

enter the boiler drum. The steam vapour escape through the water to the upper half of the drum. The cold water flows from the drum to the rear header and thus the cycle is completed.

To get superheated steam, the steam accumulated in the steam space is allowed to enter into the superheater tubes which are placed above the water tubes. The flue gases passing over the flue tubes produce superheated steam. The steam thus superheated is finally supplied to the user through a steam stop valve.

Specification of Babcock and Willcox Bioler

Diameter of the drum : 1.22 m to 1.83 m

Length = 6.096 to 9.144 m

Size of water tubes = 7.62 to 10.16 cm

Size of superheater tube = 3.84 to 5.71 cm

Working pressure = 40 bar

Steaming capacity = 40,000 Kg/hr (Maximum)

Efficiency, η = 60 to 80%

3.17 BOILER MOUNTING

Boiler mountings are those machine components which are mounted over the body of the boiler itself for the safety of the boiler and for complete control of the process of steam generation. These mountings form an integral part of the boiler.

As per Indian Boiler Act, the following mountings are usually provided on the boiler:

- | | |
|--------------------------------|--------------------------|
| (i) Two water level indicators | (ii) Two safety valves |
| (iii) Fusible plug | (iv) Pressure gauge |
| (v) Steam stop valve | (vi) Feed check valve |
| (vii) Blow off cock | (viii) Man and mud holes |

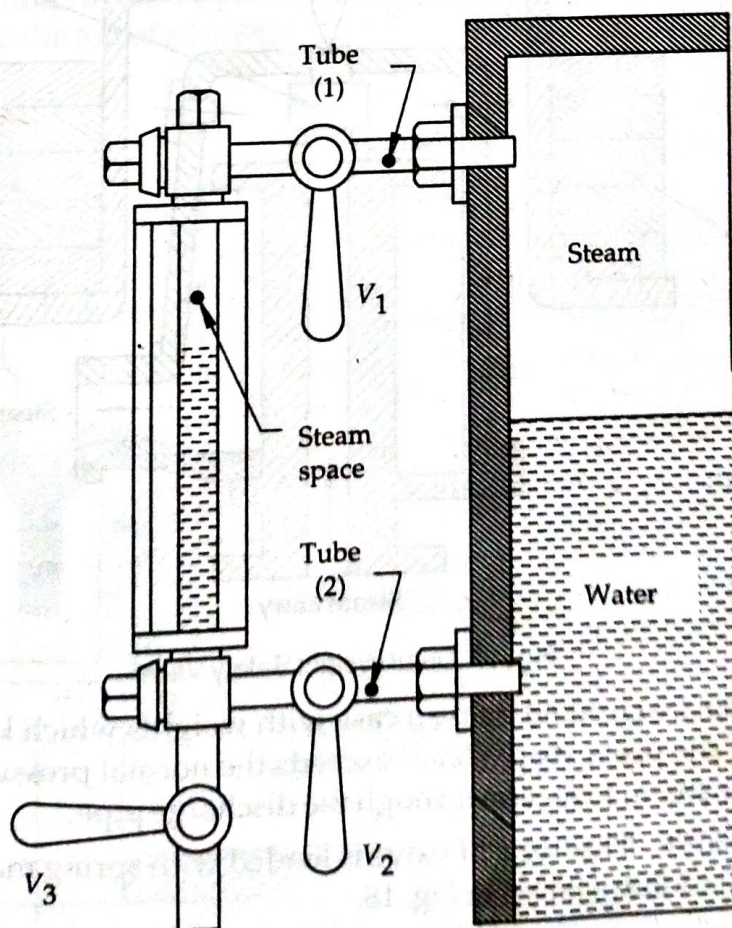


Fig. 16 Water Level Indicator

Among the above mountings water level indicator, safety valve and fusible plug are called safety fitting and the remaining are the control fittings.

3.17.1 Water Level Indicator

The function of the water level indicator is to show the level of water in the boiler.

Water level indicator is a device that indicates the water level inside the boiler and also acts as a safety device as shown in Fig. 16.

It consists of three valves and a glass tube. Steam valve V_1 connects the glass tube with the steam space and valve V_2 connects the glass tube with the water in the boiler. Drain valve V_3 is used at frequent intervals to check whether the steam and water valves are clear. If the glass tube is broken, two balls after V_1 and V_2 close the ends of the glass tube and protect water and steam from escaping. The glass tube can be easily replaced by closing the steam and water valve and opening the drain valve. The glass tube is kept free from leak by means of conical ring and the gland nut.

3.17.2 Safety Valve

Safety valves are the devices attached to the steam drums for preventing explosions due to excessive internal pressure of steam. The function of a safety valve is to release the steam when the pressure inside the boiler exceeds the design level.

The types of safety valves used are:

- | | |
|-------------------------------|--------------------------------------------|
| (i) Dead weight safety valve | (ii) Spring loaded safety valve |
| (iii) Lever safety valve, and | (iv) High steam and low water safety valve |

1. Dead weight safety valve: In this valve, the steam pressure in the upward direction is balanced the downward force of the dead weights acting on the valve.

The dead weight safety valve, made of gun metal is shown in Fig. 17.

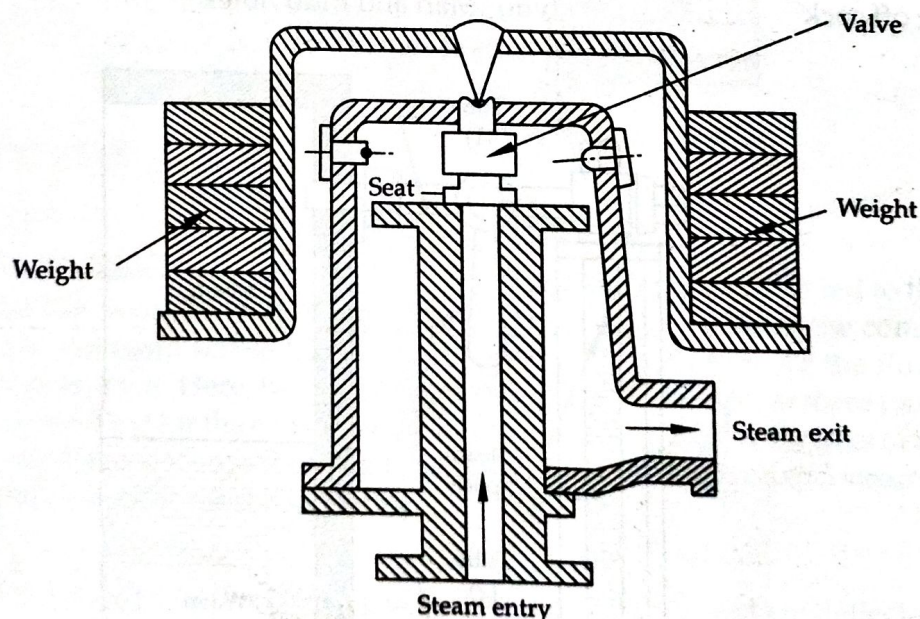


Fig. 17 Dead Weight Safety Valve

The valve and the pipe are covered using a case with weights which keep the valve on its seat under normal pressure. If the pressure of steam exceeds the normal pressure, the valve is lifted up from its seat and allows the steam to escape through the discharge pipe.

2. Spring loaded safety valve: This type of valve is loaded with spring made of steel rod in helical form placed under compression as shown in Fig. 18.

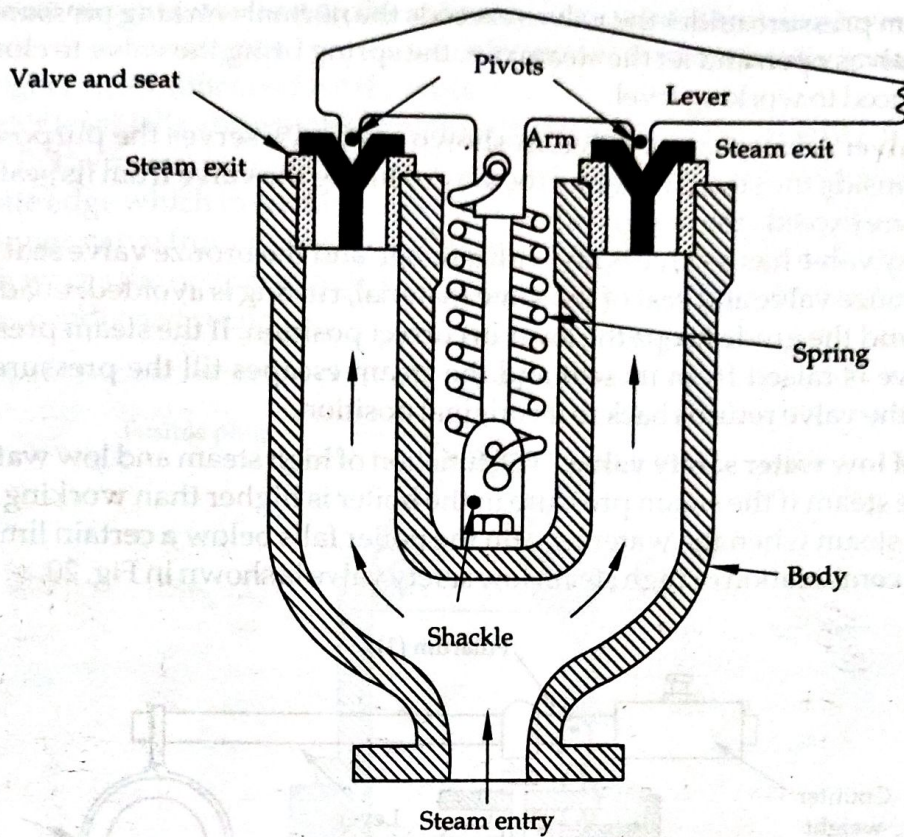


Fig. 18 Spring Loaded Safety Valve

It has a cast iron body connected at the top of a boiler. It is provided with two separate valves of same size with their seatings in the upper ends of two hollow valve chests united by a bridge and a base. The base is bolted to the top of a boiler.

