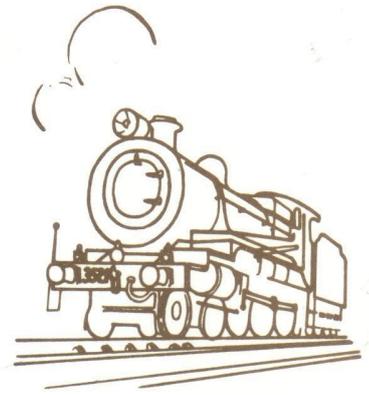


Sydney Live Steam Locomotive Society

Anthony Road, West Ryde, N.S.W.

'Newsletter'

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James Sanders and his 5 inch gauge 3526 built in record time too. Photo Geoff Hague.

The 35 Class

James Sanders

The 35 came about with some driving wheels donated from Andrew Alison several years ago. These sat in a box for some time until 2018 when a start was made on the front pony truck. The project was on and off over the time till late 2020 when it was steamed for the first time, interrupted by finishing off Gresham, an 0-4-2 Cane Loco and building a Sydney Steam Tram. Wayne and Jeanette Fletcher kindly laser cut the frames from 5mm mild steel for the 35 along with many other parts, including parts for the tender bogies. The connecting and coupling rods were water cut additionally, with machining being completed on the mill in a jig made from angle, which each rod could be bolted to in order for the fluting to be machined away.

The loco features a tapered Belpaire boiler, the taper being a particular challenge. A fair amount of bronze brazing was used to advantage in the boiler, particularly in doing the front tubeplate to inner firebox wrapper as well

as attaching the foundation ring to the inner wrapper. A large flamethrower was used to carry out most heats. A few leaks in the inner firebox were fixed with oxy propane and a cutting attachment. Steel formers made the plate forming, particularly the firebox to barrel throat-plate fairly straightforward, with the usual repetitive annealing of the copper.

A decision had to be made on whether the loco should be constructed in original or rebuilt form, I went for the later as I don't mind their lines despite understandable disgust by many members of SLSLS. The other aspect that came to mind was that a green 35, would have to be a rebuilt so the deal was sealed. By Christmas 2019 the loco chassis was running on air with most of the smokebox constructed. I distinctly remember tapping most of the holes in the cylinder castings by hand with a very young Rosie strapped to me in a baby carrier, gently bobbing to get her to sleep. Thankfully no taps were broken.

One aspect of challenge that the rebuilt form of loco pre-

sented is the unusual cab, which has a sheet metal front that appears to have been pressed in a die. For this I used copper, annealed and then beaten around a timber former. The rest of the cab was made from $\frac{1}{16}$ " zinc anneal with plenty of decorative rivets.

One advantage of the rebuilt variant is that the skirts that cover the tops of the wheels which allows pipework and draincock linkages to be hidden beneath, thus dodging the brake rigging and ashpan. However, despite this I have plenty of pipework under there to complicate things.

Late in the project I agonized over what to do about the Westinghouse compressor. Several years ago Ray Lee warned me of the challenge of making such a contraption, that I shouldn't bother and just stick to injectors! He was right. They are fiddly. I got the one that I made to run happily on compressed air, but it has been temperamental on steam, working intermittently. The engine is still relatively new, however, so it will be seen if it can be coaxed to be more compliant.

The tender was made from brass and soldered up to seal the gaps. I intended to ride on the tender but during early trials I discovered I could hardly see inside the cab, since I do not intend on making the cab removable. It is quite comfortable to drive sitting on an S truck behind the engine.

Painting was fairly straightforward, using black etch primer and a selection of rattle cans, including green industrial enamel specially mixed to resemble the supposed green on the prototype. Painting was only frustrated by dismantling

and waiting for paint to dry, not to mention the unwelcome bugs. I did the lining with a bow pen to get the desired line thickness, using tin templates for some of the curves.

The first steam trial was carried out at home on my track around the house. First time it was like a volcano and plenty of water went up the chimney. I could tell something wasn't right. Also, the engine was tight on the 9.7m radius curves. A bit of a worry. Investigations revealed my "dry pipe" installed during boiler construction was lower than I thought and was sucking water off the firebox crown. I blocked it and extended the take off point in the dome. This made a remarkable difference, steaming dry thereafter at a very satisfying rate, having to run with the door open.

The later problem of being tight on the curves was also investigated and I found that the flanges were a little on the thick side. So I dropped out each driving wheelset and skimmed a bit off each side, checking as I went. This operation took a few hours including disassembly and reassembly. Back on the track the difference was incredible. The engine suddenly had plenty of power and ran freely.

The engine was a mostly enjoyable build. I think this engine has been the one that I have referred to photos most closely for those details you just can't get off a drawing. Speaking of drawings, I found that working across a mix of original form NSW railways drawings and the rebuilt cab drawings, coupled with Greg Edward's data sheet of the rebuilt presented inevitable discrepancies. It is one of those situations of measure thrice to avoid frustrating errors!

Editorial

With a new year there is always optimism that it will be better than the last. Considering the challenges presented to us in 2020 it will be easy to expect that hopefully 2021 will see things getting back to what we were able to do in the past. We did manage to make progress on a number of fronts and should be thankful for the guidance provided by our executive.

We have in hand plans to begin running days for the public again soon, taking into consideration the precautions we must follow to be Covid-19 safe. It will be a different mode of operation and will need the support of as many members as possible. As well we will need to be flexible to cope with whatever sudden changes that may be made on very short notice.

Let's hope then, that 2021 will see us collectively make an effort for further improvements to our grounds and facilities and individually make lots of progress on our own model engineering projects.

Fill in Editor. John Lyons

Election of our 2021 Board – Request for nominations

As required by our Rules, all current members of the board retire at the Annual General Meeting, to be held in June this year. Nominations are required for all board positions for the incoming year. There are seven board positions: President, Vice President, Secretary, Treasurer, and three Directors.

