SNS COLLEGE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

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DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE CODE & NAME: 19AGT301 & HEAT POWER ENGINEERING

III YEAR / V SEMESTER

UNIT : 1 FUELS AND COMBUSTION
TOPIC 6 : Gaseous Fuels

COMPRESSED NATURAL GAS

- Natural Gas is obtained from wells dug in the oil bearing regions. When natural gas occurs along with petroleum in oil wells, it is called as ‘wet gas’ and contains gaseous hydro carbons from C1 to C4. The wet gas is then suitably treated to remove propane, propene, butane and butane, which is used as LPG.When the natural gas is compressed, it is called Compressed Natural Gas (CNG).
- The primary component present in CNG is methane. It is mainly derived from natural gas.
- The natural gas can either be stored in a tank of a vehicle as compressed natural gas (CNG) at 3,000 or 3,600 psi or as liquified natural gas (LNG) at typically 20-150 psi. A suitably designed natural gas engine may have a higher output compared with a petrol engine because the octane number of natural gas is higher than that of petrol.
- Compressed natural gas vehicles require a greater amount of space for fuel storage than convention gasoline power vehicles. Since it is a compressed gas, rather than a liquid like gasoline, CNG takes up more space for each GGE (Gallon of Gas Equivalent). This makes it difficult to design smaller vehicles that look and operate like the vehicles that people are accustomed to.

- CNG is often confused with liquefied natural gas (LNG). While both are stored forms of natural gas, the key difference is that CNG is in compressed form, while LNG is in liquefied form. CNG has a lower cost of production and storage compared to LNG as it does not require an expensive cooling process and cryogenic tanks. CNG requires a much larger volume to store the same mass of natural gas and the use of very high pressures (3000 to 4000 lbf/in², or 205 to 275 bar).
- CNG has been made mandatory for all public transport in the Indian capital city of New Delhi.

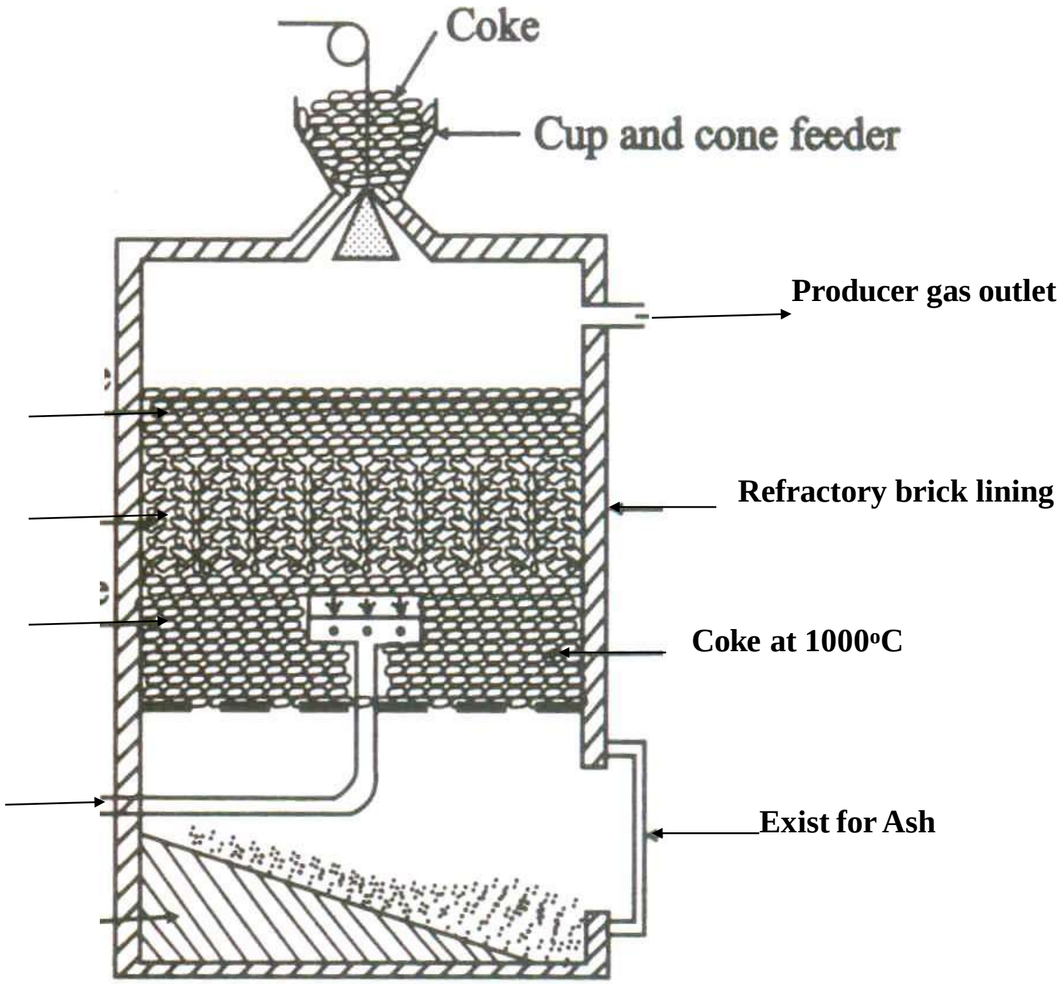
- **Properties**
- l. CNG is; the cheapest, cleanest and least environmentally impacting alternative fuel.
- 2. Vehicles powered by CNG produce less carbon monoxide and hydrocarbon (HC) emission.
- 3. It is less expensive than petrol and diesel.
- 4. The ignition temperature of CNG is about 550°C. CNG requires more air for ignition.