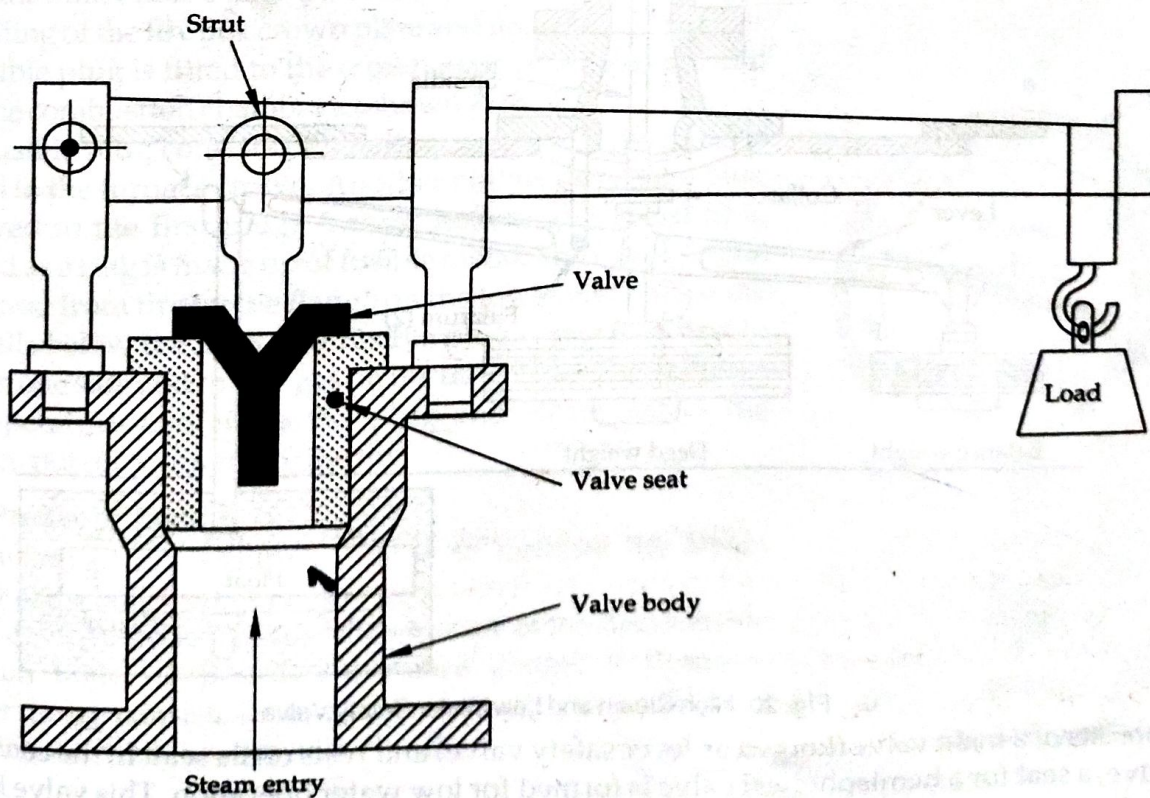


Fig. 19 Lever Safety Valve

When the steam pressure under the valves exceeds the normal working pressure and downward spring force, the valves open and let the steam out, the spring bring the valve to close position when the pressure is reduced to working level.

3. Lever safety valve: A lever safety valve, as shown in Fig. 19, serves the purpose of maintaining required pressure inside the steam boiler by the way of lifting the valve from its seat and blow off the steam when pressure exceeds the design valve.

The lever safety valve has a valve body with a flange and the bronze valve seat is screwed to the body. Using the bronze valve and seat of the same material, rusting is avoided. Load acts on the valve through the strut and the guide keeps the lever in correct position. If the steam pressure exceeds the safe limit, the valve is raised from its seat and the steam escapes till the pressure falls back to its normal value and the valve returns back to its original position.

4. High steam and low water safety valve: The function of high steam and low water safety valve is

- to blow off the steam if the steam pressure in the boiler is higher than working pressure.
- to blow of the steam when the water level in the boiler falls below a certain limit.

A best known combination of high steam low safety valve is shown in Fig. 20.