Nomination Forms are available in the clubhouse and can be provided by email on request. Please follow the instructions on the Nomination Form, which must be given to Jo-Anne Topp by **Thursday 6th May**.

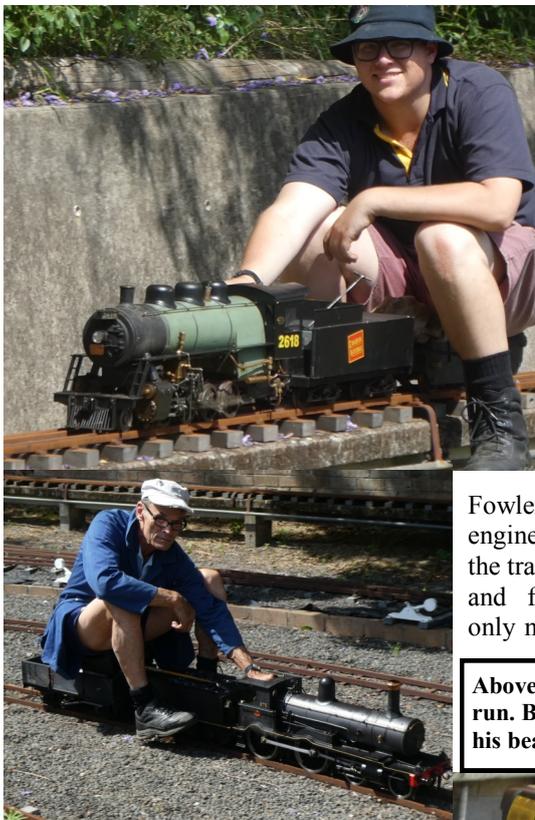
Note: Nominations from the floor will **not** be accepted at the AGM, unless there are insufficient formal nominations.

Of the current board, the following have or intend to nominate for next year:

- | | | | |
|---------------|----------------|---------------|----------|
| • Mick Murray | President | • Neal Bates | Director |
| • Evan Lister | Vice President | • Ross Bishop | Director |
| • John Hurst | Treasurer | | |

Society Events November Third Saturday.

A meeting was held in the morning to give members a chance to hear from the board and have discussions as to where we stand with the way things have run for 2020. Ross B set out the procedure that we hope to follow when the grounds are opened to the public again for a running day of some form. While this may happen very soon we will just have to see what the regulations will be when ever this actually happens. Following the meeting and morning tea some members were busy preparing locomotives for a run. Graeme K steamed his 17 class while Mick and Scott ran the Shay on the inner main. Garry B had his C38 class out on the outer entertaining some family and friends. The elevated saw some action with John H and the King and Simon and the 0-6-0 Simplex. Warwick R has acquired James Sander's Buffalo and was giving it a good run. David T was busy in his role of boiler inspector. John S was delighted to have his C32 boiler at last declared for its hydrostatic test. Ross B was well prepared with the boiler for his Fowler ploughing engine strapped in the tray of his utility and full of water only needing a couple pumps to get the pressure up for its hydro test which it passed easily. This boiler is a very neat piece of work, the welding is very well executed. It is such a shame that so much of the workmanship will be hidden from sight when it is all assembled. Chris D presented his stationary steam plant in steam for inspection and Warwick A had a new Ellie for a steam test. Simon had his Jack on display with its tiny coal fired boiler. A BBQ was enjoyed for lunch by those present. Warwick and Andrew fabricated a length of elevated track but it was not as good as required so some jig adjustment was made the following week.



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John Simpson shows how to celebrate a passed boiler!

December Third Saturday & Christmas BBQ run.

The weather was not the best for this event. It was dull and gloomy all day with damp mist and the odd shower through the day. Here were some dry spells that allowed some outside eating and discussion time. There were a few locomotives out running despite the atmospheric conditions. Neal and Joanne ran the 422 diesel outline locomotive on the inner main with a number of drivers. Graeme K ran his 2-6-0 American loco also on the inner running well for most of the afternoon again with some other members enjoying a drive. Greg C steamed the Leishman built PS4 after a lengthy overhaul for testing

Above: Warwick R steams uphill with Buffalo, Left: Graeme K takes the H class for a run. Below Left: Warwick A's new Jackshaft Ellie, and Below Right, Ross Bishop and his beautifully presented ploughing engine boiler.





and after a determination of issues had it packed up to be taken home. On the outer main Matt Lee ran C3112 on the blue car set while Ray had C3281 in loco. A broken gauge glass at about the same time as some rain starting saw both Lee locomotives put away to be returned home. David L had his twin GM Commonwealth Railway diesels covered up in suitable rain protection but were packed back in the trailer without running. Warwick steamed C3609 by about 2.00pm and ran till pack up time at about 7.00pm. This was virtually a trial run as there had been some mechanical work completed. Steaming was a bit dull but there were a variety of drivers and the passengers were mainly family. There was one group who managed their meal at lunch time then another good sized group for the evening meal. Martin D had previously attended to the points and they operated without trouble all day despite the conditions.



Above: Eddie tries out Graeme K's American.
Left: Jo-Anne and friend with their 422.
Below: Andrew striding out with 3609.

NYE Run and BBQ

There were about 12 members and guests at the grounds for the last run of the year. It was not the best of days as there was drizzle on and off all day with a few dry spells, fortunately one was at tea time! Garry steamed his B1 and Warwick and Andrew ran C3609. Warwick R had his newly acquired Buffalo in steam. All was finished by about 8.00pm and that was the end of our activities for a much disrupted 2020!



Garry B preparing Impala in loco.

January Third Saturday.

The weather was much better for this day than the conditions we experienced for the last couple of running opportunities that ended 2020. It was sunny all day, no cloud and temperature in the mid 20's. While there was a lot of work completed around the grounds there was still some train running. David L ran his Commonwealth Railway GM's with his carriages set up for passenger hauling. Garry B had B1 Impala in steam and coupled up "the Old Girl's" collection of British rolling stock. Garry reported that the load made the locomotive work very hard coping with some coal related steaming problems. Graeme K ran 2401 on the inner main with a number of drivers having a turn. There was also some double heading with 2401 and Ken's Simplex. Warwick & Andrew steamed C3609 and ran the Central West car set. They





Above: Graeme K with 2401 stops for a chat with Ken B and his Simplex. Below: Garry had Impala take the "Old Girl's" wagons for a run.



