The Shirpur Education Society's

R. C. Patel College of Engineering and Polytechnic, Shirpur

Department of Mechanical Engineering

NAME OF COURSE: - POWER PLANT ENGINEERING

CODE OF COURSE: - 315374

SEMESTER: - TYME-5K

SUBJECT TEACHER: - Mr. ANUP PRALHAD PATIL

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Department of Mechanical Engineering

NAME OF COURSE & CODE: - POWER PLANT ENGINEERING -315374	Academic Year: 2026-27
Program Code, Semester & Scheme: ME-5K	

CHAPTER:- 02:- Modern Steam Power Plant

COURSE LEVEL LEARNING OUTCOMES (COS):- Apply relevant knowledge & skills to maintain modern steam power plant efficiently and safely.

Learning Hours	R-Level	U-Level	A-Level	Total Marks
12	4	8	6	18

Subject Teacher

Mr.Anup P.Patil

HOD ME 24/06/2026

Mr.A.D.Patil

The Shirpur Education Society's

R. C. Patel College of Engineering and Polytechnic, Shirpur

Program Name: Mechanical Engineering **Program Code:** ME5k

Name of Subject & Code : Power Plant Engineering (315374) **Semester :** Fifth **Date:-** 18/06/2026

QUESTION BANK

Unit - II Modern Steam Power Plant

Sr.NO	QUESTION	MSBTE QUE. NO	MARKS	EXAMINATION		BLOOSMS LEVEL
1	State the types of FBC Boiler.	QUE-01	2M		W-2025	CO-02,TLO-2.9,R
2	State any four fuel handling system used in steam power plant.	QUE-01	2M		S-2026	CO-02,TLO-2.1,R
3	Explain with neat sketch working of electrostatic precipitator.	QUE-02	4M	W-2025	S-2026	CO-02,TLO-2.4,U
4	State the four objectives of feed water treatment in steam power plant.	QUE-03	4M		W-2025	CO-02,TLO-2.8,R
5	State single line function of the following components: i. Superheater ii. Air preheater iii. Economizer iv. Feed pump	QUE-03	4M		W-2025	CO-02,TLO-2.3,R
6	State advantage and disadvantages of steam power plant.	QUE-03	4M		S-2026	CO-02,TLO-2.1,U
7	Draw schematic diagram of boiler feed water control system. State its importance in Thermal Power Plant.	QUE-05	6M	W-2025	S-2026	CO-02,TLO-2.10,U
8	Explain with a neat sketch working principle of Fluidized Bed Combustion (FBC) boiler. Also state types of FBC boiler.	QUE-05	6M	W-2025	S-2026	CO-02,TLO-2.9,U
9	Compare between gas turbine, steam turbine and hydroelectric power plant.	QUE-05	6M		S-2026	CO-02,TLO-2.1,A
10	Draw a neat line diagram of in-plant coal handling and indicate the components used at different stages.	QUE-06	6M		W-2025	CO-02,TLO-2.5,U

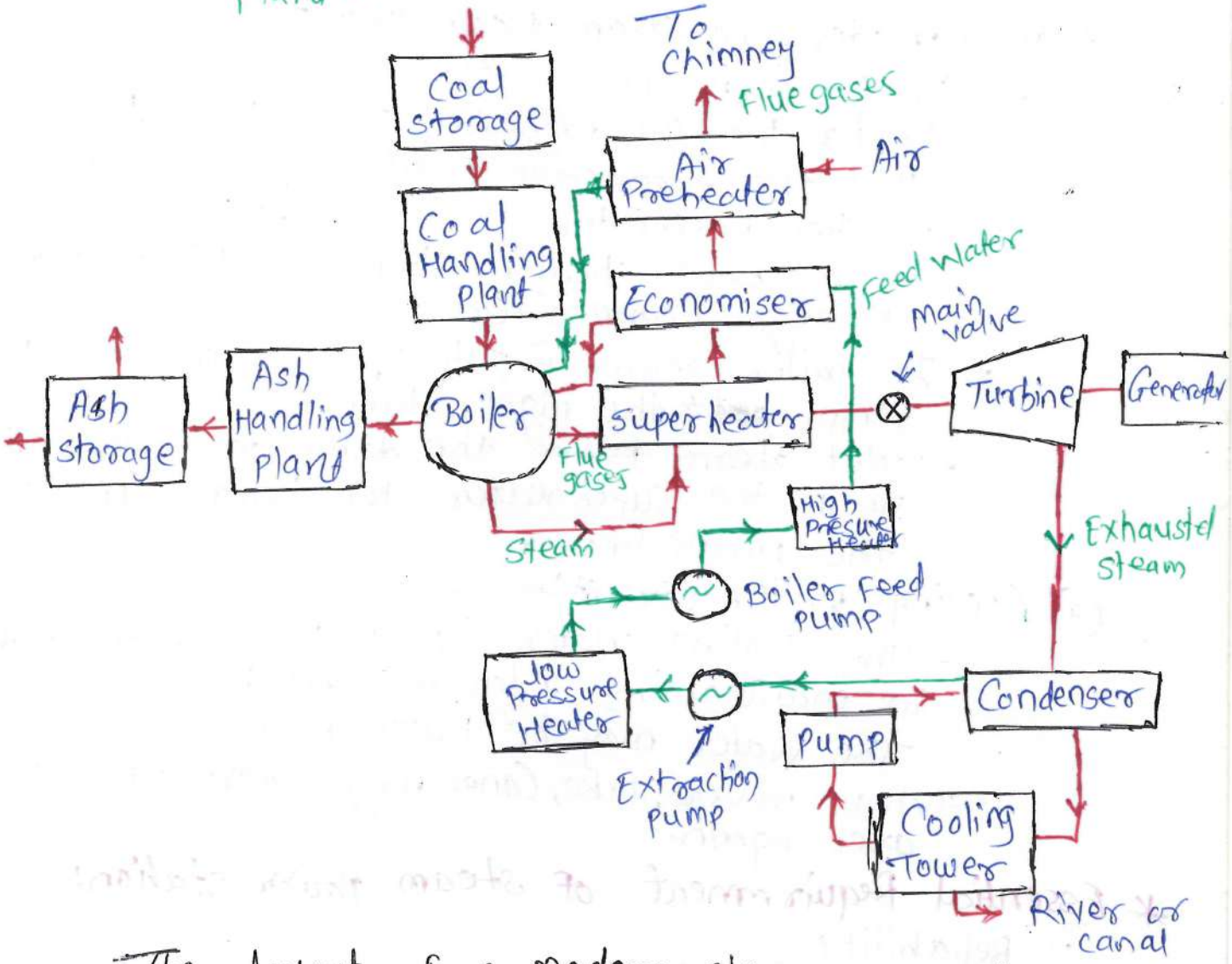
Subject Teacher
Mr.Anup P.Patil

24/6/26

HOD (ME)
Mr.Amol D.Patil

Unit-2- Modern steam Power Plant

TLO·2·1- Schematic Diagram of modern steam Power Plant:-



The layout of a modern steam power plant comprise of the following four Circuits:-

(1) Coal and Ash Circuit:-
- Coal arrived at storage yard and after necessary Handling passes on to the furnaces.
- Ash resulting from Combustion of Coal Collects at the back of the boiler and is removed to the ash storage yard through ash Handing equipment.

