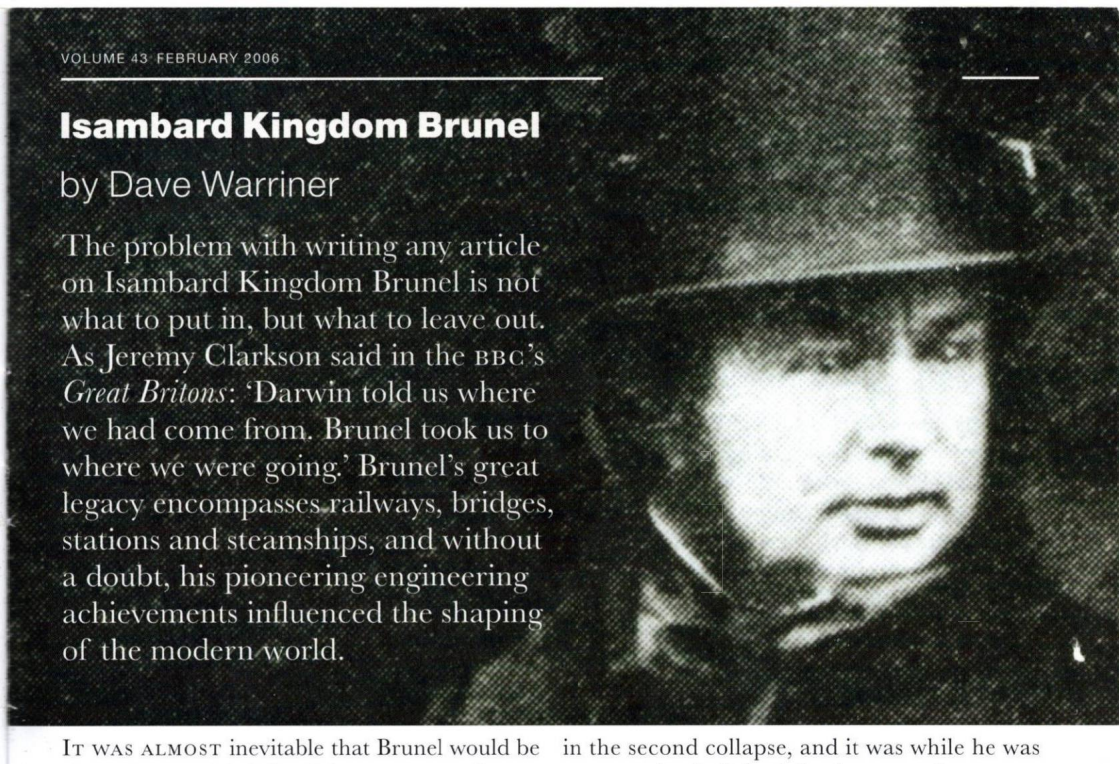
Isambard Kingdom Brunel

by Dave Warriner

The problem with writing any article on Isambard Kingdom Brunel is not what to put in, but what to leave out. As Jeremy Clarkson said in the BBC's *Great Britons*: 'Darwin told us where we had come from. Brunel took us to where we were going.' Brunel's great legacy encompasses railways, bridges, stations and steamships, and without a doubt, his pioneering engineering achievements influenced the shaping of the modern world.



IT WAS ALMOST inevitable that Brunel would be an engineer, as his father, Marc, was one of some genius. When Isambard was born in 1806 Marc, a French royalist who had fled the revolution, was running a factory turning out the 100,000 pulley blocks required every year for the Royal Navy's fleet. As these had previously been laboriously crafted by hand it would be fair to say that Marc's machinery helped defeat Napoleon.

The young Isambard was fortunate enough to attend Dr Morrell's progressive boarding school, and then to go to France where, after studying in Caen and Paris, he was apprenticed to precision instrument maker Louis Bréguet. Back in Britain in 1822, he joined the family consulting engineering practice; soon father and son were working on an ambitious project to drive a tunnel beneath the Thames linking Limehouse to Rotherhithe, thanks to Marc's patented tunnelling shield.

Marc contracted pleurisy working in the hellish conditions of the tunnel, and at 21 Isambard was left in sole charge of the excavation. Despite problems with funding and two tunnel collapses, the tunnel was eventually completed in 1843, and is still in use today as part of the London Underground system. Isambard was seriously injured in the second collapse, and it was while he was recuperating in Bristol that he entered a competition to design a bridge to span the Avon Gorge.