Andrew changing blast nozzles on the main line! Impala watches.



were doing some testing with a couple of blast pipes, both worked well but the coal used was a bigger variable. Andrew had a steam tram boiler for hydro testing and David T officiated. Scott M had some pony truck wheels for his NA class. Neal had a collection of traction engine parts which he discussed with Andrew. BBQ lunch was enjoyed with Scott M cooking and Jo-Anne looking after the bread rolls. It was nice to be able to start the year on a positive note.

Works Report

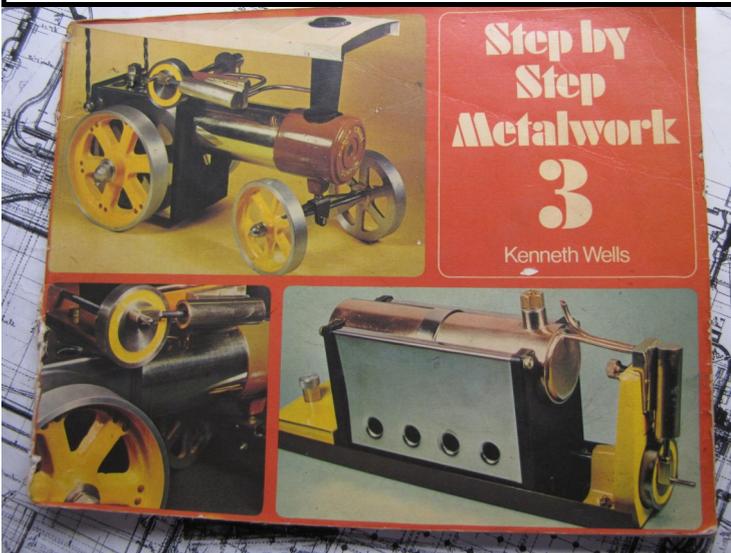
Despite the restrictions we have managed to continue on with our improvement for our grounds. The western retaining wall has progressed to near its southern extremity. There has been a lot of concrete removed, pavers and old elevated beams that formed the previous retaining wall. This involved some heavy lifting and a few weeks ago these were packed into a skip bin and taken for recycling. Neal B has been leading the team with this project and with some mechanical assistance has made good use of team work. We have had a post hole digging team, concrete mixing and a concrete delivery train getting the posts into place and others removing the spoil for storage and, or, reuse in other parts of the grounds. David L and Peter W have proceeded with the signalling project for the inner main. This has involved trenching, cable laying, cable terminating and a new terminal box with its protective retaining wall. A mid week group assembled to do a run of trenching and cable laying. Some interesting archaeological discoveries were made and what was considered to be a three hour job was considerably longer, but was completed anyway. Mick has continued with the CCTV installation and it should be in operation before long. Preparation for the extension of the elevated track replacement is continuing well. Each Saturday another three piers are poured and before too long there will be sufficient to get to the middle of the bottom curve. Some of those involved have been Bill P, John L, Mike D, Scott M, Andrew, Warwick and David J. Track sections are being completed and the stockpile is growing on the signal box deck. Some of the previously mentioned have been involved in the track welding as well. The ground level track team Paul B, Peter D, Tony K and others have continued with track section upgrades and recently have installed a new design expansion joint in the inner main. It is worth having a look at. David T continues to care for the gardens about the grounds as does Sheila D attending to the club house garden.

Diary

20 March Running Day
 Note the Annual Convention is Cancelled.
 17 April Running Day
 15 May Running Day
 5 June AGM
 31 July 2021 SLSLS Interclub.



The retaining wall team, from left Neal, John, Mike and Craig.



Step by Step Metalwork 3 John Lyons

by **Kenneth Wells** who was Head Teacher Craft, Design and Technology at Springfield School Portsmouth, United Kingdom, was reviewed by David Proctor in the very last Australian Model Engineering magazine. I was very surprised and pleased to see that a book, first published in 1972, was still available, it contained so much useful information.

I first came across this book at School Certificate exam marking in 1973 and very soon purchased a copy of my own. At the school where I was teaching at that time I had already introduced my Year 10 Metal Work students to model engineering building the Simple Steam Plant described by Tubal Cain (Tom Walshaw) in the Model Engineer magazine of March 1972. There were many of these completed, they ran well and were very well finished and the students were very keen to work on them. I think it was about 1974 when I started building my traction engine. The wheels and smoke box were made from good quality ply wood, old school desk tops, and the chimney was rolled

from sheet copper and stuck in place with Araldite. Work progressed very slowly and some of the students started to take interest in its progress. Eventually all was ready to go, I had an afternoon year 9 class with some very keen kids and with their encouragement it was lit up for the first time. With steam raised the engine unit had some trouble. The big end was catching on the crank pin. The fire was put out and the piston removed from the engine unit. The big end hole was drilled out 5/32" the size up from its specified size of 1/8", and then assembled back together. With steam restored it was kicked over and ran very well. A rubber band drive belt was then fitted, the engine was put on the floor, given a push and away it went. I think that I was as surprised as the kids as to how well it went! The kids guided it out of the metal work room, up and down the corridor and into the wood work rooms and then back home to my metal work room. The response was "can we make this next year". The answer was "yes" and that presented the problem, what are we to do about the castings!

My Dad and grandfather had both belonged to the SSME at Ashfield in connection with O Gauge House. Fred Steward, life member of SSME from 1932, ran O Gauge house from his property that backed on to the SSME grounds. Fred had the ultimate back yard foundry producing an extensive range of castings in aluminium for O gauge locomotives and carriages and I was lucky enough to have had the chance to see how things were done when I was in late primary school! Fred had all his patterns on pattern boards so I decided to follow this method rather than use loose patterns. My other metal work teacher colleague had some ideas about our melting process using the muffle furnace we had, and, some galvanised pipe with a base and handles welded

on. As everything was prepared I managed to get some moulding sand from a couple of foundries and stored it in some plastic cubes. We collected a variety of scrap cast aluminium objects to break up and re-melt. We were very pleased when we produced our first set of castings.

Having a foundry in a school was a bit of a problem. You could have one if you had DLI (Department of Labour and Industry) permission but you had to have the foundry to get permission. I think there were a few un-official ones, as was ours.

We had to take great care of safety. The students were allowed to pack the moulding boxes but we teachers took care of the pouring and over the production of many sets of castings over a lot of years there were no dramas. The students enjoyed working on these and over the years we improved our techniques. Kenneth Wells had described a method of locating the position of the inlet and exhaust ports that corrected any errors that had crept into the construction, it helped out many less able students. It was always a treat to see the excitement when the engines ran for the first time and the care that some kids took in painting and finishing the models. Many of the completed engines were taken to



The first smoke box pattern board with one conical sprue in place.

job interviews and helped their builders gain apprenticeships.

There were a couple of interesting stories I can remember over the years. In 1977 we had three metal work classes and made over 50 traction engines. Towards the end of the year we ran many match races up and down the long wide corridor of our industrial arts block, it was great fun and kept the kids attending school till their School Certificate graduation. Getting the casting sets completed was a big task. As I was checking who still needed castings in one

of my classes one rather sly, disagreeable student indicated that he was right for castings and I knew full well that he was not! As time went on we dis-



This is the fourth evolution of my traction engine. Mk.1 had wooden wheels and smoke box, Mk.2 had the aluminium castings used, Mk.3 was fitted with a new engine unit and Mk.4 is fitted with a solid fuel burner and improved safety valve

covered that this student was intending to hand in another student's work as his own. When the assessment day arrived our sly student was absent so the engine he was intending to "borrow" was taken apart and marked in a number of places. The assessed engines were all handed back at the end of the day. The following school day our suspect student was there with "his" engine. We sat him down and took the model apart and asked him to explain the marks we had put on the components. It was very satisfying hearing him having to admit to the scam! He did not get a grade for metal work and the other student who was the engine builder got a hard time from his parents

Part of the "crop" from 1977. We had three classes and they all ran some better than others!



who were shocked that their son would be part of such a deception.

The second story had a much happier outcome. At my next school I had continued making the traction engines with my year 10 classes. With one very good class one of the students completed his engine on a Friday afternoon but I had run out of methylated spirits so he asked if he could take it home to try it out. When it came back the following week it was very, very sticky and had a terrible smell. Now the student was of Italian heritage! I asked what he used for the fuel and was told it was something his father had made "grappa" perhaps? Well, did it work, yes it ran very well but it took the rest of the week to get it clean enough for painting and the smell remained.

The sets of castings were produced professionally. I had gone to Arthur Mears, model engineer suppliers for some rivets and other bits and pieces. I told him I was an Industrial Arts teacher and what we were making in class. He had a copy of the casting patterns page from the book that a teacher from some school had sent to him to see if he could help. With a one off order it was not worth his while so I asked if he had more orders would it make a difference, he indicated yes. Through the Sydney Metropolitan West Industrial Arts consultant a survey was prepared and circulated through most of the state with the replies sent to me. The initial response was for about three hundred sets. The survey results were sent on to Arthur and he took it from there. The sets continued to be supplied after the business was taken over by Doug Richards and then by Hucar at Kingswood. However with changing times the demand petered out, the subject elective pie was cut into many more subjects that were easier and did not involve getting hands dirty! I had heard a comment that in some far western school the metal work class was the only one that some kids attended to complete their engines.

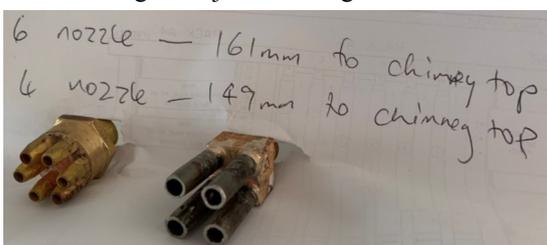
Just before I finished teaching, 2004, we had received an official letter from the Department of Education stating that all foundry equipment should be removed from school premises IMMEDIATELY. It was removed to my place!

Nozzle Experiments on the 36

Andrew Allison

Over several years since the 36 rebuild was 'complete', it has effectively been a running restoration with various jobs slowly worked on to improve its operation. The biggest issue to date has been the piston valves, significant blow through was eventually traced to poor material identification and tracability! (Nylon looks a bit like Teflon!) With the valves now sorted and performance much improved, the steaming seemed to be the next issue to be investigated.

Most model engineers would be familiar with the proportions set out by Greenly and repeated by other miniature designers for front end design. Greenly was on the money quite early in 1904 with his ratios of 1 in 3 from nozzle to choke and 1 in 6 from nozzle to chimney top for proportioning the ejector configuration for close to optimal performance.



6 & 4 nozzle blast pipes.

It took full size designers another 40 years to eventually arrive at similar proportions (and some never did). The other Greenly

proportion well known and used by model engineers is a blast nozzle diameter of about 1/7th the cylinder bore. This is not so much a rule but a starting point. Full size is usually far more generous than this, for example full size 38 class is 1/3. (21.5" bore cylinder and 7.5" blast nozzle.)

In general, the smaller the nozzle the greater the exhaust velocity and corresponding smokebox vacuum, creating favourable firebox conditions. However, the smaller the nozzle the greater the back pressure in the cylinders, lowering the power output from the loco. The aim is to get the vacuum you *require* (not necessarily maximum vacuum) for the least back pressure. Enter things like double chimneys, multiple jet blast pipes, Klychap, Giesl and Lempor. These all work by increasing the surface area of the exhaust, allowing greater mixing of exhaust and smokebox gasses while providing greatest possible exhaust nozzle area.

In practice most things 'work' to some degree so usually if you have an arrangement that you are satisfied with then you don't worry too much. (That went for full size too.) however the fact that we like to build prototypical locos and

full size was usually suboptimal in this area doesn't help. There's not much you can do if the prototype has a long, slender chimney e.g. a Huntslet, the 1 in 6 will be part way down the chimney and the exhaust will be starting to choke itself.

In more modern steam locos, the reverse situation is often

encountered where the short, fat chimney diameter is so large that to achieve the 1 in 6 at the chimney top, the blast nozzle would end up below the level of the smokebox floor! Practical issues with mounting the nozzle so low need to be considered, you certainly do not want to mount it where ash may get down the nozzle.

The Winters design for the 36 has an unprototypically small diameter chimney to meet the Greenly requirements. During the rebuild, this chimney was replaced with a new chimney of prototypical dimensions. This larger chimney bore meant that the 1 in 6 was now well outside the chimney top. On initial runs steaming was average, and so had been compensated for by reducing the blast nozzle diameter a bit (nozzle B). The grate had also been altered to limit the large slope at the front and encourage a more uniform fire depth. These adjustments meant the steaming was okay for the moment as the other problems on the loco took priority.

After the piston valves were fixed and became steam tight, steaming was notably worse and impossible to maintain (100psi at the bottom of the hill and 60-70psi by the top).

Presumably, the extra steam leaking past the valves and up the chimney was improving the steaming if nothing else!

As an issue was known to be the large diameter of the chimney, it was decided the best fix for this was to try a multi-jet exhaust that distributed the exhaust closer to the chimney walls and would provide greater surface area to the exhaust. 2 different multi-jet nozzles were made. One had six jets arranged in a ring, of combined area equal to the existing single nozzle (D). The other nozzle was a 4 jet nozzle at the logical upper limit, the area equal to that of the exhaust pipework (E). These 4 nozzles were angled out a couple of degrees. The one large chimney was effectively treated as 4 independent small chimneys bundled together. For comparison, an even smaller single nozzle was made (C). The table shows the nozzle particulars.

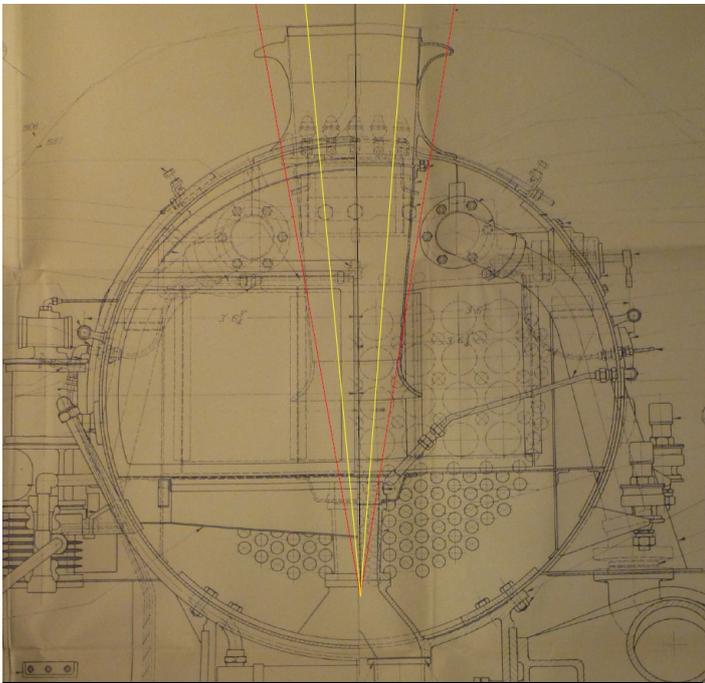
The main aim was really to attempt to get the loco to steam better. On the first test run the loco was fitted with the 6 nozzle exhaust (D). It proved superior to the equivalent sized single hole, and could maintain pressure, but what was obvious was different coal was the biggest factor in steaming!

To normalize for coal type and examine the extremes, the next test the smallest (nozzle C - 65%) and largest (nozzle E - 166%) were hot swapped a few times during the day to provide direct comparison. Of these, the small single jet was a slightly better steam producer, and superior in that regard, however the larger nozzle was still satisfactorily able to maintain pressure.

Perhaps the more interesting results were the ones we were not really expecting!

With the small nozzle, the loco and driver received a con-

Nozzle	Diameter of Nozzle (mm)	no. of nozzles	total area (mm ²)	% area of Greenly recommended
A (Greenly 1/7)	7.3	1	41.83	100%
B	6.7	1	35.24	84%
C	5.9	1	27.33	65%
D	2.8	6	36.93	88%
E	4.7	4	69.36	166%



Creating a pdf of a dwg imposed onto a jpg seems to readjust everything, but you will get the idea. Note the large taper of the prototype exhaust. Red lines are 1 in 3, yellow lines 1 in 6.

stant rain of oil droplets. With the multi-jet this did not occur. Instead you could see the oil droplets hitting and forming around the rim of the chimney. An indicator that the single nozzle was not filling the chimney, but the multi-jet was.

The sound. The small nozzle sounded like a steam engine. The multi jet almost completely removed any chuff. This was a bit eerie especially at speed, as you had lost a source of feedback! Without a chuff, the clanks in the loco sound worse!

Drifting steam. In the past the loco had a problem with forming a steam cloud around the chimney. This would cause the driver's glasses to fog up and was particularly frustrating. The multi-jet exhaust appears to have cured this. There are several possible theories. Maybe all contribute to some degree, but in order of least to most likely contributors:

1. the better performance of the fire is simply providing higher superheat, providing a higher temp exhaust and less condensation of steam once out of the chimney.
2. The better mixing of exhaust and smoke gasses transfers heat and promotes dispersion of the exhaust steam.

The single jet was not



filling the chimney, creating a vacuum around the chimney rim, causing the exhaust to be sucked back down around the chimney top. Filling the chimney with the multi-jet has removed this vacuum the steam was trying to fill.

The speed. With the multi-jet nozzle the loco went faster. There was less sense of struggle maintaining speed out of the bottom curve or the pinch halfway up the hill. With the single jet, you could come up the hill at a reasonable speed with regulator fully open. But with the multi-jet, having the regulator open fully was a bit too much.

The adhesion. The loco was more slippery with the multi-jet. At times the loco went into a slip at speed and it was difficult to tell this was happening because you couldn't hear it! This is consistent with extra power output of the engine. If there is restriction in the exhaust, then slipping will be limited by the increase in back pressure.

While I knew in theory that increasing the blast nozzle area and reducing back pressure would increase the power output of the loco, I supposed I always thought there wouldn't be that much back pressure in our models... I would not have expected the performance improvement would be noticeable. In retrospect perhaps I should have, as most 'modern steam' conversions focus heavily on front end design to increase power. Some of the observations are nuanced, however by swapping back and forth during the one running session over several hours made the comparison clear. There is plenty of room for further experimenting and refining. Given the full size 36 class flirted with smoke defectors and 3616 eventually received a Giesl ejector, perhaps this is some admission the prototype drafting was not all it could be.

So what's the next improvement? Up to this point, the loco has not been slippery at all, but with steam tight valves and reduced back pressure more power is available than can be applied to the rail! The loco is fully compensated with plenty of weight and side control on the front bogie. This makes it excellent riding but at the expense of adhesion. Perhaps these arrangements can be examined to redistribute the weight a bit, or some nooks found to hide some extra weight!

Left: The 4 nozzle installed. Below 3609 on test!



Scale Riding Cars

David Lee

I always had intentions of building rolling stock to suit the era of my locomotives, including the steam loco under construction. My Commonwealth Railways GMs seem a little lonely circulating the tracks with just the louvre van as my bum truck, 3.5m (12') of locos and only 1m of rolling stock, so I thought I should build some scale rolling stock that would double up as passenger carrying cars. I have seen this with other peoples' consists, Barry Webster's 81 from Hornsby Model Engineers at Galston and his candy cars springs to mind.



Barry Webster's candy car.

The Trans Australia rollingstock fitted the criteria so the research begins. This consist had a variety of cars and as fate had it, only 2 ARA carriages were ever built and as they had Masonite sides it seemed the perfect carriage to scale down for my passenger carrying cars, as there is less detail than the timber slat sided carriages. The original cars have a welded double I beam design as a deep girder centre underframe and came in at 76' 7" long. The car-

The underframe care of Steamtown Heritage Rail Centre



riages sit on a pair of 4 wheel bogies with an 8' wheelbase fitted, with swing links and elliptical springs typical to most passenger carrying stock. These 1st class sleepers entered service in 1944 and were used on the Trans Australia until the sixties when they were converted to narrow gauge and then used on the Ghan. In the early eighties, ARA71 went to Steamtown Petersborough whilst ARA72 went to the Ghan Preservation Society.

The scale cars are around 2.2m (7' 2") long so should comfortably sit 5 adults which means the overall weight carrying capabilities have to be taken into account, estimated at a possible 400 – 500kg. To keep to scale proportions a 65mm x 35mm x 4mm RHS tube was substituted for the centre beam. I have not made fancy 3D drawings with stress analysis or actually made stress calculations to see if I am correct, but rather relied on my modellers' instinct and experience. Another issue with long cars is will they actually traverse our 5" gauge tracks? A board was strapped to the centre beam that represented the overall width including the foot boards and run around the track at West Ryde. When the cars were taking shape, another trip around the track was made to see how much travel from side to side there would be between the cars ends. Final confirmation was carried out at the Orange track during one of their invitation runs. I was concerned with the carriages changing direction through points with such a long overhang from the bogie pivot point to the car's end. The cars were coupled together with an almost scale distance between them and they traversed the tracks with ease.

So how did I go about getting the cars done.

The centre beam needed a little shaping and had the slope and cut out sections for the bogies chopped out using a slitting saw on the horizontal mill. The base plate had been laser cut from 3mm plate with notches for locating all the cross webs which have corresponding high spots for locating before welding. The whole lot is tied together with a split RHS to form a C channel welded to the ends of the cross webs and some 1mm thick straps tacked along the edge of the webs to represent the cross straps as per the full size bogie. To bolster the strength of the underframe a tubular frame was manufactured to form the seat carrying area to which the 2.5mm aluminium side panels are glued to using industrial adhesive, @Sikaflex. Further aluminium sections were laser cut to form the window frames and door frames and these were also glued on. Some painting in the appropriate colours, cream and chocolate with black for the underframe.

Attention now turns to the bogies. As with the carriage, the bogies need to be scale in appearance and functional in a passenger carrying capacity. Some modeller's license



Testing on the bottom curve.

gussets and horns, along with the framework to hold the swinging bolster.

The holes were all drilled on a CNC mill, 6 bogies for 2 passenger cars and a guard's van, meant 38 holes per side frame in other words 456 holes of 4 different diameters and a little tapping for brake hangers. The curse of repetition cured by modern machinery. As can be seen in the picture, a jig first had to be manufactured to facilitate the

was required as the full scale bogies are tied at each end and I didn't feel I could get the necessary vertical movement on the axleboxes and weight carrying capacity in a single unit. The decision was made to make separate side frames tied together by a bolster in a similar way to the ©Sandberg and ©DNC bogies commercially available. These were cut from 12mm mild steel and the side frames are fitted with 3mm gussets to represent the plate to which the axlebox horns would normally be rivetted to. The full size bogies are made from 2 channels plated together to form a tube. To this end plates are rivetted and the previously mentioned

machining. The equalising beam was milled down only on the outside to represent the smaller width and has the horn for the bolster welded to it on the inside, away from view more or less. Solid wheels were used on the passenger cars and 8 spoke wheels on the guard's van. The solid wheels were purchased from DNC already pressed onto the axle and fitted with deep groove ball bearings, hence the large hole in the side frame.

To maintain some degree of scale appearance the non-functioning components were 3D printed care of ©Shapeways in an aluminium/nylon composite and are shown below. The axleboxes are year stamped as per full size, 1944 for the ARa and 1937 for the HRa guard's van, which is in the pipeline. More modeller's licence was required for the elliptical spring so I could fit die springs for the load capacity. Calculations from spring manufacturers allowed for 6 springs per bogie giving me 4mm movement at 450kg capacity per carriage. The equalising springs are printed complete with the top and bottom caps, or retainers, and these fastened to the side frame. They actually have the inner spring with the opposite helix, just because I can. My next headache was braking.

Due to the centre beam design, the traditional straight pull on the brake arm did not appear practical. I could have offset the rigging as I will with the guard's van, however with several people's wellbeing taken into consideration I turned to a commercial option and contacted DNC for their brake gear. Some elements of their system had to be redesigned to fit my bogies and this was under taken by Ian Ramsay of DNC. Another hiccup now presented itself, the vacuum cylinder was sitting too high and the pipe was vertical. This next redesigning was my responsibility now. At first, I simply made some square blocks that turned the cylinder 90°, however this also had its problems. I could either have the cylinder low enough to miss the beam, or high enough for the vacuum hose to clear the axle, but not both, yet. The final outcome was an angled adapter produced with a little calculated guess work, aka trial and error. Lucky for me, first go was a success, about 10° - 15° of angle was enough.



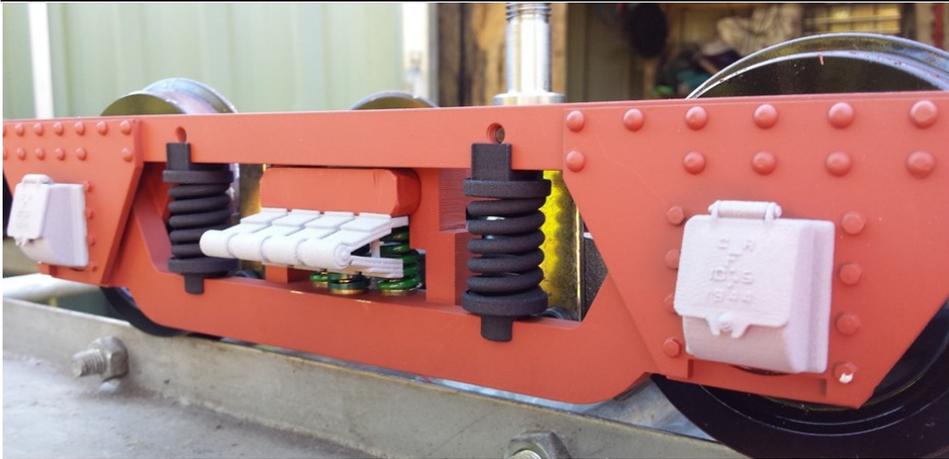
Left: Time to check traversing the rails through the points. The carriages were built at the Port Augusta workshops where DR1 was in service (in fact DR1 entered service after the cars were converted to narrow gauge so not quite a prototypical picture. Sorry purists.)

Below: Putting the jigsaw together. Thanks Shane (A more experienced welder than I).





Above: So many holes! Below: Printed parts in grey and black. Further Below: HRa Bogie. The text is quite legible after some paint.



The seat cushions, aka roofs, have been cut to the profile in a high-density foam and covered in vinyl. I have used

this same principle for my louvre van which I have had for over 15 years. As all the pictures from the time were black and white, finding the right colours was another challenge. A call to Steamtown shed some light on the situation. The colours for these cars must have been by a lover of food. The body is chocolate and cream with a mustard roof, an interesting mix of flavours. The problem is mustard has shades from an orange sunset through to a banana skin sort of colour. Also colours on the web sites vary from real life. After much searching, a suitable coloured vinyl was purchased and the cushions made up.

Although I won't fit hand rails and some small fittings, I felt the need for the CR logo to be present on the models. Finding information on this was the most difficult research I have had to undertake. Once again the photos are black and white plus taken from far away so as to get the whole carriage in the frame, not great for small detail such as the name plate. I asked around the relevant museums and heritage railways for some idea of colours to no avail. One photo I chanced upon just didn't sit right so I continued to search, trolling the internet. Alas I found something, however I cannot find it again to give credit or thanks. I turned again to 3D printing to help with the painting. Letters are 0.5mm high with the shadowing 0.2mm below. A little modeller's licence was used so I could replicate the name plates on more scale cars at a later date. No, they won't be passenger carrying this time.

owing 0.2mm below. A little modeller's licence was used so I could replicate the name plates on more scale cars at a later date. No, they won't be passenger carrying this time.



Poking up too high



Not enough clearance.

or



Ara71 without foot boards followed by Ara72 with boards fitted.

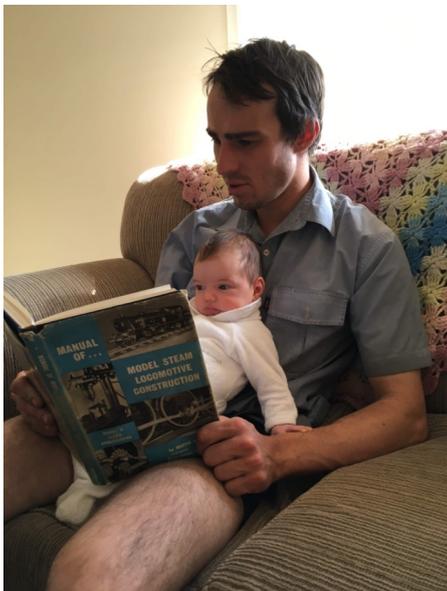
Central Station in the good old days! The ads on the post for 2UE when it was “TOP FOURTY, NEWS, WEATHER & SPORT” and John Laws was just a “Disc Jockey”! From Ray Lee via John Lyons.



