# Rubber revolutionary

Brian Marr of the RW Thomson Memorial Fellowship revisits the extraordinary contribution Thomson made to the development of rubber tyres.

When asked 'Who invented the pneumatic tyre?' most people answer 'John Boyd Dunlop'. But they are quite mistaken. So who did invent this ubiquitous device without which motor and air transport could not exist? His name was Robert William Thomson and his original patent in 1845 'for the purpose of lessening the power required to the carriage rendering the motion easier' preceded Dunlop's by 43 years.

The Thomson Carriage Wheel was constructed by cementing together folds of canvas that had been saturated with a rubber solution. After sulphurising, a strong outer casing was built around the tyre, with the whole thing bolted to a wooden carriage wheel. What makes the patent fascinating is that not only does it involve the use of air-inflated tyres, but includes different tyres for different loads: a single inner tube for light loads and up to nine inner tubes for heavy loads.

So why was it not a success? At the time, commercial vulcanisation of rubber was relatively new and Thomson had to deal with an industry unable to build a product to his specification, in a market too limited to justify large-scale manufacture. Remember, this was 50 years before the motor car hit the road. But perhaps the main reason was the cost: £142 for a set of wheels works out at more than £13,000 at today's prices.

However, the new tyres were a technical success, requiring only 30-60% of the force required for conventional iron-banded carriage wheels. The smoothness and silence pleased fare-paying passengers, although pedestrians preferred the warning rattle of conventional wheels. After a trial by the Edinburgh Carriage Company, the tyres were returned to Thomson having covered 1,700 miles without giving any trouble.

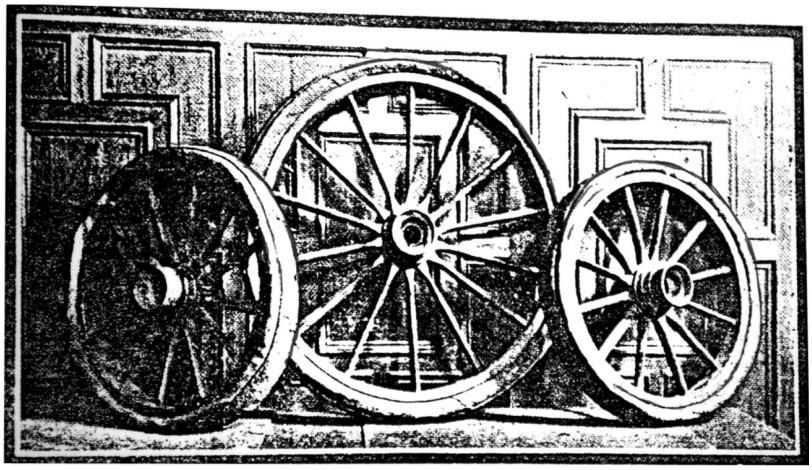
## Early years

Robert Thomson was born on 29 June 1822 in Stonehaven, Aberdeenshire, the 11th child of a local mill owner. Aged 14 he was sent to live with an uncle in South Carolina, USA, but soon returned to Scotland to study engineering at works in Aberdeen and Dundee. Thomson's first piece of inventive application was a double roller mangle for his mother – this enabled wet linen to return back in the direction of loading following the squeezing of water from the linen sheet. At 17 he designed and built a ribbon saw and completed his first working model of the elliptic rotary steam engine, which he patented in later life.

Following his engineering apprenticeship, Thomson worked for a civil engineering firm contracted for demolition work at Dunbar Castle. It was during this time that he developed the idea of detonating explosive charges by electricity, an invention that went on to save countless lives in the mining industry. From here he went to work for Ransomes of Ipswich, tasked with supervising blasting operations for the South Eastern Railway extension to Dover.

In 1844 Thomson set up his own railway engineering consultancy and submitted proposals for the railway in the eastern counties, beating the Stephensons for the project. The railway company delayed the project, but used the Thomson route at a later date, unfortunately of no benefit to Thomson himself.

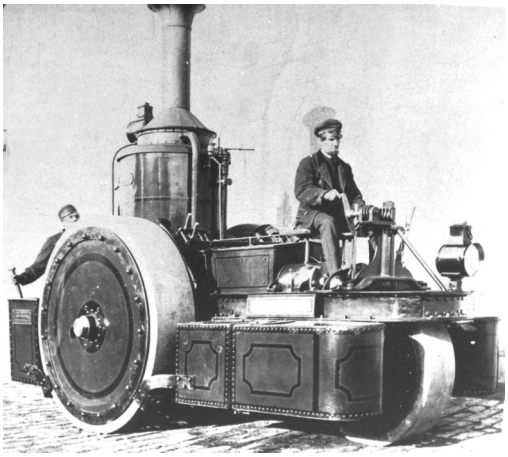
**The late Mr R.W. Thomson, C.E. of Edinburgh**

