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Opening extract from
Peter's Railway Hits the Jackpot

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Published by
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Peter's Railway Hits the Jackpot

Published by Christopher Vine 2013

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Printed by The Amadeus Press
Cleckheaton, West Yorkshire,
England.

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ISBN 978-0-9553359-9-0





The watercolour illustrations are by John Wardle.

*A big Rolls Royce crunched across the gravel drive.
But what was a large and expensive motor car doing at Crossacres Farm?
Grandpa had never owned a car, not even a small one.*

It all started with... **The School Visit**

Fiery Fox was simmering quietly at the little station by the river. The sun was shining, and steam from the chimney was drifting across the water. The children from Peter's school in Yockletts village were visiting the railway.

The visit had been organised by Peter's science teacher, Mr Hunter. Apart from being fun, it will be educational too. A steam engine is science and physics come to life, with nearly all the works on the outside so you can see and understand it. You can even see the coal releasing its energy as hot flames, making steam to move the train.

There were lots of passengers, so Peter and Grandpa had made the train as long as possible, using all of their wagons and carriages. Peter was on the engine, with Grandpa riding on the guard's van at the rear. The headmistress was sitting in the Granny Wagon, more politely known as Grandma's Special Saloon.

Having checked there was plenty of coal on the fire and water in the boiler, Peter was ready. "Hold on tight!" he called back to his friends on the train. "Enjoy the ride," he added as he released the brakes and opened the regulator.

Fiery Fox eased slowly forward and ran along the line beside the river. It was quite flat here and they built up speed rapidly.

"This is better than being at school!" the children shouted to each other, the wind blowing in their hair.

As the line turned away from the river, it started to climb across the field. Peter opened the regulator to work Fiery Fox harder. More steam rushed from the boiler into the cylinders, pushing the pistons back and forth, back and forth, turning the wheels and pulling the train up the steep gradient. Soon they were crossing the drive to the farm and running round behind Grandpa's house and through the farmyard beyond.

There was much to see. Animals, engine shed, turntable, duck pond and, of course, the lovely Highland cows in their field. One of the cows was standing on the track, so Peter gave a long, loud blast on the whistle. Grandpa's animals were quite used to having small steam trains running through their field, so the cow stepped lazily out of the way as the engine chuffed past.

A few minutes later, they arrived at the other end of the line, a mile from Yockletts village. Here was Woodland Cottage, the house where Peter lived. They didn't stop, but kept going round the loop and headed all the way back to Grandpa Gerald's house at Crossacres Farm.

"Did you enjoy the trip?" Peter asked when they had stopped.

"Yes!" everyone shouted at once, then off they went to explore the engine shed, the workshop and all the other things which make up a railway.

Peter and Grandpa showed them everything and tried to answer all of their questions, especially about how the engine worked.

Grandpa showed them how the coal burned, heating the water in the boiler to make steam.

"The boiler is incredibly strong. It has to be, to contain all the steam," he told them. "It can't escape, so it builds up to a great pressure. This high pressure steam is nothing like the steam you see coming out of a kettle. It contains lots of energy which can be used to force the pistons back and forwards in the cylinders."

"The pistons are a bit like your legs pushing the pedals on your bicycle," he explained.

Grandpa got them all to lie on the ground, right next to the track, while he drove the engine very slowly past them. They could see the piston rods pushing and pulling on the connecting rods, turning the wheels. Everything moved so smoothly and quietly.



"Would you like to see the engine go faster?" he asked them.

Of course they did, so Grandpa reversed back up the line, out of sight.

They heard the train approaching before they could see it. Suddenly it burst round a bend, going at an amazing speed. Steam, smoke and sparks were shooting out of the chimney with a roar. It was swaying from side to side as it rushed along the track.

Would it hold the rails?

Grandpa knew it was quite safe as he had been even faster before. But the children were alarmed and fascinated at the same time, as the engine shot past them.

It was a sensation of sight, sound and smell. Even the ground vibrated under the heavy engine. None of them dared to move until it had gone, then they all burst out laughing and chattering.

Mr Hunter was as thrilled as the children. "It's one thing teaching about science and engineering," he exclaimed. "But this is the laws of physics in action!"

"It's been fun showing you," replied Grandpa. "If you like our home-made science and engineering, jump back on the train and let me show you something else."

It was a pretty journey as they steamed down the line to Yocketts, then back through Bluebell Wood, across fields and through cuttings. Peter and Grandpa had made every bit of the railway themselves. Eventually the line swung back towards the river where Peter stopped at their watermill.



