

Performance of a Milling System in a Thermal Power Plant

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Abstract— A milling system in a thermal plant is an important mechanical device which grinds the raw coal into a pulverised powder. The pulverised powder is then forced into the boiler furnace by the air called primary air for combustion. The process of pulverisation is essential since the coal is ground to a fine powder, it increases the surface area of ensuring complete combustion and thereby efficient power generation. The efficient performance of the milling system is essential for improved combustion efficiency, enhanced heat transfer, stable flame control and efficient load management with reduced emissions.

Keywords— Milling System, Pulveriser, Combustion Efficiency, Load Management, Heat Transfer

I. INTRODUCTION

A milling system in a thermal power plant is one which grinds raw coal into fine talcum sized powder making it easily burnable. The milling system is one of the prime equipment in thermal power plant as the process of grinding, classifying drying and transmission of pulverised coal dust is done by this system. If the mill fails, the fuel supply to the boiler is disturbed and results in handling rapid load reduction operation [1].

Fault diagnosis has been developed by the rapid development of artificial intelligence technology where algorithm are used in pattern recognition [2], bearing fault diagnosis [3], rotating machinery fault diagnosis [4] and extract data features from various recorded machine history. Therefore, effective fault diagnosis of a pulveriser system and hence the rectification the same is essential for the secured operation of the coal-based thermal power plant.

II. MILLING SYSTEM – AN OVER VIEW

The schematic line diagram of a coal and ash handling unit of a coal fired boiler is shown in Figure.No.1. The coal is handled in a coal handling plant from the temporary coal storage. The feeding of the raw coal from the coal storage unit passes from the bunker to the coal feeder unit which regulates the coal flow to the pulveriser.

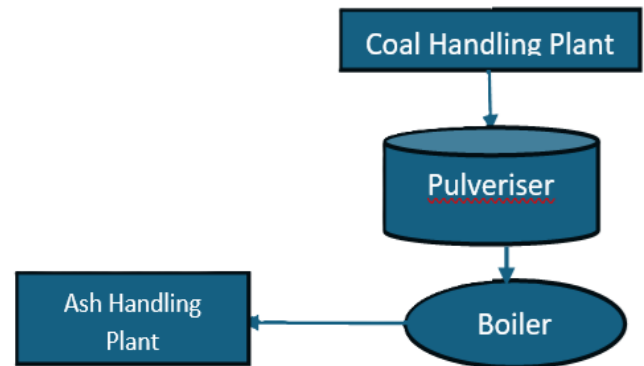


Figure No.1 Schematic of Coal and Ash Circuit

The process of grinding, drying and classifying are done in pulveriser unit. The mechanical force crushes the coal and consequently hot primary air is blown which dries the surface moisture and raises the fine powdered coal particles. The coal particle passes through the classifier which sorts the particle and the classified particle enters the burners for burning and the unclassified particles goes back for the process of grinding. This process is continuous and the primary air fan sends the primary air necessary for the supply of fuel into the furnace.

III. PERFORMANCE OF A MILLING SYSTEM

The Milling system consists of coal bunker, coal feeder, coal mill, primary (PA) and sealing fan with hot(HA) and cold air (CA) regulating valves as shown in Figure No.2. The raw coal is transported to the mill by the coal feeder. The primary fan pressurises the primary air into two paths: one path enters hot primary air duct after getting heated by air pre-heater (APH) . The another duct enters the cold primary air duct. When mixed air enters the mill and during the process, the coal is dried and transmitted too.

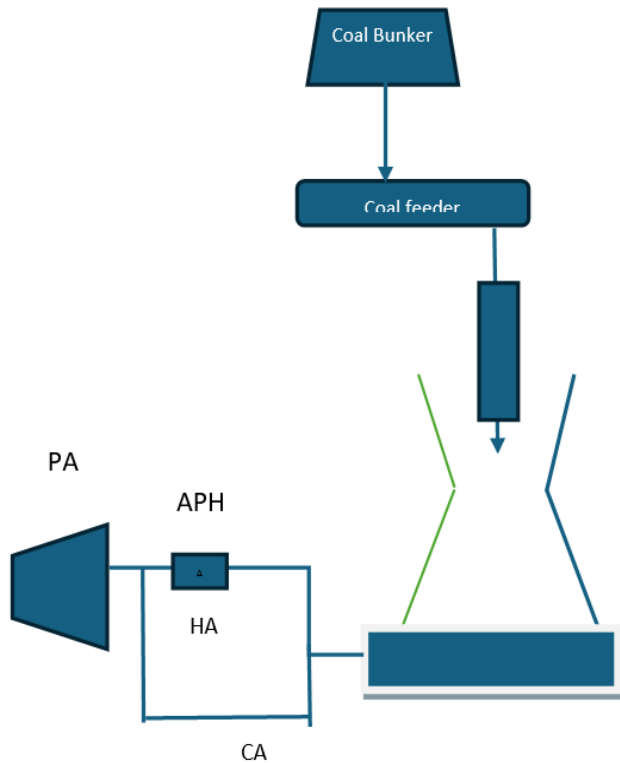


Figure No.2. Milling system of a thermal power plant

The partial cold air is pressurised to prevent the leakage of coal powder. Inside the mill, the grinding unit is a groove type grinding plate and has three convex grinding rollers. By the action of spring force, the roller of the grinding unit and plate are tightly held together to roll the raw coal between the grinding elements and thus the coal is ground into fine powder. The primary air blows this powdered coal into the furnace and the coarse particles will be separated by centrifugal force and resent for grinding and this process continues as the mill is in operation continually.

The performance of the system is varied by number of factors discussed below:

A. Improper Operation

Improper operation of the crusher in daily operation results in deficient use of crusher which affects the production efficiency.

B. Material Hardness

The wear and tear of the equipment is more as the material is harder.

C. Material Humidity

When moisture content is large enough so that the particle stick to the crusher and it may block the process of feeding thereby resulting in improper function of the crusher unit. Sunlight drying of fuel particle is normally done during its travel to feeder.

D. Finess of material

The size of the material significantly affects the combustion efficiency, combustion stability and unburnt ash content [5,6]. To control the particle size of the output, the roller mills are usually equipped with a rotary classifier [7,8].

E. Density of material

The higher viscous material are easily to adhere in the crusher and hence will affect the efficiency to the crusher.

F. Improper Maintenance

The abrasive parts of the crusher are borne to more wear and tear. Hence proper maintenance of the equipment should be there failing to which efficiency drastically will reduce.

G. Operational Optimisation

The equipment should be operated under the performance region irrespective of the load fluctuation in a day.

IV. CONCLUSION

Complete combustion is possible as coal is ground finely thereby improving combustion efficiency. The flame stability is achieved Since the pulverised coal ensures the consistent flame shape. The complete combustion lowers unburnt carbon deposit and emission of harmful gases formed due to incomplete combustion.

The efficient load management is achieved as the pulverised coal easily allows the rapid adjustment and enhances the heat transfer with the boiler tubes. The selection of the milling system depend on the type of material, and high energy is required for fine particle size reduction.

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