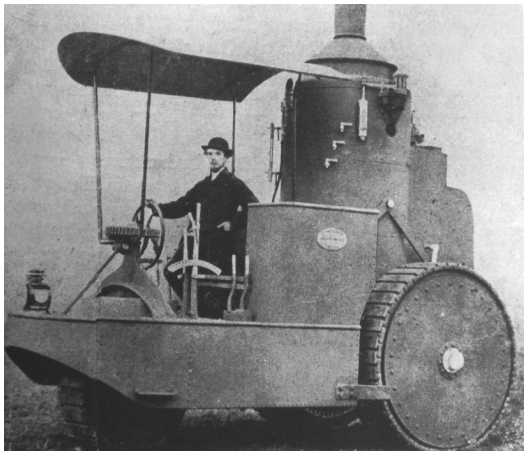


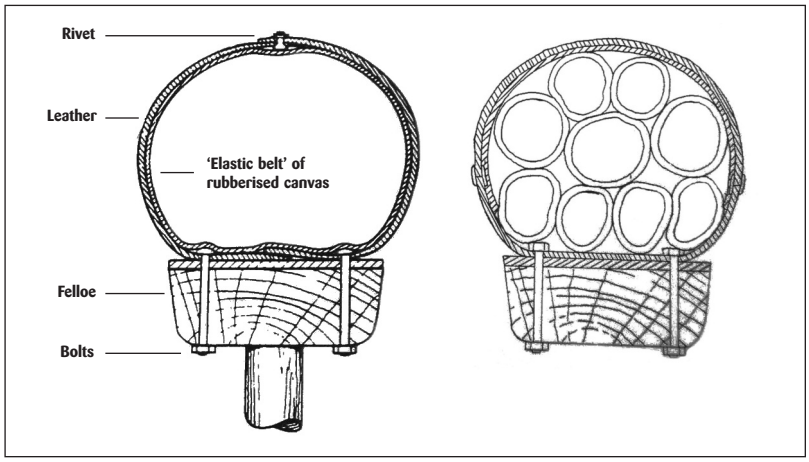
**Tyres made in 1846 by R.W. Thomson**

Right: An early Tennant-built road steamer clearly showing Thomson's smooth rubber tyred wheels

Far right: A Burrell-Thompson road steamer built for the Turkish Government with the notorious vertical 'pot' boiler








Cross-sections of the pneumatic tyre for carriages

With this rather unsatisfactory experience of railway engineering, he turned to designing other things, most notably the first self-filling fountain pen. The pen comprised a glass tube tapered at one end to take the ink, and the rubber insert to draw the ink by capillary action. The pen can be seen as a forerunner to our modern fountain pen and was exhibited at the 1851 Great Exhibition.

## Sugar and steam

The following year, Thomson went to Java to act as an agent for an engineering firm setting up the sugar manufacturing machinery. Not surprisingly he redesigned the machinery to be superior to anything previously used on the island. It was while on Java that he had the inspiration for the mobile steam crane. The Dutch colonial authority had refused permission for the erection of a waterside crane unless it could be removed at night because they thought people might stumble against it in the dark. Unfortunately he did not patent the design, but Messrs Chaplin of Glydeside who made the prototype went on to manufacture the crane in large numbers.

In 1860, Thomson returned to London to design and oversee the building of a novel dry dock with interchangeable sections that could be easily shipped and rebuilt. John Elders Ltd built the dock, but unfortunately it sank due to the failure of untested pumping equipment. Two other docks of similar design were built and proved entirely satisfactory, one lifting a 72-gun frigate at the first attempt.

With his health failing, Thomson returned to Scotland in 1862 to live in Edinburgh, where he continued innovating – particularly the use of steam power for transportation and solid rubber tyres for heavy loads over rough roads.

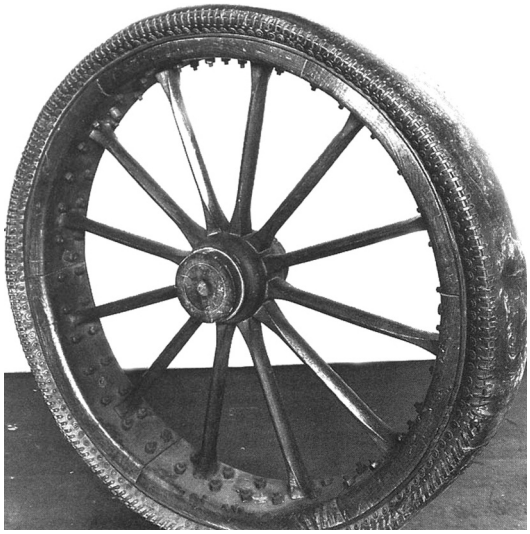
In 1865, Thomson sold one of his road-going steam tractors to the Indian government. This had solid rubber tyres and to this day is recognised as the first successful attempt to apply the rubber tyre to heavy machinery. By the 1870s, Thomson's solid tyres for steam traction were known all over Europe. Thomson continued his work, and in 1867, further patented an improved wheel for steam carriages to be used on common roads. These improvements enabled the steam carriage to be propelled over poor roads with less power, and showed that travel over ploughed land with very little sinking into the soil was possible.

