BOILER

MOUNTINGS & ACCESSORIES

BOILER MOUNTINGS

- Mainly seven (7) mountings are required and essential to a Boiler :
  1. Water level indicator. (Water gauge)
  2. Main steam stop valve.
  3. Pressure gauge.
  4. Feed check valve.
  5. Fusible plug.
  6. Blow down valve. (Blow off cock)
  7. Safety valve.

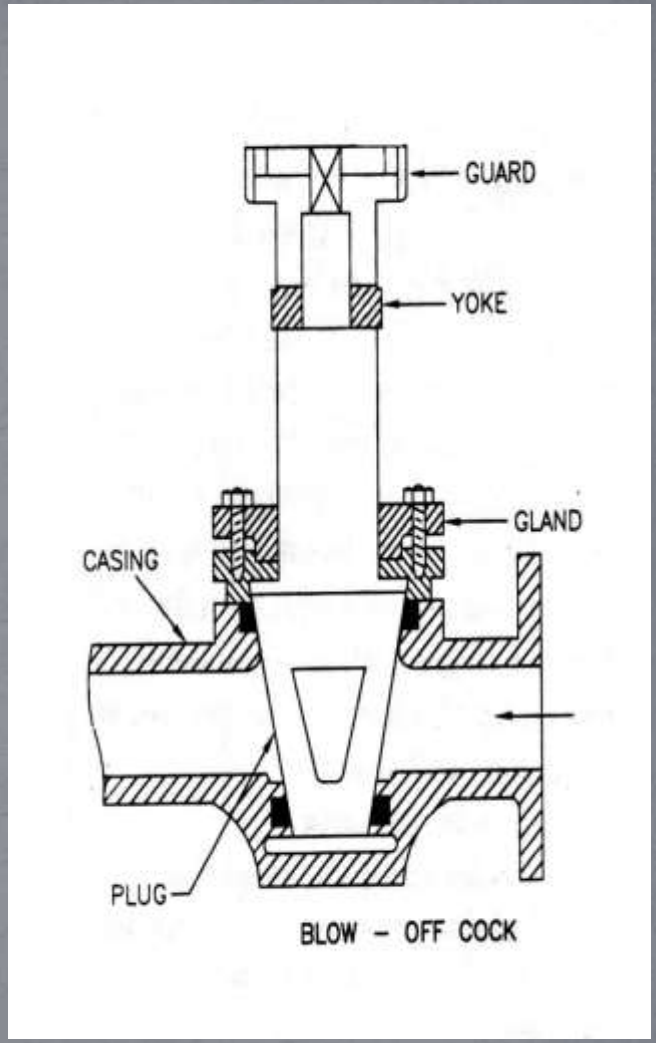
Normally these devices are mounted on boiler shell.

Blow-Off Cock

Removes impurities and sediment buildup to maintain water quality and efficiency.

Function:

The function of blow-off cock is to discharge mud and other sediments deposited in the bottom most part of the water space in the boiler, while boiler is in operation. It can also be used to drain-off boiler water. Hence it is mounted at the lowest part of the boiler. When it is open, water under the pressure rushes out, thus carrying sediments and mud.



CONSTRUCTION

- It is fitted on the boiler shell directly or through the short branch of pipe at lowest part of the water space. It consists of gun metal conical plug having a rectangular hole, spindle with yoke a shown in fig. The plug meshes accurately into the similar casing. The plug spindle is generally rotated by mean of spanner on the top of the yoke, two vertical slots are provided for fixing spanner.

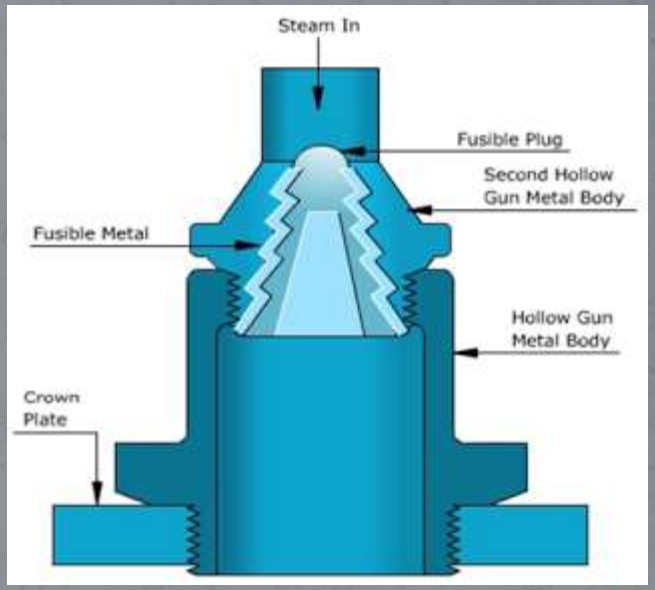
Working

- When rectangular hole of plug is brought in line with casing hole by rotating spindle, the water flow out. When the solid portion of the plug is in front of casing hole (this position shown in the fig.) the water cannot flow out of boiler.

Fusible plug

- Function :

  It is use to protect the boil against damage due to overheating caused by low water level in the boiler.



CONSTRUCTION

Fitted on the crown sheet or the firebox of the boiler.

- It is fitted on the fire box crown plate or over the combustion chamber. The fusible plug consist of two hollow guns and one conical plug a shown in figure. A hollow gun metal body is screwed to the fire box crown plate of boiler. Another hollow gun metal is screwed to the first body. Third plug is made from copper is locked with second plug by pouring metal in to the grooves provided on the both plugs.

Working

- In normal working condition, the upper surface of fusible plug is covered with water which keeps the temperature of the plug below its melting point while other end of plug is exposed to fire or hot gases. The low melting point (tin or lead) does not melt till the upper surface of plug is submerged in water. But in case of water level in boiler falls below the danger levels, the fusible plug uncovered by the water and get exposed to steam. This overheats the plug and the fusible metal having low melting point which melts quickly. Thus the third plug drops down and second hollow gun became open, the steam rushes into the furnace and puts out the fire (stop).

Feed check valve

- Function: It controls the supply of water from the boiler when the feed pump pressure is less than boiler pressure or pump is stopped.

Allows the entry of feedwater into the
boiler while preventing backflow

Construction

Connected to the boiler's water inlet.

- The feed check valve is fitted in water space of the boiler just below the normal level of the water. It consist of non-return valve,water inlet pipe,out let pipe,spindle,gland and wheel as shown in fig. the outlet pipe of valve connected with and of delivery pipe of feed pump

WORKING

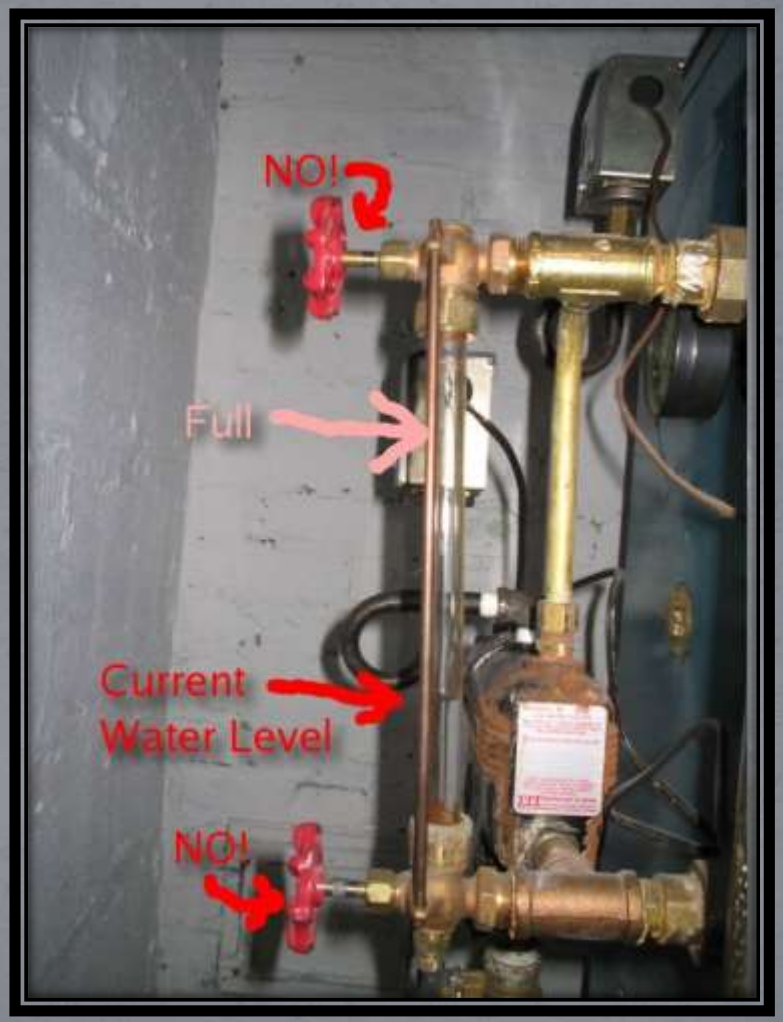
Inlet and outlet pipe of valve expose different pressure .at inlet of valve the feed pump pressure acts and outlet pipe of the valve the boiler pressure act . When feed pump is in operation,

The pressure on the feed pump side(inlet) is more than pressure on the boiler side(outlet).This pressure difference lifts the non return valve, And allows water flow into boiler.

WATER LEVEL INDICATOR

Function:-

It indicate the water level inside the boiler vessel. It shows the level in the boiler drum.



CONSTRUCTION

Usually located on the front of the boiler shell or drum

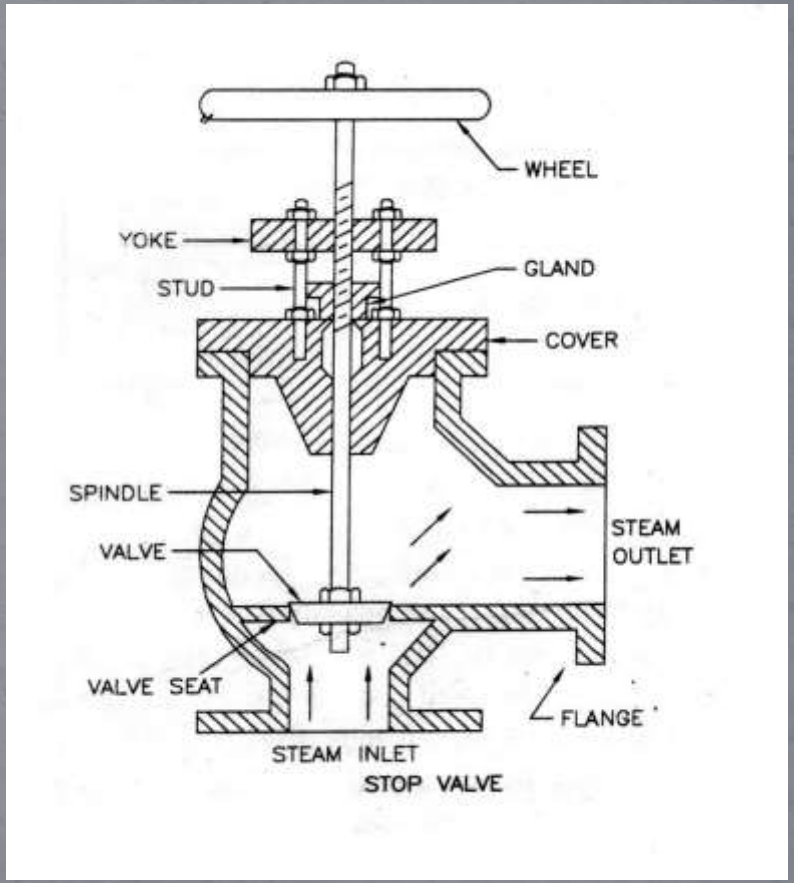
- Normally two water level indicator are fitted to the boiler. these are fitted at the *front end of every boiler.* Water level indicator consist three cock as steam cock, water cock, drain cock and glass tube. The steam cock connect or disconnects the glass tube with steam space. while water cock connect or disconnect the glass tube with water in the boiler. the drain cock is used to drain out the water in from glass tube at interval to ensure that the steam and water cock are clear in operation. The glass tube protected by means of a cover,and made of specially

WORKING

- When steam cock and water cock opened, steam rushes from upper passage and water rushed from lower from passage to the glass tube. This will indicate the level of water in the boiler. Two ball are places at the junction of metal tube. Under normal operating condition the ball are kept. full line circle in case the glass tube is broken, steam will rushes from upper passage and water from lower passage due to pressure difference between boiler pressure at atmospheric pressure. the ball are carrier along the passage to and of glass tube and then closed passages. This position of ball sown in fig by dotted circle. Thus flow of water and steam out of boiler is prevented.

Steam Stop Valve

- Function:-It control ~~regulate~~ the flow of steam from boiler to the steam pipe or from one steam pipe to the other.



CONSTRUCTION

Usually connected to the steam pipe near the boiler outlet.

The common type of steam stop valve. The flange of valve body bolted to the boiler at the highest part of steam space. It consist of valve seat and nut. The main body of valve is made of cast iron and valve seat made from gun metal.

when steam stop valve is placed directly over the boiler and connected to the steam pipe line is called the **junction valve.** If it is placed near to prime mover than normally called steam stop valve.

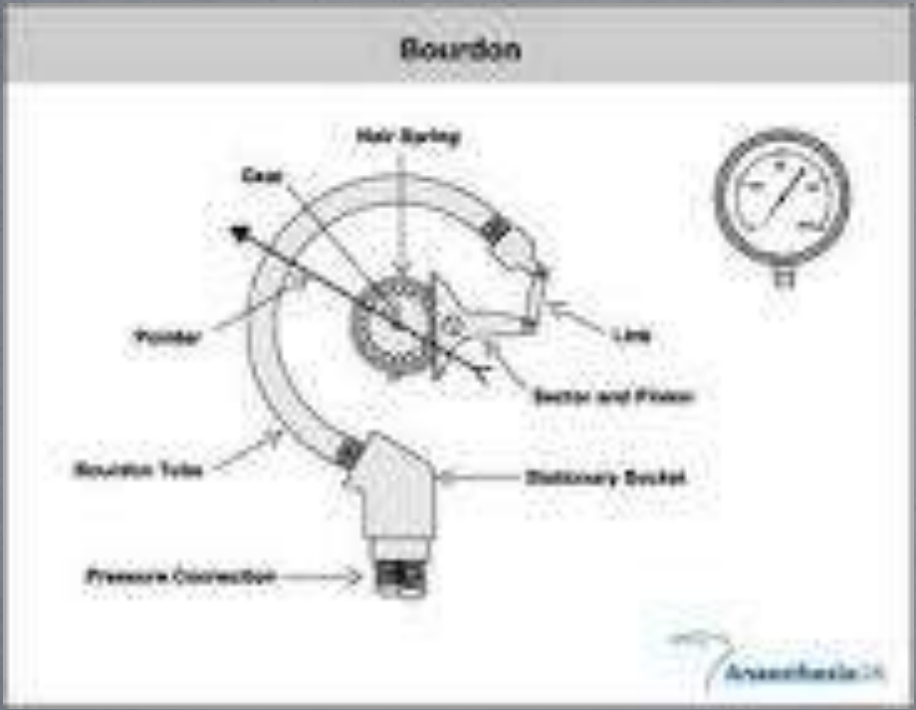
The lower ends of spindle connected to valve upper and pass through gland and yoke, and connected with hand wheel. The gland is used to prevent the leakage of steam.

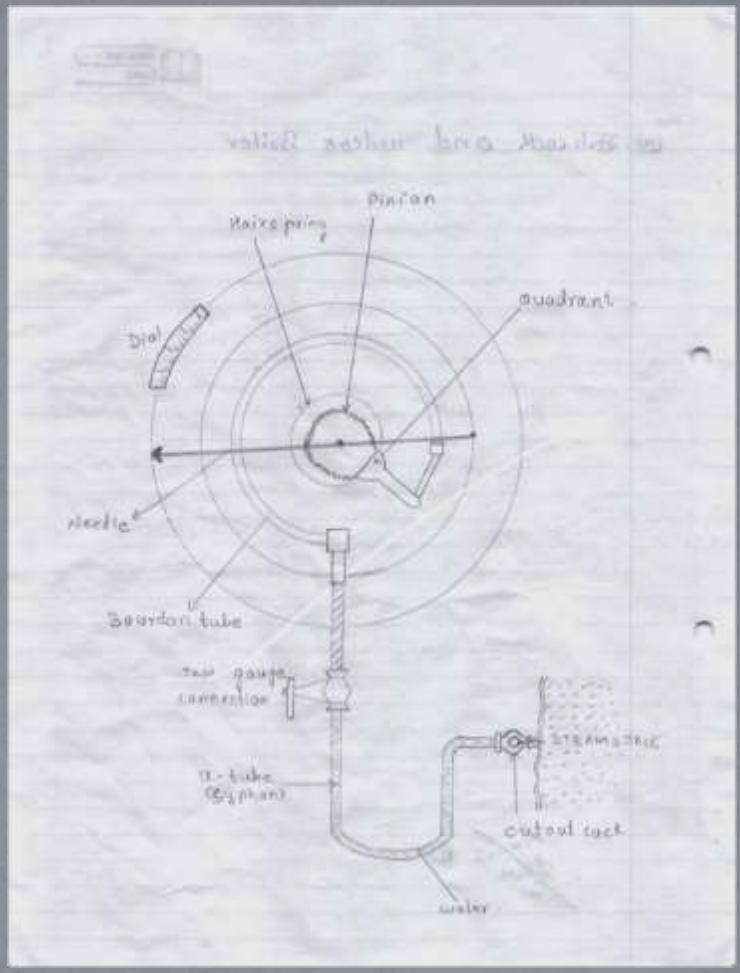
WORKING

- The spindle it rotated by help of hand wheel due to rotation of spindle the valve move up and down. When the valve sits over the valve seat, the passage of steam is completely closed. The steam passage may be partially or fully opened by moving the valve up, help of rotating the hand wheel the clearance (passage) between valve and valve seat regulates the flow of steam out of boilers. in locomotive boilers, the supply of the steam is regulated by means of a regulator which is placed inside boiler cell and operated by a handle from driver's cabin.

Pressure Gauge

- Function : It indicates the pressure of steam in boiler.





CONSTRUCTION

- The gauge is usually **mounted** on the front top of the shell or on the drum. It is having dial which graduated to read pressure in bar, above atmosphere A bourdon tube gauge with its interior mechanism is shown in fig. The circular bent bourdon tube of oval-cross section is close at one end and connected at the other end to steam space of boiler through siphon (U-tube). The siphon is filled with water which prevents hot steam from entering the pressure gauge and keeps the gauge cool. Closed end of bourdon tube is attached to a toothed quadrant with help of link and pin. This quadrant meshes with a small pinion on the central spindle.

Working

- When pressure is applied to inside of oval bourdon tube. It cross section tends to becomes circular, and free end of bourdon tube try to becomes straight, so turning the spindle by the links and gearing. This causes the needle to move and indicate pressure on graduated dial.

Safety valves

Releases excess steam to prevent pressure buildup and ensures boiler safety

- Function : Safety valves are located on the top of the boiler. They guard the boiler against the excessive high pressure of steam inside the drum. If the pressure of steam in the boiler drum exceeds the working pressure then the safety valve allows blow-off the excess quantity of steam to atmosphere. Thus the pressure of steam in the drum falls. The escape of steam makes a audio noise to warm the boiler attendant.

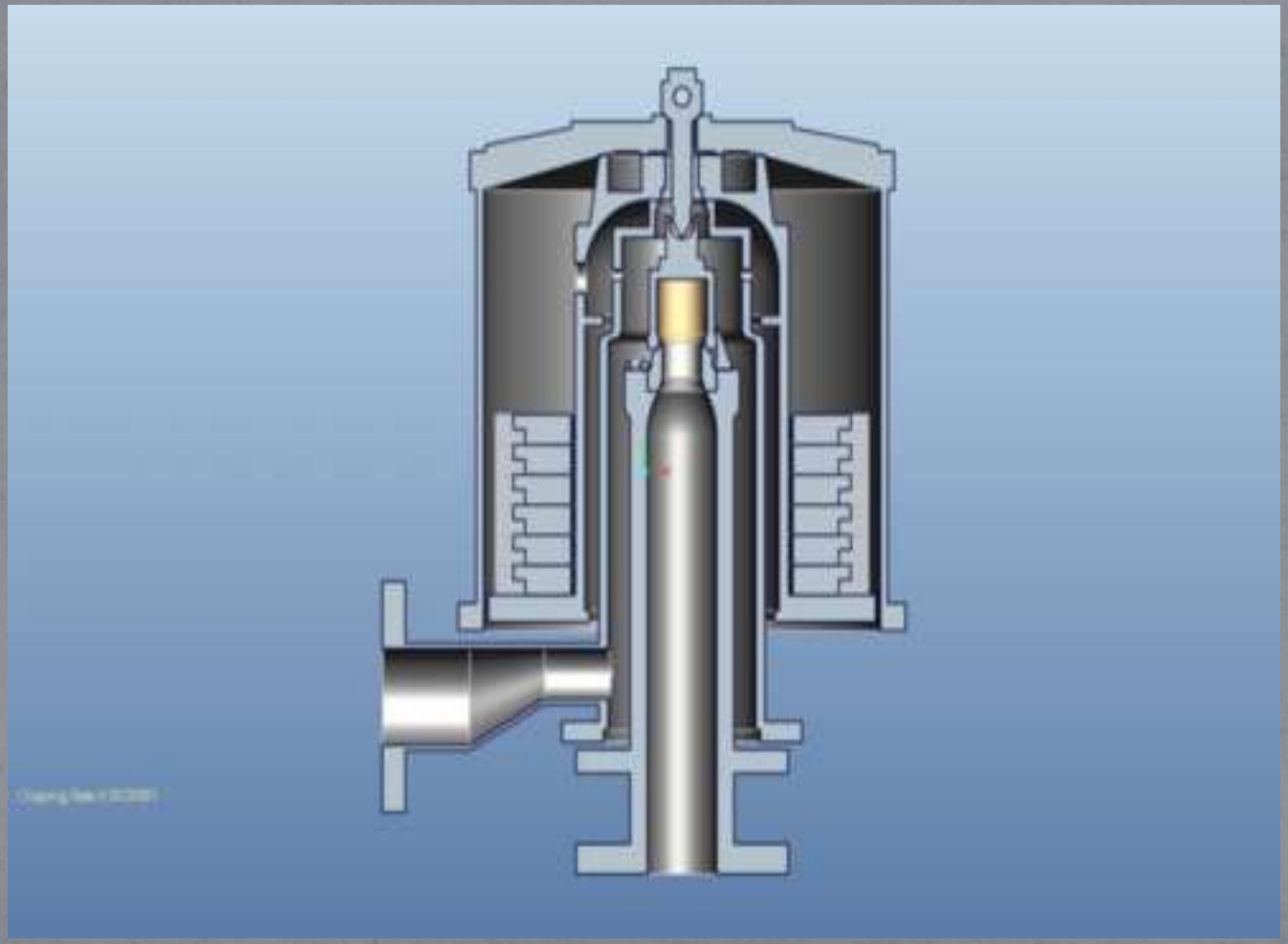
on the top of the boiler or on the steam outlet pipe.

Safety valves

:There are four types of safety valve:

1. Dead weight safety valve.
2. Spring loaded safety valve
3. Lever loaded safety valve
4. High steam and low water safety valve

Dead weight safety valve



CONSTRUCTION

- It consists of valve V is placed upon a valve seat which is fix upon a long vertical pipe having a flange at the bottom for fixing at the top of the boiler. The weight carrier D suspended from the top of the valve which carries cast iron rings (weight) as shown figure. The total weight must be sufficient to keep the valve on it seats against the normal working pressure.

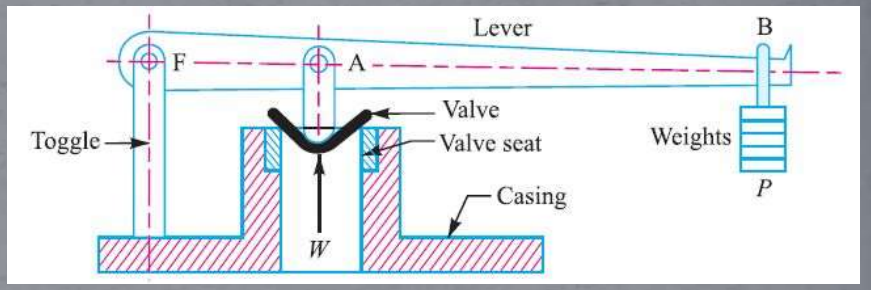
Working

When the steam pressure exceeds the normal limits, this high pressure stream creates upward force on valve, thus valve V lift with its weights and the excess steam escapes through the pipe to the outside.

The construction of this valve is simple. It gives satisfactory operation for low pressure and stationary boilers. It is not suitable for moving boilers as the force of the weights should always work vertically downward. It is also not suitable for high pressure boiler as the weight becomes to large.

Lever safety valve

- The main disadvantages of dead weight safety valve as heavy weights required for high pressure boiler is eliminated in a lever safety valve by use of a lever.



CONSTRUCTION

The valve rests over the gun metal seat which is fixed to a mounting block. The mounting block is fixed upon the boiler. One end of the lever is hinged while the other end carries a weight W as shown in figure. The thrust of the lever with its weight is transmitted to the valve by a short strut. The position and amount of weight W decides the safe pressure limit.

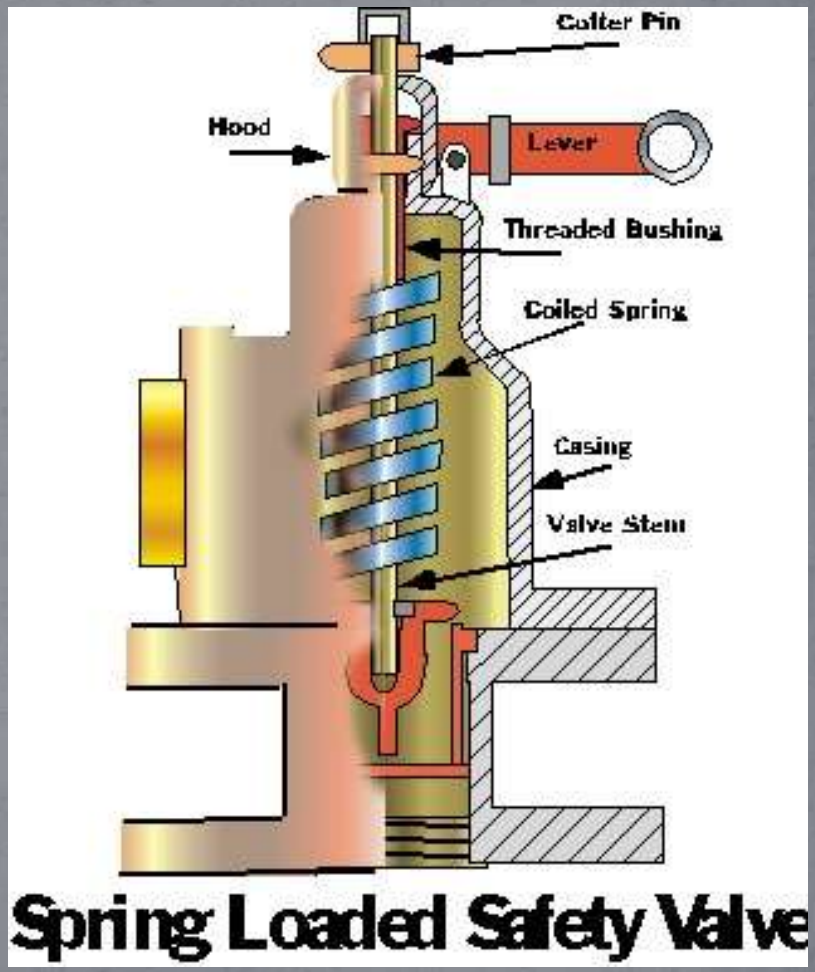
Working

When the pressure exceeds the normal limit, the upward force on valve is become higher than the downward thrust on valve due to weight W on lever. Thus the valve lifted from it seat with it weight and excess steam will come out of the boiler.

