

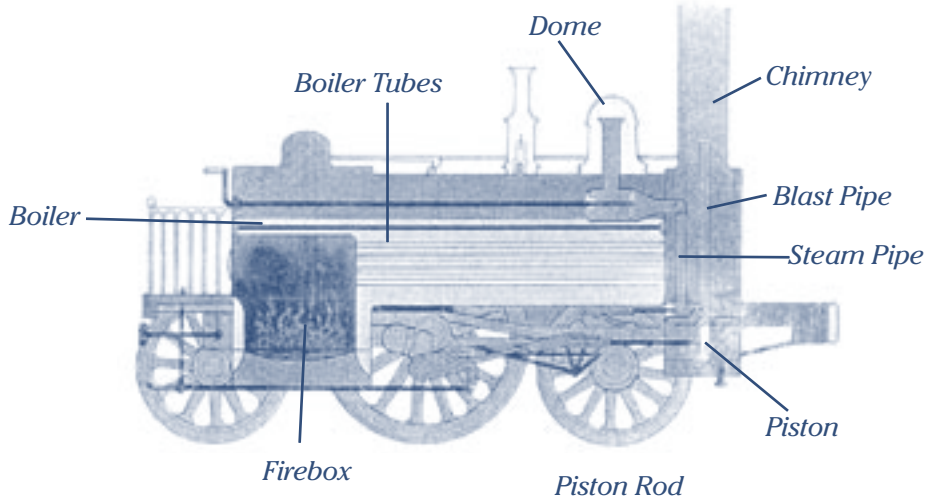


ROBERT STEPHENSON

ROBERT STEPHENSON'S LOCOMOTIVES

HOW DOES A STEAM LOCOMOTIVE WORK?

The diagram below shows the inside of an 1840's locomotive.



Burning coal in the **firebox** heats air in the **boiler tubes** which boil water in the **boiler**. This makes steam, which collects in the **dome**. The driver then opens a valve to let **steam pass** through the steam pipe and push the **pistons** backwards and forwards. The **pistons** are connected to the driving wheels by **piston rods**, which make the wheels turn. **Pistons** also push exhaust steam up the **blast pipe** and out of the **chimney**. This also draws hot air from the **firebox** and helps the fire to burn.

THE DEVELOPMENT OF THE LOCOMOTIVE

From his childhood Robert Stephenson had been interested in locomotive design. He was encouraged both by his father, George, and by Richard Trevithick, the designer of the first locomotive.

As a child he used to help his father with his work on the low-pressure steam engines in the mines.

Robert's aim was to develop Trevithick's earlier ideas and to construct engines which would create a fast, smooth running network of railways to move passengers and goods.

Between 1828 and 1830 Robert kept redesigning and improving his locomotives. Each new design was a link in the chain of locomotive development and improvement.

When designing the "Lancashire Witch" in 1828 Robert Stephenson made his first great improvement by placing the two cylinders outside the locomotive in an inclined position at the back of the engine where they were attached to the boiler at an angle of 39 degrees by a long bracket. This engine was used on the Bolton and Leigh Railway.

In 1829 Robert Stephenson's locomotive, the "Rocket" rode to fame in the Rainhill Trials. The "Rocket", originally named the "Premium



Engine”, was built in Stephenson’s Forth Street works, Newcastle upon Tyne. The design was modelled on the on Trevithick’s earlier road steam locomotive but with large uncoupled driving wheels, two outside inclined cylinders and a newly designed multi-tubular boiler. Twenty-five copper tubes ran the full length of the boiler giving greatly increased efficiency and power. Hot gases from the firebox passed through the tubes, which were surrounded by water in the boiler, thus giving a much larger heating surface. The “Rocket” also had a “blast pipe” which channelled the exhaust steam into the chimney, thus creating a draught for the fire and increasing power even more. On its first test run at Killingworth the “Rocket” achieved an extraordinary top speed of 12 mph while pulling a tender and five wagons carrying 40 men.

In October 1829 the “Rocket” won the Rainhill Trials in Lancashire for the new Liverpool and Manchester Railway and the Stephensons were now established as the foremost railway engineers in the country.

In 1830 the “Northumbrian”, driven by George Stephenson opened the Liverpool to Manchester Railway. This locomotive included a smoke box, combined firebox and multi-tubular boiler, outside horizontal cylinders and an inside load bearing wrought iron plate frame making it the most advanced locomotive of its time.



Above - Robert Stephenson’s “Northumbrian”, Liverpool and Manchester Railway, circa 1830. An example of outside cylinder type.

Left - The “Planet” engine, circa 1831. An example of inside cylinder type

Mechanics' Magazine,

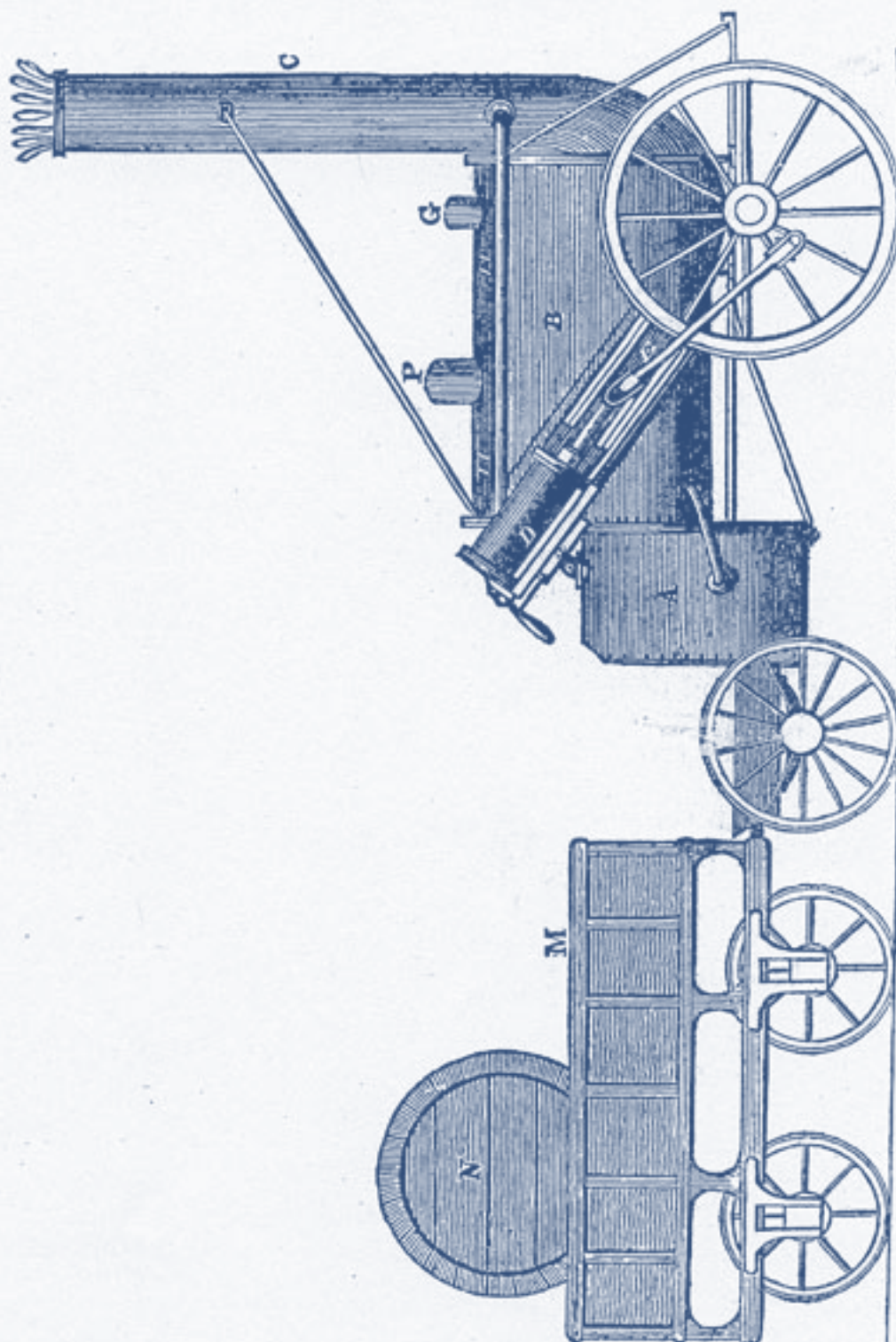
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"THE ROCKET," LOCOMOTIVE STEAM ENGINE OF
MR. ROBERT STEPHENSON.



