



SteamRanger's Heritage - an insight into our past

BACKGROUND

This report by the ARHS Loco Manager describes major maintenance work carried out on loco 520 in 1981 and 82, using both contractors and volunteers working at our Dry Creek Depot.

Attached is a further report describing the delicate task of lifting the loco off its wheels so that work could be carried out off site on reprofiling the wheels.

This download contains the full text of both articles, and includes a selection from photographs published in the printed reports.

PROJECT 520

Reported by Ian Johnston

ARHS Recorder August 1982 pages 148 - 153

520 is back in service. This article written by Loco Manager, Ian Johnston, details the work done on the locomotive to restore it to running condition. This locomotive will earn a place in history when, all being well, it becomes the last broad gauge steam engine to run to Port Pirie on September 11th, 1982.

In the few years leading up to 1980 it was becoming all too obvious that something would have to be done to rectify problems in 520's running gear, in particular the worn tyres on the coupled wheels and a big end that persisted in running too hot. For sometime ideas had been considered but these invariably ended up in the 'too hard basket'¹. However during 1980 the problems became more severe and it was finally decided that 'something' had to be done.

The problem areas were: —

1. The tread profile of the coupled wheel tyres had become worn to such a degree that the flanges were too deep and too thin. Because of the closeness of the condemning mark, the tyres could not be re-machined.
2. The LHS big end continually ran too hot. The original crankpin had been found to be bent but the fitting of a new pin did not completely cure the complaint. The final theory is that the coupled wheels were of slightly different diameters brought about by the tyre wear problems. This was evidenced by the different rotating speed of the driving wheel when the rods were removed.
3. The tendency for the coupled wheels to slip, even when hauling moderate loads — thought to be caused by the uneven wheel diameters and/or uneven weight distribution caused by springing problems.

4. Engine sitting too low causing fouling between engine frame and trailing truck.

Wheels and Spring Gear

What all this boiled down to was that the coupled wheels and spring gear were worn out. Ideas were dragged back out of the too hard basket and after much deliberation it was decided that the only solution was to separate the engine from its wheels, retyre the coupled wheels and completely rebuild the springing gear. Initial thoughts were to jack the engine but because of the cost and some impracticalities, this idea was discarded.

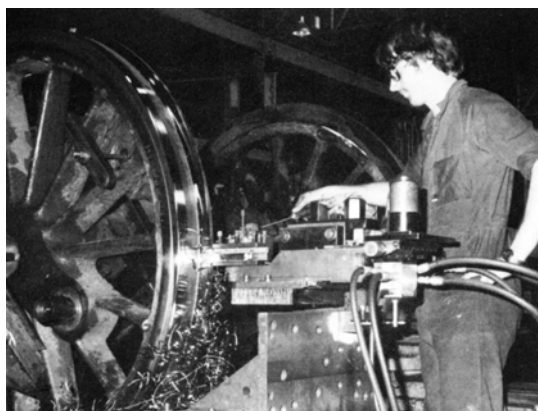
The only real alternative was to lift the engine from its wheels and place on steel stands while the work proceeded. Perry Constructions were contracted to organise the major part of this exercise and in February 1981, two 90 tonne cranes were used to separate 520 from its wheels. With all the springing gear exposed for assessment, Perrys prepared cost estimates for work covering:

1. Retyring of coupled wheels
2. Inspection and adjustment of axle roller bearings
3. Renewal of pins and bushes in spring gear
4. Overhaul of trailing truck
5. Overhaul of pony truck
6. Renewal of brass bushes on connecting and coupling rods.

The estimated cost of the above was \$75000 and, while more than we had first thought, we were not really surprised. However this amount was beyond Society resources and unless some outside assistance was obtained, 520 was destined to lament for some time.

An extensive submission was prepared and presented to the S.A. Government, Department of Tourism, and in October 1981, we were successful in obtaining a grant of \$60000 provided the Society also contributed at least \$15000.

The project gradually began to gain momentum but it still took many weeks for the heavy engineering work to progress. While it may seem simple enough to cut off the old tyres and shrink new ones to the wheels, many hours of research and planning were necessary. It is a one shot process; if you don't get it right first time, that's it — there is no opportunity to remove the tyre and start again. Consequently the machining of each tyre had to be spot on and the tyre heated to the right temperature to ensure that it did not end up being loose on the wheel or too tight thereby creating undue stresses. Once the tyres were on each wheel, the correct tread profile had to be machined so that each wheel ended up exactly the same diameter.



