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## **RICHARD TREVITHICK : CORNWALL'S PIONEER OF STEAM**

Written by John Haynes

### **INTRODUCTION**

When one thinks of early steam railway locomotives, Stevenson's "Rocket" springs to mind. This engine is famous for winning the Rainhill Trials in 1829. However, the "Rocket" was something like the 70th railway engine to be built in Britain, and drew on the inventions of earlier engineers, who had worked on the development of steam as a source of power. Over 100 years earlier, in 1712, Thomas Newcomen had installed the first known working reciprocating steam engine in Dudley Castle.

Before 1800 James Watt had improved Newcomen's system to produce the first practical rotary motion. However, it was only when Richard Trevithick came onto the scene that Britain's first steam driven road carriage and the world's first railway locomotive appeared. These were in 1802 and 1804 respectively. This is why the Cornish proudly claim that Richard Trevithick was the father of the steam locomotive.

### **BACKGROUND HISTORY**

Early in the 18th century, Thomas Newcomen made the first commercially practical reciprocating steam engines for pumping water. The real power was that of the atmosphere, for steam was admitted simply to create a vacuum in the bottom of the cylinder by condensation. Newcomen's first known working engine was at Dudley Castle, Staffordshire in 1712, after he had been working on its development for at least 14 years.

James Watt (1736 - 1819), a Scot, improved on Newcomen's system by providing a separate condenser, greatly speeding the action of the engine, and also produced the first practical rotary motion by crank and flywheel. Watt's engine could drive machines as well as work a pump. Pressure was still very low and the steam was still condensed.

### **RICHARD TREVITHICK**

At the end of the 18th century Richard Trevithick appeared on the scene. He was born at Illogan, a village between Redruth and Camborne, in 1771. He was the son of another Richard Trevithick who was a mine 'captain' with a considerable reputation in the area. Young Richard had little formal education, but he learned to write and his letters are the source of much of our knowledge of his life and work. He also apparently had a considerable aptitude for arithmetic, but this did not lead in later life to prudent management of his own finances.

### ***Richard Trevithick (1771 - 1833)***

His main education was a practical one, acquired by close contact with the local mines. In fact he could have done no better than this anywhere, because there was no means of gaining an academic training in engineering in those days. The Cornish mines were one of the main centres of the use of the steam engine, so the opportunities to gain knowledge of engines and their practical uses was unrivalled. Richard was first employed at Eastern Stay Park Mine, near Camborne in 1790 at the age of 19.

In 1792 he was employed to report on the Hornblower engine at Tincroft, Illogan. He worked on various other mine engines, erecting, moving from one site to another, supervising and reporting, until 1797.

In 1796 he met Davies Gilbert in London while engaged in a patent suit between Boulton & Watt and Maberley. He remained friendly with Gilbert all his life and this provided him with a valuable source of advice on technical matters. Gilbert also helped many other scientists and engineers with advice, and later became President of the Royal Society.

Between 1797 and 1800 Trevithick made improvements to the existing methods of pumping water from Cornish mines, which were very useful, but not fundamental. Of much greater importance was his contribution in the next

few years to high pressure steam engines and to locomotion.

In about 1798, Trevithick had made a model high pressure engine and then a model locomotive. The real advance was not simply in the idea of using high pressure steam, but in the realisation that by using it non-condensing, the whole engine could be made much smaller, lighter and generally more manageable, by dispensing with the condenser itself, the beam, air pump and so on.

It was the answer to the industrialists' prayer. The huge low pressure engines of Watt had needed a large building to house them, but one could put a Trevithick engine almost anywhere. Watt was very annoyed and, playing on the idea that the use of high pressure steam was very dangerous, publicly remarked that his rival ought to be hanged ! But at last there was a steam engine sufficiently compact to make the locomotive a practical possibility.

Trevithick approached steam locomotion first with a model, and then with a full-size road locomotive. With his cousin, Andrew Vivian, he built a steam road carriage which they drove along the roads from Redruth to Plymouth in 1802, a distance of about 60 miles. The carriage was shipped to London and there is no doubt that it ran about the Capital a great deal. However, the press ignored it completely, which seems amazing, since the novelty must have been enormous. This was the first practical motor-car, but the public were not yet ready for the motor-car era.

The carriage eventually got damaged, and then became apparent a fatal flaw in Trevithick's character. He was a giant among original inventors, but about as poor a businessman as ever hoped to exploit an invention. If anything went wrong, he lost interest in it and went after something else. But although the steam carriage was lost, the world's first railway locomotive was about to be born.

In the winter of 1803-4, Trevithick was in South Wales, and it was there that this engine was built, to be demonstrated on the Penydaren mining railway, or tramway as it was called, near Merthyr Tydfil. On February 21st, 1804, it was publicly steamed. Even in stern, evangelical Wales, it was a time of heavy betting. The owner of Penydaren Ironworks wagered a neighbouring iron-master that the steam engine would haul ten tons of iron on the tramroad from Penydaren to Abercynon, a distance of nearly 10 miles. The stakes were 500 guineas !

