Lancashire Boiler: Definition, Parts, Working, Applications, Advantages, and Disadvantages [With PDF]

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Lancashire Boiler is a horizontal type and stationary fire tube boiler. This boiler was invented in the year 1844, by William Fairbairn.

This is an internally fired boiler because the furnace uses to present inside the boiler. This boiler generates low-pressure steam and it is a natural circulation boiler.

It has high thermal efficiency of about 80 to 90 percent.

The size is approximately 7-9 meters in length and 2-3 meters in diameter.

It is mostly used in locomotive engines and marines etc.

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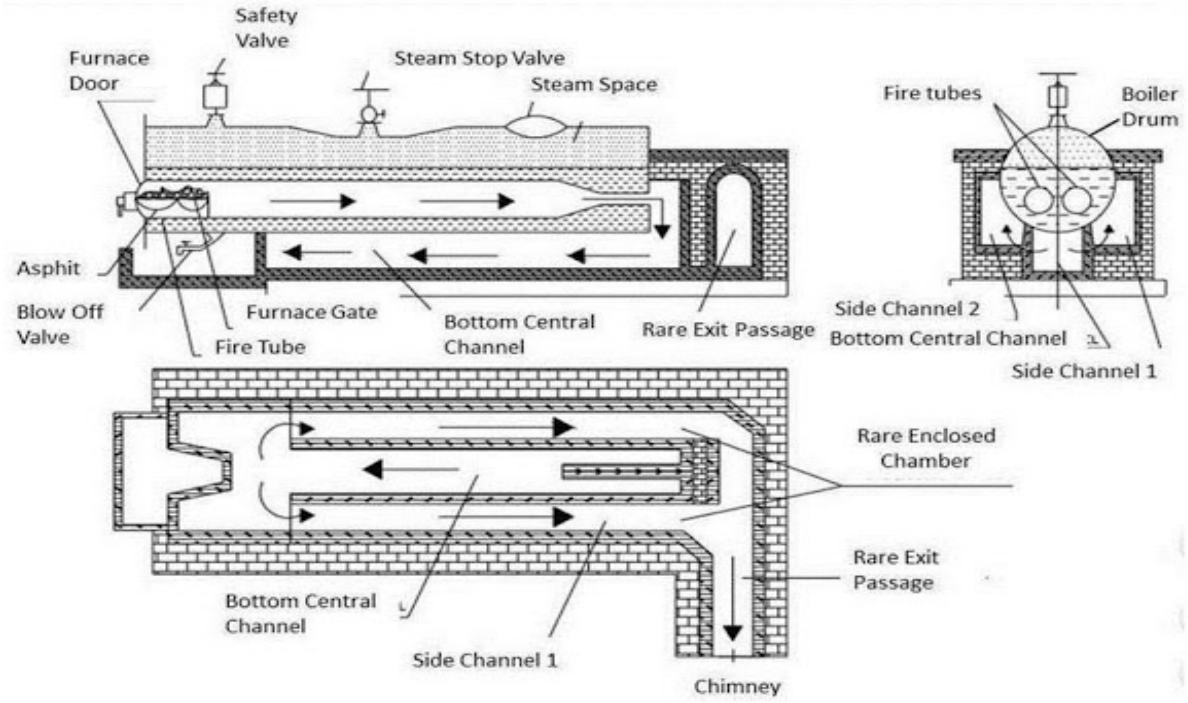
Parts of a Lancashire Boiler:

A Lancashire Boiler consist of following parts:

- *Safety valve*
- *Pressure Gauge*
- *Feed check valve*
- *Water Level Indicator*
- *Blow off valve*
- *Steam stop valve*
- *Manhole*
- *Fire door*
- *Fusible Plug*
- *Ash pit*
- *Economizer*
- *Air preheater*
- *Superheater*



Lancashire Boiler

Safety valve:

The safety valve is used to blow off the steam when the pressure of the steam inside the boiler exceeds the working pressure.

Pressure gauge:

The function of the pressure gauge is to indicate the pressure of the steam inside the boiler.

Feed check valve:

It stops and allows the flow of water inside the boiler.

Water level indicator:

It indicates the level of water in the boiler. It is placed in front of the boiler. Two water level indicators are used in the boiler.

Blow off Valve:

Its function is to remove the sediments or mud periodically that is collected at the bottom of the boiler.

Steam stop valve:

The function of a steam stop valve is to stop and allows the flow of steam from the boiler to the steam pipe.

Manhole:

The hole is provided on the boiler so that a man can easily enter inside the boiler for the cleaning and repairing purpose.

Fire door:

This is used to ignite the present fuel inside or outside the boiler.

Fusible plug:

It is used to extinguish the fire inside the boiler when the water level inside the boiler falls to an unsafe level and prevent an explosion.

It also prevents the damage that may happen due to the explosion.

Ash pit:

The Ash-pit used to collect the ash of the burnt fuel.

The other various accessories that are also used in Lancashire boiler are:

Economizer:

An economizer is a mechanical device that is used as a heat exchanger in the steam power plant.

It is used to pre-heat the fluid or water by taking the residual heat from the combustion products(flue gases).

It is installed to increase the efficiency of the boiler.

Air pre-heater:

Air preheater is also a mechanical device that abstracts the heat from the flue gases and transfers it to the air(atmosphere).

Superheater:

The main purpose of the superheater is to increase the temperature of the saturated steam without any change in the pressure.

Working Principle of Lancashire Boiler:

This Lancashire boiler works on the basic principle of the heat exchanger.

It is basically a shell and tube type heat exchanger in which the flue gases flow through the tubes and the water flows through a shell.

The heat is transfer from flue gases to the water through convection.

It is a natural circulation boiler that uses the natural current to flow the water inside the boiler.

Applications of Lancashire Boiler:

Lancashire Boiler can be used in several filed like:

- *The Lancashire boiler is used to drive steam turbines, locomotives, marines, etc.*
- *It is used in industries like paper industries, textile industries, sugar industries, tire industries, etc.*

Advantages of Lancashire Boiler:

These are some advantages of Lancashire boiler:

- *This has high thermal efficiency. Thermal efficiency is about 80 to 90%.*
- *This is easy to operate.*
- *It can easily meet the load requirement.*
- *Easy to maintain.*
- *Low consumption of electricity due to natural circulation.*

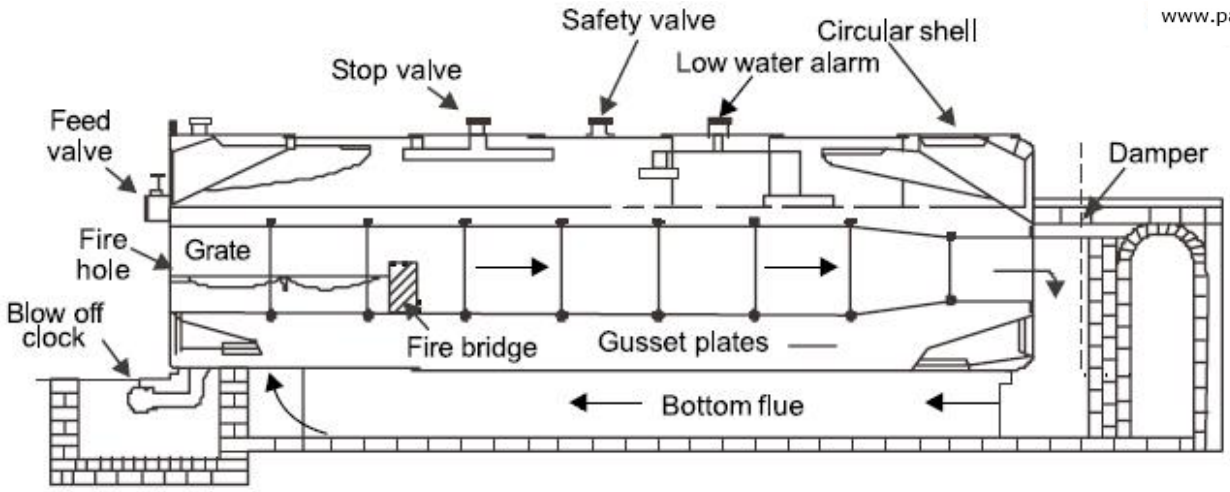
Disadvantages of Lancashire boiler:

Although a Lancashire boiler has some disadvantages and those are:

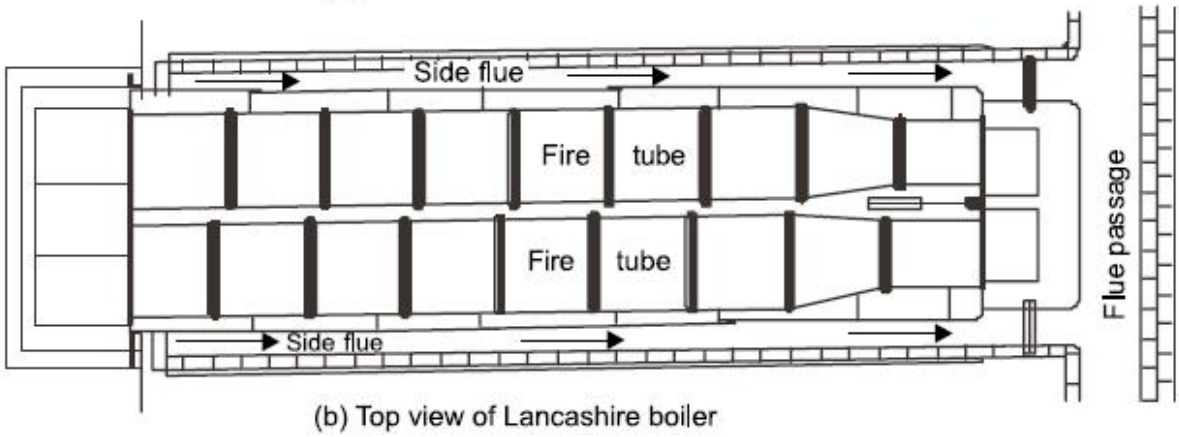
- *This is a low-pressure type boiler, so high-pressure steam is not produced.*
- *It has a limited grate area due to the small diameter of the flue tubes.*
- *The steam production rate is low. It is about 9000 kg/hr.*
- *Corrosion occurs in the water legs.*
- *This boiler requires more floor space.*

References:

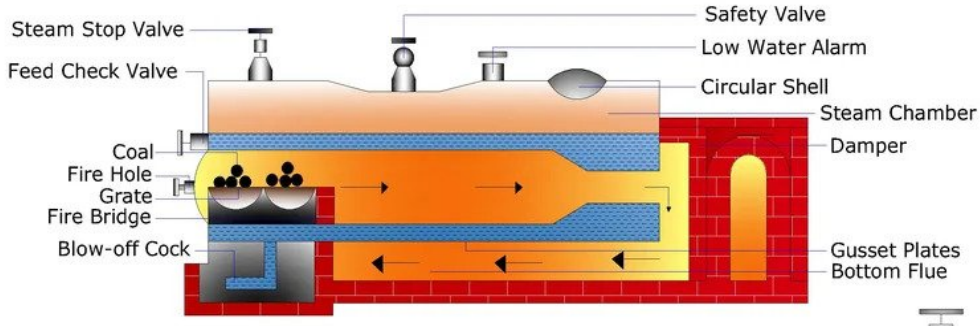
- https://patents.google.com/patent/US1735945A/en
- https://en.wikipedia.org/wiki/Flued_boiler



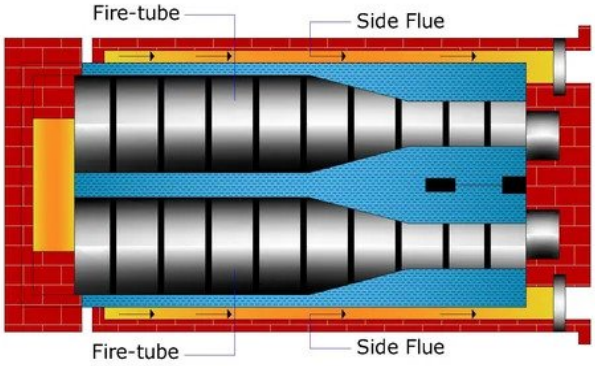
(a) Front view of Lancashire boiler



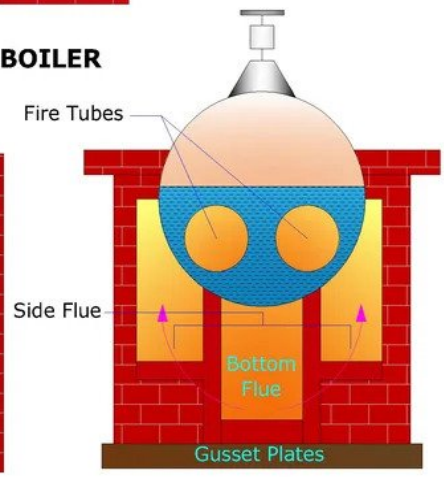
(b) Top view of Lancashire boiler



FRONT VIEW OF LANCASHIRE BOILER



TOP VIEW OF LANCASHIRE BOILER



SIDE VIEW OF LANCASHIRE BOILER

LANCASHIRE BOILER