PRODUCER GAS

- Producer gas is a mixture of combustible gases, CO(30%) and H2(15%) with large amount of non combustible gases N2(56%) and CO2(3%). Its calorific value is 1300kcal/m3

- It is prepared by passing air mixed with a little steam over a red hot coke maintained at about l100°C in a special reactor called gas producer. It consists of a steel vessel of (3 m in diameter, 4f m in height) inside lined with refractory bricks. It is provided with cup and cone feeder at the top and a side opening for produced gas exit. At the bottom, it has inlets for passing air and steam.

Manufacture of producer gas



Various Reactions

- The reactions of producer gas production can be divided into four zones as follows.
- ***(i) Ash Zone***
- This is the lowest zone consists mainly of ash. The incoming air and steam mixture is preheated in this zone.
- ***(ii) Combustion or Oxidation Zone***
- This is the zone next to ash zone. Here the coke is oxidised to CO and CO2. Both the reactions are exothermic. Hence, the temperature of the bed reaches around 1,100°C.
- C +O2 CO exothermic H + 95 k cal
- C + 1/2O2 $\longrightarrow$ CO2 exothermic H + 29 k cal
- $\longrightarrow$

(iii) Reduction Zone

- This is the middle zone. Here both CO2 and steam combine with red hot coke and liberate H2 and CO. The reduction reactions are endothermic and the temperature in the zone is about 1000°C. If no steam is supplied, the temperature of the producer raise and this may fuse the ash and refractory lining.
- $C + CO_2 \rightarrow 2CO$ endothermic – 36 k cal
- $C + H_2O \rightarrow CO + H_2$ endothermic – 29 k cal

