Frankfurt the team had been assured by Dr. Oetken that the Lurgi Company's drawings and technical reports had been evacuated to Böhlen. On being shown a letter from Dr. Oetken, however, they admitted that copies were in the custody of Herr Ruckes, the local Lurgi engineer who had them in a temporary office in the neighbouring village of Grossdeuben.

Note:

The letter was an instruction from Dr. Oetken to hand over to Dr. King the drawings evacuated to Böhlen, or failing these, to hand over their personal copies. In the latter case, Dr. Oetken promised to provide substitute copies when the originals were found. L.Ruckes' address was : 3, Boelckestrasse.

Mr. Ruckes' office was visited and a fairly complete set of prints was found of the 1939 plant (series S.G.7) and the 1943 plant (series S.G.11) with one drawing of the Brüx plant and some technical reports. The drawings were appropriated and were used in later researches at the plant as stated in the main report on this target. The drawings collected on May 8th are enumerated below; they provide, with the technical data obtained, a comprehensive picture of the present stage of development of this process.

DRAWINGS ETC., EVACUATED.

S.G.7

200.153	Toerscheider
200.172	Einzelteiler z. Belüftungsturm II Stufe
200.188	Waschölzwischenbehälter
200.270	Druckwasserwäsche u. Wasserregenerierung
200.294	Füllglocke f. Gaserzeuger
200.390	Gaskühler u. Reiniger f. Rohgasprobenahme
200.511a	Schema Gasleitungen
200.569	Temp. mestellen in Gaserzeugergebäude
200.629b	Aut. Verschluss z.d. Zwischenbehälter
200.811	Düsonringe in Teerscheider

S.G.2/7

200.012	Auslaufkrümmer

S.G.10

SGE 1900 m vil 1707 Gasschleuser (Brüx)

200 610 200 679a	Bohrverichtung der Blockplan
200 657	Ausmauerung des Gas Erzeugers

S.G.11

200 673d	Druckbehälter
200 692b	Unter Zwischenbehälter
200 716b	Schlusskühler
200 777b	Oberen Zwischenbehälters 2000/- u.Mechan.Teile
200 787c	Hauptkühler
200 832	Bunkerauslauf
200 855b	Kratzvorrichtung im oberteil d. Gaserzeuger
200 867a	Layout Gaserzeuger 10
200 938a	Verteiler Schirm
200 128	Obern Zwischenbehälters

S.G.11/2591334 Stiftschrauben im Bereich des Gaserzeugen-Druckraumes.
201.127 Verschluss des Obern Zwischenbehälters Einselteile
201.128 Verschluss des Zwischenbehälters
SGE 1083 4197 Benzinwascher
SGE 1222 8902 Rohrplan
SGE 1223 8902 Rohrplan
SG 10/15/201.038a Druckwasserwäsche Grundrisso

