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ADVANCE COAL HANDLING PLANT FOR MOISTURE REMOVAL

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ABSTRACT

In rainy season, the coal from coal mines are totally wet and it take lots of time (10 to 12 days) to get dry. Such type of coal cannot be use for boiler. The Additional new equipment like a rotary kiln, metal chamber and bunker for removal of coal moisture can be used. If CHP will work on such advance equipment which is reliable and having less maintenance cost then efficiency of the plant get increase. In present paper, the advance coal handling unit consists of three systems. Rotary kiln concept, Metal chamber concept and Flue gas bunker. An integrated solution of coal handling plant is given to meet the increasing production needs.

Keywords: *Advance coal handling plant, Rotary kiln, Metal chamber, Flue gas bunker.*

I. INTRODUCTION

The advance coal handling plant is designed by considering the moisture contain in the coal. In rainy season the coal is totally wet, and such type of coal cannot be used directly for thermal power plant.

The coal from the coal mine are having moisture greater than 50% and most of the time the coals are like a mud. So some time it is very difficult to handle such type of coal. For such type of coal there is no arrangement in present coal handling plant. Generally in coal handling plant the wet coal from coal mine are put into stock yard for 10-12 days to remove the surface moisture from the coal and then is used for further process. In rainy season most of the coal mines get closed due to the rain fall. If there is no coal then there is no generation of electricity.

For the production of 1 unit 0.700 kg of coal is required. As there is a moisture in coal, there is no Chance for proper combustion to take place in boiler. If coal contain moisture by 1% then the flame stability of coal get disturb by 0.07%, so it is very important that the coal should have as far as less amount of moisture.

II. COAL

The coal is nothing but a combustible rock with 50% by weight by carbonaceous material. Actually Coal comes in four main types or we can say ranks i.e. lignite or brown coal, bituminous coal or black coal, anthracite and graphite. Each rank of coal has a set of physical parameters which are controlled by moisture, volatile content and carbon content. Generally, in Indian thermal power station the coal used is having different grade with their calorific value. Mostly E and F grade coal are used in India. Blending is done on coal to get average D grade. The different calorific value with ash contain as shown in table 2.3.

Table: 2.3: Different grades of bituminous coal

Grade	Calorific value (K cal/kg)	% ash , moisture
A	7620	19.57
B	5601-6200	19.57-23.17
C	4941-5940	23.17-28.68
D	4201-4940	28.69-34.65
E	3361-4200	34.06-40.14

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III. PRESENT COAL HANDLING UNIT

Coal handling plant is the largest auxiliary plant in coal-based power station in term of cost and space. The Coal handling unit actually deals with coal and processing on that coal. It performs variety of process on coal starting from coal unloading to the storage and for further used. The dry coal contains 10% to 15 % moisture. So it is also important that to reduce the moisture contain from coal generally got from coal mines. In rainy season coal is totally wet. So before modified coal handling unit, have a look on the present coal handling unit.

Coal handling plant is responsible for handling, processing, stacking, loading and unloading of coal for an approximate of 60 MU per day total coal required for one unit is 180 ton /hr. The coal received is mainly run of mine coal obtain from the wardha, chandrapur, and western coal field.

Raw coal from coal mines comes by railway wagon to coal handling plant. The coal handling unit is form by the following main auxiliary:

- Wagon tippler
- Apron feeder
- In line magnetic separator
- Conveyor belt
- Wobblers feeder
- Crusher and stacker reclaimer
- Bunker

IV. MATERIAL USED FOR DESIGN

Here for the design of rotary kiln, metal chamber austenitic stainless steel is used. The austenitic stainless steel is also further classified on the basis of stabilizers used i.e. nickel, nitrogen. Austenitic stainless steel is mainly having two type 300 series and 200 series.

V. ADVANCE COAL HANDLING PLANT

To overcome the all above problem which are generally faced and to increase the efficiency of thermal power plant by utilizing waste heat, here we are focussing on to design such equipment which reduce the moisture contain in the coal.

5.1 Rotary kiln concept

The first and most important equipment in advance coal handling plant is rotary kiln. The construction and working of rotary kiln are as shown in Fig. 5.1 below. The rotary kiln is situated on the support as shown. It has inclination 3 to 5 degree. The rotary kiln have two side LHS and RHS. The rotary kiln is nothing but a hollow tube having fins on internal side which is longitudinal to the length which run on electric motor with the help of gears.

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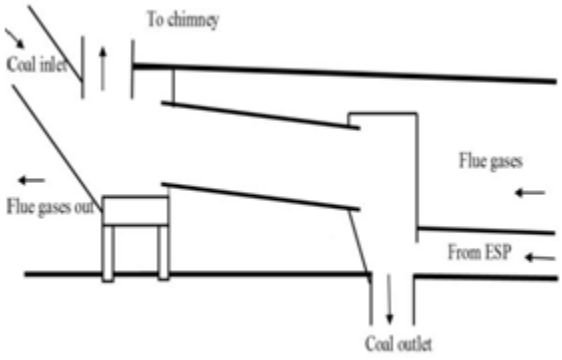


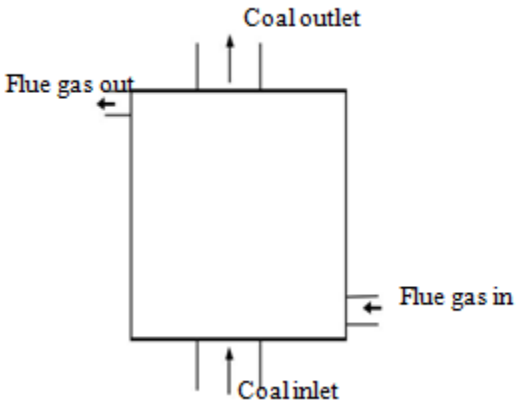
Fig.5.1 Rotary kiln

The flue gases from the second pass of the boiler which is having temperature near about 700-900 degree. Such flue gases are directly sent outside the rotary kiln from RHS side. The coal i.e. after the wagon tippler coal entered into apron feeder and then total coal is put on conveyor belt, is directly put inside the rotary kiln from LHS side. As earlier stated the rotary kiln is having inclination of 3-5 degree. The LHS side is at higher level than RHS.

The flow of coal and that of flue gases are in opposite direction for the effective heat transfer. The rotary kiln is having speed equal to 10-12 rpm. In the rotary kiln high amount of surface moisture is removed.

5.2 Metal chamber concept

The second equipment in advance coal handling plant is metal chamber. The fig. 5.2 Show the construction of metal chamber. The material used for the design of metal chamber is austenitic alloy or austenitic stainless steel.



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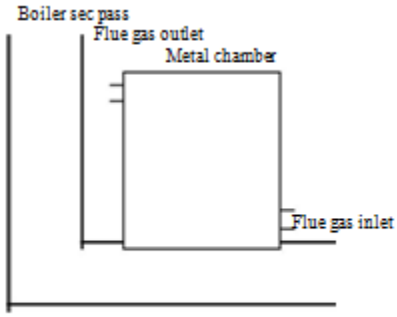

Fig. 5.2 Metal chamber

The metal chamber concept is nothing but it is a rectangular block of metal for the storage of coal and which is place after second pass of the boiler on the path of flue gas. The flue gases from the boiler are allowed to flow from the bottom side of the metal chamber, due to which the heat transfer will take place between the metal chamber and flue gases.

Here we are also providing arrangement for flue gases from ESP. To flow inside the metal chamber. The speciality of flue gases is that it is free from ash particle and the temperature is 350 degree. By the process of reheating temperature of flue gases can also be increase to near about 750-800 degree.

5.3 Flue gas bunker

The flue gas bunker is third most important part in the advance coal handling plant. The bunkers are nothing but they are the storage unit of coal for one day or simply as one day reservoir. The each bunker is having capacity of one metric ton

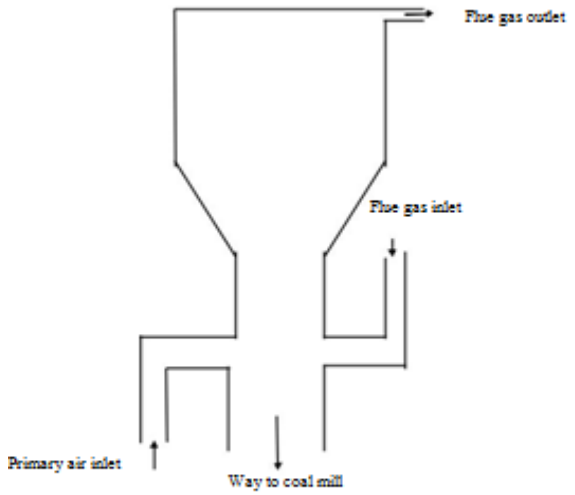

Fig. 5.3 Flue gas bunker

The bunker which is used in present coal handling unit is having only one function, to store the coal. But the bunker we design in the advance coal handling plant is used not only for the storage purpose but also for the removal of moisture from the coal. Fig. 5.3 Show the construction of flue gas bunker.

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The flue gas bunker is only the modified form of old bunker there no any big change in flue gas bunker but it quite important as less efficiency is biggest problem. The design of new bunker is in such a way that from the bottom side of bunker we are providing arrangement for the flue gases as well as the primary air from the air preheater. If we used primary air for the heating of coal inside the bunker then that primary air is also utilized for further used like in the coal mill. Otherwise we can go for flue gases from the electro static precipitator. By using flue gases the heating of coal take place inside the bunker

VI. ADVANTAGES

- Require less time for removal of moisture.
- There is no extra heat required for moisture removal.
- Better heat utilization from waste heat of flue gases.
- Moisture reduced to 100%.
- Flame stability increases by 0.7 %.
- Coal consumption gets reduced.
- Reliable and Less maintenance cost.
- Finally efficiency of plant gets increase by 0.7%

VII. CONCLUSION

By adopting all above mention technology rotary kiln, metal chamber, flue gas bunker, not only increase in the plant efficiency but also better heat utilization can be obtained. In rotary kiln surface moisture is reduced to the very high extends. In the metal chamber surface moisture as well as the moisture due to minerals is removed. In flue gas bunker we also remove moisture if present in coal by using primary air or flue gases. For the removal of all moisture contains from the coal will require the few hours. If there is 1% moisture contains in the coal then the flame stability gets disturb by 0.07%, and here moisture content is reduced to 100%. So the flame stability also gets increased. And hence directly achieve higher efficiency.

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