Different Processes for the Production of Water Gas.
October 18, 1942.

1. Oxygen-water gas from coke in rotating producers.

After treatment: Desulfurization, compression, conversion, CO_2 removal, compression to 325 atm, CO removal.

In addition to 80-85% zero water gas there is also produced 15-20% nitrogen-containing water gas which can find use as fuel. For each cub.m. hydrogen, 1.55 cub.m. total water gas is required. Of this amount, 0.31 cub.m. contain nitrogen and is to be used as fuel.

The method is adapted to largest installations and with low cost coke it produces cheap hydrogen. Used in: Leuna, Scholven (Demag and Pintsch), Pölitz, Blechhammer, Welheim.

2. Oxygen-water gas from brown coal coke (Grude), dry brown coal or coal, using Winkler producer with oxygen from Linde installation.

After treatment: Desulfurizing, compression, conversion, CO_2 scrubbing, compression to 325 atm, CO scrubbing.

1.36 cub.m. total water gas required for 1 cub.m. hydrogen. The process is adapted to largest scale manufacture.

Advantages: The use of the finest-powdered fuels, which could find no other use.

Requirements: The fuel must be cheap because of the Linde unit.
The process is in use in Leuna and in the Brabag works with brown coal, in Japan? with soft coal.

3. The Pintsch-Hillebrand Process.

~~Use of Briquettes. The process in use at Wesseling.~~

4 ~~Water gas from coke, hydrogen from Messerschmidt hydrogen producer.~~

After treatment: Hydrogen: sulfur removal, CO_2 removal with chalk; hydrogen compression to 325 atm.

2.2 cub.m. total gas required for 1 cub.m. hydrogen.

The process may only be considered for small units of up to 2500 cub.m./h.

Used in Gendorf: 2600 cub.m./h. water gas

5. Splitting of hydrogen off-gas or coke oven gas, etc, in tubular furnaces.

After treatment: Final desulfurization, conversion, compression, CO_2 scrubbing, compression to 325 atm., CO scrubbing.

Preliminary requirement: Low butane content.

The process may be used in large units.

Used in Pölitz and Wesseling.

Disadvantage for use during wartime: Special material for tubes.

6. Splitting of coke oven gas in Sachse converters with the use of oxygen.

The gas desulfurized prior to splitting.

After Treatment: Compression, conversion, CO_2 scrubbing, compression to 325 atm., CO scrubbing.

Because of rusting, the process is only adapted to operation with low BTU gases, up to coke oven gases. Methane, possibly small amounts of ethane, are the limit.

When coke oven gas is used, some 4% N_2 remains with the hydrogen.

The furnaces are heated by direct combustion of part of the gas.

Advantage: Somewhat lower installation costs.

7. Linde process for the decomposition of gas.

Desulfurization and CO_2 removal must be done first.

Advantage: The separated gases are available for independent use.

8. Linde Double Shaft Converter Process.

Has as yet not been tested in larger units.

9. Lurgi pressure gasification of solid fuels with the use of oxygen.

After treatment: CO_2 scrubbing, conversion, CO_2 scrubbing, compression to 325 atm. CO scrubbing.

Disadvantage: High methane content.

The methane content increases rapidly with increasing pressure, while the CO_2, hydrogen and CO contents are reduced.

10. Didier process.

11. Koppers process.

12. Electrolytic hydrogen.

Byproduct: oxygen

Only for small units with low price power.

Operation and Installation Costs of the Different Processes

Cost are only calculated for the water gas installation, not for the after treatment. The amount of water gas produced at the water gas installation is sufficient for the production of 1000 cub.m. hydrogen and 100,000 cub.m./h hydrogen after compression.

Process	Operating costs of the water gas plant per 1000 Nm^3 H_2, after compression RM.	Raw material costs	Installation costs of a water gas plant for 100,000 m^3/h of H_2, uncompressed after compression. RM.
Zero water gas from coke in rotating producers	22.-	coke: 23m/te	14,200,000.-
Zero water gas in Winkler producer	29.-	coke: 23M/te O_2 : 1.9 pfg/M^3	22,000,000.- Included: Linde unit for 36,600 m^3/h of O_2; 16,000,000.-
Pintsch-Hillebrand: Water gas from brown coal briquettes			22,700,000.-
Water gas from coke, hydrogen from Messerschmidt hydrogen producer.	37.70	coke: 23 M/te	
Splitting of hydrogen off-gas in tubular converters.	22,80	Hy. off-gas: 0,51 pfg/1000 H.U. correspond. to coke oven gas at 2.2 Pfg/m^3	16,500,000.- Included fuel gas 118x10⁶ H.Units (4,250,000.)
Splitting of Coke oven gas in Sachse Converters.	24.-	Coke oven gas 2.2 Pfg/m^3 Oxygen 1.9 pfg/m^3 Power: 1.4fg/kwh	14,000,000.- Including Linde unit 4,600,000 65,000,000.-
Electrolytic hydrogen	93.-		
	After treat. & compression 109,60		