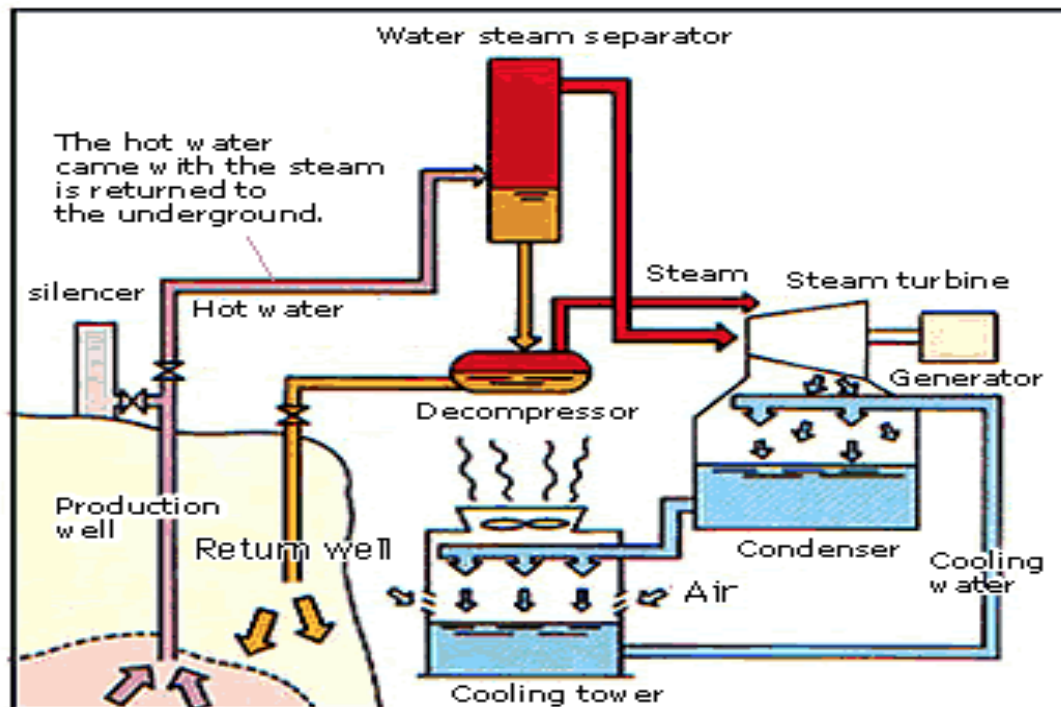

Uses of Steam Power

Early 1800s-mid 1900s

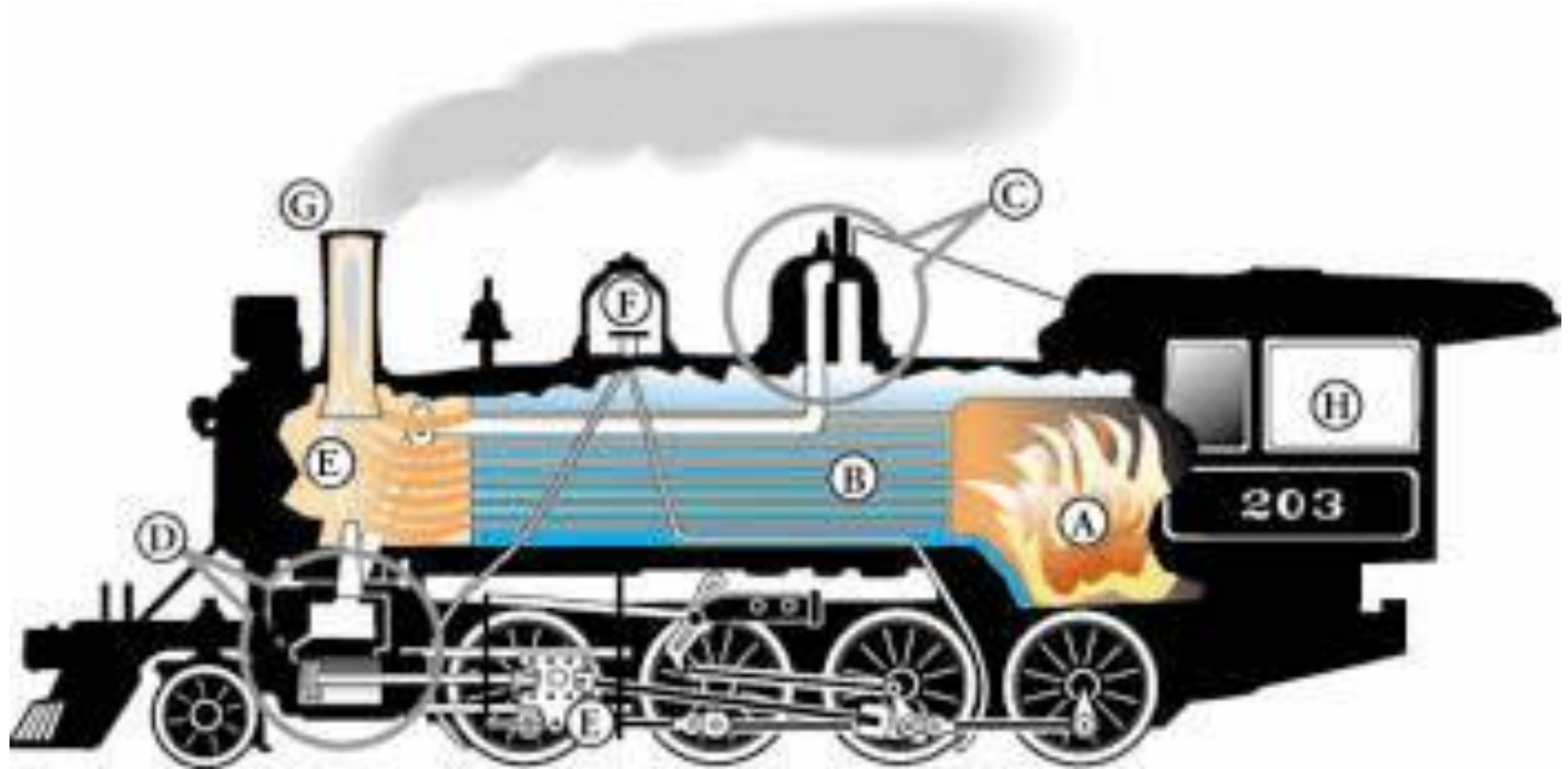
Matt Vail and Chris Ruth

What is Steam Power?

A steam engine is a heat engine that makes use of the thermal energy that exists in steam, converting it to mechanical work. Steam engines were used in pumps, locomotive trains and steam ships, and were essential to the Industrial Revolution. They are still used for electrical power generation using a steam turbine.

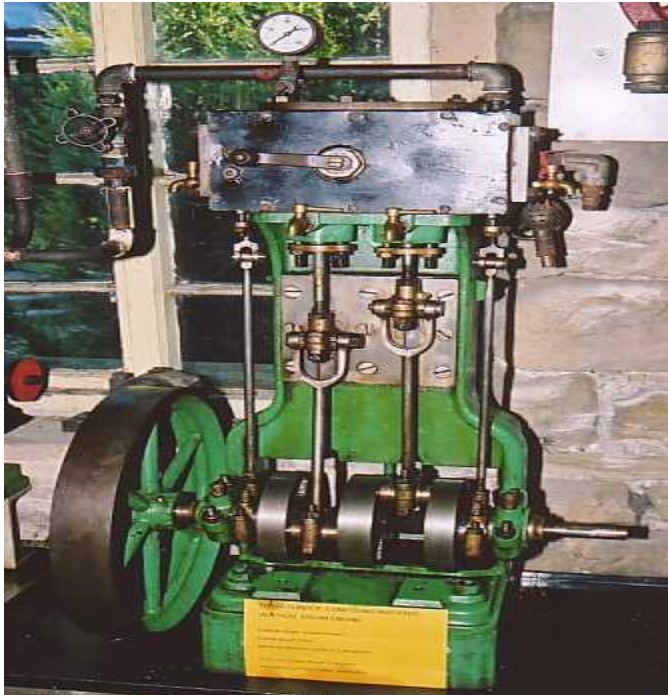


How does a Steam Engine Work?



Uses of Steam Power in the 1800s

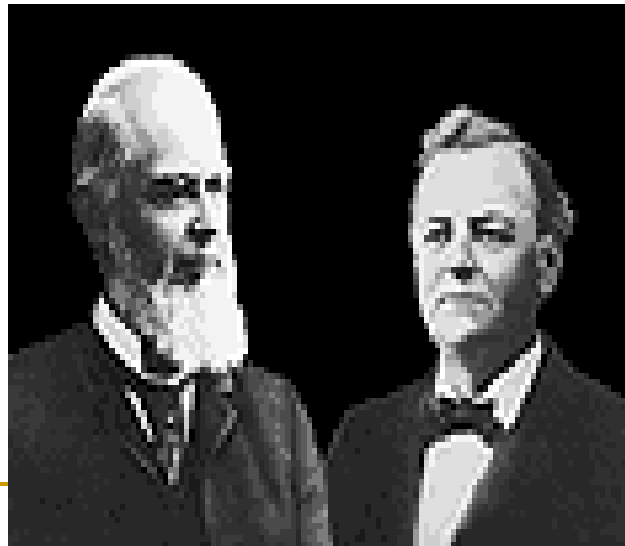
1804: Arthur Woolf re-introduces Hornblower's double-cylinder designs now that Watt's patents have expired. He goes on to build a number of examples with up to nine cylinders as boiler pressures increase.



Two-cylinder "compound" engine, in which the steam pushes on one piston (as opposed to pulling via vacuum as in previous designs), and when it reaches the end of its stroke it is valved into a second piston that works with a condenser, as "normal"

Cont.

1867: Stephen Wilcox and his partner Herman Babcock patent the "Babcock & Wilcox Non-Explosive Boiler", which uses tubing to generate higher pressures and is more efficient than existing designs. Babcock and Wilcox boiler designs become almost universal in new installations.



Babcock and Wilcox

- **1879**
B&W publishes the first edition of *Steam: its generation and use*.
 - **1880**
George Babcock is a founding member of the American Society of Mechanical Engineers in New York City.
 - **1881**
The Babcock & Wilcox Company is incorporated in New Jersey, U.S. An office is opened in Scotland to pursue international business. The first central electrical station in the United States, operated by the Brush Electric Light Company, Philadelphia, is powered by four 73 horsepower B&W boilers.
 - **1882**
Powered by four B&W boilers, Thomas Edison's Pearl Street station in New York City ushers in the concept of a public utility and the age of electricity for lighting, transportation and industry.
 - **1888**
Thomas Edison, who had B&W boilers in his laboratory, writes that a B&W boiler is "the best boiler God has permitted man yet to make."
-

More Uses of Steam Power

1897: Charles Argernon Parsons patented a Steam Turbine, which was used to power a ship. The turbine works like a multi-cylinder steam engine, but with any number of "cylinders" in series, built of simple bladed wheels. The efficiency of the turbine is considerably better than the best compound engines, while also being much simpler, more reliable, smaller and lighter all at the same time. Steam turbines have replaced pistons for extracting power almost universally since then.



Parsons Turbine



Modern Turbine

Steam Power and the American Farms

- In the early 1800s, its main source of power came from three animals-the horse, the mule, or the ox. The average farm worked by horses was 100 acres. With 100 acres, the farmer walked 800 miles to plow his fields. And he still had to plant the crop, and cultivate! For wheat and other crops the grain had to be separated from the chaff with a machine called the thresher. The thresher was powered by a power sweep, which was turned by horses. Everything depended on the strength and durability of humans and horses.



Cont.

Things began to change in 1849. Some of the first portable steam engines for farm use were built. They only provided belt power for machines like the thresher. There were three sizes-4, 10, and 30 horsepower. The 4-hp model sold for \$625 and the 30-hp model sold for \$2300. These machines were also heavy; the 4-hp model weighed two tons, or 1000 pounds per horsepower.



These machines were pulled from field to field by horses. The steam engine provided steady power, it didn't tire after hard work. Yet these machines were still crude, and a low steam pressure of 50 to 90 p.s.i. limited the amount of work that could be done.

Steam Pressure Increase

Over the next few years, the steam pressure would be steadily increased with better quality material and construction of the boilers. However the greatest change of the steam engine would make it unforgettable for the next 150 years-"Self Propelled" steam engines began their debut in 1855. At first they were just a normal "Portable" engine, with chains or gears connecting the crankshaft and the rear wheels. They couldn't even steer! They still needed horses to turn. But the self-propelled engine could also pull its thresher behind it.



The Stanley Steamer

The **Stanley Steamer** was a steam-powered automobile produced by the Stanley Steamer Company which set the world land speed record at 127.7 mph (205.5 km/h)



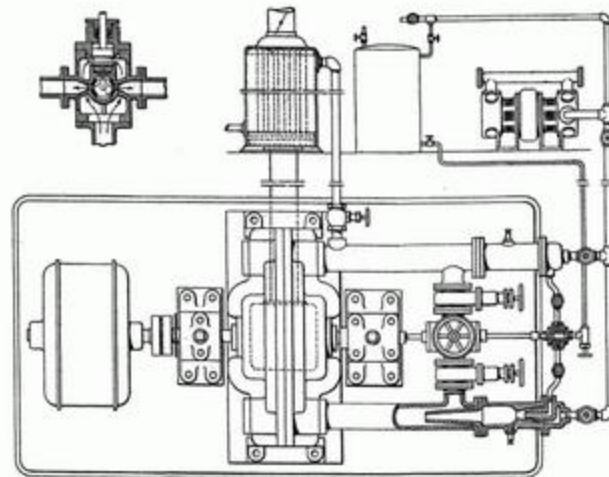
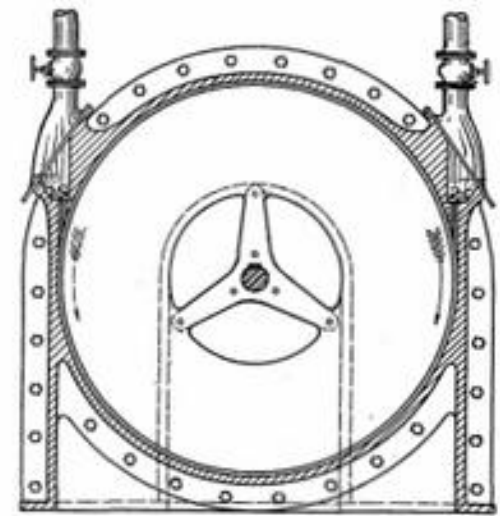
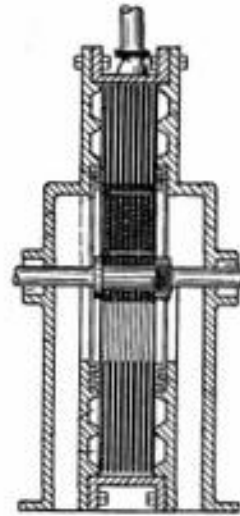
Horse Power