(2) Air and Gas Circuit:-
- Air is taken in atmosphere through the action of a forced. passes on to the furnace through the air preheater, where it has

been heated by the heat of flue gases which pass to the chimney via the preheater.
- The flue gases after passing around boiler tubes and superheater, Economiser, and finally through the air preheater before being exhausted to the atmosphere.

(3) Feed Water and steam Flow Circuit:-
- Condensate is first heated in a closed feed water heater through extracted steam from the lowest pressure extraction point of the turbine.
- It then passes through the deaerator and a few more water heaters before going into the boiler through economiser.
- In boiler drums & tubes, water circulates the lower temp. to the higher temp.
- Wet steam from the drum is further heated up in the superheater for being supplied to the prime mover.

(4) Cooling Water Circuit:-
- The cooling water supply to the condenser helps in maintaining a low pressure in it.
- The water may be taken from a natural source such as river, lake, Canal may cooled and Circulate over again.

* Essential Requirment of steam power station:-
(1) Reliability
(2) Minimum Capital Cost.
(3) Minimum operating and maintenance Cost.
(4) Capacity to meet peak load effectively.
(5) Minimum losses of energy in transmission.
(6) Low Cost of energy supplied to the consumers
(7) Reserve Capacity to meet future demand.
(8) Simplicity of design.

TLO.2.2- Construction, working, and functions of Modern steam powerplant:-

* Construction:-

① Steam Boiler:-

- The process of change of water to vapour is produced by heating the water in the tubes with energy from burning fuel.
- The combustion process is carried out continuously in the combustion room with fuel and airflow from the surface.
- The size of steam production depends upto then surface area of heat tranfer, flow rate and heat of combustion is applied. A boiler system consisting of water filled pipes is called a water tube boiler.

② Steam Turbine:-

- The steam turbine works to change the heat energy carried into steam into rotary motion.
- steam with high load and temp. were conducted to push turbine blades installed on the shaft, so the shaft turns.
- Due to complete cook on the turbine, the pressure and heat of steam coming into the turbine down to drenched vapour.
- The steam then proceeds to the condenser, while the whirling power is used to turn generator.

③ Condenser:-

- Condenser are to convert steam into water.
- The changes are made by the steam flow into room holding tubes.
- steam runs outside tubes, while the cooling water flows inside the tubes. This is called as the surface condenser. It is usually for coolant use of sea water.

(4) Generator:-

- The main idea of the activities at a plant is electricity. The electrical energy is produced by generator.
- The main function of generator convert mechanical force into electrical energy in the form of circle with the orgin of magentic induction.

(5) Alternator:-

- The steam turbine compulates to an alternators.
- when the turbine turns the alternator, electrical Energy is produced. This generator electrical voltage is then walked up with help of transformer and then transfered where it is to be employed.

*Working of steam Power plant:-

- The pulvarised coal fed into the boiler where the pulvarised coal is burnt into the furnace.
- Due to heat from the furnace, the water present in the boiler drum changes to the high pressure steam.
- From the boiler this high pressure steam is passed to the super heater where it is again heated upto its dryness.
- After that this superheated steam strikes the turbine blades with a high speed and the turbine blades starts rotating to at high speed. Here the stored potential energy of the steam is get converted into mechanical energy.
- A generator is coupled with the turbine rotor. As the turbine rotates, the generator also rotate with same speed and mechanical energy to the turbine gets converted into electrical energy.
- steam after hitting the turbine blades lost its most of the energy and leaves the turbine with low pressure steam.
- This low pressure steam enters into Condenser. Cold water Circulate in the steam Condenser from the cooling tower. Here the low pressure wet steam is converted into water.

- After that Condensed water with the feed water passes to the economiser where it gets heated up by the economiser. and finally the feed water enters into the boiler by a feed water pump to repeat the cycle.
- The burnt flue gases from the furnace passes through the superheater, economiser, and air preheater. This heat of the flue gases is used to heat the steam in the superheater to its dryness, to heat feed water in the economiser before entering into the boiler and to heat air from the atmosphere in the air pre-heater before it enters into the Furnace.
- Ash from the furnace is transported to ash handling plant and finally to the ash storage.

* Advantage of steam powerplant:-

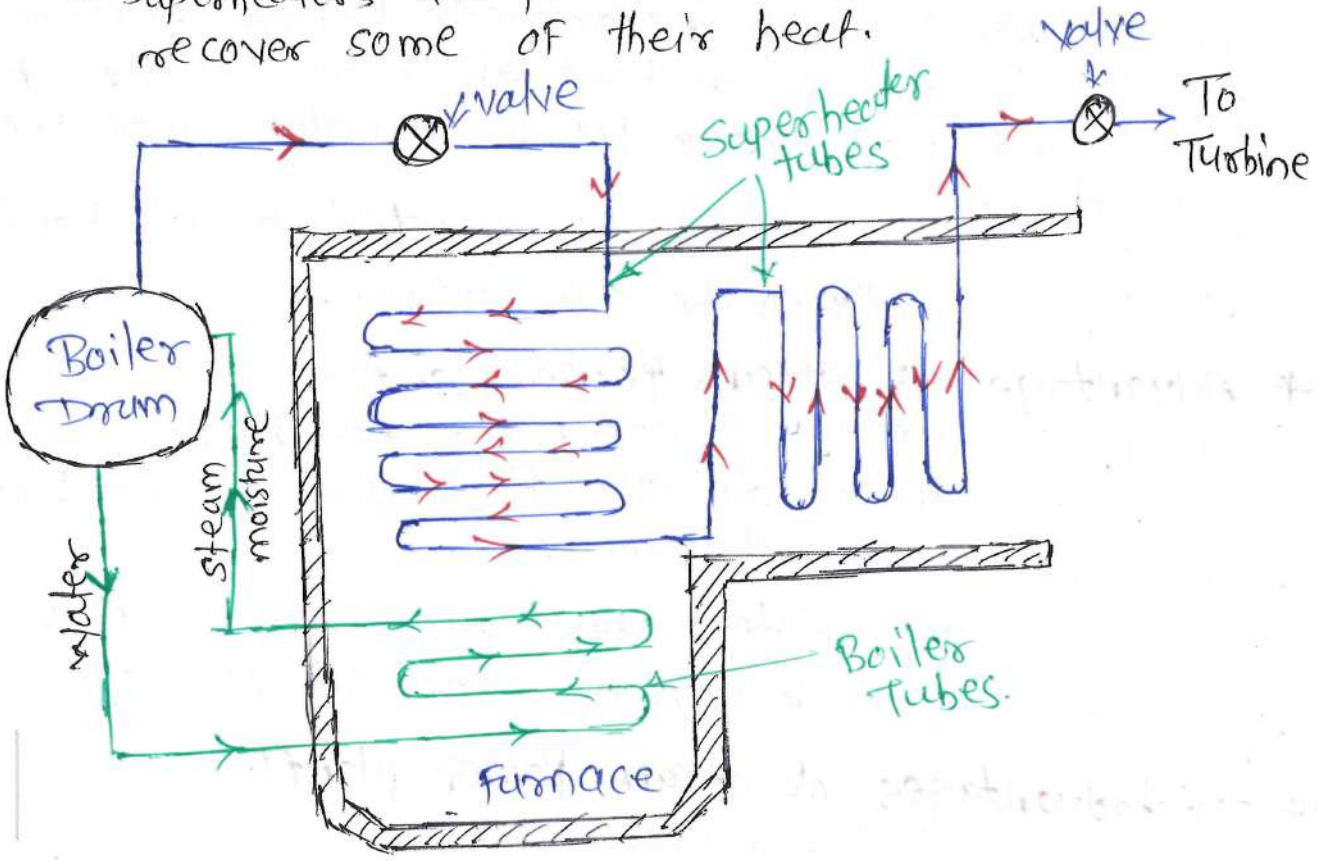
① large scale power generation is possible.
② many fuel options are available, such as Coal, Gas, biomass
③ Maintenance is relatively easy.
④ provides a consistent and stable power supply.
⑤ Can be installed in any geo-graphical location.

* Distadvantages of steam Power plant:-

① The initial Cost is Very high.
② Burning Coal causes pollution.
③ Require large space.
④ Efficiency is slightly lower than other source.

* Functions of superheater:-

- It is integral part of boiler and is placed in the path of hot flue gases from the furnace.
- The heat recovered from the flue gases is used in preheating the steam before entering into the turbine.
- It main purpose is to increase the temp. of satured steam without raising its pressure.
- Superheaters are placed in the path of flue gases to recover some of their heat.



Working:-

Steam stop valve is opened. The steam from the evaporator drum is passed through the superheater tubes. First the steam is passed through the radient super heater and then to the convective super heater. The steam is heated when it passes through these super heaters and converted into superheated steam. The superheated steam is supplied to the turbine through a valve.

Application:-

The types of superheater are used in modern high pressure boilers.

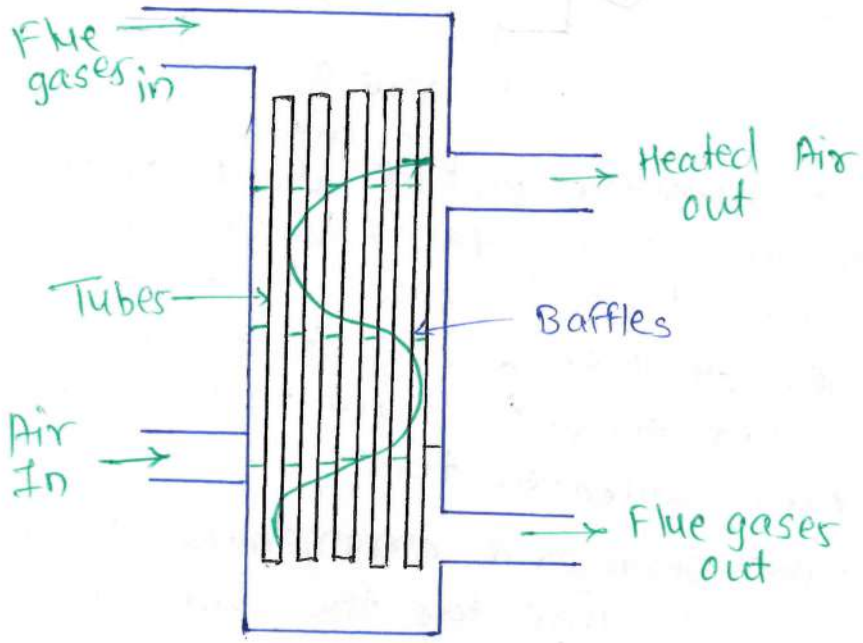
* Advantages of Superheater:-

- There is an increase in efficiency of the steam power plant.
- Erosion of turbine blade is minimized even eliminated
- steam consumption of the prim. mover is reduced.
- Condensation loss in the pipes is reduced.
- It removes entrained water particles from the steam conveyed to the steam turbine and increase the temp. of saturated steam.

* Function of Airpreheater:-

Air preheater are provided in boilers to preheat the Combustion air.

There are two main types:- Recuperative & Regenerative air Preheater.



Tubular or Recuperative air-preheaters are provided in boiler of medium and small range of steam generation. This types of airpreheater becomes very large in size if they have to be used in very high capacity boilers like 600 ton/hr. of steam production and above.

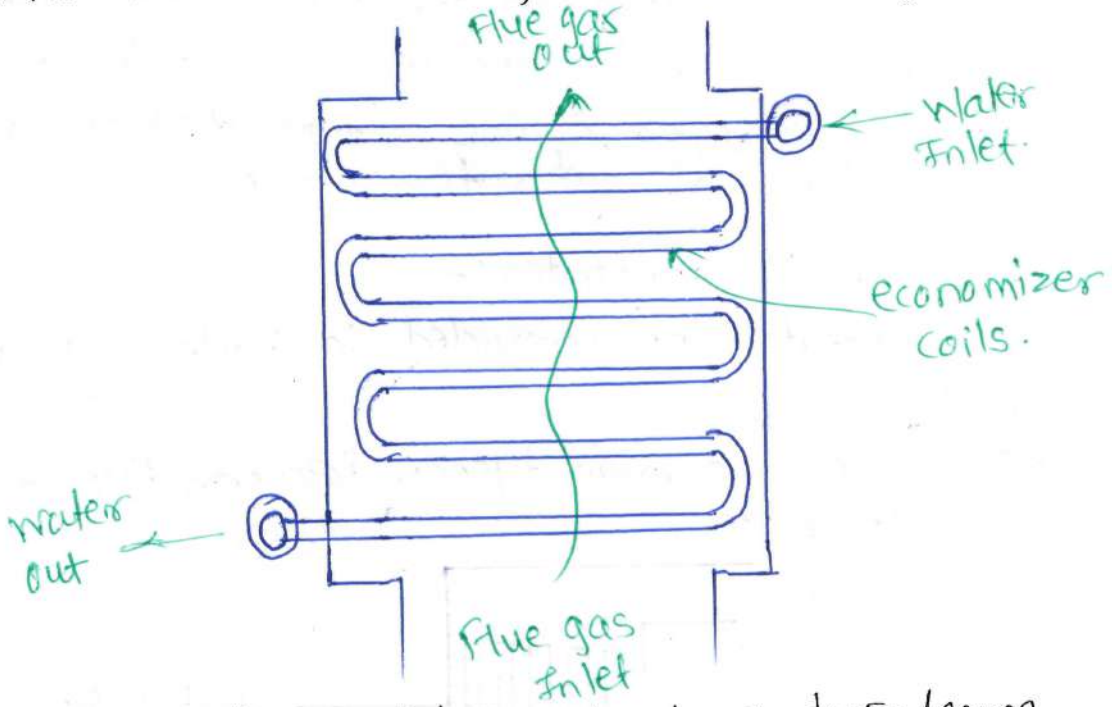
Regenerative air. preheaters are compact and can have a stationary or rotating hood. A combination of tubular and regenerative type of air. preheater is used in very high capacity boiler.

This result in flue gas temp. drop of around 230. to 250 degree centigrade.

*Function of Economizer:-

The feed water from the high pressure heater enters the economizer and pickup heat from the flue gases after the low temp. super heater.

There can be classified as inline or staggered arrangement based on the type of tube arrangement.

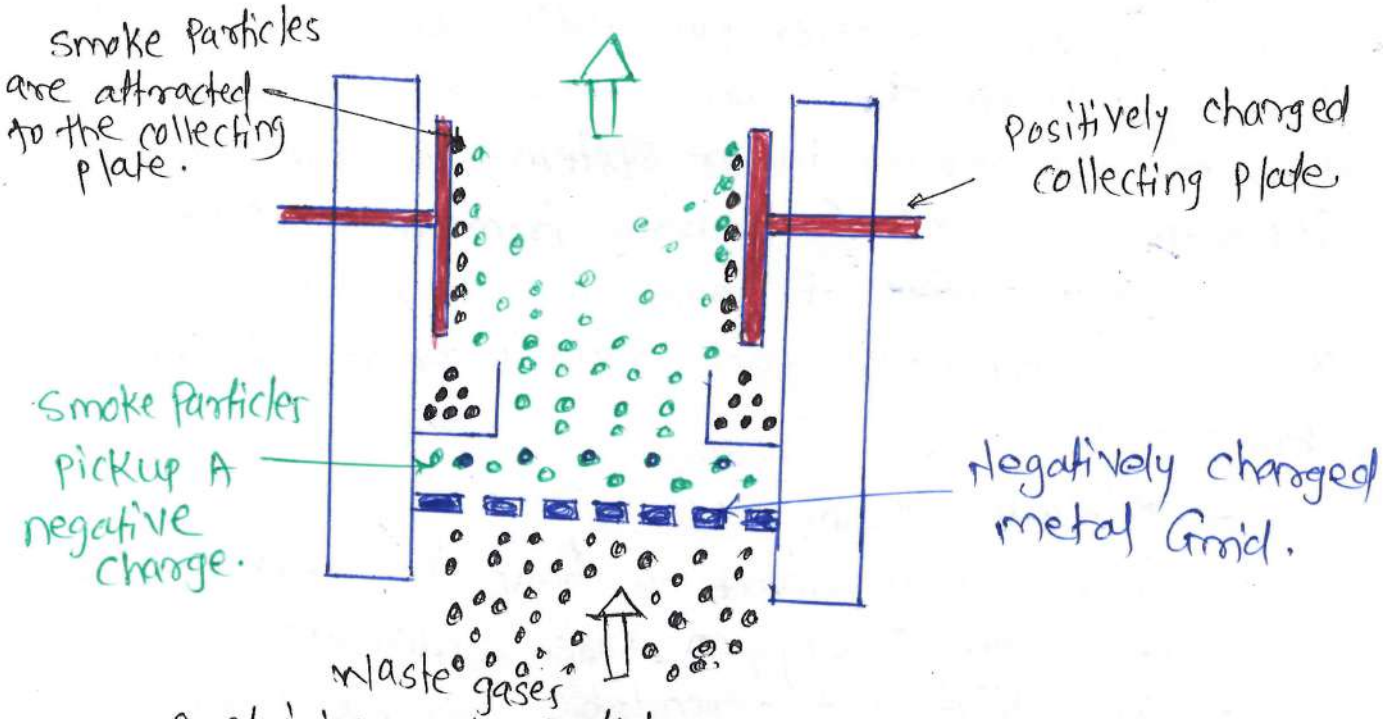


These economizer pickup about 50 to 55 degree centigrade in a large capacity boiler, which will reduce the flue gas temp by about 150 to 170 degree centegrade The boiler designer always keep the economizer water outlet temp. to about 25 to 35 degree below the drum saturation temp.

The straggered arrangement is compact and occupies less volume for the same amount of heat transfer when compared to inline arrangement.

Economizer are also designed with plain tube and fined tubes. The fins can be longitudinal or spiral. All there types are suitable for clean fuels like gas, oil and low ash coals. For high ash coal, only the plain tube inline arrangement is used. These is mainly to reduce ash erosion and thus reduce erosion failures.

* Electrostatic Precipitors :-



It has two set of electrodes, insulated from each other that maintain an electrostatic field. between them at high Nolatage.

The flue gases are made to pass between these two set of electrodes. The electric field ionises the dust particles, that pass through it attracting them to the electrode of opposite charge.

The other electrode is maintained at a negative potential of 30,000 to 60,000 Volts.

The dust particles particles are removed from the collecting electrode by rapping the electrode periodically.

The electrostatic precipitor is costly but has low maintainance cost.

* Steam Traps & its Types:-

A steam trap is an automatic valve that allows Condensate, air, and other non-condensable gases (CO_2) to be discharged from the steam system while holding or trapping the steam in the system. So, steam Traps Separate out the Condensate from the mixture.

Various types of traps include Float, thermostatic, and thermodynamics each suitable for specific Application.

Functions:-

- Minimal steam loss
- Corrosion resistance to fight the damaging effect of acidic or oxygen-laden condensate.
- long life and dependable service without Rapid wear.
- Air venting for efficient heat transfer and to prevent systeam binding.
- CO_2 venting to prevent the Formation of Carbonic acid.
- Operation against back Pressure.
- Freedom From Dirt problem by operating in the presence of dirt.

Types:-

① Mechanical Traps:-

ⓐ Float Traps:-

These use a float ball that rises and falls in response to the condensate level, opening or closing the valve.

ⓑ Inverted Bucket Traps:-

Rely on an inverted bucket that float on the Condensate and drops when steam arrives, sealing the trap. Suitable for high-pressure application and notable for their durability.

(2) Thermostatic Traps:-

(a) Bimetallic Traps:-
Utilize bimetallic strips that bend with temp. changes, opening or closing the traps.

(b) Wax Thermostatic Element Trap:-
These traps operates using a wax element that expands and contract with temp. Variation to open or close the valve.

(c) Bellows Traps:-
Feature a bellows filled with vapour pressure that expands or contract with changing temp, making them suitable for application with a steady range of temp.

(3) Thermodynamic Traps:-

Disc Traps:-
Operating a disc that moves up and down due to pressure fluctuation, allowing for the quick removal of condensate.

(4) Venturi Traps:-

Orifice Traps:-
Contain a fixed orifice and operate without moving parts, controlling flow through a variable orifice depending on the condensate load.

