



NORTHERN DISTRICTS MODEL ENGINEERING SOCIETY (PERTH) INC.

September—October 2017

# A remarkable turnout at the August public run

WE reached a new high water mark at the public run on August 27 when no fewer than 40 members signed-on to help out. And maybe there were one or two who didn't sign in!

With our membership around the 80 mark, this roll-up represented half our members coming along to do their bit. Three members of CMR were also there to help.

Seven members were at the club grounds before 8am to help roll out the tables, chairs etc, even though some could not stop to enjoy the day with us. That is a remarkable roll-up, given that many members are pure model engineers, with little interest in running a railway for the public.

Wouldn't it be nice if the same level of enthusiasm was displayed in getting the grounds and facilities ready for our Sandgropers Gathering, just two months away!

Work that needs to be done before then includes:

- ♦ Patio roof extended to cover the whole patio area (to be done by a contractor);
- ♦ Painting of wood fencing surrounding the picnic grounds (to be done by a contractor);
- ♦ Completion of steam-up bay renovation (also being done by a contractor);
- ♦ Installation of lighting in the station for night running;
- ♦ Installation of a compressor in the steam-up shed for firing up steam locos;
- ♦ A new storage shed in the picnic grounds for sweeper cart and tables and chairs;
- ♦ Completion of a second circuit on the garden railway and provision of power and lighting to the area;



While treasurer David Edmunds was acting either as a guard or driver at the August public run, his wife Alma, daughter Poppy and twin grandchildren Lauren and Christopher (4½ months) were making friends with our members and the public. They are pictured here just before leaving for home. *Photo: Tom Winterbourn*

- ♦ Renovation and re-compacting of the traction engine pathways around the garden railway site;
- ♦ General clean-up of the area on the western side of the main workshop.

Fortunately, the new toilet facilities, with showers, are now available for use.

So, if you can help in any way with these projects, please see a committee member. Working bees are planned in the weeks leading up to the event.

**Tom Winterbourn**

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**See pages 8 and 9 for more on the July and August public runs.**

Right: A study in concentration at the August public run while a mini committee meeting goes on.  
*Photo taken by a Castledare visitor using Steve Reeves' camera*



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## Are you ready for Sandgropers?

OUR next big event is just around the corner and I would like all members to get involved, in one way or another.

I am, of course, referring to the annual **Sandgropers Gathering and Traction Engine Rally** to be held at Balcatta on November 11 and 12.

The event is now staged at NDMES and SWMEA at Bunbury in alternate years and this year it is our turn to host the popular event.

A new website has been created by Eileen Briggs (wife of secretary Steve) – and an excellent job she has done, too.

She was breaking new ground with this project and I am most grateful for her time, effort and dedication in getting the website up and running. It involved much trial and error.

So, go to <http://www.sandgropers-ndmes.org.au>, download the registration form, fill it out and then you can either scan and send it to the email address [david\\_cyprus\\_edmunds@yahoo.co.uk](mailto:david_cyprus_edmunds@yahoo.co.uk) or post it with your payment to PO Box 681 Balcatta 6914.

Please respond as early as you can to give us an idea of how many locals will be attending. This is particularly important for the Saturday night dinner on the patio under the extended roof. Details of the food options are available on the website.

We will soon be drawing up a roster for members to carry out key duties over that weekend, so please don't be shy in putting forward your name.

There will be a night run on the Saturday (after dinner) and also paths are being freshened up for the traction engines. Hopefully, there will also be a tractor pull competition.

In readiness for Sandgropers, the steam-up shed has been “freshened up” with a rub-down of the metalwork and painting of rustproof undercoat and top coat by a team from Shalom House. It is hoped the station will receive similar treatment, while our electrician Jaco De Lange is wiring up the station for lighting for the night running.

Work had yet to start on extending the patio roof by the end of August, but approval has now been received from Stirling City Council, which will allow contractors to carry out the work. This should only take a couple of days.

The garden railway continues to develop and a second circuit should be completed well before Sandgropers.

But Sandgropers is not our only focus. We are still looking at the picnic grounds, and while no decision has been made, the current thinking is to paint the

### President's Report



by Tom Winterbourn

wooden fencing (which is in surprisingly good condition) rather than outlay thousands of dollars on a new metal “pool type” fence previously under consideration. The plan is still to insert a double gate at the eastern end.

It is also planned to purchase a new shed to be positioned alongside the picnic grounds to provide more room for table and chair storage. It will also provide storage for the new sweeper cart that goes behind the ride-on mower and which is a little difficult to move from its present home in the container to the picnic grounds via the ramp bridge.

Our society continues to grow with 10 new members over the past three months, while the boiler group continues to meet in the Parkerville workshop of Ron Collins. The Wednesday group has seen 24 boilers built there over the past 12 months or so, mostly under the tutelage of Ron and Phill Gibbons — see page 6.

Work is continuing on the 2018 AALS convention, which we are organising at Bunbury, with registrations now being received. The good news on this front is that the Bunbury City Council has agreed to our request that the railway be gazetted as a special event, which means we can put heavy plastic tape on the perimeter of the railway, challenge anybody not wearing a convention badge — and also allow tent camping on the site. The mayor has also committed to holding a civic reception for convention delegates on the Thursday night, in lieu of the traditional welcome drinks at the railway.

On another front, the committee has decided that all proceeds from the September 24 public run will be donated to the WA Cancer Council, which will have a significant presence on the day.

My three-year tenure as president is coming to an end. While our new rules of association now allow a president to serve longer than three years, I think it is important to have regeneration and new ideas. And if I was to do another year, I would be 80 before I finished that term! So, please give some thought to who you think would make a good president and talk that person into stepping up to the plate.

And finally, with our membership now over 80, I would like members to consider what new activities would interest them, other than building and playing trains. What about some organised events at weekends to bring members together in a social environment?

Other than club and public running and the monthly meeting, the weekends are fairly quiet, so how can we encourage more of you to visit your club on Saturdays and/or the Sundays not dedicated to train running?

Please let me know your thoughts.

**Tom Winterbourn, President.**



## Doc Martyn holds court with 'Speedy'

Stu Martyn did a great job in promoting the society with his 5" 'Speedy Gonzales' in steam and running on rollers at the Bunnings Balcatta BBQ on July 15.

The BBQ was the second we have run at our local Bunnings store and over a dozen members turned up to help. It was also a success financially.

Stu is pictured at right talking to some of the many people who stopped to find out more about the loco and our operations. Stu handed out dozens of flyers, many to "local" people who knew nothing about our operations!

The loco ran faultlessly for the entire eight hours we operated the BBQ, which can just be seen in the right background. And yes, Stu does hold a doctorate — in electrical engineering.

The lower picture was taken during one of the quieter moments at the BBQ, showing vice-president John Shugg and "bagman" Peter Maschette, while secretary Steve Briggs and Ron Casotti slave away at the coalface behind them.

The weather held out until about 3pm, when a "front" rolled in from the west, producing quite heavy rain at times. But then it cleared as quickly as it arrived and we sold almost another 100 hot dogs before we shut up shop just after 4pm.

All up, 13 members put in considerable time and effort, including new members Peter and Suzanne Smith. A big thank-you to all concerned. *Photos: Tom Winterbourn.*



## Progress on Ken Austin's 7<sup>1</sup>/<sub>4</sub>" Baldwin loco

Ken Austin has been working for some time on a 7<sup>1</sup>/<sub>4</sub>" gauge 2-6-6-2 articulated locomotive, based on one of a number that were built by the Baldwin Locomotive Works in the USA, primarily for narrow gauge logging and mining railroads.

Working from the full size drawings and various photos, this is a complex and very substantial loco, as those who have seen it in progress at various workshop visits will remember. Recently, Ken reached the stage of trial assembly of the chassis and rolling gear, so he decided to try it out on a short length of curved test track that he made up. This was to ensure no unpleasant surprises when the finished loco goes on track!

You can see from the photo (right) how much sideways movement there is in the various parts of the chassis, and how much the long boiler overhangs, which is typical of photos of the full size locos in operation.

As it turned out, everything worked as expected except for the rear pony truck, which needed to have its roller supports lengthened by 20mm or so to work properly.

A good idea for anyone building a long wheelbase or articulated loco — do a test run early to avoid surprises!



## A double-acting water pump

As you know, I have been overhauling Tom Winterbourn's loco and he asked if an axle pump could be fitted. There are two eccentrics already fitted with a 16mm stroke, so to be any good on delivery the pump needed about a 20mm or larger bore. This could have caused a bit of jerkiness when running so I have turned to a double acting pump, which pumps half the water every stroke. Normal pumps deliver all the water on every second stroke.

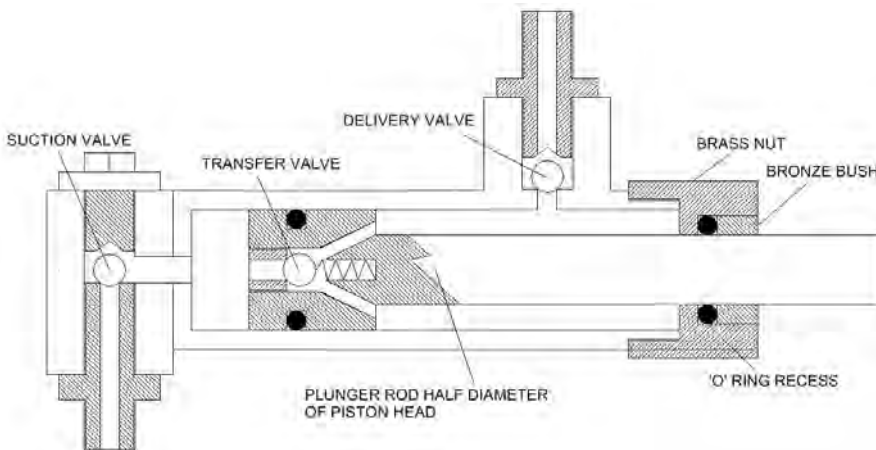
The double-acting pump drawn in the diagram below has 'O' rings instead of the traditional packing on the ram and gland. The groove on the ram is straightforward but the one on the rear gland is



Engineering Matters  
with boiler inspector  
Phill Gibbons

made differently. The brass nut is, of course, not suitable for a high wear area — it has to be gunmetal or bronze. After reaming the nut to suit the plunger rod, I then bored three-quarters of its length .125" larger, made a bronze bush a press fit in the bore, bored it to suit the plunger diameter, but kept the length of the bush .100" short of the length of the bore inside the nut when pressed in.

We have left a perfect 'O' ring groove in the middle of the bore and a bronze bush that can be replaced, all without grinding a special internal grooving tool.  
**Phill Gibbons**



### Know your Society

<b>President</b>	Tom Winterbourn	0415 682 931	<a href="mailto:twinterbourn@ozemail.com.au">twinterbourn@ozemail.com.au</a>
<b>Vice President</b>	John Shugg	9304 0338	<a href="mailto:jshugg@bigpond.net.au">jshugg@bigpond.net.au</a>
<b>Secretary</b>	Steve Briggs	0400 691 864	<a href="mailto:epsbriggs@yahoo.co.uk">epsbriggs@yahoo.co.uk</a>
<b>Treasurer</b>	Dave Edmunds	0432 426 891	<a href="mailto:david_cyprus_edmunds@yahoo.co.uk">david_cyprus_edmunds@yahoo.co.uk</a>
<b>Committee Members</b>	David Naeser	9276 8709	<a href="mailto:dnaeser@iinet.net.au">dnaeser@iinet.net.au</a>
	Dave Robinson	0417 943 678	<a href="mailto:dave.robinson10@bigpond.com">dave.robinson10@bigpond.com</a>
	Harry Roser	9525 2125	<a href="mailto:harryroser@hotmail.com">harryroser@hotmail.com</a>
	Allen Ward	0412 310 852	<a href="mailto:walker1234@hotmail.com">walker1234@hotmail.com</a>
<b>Boiler Inspectors</b>	Phill Gibbons	9390 4390	
	Steve Reeves	9354 1395	
	Noel Outram	9525 1234	
<b>Librarian</b>	John Martin	9300 2180	
<b>Birthday Bookings</b>	Paul Costall	9572 1385	<a href="mailto:costall.paul@gmail.com">costall.paul@gmail.com</a>
<b>Driver Training</b>	Phill Gibbons	9390 4390	
<b>Safety Compliance Officer</b>	David Naeser	9276 8709	
<b>Newsletter Editor</b>	Jim Clark	0407 988 746	<a href="mailto:jimclark@hardwareandsoftware.com.au">jimclark@hardwareandsoftware.com.au</a>
<b>Website</b>			<a href="http://www.ndmes.net">www.ndmes.net</a>
<b>Society On-site Phone Number</b>		9349 0693	
<b>Society Grounds and Track Site</b>	6 Vasto Place (off Balcatta Road), Balcatta		
<b>Postal Address</b>	NDMES, PO Box 681, Balcatta 6914, Western Australia		



## Editorial

IN this issue we are continuing with another member's profile, this time we focus on former club president Paul James — see article on page 7.

It is always interesting to find out a little more about where people have come from and what drew them to model engineering. Our members have such a diverse range of backgrounds and previous experiences. One thing is certain, there is no particular education, trade or profession necessary to qualify you as a “model engineer” — only a passion for mechanical things in miniature and a desire to do something about it.

