



SteamRanger's Heritage - an insight into our past

BACKGROUND

Prior to the ARHS taking over full responsibility for its steam locomotives and rolling stock both routine and major maintenance was carried out at the SAR's Islington workshops by SAR employees.

At the end of 1977 loco 520 was moved to Islington in order to prepare it for a proposed "Festival of Steam" promotion in late May 78.

This report by the ARHS Loco Manager describes the tasks that ensued - fabrication of a new tender, replacement of boiler stays and tubes, and a complete new paint job.

It well illustrates the maintenance overhead involved with preserved historic rollingstock.

This download contains the full text of the article, and includes a selection from Roger Currie's photographs included in the printed version.

PROBLEMS WITH 520

An insight into steam locomotive maintenance

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When Locomotive 520 was moved to the Islington Workshops at the end of the 1977 steam season, no-one had any idea the problems and headaches this locomotive was to cause. The superheater elements had been removed earlier by an enthusiastic band of Society members and by early December an initial inspection had been carried out. The main items requiring maintenance appeared to be fairly straightforward.

1. The tender required a fair amount of repair work to many cracked and fractured baffles, with some leaks in the coal bunker area and external sides.
2. A boiler inspection test (BIT) involving an internal inspection of the boiler and the replacement of fusible plugs, half the boiler tubes, firebricks as necessary and some new smokebox fabrication.

For continuity of story, each item of maintenance will be related from start to finish even though some jobs were progressing at the same time. The overall plan was to have the locomotive operational for the *Festival of Steam* on 21st May.

TENDER

As Islington could not commit themselves to repairing the tender, quotes were sought from outside firms. However it soon became obvious that it was not practical to repair the tender due to the difficulties of welding new material to old material that had undergone a fair degree of corrosion. Various ideas and quotes were discussed and it was eventually decided that, in an endeavour to save costs, the water space only would be rebuilt and the underframe and the top plate with front curved section would be reused. An attractive quote was received and accepted from G. & R. Constructions of Dry Creek. However, because there was no rail access, the tender had to be moved by road.

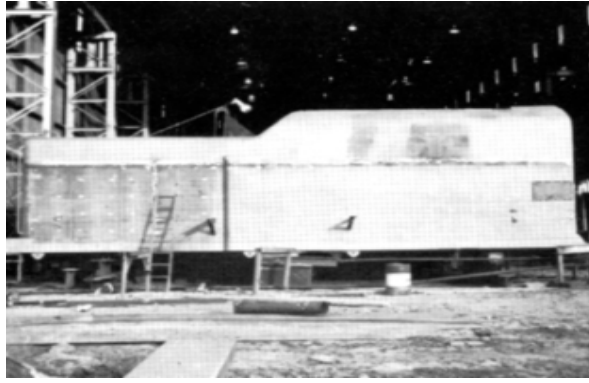
The fuel oil and water treatment tanks were removed and the tender lifted from its bogies in preparation for the transfer. F.I. & B T. Thomson supplied the low loader and in late February all 20 tonnes of the tender were moved to Dry Creek, but not without a few problems. The greatest headache was when the low loader plus tender became firmly jammed in the gateway of G. & R.'s. A mobile crane had to be summoned to lift the rear end clear of the gate. The whole transfer operation took 5 1/2 hours.



Securely tied down on a low loader 520's tender leaves Islington Works

The tender remained at G. & R.'s for 9 weeks during which time the following work was carried out:

- (a) The dimensions of the old tender were recorded.
- (b) The top section was removed by oxy-cutting
- (c) The underside of the top plate was repaired where necessary.
(This plate was still in reasonable condition).
- (d) The sides and internal baffles were cut from the underframe.
- (e) Minor repairs were carried out to the underframe which was then levelled
- (f) Replacement baffles were cut from new steel plate and welded to the underframe.
- (g) The back plate was rolled and welded to the underframe.
- (h) The side plates were positioned and welded to the underframe. Great care had to be taken dimensionally so as the top section would fit correctly,
- (i) Internal stiffeners were welded around the sides,
- (j) The internal baffle system was welded to the sides.
- (k) The complete top section was welded back into place in a rather delicate operation.
- (l) The coal bunker and crew lockers were replated.
- (m) The finished tender was sandblasted in a 6 hr. operation.
It promptly rained the next day resulting in minor rusting.
- (n) One week later, painters filled the major holes and weld marks and applied the special undercoat.



At G&Rs at Dry Creek the new tender sand blasted and ready for painting

It was unfortunate that more of the imperfections could not be filled but a compromise had to be reached with the cost and time involved.

The tender was moved by road back to Islington where it was filled with water. A few leaks were detected and repaired by Islington. The fuel oil tank was replaced but the water treatment tanks were left off as they are no longer used. The Hawthorn Green Dulux Acran paint was applied on 13th May. This paint is reported to be extremely hard and should retain its natural gloss for years to come. The tender was eventually attached to the engine on Tuesday, 16th May. The letters "S.A.R." and lining out were painted on 19th May after the boiler steam tests.

BOILER

Work began on the boiler in mid-March with the stab removal of 50 boiler tubes. The boiler inspector carried out a visual examination of the boiler flues and remaining tubes and all were found to be in good condition. The swiftness of the main inspection took the Tours Committee by surprise and an urgent working party had to be organised in late March to transfer the superheater elements and 50 new boiler tubes to Islington. The boiler tubes are fitted into copper ferrules in the firebox tubeplate but unfortunately no ferrules could be found. Consequently a length of copper tubing was purchased and a Tours Committee member turned the ferrules on a lathe during lunch breaks. The 50 new tubes were duly installed and the boiler prepared (including reassembly of the regulator) for its first hydrostatic test. The test involved filling the boiler with hot water and pressurising to 275 psi (normal working pressure 215 psi).



520 as Islington undergoing a boiler inspection

The result was a real calamity. Water poured from the superheater header, leaks were found from 4 boiler stays around the firebox and the boiler would only "hold" 190 psi. The leak from the header indicated either a problem with the regulator or, more seriously, a leak in the main steam pipe, a pipe which delivers the steam from the boiler to the superheater elements then to the cylinders. The dome cover was then removed but the regulator was found to be holding water OK. Things began to look grim. To replace a steam pipe was a major 5 week job even in the hey-day of steam as considerable dismantling of the locomotive was involved followed by hours of careful lapping and fitting of pipe joints.

We decided to carry out a leak test on the steam pipe by filling it with water. However this was not straightforward as sixty holes for the element ends in the header had to be sealed and the location of the steam pipe inside the boiler made inspection difficult. The first problem was solved by a rush trip to buy 60 corks and the second by boilermaker Les Burgess squeezing through the dome hole and examining the steam pipe by torch light.

The pipe was filled with water through the open regulator but no leaks were found. This puzzled everyone so we decided to reseal everything and repeat the hydro test. Before this was done, all the steam valves on the steam head were overhauled. These valves supply steam to such things as the air compressor, blower, atomiser, turbo etc.

The second hydro test was successful in one respect as no water leaked from the header at 275 psi. To this day no-one knows where the water came from during the first test, but an improperly seated regulator was suspected. The test was not so successful as a total of 10 boiler stays were now found to be cracked or broken. This was shattering news as 8 of these were 28" long rigid crown stays and no spares were available. The other two were small ball stays of which there were plenty of spares. The replacement of crown stays was never a small job. Before we knew what was required, the old stays had to be removed by a rather laborious process taking nearly two days. Meanwhile it had been ascertained that while Islington still had 50 feet of stay bolt steel and the dies to forge new stays, their forging machine was completely useless with a cracked crankshaft.

The Society purchased the steel and borrowed the dies and the Society President, Graham Bowes, made extensive enquiries to forging works in Adelaide. Only one firm, Perry Engineering, had a forge of sufficient size and were willing to attempt the job in the few days we could allow. This was good news until it was found that the dies would not fit and could not be easily adapted to fit either of their large forges. However by adapting some of their own dies, they were able to forge "heads" for 12 bolts even though extensive machining was then necessary to produce the buttonhead and taper neck bolts required. Perry's worked wonders and from scratch had the forging and heat treatment completed within 2 days.

The machining could only be done at Islington where the necessary expertise and tools were available. The machine room boys rose to the occasion and after some minor problems, had all stays machined in 3 1/4 days which included 2 nights overtime. The stays had been progressively fitted as they were machined and all stays were finally screwed and riveted into place on Friday, 12th May. The boiler was then washed out to remove scale etc. dislodged during the riveting process.

A hydro test to 275 psi was again necessary to test the new stays and to determine whether the riveting had cracked or broken other stays as quite commonly occurred years ago. It was all important for the boiler to pass this test as failure would have certainly sidelined the locomotive for the Steam Festival. Luck was with us with the boiler holding 275 psi with no problems. The next task was to steam test the boiler but before this could be done, the brick arch in the firebox had to be rebuilt and the smokebox completed.

Steam was raised on Thursday, 18th May: the safety valves were set and the boiler inspector was happy with the result. All that remained was for the lagging to be installed around the firebox and the streamlined clothing to be replaced. However this had to wait until the next day, Friday, 19th May when the boiler was cool enough to work on.

After all the headaches and problems, 520 was to be ready for the Festival of Steam, even though it steamed to Mile End on the last working day available. Unfortunately there was no time to repaint the engine itself but it was hoped this could be carried out in late June.

SMOKEBOX

The smokebox spark arresters and baffles were removed by Society members in the process of removing the superheater elements last November. Inspection of these at Islington revealed that some baffles needed replacement and that the main blast pipe had been severely eroded, especially around the bottom joint. This was repaired by building up with weld and machining flat again but it will probably be necessary to have a new one cast next year. The intricate shapes of the baffles were cut from new plate steel and after much juggling were fitted into the smokebox. Considerable repair work was also required around the smokebox door seals.

OIL SEALS

For some time oil has leaked from one of the flexible joints in the pipe which carries fuel oil from the tender to the firebox. When the tender and pipes were disconnected it was easy to see why, the oil seals had wasted away. The seals were odd looking devices and of course no spares were available. Enquiries at different firms revealed that this particular type of seal was no longer made.

After thumbing through various catalogues, a similar type of seal was found but none were in stock. A telex message was sent to Sydney where luck was with us and four new seals duly arrived by Priority Post. These have since been fitted and the oil leak cured.

CYLINDER RELEASE COCKS

When locomotive 621 was steamed from Islington to Mile End at the end of March, one of the cylinder release cocks was found to be defective and would not shut off completely. On removal it was found that of the two piston rings in the cock, one was missing and the other broken. As usual no spares were available (This problem is not to be confused with problems found later with the main cylinder piston rings of 621).

As the locomotive was required for the Anzac Day Tour, the problem was overcome by using a release cock from locomotive 520, the cocks being interchangeable. This now meant that to get 520 operational, new rings would have to be obtained. From drawings it was soon realised this would not be easy as the rings were made from a special bronze (M23), were eccentric in that one side was wider than the other and it would be difficult to machine the "bevel" gap. An ingot of M23 bronze had to be specially cast and Southcott Engineers did a marvellous job, firstly boring out the cylinder then producing 2 rings plus 2 spares as required, except with a "step" gap, in four working days. There is still sufficient bronze to make 12 more rings if and when required.

THE JOB COMPLETE!

The ARHS is extremely indebted to the management and workers at Islington for their extraordinary efforts in having 520 operational for the Festival of Steam on 21st May. At some stages the position looked absolutely hopeless, especially when the 8 broken crown stays were found with no replacements readily available.

However everyone maintained a positive approach and the result was rewarding. A special mention must also go to G. & R. Constructions for rebuilding the tender, Perry Engineering for forging the stay bolts and Southcotts for manufacturing the cylinder release cock piston rings.

Maintenance of steam locomotives is a continuous operation as further work was carried out at Islington during late June prior to repainting. Briefly the work involved was:

1. Boiler thoroughly washed out.
2. Smokebox cleaned out.
3. Piston packing on both sides renewed
4. Both injector starting valves repacked.
5. Right hand injector cones checked for blockage.
6. Right hand water level glass renewed.
7. Extra support lugs provided for back firebricks (already lost 4 bricks into the fire this season).
8. Water pipe to ash wetter renewed.
9. Steel plates under cab floor renewed.
10. Rusted section of skirt replaced.



Fresh from the Islington paint shop, 520 shines in all its glory

On Friday, 23rd June, the engine was acid washed and rubbed down with steel wool in preparation for repainting. The next morning was spent removing old flaked paint then, in the afternoon, the special undercoat was applied. On Sunday, 24th June, the three coats of Hawthorn Green Dulux Acran paint were applied and the locomotive was transformed once again to a gleaming green giant. Lining out and bogie painting were carried out on the following Saturday; the weekend work being necessary because of the heavy work load on the Paint Shop at Islington.