[The earliest known contemporary illustration of the 'Rocket']

In the same year, the “Planet”, the ninth locomotive built by the Stephensons for the Liverpool & Manchester Railway, incorporated features of the “modern” steam locomotive. It had a horizontal cylinder, a multi-tubular boiler and used the blast of the exhaust steam to create a draught for the fire. In December 1830 the “Planet”, pulled a 76 ton train from Liverpool to Manchester in two hours thirty nine minutes at a maximum speed of fifteen and a quarter miles per hour (24.25kph).

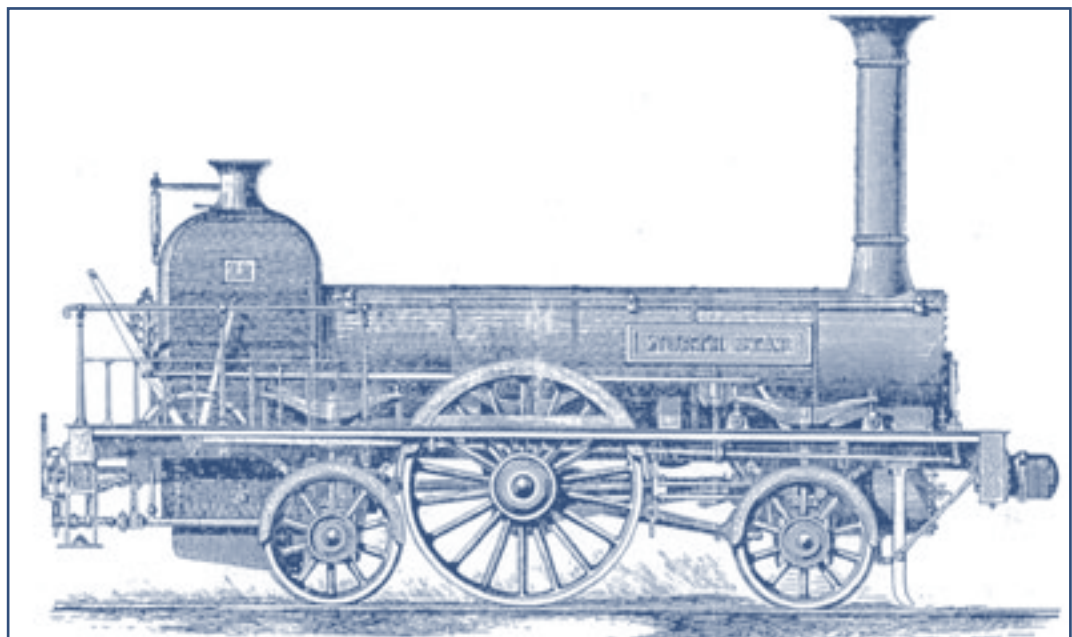
Robert Stephenson & Co. also built the “Invicta” for the Canterbury and Whitstable Railway in 1830. Many of the locomotives from their Newcastle works were now being exported to America and the rest of the world.

Robert Stephenson’s friends stated that he “had raised the locomotive by a series of beautiful improvements from the ill-proportioned and ineffective machine of 1828 to its present perfection of mechanism”.

Robert then increased the power of his locomotives by lengthening the firebox and boiler, which meant they had to have an extra axle. In 1833 he patented his ideas for a six-wheel “Planet” type locomotive. This was known as the “Patentee”. This locomotive also included the very first steam brake ideas. The Grand Junction Railway, the Nuremburg Railway, the Brussels-Mechlin Railway, the St. Petersburg-Pavlovsky Railway in Russia and the Great Western Railway in Britain used this new “Patentee” type locomotive.

Further improvements were made in 1841 when Robert patented his final “long boiler” design on 23rd June. This locomotive proved very popular, particularly in Europe. In 1846 he introduced an eight-wheeled locomotive.

In a quarter of a century Robert had developed the locomotive from the experimental machines built by the early locomotive pioneers to the powerful engines which would help create an almost world-wide railway system.



Robert Stephenson’s “Long Boiler”, passenger engine, circa 1841