Module 2: Solid Fossil Fuel (Coal)

Lecture 8: Coal Mining

Keywords: Extraction of coal, types of mining, equipments of mining, stripping
2.2. Coal Mining

Introduction:

The technology required for recovering coal from the earth crust and transporting it into coal processing unit, is the vital step of the coal mining. This technology is based on the following operations:

1. Extraction of coal: the method used to break out the coal deposit into smaller lumps
2. Material handling: transportation of coal from the production locality.
3. Ventilation: the development of proper air circulation system within the mine
4. Ground control: to control and prevent the sagging of the underground or surface opening developed during extraction of coal.

There are two broad categories for mining of coal

a) Surface mining

b) Underground mining

Surface mining

Surface mining is generally used when the coal seams are found within 200 ft below the earth surface. Very big utilities and machineries are used for removing soil and rocks to expose the top layer of coal. After extraction of coal, the rocks and soils are returned to fill up the holes of the mine and the whole surface on the ground is properly revived to its original state and can be used for cultivation, industrialization etc. This process is comparatively less expensive compared to underground mining.
The prime considerations for this technique are geographic location, thickness and removal of inter-seam waste and overburden and quality of the coal to be produced. Much of the overburden contains layers of shale, limestone or sandstone and must be blasted before it can be removed. After the overburden is removed coal is usually drilled and blasted, then loaded into coal haulers with a shovel. Removal of overburden is called stripping and hence it is called strip-mining. The types of surface mining are

a) area mining or modified open-pit mining
b) contour mining
c) mountain top removal
d) auger mining

Area mining is applied in relatively flat coal seams, where they are expanded in large area at different depths. In this type of mining, overburden is removed by scrapers and placed outside the mining area and loaded into trucks. Mining begins with drilling and blasting waste rocks to expose the coal seams. Coal is removed and transported. The size and depth of the pit are increased as mining progresses. This mining is adapted for the case when several seams lie in parallel.

Contour mining and mountain top removal are used in hilly areas. Contour mining creates a shelf or bench on the side of the hill. The mountain top mining process involves the removal of upto 1000 vertical feet of overburden to expose underlying coal seams. The overburden is often scraped into the adjacent valley which is called a valley fill. Overburden is the soil and rocks to be removed to expose the coal seams.
Augur mining is another type of surface method where overburden removal is uneconomic, where terrain is too steep for overburden removal and where the underground method is impractical or unsafe. It involves boring of large diameter holes into more or less horizontal coal beds. In this method, exposed surface of the coal is drilled and removed by means of an auger. Single, dual or triple auger heads can remove up to 90 inches of coal for a distance of about 200 ft.

**Underground mining**

When a coal seam does not appear near to the surface, it must be extracted by underground process. Different underground methods may be classified as 1) room and pillar, 2) longwall. **Room and pillar** is a mining technique in which the coal is extracted across a horizontal plane making horizontal arrays of rooms and pillars to support the roof created due to extraction. In this type of mining, the methods may be either continuous or conventional. The main differences between the two methods are in the nature of equipments and the face of operation. In continuous mining, the cycle begins with the continuous sumping cut into the coal face by a continuous cutter or miner. A shuttle car is positioned behind the miner to receive and transport the cut coal to the belt feeder. When the shuttle car is filled up, it moves away and the next shuttle car is fed by the new cut and the cycle is continued.

In conventional mining, the breaking out of the coal from the face is done by cutting, drilling and blasting operation. At the beginning, the cutting machine cuts a 3-4 meter slice horizontally across the room width and then moves out to the next place to be cut. Then the drilling machine moves in and drills holes into the cut face. This is followed by the blasting operation. Now the
area is examined for safety for entering the loading machine and shuttle car. The cars come in for loading the coal cut.

The system of rooms and crosscuts driven in the production panels divides the panels into a series of coal pillars. These coal pillars are extracted by the methods that allow the mining operation to retreat toward the panel entries. Since methane gas may accumulate into the caves, a ventilation arrangement is done by circulating air through the caves.

**Longwall mining** is a typical form of underground coal mining where a long wall of coal is mined in a single piece of around 3–4 km long and 250–400 m wide. Longwall mining has a greater production activity than room and pillar arrangement and is safer, as mining is done beneath a complete overhead steel canopy that moves forward as the face of coal deposit is mined.

Three pieces of equipment are fundamental for modern longwall mining: armored face conveyors, powered supports and the coal cutting machine. The cycle of face operations is based on the movement of this equipment. The armored face conveyors are erected along the coal face and are connected to a power support with the help of hydraulic jacks. The cutter loaded usually slides along the top of the conveyor and breaks out a 20-30 in coal strip. The broken coal chunks are carried by the conveyor.

**Other methods**

**Shortwall mining** is an alternative method which uses the equipments of both room and pillar and longwall mining. The shortwall layout is similar to the longwall panels except that the panel width is 150-200 ft wide. A continuous miner loading shuttle cars substitute for the cutter-loader face conveyor system. Shortwall mining is applied to relatively shallow coal seam.
Hydraulic mining uses large amount of water at high pressure to break and convey the coal from the working area. It is usually applied for a relatively thick coal seam. Jets of water are directed tangentially to the coal face for breaking coal lumps.

Modification of the equipments and methods for underground mining system to overcome the difficulties of mining is a great challenge for the future. Remotely controlled longwall and continuous miners may be adopted for higher productivity and improve safety.

References: