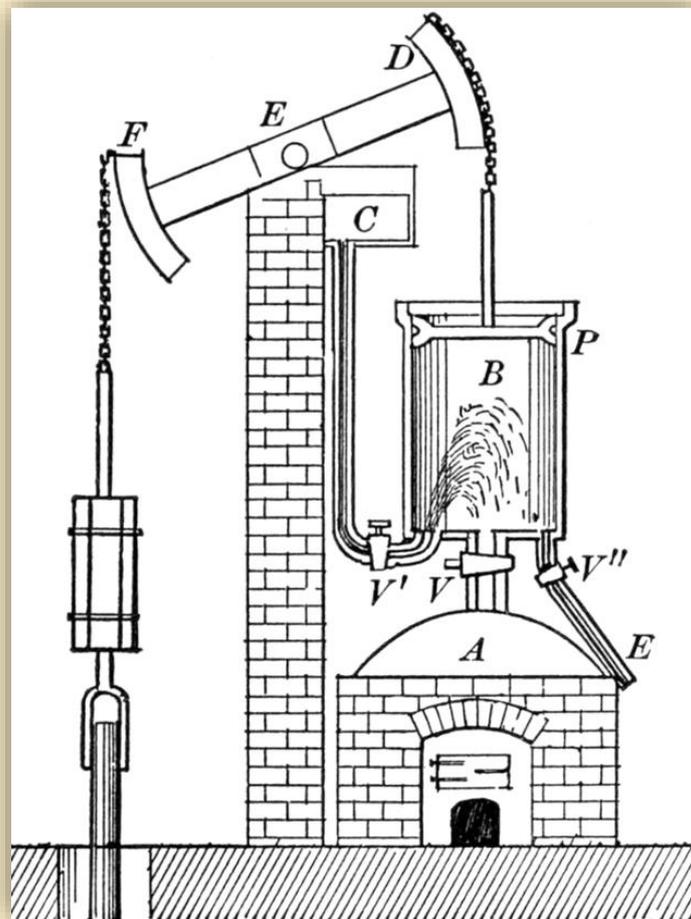


How Steam Engines Work

This resource can be used in association with the clip found here:

<http://www.bbc.co.uk/education/clips/zghd2hv>

In 1705, a blacksmith, Thomas Newcomen invented the first steam engine but rather than developing it to travel on rails, he was looking for a way to pump water out of mines. His 'atmospheric engine' used atmospheric pressure and steam to alternately push a piston, enabling a pumping action to take place. The engine worked by heating up water to create steam before condensing the steam again. This created a vacuum in the cylinder and allowed atmospheric pressure to act on the piston. This continued at regular intervals, with the injection of heat and cold water being controlled by valves to create an up and down movement on a rocker arm.



Thomas Newcomen's atmospheric engine

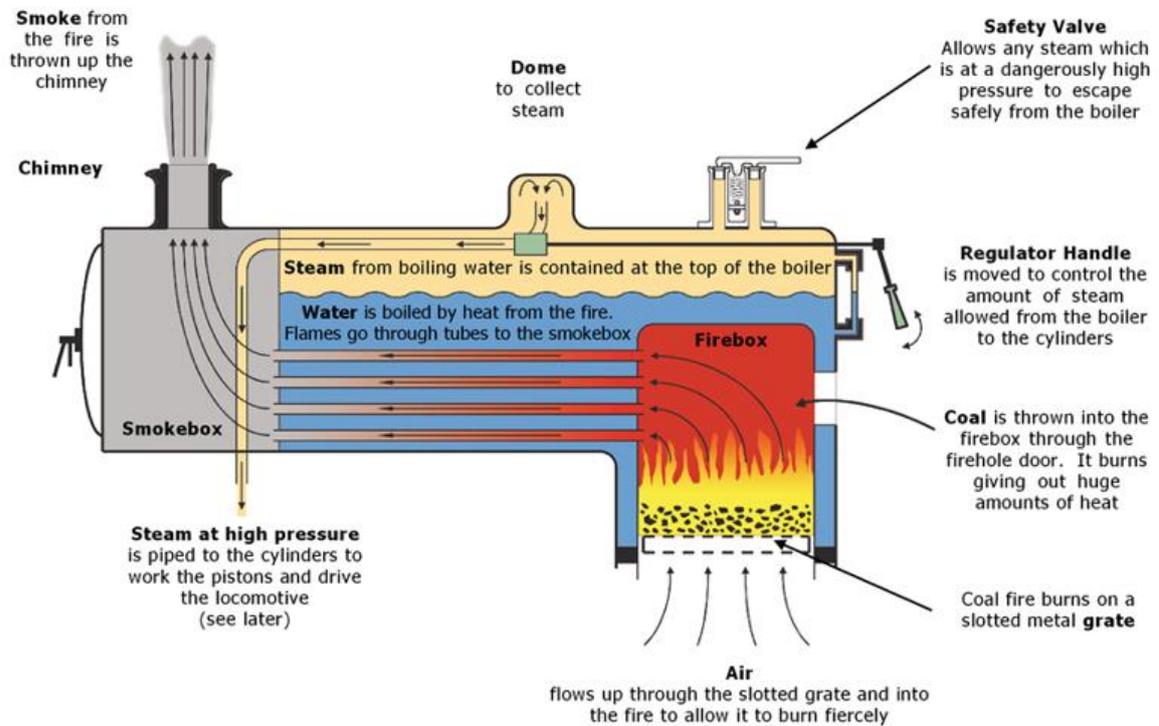
A shows the firebox where the heat from a fire is used to heat up water above.

B shows the cylinder where the steam is condensed using brief injections of cold water delivered from **C**.

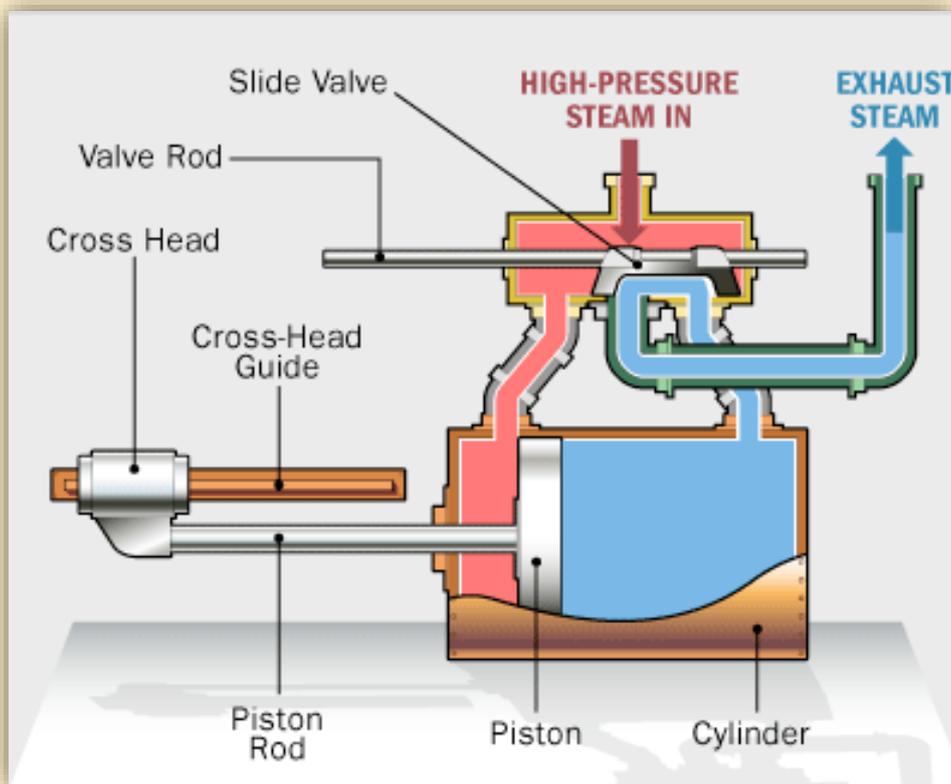
P shows the piston which is pushed up and down by steam pressure and atmospheric pressure.

D shows the rocker arm which subsequently moves, carrying this movement over to **F**.

The Boiler - How the Locomotive Makes Its Steam



STEM Fact: Early steam engine only contained one large tube through the boiler but were eventually developed to contain numerous smaller tubes as seen in the diagram above.



Using the diagrams and the information on pages 1 and 2, answer these questions

In the atmospheric engine, how was a vacuum created in the cylinder when the steam was condensed back into water? (think about air pressure).

Why did steam engine boilers eventually develop to have numerous smaller tubes to carry the heat through the water rather than one large tube?

Why can steam be compressed to create movement in the pistons? (Use the particle model to describe why this happens).

Why is 'superheated' steam (steam which is heated significantly beyond the original water's boiling point) more effective in steam engines? (HINT: Think about the behaviour of gases).

Create an energy transfer diagram using the labels below. Put them in the correct order and describe what type of energy is released between each stage.

Wheels

Coal

Water in boiler

High pressure steam

Fire in firebox

Piston