This safety valve used only for stationary boiler. It used at a pressure higher than that of dead weight safety valve.

Spring loaded safety valve

- There are various types of spring loaded safety valve use on different boilers.



CONSTRUCTION

It consists of a cast iron body having two branch pipes. Two separate valves V are placed over the valve seat as shown in figure. A lever is placed over the valve by means of two pivots. The lever is held tight at its proper position by means of a spring. One end of spring is connected with the lever while other end with the body of the valve. The valve is kept on it seats with help of spring force.

Working

- In the normal condition, the downward force due to spring is higher than upward force applied by steam. The valve is closed due to spring force. When steam pressure exceeds the normal limit, upward force due to steam pressure is became higher than downward force due to spring. Thus the valves are lifted from their seats opening the passages for steam to release out of boiler.

High steam & low water safety valve

Function

1) The steam automatically escapes out when the level of water falls below a normal level.
2) It automatically discharges the excess steam when the pressure of steam rises above a normal pressure.

- This valve is generally used in Cornish or Lancashire boiler.

CONSTRUCTION

- This valve is combination of two valves and serve two purpose. It consists of valve V resting on the valve seat and the valve U loaded with the weights W rests on the valve Vas shown in figure.
- Inside the boiler ,a lever L_2 hinged at the fulcrum F_2 . One end of lever L_2 attached to a float E and other end carries balance weight *w*.

Working

When steam pressure rises above the normal pressure of the boiler, the valve V lifted along with valve U and excess steam is released out of boiler. The weight W_1 and w decides the limit of normal steam pressure. If W_1 is more, the valve V to lifted at higher steam pressure.

When float E submerged in water in normal condition, the lever L_2 is balanced about fulcrum F_2 and valve U is remained close. When water level in boiler falls below a normal level, the float with its weight moves downward and left side part of level L_2 moves upward. So that knife edge pushes the spindle which opens the valve U with weight W and steam escapes through specially constructed passage causing a loud noise. This alerts operator to start the feed water pump to increase the level of water in the boiler.

Boiler

:Accessories:

:Boilers Accessories:

- These are auxiliary plants or parts required for steam boilers for their proper operation and to increased efficiency of the boilers

:Boilers Accessories:
:are as under:

(1) Feed pump
(2) Injector
(3) Economiser
(4) Air preheater
(5) Superheater
(6) Steam separator
(7) Steam trap

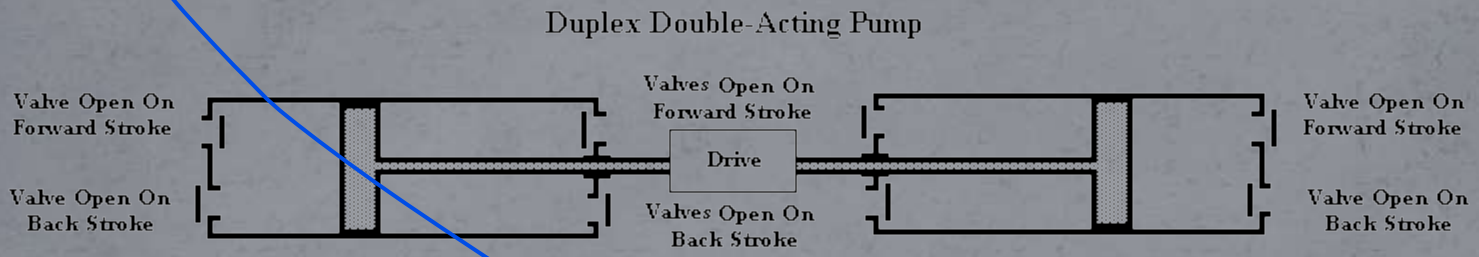
Feed Pump

- Function:
- The feed pump is a pump which is used to deliver feed water to the boiler.
- Double feed pump is commonly employed for medium size boilers.

Types of Feed pumps

- There are Three types of feed Pumps mainly:
- Reciprocating pumps-simplex,duplex,Triplex
- Rotary pumps
- Centrifugal pumps