8.452 Schema der 940 m^3 O_2 Anlage

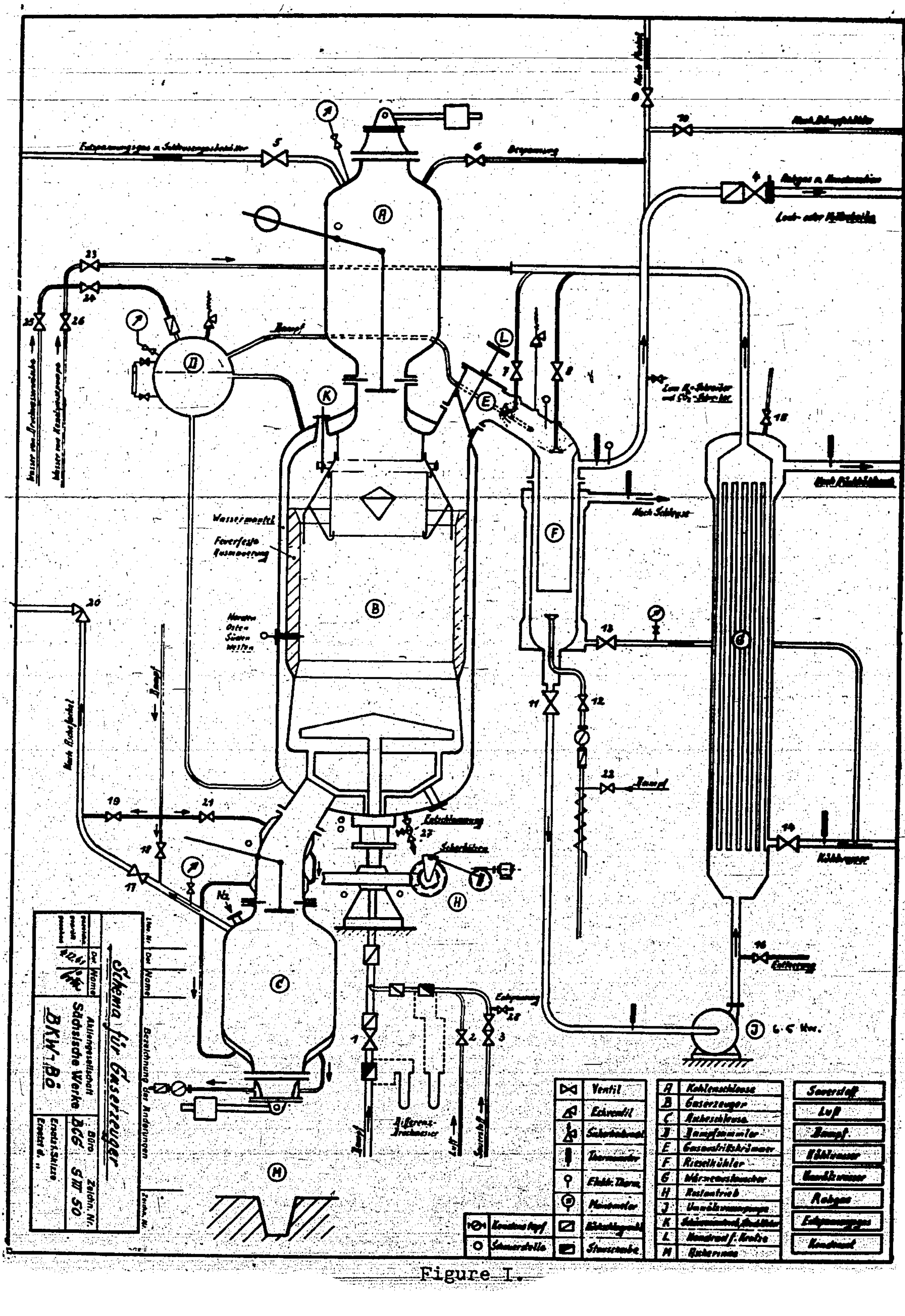
Schema für Gaserzeuger
Sächsische Werke
BKW-Bö
Wassermantel
Feuerfeste Ausmauerung
Bezeichnung der Änderungen
Ventil
Eckventil
Thermometer
Manometer
Kohlenschleuse
Gaserzeuger
Ascheschleuse
Dampfsammler
Rieselkühler
Wärmeaustauscher
Rostantrieb
Sauerstoff
Luft
Dampf
Kühlwasser
Rohgas
Kondensat
Dampf
Luft
Sauerstoff
Kühlwasser
Nach Schleuse

Figure I.

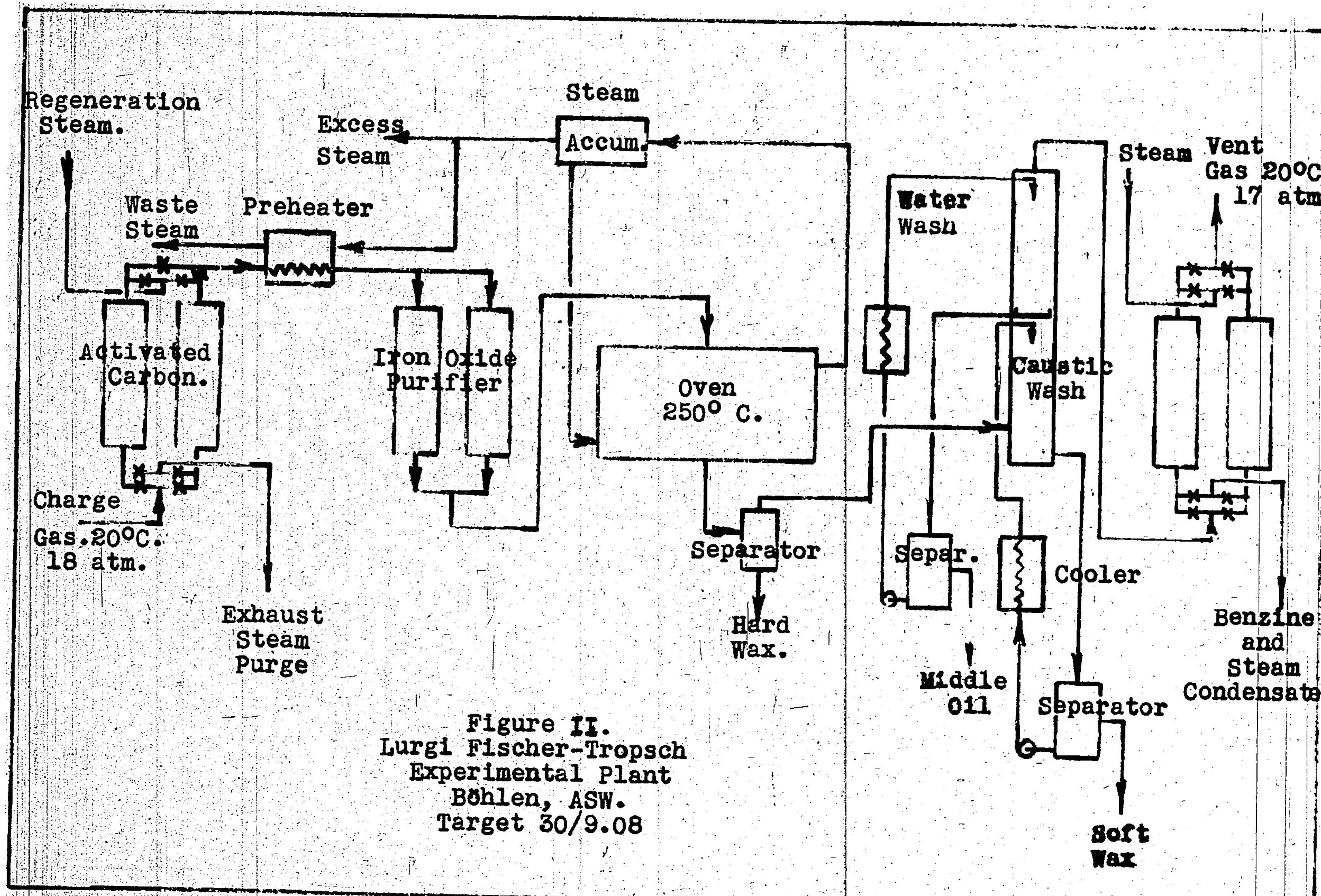

Figure II.
Lurgi Fischer-Tropsch
Experimental Plant
Böhlen, ASW.
Target 30/9.08

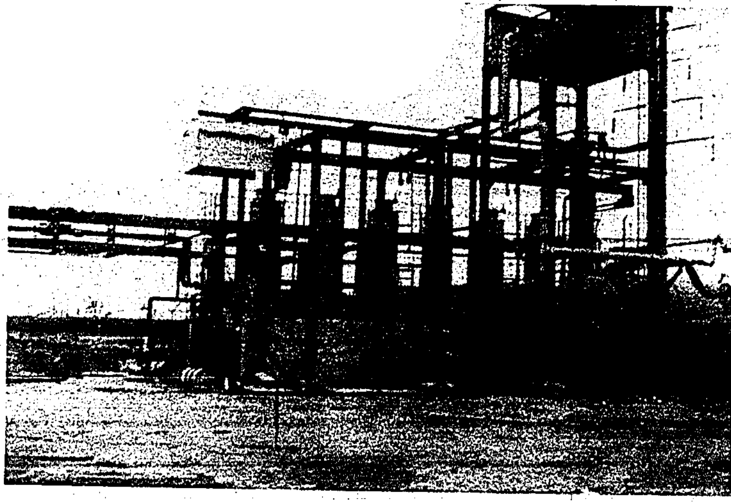

Figure III

Experimental
Fischer Tropsch Plant
20 Atm. Pressure
Reactor (contact vessel) on the right.
2 columns, Act. charcoal to adsorb resinous constituents from charge.
2 columns, organic S removal.
2 columns, Act. charcoal to adsorb light hydrocarbons from residue.