(5) Specialized Traps:-

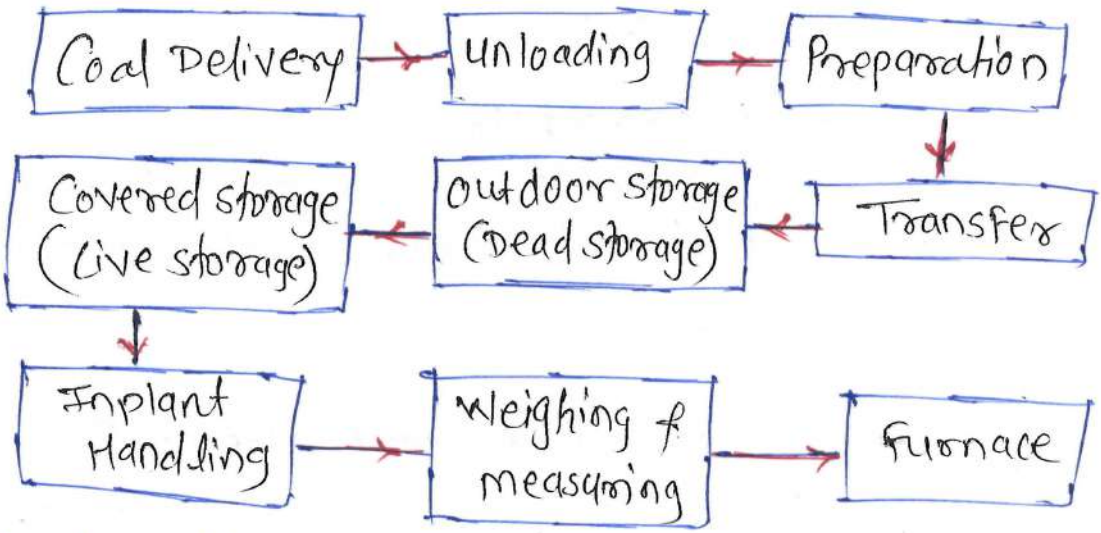
(a) Impulse Traps:-
Utilize the kinetic energy of flash steam to operate valve.

(b) Ball Float Traps:-
These are typically used in heavy-duty application, handling large volume of condensate efficiently.

(c) Radiator Traps:-
Designed specially for radiator, these trap use a thermostatics element to discharge condensate once it cools below steam temp.

TLO.2.3- Fuel Handling system:-

(A) Coal Handling system:-



① Coal Delivery:-

The coal from supply point is delivered by ship to power stations situated near to sea or river whereas as coal is supplied by rail or truck to the power station which are situated away from sea or river.

② Unloading:-

The type of equipment to be used for unloading the coal received at the power station depends on how coal is received at the power station.

If coal is delivered by truck there is no need of unloading device as the trucks may dump the coal to the outdoor storage.

③ Preparation:-

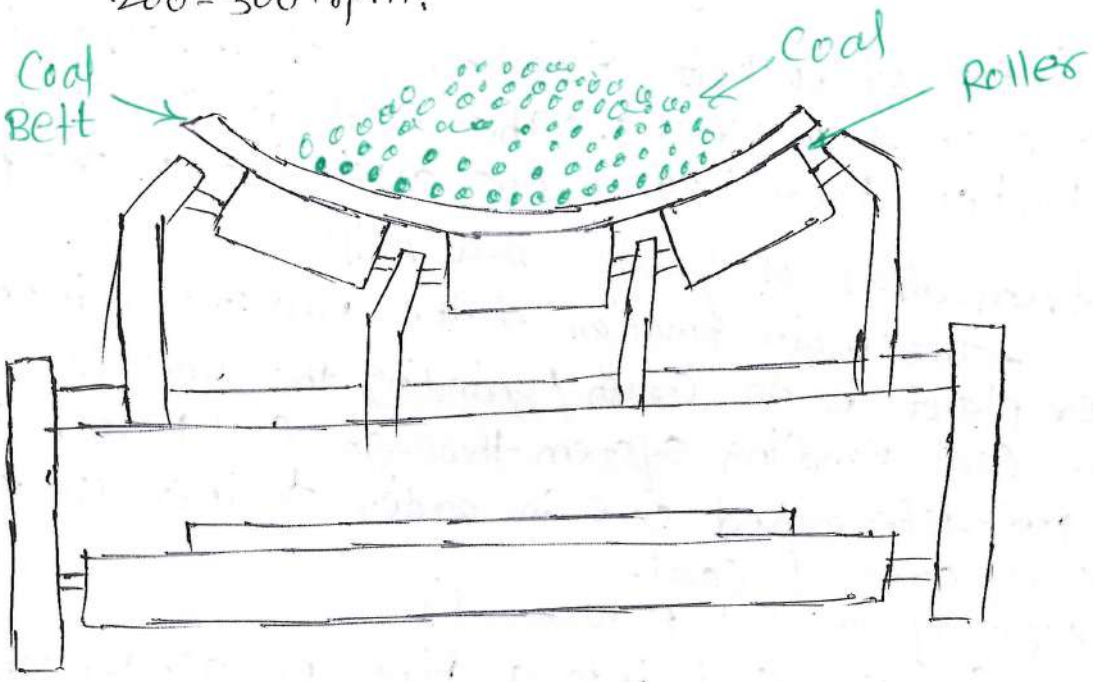
When the coal delivered is in the form of big lump and it is not of proper size, the preparation of coal can be achived by crushers, breakers, sizers, driers and magnetic separators;

④ Transfer

After Preparation coal is transfered to the dead storage :- ① Belt Conveyors ② screw Conveyors ③ Bucket Elevator ④ Grab bucket elevators ⑤ skip Hoists ⑥ Flight Conveyors.

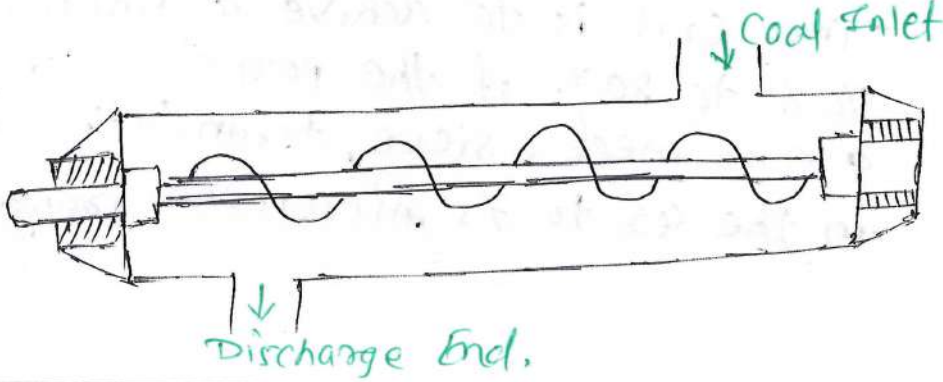
(A) Belt Conveyors:-

- It consist of an endless belt. moving over a pair of end drum(rollers). At some distance a supporting roller is provided at the centre.
- The belt is made, up of rubber or canvas.
- Belt Conveyor is suitable for the transfer of coal over long distance.
- The inclination at which coal can be sucessfully elevated by belt conveyor is about. 20.
- Average speed of belt conveyors varies bet? 200-300 rpm.

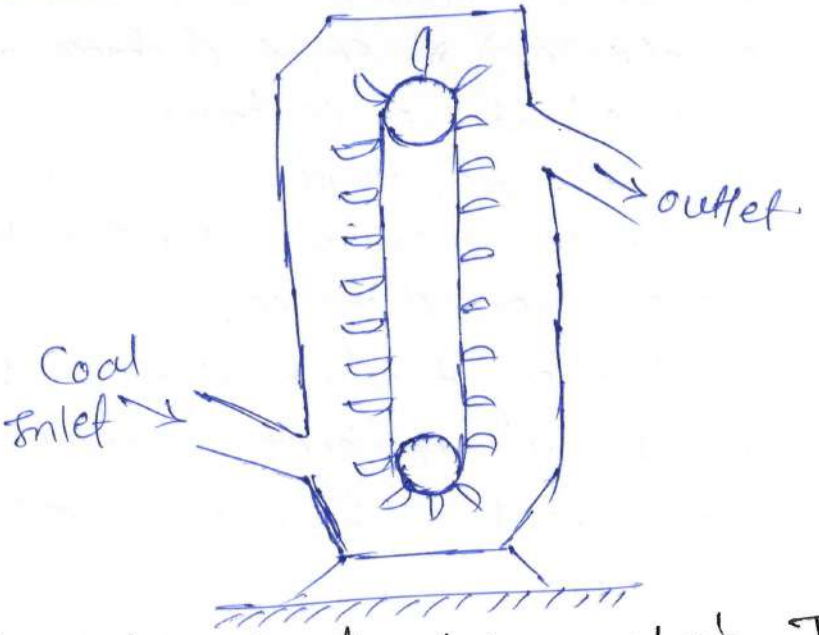


(B) Screw Conveyor:-

- It consist of an endless helicoid screw fitted to a shaft.
- The screw while rotating in a through transfers the coal from feeding end to the discharge end.
- It suffers from the drawbacks that the power consumption is high and there is considerable wear of screw.
- Rotation of screw varies between 75-125 rpm.



(3) Bucket Elevator:-



It Consist of buckets fixed to a chain.. The chain moves over two wheels. The coal is carried by the bucket from bottom and discharged at the top.

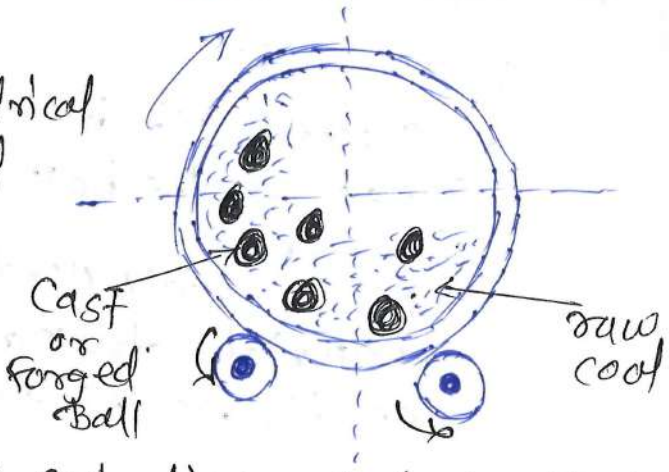
* Pulverization of Coal:- Ball Mill:-

The main function of the pulvanizer in thermal power plant is to crush / grinding the raw coal coming from Coal Handling system through Coal Feeder into a pre-determined size in order to increase the surface area of coal.

* Necessity of Coal Pulvanization:-

- Grinding Coal into a fine powder fundamentally changes the physics of combustion.
- Breaking a large lump of coal into microscopic particles dramatically increase the fuels total exposed surface area.
- The coal to ignite and burn almost instantaneously, similar to how a gas or liquid fuel combusts.
- The coal is to achive a fineness where 70 % to 80 % of the particles can pass through a 200 mesh - sieve, translating to particles in the 45 to 75 micrometer range.

* operation of Ball Mill Pulveniser:-



- The Ball mill Pulvaniser is basically Horizontal cylindrical tube rotating at low speed on its axis, whose length is slightly more to its diameter.
- The inside the cylinder shell is fitted with heavy cast linear and is filled with Cast or forged balls for grinding to approx- $\frac{1}{3}$ of dia.
- The shell rotates the balls are lifted up on the rising side of the shell and they cascade down from near the top of the shell.
- Large piece of coal are broken by impact and the fine grinding is done by attribion and roushing as the balls roll and slide within the charge.
- Hot air flow is induced through the mill in order to dry the coal and remove the fines from the pulverizing zone.

TLO-2.4:- Ash Handling System :-

- A large quantity of Ash is, produced in steam Power plant using coal.
- Handling of Ash is a problem because ash coming out of the furnace is too hot, it is dusty and irritating to handle and is accompanished by some poisonous gases.
  - Quenching reduces the temp. of Ash.
  - It reduce the corrosive action of Ash.
  - Handling of Ash includes its removal from the furnace, loading on the conveyors and delivered to the fill from where it can be disposed off.

* Types of Ash:-

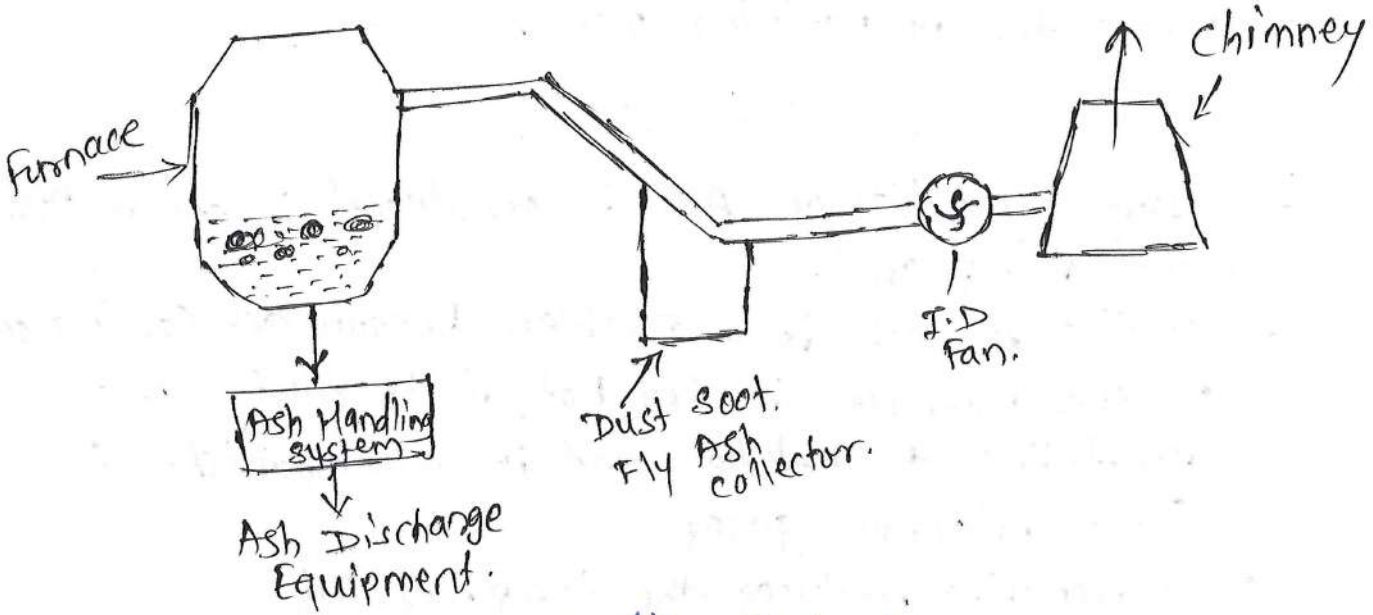
① Bottom Ash:-

- Bottom ash is the coarse, heavier residue that settles at the bottom of the boiler's combustion chamber.
- It is widly used in construction, road base material, structural fill, snow and ice traction on icy roads, and as abrasive blasting grit.

② Fly Ash:-

- Fly ash is the fine, powdery particulates that is carried away from the furnace in the exhaust flue gases.
- Fly ash acts as an incrediable supplementry cementitious material. When mixed with concrete it improves workability, increase strength and durability.

* Layout of Ash Handling system:-



* Need of Ash Handling System:-

- To remove the ash from the furnace ash Hopper.
- To convey the ashes from furnace ash Hopper to a storage.
- To dispose the ashes from the storage.

③ Pneumatic Ash Handling system:-

- This has been designed in such away that it can handle abrasive ash and fine dust material.
- The ash separated in two stages:- separated in the primary and secondary cyclone separator and the ashes are collected in the hopper.

④ steam jet system:-

- In this system jet is used to carried dry solid materials of considerable size along with it. In this system, the direction of steam and ash travels are same.
- Ash removal is economical for a horizontal distance of 200 meters and vertical distance of 30 meters.

TLO-2.5 - Feed Water Treatment:-

Feed Water Treatment is the process of purfying water before it enters industrial system. It removes suspended solid, dissolved minerals, and corrosive gases to prevent catastrophic equipment failure, dangerous scale & buildup and system corrosion.

* Necessary for Feed Water Teatment:-

① Scale formation:-

Dissolved minerals (calcium, magnesium, silica) deposite on heating surfaces, restricting heat transfer and increasing energy consumption.

② Corrosion:-

Dissolved gases (oxygen & carbon dioxide) attack pipes and turbines, leading to leaks & failure.

③ Carryover & fouling:-

Suspended matter and dissolved solid can contaminate steam and down steam equipment.

① Mechanical Handling system:-
- This system is used for low capacity power plant
- The hot ash from the furnace, falls on the belt conveyor and it is continuously carried to the overhead bunker or dumping site.
- With the help of truck, the ash is carried from ash bunker to dumping site.
- The maximum capacity of this plant is 5tons per hr.

② Hydraulic Ash Handling System:-
- In this system the ash is carried by the water with high velocity a channel and dumped fully to the sump.

(a) Low velocity system:-
- The ash from the grate is made to fall into the system at lower velocity and it is carried to the sump with water.
- The velocity of water in trough is bet^n 3 to 5 m/sec.
- The Ash & water are separated when it reached to the sump.
- The ash carrying capacity is 50 ton/hr. and distance covered is 500 mts.

(b) High velocity system:-
- In this system, the water nozzles are fitted at the top and on the sides of the hoppers below the boilers.
- The top nozzle is used to quench the ash and the side of the hopper nozzle are provided to carry the ash through trough.
- The ash carried capacity 120 tonnes and distan covered is 1000 mts.
- The troughs and sumps are made of corrosio and wear resistant material.

* Parameter of Feed Water:-

① Total Hardness:-

- The Concentration of dissolved Calcium and magnesium ions in the water.
- Range :- < 75 mg/L (soft)
- For general drinking water, the acceptable limit is usually ≤ 200 mg/L. However for high pressure boiler feed water, hardness must be kept near nil (0 ppm) to prevent severe scaling.

② pH. (Potential of Hydrogen)

- The acidity or alkalinity of the water, measured on scale of 0 to 14.
- Range:- 6.5 to 8.5
- most domestic and industrial water quality standard set the acceptable pH band firmly between 6.5 and 8.5. Boiler feed water often has slightly more basic target to prevent boiler tube Corrossion.

③ Total Dissolved solid (TDS):-

- Total concentration of all dissolved substances such as minerals, salts and metals - similar than 2 microns.
- Range:- < 500 mg/L (For Driking water)
- For reverse Osmosis (RO) feed water, the optimal range is typically 100 to 2000ppm depending on membrane specification. While boiler feed water may require a TDS of < 0.1 ppm.

TLO-2.6 - Fluidized Bed Combustion Boiler (FBC):-

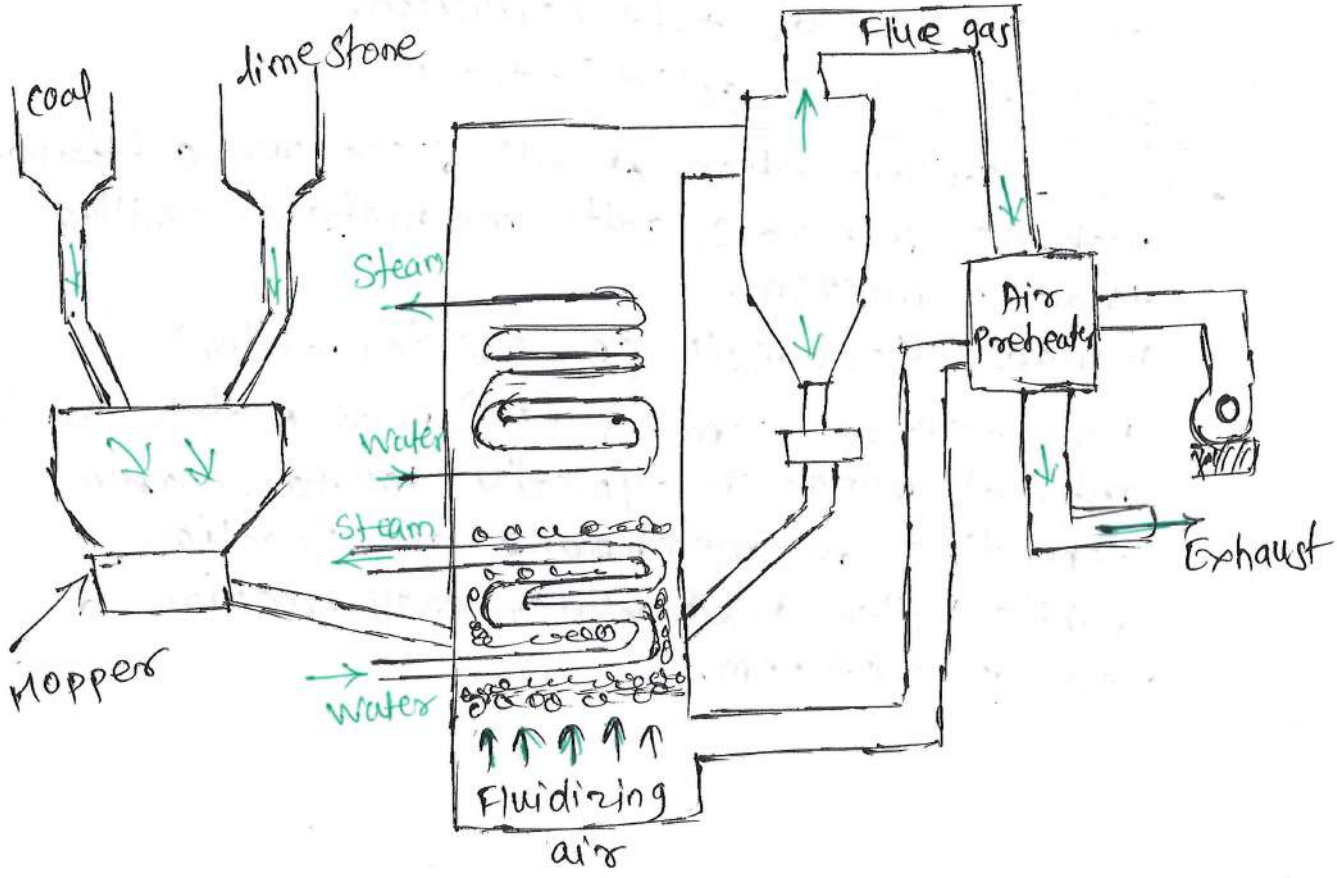
A Fluidized bed combustion boiler suspended solid fuel (like Coal or Biomass) and insert materials (limestone) on upward flowing air. The mixture behaves like boiling fluid.

Advantages:-

① Fuel Flexibility:-
Can burn a wide variety of low grade, solid fuels, including agricultural waste and municipal refuse.

② Low Emission:-
Limestone added to the bed natively capture sulphur dioxide (SO_2) right in the furnace.
The low burning temp. (850°c - 900°c) drastically reduce nitrogen oxide (NO_x) emission.

* Construction & working of FBC:-



* Construction:-

1) Combustion chamber:-
The main vessel where fuel is mixed with the bed material and burned.

2) Air Distribution plate:-
Locate at a bottom of the furnace, this plate contains nozzole or tuyers.

3) Bed material:-
A layer of inert granular material (silicalsand, Crushed refractory, or lime stone) sit on the distribution plate.

4) Fuel & sorbent feeding system:-
Injector or screw Feeders that introduce Crushed fuel (coal, biomass) and sorbents (limestone) into or above the bed.

5) Heat Transfer Tubes:-
Water tubes immersed directly inside the Fluidized bed. Because of the high heat transfer rate of the bed, these tubes absorbed a massive amount of heat to generate steam.

6) Superheater/ Economiser:-
Locate in the upper path of the flue gases to recover remaining heat.

7) Cyclone separator:-
Poistioned at the Furnace outlet to capture unburnt fuel and bed material From the flue gas and return them back to the bed for Complete combustion.

* Working:-
- Air is blown upward through the distribution plate into the bed of solid sand particles.
- As the air velocity increases, it reaches a point where the drag ~~force~~ force of the air equals the weight of particles.

- The bed is initially preheated to the ignition temp. of the fuel (around 500°c to 600°c)
- Crushed fuel is then fed into the boiling bed. The fuel rapidly mixes with the hot bed material and igniter.
- The operating temp. of the bed is strickly maintained between 800°c and 900°c.
- The heat generated in the bed is rapidly transferred to the in bed tubes as water circulates through them, turning into steam.
- The hot flue gases rise, passing through the superheater and economiser tubes to heat more water/steam before exiting through the stack.

* Types of Fluidised Bed Combustion:-

(A) Atmospheric Fluidized Bed Combustion:- (AFBC)

(a) Bubbling Fluidized Bed Combustion:- (BFBC)

- The upward air velo. is relatively low (1 m/s to 3 m/s) which keeps the solid particles in a distinct churning bed with a well defined surface resembling a boiling liquid.

Low capacity application, biomass, small scale industrial boilers and fuels with high moisture or volatile matter.

(b) circulating Fluidzed Bed Combustion (CFBC)

- The air velocity is much higher (4 m/s to 6 m/s). This high velocity forces the fuel and bed particles to entrain in the gas stream and travel upward through the entire height of the furnace.
- Large scale power plants, low grade coals with high ash content and application requiring high sulfur retation and low NO_x emission.

(B) Pressurized Fluidized Bed Combustion (PFBC)

In a PFBC system, the entire fluidized bed operates inside a pressurized vessel, typically at pressures ranging from 5 to 20 times atmospheric pressure (0.5 mpa to 2 mPa)

It operates as a combined cycle system, which drastically increase thermal efficiency. Because the gas is compressed, the boiler size is significantly smaller than an AFBC system of the same capacity.

TLO:-7.7- Concept of steam temp. Control and Boiler Feed water Control:-

* steam Temp. Control:-

Maintaining a constant superheated steam temp is vital for maximizing turbine efficiency and preventing thermal stress.

(A) Attempreation:- (Desuperheating)

A fine spray of high purity water is injected directly into the superheated steam line, typically between the primary and secondary superheaters.

A temp. sensor downstream of the spray nozzle measures the steam temp. If the temp rises above the set point a control valve open to increase the cooling water spray.

(B) Flue Gas Bypassing / Gas Recirculation:-

Dampers direct a portion of the hot flue gases away from the superheater tubes, reducing heat absorption when steam temp. are too high.

Coolar Flue gases from the economizer outlet are ~~reinfor~~ reintroduced into the bottom of the surface.

* Boiler Feed Water Control:-

The primary goal of Feed water control is to maintain a constant water level in the boiler's steam drum.

while simple system use one or two variables, large individual industry and utilized boilers Three Element Control to handle rapid load changes and combat phenomenon known as "swell & shrink".

swell & shrink:-

when steam demand suddenly increases the pressure in the drum drops. This drop in pressure causes steam bubbles below the water line of expands, making the water level look like it is rising (swell) even through water mass is actually leaving.

* Three elements System:-

① The anticipation step: (Feed Forward):-

The system continuously measure the steam flow leaving the drum. If a turbine demands more steam, the steam flow transmitter instantly signal the controller that water is leaving the system.

② The Balancing step:-

The controller compress this steam flow directly against the incoming feed water flow.

steam flow = Feed water flow.

③ The Correction step:- (Feed back):-

The drum level transmitter monitors the actual water level. If there is a residual error, the drum level controller trims the main signal to fine tuner the Feedwater valve position.