RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

- A Boiler is a closed metallic vessel - generates the steam at desired pressure & tempereature from water by application of heat.

Why steam?

In the Industries :

Hospitals & Healthcare Facilities, Breweries & Distilleries, Food & Beverage Processing Plants, Commercial Laundry Facilities, Textile Manufacturing, Automotive, Manufacturing, indoor heating

Steam is used for:

Electricity generation, cleaning, dyeing, Propulsion /Drive, Moisturization & humidification (indoor heating).

RAMAIAH
Institute of Technology

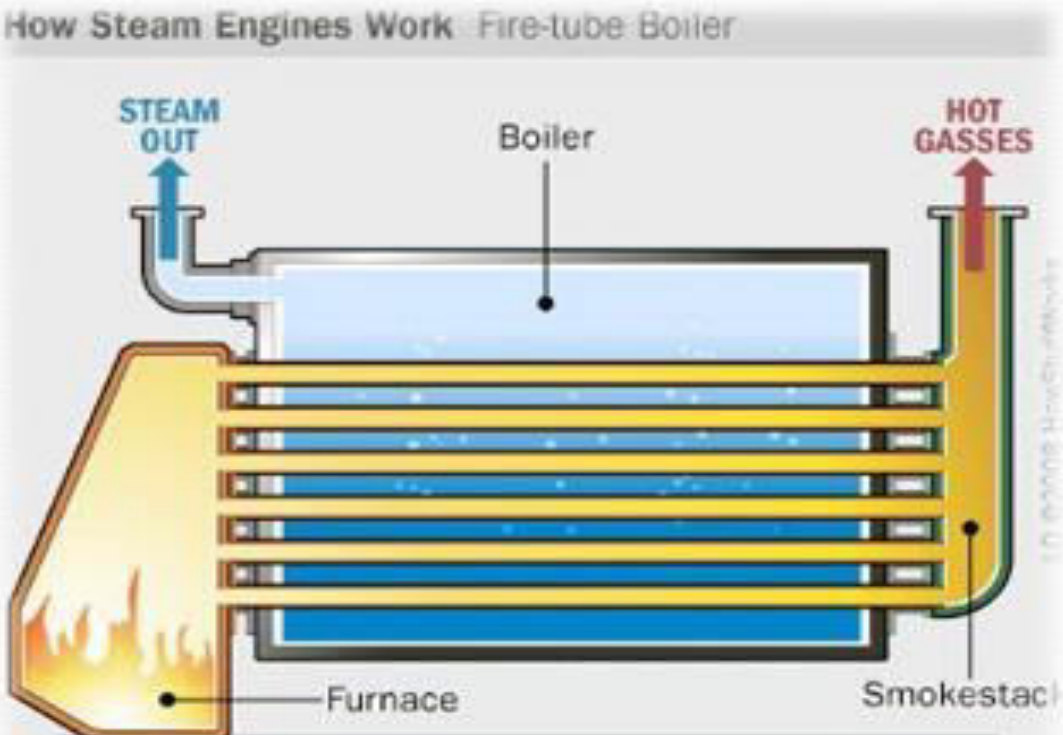
BOILERS

MECHANICAL ENGINEERING

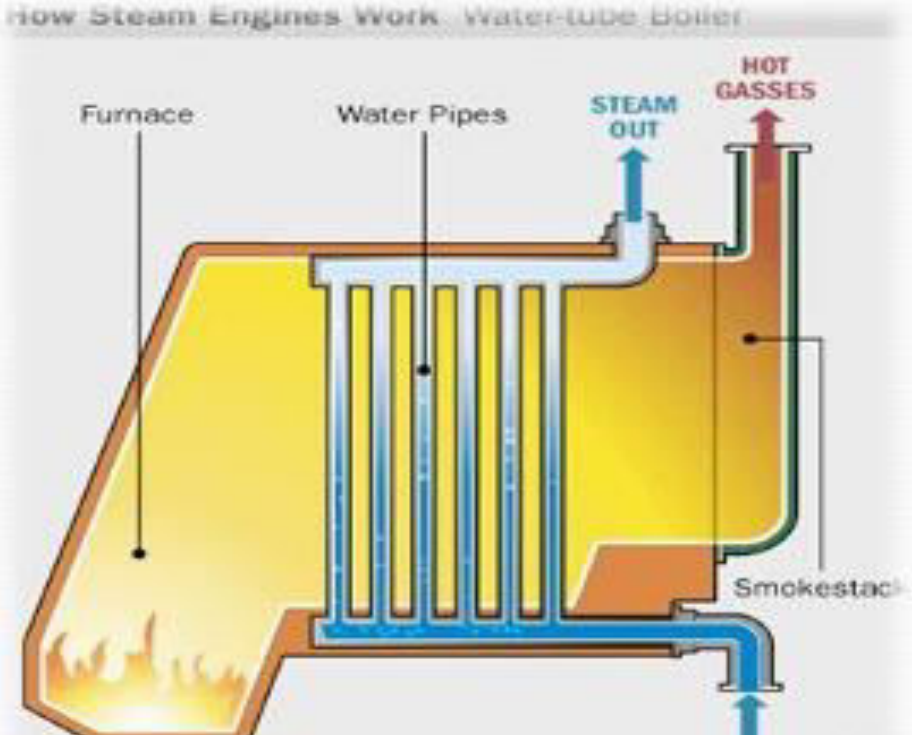
Classification of boilers

1. According to the circulation of water & hot gases

➢ Fire tube boiler.



➢ Water tube boiler.



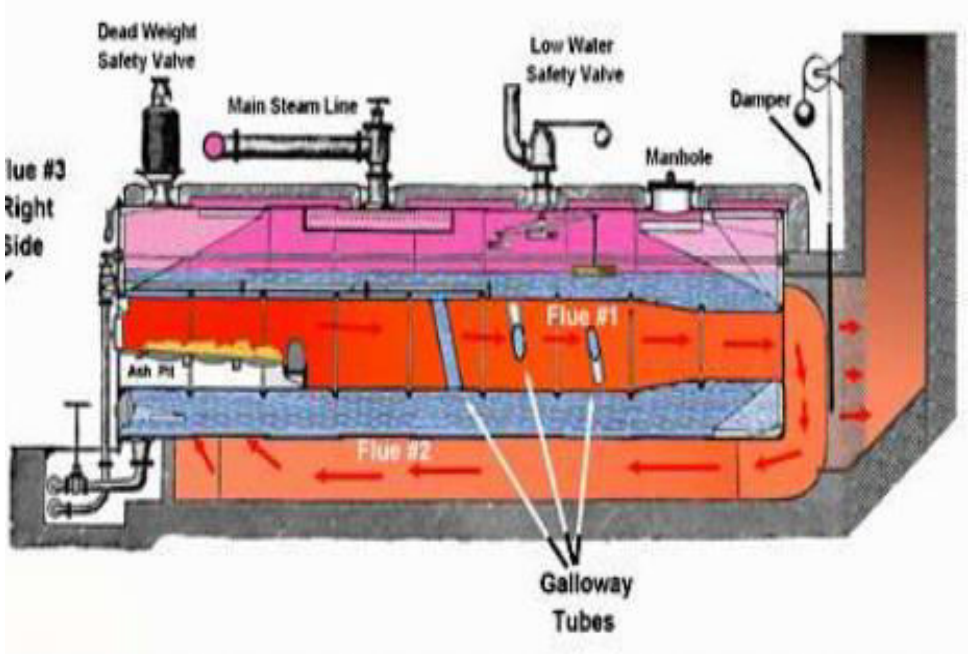
RAMAIAH
Institute of Technology

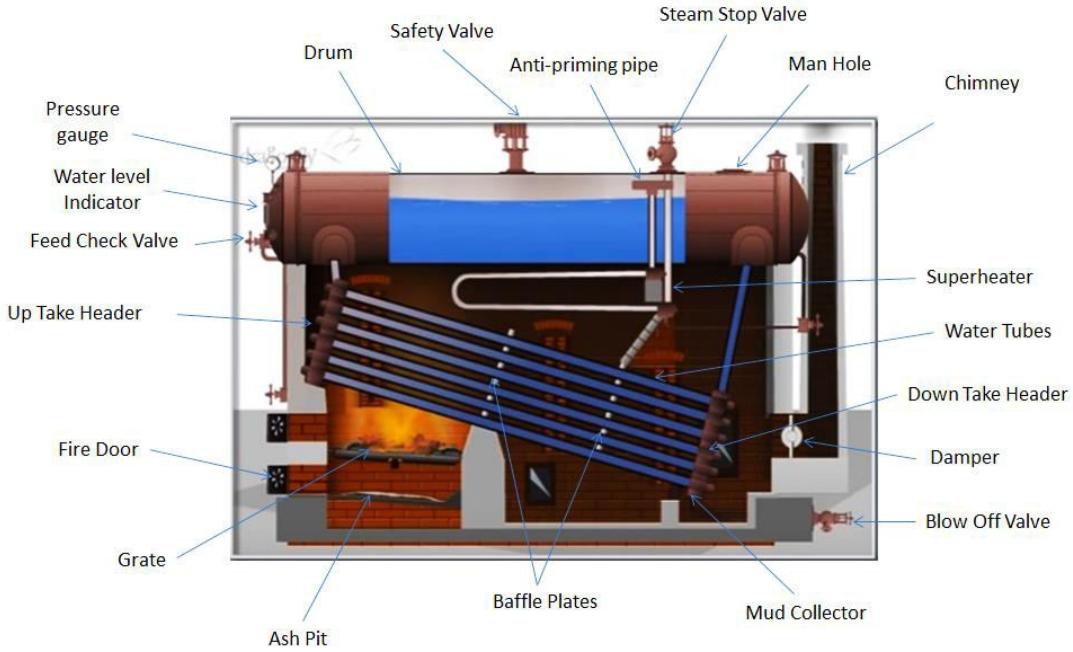
BOILERS

MECHANICAL ENGINEERING

Classification of boilers

1. According to the circulation of water & hot gases





RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Classification of boilers

2. According to the location of furnace

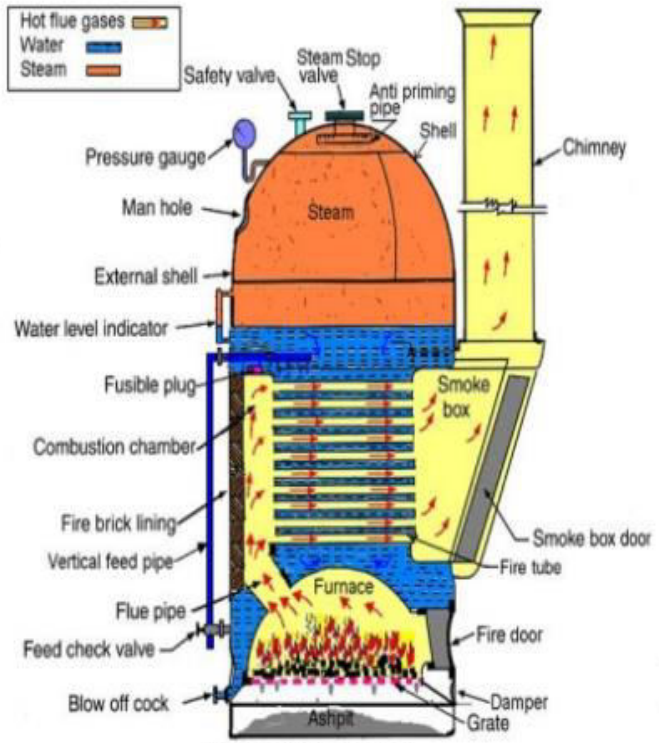
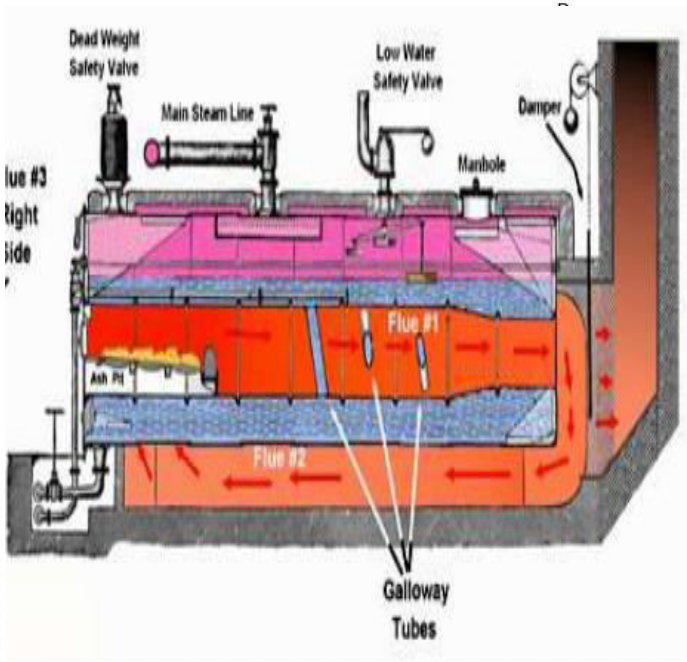
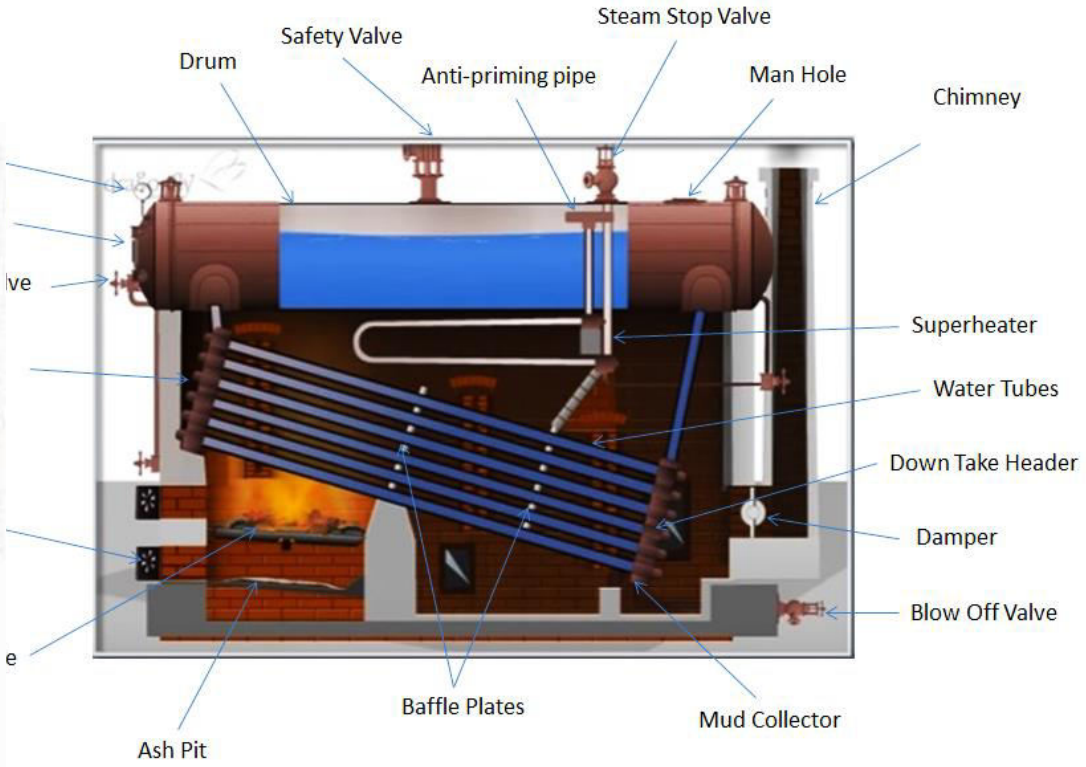


Fig: Cochran Boiler



Pramod Kathamore



RAMAIAH Institute of Technology

BOILERS

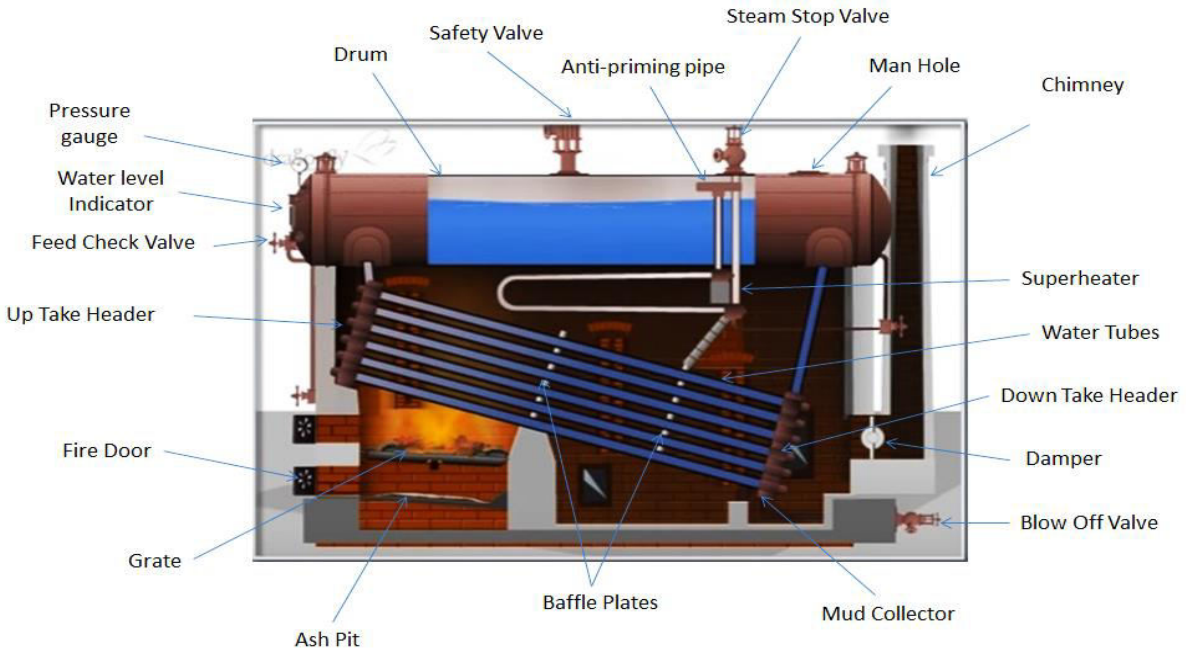
MECHANICAL ENGINEERING

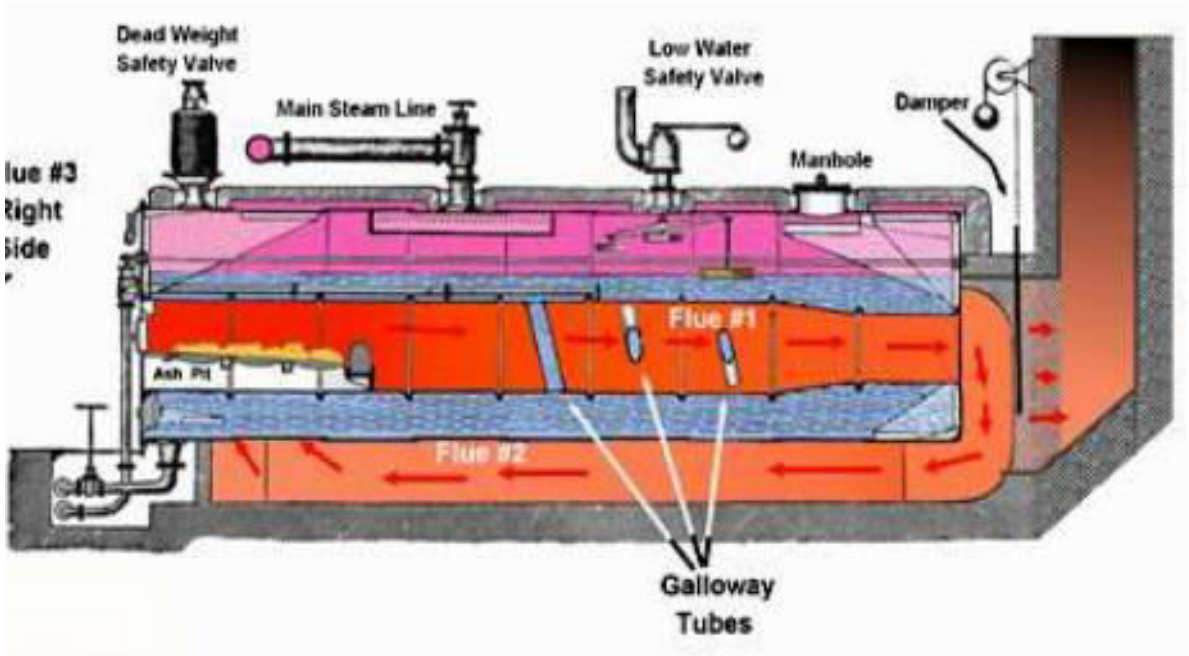
Classification of boilers

3. According to the circulation of water :

Natural - Circulation of water due to temperature difference – all low pressure boilers

Forced circulation - Circulation of water using pumps – all high pressure boilers





BOILERS

Classification of boilers

4. According to the axis of boiler shell or drum

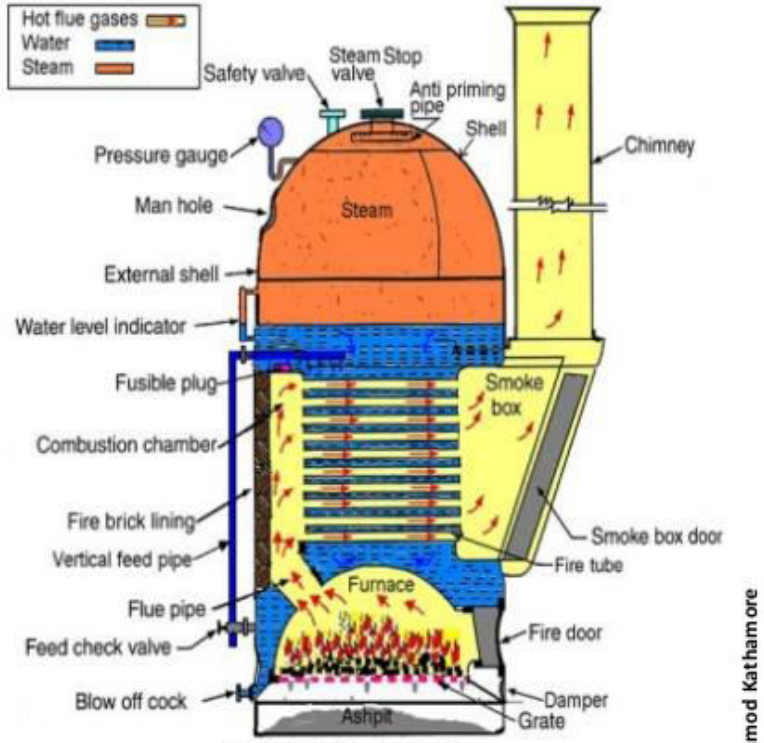
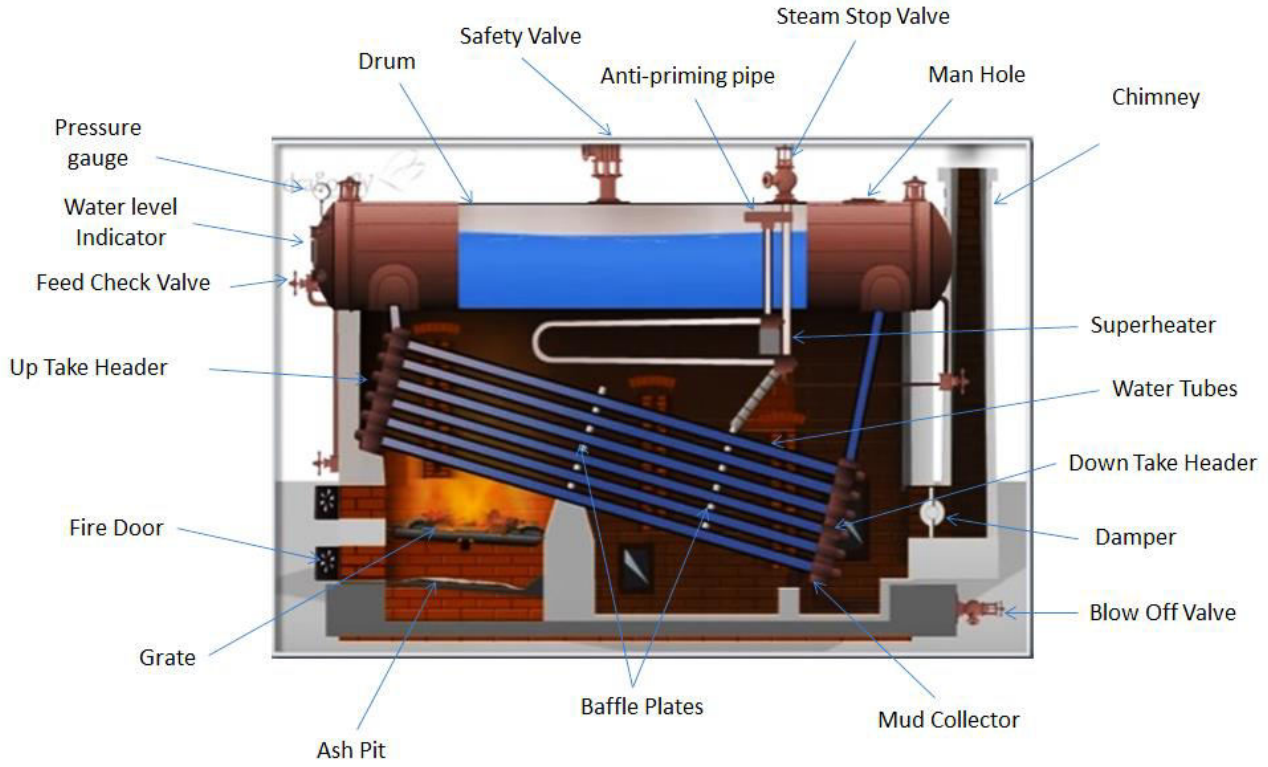


Fig: Cochran Boiler



RAMAIAH Institute of Technology

BOILERS

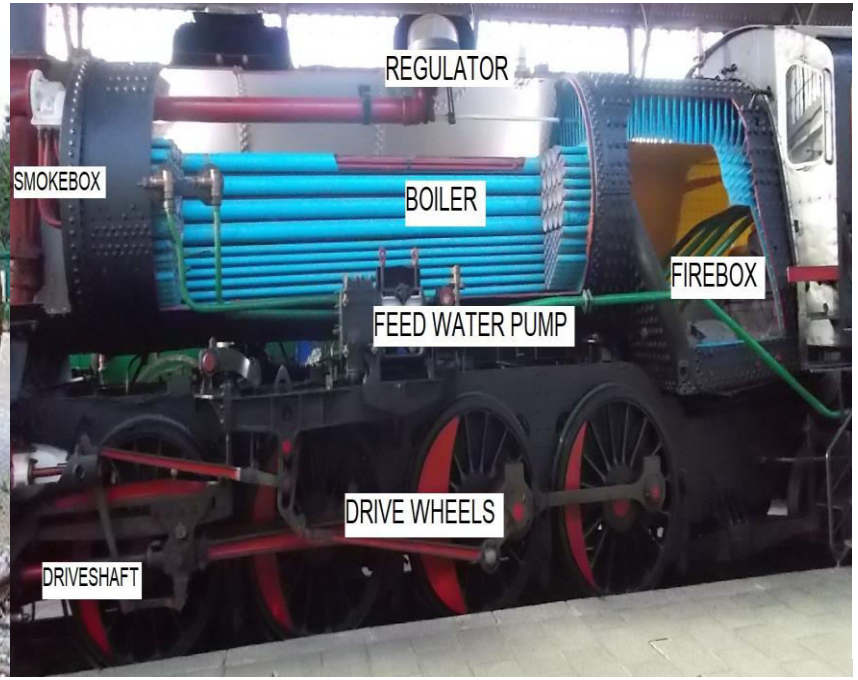
MECHANICAL ENGINEERING

Classification of boilers

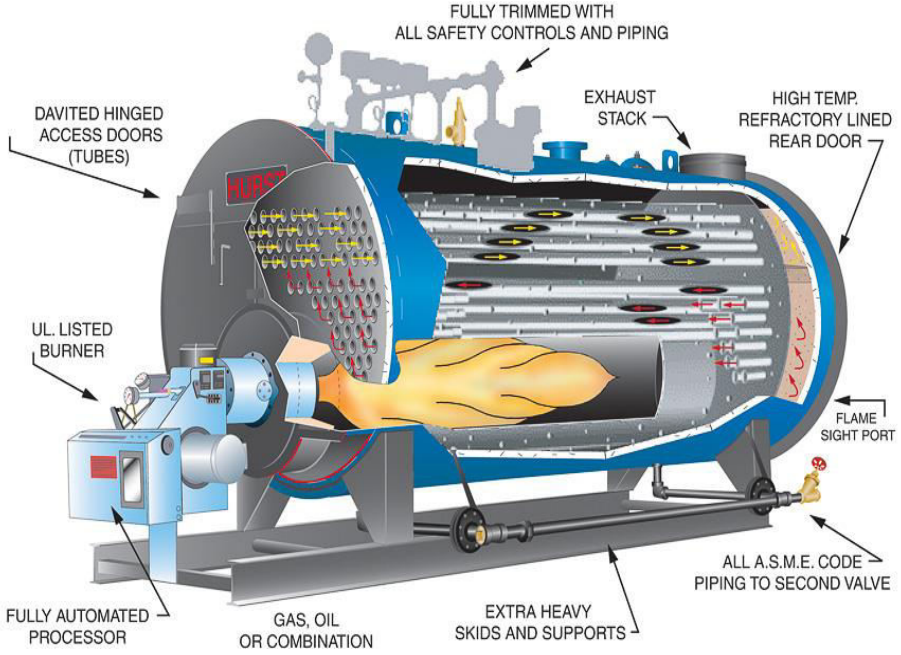
5. According to their uses

Stationary Boilers (Lancashire)

Mobile Boilers (Locomotive)

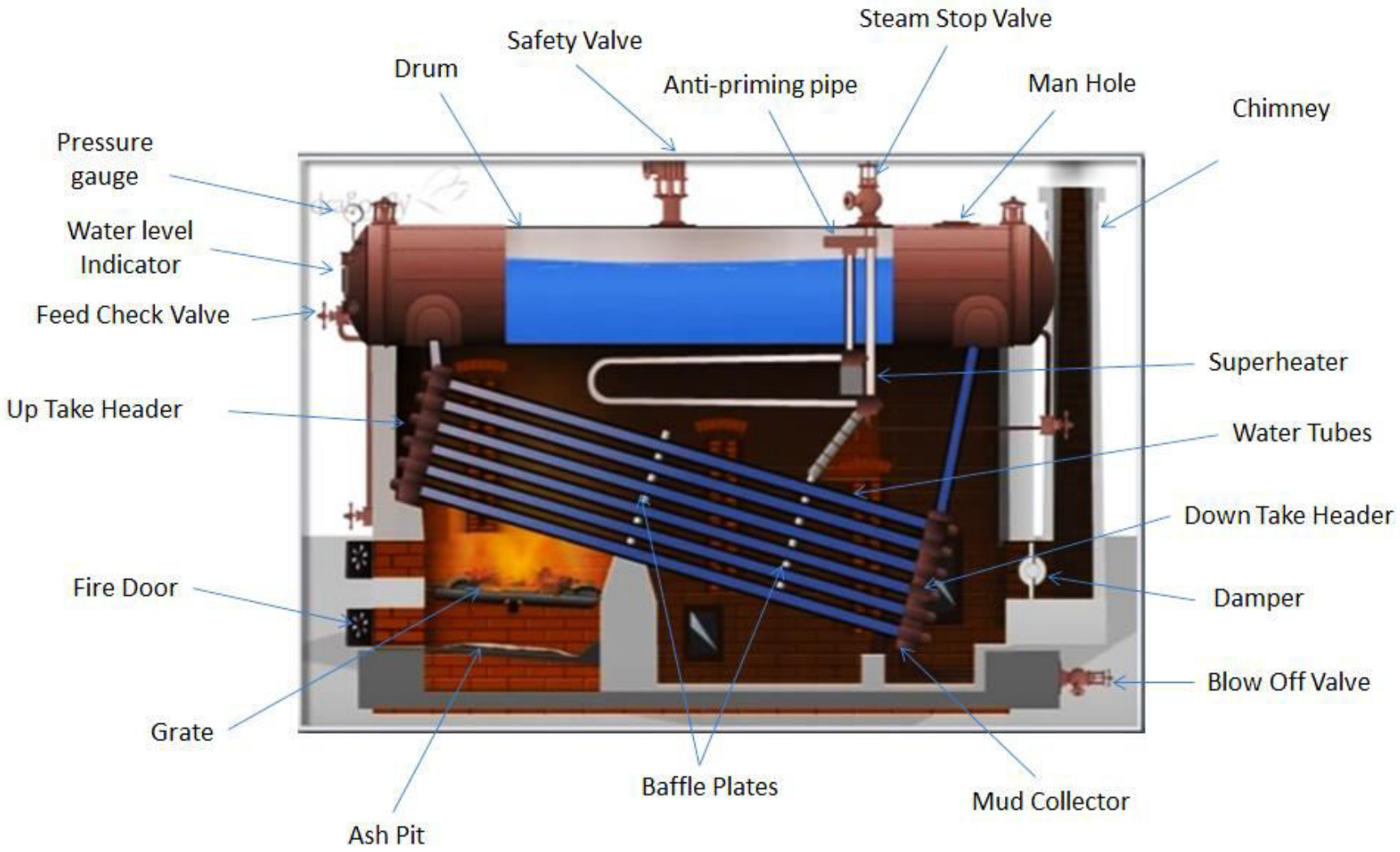


Marine Boilers (Scotch Marine)



BOILERS

Bobcock and Wilcox boiler (Water tube Boiler)

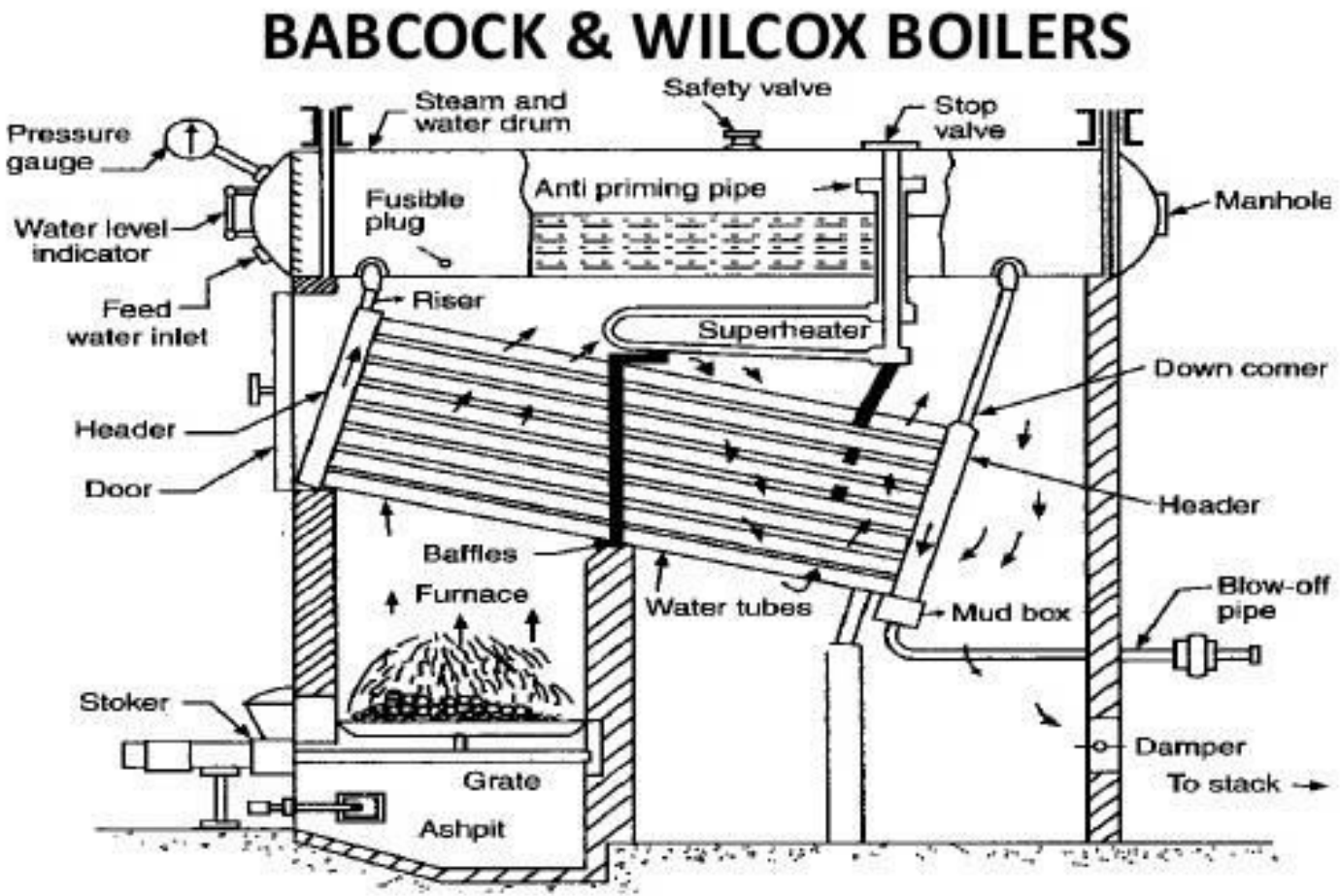


RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Bobcock and Wilcox boiler (Water tube Boiler)



BOILERS

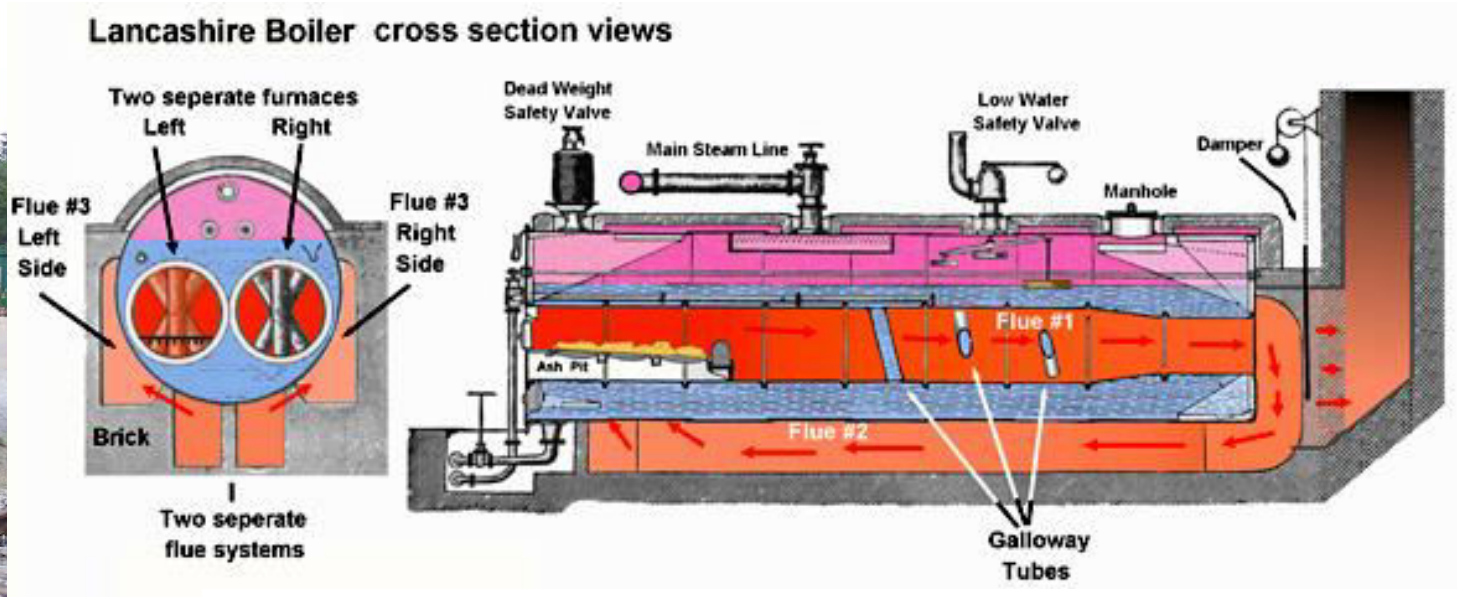
Bobcock and Wilcox boiler (Water tube Boiler)

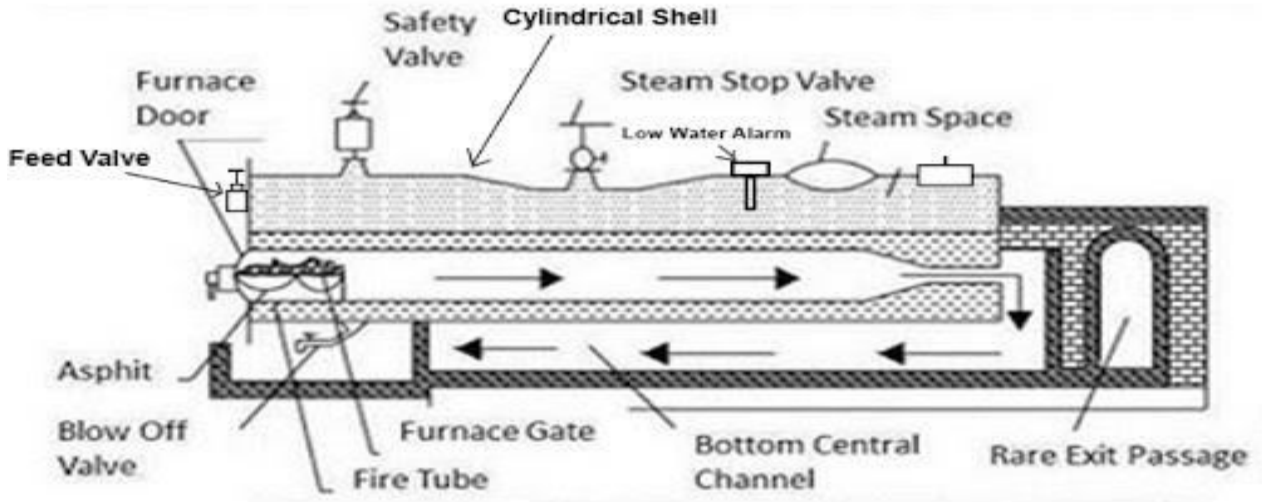
RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

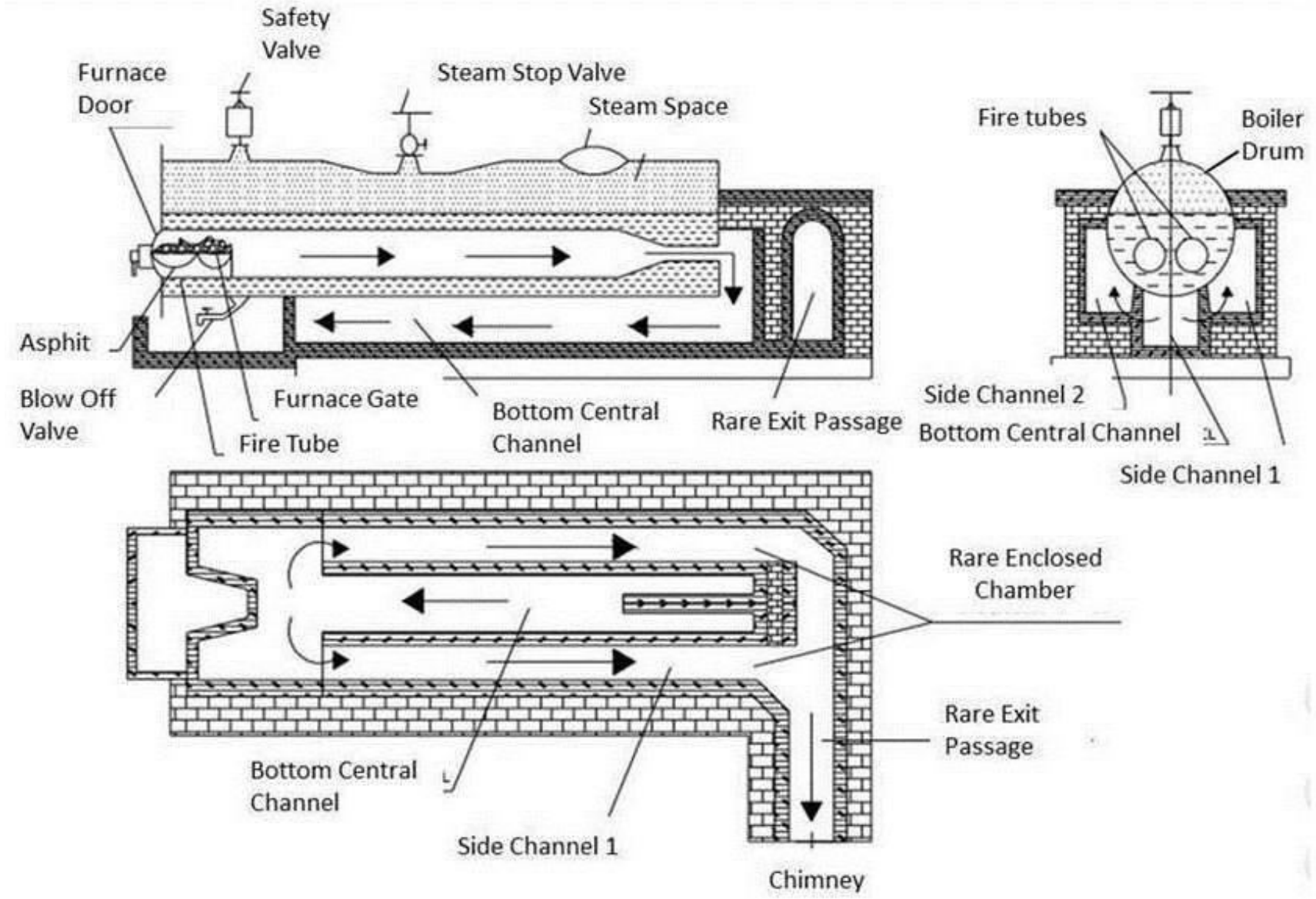
Lancashire boiler (Fire tube Boiler)





BOILERS

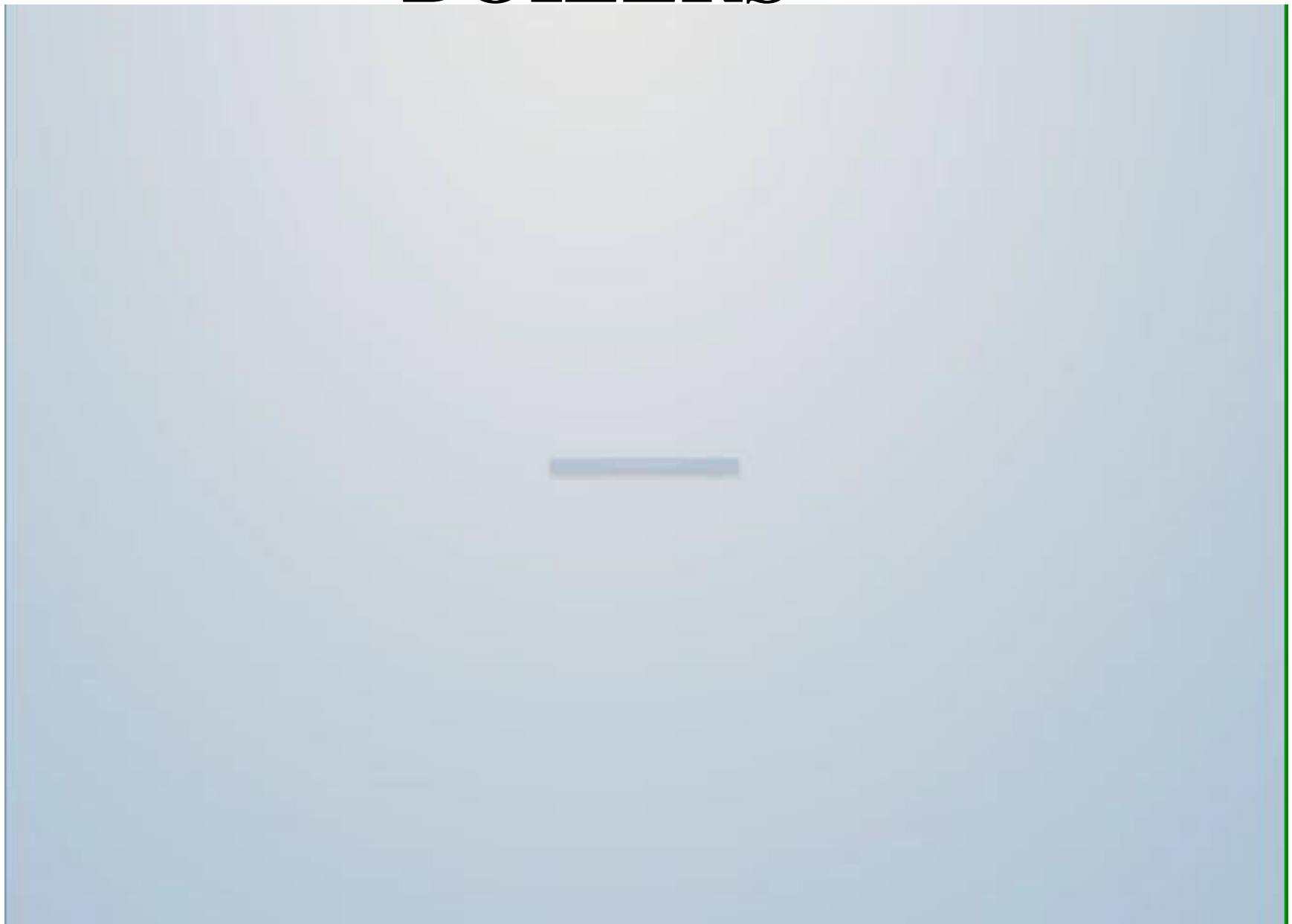
Lancashire boiler
(Fire tube Boiler)



BOILERS

Lancashire boiler

(Fire tube Boiler)



RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Lancashire boiler
(Fire tube Boiler)
Vs
Bobcock and Wilcox boiler
(Water tube Boiler)

S.No	Fire tube boiler	Water tube boiler
1	In Fire-tube boilers hot flue gases pass through tubes and water surrounds them.	In Water-tube boilers water passes through tubes and hot flue gasses surround them.
2	These are operated at low pressures up to 20 bar.	The working pressure is high enough, up to 250 bar in super critical boilers.
3	The rate of steam generation and quality of steam are very low, therefore, not suitable for power generation.	The rate of steam generation and quality of steam are better and suitable for power generation.
4	Load fluctuations cannot be handled.	Load fluctuations can be easily handled.
5	It requires more floor area for a given output.	It requires less floor area for a given output
6	These are bulky and difficult to transport.	These are light in weight, hence transportation is not a problem.
7	Overall efficiency is up to 75%.	Overall efficiency with an economizer is up to 90%.
8	Water doesn't circulate in a definite direction.	Direction of water circulated is well defined.
9	The drum size is large and damage caused by bursting is large.	If any water tube is damaged, it can be easily replaced or repaired.

RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Boiler mountings:

Boiler mountings are those mechanical parts which are considered essential for operating a boiler smoothly and safely which are usually mounted on the surface of a boiler.

The followings are the important mountings of a boiler:

- Water level indicator
- Pressure gauge
- Safety valve
- Fusible plug
- Steam stop valve
- blowdown valve
- Feed check valve

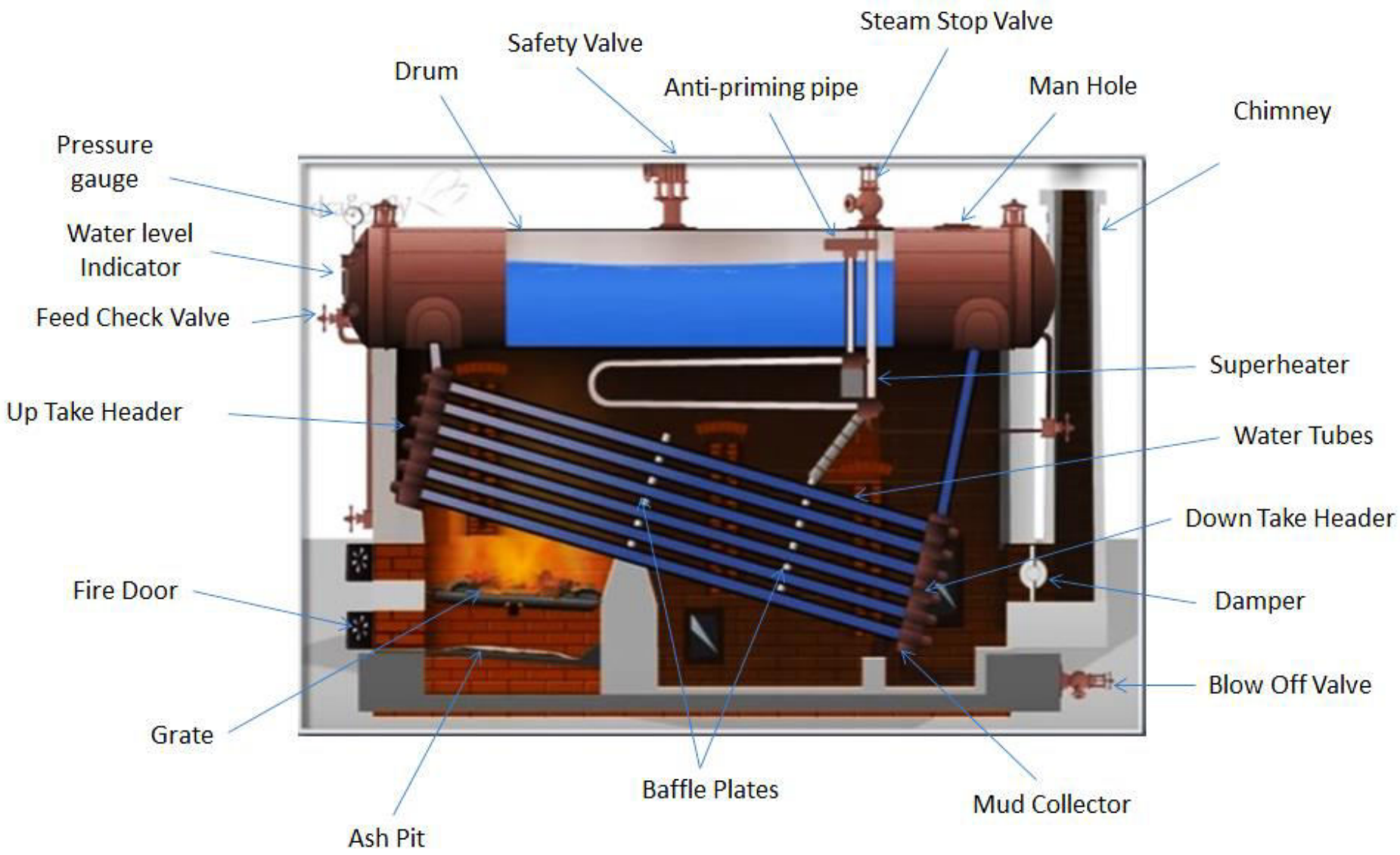
RAMAIAH
Institute of Technology

MECHANICAL ENGINEERING

BOILERS

Boiler mountings:

- Water level indicator
- Pressure gauge
- Safety valve
- Fusible plug
- Steam stop valve
- blowoff valve
- Feed check valve



BOILERS

Boiler accessories

Boiler accessories are those parts and plants which are installed along with a boiler to improve the operating condition and overall efficiency of the boiler plant.

There are several boiler accessories, and those are:

- Economizer
- Super heater
- Steam separator
- Steam trap
- Feed pump
- Injector

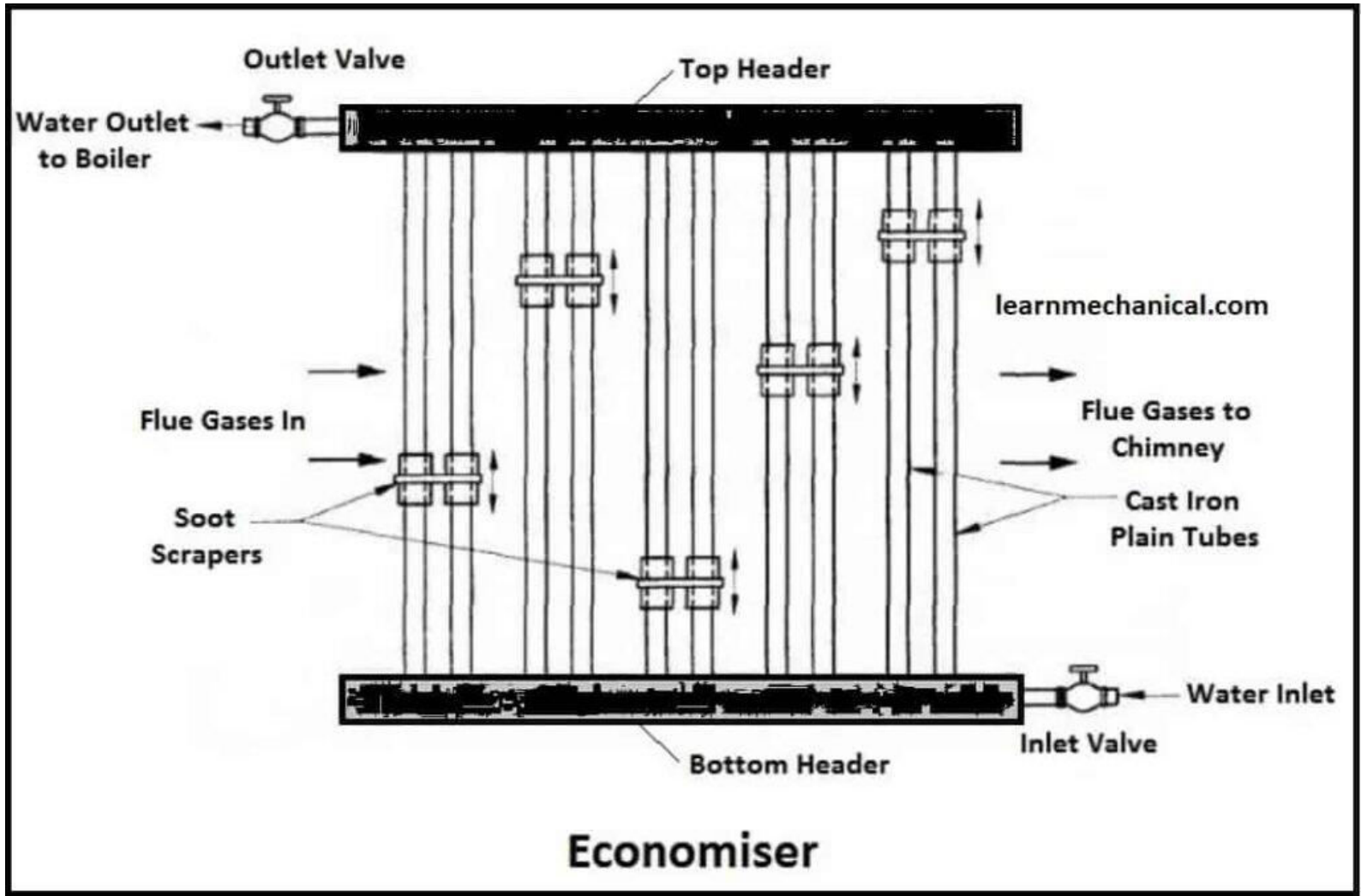
RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Economizer

The **economizer** is a part in which the feed water is preheated before it enters into a boiler, the heat is taken from the waste flue gases of the boiler

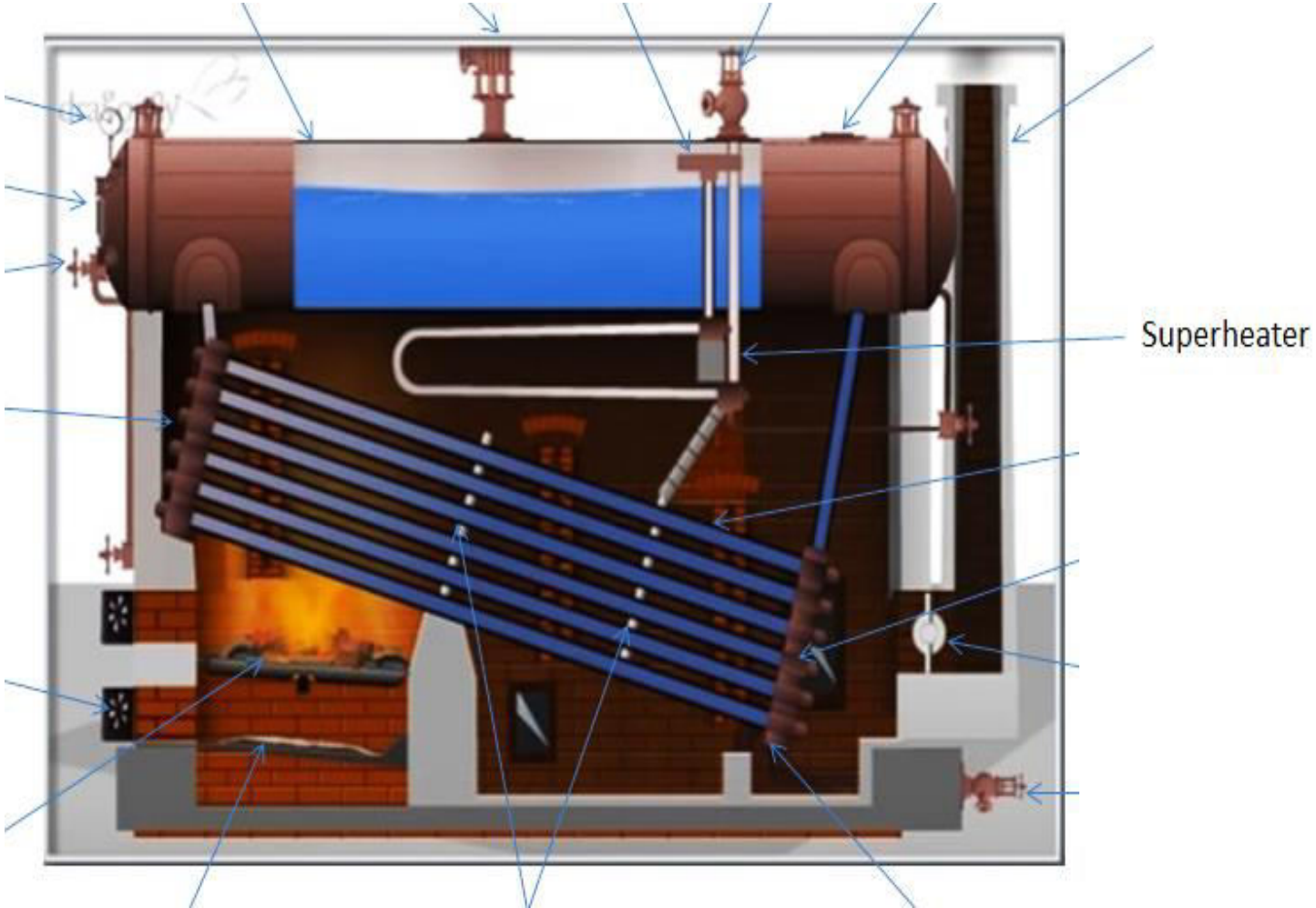


BOILERS

Super heater

It is a **heat exchanger** in which products of the heat of combustion is utilized to dry the wet steam and to make superheated by increasing its temperature.

