

Tishk International University
Engineering Faculty
Petroleum and Mining Engineering Department



Introduction to Petroleum Engineering

Lecture 5- Drilling Process

Second Grade- Fall Semester 2021-2022

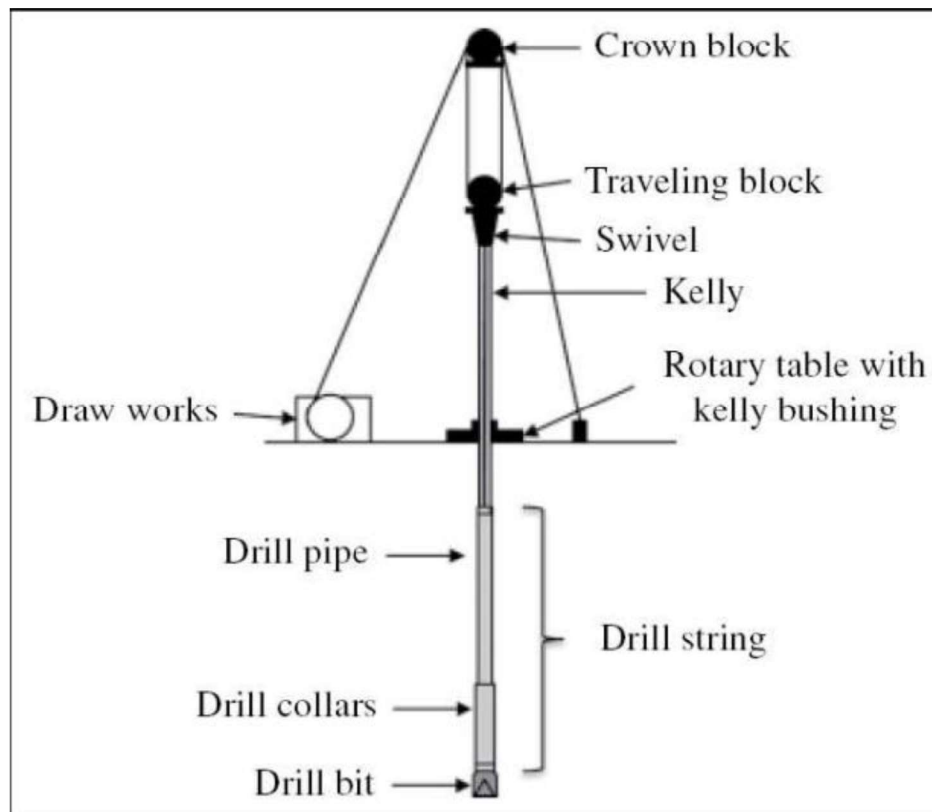
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Content



- **Rotation System**
- **Circulation System**
- **Drilling Process**

Rotation System



Rotation System

Swivel:

- A mechanical device that suspends the weight of the drillstring.
- It is designed to allow rotation of the drillstring beneath it conveying high volumes of high-pressure drilling mud between the rig's circulation system and the drillstring.

