



Experiment No: 4

TITLE:- Study the working and function of mountings and accessories in boilers.

APPARATUS: - Model of mountings and accessories parts in boilers.

THEORY:-

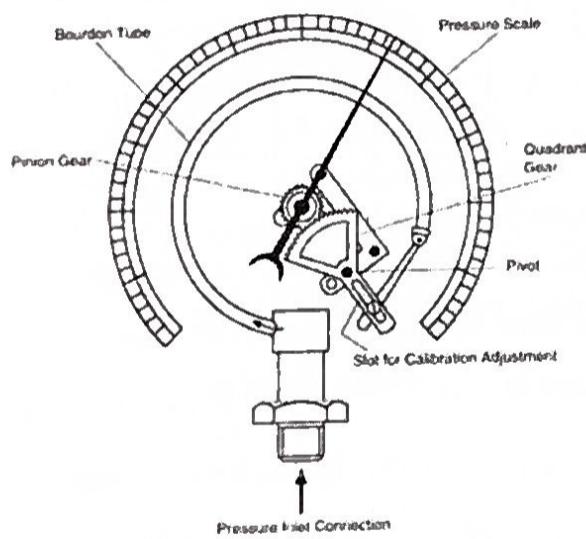
Boiler: - A steam boiler is a closed vessel in which steam is produced at pressure from water by combustion of fuel.

BOILER MOUNTINGS: -

The components which are fitted on the surface of the boiler for complete safety and control of steam generation process are known as boiler mountings. The following are the various important mountings of a boiler.

Pressure Gauge- It is usually mounted on the front top of the boiler shell. It is mounted on each boiler to show the pressure of the steam. Its dial is graduated to read the pressure in Kilograms per sq. centimeter. Bourdon's pressure gauge is commonly used as shown in Fig. The essential elements of this gauge are the elliptical spring tube which is made of bronze and is solid drawn. One end of this tube is attached by lines to a toothed quadrant and the other end is connected to a steam space.

The C-Type Bourdon-Tube Pressure Gauge



Safety Valves- They are needed to blow off the steam when pressure of the steam in the boiler exceeds the working pressure. These are placed on the top of the boiler. There are four types of safety valves:

1. Dead weight safety valve
2. Lever safety valve
3. Spring loaded safety valve
4. Low water high steam safety valve



Spring loaded safety valve- A spring loaded safety valve is mainly used for locomotives and marine boilers. In this type the valve is loaded by means of a spring, instead of dead weight. A spring loaded safety valve is as shown in the Fig.

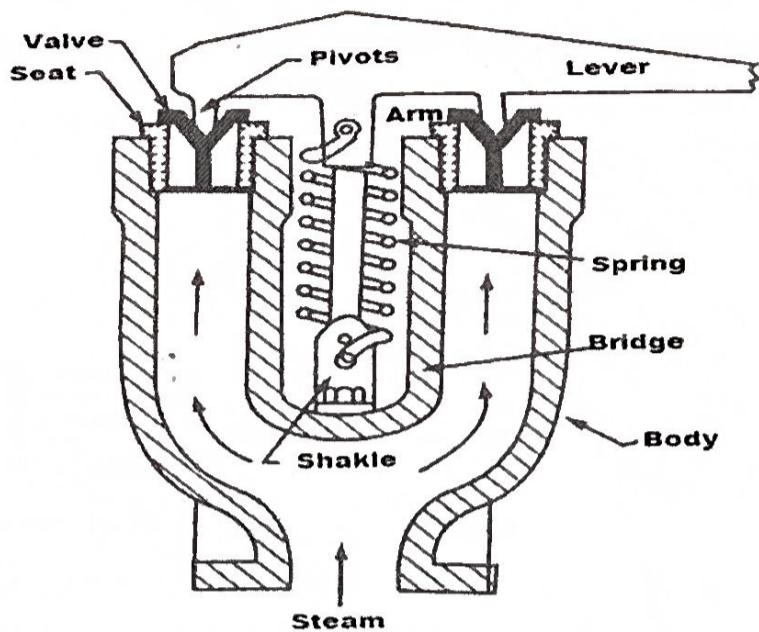


Figure- Spring Loaded Safety Valve

It consists of two valves, resting on their seats. Valve seats are mounted on the upper ends of two hollow valve chests, which are connected by a bridge. The lower end of these valves chests have common passage which may be connected to the boiler. There is a lever which has two pivots, one of which is integral with it and the other is pin jointed to the lever. This pivot rests on the valves and forces them to rest on their respective seats with the help of a helical spring.

Feed Check Valve- A feed check valve is shown in Fig. The function of the feed check valve is to allow the supply of water to the boiler at high pressure continuously and to prevent the back flow the boiler when the pump pressure is less than boiler pressure or when pump fails. Feed check valve is fitted to the shell slightly below the normal water level of the boiler.

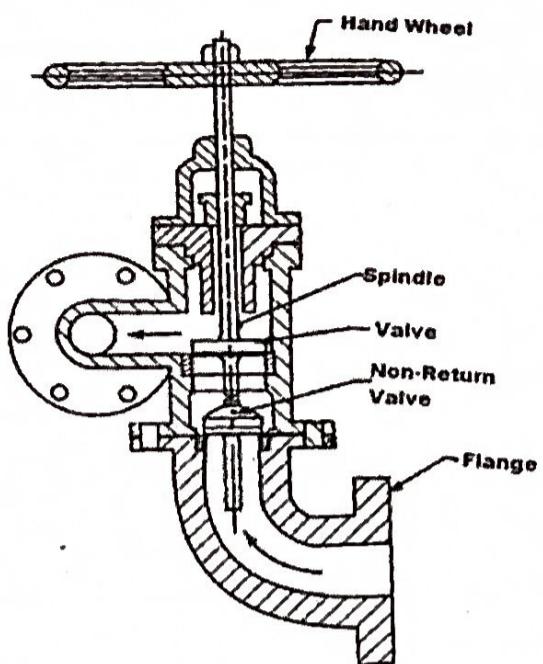


Figure- Feed Check Valve

Fusible Plug- It is fitted to the crown plate of the furnace of the fire. The function of fusible plug is to extinguish the fire in the fire box, when water level in the boiler comes down the limit and it prevents from blasting the boiler, melting the tube and over heating the fire-box crown plate. A fusible plug is shown in fig. It is located in water space of the boiler. The fusible metal is protected from direct contact of water by gun metal plug and copper plug. When water level comes down, the fusible metal melts due to high heat and copper plug drops down and is held by gun metal ribs. Steam comes in contact with fire and distinguishes it. Thus it prevents boiler from damages.

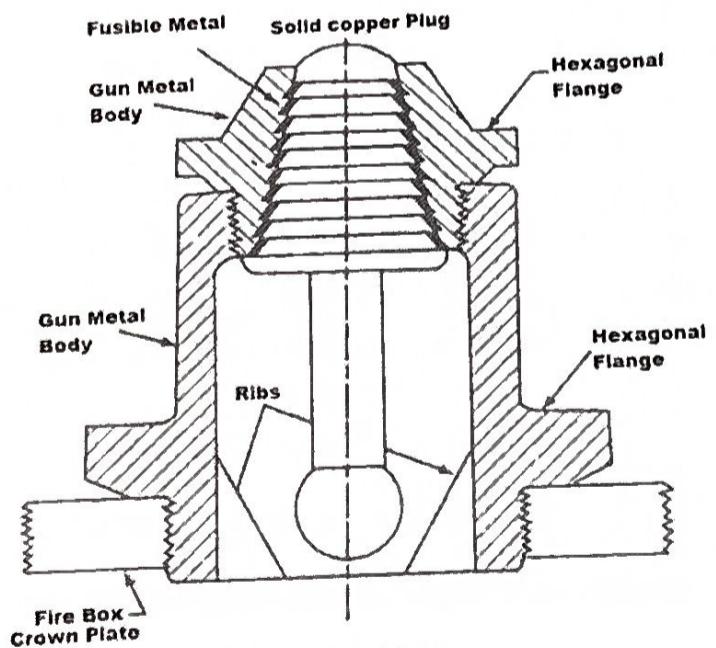


Figure- Fusible Plug

Blow Off Cock- The blow off cock as shown in fig., is fitted to the bottom of a



boiler drum and consists of a conical plug fitted to body or casing. The casing is packed, with asbestos packing, in grooves round the top and bottom of the plug. The asbestos packing is made tight and plug bears on the packing. Blow off cock has to principle function are:

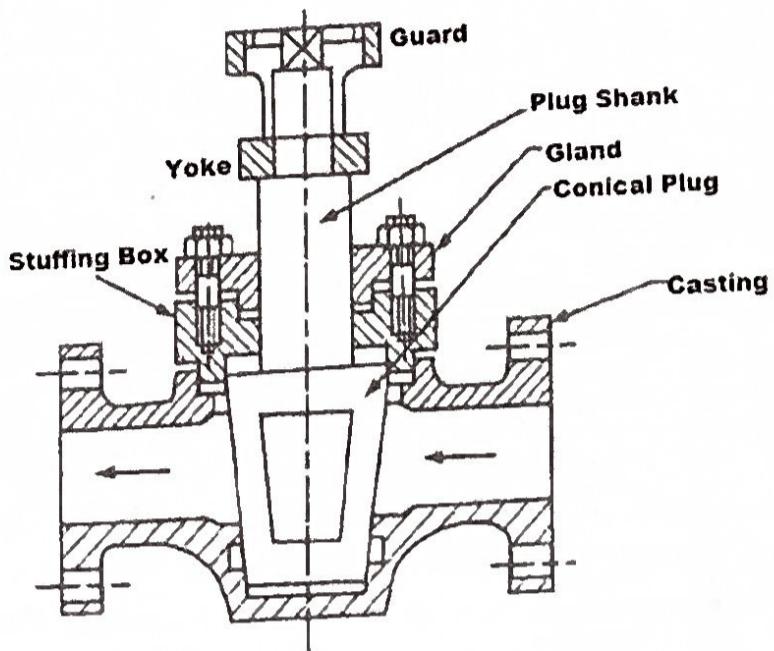


Figure- Blow Off Cock

1. To empty the boiler whenever required.
2. To discharge the mud, scale or sedimentation which are accumulated at the bottom of the boiler.

Water Level Indicator- It is an important fitting, which indicates the water level inside the boiler to an observer. It is a safety device, up on which the correct working of the boiler depends. This fitting may be seen in froth of the boiler, and are generally two in number. The upper end of the valve opens in steam space while the lower end opens in the water. The valve consists of a strong glass tube. The end of the tube pass through stuffing boxes formed in the hollow casting. These casting are flanged and bolted to the boiler. It has three cocks; two of them control the passage between the boiler and glass tube, while the third one (the drain cock) remains closed.