### *Trevithick's railway locomotive 1804*

Trevithick's locomotive made the journey in four hours, five minutes with the 10 ton load of pig-iron, on top of which about 70 men had climbed. These were the first people to travel by a mechanically powered railway train. Did Trevithick press home this advantage with the rich patron, who had backed his engine with such a princely wager ? Well he might have done, but the "wonder" was a thing for a few months only. For the first time it was seen how an iron locomotive smashed to pieces the flanged cast-iron plates which formed the early rails. Yet Richard Trevithick had made a huge contribution to technological history.

His next venture was in London again, in 1808, where he showed off another locomotive he had built, called "Catch-me-who-can". This was run on a circular track near the present Euston Square. Round the circle was built a high fence to guard the display against becoming a free show. Londoners were admitted at a shilling a head, which covered a ride in an adapted carriage drawn by the little locomotive. From old drawings it appears that the locomotive was smaller than the Penydaren engine.

### *Catch-Me-Who-Can Locomotive 1808*

Although this venture was a kind of circus, the visitors were truly the first fare-paying passengers ever to have been hauled on the rail by any sort of locomotive. Before long there was a derailment, but it does not seem to have been serious. Nobody was badly hurt, but it was enough for the ingenious inventor to lose interest. Very possibly he was too hard-up to repair the damage, as he often was.

During the period 1802 to 1810, Trevithick did not spend a great deal of time on locomotives, but devoted most of his energies to applying the high pressure engine to a wide variety of uses. These included canal dredgers, rolling mills, corn mills, forge hammers, blast furnace blowers and agricultural engines.

He was also involved in a major job at Rotherhithe in 1807, which was to tunnel under the Thames. He was almost drowned when it ran into a quicksand, and further work was halted. He suggested a method of completing the job by excavating a trench in the river bed. in a caisson, and putting in cast iron tubular sections. But the Directors had lost their nerve, and the idea was not tried until many years later, first under the Detroit river.

In 1811 he became bankrupt and returned to Cornwall, where he again began to make a number of new inventions, some of the greatest practical importance. Probably the best known was the Cornish boiler, the first being installed at Dolcoath in 1812. This type became the standard for many years after, together with the similar (twin flue) Lancashire type. About this time he applied to the beam engine high pressure, expansive working and condensing, with his boilers - the first real 'Cornish' engines, which were to become so efficient and widespread.

Between the years 1816 and 1827, Trevithick was in South America. In about 1813 Francesco Uville came to England from Peru to find out if he could get steam engines to pump the water out of the ancient and very rich silver mines of Cerro de Pasco, which are at an altitude of over 14,000 feet. He landed at Falmouth to look for Trevithick and only 15 months later he returned to Peru with nine engines, boilers and some helpers sent by Trevithick. As the men who had been sent were not competent enough to overcome all the technical problems, Trevithick went himself from Penzance in 1816.

After being involved in various ventures, he returned to Cornwall in 1827. He found that much had changed. In the mines and elsewhere his inventions and improvements were in every day use. At his homecoming the church bells rang for him in Camborne and he was afforded a hero's welcome. But no-one was willing to pay him for the use of his ideas, which they had enjoyed for so long. Foolishly, but typically, he refused a cheque for £8,000 for his mining concession in Costa Rica, regarding this as an insultingly low offer.

There followed several more inventions but comparatively little practical achievement. In 1828 he wrote to Davies Gilbert about an idea he had for making ice using mechanical means, but he did not pursue this. It was left to Dr. Gorrie in New Orleans to invent the first air cycle refrigeration machine in 1845. Also in 1828 Trevithick went to Holland, where he made some very practical suggestions for draining the Zuyder Zee, using material dredged from the Rhine, years ahead of it actually being carried out. He designed and built at Hayle

a ball and chain pump for the proposed drainage work, probably the largest of its kind ever made.

In the year 1833 he was working with John Hall at Dartford in Kent on some form of turbine engine, when he was taken ill. After a short illness he died and was buried in Dartford churchyard.

## SUMMARY

Richard Trevithick was a versatile but erratic genius. In his own county of Cornwall he was looked up to with veneration. By force of personality, courage and a capacity for hard work, he fought his way to immortal fame. In the brief period between 1799 and 1808 he totally changed the breed of steam engines, and from an unwieldy giant of limited use he evolved a prime mover of universal application. However, because he was a dashing adventurer and pioneer, he never followed up and reaped the rewards of his astonishing pioneering work.

He is still remembered annually in Camborne, when on " Trevithick Day ", held the last Saturday in April, the whole town turns out with brass bands, choirs, street dancing, stalls, flowers and many other side-shows. There is also a parade of steam traction engines, when as many as 30 machines lumber majestically along the main street. This steam parade is Richard Trevithick's true memorial.

J. W. Haynes. March '98.

## SOURCES.

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