Newman

T. O. M. Reel 181
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U. S. Bureau of Mines
Hydro. Demon. Plant Div.

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Comparative Efficiencies of Synthetic Liquid Fuels Production

I N D E X

TABLE I

High Pressure Hydrogenation and Synthesis

	(A) PROCESS	(B) PRODUCTS	(C) Coal Consumption St= Bitumin. Coal, Hu= 7000 Kcal/Kg. Br= Brown Coal Hu=2300 Kcal/Kg. T/T Product	(D) Coal Reg'd T/T Product	(E) Efficiency of Fuel Production, based on Coal Consumption %	(F) Efficiency of Power Generated at the Motor Shaft based on Coal Consumption %	(G) Coal Consumption Kg/HPh	(H) Coal Consumption Kcal/HPh
1)	Bitumin. Coal Hydrogenation	High Performance Gasoline Aviation Gasoline Auto Gasoline Marine Fuel Oil Liquid Gas	4.5-6 St	4.5-6 St.	36-40	9-10	0.9-1.05 St.	6300/7400
2)	Brown Coal Hydrogenation	Aviation Gasoline Auto Gasoline Diesel Oil Lubricating Oil Liquid Gas	12-14 Br	12-14 Br	36	9	2.9-3.1 Br	6700/7200
3)	Brown Coal Synthesis	Auto Gasoline Diesel Oil Paraffin Liquid Gas	12.5 Br	12.5 Br	36.2	9.9	2.78 Br	6400
4)	Bitumin. Coal Synthesis	Auto Gasoline Diesel Oil Paraffin Liquid Gas (Benzol)	4.0 St	5.6 St	37.4	10.1	0.91 St	6350

(Note:-HP=Metric Horsepower)

TABLE 2

Combined Hydrogenation and Synthesis Process

(See Table I for Column Headings)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1)	Bitum. coal kiln operation with kiln tar hydrogenation.	High Performance Gasoline Aviation Gasoline Auto Gasoline Marine Fuel Oil Liquid Gas	3.0 St	10.5 St	50	12.5	0.73 St	5100
2)	Brown coal kiln operation with kiln tar hydrogenation.	Auto Gasoline Diesel Oil Liquid Gas	9 Br	16 Br	50	12.5	2.24 Br	5200
3)	Bitum. coal kiln operation with kiln tar hydrogenation & kiln coke synthesis	High Performance Gasoline) from hydro. stage (1) Aviation Gasoline) from hydro. stage (1) Auto Gasoline) from hydro. stage (1) Marine Fuel Oil) from hydro. stage (1) Auto Gasoline) from synthesis stage. Diesel Oil) from synthesis stage. Paraffin) from synthesis stage. Liquid Gas	3.8 st	3.8 St	40.1	10.4	0.87 St	6080

(Continued on next page)

TABLE 2 - Continued

(See Table 1 for column headings.)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
4) Brown coal kiln operation with kiln tar hydrogenation & kiln coke synthesis.	Auto Gasoline) from hy- Diesel Oil) dro.stage (2) Auto Gasoline) from the Diesel Oil) synthesis Paraffin) stage Liquid Gas	10.5 Br	10.5 Br	43.6	11.1	2.48 Br	5720
5) Bitum. coal coking with tar hydrogenation and high temp. coke synthesis.	High Performance Gasol) from Aviation Gasoline) hydro. Auto Gasoline) stage Marine Fuel Oil) (3) Auto Gasoline) from Diesel Oil) synthesis Paraffin) stage Benzol Liquid Gas 250 atm. bottle gas	2.5 St	2.5 St	44.6	11.0	0.78	6460

(Note:-Kiln operation (Schwelung)=low temp. carbonization.)

(Proportion of Products from the hydrogenation stage to those from the synthesis Stage (1) 1 : 1, (2) 2 : 1, (3) 1 : 4.

TABLE 3

Process for Production of 250 Atm. Bottle Gas.

(See Table I for Column Headings)

(A)	(B)	(C)	(E)	(F)	(G)	(H)
1) Brown coal high pressure gasification	55 kg Gasoline 955 m^3 L.P.G. 250 atm.	4350 kg Br	46.2	11.5	2.4 Br	5520
2) Bitum. Coal coking	45 kg Benzol 1480 m^3 L.P.G. 250 atm.	1430 kg St	67.1	16.8	0.54 St	3780

L. P. G. (Treibgas) = Liquified Petroleum Gas

TABLE 5

Comparison with other Vehicles

(A)	(B)	(C)	(E)	(F)	(G)	(H)
	(See Table I for Column Headings)					
Steam Locomotive						

TABLE 4

Fuel Process for Use in Vehicle Generator
(See Table I for Column Headings)

	(A)	(B)	(C)	(E)	(F)	(G)	(H)
1)	Bitum. coal kiln operation with kiln tar hy'genation and kiln coke processing in the vehicle generator.	114 kg Gasoline 23 kg L.P.G. 4120 m^3 Generator-gas	1430 kg St.	55.8	12.6	0.72 St	5040
2)	Brown coal kiln operation with kiln tar hy'genation and kiln coke processing in the vehicle generator.	244 kg Gasoline 24 kg L.P.G. 2520 m^3 Generator-gas	4350 kg Br	55.3	12.4	2.22 Br	5110
3)	Vehicle generator with brown coal kiln coke	6360 m^3 Generator-gas	4350 kg Br.	63.6	13.9	1.98 Br	4560
	with bitum. coal kiln coke	6400 m^3 Generator-gas	1430 kg St	64.0	14.1	0.65 St	4550
	with Anthracite	7500 m^3 Generator-gas	1350 kg Anthracite	75.0	16.5	0.62 Anthracite	3850
	With wood	7500 m^3 Generator-gas	2590 kg Wood	25.0	16.5	1 wood	3850

REMARKS

TABLE I

Item-1.) Used for production of high performance and aviation gasolines and marine fuel oil.

Item-2.) Used for production of aviation and auto gasolines and diesel oil.

Item-3.) & Item-4.) Used primarily for production of paraffin and diesel oil.

TABLE 2

Item-1.) Under construction in Upper Silesia at present. Could not be used before, because kiln operation had not been sufficiently developed and the sale as well as the utilization of kiln coke had not been fully clarified.

Item-2.) This process combination is used very extensively. The quality of the gasoline comes within the lower limit of aviation fuel. The sales problem of the surplus crude has been eliminated since this is used in trucks.

Item-3.) A small plant is operating in the Ruhr, though with this difference, that the kiln tar is not further processed in a hydrogenation stage, but is used directly as marine fuel oil. The preceding applies to the products from the synthesis stage.

Item-4.) This combination can not be used for the production of aviation gasoline. The kiln operation with the following tar hydrogenation is used very extensively. In Ruhland, instead of using crude as raw material, the synthesis stage processes brown coal briquettes.

Item-5.) This combination is used in several Ruhr plants; practical for small plants, too. In further development of this process combination different aspects must be tried out; good coking coal is scarce. Coincidental production of the various products must agree with the demand for them.

TABLE 3

Item-1.) & Item-2.) In these processes, gases with a heat value of 4250 WE/m^3 are bottled @ 250 atm. The utilization of these processes is limited by the use for the product. Its range of action is small and the heavy bottles reduce the useful load.

TABLE 4

Item-1.) Disadvantages are the high HP weight of the motor and generator and the high heat value of the fuel carried. Can not be used for military purposes.

Item-3.) Anthracite must first be de-ashed. Wood can not be used in Germany because of the great demand for it for other uses.