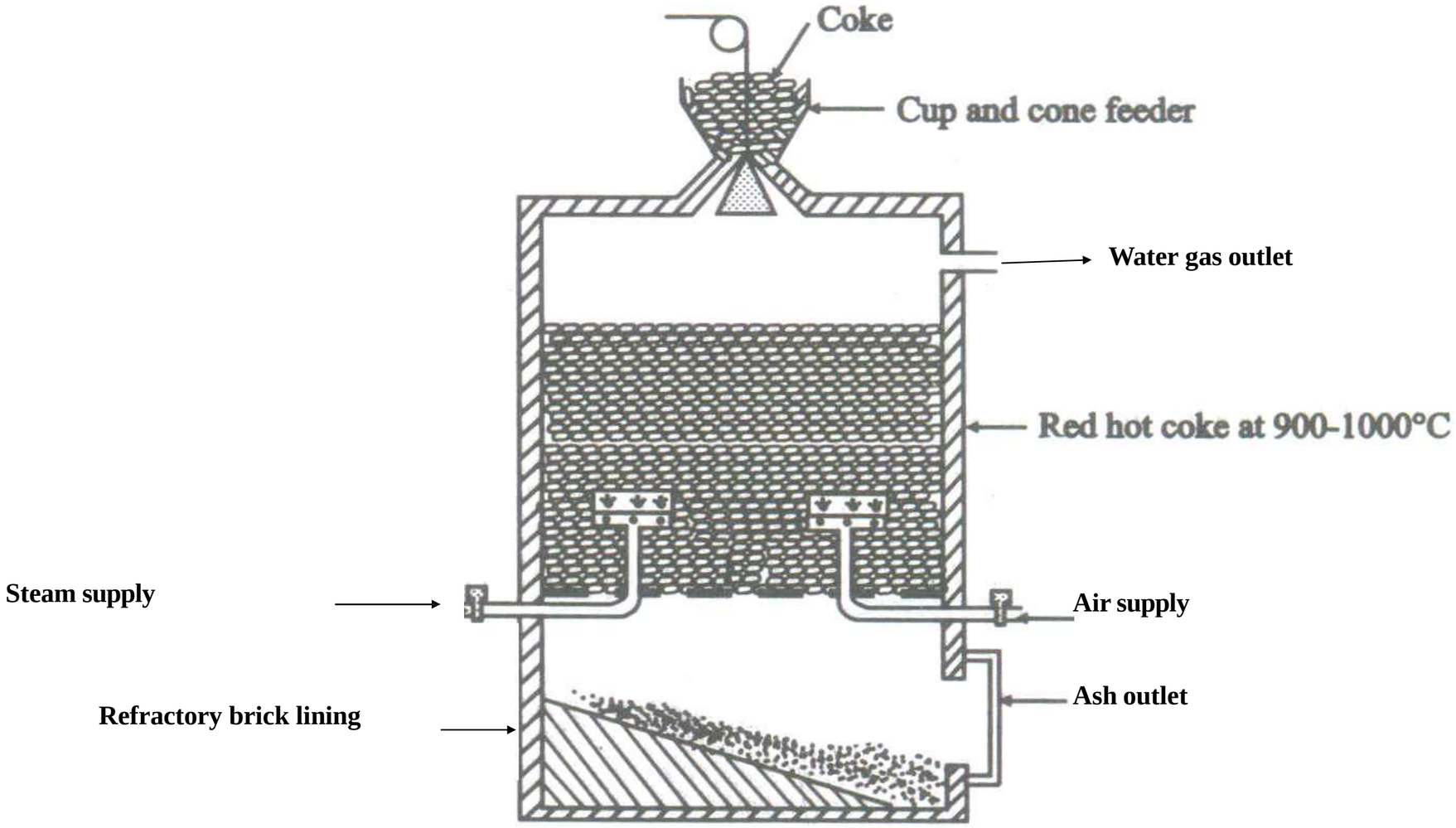
- ***iv) Distillation or Drying Zone***
- In this zone (400 - 800°C) the down coming coal is heated by the outgoing gases. The heat given by the gases and the heat coming out from the reduction zone will distill the fuel.
- **Uses**
- 1. It is used as a reducing agent in metallurgical operations.
- 2. It is also used for heating muffle furnaces, open-hearth furnaces etc.

WATER GAS

- It is a mixture of combustible gases, CO(41%) and H2 (51%) with small amount of noncombustible gases, CO2(4%) and N2(4%). Its calorific value is about 2800

- **Manufacture**
- The water gas producer consists of a tall steel vessel, lined inside with refractory bricks. It is provided with cup and cone feeder at the top and a side opening for water gas exit. At the bottom it is provided with two inlet pipes for passing air and steam
- When steam and little air is passed alternatively over a red hot coke maintained at about 900 - l000°C in a reactor, water gas is produced.

Manufacture of water gas



MANUFACTURE

- The reactions of water gas production involves the following two steps.
- **Step 1**
- In the first step, steam is passed through the red hot coke, where CO & H2 gases are produced. The reaction is endothermic. Hence, the temperature of the coke bed falls.
- $C + H_2O \rightarrow CO + H_2$ endothermic – 29 k cal
- **Step 2**
- In the second step, in order to raise the temperature of the coke bed to 1000 C , the steam supply is temporarily cut off and air is blown in. The reaction is exothermic.
- $C + O_2 \rightarrow CO_2$ exothermic H + 95 k cal
- $2C + O_2 \rightarrow 2CO$ exothermic H + 59 k cal
- Thus the steam – run and air blow are repeated alternatively to maintain proper temperature.
- **Uses.**
- It is used for the production of H2 and in the synthesis of ammonia. It is also used as a source of and illuminating gas and fuel gas.


THANK YOU...