School lesson around the 16-tonne flywheel.

Steam rises

By Terry Snow

PHOTOGRAPHS: GERALD SHACKLOCK

Ken Pointon (rear) observes Graeme Quayle and Bruce Lawson working on the spindles.

A mighty beam engine is about to be powered by steam again after 80 years

In the sturdy brick building that is the core of the Museum of Transport and Technology at Western Springs in Auckland, an engineering rebirth is taking place. The giant beam engine that once used to pump around one million gallons (4.5 million litres) of water a day to supply Auckland is about to puff into life again with steam power some 80 years after it stopped working.

A bunch of enthusiasts led by Ken Pointon has been working since 2005 on Thursday evenings to finish freeing up the massive double compound condensing steam engine and sorting out its reconnection to a steam boiler in the adjacent pumphouse.

A generation before Ken Pointon's team, a group of enthusiasts started the business of mobilising the engine. They worked on getting the pistons moving. Then they reconnected the connecting rods after freeing up the engine and removing the bottom pump piston which was rusted solid in place. This team fitted a heavy electric motor drive to move the engine round. The present band of enthusiastic engineers, fitters and turners and steam fans has had to tackle the worn 1 ¼ inch valve spindles (some spare 1 3/8 inch chrome bar has been machined to replace

McLaren traction engine under piped steam power.

the worn spindles), 16 valve covers and bushes have been remachined to fit the new spindles, the double beat valves have been painstakingly ground, there are new neck bushes and the push rods and other parts have been polished.

"Much of the engine is hand-made," says Pointon. "The holes are different sizes and the studs line up in different places."

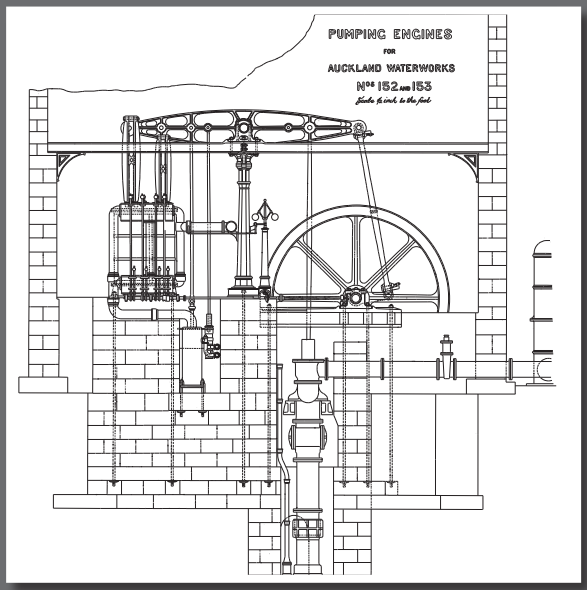
The expansion glands around the large cast iron pipes carrying the steam had also seized solid. If they had been left, the pipes could have fractured with the first run of the steam engine when they heated up and expanded.

"It was a hell of a job to get them out. We used wedges and the guys had chipped away for nights on end. We drilled and chipped and still they remained stuck for ages."

Now the glands are freed up they will be repacked to allow for the expansion when the steam starts coursing through these pipes again.

STATS

The double compound beam engine in the pumphouse at Motat, opened formally 130 years ago to pump water to reservoirs for Auckland, boasts some impressive statistics. The engine was built by John Key and Sons, Kirkcaldy, Scotland.



Flywheel

Total weight 16.25 tonnes, weight of rim 11.7 tonnes, diameter 6.25m, circumference 19.6m. Rim speed 280m / min, output 300hp at up to 14.5 revs / min (224kw).

Pump

Two pumps in the pumping shaft connected to the beam engine and as the rod of the pump went up, each of the two pumps sucked up 318 litres (70 gallons) in one move and could move up to 4.5 million litres (1 million gallons) of water in a 12-hour shift.

Water rise

Water was lifted 71.6 m (235ft) through a 533mm (21-inch) cast-iron pipe rising main to Ponsonby reservoir, then raised another 26m (85 feet) through a 300mm (12-inch) main to Khyber Pass reservoir. One of three reservoirs established at Ponsonby still feeds Auckland with water today.

Triple expansion engine from former Sydney ferry. Note grooved flywheel at left.

Pointon says they had to re-create the pipework underneath the pumphouse floor and more than half the work of the restoration was in the pipework infrastructure. Getting to it included excavating basalt rock and rubbish.

At one point in the 1950s there were laboratories in the upper rooms of the pumphouse where rock samples were tested for construction works around Auckland (the Auckland Harbour Bridge, Albert Street carpark). Rubbish and rock from these laboratories was simply tipped down into a convenient hole – where the old pumps lay in the basement.

A quick tour of the under-floor regions reveals that the A-side water pump is missing. In its place there's a box filled with concrete. Without it, the engine would be imbalanced and would not revolve smoothly. Without it, the weight of the single engine would tip over. Everything was duplicated – two water pumps, two boiler feed pumps, two condensers, two air pumps (vacuum pumps). A cylinder cock was saved from the original engine so the present engineers know how the how to make some more. There are four required. The lower pump plunger has been removed on the 'B' engine so that the pump cannot pump water. In the past few years, an electric motor has been used to run the pump and turn the flywheel from time to time for visitors, but the steam connection will be the real thing.

WATER

In 1880s water for Auckland was taken by bucket or hand pump from municipal wells, ponds at Auckland domain, rain water or streams. However, human waste was poured into streets and seeped into the water table causing cholera epidemics to break out.