During superheating of the steam, pressure remains constant and its volume and temperature increase. A superheater consists of a set of small diameter U tube in which steam flows and takes up the heat from hot flue gases.



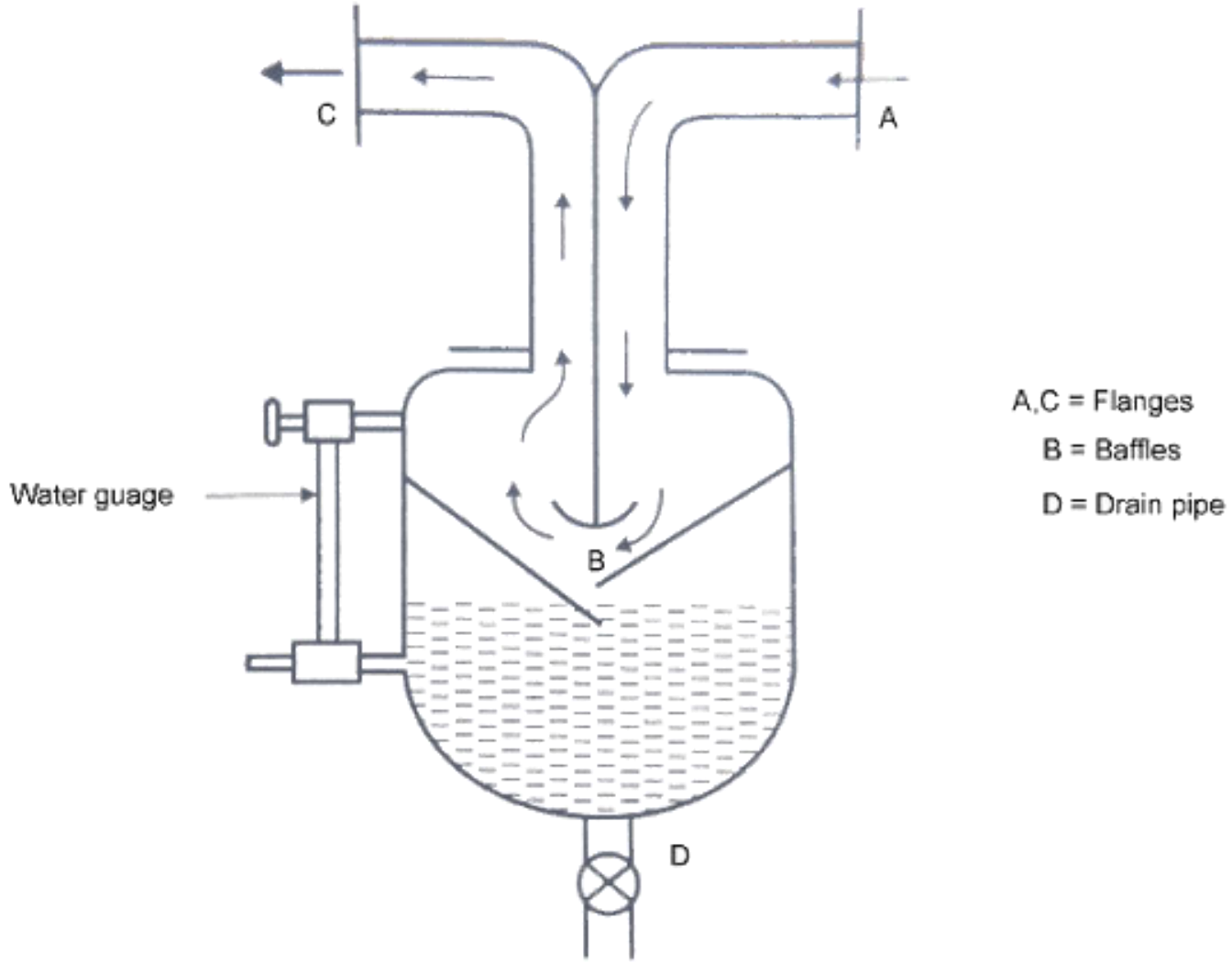
RAMAIAH
Institute of Technology

MECHANICAL ENGINEERING

BOILERS

Steam separator :

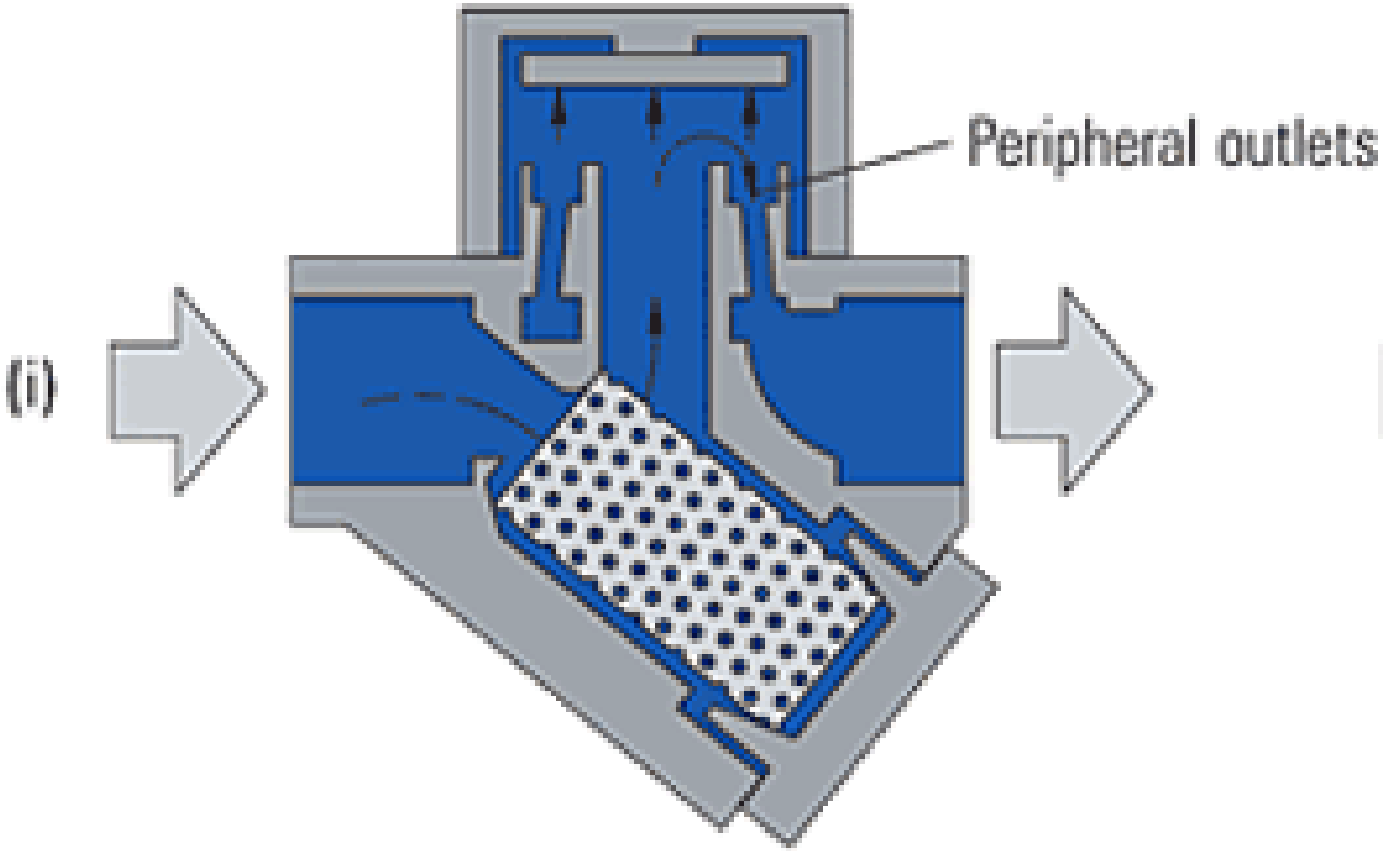
Saturated steam obtained from all types of industrial boilers contains some water particles which decries the economy and efficiency of steam engines and steam turbines. For this, a steam separator is fitted before the steam engine or steam turbine to separated water particles from steam.



BOILERS

Steam trap:

The function of a **steam trap** is automatically to drain away or return to the boiler, the water collected in the steam pipe or steam jacket due to partial condensation of steam without allowing steam escape.



BOILERS

Feed pump :

Feed pump delivers feed water at a pressure higher than that in the boiler

RAMAIAH
Institute of Technology

BOILERS

MECHANICAL ENGINEERING

Injector:

An injector is a system of ducting and nozzles used to direct the flow of a high-pressure fluid in such a way that a lower pressure fluid is entrained in the jet and carried through a duct to a region of higher pressure.

BOILERS

Difference between boiler mountings and accessories:

Mountings	Accessories
1. Boiler mounting is an essential apparatus without which a boiler cannot be operated.	1. Boiler accessory is not an essential apparatus. This is used to improve the operating condition and overall efficiency of the boiler plant.
2. Boiler mountings are mounted on the boiler.	2. Boiler accessories are not generally mounted on the boiler but installed within or near the boiler.
3. Boiler mounting occupies less floor space.	3. Boiler accessory occupies comparatively greater floor space.