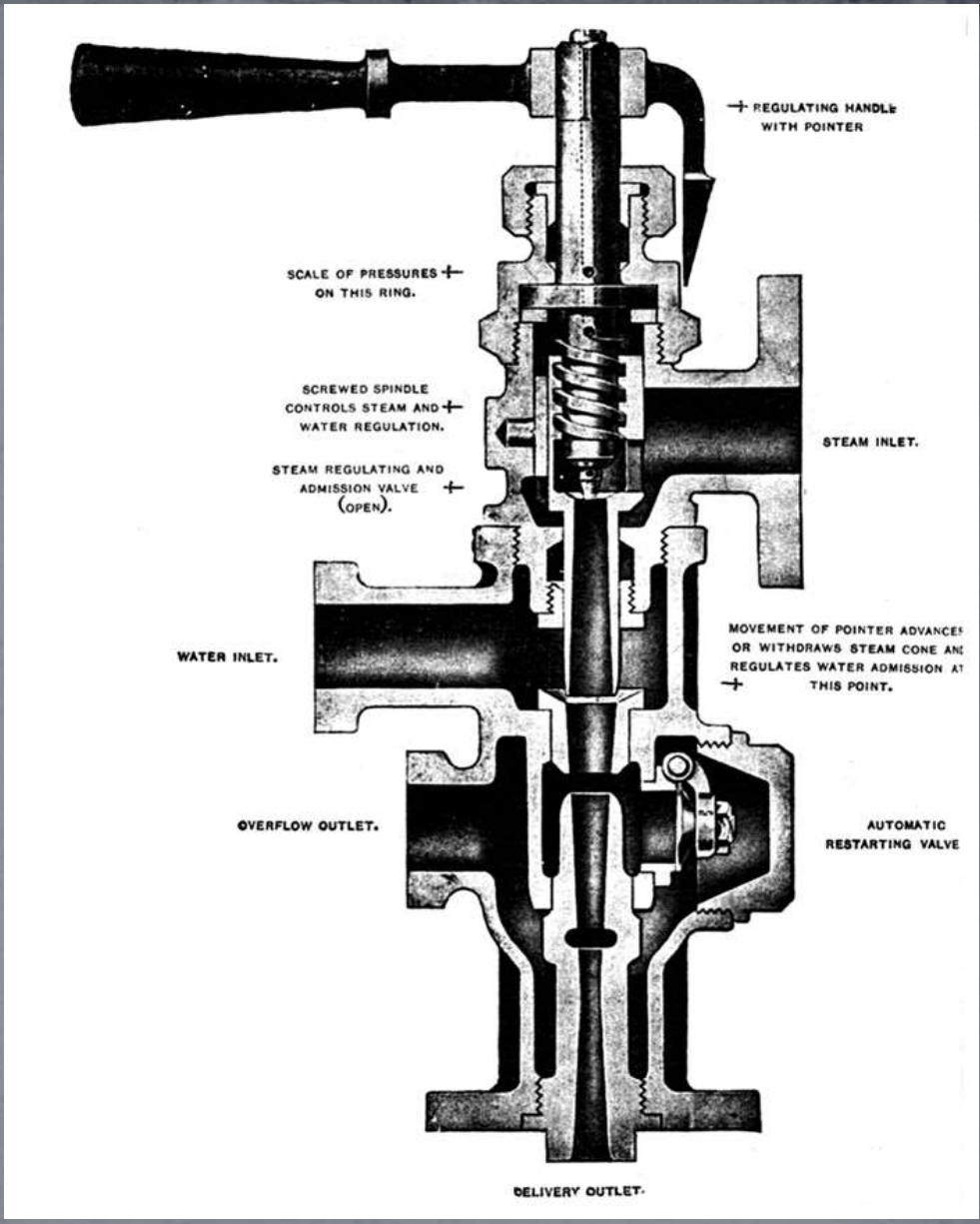
Reciprocating Duplex Pump



- Duplex pump is very common steam driven reciprocating pump. It consist of two steam cylinder placed side by side. There are two steam ports for each of the cylinders.

Injector

- Fucntion : Injector is used to feed water in the boiler .
- It is commonly employees for vertical boiler and does not find its application in large capacity high pressure boilers . it also uses more space is not available for the installation for feed pump.



- Construction: It consists of spindle,a steam cone ,a combine cone,a delivery cone and a handle
  The lower end of the spindle works as the valve and the upper end is fitted with the handle.The rotation of the handle cause an upward or downword movement of the steam cone.

Economiser

- Function: Economiser increases the temperature of feed water using waste of heat to flue gases leaving the boiler through chimney.

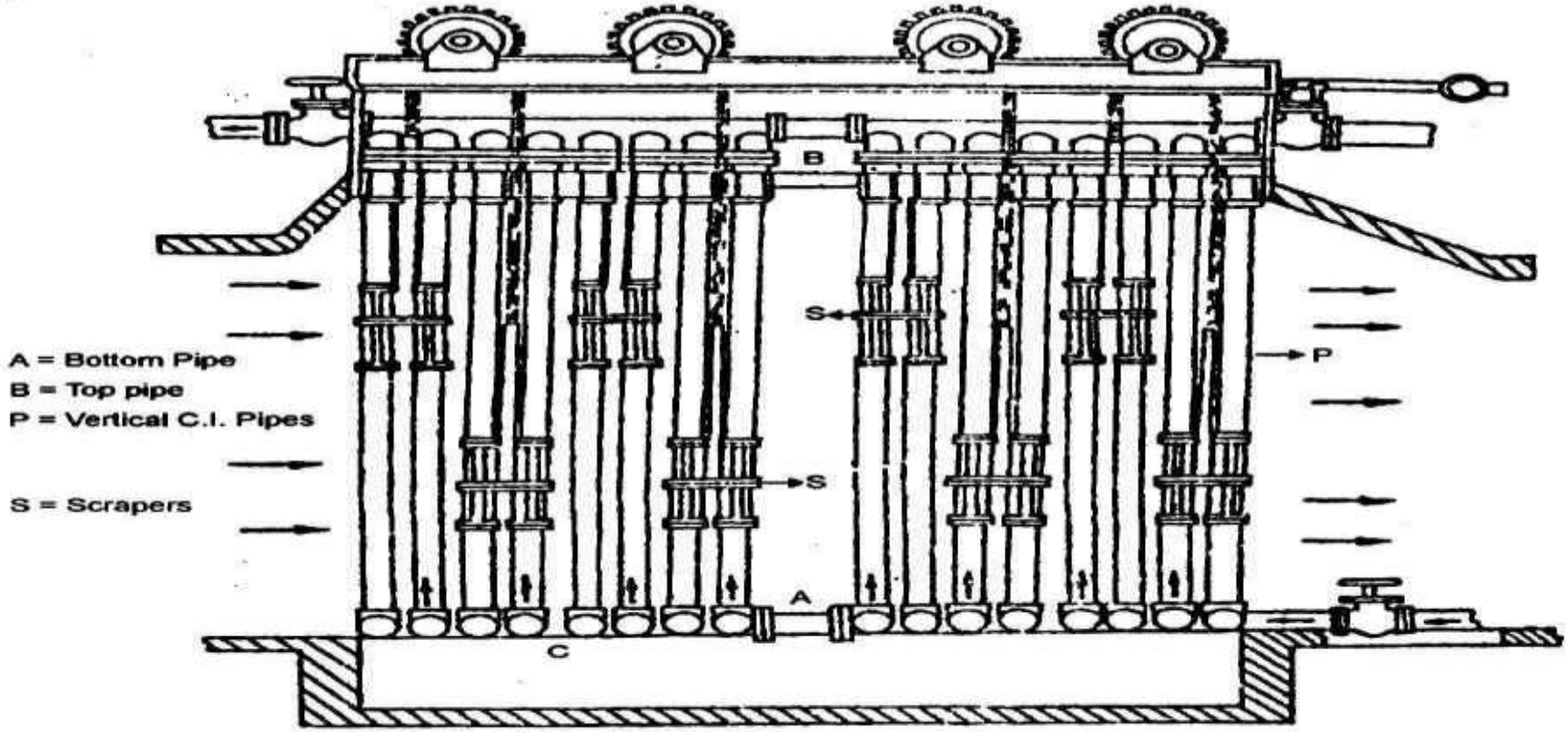
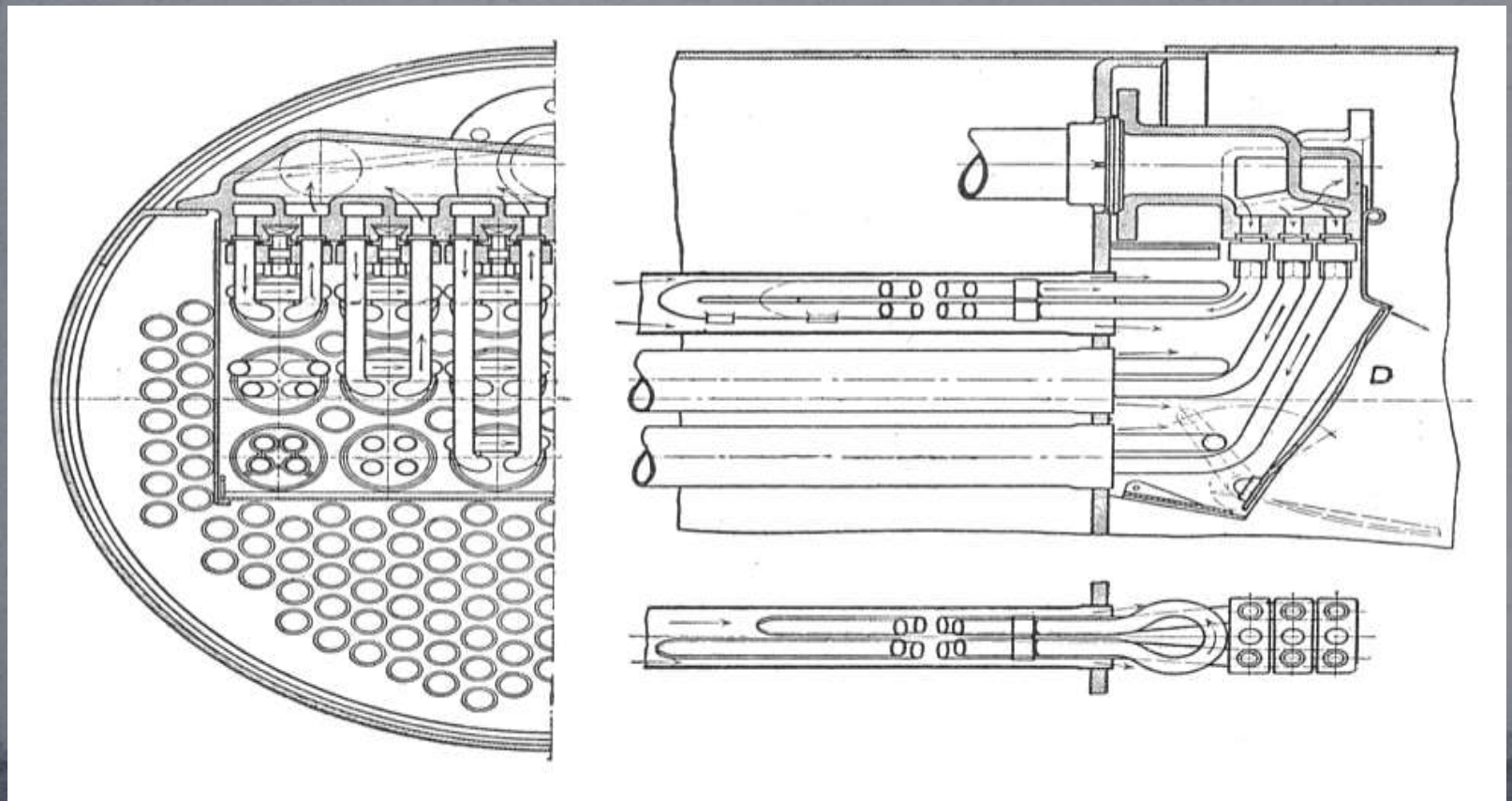


Fig. Economiser

- Construction and working:
- Economiser consist of a large vertical cast iron or steel water pipes,one end of vertical pipes is connected with vertiveal pipes A and other end with B. Hot flue gases from boiler pass over the vertical tubes .The heat transfer take place from flue gases to cold water rising in vertical tubes

Super heater

- The function of super heater is to increase the temperature of the steam above its saturation point.



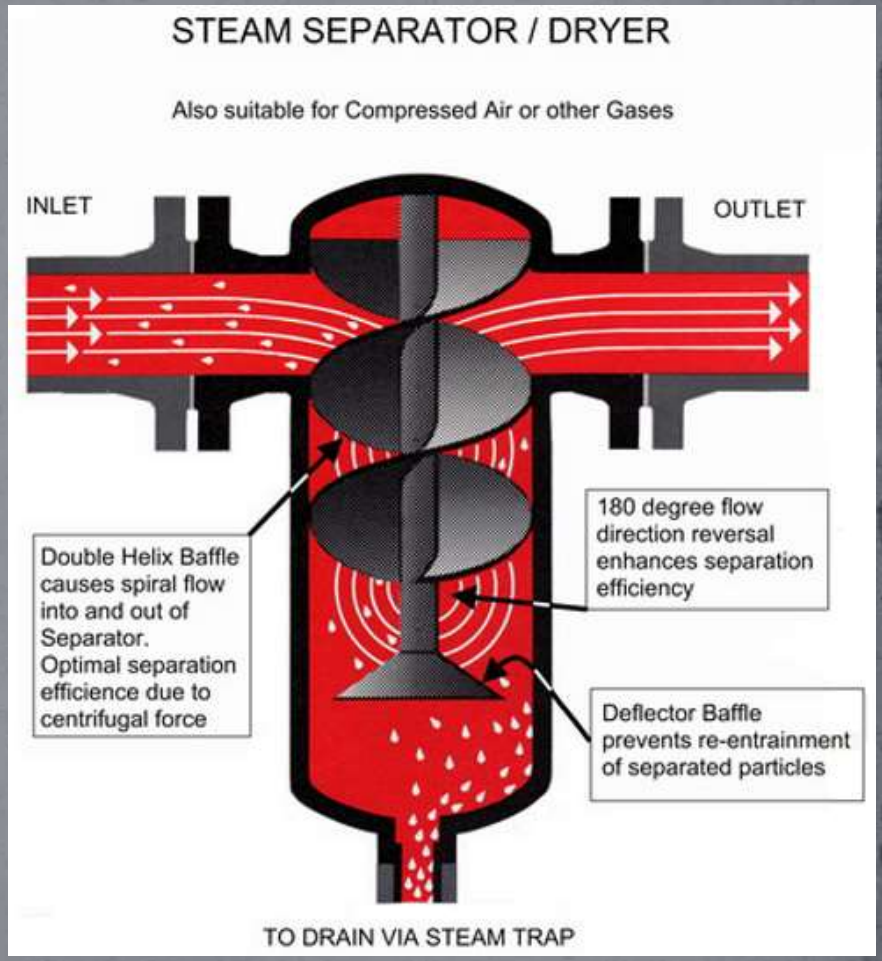
Working

- To superheat the steam generated by boiler.
- Super heaters are heat exchangers in which heat is transferred to the saturated steam to increase its temperature.
- Superheated steam has the following advantages :

i) Steam consumption of the engine or turbine is reduced.
ii) Losses due to condensation in the cylinders and the steam pipes are reduced.
iii)Erosion of turbine blade is eliminated.
iv) Efficiency of steam plant is increased

Steam Separator

A Steam separator, sometimes referred to as a moisture separator, is a device for separating water droplets from steam. The simplest type of steam separator is the steam dome on a steam locomotive. Stationary boilers and nuclear reactors may have more complex devices which impart a "spin" to the steam so that water droplets are thrown outwards by centrifugal force and