The exacting profiling task was carried out on Perry's heavy lathes
Photo: Andrew Gramp

The axleboxes were dismantled to expose the massive axle roller bearings. These were inspected by a Timken engineer who was somewhat amazed at their good condition considering the pounding they have to absorb. The bearings had a small amount of end play which was taken up with new shims, the springing gear was held together with dozens of pins and bushes and approximately 70% had to be renewed, the remainder being refurbished.

Sixty new pins were required and each pin has three bushes so it was a major exercise to get these machined, hardened and fitted without mixing them up. The pins are full of grease holes and grooves and required extensive machining. The trailing truck was dismantled and all springs were found to be defective. Two coil springs were broken, some new spring leaves were required while others were reset. The rear rockers were built up and flame hardened. By comparison the pony truck was in good condition and required very little work.

Other work at Dry Creek

While this work was proceeding at Perrys, considerable work was carried out on the engine by volunteer workers from the loco maintenance team at Dry Creek. Not the least of these were the air receivers. The retired workers group laboriously degreased, cleaned, primed and painted the entire frame and undergear of the engine. In doing so they removed a mounting band from an air receiver only to find a series of holes. Further inspection revealed extensive corrosion and the receivers had to be replaced. Under current codes, air receivers have to have inspection holes etc. etc. so that they were not particularly cheap at \$1500 for three.

Among other work undertaken was a rather awkward one — a new feed water tray for the boiler. Feed water when injected into the boiler enters via check valves on the top front of the boiler barrel. Immediately below is a tray 48" long x 18" wide x VV thick steel and held in place by six brackets clamped to palm stays. The tray disperses the cold water over a greater area thus reducing thermal shocks to the boiler. The existing tray had three of the clamps either missing or broken and was so severely distorted from thermal shocks that sufficient back pressure was being created to interfere with the operation of the injectors.

The old tray was easily removed by oxy cutting but fitting the new tray (approx 80 lbs) took four full days to get it assembled into position and separately fabricate six new clamps, as each position was different. This was all done by lying on top of the boiler tubes with about 12" clearance to the top of the barrel. That was bad enough but the presence of the palm stays on each side and the huge steam pipe down the middle made working conditions decidedly cramped. We found out later from Islington that this was the first time a feed tray had been replaced this way as normally tubes and flues were removed to gain access. However, removing and replacing of tubes and particularly flues is another job we don't go around looking for.

Back onto its Wheels

In April 1982, all was ready to lift the engine back onto its wheels using the 90 tonne cranes. It was a delicate day-long operation to get everything lined up correctly at the same time as the engine was lowered. It took a further week to get the engine mobile but even then it did not look quite right. Due to the many changes made, e.g. increased wheel diameter, tightening up of spring gear, new springs etc., the weight distribution did not appear to be correct. Attempts were made to determine where the weight was and was not by using calibrated jacks but these were not sufficiently accurate. AN were sympathetic to the problem and agreed to 520 being moved to Islington to be tested on the multi scale weighing machine. As expected, too much weight was on the coupled wheels and not enough on the trucks. Different sized spring adjusters and packing plates were judiciously fitted and the weight distribution is so close to being spot on, it doesn't matter.

The rest of the story is now well known in that 520 had only minor settling down troubles on its test run and on its first public run hauling 14 cars (500 tonnes) to Bow-mans and Balaklava, the engine exceeded all our hoped for expectations by arriving back in Adelaide on time with both big ends cool and not one item needing attention. The whole project from start to finish has cost around \$100,000; not a particularly cheap exercise, but one which had to be done as the hauling capacity of a large power engine like 520 will be essential to keep SteamRanger viable in the years to come.

The full list of tasks

To complete the record the list below details all the work done on 520.

(P) denotes work performed by Perry Constructions, all other jobs being done by the loco maintenance team:

Boiler and Associated Equipment

- New firebricks made
- New pins in blowdown valve linkages
- Repack steam head valve glands
- Repack steam valve glands in cab
- Retap two washout plug holes
- Whistle valve seat machined and lapped
- New feed water tray
- New longitudinal stay pin
- Overhaul injectors
- Overhaul injector starting valves
- Syphons rewelded to throat plate (P)
- Repairs to crack in rear firebox support (P)
- Firebox needlegunned
- Reconditioned superheater elements fitted
- Firegrates refitted — 1 new grate
- New blow off valve
- New insulation around part of the boiler
- Both blow-down valves overhauled and reseated
- Fusible plugs reloaded

Braking System

- Main brake levers and pins refurbished (P)
- Three new air receivers with mods and repairs to pipes
- Eight new brake blocks
- Overhaul of air compressor governor
- New leathers in brake cylinders
- Tender brakes checked and adjusted
- Air compressor piston rod remetalled
- Reconditioned main feed valve

Wheels and Motion

- New wear pads for lateral motion device (P)
- New tyres on all coupled wheels (P)
- All axlebox roller bearings inspected and reshimmed where necessary (P)
- Crosshead / slidebar clearances shimmed
- Overhaul of sand gear
- New brass bushes in rods (P)

Spring Gear and Frame

Engine frame decreased, primed and painted with bitumen paint
Welds to cracks in frame cross members (P)
New pins and bushes in spring gear (60 pins, 180 bushes) (P)
All axlebox horn blocks trammelled (P)
Engine spring adjusters machined to allow for new tyres (P)
Trailing truck rebuilt— new coil springs (P)
— leaf springs renewed and reset (P)
— rockers and pads rebuilt and flame hardened (P)
Pony truck overhauled (P)
Engine weighed and adjusted for correct weight on each axle.

Miscellaneous

Overhaul of four cylinder release cocks
Release cock mounting studs drilled out and renewed (P)
New cylinder clothing and insulation
Stiffener welded into tender
Lubricator checked
Atomiser overhauled
Cab repaint
Turbo generator cleaned and checked
All gauges recalibrated



Volunteers at Dry Creek working on superheater elements (top) and installing heavy firegrates (below)
Photos: Roger Currie

520 Lifted

ARHS Recorder March 1981, page 70

520 has not been taken from Dry Creek Depot by persons unknown, although at times some members of the Loco team secretly wish it would do a disappearing act. The truth of the matter is that 520 is now minus its wheels and is perched on massive steel stands 5ft off the ground.

During December and January (the hot weather!) the Loco team removed literally tonnes of fittings from the engine in preparation for removing the wheels. This had become necessary for a number of reasons; worn driving wheel tyres, worn springing, recurrent big end problems and for a general checkover.

The fittings removed (testified by the number of sore backs) included:

- (1) all the rods—we've done this so often now that next time we'll do it in the dark with one hand behind our backs
- (2) all the fire grates
- (3) a section of the ashpan to make provision for a special lifting beam
- (4) all the brake gear incl. pull bars, pins, crossbars, hangers, etc.
- (5) some clothing panels
- (6) disconnecting the tender from the engine.

Perry Construction were contracted to do the actual work of removing the wheels with every conceivable method being considered. There were a number of limitations which finally dictated how and where it was to be done. Some of the systems looked at were:

- (1) jacking
- (2) lifting in the shed on a side road by removing sheets of roof iron for crane access
- (3) either jacking or lifting outside.

Jacking was eventually rejected due to being costly and slow. Lifting in the shed was rejected because access requirements and height restrictions meant it had to be done at the Dry Creek end and this would have meant blocking off of an entire road. Eventually an outside site was selected between roads 6 and 7 even though the engine would be out in the weather.



The huge bulk of 520 is steadied by one man as it is slewed towards its temporary site at Dry Creek
Photo: Roger Currie

Once 520 was positioned on road 6, Perrys removed the pedestal binders and automatic wedges, separated the springing between engine and trailing truck, and fabricated a massive beam for lifting through the ashpan at the firebox end. The smoke-box end was lifted by a sling at its joint with the boiler.

Thursday 12th February dawned as an excellent day with plenty of sun for photos. Two 90-tonne mobile cranes had been positioned the previous day so that all that was required was the final positioning of the lifting beam and sling. With two TV news crews present, the big lift began until one crane had trouble with its braking system. By the time this was overcome, the TV people had gone but those who had waited saw 520 rise majestically from its wheels and it was quite unreal to see it gently swinging in mid-air before being lowered onto the support stands. The weight of the engine without the wheels was estimated at 70 tonnes.

All the wheels are now with Perrys who at this stage cannot foresee any great problems with the rety ring operation. The pony and trailing trucks will be overhauled as well as checking the springing and frame for undue wear.