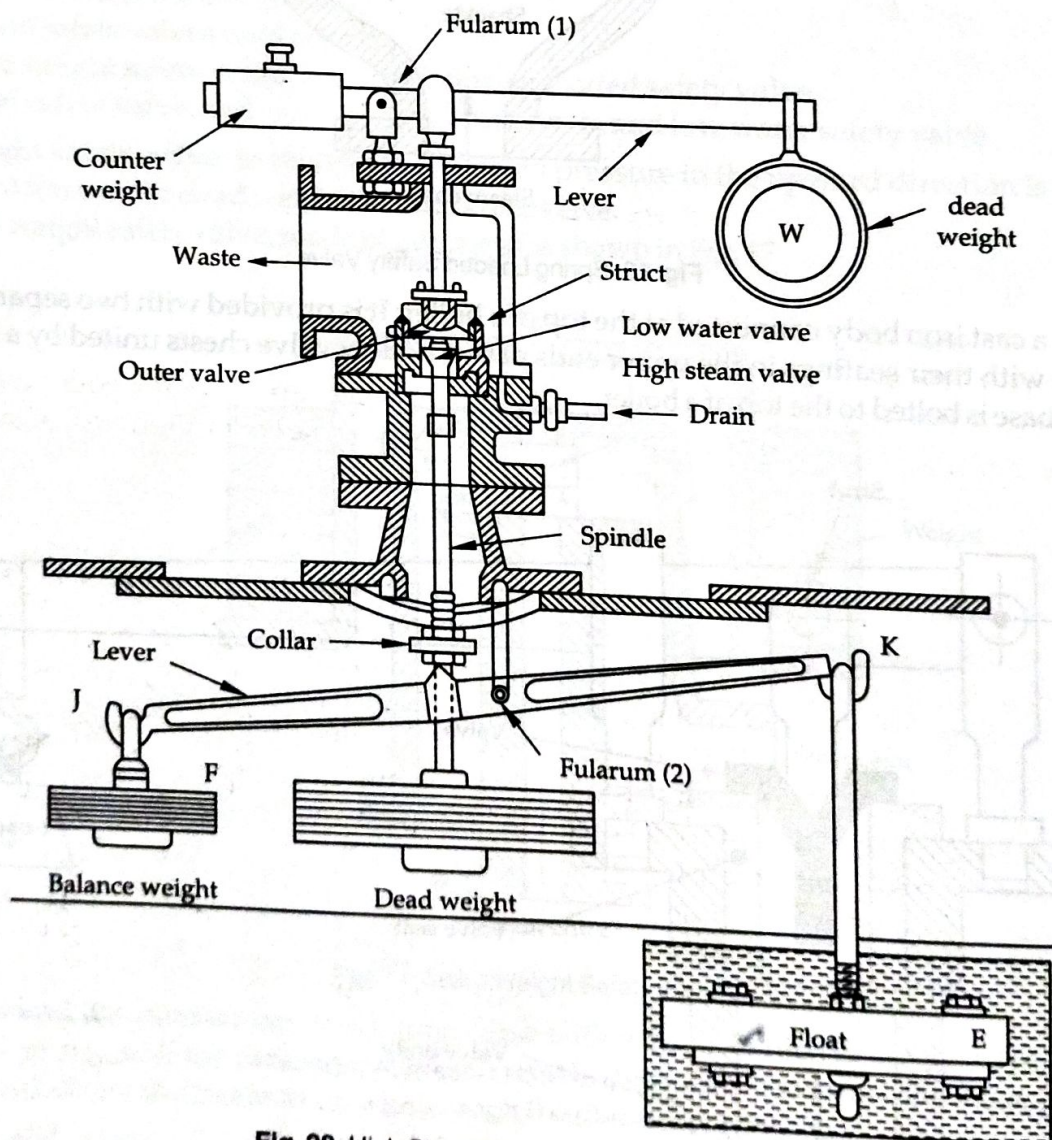


Fig. 20 High Steam and Low Water Safety Valve

It consists of a main valve (known as lever safety valve) and rests on its seat. In the centre of the main valve, a seat for a hemispherical valve is formed for low water operation. This valve is loaded

directly by the dead weights attached to the valve by a long rod. There is a lever *J-K*, which has its fulcrum at *K*. The lever has a weight *E* suspended at the end *K*. When it is fully immersed in water, it is balanced by a weight *F* at the other end *J* of the lever.

When the water level falls, the weight *E* comes out of water and the weight *F* will not be sufficient to balance weight *E*. Therefore, weight *E* comes down which tilts the lever to the right.

This has a knife edge which in contact with a collar of spindle. Due to tilting, it pushes the collar, thus raising the inner valve from its seat. Thus steam start escaping through the waste pipe with a loud noise, which warns the operator. A drain pipe is provided to carry water, which is deposited in the valve casing as condensed steam.