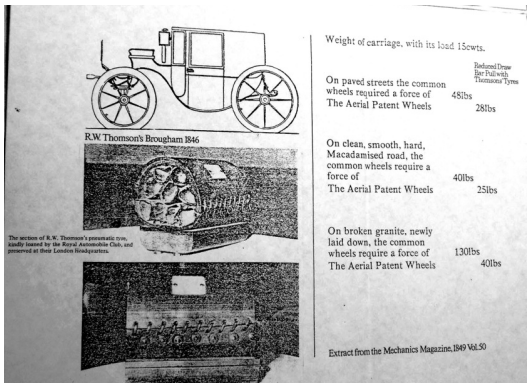
## Gaining traction

A newspaper report from the period gives a description of the engine pulling four loaded wagons, a total load of 40 tonnes from Dalkeith to Edinburgh up some considerable inclines and around very tight corners. Local police presence was required to keep the crowds back, and the report stated, 'There can be no doubt that this invention of the application of India rubber to the tyre of road steamers forms the greatest step which has ever been made in the use of steam on the common road'.

This prompted the British government to carry out a series of tests on the Thomson steamer on suitability for use in military transport. Testing on the Portabello beaches left the inspectors in no doubt about its suitability, although the Commons

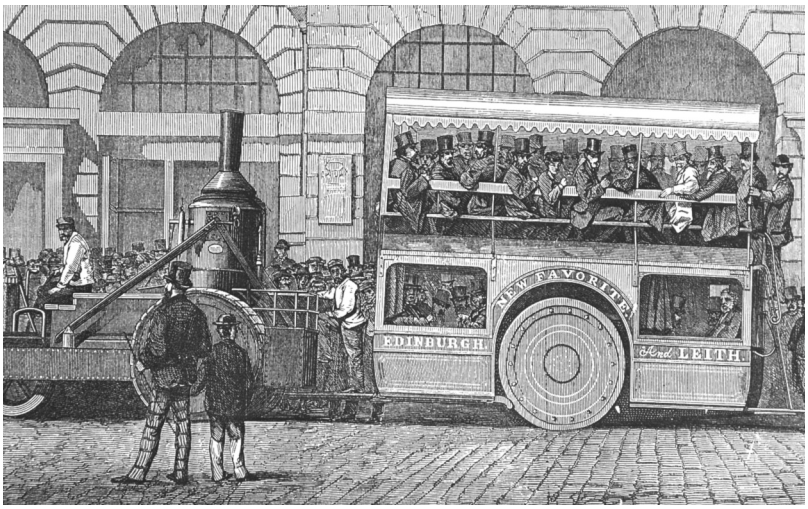
The Thomson pneumatic tyre as fitted to Loraine's Brougham in 1846







RW Thomson's first road steamer with corrugated rubber tyres on test before shipment to Labuan




Thomson's road steamer at Edinburgh

committee must have concluded that the inspectors were unduly influenced by Scottish hospitality, as a further set of more stringent tests was implemented, the second report confirming the original results. One of the conclusions in the report stated, 'This marks the end of the horse as a form of transport for military use'.

Although by this time Thomson's illness confined him to bed, he continued to receive visiting engineers for discussions and was invited to become a member of the Royal Society of Edinburgh. One of his last acts was to present a paper to the Society on 'Formation of Coal' and on the 'Changes produced in the composition of the strata by the solvent action of water alowly penetrating through the earth's crust during long periods of geological times'. Robert Thomson died at 3 Moray Place on 8 March 1873, and was interred in Dean Cemetery, Edinburgh. Just months after his death, his wife submitted his final patent for elastic seats and cushions.

So what can Robert Thomson teach aspiring engineers today? Firstly, if you have a idea, patent it. Secondly, don't give up if your idea is not an instant success. Remember, it took 43 years for the pneumatic tyre to hit the road.

| Patent | Description | Year |
|---|---|---|
| 10990 | Carriage wheels | 1845 |
| 12691 | Writing and drawing instruments | 1849 |
| 512 | Obtaining and applying motive power | 1863 |
| 1493 | Dividing rock, stone or coal | 1864 |
| 401 | Steam boilers | 1865 |
| 1006 | Steam gauges | 1866 |
| 2986 | Elastic tyres | 1867 |
| 2630 | Elastic wheel tyres | 1870 |
| 573 | Steam omnibuses | 1870 |
| 601 | Applying steam power in cultivating land | 1870 |
| 434 | Road steamers | 1871 |
| 2409 | Guiding road steamers on street tramways | 1871 |
| 775 | Elastic wheel tyres | 1873 |
| 1931 | Elastic beds, seats and other support cushions | 1873 |

The full list of Thomson's patents