Robert Stephenson

A Great 19th Century Engineer

Early Years

Robert Stephenson was born in a small cottage in Willington Quay, a few miles east of Newcastle upon Tyne, on October 16th 1803. His father was the now famous George Stephenson.

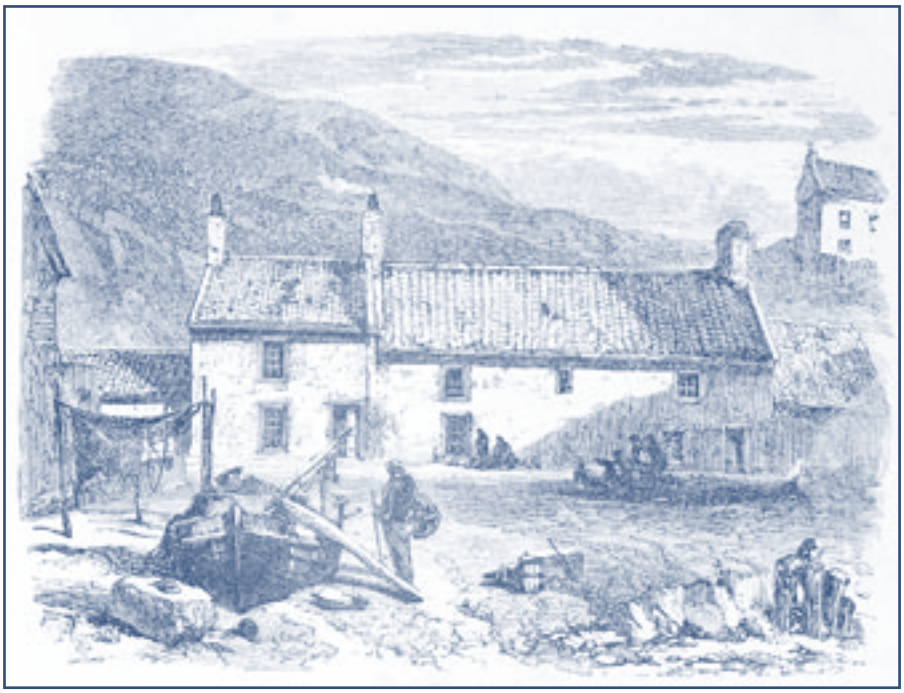
At this time George was a brakesman at Ballast Hills Colliery, Willington Quay working on low-pressure stationary engines.

In 1804 Richard Trevithick, the Cornish inventor of the high-pressure steam engine visited the area and called on the Stephensons in their small house.

In that same year the Stephensons moved to a cottage in Paradise Row, West Moor near Killingworth because George had accepted work as a brakesman at the West Moor colliery which was owned by the Grand Allies (an alliance of powerful coal-owning families formed in 1726).

Richard Trevithick continued to visit the Stephensons and in 1805 he demonstrated one of his new locomotives at Whinfield's Pipewellgate works in Gateshead.

Unfortunately in the same year Robert's sister died and in 1806 his mother died. George was so upset he moved to Montrose and took up work there but he left Robert with Ann Snaith, George's housekeeper. In 1808 Ann Snaith married Robert's uncle also named Robert. George returned to Killingworth and set up a business to repair low pressure stationary engines and also went back to work as a brakesman.

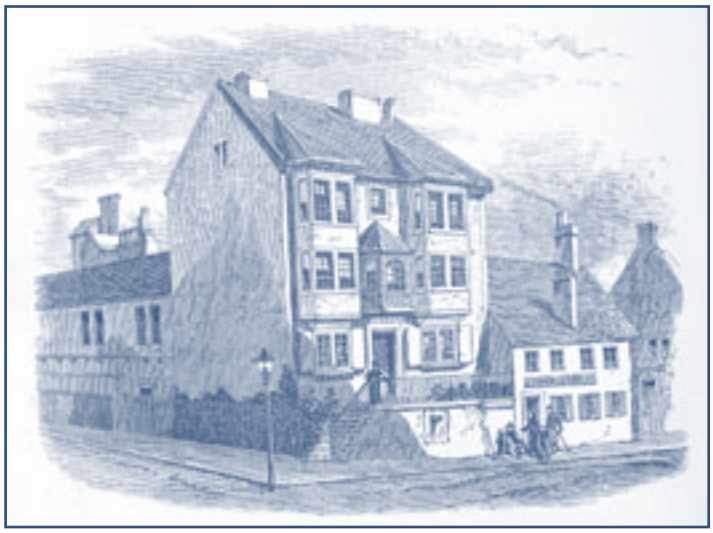


Cottage at Willington Quay, North Tyneside

School Days

Robert was sent to school at Longbenton in 1810 because his father wanted him to be a "viewer" (mining engineer) in the mines and he was determined that Robert would have a proper education. The parish clerk, Tommy Rutter, taught him. His father also believed that all children should be earning money so before and after school Robert had to carry miner's picks and shovels to the Longbenton blacksmith shop to be repaired.

In 1815 Robert attended Dr. Bruce's Academy in Percy Street, Newcastle upon Tyne where he studied French and Mathematics. He also became a reading member of the Literary and Philosophical Society in Newcastle.



Dr Bruce's Percy Street Academy

This was the era of the Napoleonic Wars and both George and young Robert would follow the happenings at home and abroad in the papers. There were also problems at home because many horses had been sent to the wars and there were few left to till the soil or pull the coal wagons. Harvests failed and many people were starving. The coal owners could not move their coal and so there was little cash to pay anyone

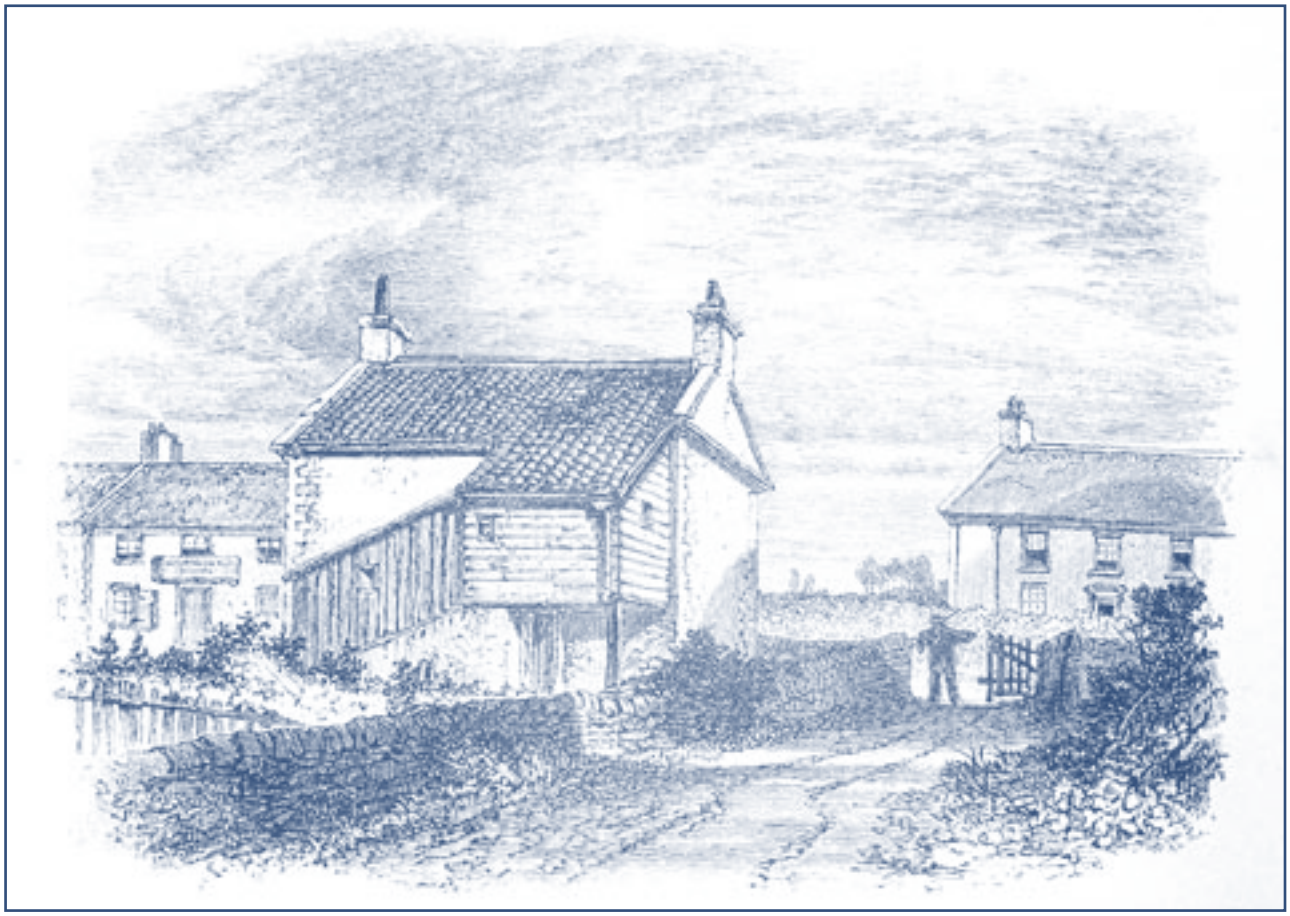
During this period other men were also experimenting with both low and high-pressure steam engines. Men such as Mathew Murray, William Chapman, William Hedley and William Brunton.

The northern colliery owners asked their engineers to use locomotives instead of horses. In April 1811 John Blenkinsop employed Mathew Murray to construct a locomotive using Trevithick's high-pressure engine, which he ran on the Kenton and Coxlodge rack and pinion railway in 1813, with Robert's uncle as the Engineman.

In 1812 William Hedley ran a locomotive on his plateway from Wylam to Lemington on Tyne. In the same year George became enginewright at the Killingworth colliery. George also became involved in designing a new miner's safety lamp for a prize of £1000. Together with Nicholas Wood and Robert he constructed the Geordie safety lamp but he did not win the prize. He was incensed that he was beaten by Humphrey Davy and maintained that his lamp was superior to Davy's. Between 1817 and 1822 Robert, on behalf of George, wrote numerous letters to newspapers.

Sundial created by R. & G. Stephenson

About this time (1816) Robert designed and carried out the necessary mathematical calculations for a sundial. He helped his father to manufacturer it and then placed it over the front door of their Killingworth cottage. *(It is still there today at Dial Cottage, West Moor).*



Rutter's School, Longbenton

Stephenson's Cottage, West Moor

Apprenticeship

After leaving school Robert was apprenticed to Nicholas Wood, the under viewer at Killingworth colliery in order to qualify as a mining engineer. He was very pleased to leave school as other pupils had bullied him because of his "Geordie" accent and poor clothes. During this year he designed a mining compass and engraved "Robert Stephenson fecit" on the brass plate. He was often left in charge of the West Moor engine workshop while his father travelled to other mines belonging to the "Grand Allies" as their enginewright.

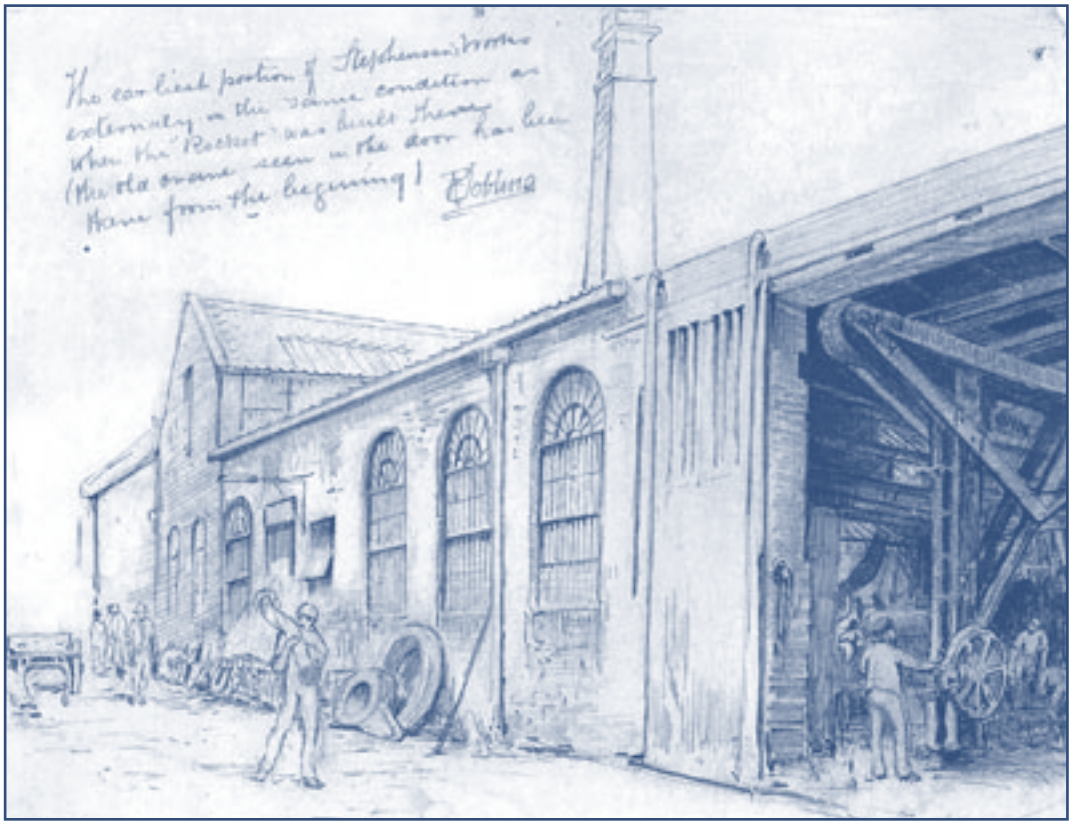
William James, a man who had promoted a passenger carrying railway system for many years, visited Killingworth in 1821 to buy locomotives capable of travelling at speed. As a result, Robert built a simple, compact high - pressure showpiece locomotive, which travelled on wrought iron rails which were superior to the usual cast iron rails. Robert wrote that the new rails *"…are so much liked in this neighbourhood that I think in a short time they will do away with the cast iron railway…"*

Early Working Life

After two years' apprenticeship Robert went to work with his father on the Stockton & Darlington Railway (S&DR) survey. George insisted that Robert's name be placed on the S&DR plans, reports and contracts, as Engineer. Robert was only eighteen years old at the time.

Robert also began the construction of three locomotives for the Hetton Railway and one for Killingworth. The Killingworth locomotive was very powerful because Robert had put the exhaust pipe into the tall chimney to stimulate the fire.

South Street Works 1870



During 1822 the S&DR contractors were still reporting to Robert Stephenson at West Moor. He also helped William James with the Liverpool to Manchester railway survey. In October he enrolled as a student at Edinburgh University but left in April 1823 to prepare for an appearance before a Parliamentary sub-committee for the second Stockton & Darlington Railway Bill.

In the same year George and Robert moved from Dial Cottage, Killingworth to a new house in Eldon Place, Newcastle.

South Street Works in 1900

George, together with Robert, then decided to go into business with Edward Pease, a leading director of the Stockton & Darlington Railway and Michael Longridge, the manager of Bedlington Iron Works in Northumberland.

They leased some land in South Street, off Forth Street and the works were established there in a rapidly developing area around Forth Banks (now behind the Central Station). The offices and the boiler/plate workshop still survive.

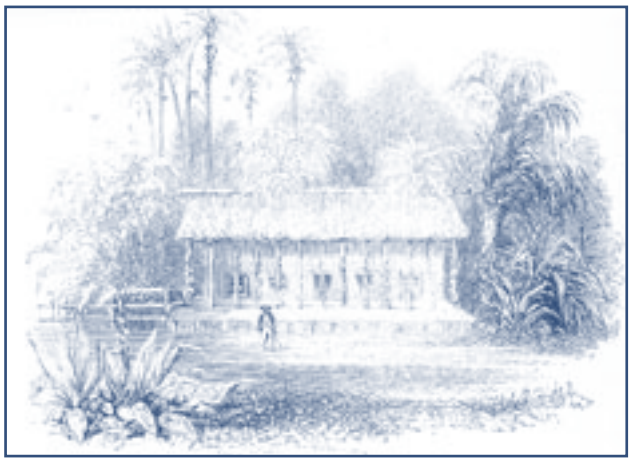
On 23rd June 1823 Robert became the working manager of "Robert Stephenson & Co." - the first engineering works specialising in locomotive construction, at the age of 19.

He had to "supervise the building operations, engage men, take orders, advise on contracts, draw plans, make estimates, keep accounts, and in all matters, great or small, govern the young establishment on his own responsibility." He earned the title of "Chief".

The first locomotives produced at the new Forth Street works were "Locomotion" and "Hope" for the Stockton & Darlington Railway.

Three Years in Columbia

Friends became concerned for his health during 1824. He was working very hard and steering the third Stockton & Darlington Railway Bill through Parliament. He was also frustrated by design restrictions placed on him by his father. So, in June he accepted work as the Mining Engineer with the Colombian Mining Company in South America to re-open the old silver mines and make them profitable. There was however no rest for Robert. The work was arduous but it gave him an opportunity to show his leadership and problem-solving skills without interference from his father George.



Robert Stephenson's Cottage at Santa Anna

Robert stayed in Colombia for three years before returning home via New York in December 1827. He had many adventures and some of his letters home contain vivid details of his time there. He was shipwrecked between Columbia and America but survived unhurt.

While in Bogota he had attended the University and met again with Richard Trevithick who was also working there. It was an amazing opportunity to develop new ideas about locomotive development.

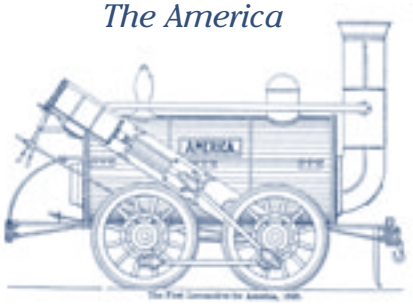
Civil and Locomotive Engineering Work

On his return to Newcastle he began to develop ideas on improving the performance and appearance of locomotives. He was now an expert in metals and their properties. He aimed to simplify the design, ensure reliability and reduce heat loss in locomotives. He persuaded George to abandon indirect drive engines and wrote of *"endeavouring to reduce the size and ugliness of our travelling engines, by applying the engine (cylinder) either on the side of the boiler or beneath it entirely"*. He designed the "Lancashire Witch" and the "America" on these principles.

1829 was a momentous year for Robert. In that year he married Frances Sanderson and they moved into 5, Greenfield Place, Summerhill Square, Newcastle upon Tyne.

Also in 1829 Robert and Joseph Locke completed their locomotive report for the Liverpool & Manchester Railway Co. Unfortunately the Directors were split over the wisdom of using locomotives and so proposed a competition to take place at Rainhill in October 1829 with a prize of £500 for the best performing locomotive. Robert began to design his "Premium Engine" for the Trials. In August Robert, together with William Hutchison his chief mechanic since 1821, Ralph Hutchison, Edward Fletcher and George Phipps his draughtsman, began construction of their locomotive at Forth Street in Newcastle. During September the locomotive, now called the "Rocket", was moved to the West Moor works and had a trial run on the Killingworth Waggonway.

The America



On October 6th and 8th 1829 the Rainhill Trials took place and Robert Stephenson's locomotive, "Rocket", fulfilled all the conditions and won the competition.

Robert's success at Rainhill was a watershed for railway development in this country and the forerunner of our modern railways.

5 Greenfield Place

In February 1830 Robert sent four new locomotives, "Meteor", "Dart", "Comet" and "Arrow" to Liverpool. More locomotives were sent over a period of time - all built at Robert Stephenson & Company in Newcastle. In June he developed the "Northumbrian" which was the prototype for all *outside* cylinder locomotives and in September he developed the "Planet" the prototype for all *inside* cylinder locomotives, which set the pattern for all future locomotives.

By the early 1830s Robert was becoming nationally known as an engineer. He branched out into bridge design. With his knowledge of metals he worked on better and stronger bridges and was able to design them "on the skew" which added to their span.

In 1832 he was invited to become a partner in a rival company, the Vulcan Foundry based in Lancashire. Encouraged by his colleague Michael Longridge, Robert joined the Company and the Vulcan Works proved to be as successful as Robert Stephenson & Co.

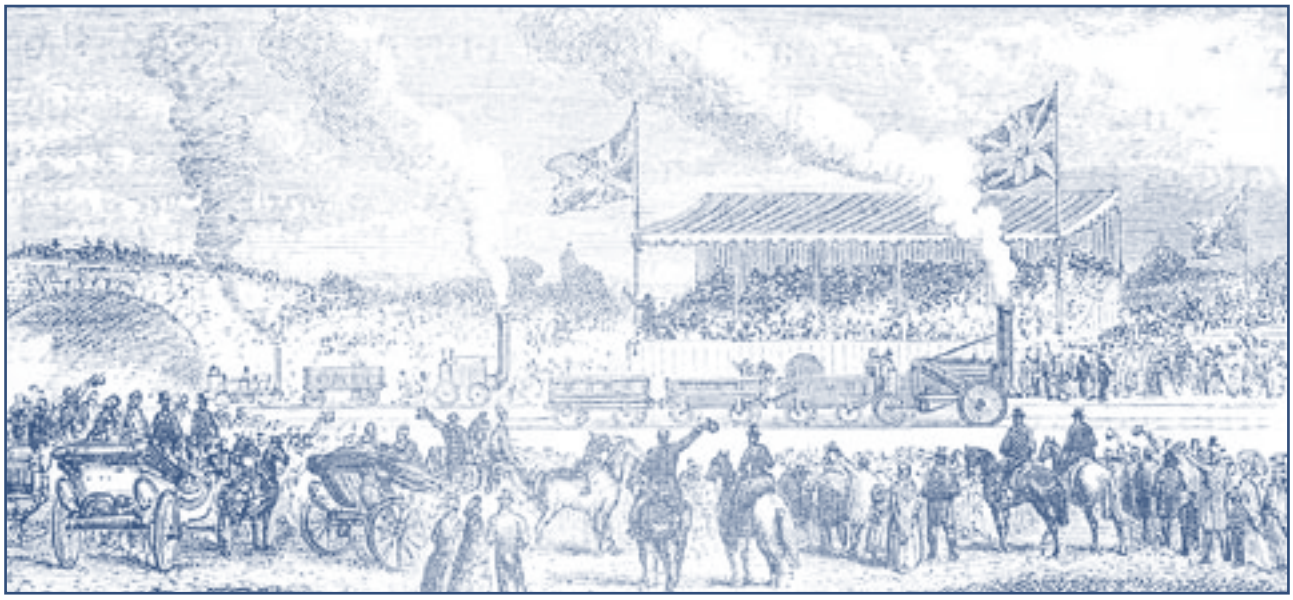
In 1833 Robert became Engineer in Chief with the London & Birmingham Railway, which was the first metropolitan railway in the world. His innovative designs dealing with the construction of cuttings and bridges include the tied arch bridge at Long Buckby and the first wrought iron truss to span a railway forming the train shed roof at Curzon Street, Birmingham.

On 7th October 1833 he obtained a patent for a Planet type locomotive with six wheels and a steam brake, which became known as “The Patentee”. In 1835 he was invited with his father to go to Belgium to advise on a railway network there. In 1836 he was involved with the construction of the Birmingham & Derby Junction, York & North Midland and North Midland railways. In June 1841 he patented a new long boiler.

Robert and his wife had moved to Haverstock Hill, London but tragedy struck in October 1842 when his wife, Frances, died. He was working as Engineer in Chief to the Newcastle & Darlington Junction Railway at the time. In the same year he became a consultant to the French railways and in 1843 he was a consultant for Italian and German railways. These consultancies brought many orders for Robert Stephenson & Company.

In 1845 Robert became the Engineer in Chief of the Newcastle & Berwick Railway. He was responsible for the construction of a number of important bridges on the route including the Dean Street Viaduct and the High Level Bridge in Newcastle upon Tyne and the Royal Border Bridge at Berwick upon Tweed. He was also responsible, as Engineer, for the proposed Newcastle Central Station.

The Rainhill Trials



Later Life

In 1846 Robert was joint Engineer in Chief with Joseph Locke of the newly formed London & North Western Railway Company. He developed the tubular girder for bridges on the Chester and Holyhead Railway over the Menai Straits and the Conway river.

He was elected as MP for Whitby in 1847 and moved to 34 Gloucester Square, London.

Tragedy struck on 12th August 1848 when his father, George, died suddenly from pleurisy. Even though there had been arguments between them, Robert had great respect for his father and admired what he had achieved.

Robert designed the combined rail and road High Level Bridge spanning the River Tyne. It was opened on 28th September 1849 by Queen Victoria and Prince Albert. The road way was completed four months later.

The design of Newcastle Central Station was a collaboration between architect John Dobson and Robert Stephenson. Queen Victoria opened the station in 1850.

As well as the opening of the Newcastle Central Station, 1850 was a year of celebration for Robert. In March he drove the last rivet into the Britannia Tubular Girder Bridge across the Menai Straits, and on 30th July he celebrated the completion of the London to Berwick upon Tweed railway with a dinner held in his honour at Newcastle Central Station.

He refused a knighthood from Queen Victoria in August of that year and in September he became consulting engineer to the Swiss Cantons and Egypt. In 1851 Robert Stephenson & Co. won contracts for all the tubular bridges in Egypt.

He was a Commissioner for Prince Albert's Great Exhibition held at the Crystal Palace in London in 1851 and, in the same year accepted a challenge to race his yacht *Titania* against the American, Commodore Stevens. Thus began the America's Cup challenge races which are still held today.

In 1852 he had the honour of accompanying Queen Victoria on a train over his own tubular girder Britannia Bridge. In 1853 he designed a tubular bridge to cross the St. Lawrence River in Canada - which became the longest bridge in the world at the time. In 1854 "Locomotive No. 1" was exported to Australia and in 1855 he was awarded the "Legion of Honour" by the Emperor of France, in Paris, for his engineering achievements.

In 1859 following a visit to Norway he developed a liver complaint and died on 12th October at his home at 34 Gloucester Square, London . On 21st October he was buried in Westminster Abbey where so many famous people are buried.

On his death the President of the Institution of Civil Engineers, Joseph Locke stated:

"Robert Stephenson achieved some of the greatest works of art which have been witnessed in our day, he obtained at the same time an eminence in the scientific world rarely reached by any practical professional man."