Pulverized Coal Firing

In pulverised fuel firing system, the coal is powdered and then charged into the combustion chamber with the help of hot air current. The **main purpose** of pulverizing coal is to increase the surface area of exposure to the combustion process, which results in faster and efficient combustion. In burning the pulverized coal, the secondary air required for the complete combustion of fuel is supplied separately to the combustion chamber. The resulting turbulence in the combustion chamber helps for uniform mixing of fuel and air. The air required to carry the pulverized coal and dry it **before entering the combustion** chamber is termed the **Priming Air**, and the air supplied separately for complete combustion is termed the Secondary Air. Pulverized coal firing systems are universally adopted for large scale power plants.

The choice of pulverized fuel firing system depends upon the **size of the boiler unit, type of coal available, cost of coal, type of load (i.e., fluctuating or constant), the load factor and availability of trained personnel**. Generally such systems are not economical for small capacity thermal power plants.

**Advantages of using pulverised coal**
1) A wide variety of low grade fuels (coal) can be used and burnt easily.
2) Greater surface area is exposed for combustion and hence combustion is faster and efficient.
3) The system is free from clinker and slagging troubles.
4) Combustion control is easy, and hence the system gives fast response to load changes.
5) Preheated secondary air (up to 350°C) can be used, resulting in rapid flame propagation and faster heat supply to the boiler.
6) The pulverizing system can be maintained or repaired without affecting the combustion process.
7) It has a very high rate of heat release.
8) Banking losses (unburnt fuel with ash) are lower, as compared to stoker firing.
9) The boilers can be started from cold very rapidly.
10) Usually combustion will be smokeless.

**Disadvantages of Pulverised system**
1) The capital investment of the system is **high** as it requires additional equipments (for pulverizing, and handling).
2) Its **operation and maintenance** costs are very **high**.
3) It produces fly-ash/fine dust and needs costly fly-ash removal equipments like **electrostatic precipitators**.
4) The chances of **explosion are high as coal burns like a gas**.
5) The storage of powdered coal requires special attention as it has possibilities of fire hazards. 6) Skilled workers are required for safe-operation and maintenance.
7) Air pollution takes place by the emission of fine particles of grit and dirt.
8) The removal of liquid slag formed from low fusion temperature ash requires special handling equipments.

**Pulverised Fuel Burning System**
There are two common methods of pulverized fuel burning systems-
1. Unit system
2. Central or Bin system
1. Unit System

In this system, each burner and a pulveriser constitute a unit. It consists of a raw coal bunker, a feeder, pulverizing mill, separator, and the burner. In operation, the raw coal is supplied to the bunker, where it is crushed to the required sizes, the crushed coal is then fed to the pulverizing mill through the feeder at the required rate, depending upon the combustion requirements. Hot gases are passed through the feeder to dry the coal. The dried coal is pulverised in the mill and it is carried to the burner. An induced draft fan is used at the pulverizer to carry the powdered coal to the burner. A separator is provided to separate the grains of bigger size from the powder and returned to the pulveriser for further crushing.

Advantages

1. It is simple in operation and economical than the central system.
2. Combustion is controlled directly after pulveriser.
3. Maintenance cost is low.
4. Fuel supply to the burner can be controlled easily.

Disadvantages

1) The performance of the pulverizing mill is poor as the system operates at variable loads.
2) The total capacity of mills must be higher than the central system.
3) The unit system of fuel burning is less flexible.
4) Whenever any of the auxiliaries fails the burner has to be put-off.
5) Wear and tear of the fan blades is more since it handles hot air and coal particles.
6) Strict maintenance of pulverizing mill is a must for perfect operation of the system.
**Central or Bin System**

Fig. shows schematic arrangement and the principle of operation of a central, or bin system for burning pulverised coal. The crushed raw coal is dried using hot air or flue gases and fed to the pulveriser. The pulverised coal from the pulverizing mill is passed to the *cyclone separator* where over-sized particles are separated and fed back to the mill.

The pulverised coal is then transferred from the separator to the central bunker (bin) through a conveyer system. The pressurized air from the forced draft fan, supplies the stored coal to the burner. This air not only carries the fuel, but also acts as the primary air for the combustion of the fuel. Secondary air is supplied to the burner separately to assist in the complete combustion.

**Advantages of Central system**

1) Central system is highly flexible and hence can meet any quick changes in the demand.
2) Burner operation is independent of coal pulverization.
3) The pulverizing mill can be stopped when there is a good stock of pulverised fuel in the bin.
4) The fan wear is less as it handles only natural air. 5) Coal size can be controlled efficiently.

**Disadvantages**

1) Central system is expensive, and occupies more space.
2) It requires complicated coal handling systems.
3) Power consumption in auxiliaries is high.
4) Chances of fire hazards are more since the pulverised fuel is stored.
5) Operation and maintenance costs are high.