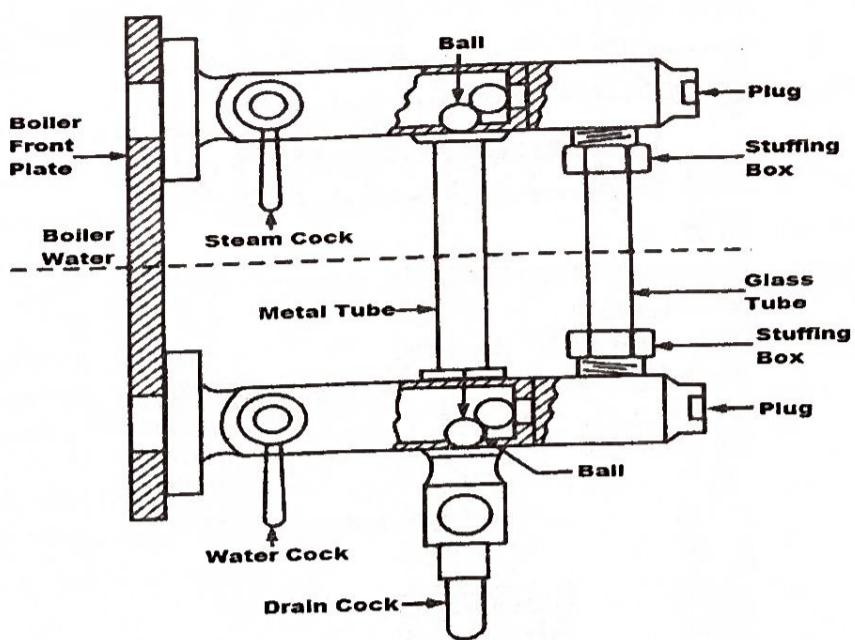


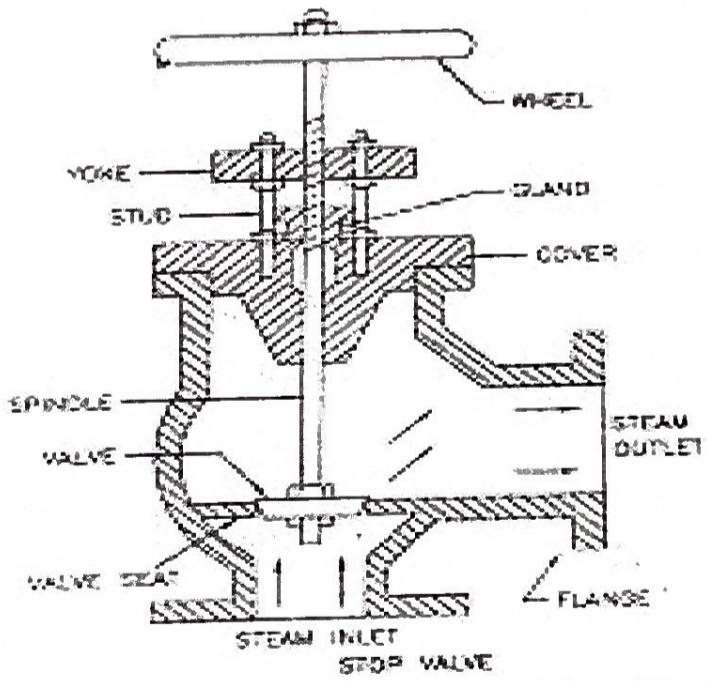
Fig. Water Level Indicator

Steam Stop Valve- A valve placed directly on a boiler and connected to the steam pipe which carries steam to the engine or turbine is called stop valve or junction valve. It is the largest valve on the steam boiler. It is, usually, fitted to the highest part of the shell by means of a flange as shown in fig.

The principal functions of a stop valve are:

1. To control the flow of steam from the boiler to the main steam pipe.
2. To shut off the steam completely when required.

The body of the stop valve is made of cast iron or cast steel. The valve seat and the nut through which the valve spindle works, are made of brass or gun metal.





BOILER ACCESSORIES:

The appliances installed to increase the efficiency of the boiler are known as the boiler accessories. The commonly used accessories are:

Economiser- Economiser is a one type of heat exchange which exchanges the some parts of the waste heat of flue gas to the feed water. It is placed between the exit of the furnace and entry into the chimney. Generally economiser is placed after the feed pump because in economiser water may transfer into vapour partially, which creates a priming problem in feed pump water into the boiler drum. If economiser is used before feed pump it limits the temperature rise of water. As economiser is shown in fig. It consists of vertical cast iron tubes attached with scraper. The function of scraper is to remove the root deposited on the tube, mechanically.