The city needed a piped water supply for health reasons, but with no major river in Auckland as in other cities (Hamilton, Wanganui, Hutt Valley, Christchurch) citizens needed to find a source of purer water. There were only a private stream owned by breweries in Khyber Pass and streams in the Domain.

As is typical for Auckland, the water supply was argued over for 20 years, with the case both for and against privatising the water supply strongly advanced (it sounds familiar).

Two large springs were found on the edge of the main Mount Eden-Mount Albert lava flow which extends into the Waitemata Harbour as Meola Reef. The water flowed into an extensive swamp on the site of what is now known as Western Springs Lake. It was decided to dam this and pump water into the city from here.

The entire swamp was excavated using horse scoop and shovel under the supervision of Mr J Blewdon, a city contractor. A 300-yard-long (275 metre) embankment was constructed along the eastern edge of the swamp creating a 15-acre (6ha) artificial lake nearly two metres in depth and holding 22 million gallons of water.

An 18-metre long tunnel was dug between the lake and the engine house and in 1877 the Western Springs Waterworks were formally opened.

History

With the need to develop a safe reliable water supply reaching crisis point, early Auckland City fathers, after a decade of procrastination and 13 consultant reports, finally decided to develop the source of supply known as Western Springs in 1874. Things then moved quickly. By May they engaged engineer William Errington to prepare plans and set about raising a 100,000 pound loan immediately.

Errington produced extremely detailed designs for the beam engine, engine house, engine pond, boilers and boiler house, the Western Springs impoundment (now Western Springs Lake), the main reservoir (Ponsonby), the service reservoir (Khyber Pass) the valve house, pipes, valves, pipelines and a tramway to feed coal to the furnaces – no mean feat.

One of the three reservoir tanks in the big concrete tank on the corner of Ponsonby Road and Karangahape Road is still in use today. The Khyber Pass reservoir can be seen as a large concrete structure in Burleigh Street.

When work began in 1875 on the Western Springs scheme, it was the largest civil engineering project under construction in the Auckland region. The double compound condensing steam engine, pumps and four "Lancashire" boilers were manufactured at John Key & Sons Whitebank Foundry in Kirkcaldy, Scotland, transported in sections and assembled at Western Springs.

There is some question today among engineers about whether the 16-tonne flywheel was assembled upright – sections of the rim are marked with Roman numerals to indicate where they were positioned – or lying on the ground. The problem with the latter system is that it is inconceivable there would be a portable crane in Auckland at the time that could lift that weight.

The pump/engine combination was a rotative beam engine of the Woolfe compound type comprising two pairs of low and high pressure cylinders, each pair driving a beam. Both beams were connected to the flywheel. Steam was supplied by four Lancashire type boilers providing steam at up to 60psi with normally three in use at one time (coal consumption was a maximum of five tons/day.) The engine was rated at 300hp.

Governor for the beam engine.

A simple piston type pump was attached to each beam. They had a four foot (1.2 metre) stroke and sucked from a 7.6 metre deep well connected to the impounded spring water by tunnel. The beams also had pumps attached on the engine side which provided the vacuum for the condensers and the boiler feed water. The flywheel drove a crankshaft which was connected by layshafts to the steam chests which operated the inlet and exhaust valves and were controlled by the governor.

Steam

The Motat museum "chief engineer" Mike Austin gets to enjoy a warm winter in the brick building that houses all the steam engines, although it's a "real killer" in summer with all the steam from the machines. But I look forward to coming to work, he says. "I get to play with a whole lot of steam engines – it beats working for a living."

Mike Austin has stationary, locomotive and traction engine steam tickets. He can look after boilers but cannot drive steam machines on the road. He has worked for 34 years at Glenbrook Vintage Railway under the umbrella of the Railway Enthusiasts society as fireman, driver, stoker, guard as they all do.

"When you think of steam engines you automatically think of trains. But steam powered just

Mike Austin demonstrates the Tangye steam engine to Torbay School seven-year-olds Joel Howard, Sam Anderson and Mitchell Bowman.

Stoking the boiler that will power the beam engine.

about everything else you could think of in the old days," he says. There are plenty of examples of steam engines working at Motat to prove his point.

The 1957 Daniel Adamson steam boiler from England and which will power the beam engine was used at Frankham's Mill, Te Puna. This supplies steam to the engines in the pavilion and has a heating surface of 65 square metres.

The 1911 triple expansion steam engine was made by Campbell Calderwood, Paisley, Scotland for Sydney ferry Greycliffe. The engine finished up at a Tirau dairy factory for many years. It has a grooved fly wheel filed for driving machinery by rope belts and a speed of approx. 130 rpm.

Ken Pointon notes that machines with flat belt drives evolved to having grooved flywheel and rope-belt drives before the next step which was V-belt drives.

The boiler also drives a 8 NHP McLaren Traction engine No 1428 Built 1916 by J & H McLaren engineering Ltd which is out the front of the building. A steam pipe into it runs the engine as there are no tubes in the boiler.

Motat also boasts a Tangye steam engine, circa 1910, with a 12-inch cylinder bore and 24-inch stroke generating 47hp @ 95 rpm. The machine presented by Carter merchants was used until 1977 at a nearby Morningside timber mill.

But for all the interest in these independent steam engines, it's when the great beam engine chuffs into life powered by steam again that the real enthusiasts will look on their work with pride.

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