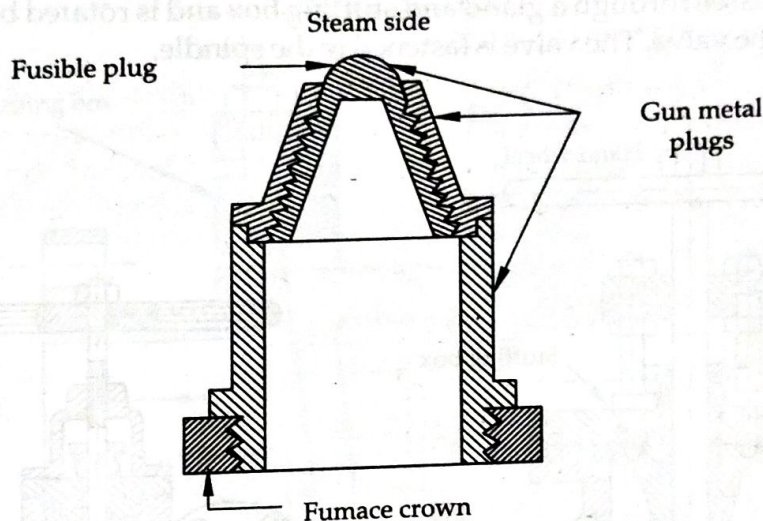


Fig. 21 Fusible Plug

3.17.3 Fusible Plug

The function of the fusible plug is to extinguish the fire in the furnace of the boiler when the water level in the boiler falls below the safe limit thereby preventing the boiler from explosion as a result of overheating of the fire box crown plate and fire tubes.

Fusible plug is fitted to the crown plate of the furnace and above the combustion chamber as shown in the Fig. 21.

A fusible plug consists of a hollow gun metal plug and is screwed to the furnace crown. Another hollow gun metal plug is screwed to the first plug. A third hollow gun metal plug extended as a ring is made up of fusible metal. The fusible metal is protected from fire by the flange on the lower end. When the water falls below the limit, the fusible plug is exposed first to steam on one side and to flue gas on the other side. This increase the temperature and melts the plug and steam enters the furnace to put off (extinguish) the fire.

3.17.4 Pressure Gauge

The function of a pressure gauge is to indicate the steam pressure of the boiler in bar gauge.

The device used to measure the pressure of the steam inside the steam boiler is Bourden pressure gauge. A Bourden pressure gauge consists of an elliptical elastic tube *ABC* bent into an arc of a circle, as shown in Fig. 22.

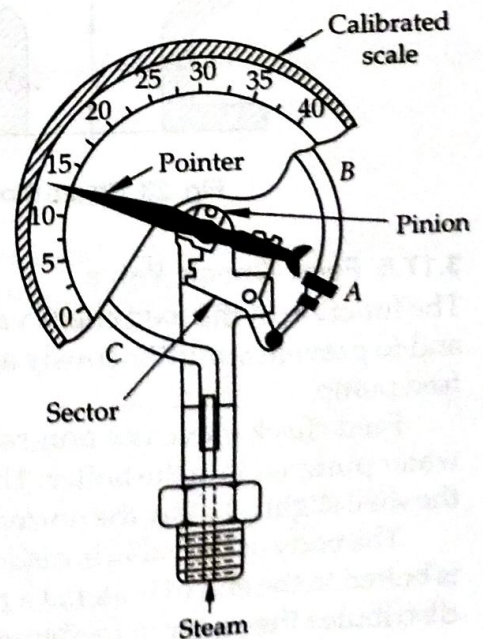


Fig. 22 Pressure Gauge

One end of the tube is fixed and connected to the steam space in the boiler and the other end is connected to a sector through a link. The steam flows into the tube and increase the pressure. The tube tends to straighten itself to become circular and the pinion and sector arrangement rotates a pointer. The pointer moves over a calibrated scale to show the gauge pressure.

3.17.5 Steam Stop Valve

The functions of a steam stop valve (shown in Fig. 23) are:

- (i) to control the flow rate of steam from the boiler
- (ii) to shut off the steam flow completely if required.

Body of the stop valve is made of cast iron or cast steel and the valve, valve seat are made of gun metal. The spindle passes through a gland and stuffing box and is rotated by means of a hand wheel to open and close to the valve. The valve is fastened to the spindle.