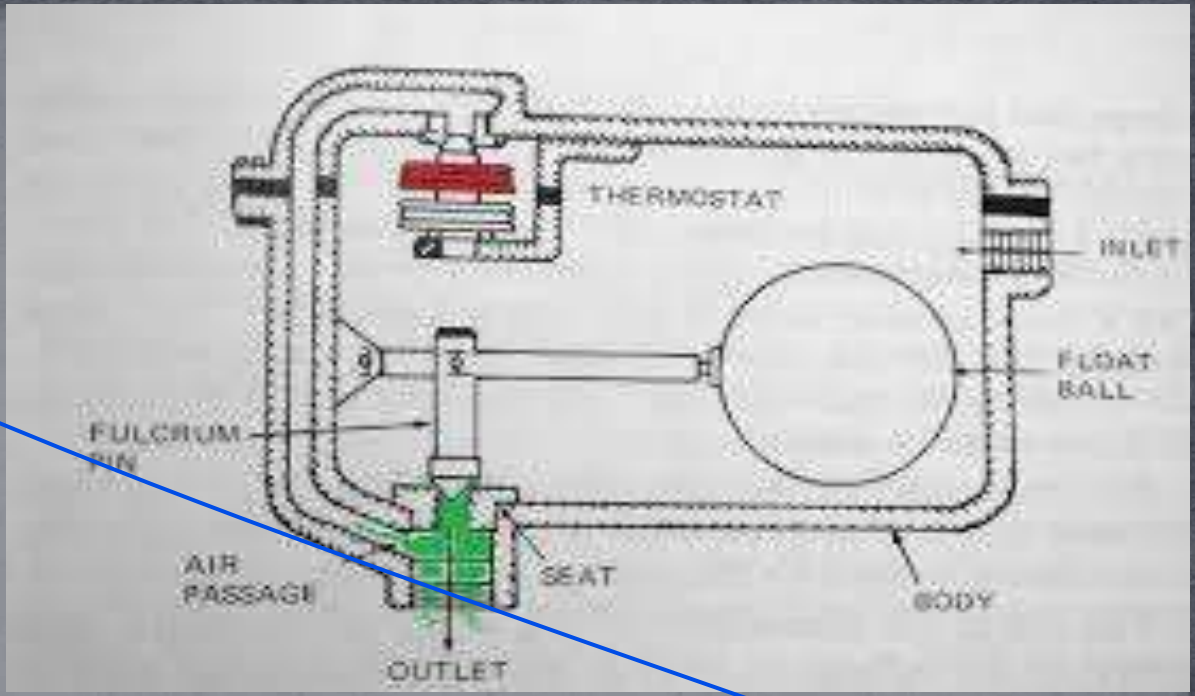
Steam separator is important to remove water droplets from steam because:

In all engines, wet steam reduces the thermal efficiency
In piston engines, water can accumulate in the cylinders and cause a hydraulic lock which will damage the engine
In thermal power stations, water droplets in high velocity steam coming from nozzles (or vanes) in a steam turbine can impinge on and erode turbine internals such as turbine blades.

Construction and Working

- It consists of inlet and outlet steam pipes, baffles and water drain cock. The steam enters at the inlet pipe and flows down it strikes the baffles as a result it gets deflected but as the water particles have the grater weight , inertia and density falls to the bottom of the separator as a result steam and water are separated

Steam Trap:

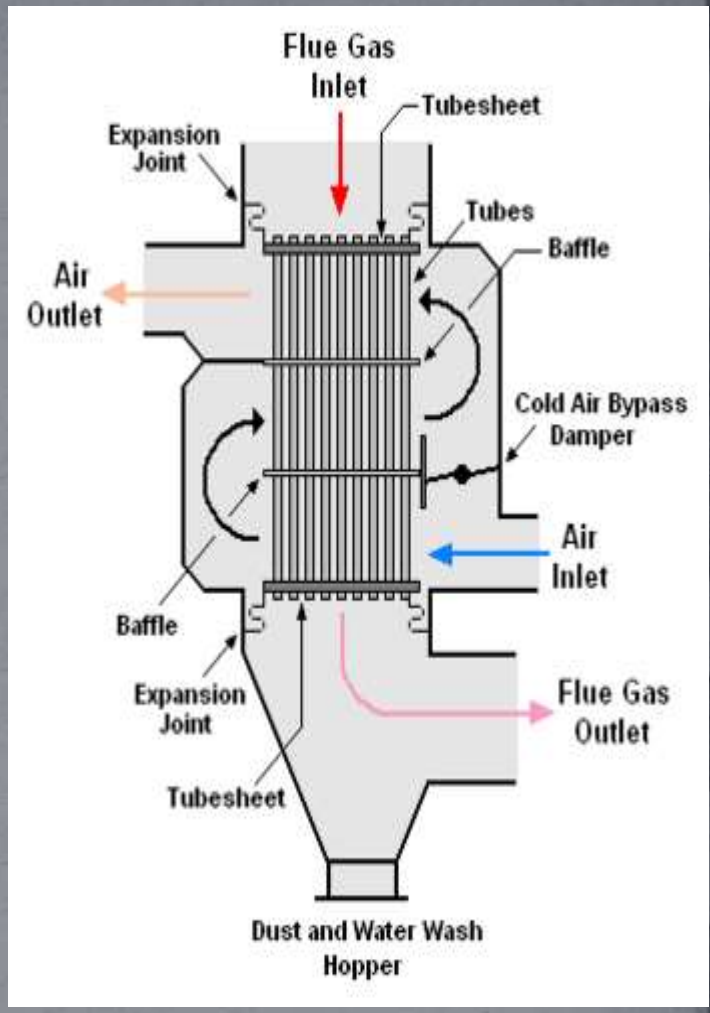


:: A steam trap is a device used to discharge condensate and non condensable gases with a negligible consumption or loss of live steam. Most steam traps are nothing more than automatic valves. They open, close or modulate automatically. Others, like venture traps, are based on turbulent 2-phase flows to obstruct the steam flow.::

- The three important functions of steam traps are:
  1 Discharge condensate as soon as it is formed.
  2 Have a negligible steam consumption.
  3 Have the capability of discharging air and other non-condensable gases.
- Construction and working:
- steam trap is a disc or short solid pipe nipple with a small hole drilled through it installed at the lowest point of the equipment. Since steam condensate will collect at the lowest point and live steam is about 1200 times greater in volume than this hot liquid, condensate is effectively removed and steam is blocked. However, the vast majority of steam traps in current operation are of the mechanical or thermostatically operated design.
- Mechanical and thermostatic steam traps basically open when condensate and inert gases need to be removed, and close when there is only steam present.

❖Air Preheater

- An air preheater is a general term to describe any device designed to heat air before another process (for example, combustion in a boiler) with the primary objective of increasing the thermal efficiency of the process. They may be used alone or to replace a recuperative heat system or to replace a steam coil.



❖ Air preheater construction and working.

- Air preheater is installed between economiser and chimney. It consists of large number of tubes which are arranged in the path of the flue gases. Hot flue gases enters into the tube from the top of the shell and leaves from the bottom of the chimney. The inlet air at room temperature is admitted into the shell at the lower end with the help of fan. The air passes upward around the tubes in the opposite direction of the flow of the hot gases. Baffles are provided in the Air preheater. The soot hooper provided at the bottom is used to collect soot during cleaning operation of the tubes

THANK YOU