Horsepower in steam engines was first measured with the formula, 1hp for every 10-14 square feet of boiler surface. But this formula was outdated by the increase of steam pressures in the engines, yet the formula was used until 1911. Then a new measurement-brake horsepower (which was measured on a Prony Brake-type dynamometer). An engine from 1908, which was advertised as 30hp, might be advertised as a 100hp engine in 1912! Some ads had both types of horsepower rating, such as 30-100hp



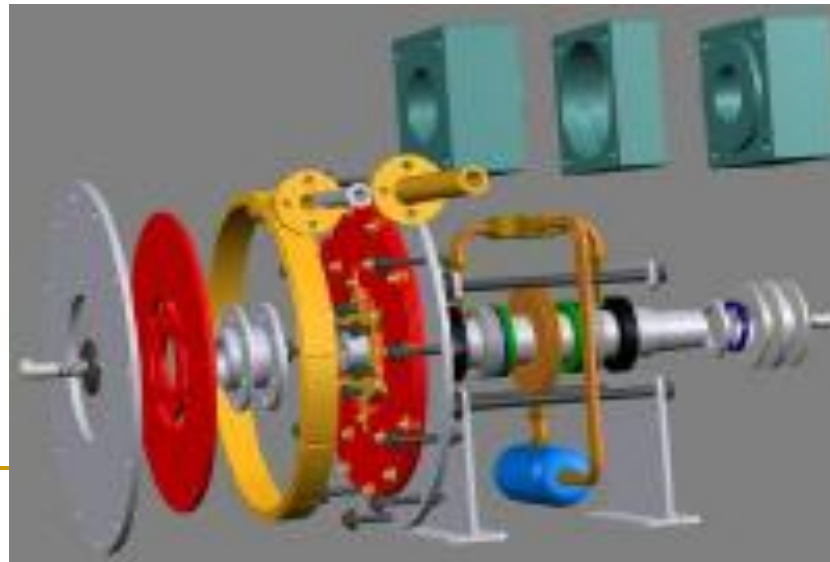
Tesla Turbine

A Tesla turbine consists of a set of smooth disks, with nozzles applying a moving gas to the edge of the disk. The gases drag on the disk by means of viscosity and the adhesion of the surface layer of the gas. As the gas slows and adds energy to the disks, it spirals in to the center exhaust. Since the rotor has no projections, it is very sturdy.



Traits of a Tesla Turbine

Installation normally working with a mixture of steam and products of combustion and in which the exhaust heat is used to provide steam which is supplied to the turbine, providing a valve governing the supply of such last mentioned steam so that the pressures and temperatures can be adjusted to the optimum working conditions.



Steam Engine Explosions

Steam engines exploded every day in the U.S. in the early 1900s. For a plain steam traction engine-the boiler holds 52 cubic feet of water, and 26 cubic feet of steam at 150 psi. That 26 cubic feet of steam at 150 psi weighs 9.73 lbs, but holds 1,300,000 foot pounds of energy. The 52 cubic feet of water is at 366° F. It holds 38,000,000 foot pounds of energy. When the boiler fails, it releases enough energy (from the steam and water) to send a one-pound object straight up 7,500 miles (into orbit). Or a 7,500 pound object (the traction engine) one mile up!



Drop off of Steam Engines in the 1900s

From 1900 and on the steam engine became less popular. In 1924 came the Farmall, a gas tractor that could do all the jobs on the farm. It was the final nail in the coffin. Steam production stopped a few years later. A few steam engines worked until WW2. Then many were lost in the scrap drives. Not too many are around today, and you can only see them at antique tractor shows. Yet, when they are there, you notice them. Just look for the plumes of coal/wood smoke, and listen for the whistles. They still are impressive.

The End