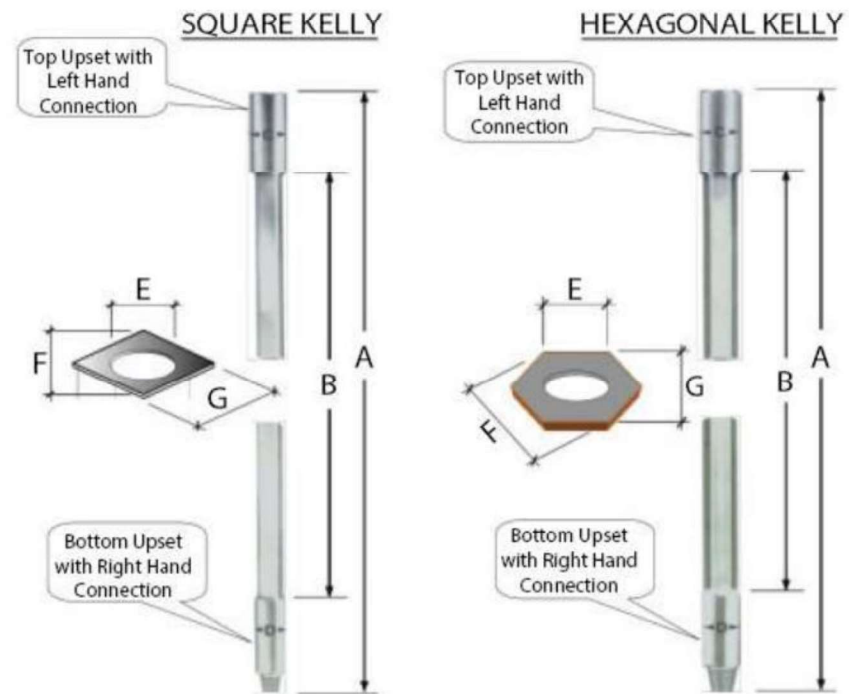


Rotation System



Kelly:

- It is a special section of pipe that is attached to the bottom of the swivel by threading.
- It is not round. It has a hexagonal (6 sides) or square shape (4 sides) of pipe.
- It is attached to the swivel and fits in a matching slot in the rotary table.



Rotation System



Kelly:

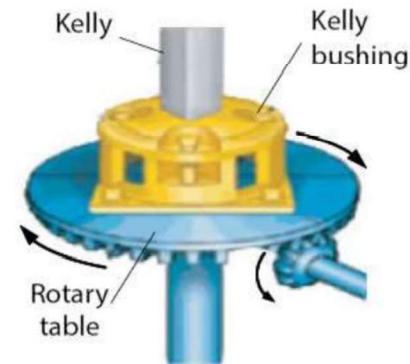
- The functions of the Kelly are:
 - ✓ To transmit rotation and weight to the drill bit.
 - ✓ To carry the total weight of the drill string.

Rotation System



Kelly bushing:

- A device which fits into the rotary table and through which the Kelly passes.
- The rotation of the table is transmitted via the Kelly bushing to the Kelly itself.
- Sometimes called the “drive bushing”.

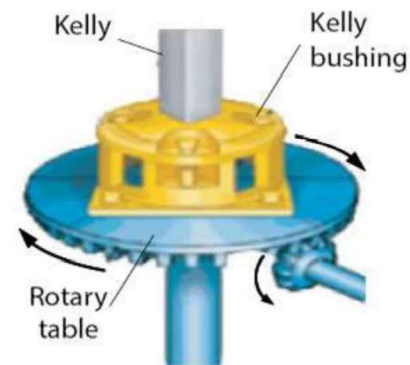


Rotation System



Rotary Table:

- The main component of the rotating machine which turns the drillstring.
- It has a beveled gear mechanism to create the rotation and an opening into which bushings are fitted.



Rotation System



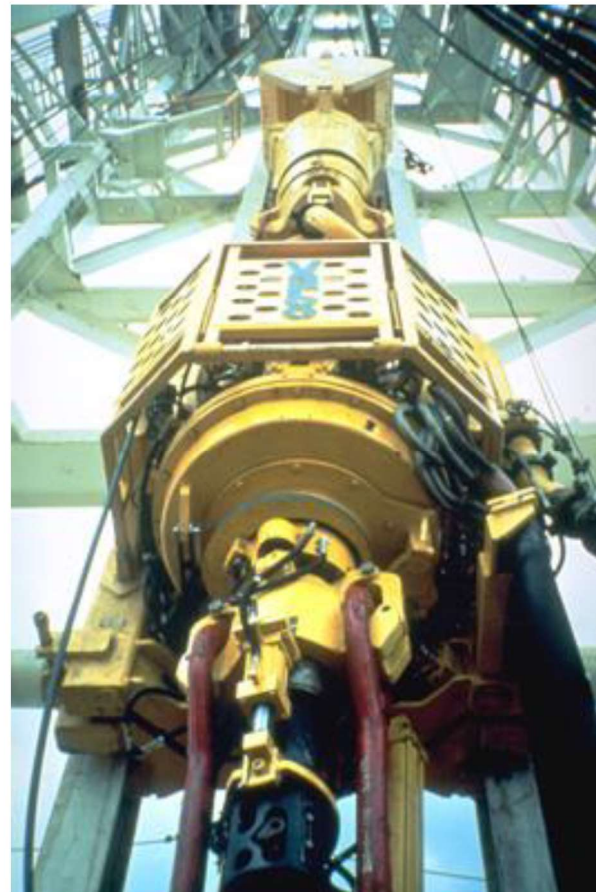
Top drive:

- Newer rig systems use a top drive to rotate the pipe string.
- The top drive can be hydraulically or electrically powered.
- The top drive in rotary drilling eliminates the need for a Kelly and rotary table.
- The top drive reduces the amount of manual labor during trips and the associated hazards of working on the derrick floor.
- Top drive rigs are designed to work with a smaller footprint than other drilling rigs, which reduces its environmental impact, especially in urban environments where the space available for well sites is limited.

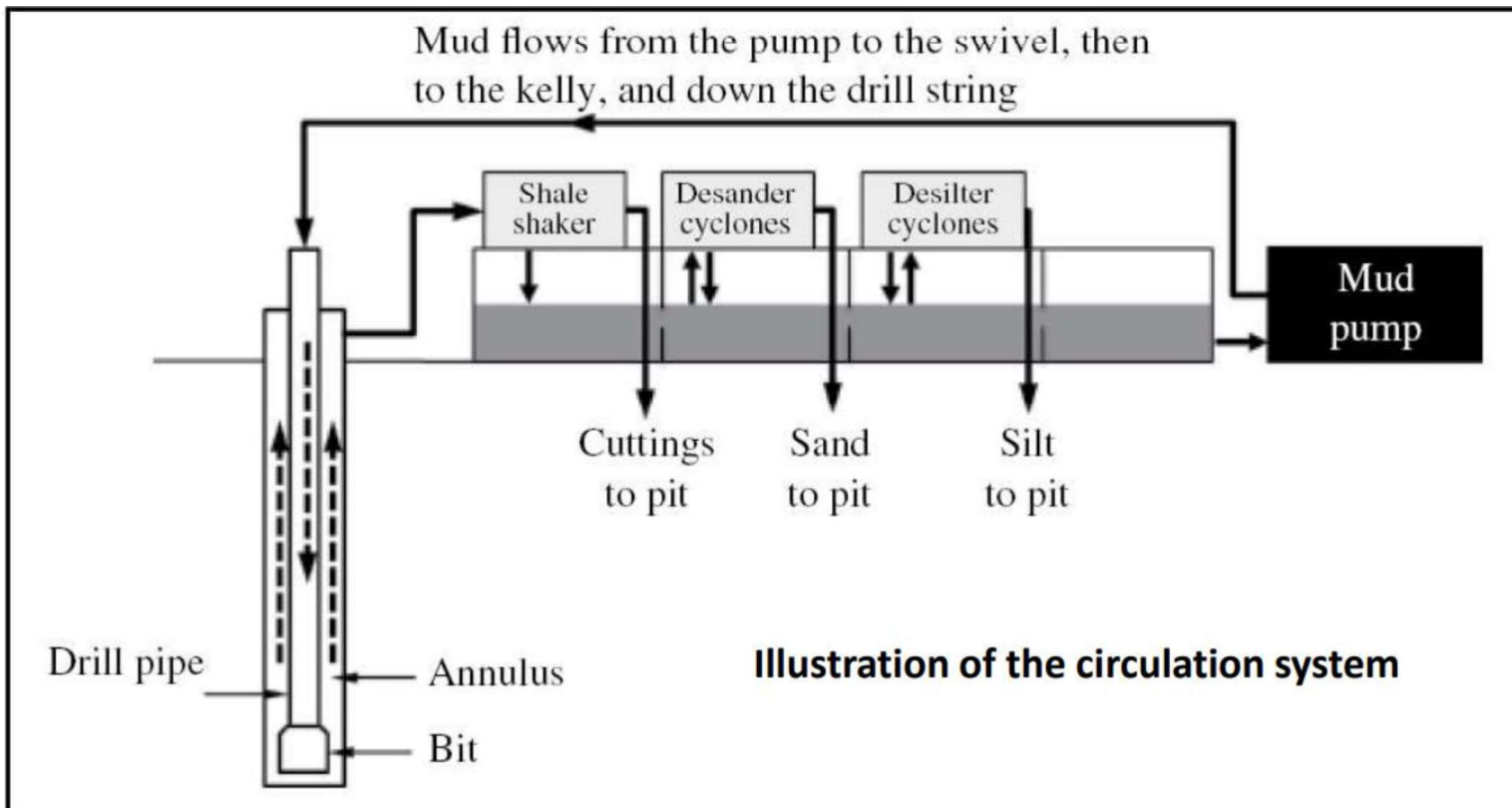
Rotation System



Top drive:



Circulation System



Circulation System



Mud Pump:

- A mud pump or drilling pump is used to circulate drilling mud (also referred to as drilling fluid) downhole during drilling operations.



Circulation System



Shale Shaker:

- A device on the rig for removing drilled solids from the mud.
- This vibrating sieve is simple in concept, but a bit more complicated to use efficiently.
- A wire-cloth screen vibrates while the drilling fluid flows on top of it.
- The liquid phase of the mud and solids smaller than the wire mesh pass through the screen, while larger solids are retained on the screen and eventually fall off the back of the device and are discarded.



Circulation System



Desander:

- A hydrocyclone device that removes large drill solids from the whole mud system.
- The desander should be located downstream of the shale shakers but before the desilters or mud cleaners.



Circulation System



Desilter:

- A hydrocyclone much like a desander except that its design incorporates a greater number of smaller cones.
- As with the desander, its purpose is to remove unwanted solids from the mud system.
- The smaller cones allow the desilter to efficiently remove smaller diameter drill solids than a desander does.