Brunel won a second competition to design the Clifton Suspension Bridge (60p), as none of the entries in the first contest had been deemed good enough by the judge, Thomas Telford, and Telford's decision to use his own design was unpopular. Brunel's design for a single span suspension bridge, at 702 feet the longest in the world at the time, was initially rejected, but a modified version persuaded the judges to grant Isambard his first major independent commission.

Fated never to be completed in his lifetime, the bridge's foundation stone was laid in 1836, but by 1843 funds had run out leaving only the piers built. It was completed in 1864 by members of the Institution of Civil Engineers as a tribute to the Victorian age's most innovative engineer. One of Bristol's most distinctive landmarks the bridge was intended only for pedestrians and the occasional horse-drawn wagon, but today it carries around 12,000 motor vehicles every day.

Appointed as Chief Engineer to the Bristol to London Railway in 1833 Brunel told its directors 'the route I will survey will not be the cheapest –

The Brunel stamps will also be issued in a miniature sheet and in a prestige stamp book. The issue goes on sale on 23 February.

but it will be the best'. Although he had no experience of railway design, Brunel knew that locomotives were not very good at climbing hills, so he set about making the route as flat as possible, with bridges, cuttings, tunnels and viaducts. With a mean gradient of 1 in 1,380 the finished line was known as 'Brunel's billiard table'. A formidable obstacle on his route was Box Hill, between Bath and Chippenham. Brunel resolved to cut through it. The Box Tunnel (40p) is almost two miles long, lined with 30 million bricks, and took five years to complete. At its peak, the operation employed 4,000 men and 300 horses and consumed a ton of gunpowder and a ton of candle every week.

Another problem for the Great Western Railway lay closer to London where it had to cross the Thames. Brunel solved this with the Maidenhead Bridge (68p). This comprises of two brick arches, at that time the widest and flattest in the world. The pier foundations were sunk using a revolutionary caisson which helped prove the value of compressed-air technology in underground construction. Each span of the bridge is 128 feet long and critics said it would surely fall down. Originally built for two lines of Brunel's broad gauge track the bridge was later widened and today carries trains at 125 mph from London to the south-west and Wales on four lines of standard track.

Brunel was involved in nearly all aspects of the railway's construction, from stations and locomotive works to the ornament of lampposts. It was intended that the GWR should share the London terminus of the London and Birmingham Railway at Euston, but a failure to agree terms meant that a new site to the west of London was chosen. Paddington Station (42p) was designed in collaboration with the architect Matthew Digby Wyatt 'After my own fancy.' Inspired by Joseph Paxton's Crystal Palace, Brunel hired the same contractors to supply the 69 cast iron columns for the three-span, 700 foot long iron and glass structure.

The Royal Albert Bridge (1st), at Saltash, was Brunel's final bridge. Two main spans supported by a single deep water pier in midstream and two masonry piers on either bank carry the Cornwall Railway, at a height of 100 feet, 2,000 feet across the Tamar. Brunel had the two iron spans floated on the river and lifted into place under his direction with flag signals. The main spans are based on the principle of a suspension bridge; this is the only bridge of its type carrying main line trains.

Brunel's genius was not confined to the land. A chance remark at a GWR board meeting caused him to think about how a passenger could board a train in London and continue on to New York. Convention held that a steamship could not carry enough coal to cross the Atlantic. Brunel saw that the larger a ship was, the more fuel it could carry, while using proportionally less to drive it through the water. His first ship, the paddle steamer *Great Western*, made its first Atlantic crossing in 1838.

Brunel's next ship, the *Great Britain*, was even larger, with a hull of iron and a screw propeller instead of paddles. His third ship, the *Great Eastern*, (47p) was a monster: 692ft long, 83ft wide, displacing 22,500 tons with four steam engines driving a screw and a pair of paddle wheels, she was six times the size of any other vessel in the world. Designed to take 4,000 passengers, she was intended to run to Australia and back without refuelling. Construction was dogged by problems, and while Brunel was on board watching preparations for her maiden voyage, he had a seizure. He died ten days later on 15 September 1859 •