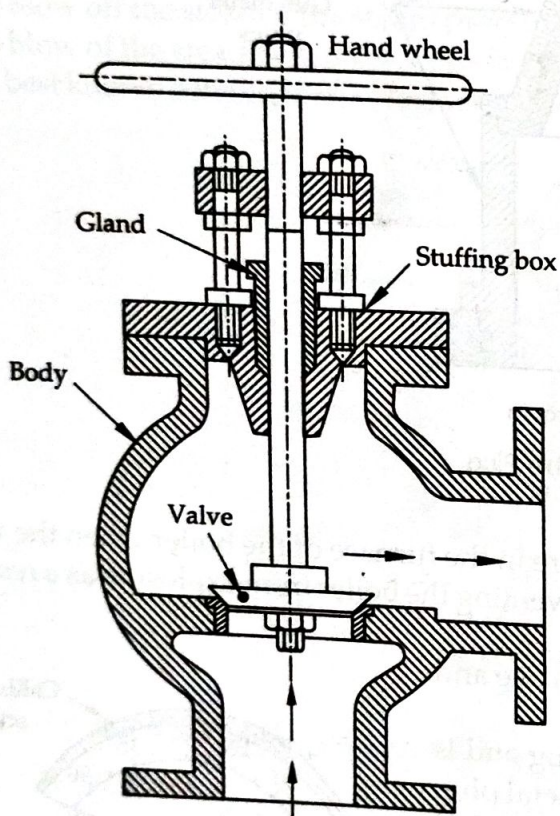


Fig. 23 Steam Stop Valve

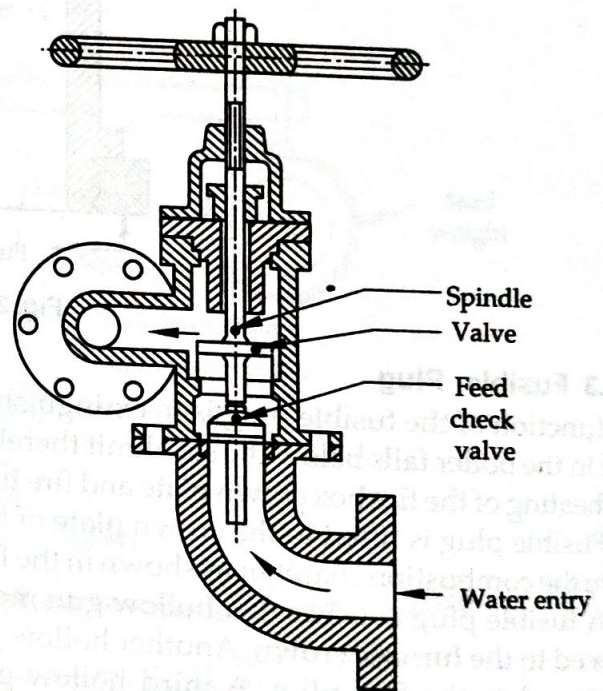


Fig. 24 Feed Check Valve

3.17.6 Feed Check Valve

The function of the feed check valve is to allow the feed water under pressure to pass into the boiler and to prevent simultaneously any water escaping back from the boiler in the event of failure of the feed pump.

Feed check valve is a non-return valve, fitted with a screwed spindle to regulate the supply of water pumped into the boiler. This valve has its spindle lifted before the pump starts and is fitted to the shell slightly below the normal water level of the boiler as shown in Fig. 24.

The body of the valve is made of brass casting and the spindle is made of muntz metal. The flange is bolted to the end of boiler at a point from which perforated pipe leads the feed water and this pipe remains closed due to the back pressure of water and does not allow water to flow back to the pump side.

3.17.7 Blow-off Cock

The functions of a blow-off cock (shown in Fig. 25) are:

- (i) to empty the boiler if required
- (ii) discharge the mud and scale accumulated at the bottom of the boiler.