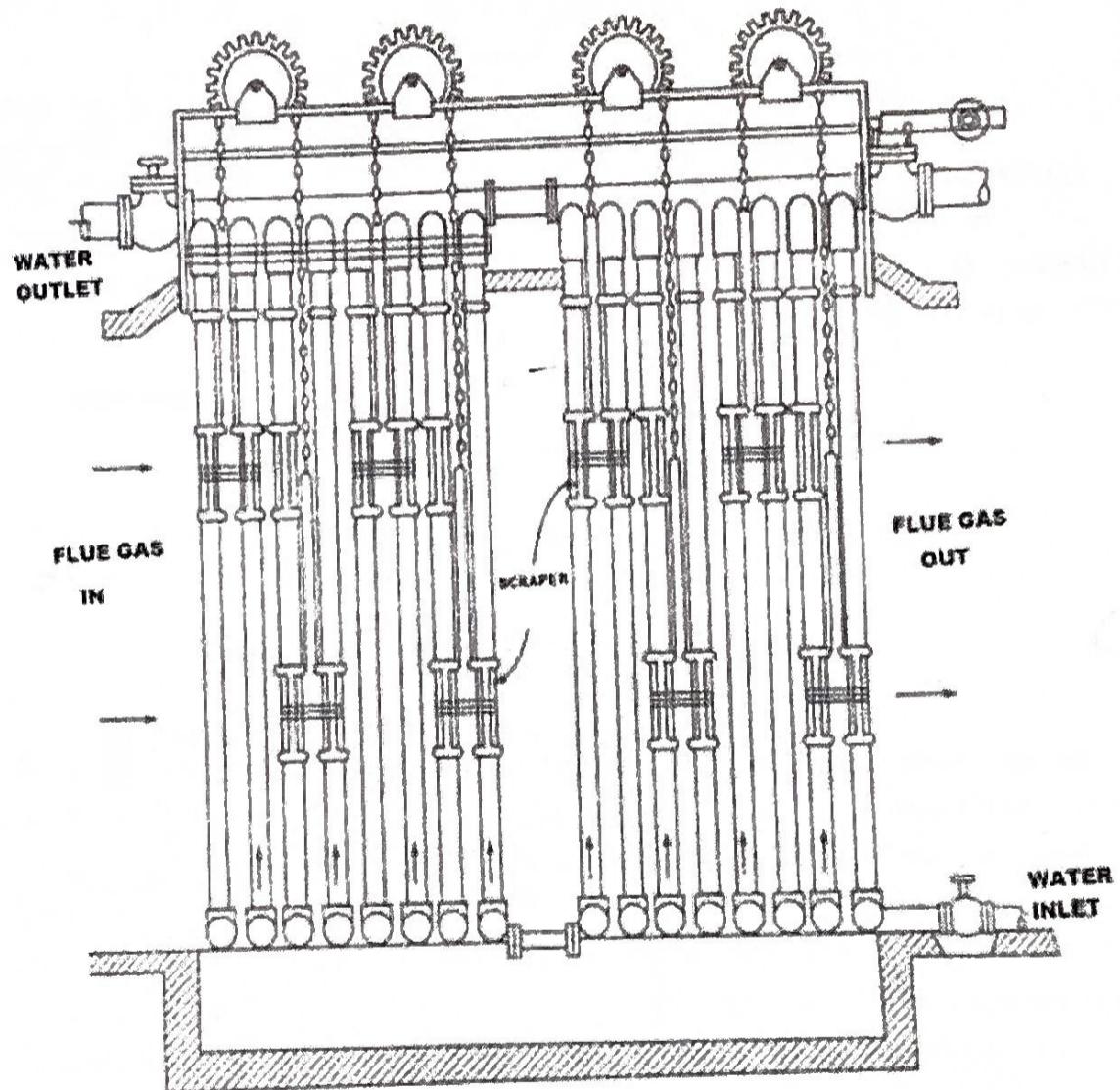


Figure- Economiser



Steam Injector- An injector is a device which is used to lift and force water into a boiler i.e. operating at high pressure. It consists of a group of nozzles, so arranged that steam expanding in these nozzles imparts its kinetic energy to a mass of water. There are many advantages of using injector such as they occupy minimum space, have low initial costs and maintenance cost. Though the steam required to operate the injector is much more than that in the feed pump for an equivalent duty; the injector has the advantage that practically the whole of the heat of the steam is returned back to the boiler.