Model Engineering with a Baby?

James Sanders

It may sound like a ridiculous question. But, is it possible to continue making steam engines when a little bundle of joy comes along? Yes, it certainly is, however you need to accept that things slow down and some safety precautions obviously have to be taken. How preposterous!



Why would you even ask the question?

Being an avid model engineer, who likes to get things done in the workshop I contemplated what this aspect of my life would look like. I didn't want to chuck the towel in, but came to accept that things were going to change. To some, the very thought of a child being in a workshop probably makes them sick, however when your day job is teaching kids how to use

tools and machinery in a workshop (albeit a little older) it is something that I am accustomed to. Other non technol-

ogy teachers often comment, how do you cope with the noise and the kids using dangerous tools? I say it is rather more daunting being in a classroom with desks where they have to sit down and be quiet! One has to way up the risks and manage them accordingly. Obviously the risks can increase with the younger the child, but you have to start educating them young!

Some anecdotes from a new learner.

We had our little girl in September 2019 and prior to her arrival my wife and I discussed how life would change (how surprising?). This included workshop activities,



which would obviously be in a much more limited state. We agreed that Rosie wouldn't be allowed out in the workshop until she had had her 6 week vaccinations which meant that activities until then were conducted when she was asleep!

Following the vaccinations, she was allowed in the workshop, most of the time being in a baby carrier, often being nursed off to sleep by the sounds of hand tools. One early memory of one of the first times I had her out there was tapping M3 holes with a HSS tap by hand in the cylinders for my NSW 35 build, hard to do when a squirmy one is strapped to your tummy, just need to make sure that the tap wrench is done up lightly on the tap, always do things over the bench so that if you drop them, they won't hit the floor or have far to fall. I didn't break a tap in either cylinder assembly.

Managing risks.

As the months went by, most activities conducted in the workshop were planned to be mostly hand tool jobs which made minimal noise, babies have very soft skulls when they are that little, so you can't put earmuffs on them until they are 3 months or older. You can purchase baby earmuffs which are easily adjustable - many farmers take their little ones on the tractor with them, so being out in the sticks made them easy to source. The earmuffs meant the lathe, drill press, mill and bandsaw could be put into action, taking care where the chips were flying of course and making sure that they stayed on!

More recently I will judge whether it is safe or not to





carry out an operation based on attention span or liveliness. Rosie spent a great deal of time in the baby carrier in the first few months, on my front or on my back depending on whether it is wake or sleep time. As she has learnt to crawl and walk, the floor in the workshop has had to be kept clean and a good drawer of outside dirty clothes are readily available for her. Every few days things change. Rosie has become more adventurous and curious to

grab all sorts of things - I have had to change what I do and where I put things. You need to watch those 10ba screws left on the engine assembly stand... I have found that it pays to have several nut runners available because the one you are working with is always the most interesting! She has started wanting to "help" this is only to be encouraged, but choice of job and risk of damage needs to be judged with discernment.

Being productive

Like all projects, particularly those of the live steam locomotive variety, it is helpful to have a list of things to do and drawings/measurements to hand to limit unproductive time outside. I have found lists to be most helpful - particularly when you haven't got the brain capacity because you are looking after a little one, whilst trying to get something meaningful done at the same time. I have had to learn to accept that I cannot get things done without interruptions or slower than I would like. I try to do jobs when I have company which can be handled without undue risk and save the ones that require concentration when I have some time several evenings a week to myself for an hour or two. Marking out jobs are often left to solo time, double checking things for accuracy. It makes it much easier to cope with distractions and interruptions when carrying out the job.

Looking back at the first year

Now that Rosie is over a year old I look back at the time and think how it has flown. I often will take pictures using my phone of project progress over time, this, along with photos of apprentice number 1 gives a good idea of what I have managed to get done during this time. I am pleased with the workshop output, the 35 is progressing nicely, there have been other sideline projects too to break up the big job. I am not sure how many other members would find themselves in a similar situation, but it is amazing what you can get done, if you are keen and willing.



Below, the 35 class boiler getting close to completion.



Duty Roster.

- March:** Mick Murray, Andrew Allison, Mark Gibbons, Wayne Fletcher, Graeme Kirkby, John Noller, Ian Tomlinson, Glen Scott, Chris Denton, Warwick Reinhardt.
- April:** Evan Lister, Simon Collier, Garry Buttler, Barry Millner, Scott Murray, Graham Tindale, Paul Brotchie, Mike Dumble, Deven Shirke, Craig Deacon.
- May:** David Thomas. Bernard Courtenay, Greg Croudace. Stuart Larkin. Shaun Sorensen. David Lee. Brad Wilkinson. Geoff Hague. Martin Dewhurst, Ken Baker, David Coulshed.
- June:** John Hurst, John Lyons, Matthew Lee, Jim Mulholland, Martin Yule, Warwick Allison, Tony Kidson, Nigel Woolley, Bill Perrin, Eddie Jones.

Gate Roster and Track Superintendents: To be advised when running recommences.



Above: Newly completed is Andrew Allison's gauge 1 model of a NSWGR 26 class. This fine model is gas fired with a 75psi boiler and has slip eccentric valve gear. Radio control is fitted. Completely CAD designed by Andrew, the model features full use of modern technologies including laser cut frame and components, including cylinders, Walsall wheels from the UK especially produced to suit this loco, and 3D printed components for brass castings such as buffers, dummy whistle, Westinghouse pump, crossheads and the distinctive tapered tank pillars now available through Shapeways on line.

Below: Another rear three quarter view of James' 35 class looking very flash in its green livery. Photo Geoff Hague.



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Web Page Address: <http://www.slsls.asn.au>

Public Running Day is the **THIRD** Saturday in each month from 1.30pm. Entry is \$4 adults, \$2 children. Rides are \$2 each.

To ride on the trains, enclosed footwear must be worn.