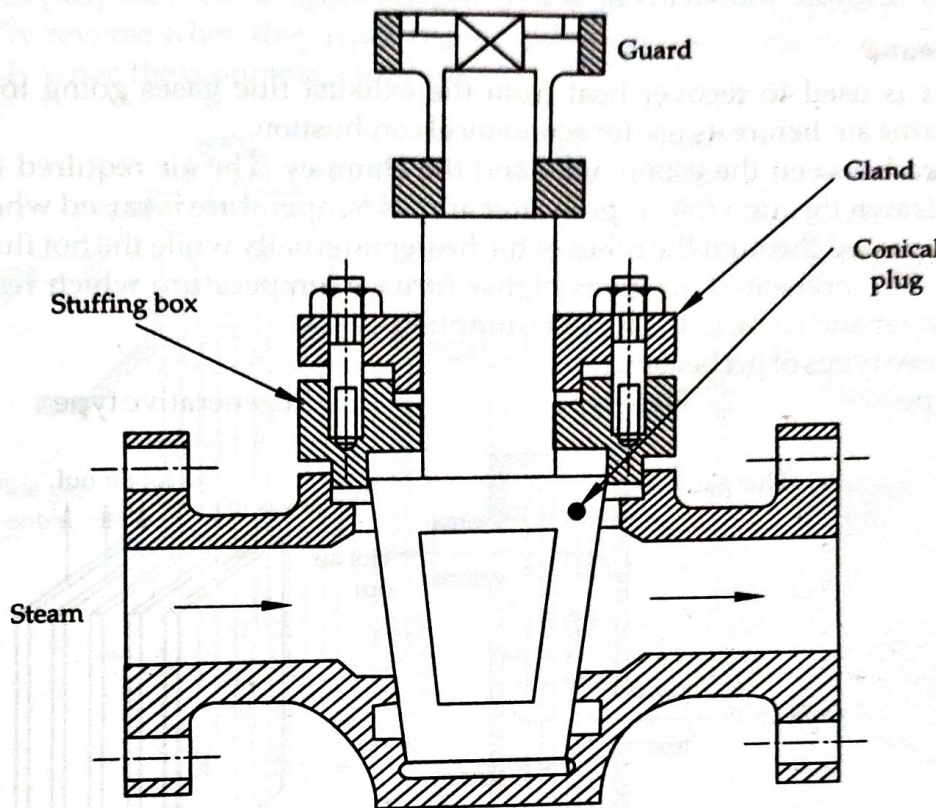


Fig. 25 Blow-off Cock

The cock is fitted to the bottom of a boiler drum and consists of a conical plug fitted to the body. The plug stem passes through a gland and stuffing box. There are two vertical slots on the inside of a guard for the box spanner to be used for operating the cock.

3.17.8 Man Hole

The function of man hole is to provide an opening through which a man can enter a boiler for cleaning and inspection purposes.

The man hole is provided on the boiler shell at a convenient place.

3.18 BOILER ACCESSORIES

These are those machine components which are installed either inside or outside the boiler to increase the efficiency of the plant and or to help in the proper working of the plant.

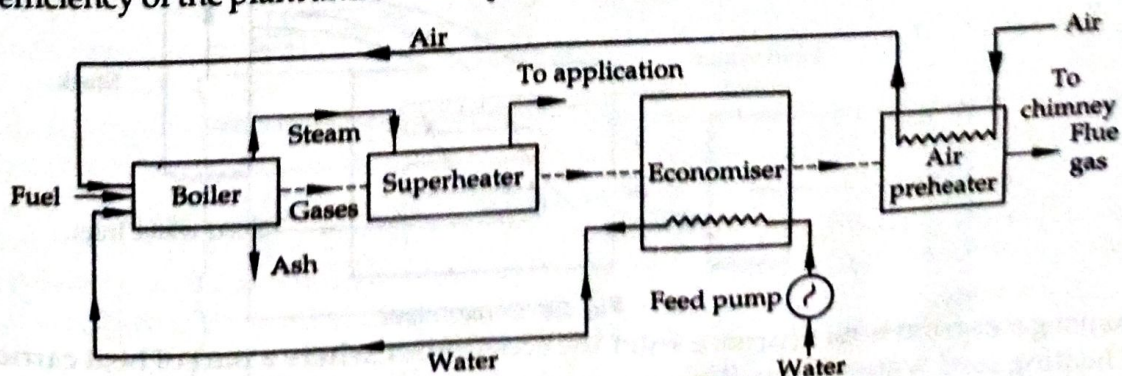


Fig. 26 Boiler Accessories