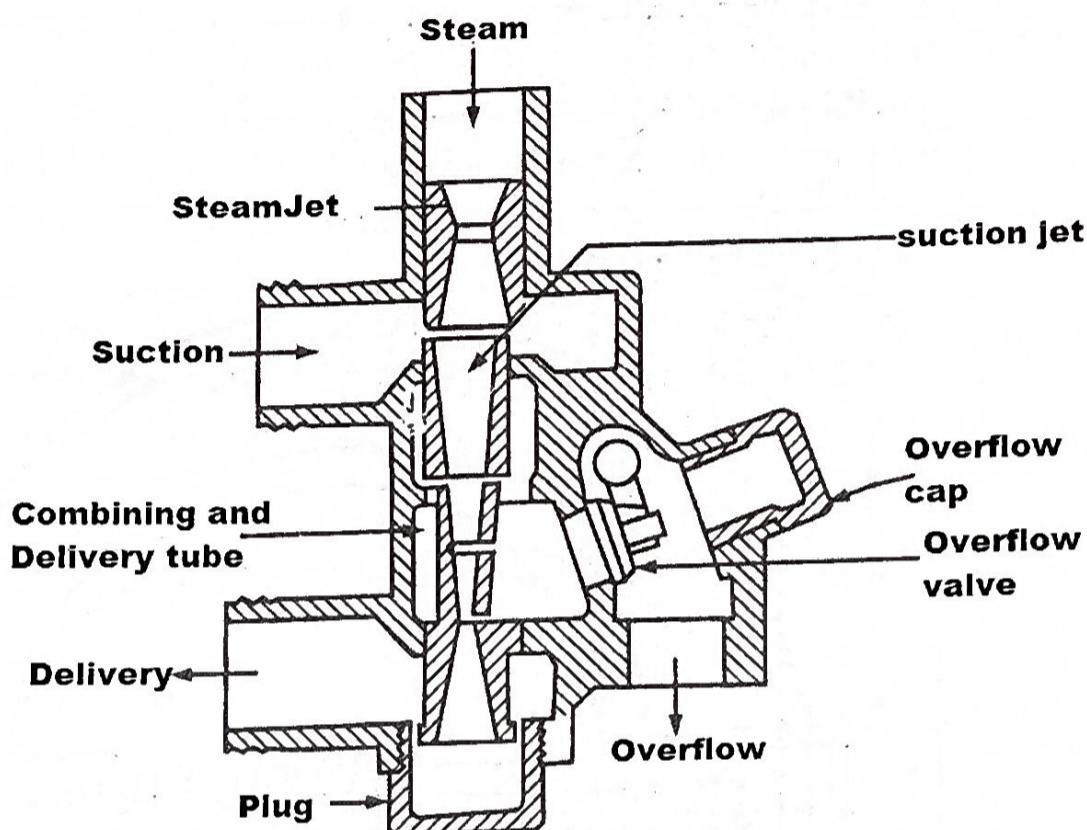


Figure- Injector

Super Heater- An element of steam generating unit in which the steam is super heated, is known as super heater. A super heater is used to increase the temperature of saturated steam at constant pressure. It is usually placed in the path of hot flue gases and heat of the flue gases is first used to superheat the steam as shown in figure. The steam enters in the down-steam tube and leaves at the front header. The overheating of super heater tube is prevented by the use of a balanced damper which controls the flue gas. Steam consumption of turbine is reduced by about 1% for each 5.5°C of superheat.

