

## 9. Nigel Phillips' The Wylam Dilly

One of my favorite places whenever I visit Edinburgh is the National Museum of Scotland, located in the Old Town and a five minute walk from the Castle. In the museum is my favorite locomotive. The Wylam Dilly, a 0-4-0, two cylinder locomotive is one of the two oldest surviving railway locomotives in the world (the other is its brother locomotive Buffing Billy). Built



around 1813, it was designed to haul coal on the Wylam Wagonway. The five mile long single-track wagonway (with passing sidings) was built in 1748 and transported coal from the Wylam Colliery near Newcastle-on-Tyne to the coal staithes (elevated platforms) at Lemington on the River Tyne. Oxen or horses were the original motive power. Steam locomotives were used from 1813. Originally laid with wooden rails, cast iron plate ones were used from 1808.

William Hedly, a manager at the Wylam Colliery, researched a practical adhesion steam locomotive during a miners' strike in 1810 before building Puffing Billy in 1913 and then Wylam Dilly ("Dilly" refers to the coal wagonway). With two vertical cylinders on either side of the boiler and rocking beam cranks on top, the smoke stack was next to the firebox and there was a separate water and coke cart tender. They pulled seven to eight coal wagons at a top speed of five miles per hour making up to five return trips a day. There were no side rods connecting the axles, the vertical piston rods were connected via the beams and motion rods to an underframe cranked pinion gear train. This powered both axles with flat, flangeless wheels, making it a 0-4-0 locomotive.

The rocking beams also drove the water pumps on either side of the boiler. The piston exhausts were combined and connected to the stack, providing a vacuum draft for the firebox (an idea probably borrowed from George Stephenson's Blücher of 1815). The boiler was return-flued and did not have the efficiency of later multiple flue tubes. That invention came about in 1826. One large diameter flue tube ran in a U-shape from the firebox to the front and then to the back of the boiler and the stack, maximizing the surface area available for heating without the issues around multiple

boiler flue tubes and the then relatively high boiler pressure of 50 psi. The locomotive was briefly taken off the rails in 1822 to power a paddle steamer ferry transporting strike-breaking miners across the River Tyne. Wylam Dilly was transferred to Craghead Colliery, Northumberland, in the early 1860s, working until 1883.



Its weight was too much for the cast iron L-profile flanged rail plates, and it was rebuilt as an articulated geared 0-4-4-0. This configuration lasted until around 1830 and the introduction of a more robust wrought-iron rail when it was converted back into a 0-4-0 with flanged wheels. Stone setts (paving blocks) would have been used to support both flanged and regular rail, a design still being used with reinforced concrete in the UK during WW2. I suspect the dynamic downward forces generated by the opposed vertical pistons (piston hammer blow) were partially responsible for cracking the cast iron plates.

The museum also has a Balton and Watt beam steam engine, built in 1786. The same principles, a rocking beam, vertical piston, and vertical motion rod drive a gear train. I suspect the design of the Wylam Dilly engine was heavily influenced by the work of James Watt, and the reason why this locomotive is in a Scottish museum. George Stephenson was born in Wylam and was appointed as engine wright in 1812 at the Killingworth Colliery, just 15 miles away, and was well aware of these locomotives. No accident that some of the Wylam Colliery locomotive design elements can be seen in George Stephenson's Killingworth locomotives (and *vice versa*) and Robert Stephenson's original Rocket. **Nigel Phillips**