Benson Boiler: Parts, Construction, Working, Advantages, Disadvantages, Application [With PDF]

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Benson Boiler is a water tube boiler. This is a drum-less and high-pressure boiler.

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Benson Boiler Construction or Parts:

Benson Boiler Main parts or construction are:

- *Economizer*
- *Radiant Evaporation*
- *Convection Evaporation*
- *Steam Outlet*
- *Capacity*

This boiler has a unique characteristic of an absence of steam separating the drum.

The entire process of **heating, steam generation, and superheating** are done in a single continuous tube.

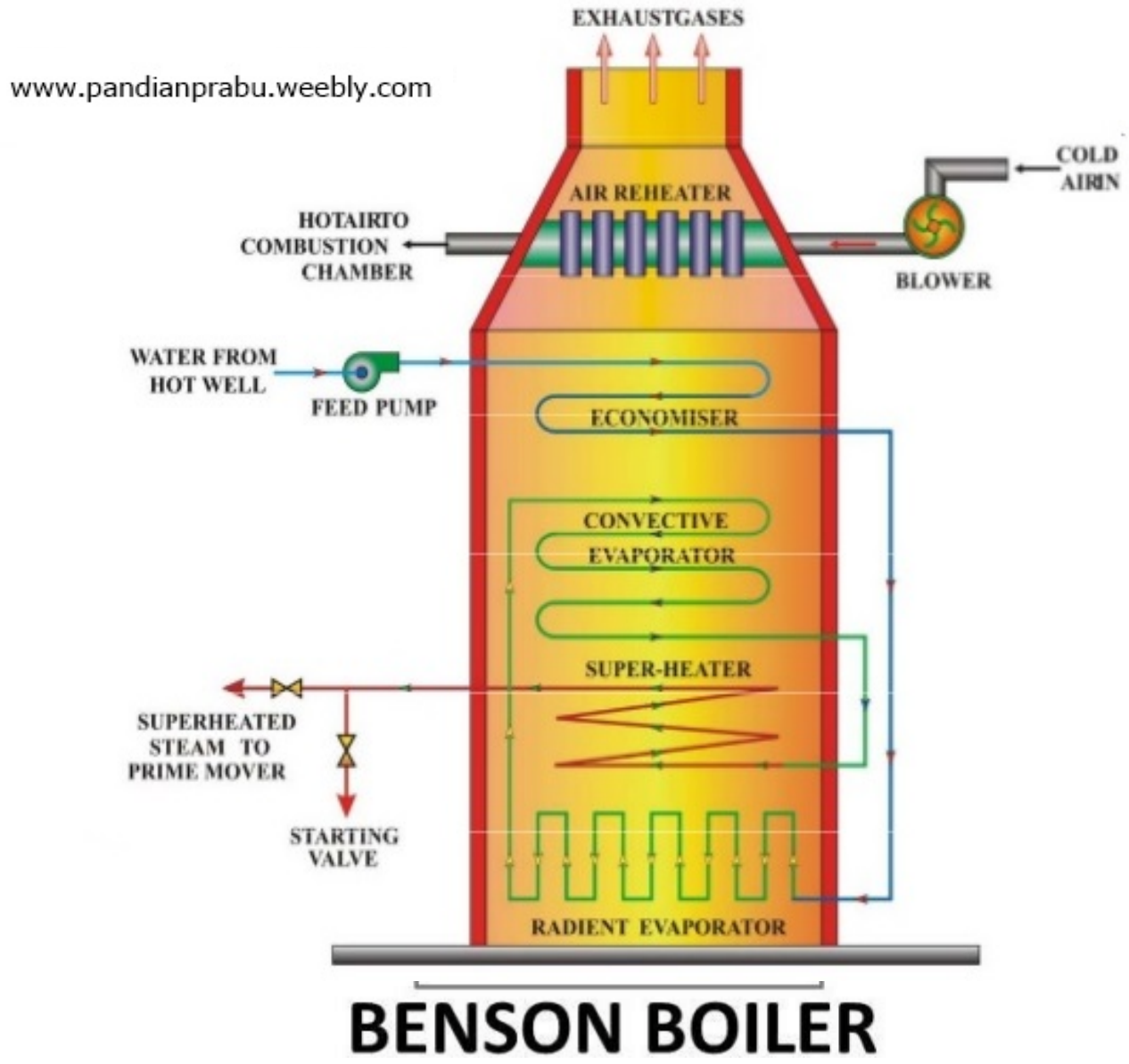
Economizer:

The feed water by means of the feed pump is circulated through the economizer tubes. Hot flue gases pass over the economizer tubes and the feed water is preheated.

Radiant evaporator:

The feed water from the economizer flows into the radiant evaporator with radiant parallel tube sections.

The radiant evaporator receives heat from the burning fuel through the radiation process and the majority of water is converted into steam in it.



Benson Boiler

Convection Evaporator:

The remaining water is evaporated in the convection evaporator, absorbing the heat from the hot gases by convection. Thus the saturated high-pressure steam at a pressure of 210 kg/sq.cm is produced.

Convection Superheater:

The saturated steam is now passed through the convection superheater where the saturated steam os superheated to 650’C. The radiant evaporator, the convection evaporator, and the convection superheater are all arranged in the path of the flue gases.

Steam outlet:

The superheated steam is supplied to the steam turbine through the steam outlet.

Capacity:

The capacity of the Benson boiler is about 150 tonnes/hr at a pressure of 210 (kg force per square centimeter). and at a temperature of 650ºC.

Benson Boiler Working:

It works on the pressure of the water which is increased to the supercritical pressure (i.e. above the critical pressure of 225 bar).

When the pressure of water is increased to the supercritical level, the latent heat of water becomes zero and due to this, it directly changes into steam without boiling. And this prevents the formation of bubbles at the tube surface.

In Benson Boiler, the feed pump increases the pressure of the water to the supercritical pressure and then it enters into the economizer.

From an economizer, the water passes to the radiant heater.

Here the water receives the heat through radiation and partly gets converted into steam.

The temperature raises almost to the supercritical temperature.

After that mixture of steam and water enters into the convective evaporator where it is completely converted into steam and may superheat to some degree.

Finally, it is passed through the superheater to obtained the desired superheated steam.

This superheated steam is then used by turbines or engines to produce electricity.

Benson Boiler Advantages:

- *It is lightweight and it has no drum. For this reason, it is lighter than another boiler.*
- *It starting time is less than other boiler and*
- *it has up to 90 percent thermal efficiency.*

Benson Boiler Disadvantages:

- *Due to supercritical types of boiler, its controlling need to monitor every time for preventing an explosion.*
- *Boiler control for the variable load is difficult.*

Benson Boiler Application:

Some application of Bension Boiler:

- *This supercritical boiler is used in different industries to generate steam for the production of electricity or mechanical power.*
- *The average operating pressure, temperature, and capacity of Benson boiler is 650 degree Celsius, 250 bar, and 135 tonnes/h.*

Benson Boiler Features:

- In the Benson boiler, there are no drums, so the total weight of the Benson boiler is 20% less than the other boilers. that reduces the cost of the boilers.
- Because of no drums are used in this boiler, the transfer of the Benson boiler parts is easy. chances of all the parts may be carried to the site, without pre-assembly.
- One more feature is a once-through boiler and the feedwater entering at one end is discharged as superheated steam at the other end.

FAQ:

What is Benson Boiler?

It is a water tube boiler.

What are the different types of water tube boiler?

The water tube boiler are:
1. *Benson Boiler*
2. Loeffler boiler and
3. Yarrow boiler.
4. Lamont Boiler
5. Babcock and Wilcox Boiler
6. Lamont Boiler
You can read all the boiler here.

What are the advantages of this Boiler?

Here are some advantages:
1. It is lightweight and it has no drum. For this reason, it is lighter than another boiler.
2. Its *starting time is less than other boiler and*
3. it has up to 90 percent thermal efficiency.

References (External Links):

- https://www.forbesmarshall.com/Knowledge/SteamPedia/Boilers/What-is-a-Boiler-Introduction-to-Boilers
- https://www.myodesie.com/wiki/index/returnEntry/id/3061