- For that reason, the desilter is located downstream from the desander in the surface mud system.



Circulation System



Drilling mud:

- Drilling mud or drilling fluid is any fluid that is circulated in the borehole to help in carrying out a cost-effective and efficient drilling operation resulting in stable and gauged borehole to targeted depth with minimum possible damage to prospective formations.

Circulation System



- Drilling mud has several functions:
 - ✓ lifts cuttings and contents of drilled formations to the surface.
 - ✓ controls formation pressure.
 - ✓ lubricates the drill string and bit.
 - ✓ cools the bit.
 - ✓ mechanically supports the wellbore.
 - ✓ transmits hydraulic power.
 - ✓ The mud can also prevent movement of fluids from one formation to another.

Drilling Process



- Three basic functions are carried out during rotary drilling operations:
 - ✓ Torque is transmitted from a power source at the surface through a drill string to the drill bit
 - ✓ A drilling fluid is pumped from a storage unit down the drill string and up through the annulus. This fluid will bring the cuttings created by the bit action to the surface, hence clean the hole, cool the bit and lubricate the drill string
 - ✓ The subsurface pressures above and within the hydrocarbon bearing strata are controlled by the weight of the drilling fluid and by large valve assemblies at the surface

Drilling Process



- The process of drilling begins months, and often years, before a drilling rig arrives on location. The following five stages of the process will be considered:
 - Planning
 - Site Preparation
 - Drilling
 - Open-hole logging
 - Setting Production Casing

Planning is the longest of these five stages, and open-hole logging and setting of casing are the shortest, often just 1-3 days for each.