Lecture №14. Technological scheme and operation mode of delayed coking units.

Delayed coking is a crucial process in the petroleum refining industry, which involves the conversion of heavy, high-boiling point petroleum fractions into valuable products like gasoline, diesel, and petroleum coke. This process is characterized by a technological scheme and operation mode that are intricate and require careful control. Here, we'll delve into the key aspects of the technological scheme and operation mode of delayed coking units.

Technological Scheme:

- ***Feedstock:*** The process begins with the selection of a suitable feedstock, typically heavy residue from the crude oil refining process. This feedstock is high in molecular weight and contains various hydrocarbons that need to be broken down.
- ***Preheating:*** The feedstock is preheated to reduce its viscosity and make it easier to handle. The preheating process involves passing the feedstock through heat exchangers and furnaces to achieve the desired temperature.
- ***Coking Drums:*** The heart of the delayed coking unit consists of one or more coking drums. These large, vertical vessels are where the actual coking reactions take place. The hot feedstock is introduced into these drums, and the coking process occurs under controlled conditions. Coking drums are usually operated in a batch mode.
- ***Heating and Soaking:*** Inside the coking drums, the feedstock is heated further to extremely high temperatures (900-950°C) to break down the large hydrocarbon molecules. The feedstock is allowed to "soak" at these high temperatures for a specific period, typically 12 to 24 hours. This allows for the thermal cracking of the feedstock.

Quenching: After the soaking period, the hot, thermally cracked material is rapidly quenched with water or steam. This quenching step is essential to stop the coking reactions and prevent the formation of excessive coke deposits on the drum walls.

Coke Cutting: Once the coking process is complete, the solid petroleum coke that has formed is cut and removed from the drum using specialized cutting tools. The removed coke is sent for further processing or used in various industrial applications.

Vapor Recovery: The volatile hydrocarbon vapors produced during coking are recovered and condensed into valuable liquid products like gasoline and diesel through a series of fractionation and condensation steps.

Operation Mode:

The operation of a delayed coking unit is a well-choreographed process with careful attention to several key parameters:

- ***Temperature Control:*** Maintaining the right temperature profile is critical. This involves controlling the heating, soaking, and quenching phases to ensure efficient cracking of hydrocarbons without overheating or undercooking.
- ***Pressure Control:*** Proper pressure control is essential to prevent leakage and maintain the integrity of the coking drums.
- ***Drum Switching:*** Delayed coking units typically consist of multiple drums that are operated in a cyclic manner. While one drum undergoes coking, the others are in different stages of the cycle (heating, soaking, quenching, or coke cutting).
- ***Safety Measures:*** Safety is paramount in the operation of these units. Coking drums can contain highly flammable and corrosive materials, so robust safety systems and measures are in place to mitigate risks.
- ***Environmental Compliance:*** Stringent environmental regulations necessitate the capture and treatment of emissions, which include volatile organic compounds (VOCs) and particulate matter, to reduce environmental impact.

The technological scheme and operation mode of delayed coking units are finely tuned to maximize the yield of valuable products while ensuring safety, environmental compliance, and efficient energy utilization. These units play a crucial role in the refining of heavy crude oil, making it more suitable for various downstream applications while producing valuable byproducts like petroleum coke.

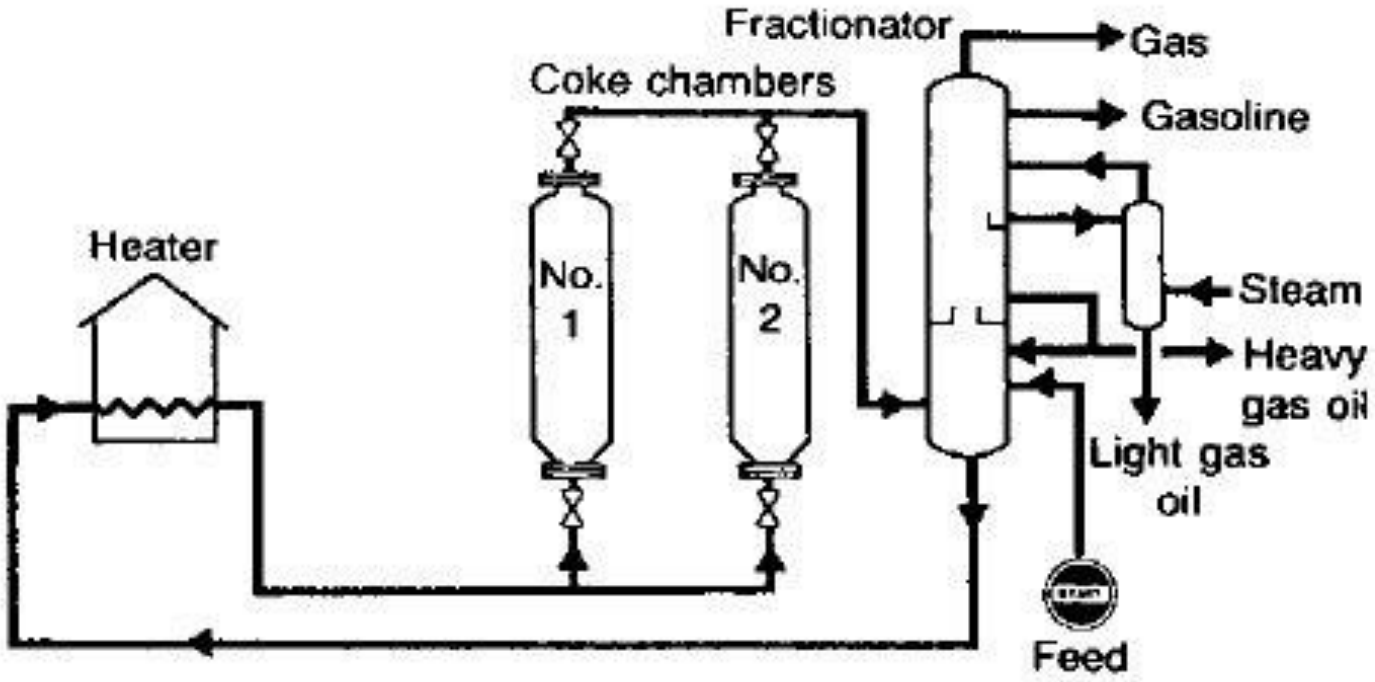

Fig.1. Delayed coking flow diagram