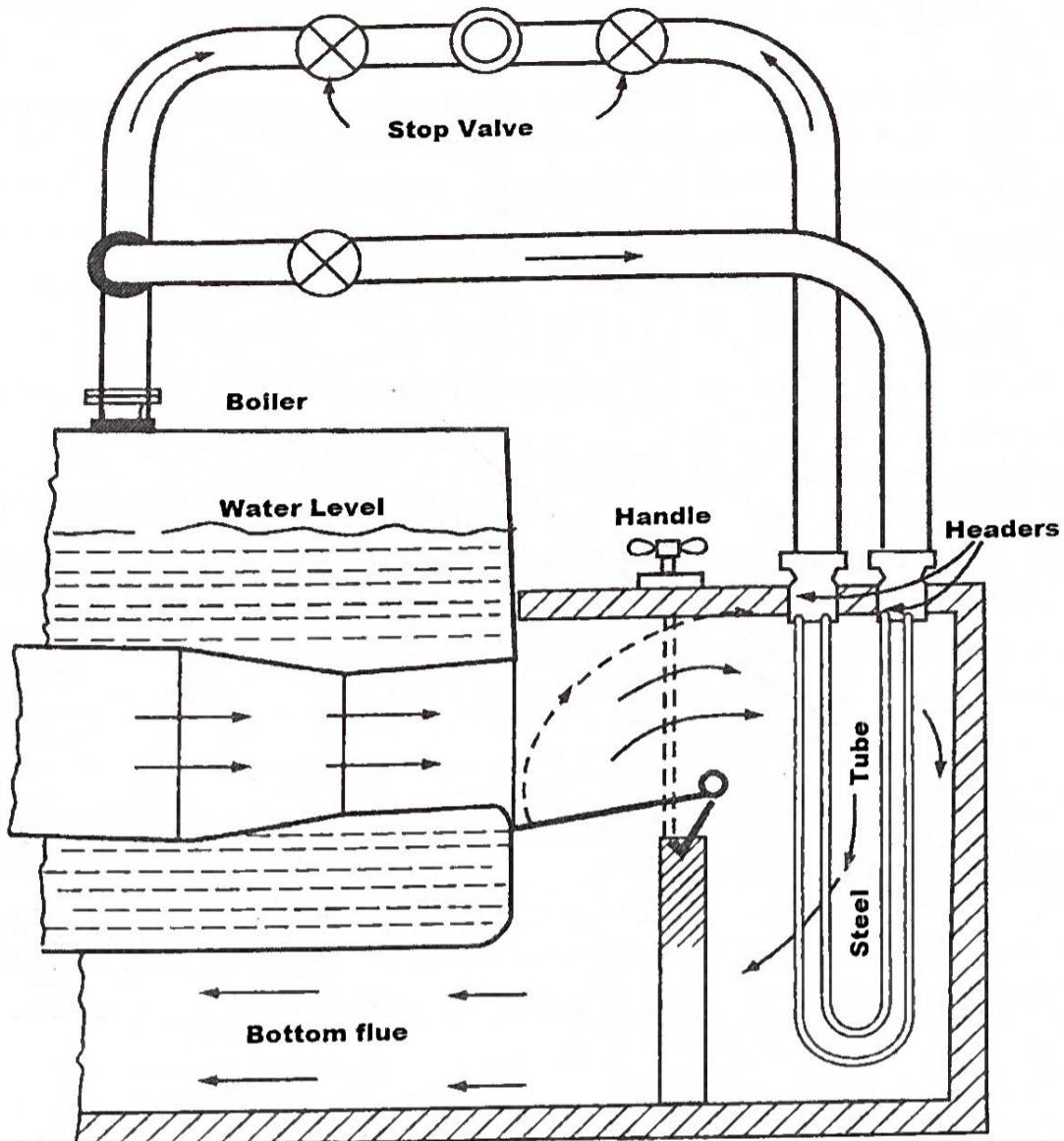


Fig. Super Heater

Feed Pump- The function of the feed pump is to pump the feed water to the boiler. The pumps may be rotary or reciprocating. The rotary pump is generally of high speed centrifugal type. They are driven by small steam turbine or by electric motor and are used when large quantity of water is to be supplied to boiler. The reciprocating pumps may be single or double acting. The most commonly used form of independent reciprocating feed pump is that in which the steam cylinder is directly connected to the rod or to the piston of the water cylinder.

Air Pre-heater- The function of air pre-heater is to increase the temperature of air before it enters the furnace. It is installed between the economiser and the chimney. The air required for the purpose of combustion is drawn through the air pre-heater and its temperature is raised when passed through ducts. The preheated air gives higher furnace temperature which results in more heat transfer to the water and reduces the fuel consumption. There are three types of pre-heaters:

