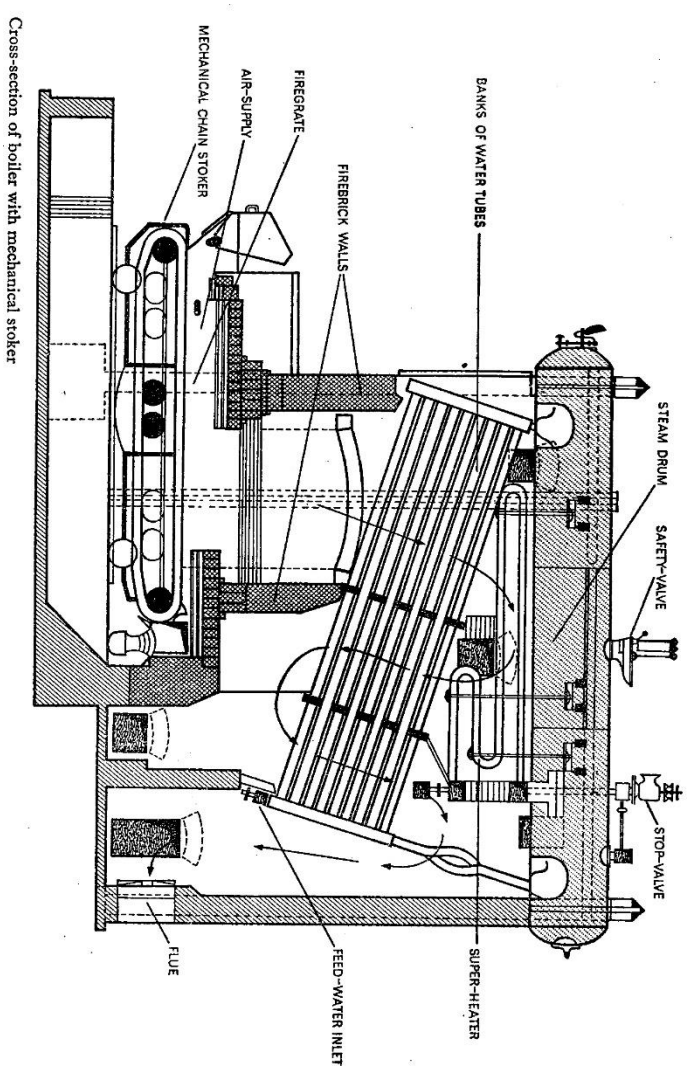
STEAM BOILERS

Large quantities of steam are used by modern industry in the generation of power. It is therefore necessary to design boilers which will produce high-pressure steam as efficiently as possible. Modern boilers are frequently very large, and are sometimes capable of generating 300,000 lb of steam per hour. To achieve this rate of steam production, the boilers should operate at very high temperatures. In some boilers, temperatures of over 1650° C may be attained. The fuels which are burned in the furnace are selected for their high calorific value, and give the maximum amount of heat. They are often pulverised by crushers outside the furnace and forced in under pressure.

Modern boilers which employ solid fuels are usually **too large to** be hand-stoked, and stoking is then carried out by mechanical stokers, which ensure that an **adequate** quantity of fuel is conveyed into the furnace at the proper speed. The air which is *needed by* the fuel for combustion is *blown across* the firegrate by steam jets or fans. The amount of air which is allowed to enter is just more than **sufficient for** complete combustion of the fuel. An **insufficient** supply of air will prevent complete combustion, but any air **in excess of** the minimum merely reduces the temperature of combustion. The hot gases which *are produced by* the combustion of the fuel are circulated round banks of water-tubes. These are inclined at an angle over the furnace, and connect the upper and lower steam drums. A large proportion of the heat *is absorbed by* the water in the boiler. The remainder may be used to heat up the incoming air-supply through an air-heater. The water and steam in the boiler should circulate freely. The water and steam circuits are designed to allow the greatest possible fluid velocity to be attained, and rapid movement of the fluid *is achieved by* forced circulation. This assists rapid heating and also prevents the formation of steam pockets in the tubes.



Loss of efficiency in the boiler will *be caused by* the dissipation of heat through the walls of the combustion chamber. This heat loss can be considerably reduced by the use of firebricks round the walls of the chamber. This helps to insulate the chamber and to conserve the heat which is generated. However, at the temperatures which are attainable in modern boilers, the solid walls of the furnace are liable *to be damaged by* **excessive** beat. To aviod this, they are often lined with water-tubes, and some of the heat of cumbustion is absorbed by the water.

The steam from the boiler is passed through a superheater and out past a stop-valve at a high pressure. A fresh supply of water is fed by pumps into the boiler to replace it. The feed-water should be pure, and free from dissolved salts which will cause deposits on the tubes and lead to overheating.

Convection

1. The warm air is conveyed upwards and displaces the cold air.
2. The heat from the engine is carried away by the air-stream.
3. The heat from the engine is transmitted by convection into the air.
4. When the liquid is heated from the bottom, a convection current is set up.

Conduction

l. The heat from the furnace is conducted through the cylinder walls.
2. The heat of the soldering iron is conducted to the metal of the joint.
3. Power from the generator is conducted through cables to every house.
4. The heat from the steam is transmitted through the tubes by conduction.
5. Some substances are better conductors of electric current than others.
6. Copper is a better conductor of heat than iron.

Radiation

1. The heat of the sun is conducted to the earth by radiation.
2. Heat from the fire is transmitted to the walls of the furnace.

Carry or Take

l. Boiler tubes convey the water from the upper drums to the lower drum.
2. Lorries convey the machinery to the docks ready for loading.
3. The exhaust steam is conducted led through a blast pipe.
4. The steam is conducted lead through nozzles onto the blades.