Constructing the Tunnel

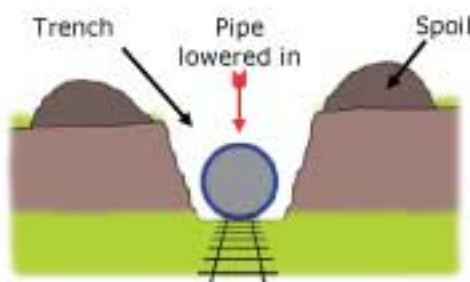


A hill is blocking the railway and a tunnel is needed to get through. The problem is to dig the tunnel in a safe and simple way.

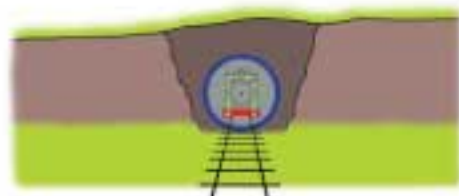


You might imagine that Peter and Grandpa would dig the tunnel underground, by hand. This would be very dangerous because the roof of the tunnel could easily collapse and bury them under tons of earth.

Tunnelling by the 'Cut and Cover' method



A trench has been 'cut' right through the hill. This is safe because there is no tunnel roof to fall in. The 'spoil' which has been dug from the trench is dumped at the top. Once the trench has been cut, the pipe (blue), which forms the tunnel wall, is lowered in.



The trench is now filled in again, using the original soil and the pipe has been covered over. The pipe which forms the tunnel must be strong enough to support the weight of the earth above it. This has been calculated very carefully, with a large safety margin.



This old picture shows the London Underground being built in 1861. For shallow lines, they dug up the streets and built the tunnels, before covering them over. It must have caused chaos!

Tunnelling Machines

For deeper tunnels, a different method is needed.

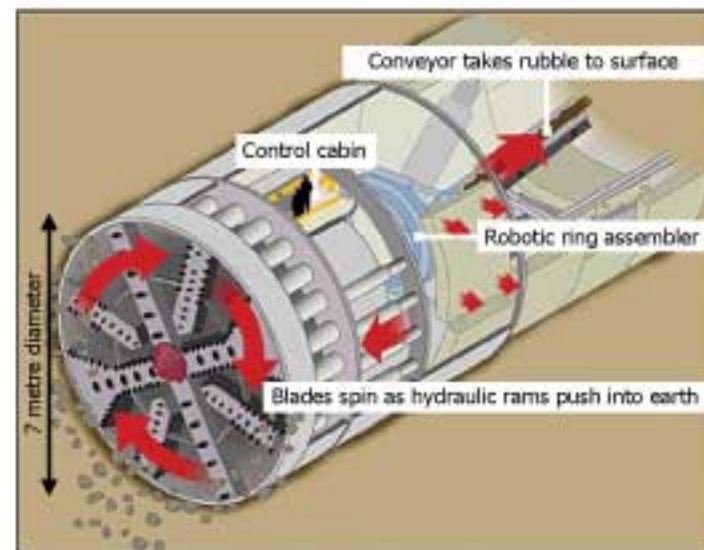


This is a photograph of a tunnel boring machine (TBM) just before it starts work, boring the London Crossrail tunnels. It is obvious that they are very large, complex and expensive machines. You can see from the size of the men, that it is enormous: the length is 150 metres and it weighs 1000 tonnes. This machine (called Phyllis) can bore up to 150 metres of tunnel in a week, and the position of the tunnel in the ground will be accurate to about 1 mm.

The TBM bores the tunnel and assembles the inside tunnel wall.

Photo courtesy Crossrail - London

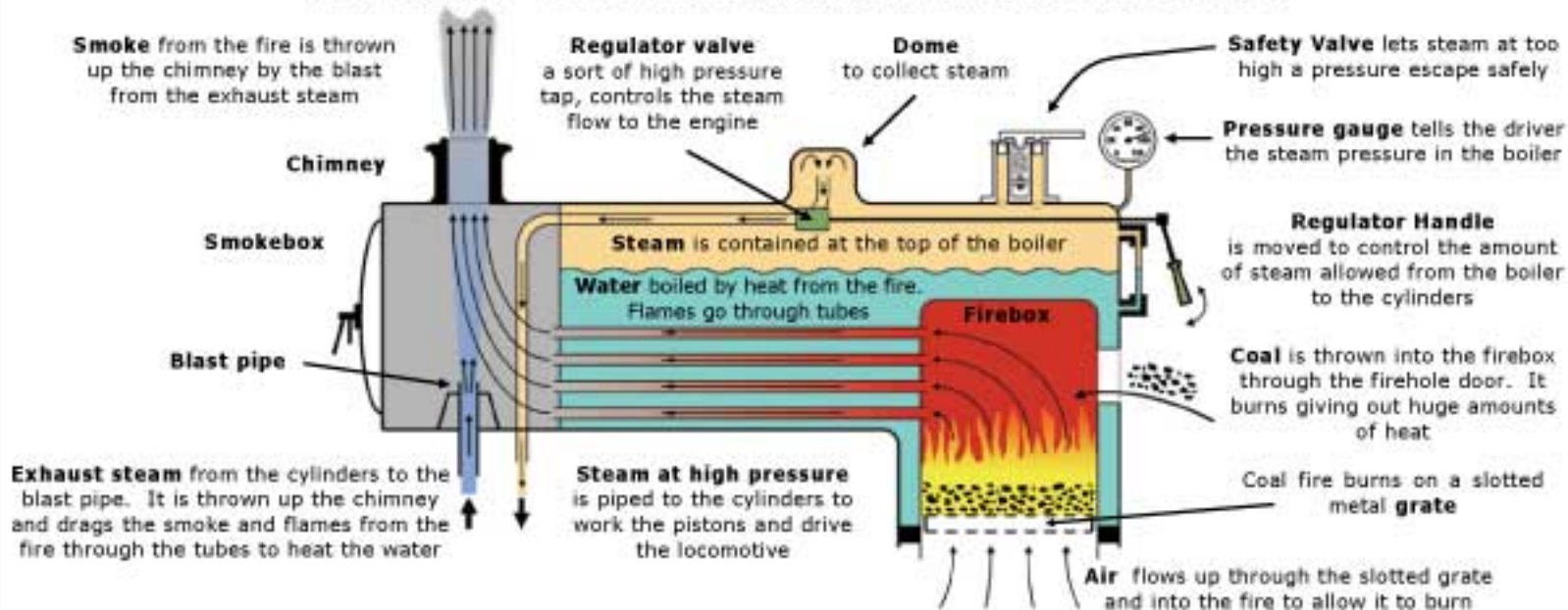
Tunnel boring machines are fantastically expensive, so it's incredible that, often when the tunnel is finished, the machine is left buried underground - entombed. It digs another short tunnel off to the side, where it is abandoned. This can be cheaper than recovering a massive and worn-out machine.



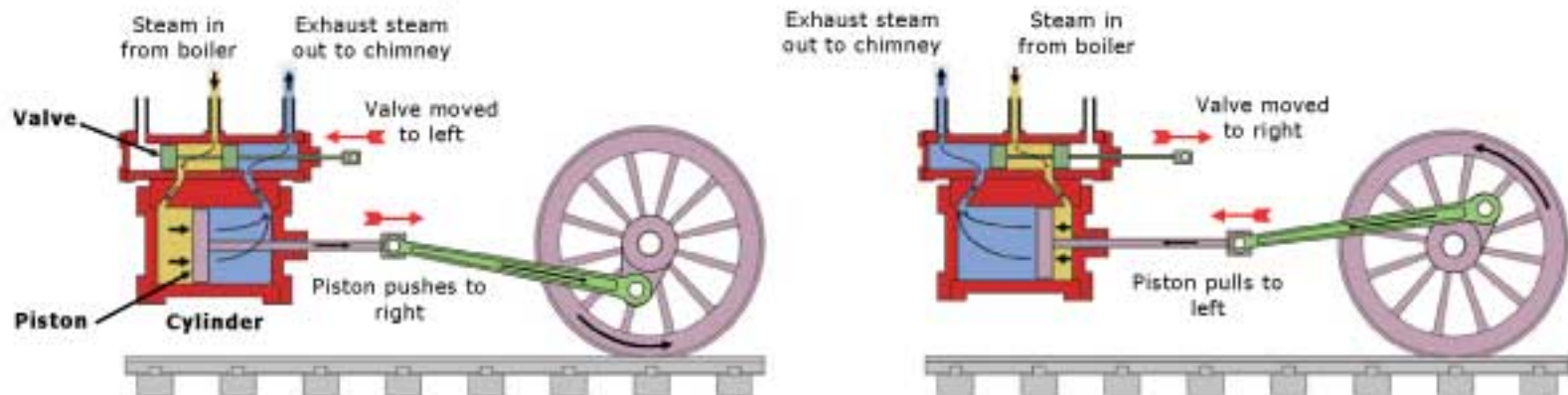
This diagram shows a tunnel borer in action. The rotating blades can cut through the ground while a conveyor belt takes the rubble away to the surface. Hydraulic rams push the rotating cutter forwards, into the ground, with enormous force so that it can cut. The clever part of the machine is that it holds the tunnel up while it is working, and then assembles wall panels or sections, to make a strong and waterproof tunnel wall. This is done by the robotic ring assembler.

Image courtesy Bechtel - London

The Boiler - How the Locomotive Makes its Steam



Pistons and Cylinders - How the Steam Drives the Locomotive



The piston pushes and pulls the wheel round with the high pressure steam from the boiler pushing first on one side of the piston and then on the other. The steam is let in and out of alternate ends of the cylinder by the valve which is moved automatically by the valve gear.