The other great advantage to model engineering is that unlike “real” work, there is no profit motive and no boss breathing down our necks for greater efficiency and reduced costs. The only boss we need to satisfy in the model engineering workshop is ourselves and the only deadlines we need to meet are ones like conventions or run days, or just the completion of some life-long project.

So all that sets us free to pursue whatever facet of modelling or mechanics that takes our fancy and to do it to the best of our own abilities, whatever they may be.

On another subject, it's great to see that the long-standing model engineering business of E & J Winter is now back on track, under the ownership of Ben de Gabriel.



Your Editor hard at work taking photos of Ron Collins' Wombat.

One of these photos was used on the front cover of the 30th Anniversary issue of AME magazine. Photo: Keith de Graauw

I have had several good experiences with them recently, and Ben appears to have most items in stock ready for prompt despatch. I know many of us have been going overseas lately for parts, but I think it's good to support the local suppliers. **Jim Clark**

## Calendar of Forthcoming Events

<b>General Meeting</b>	Friday	8 September	7:30 pm	
<b>Club Run Day</b>	Sunday	<b>17 September</b>	9:00 am — 2:00 pm	<b>Note the changed date!</b>
<b>Public Run Day</b>	Sunday	24 September	10:00 am — 2:00 pm	
<b>General Meeting</b>	Friday	13 October	7:30 pm	
<b>Club Run Day</b>	Sunday	15 October	9:00 am — 2:00 pm	
<b>Public Run Day</b>	Sunday	29 October	10:00 am — 2:00 pm	
<b>Sandgropers Weekend</b>	<b>Saturday-Sunday</b>	<b>11-12 November</b>	Daily, Saturday dinner	NDMES Track Site

## Micrometer set for sale

Dennis Lord has generously donated a boxed set of micrometers to raise funds for the club.

The set comprises four metric micrometers covering the range 25mm to 100mm. They are pretty much “as new” and are presented in a nice wooden box.

They are offered for sale by silent auction — all bids should be received by the treasurer prior to the start of the September monthly meeting. The successful bidder will be announced during that meeting.

Remember, the proceeds of this sale will go towards funding the activities of our society, so bid generously!

Contact the treasurer Dave Edmunds or the president Tom Winterbourn for more details if you are interested.



Right The boxed set of micrometers for sale.

## Notes from the Boiler Group

Wednesday 19 July was Christmas in July day for the Wednesday boiler group. Les Harris' wife Sue provided a large platter of sausage rolls, mince pies and cake, and Tom provided a warm Christmas pudding with custard. Quite a feast for a cold wet winter day — thanks!

August saw the welcome return of boiler inspector Phill Gibbons from his holidays up north. There are still several boilers under construction, with a couple more still to come. Since the inception of the Wednesday Boiler Group just over a year ago, a total of 24 boilers have been through Ron's workshop, a few for modification and approval, and 18 complete new builds. An impressive record!



Left: Some last minute adjustments to Bill's boiler by Ron Collins, Richard Turner and John Turney...

(Bill wasn't looking so out came the hammers... oh dear!)

Right: Bill Walker is making good progress with the boiler for his "Lion".

Photos: Jim Clark



... before the foundation ring was brazed up by the "A Team" led by Phill Gibbons, assisted by "Mr Preheat" Richard Turner and Ron "Hot Fingers" Collins.

## A new member with a mission

THE society has welcomed many new members this year, but no-one has thrown themselves into the model engineering side of our activities like new member Gary Clarke.

But he did come to us with a mission, thanks to the enthusiasm instilled in him by his grandfather. Gary maintains model engineering has always been a part of his life.

"My Grandad always had something he had made to show me when I visited," he said. "I loved driving his 3½" Tich, his 2-4-2 freelance loco or his 1½" scale traction engine and enjoyed the smell of burning coal in my nostrils.

"So when I saw plans for Rob Roy in 3½", it was the obvious choice for me as a first build."

Gary said 20 years on after migrating to Australia, he finally found himself in a position to start the project.

"I have made all the steelwork with no real issues (except time), but the copper boiler is another kettle of fish," he said.

"Luckily NDMES has some great guys who give invaluable assistance and guidance. I am having great fun building the loco and can't wait to raise steam!"

At the boiler group in Ron's workshop on August 2, Gary had the boiler ready for brazing, but when Ron and boiler inspector Phill Gibbons offered to do the work, Gary wanted none of that; he wanted to do it himself! And a good job he made of it, too, under the watchful eyes of Ron and Phill.



New member Gary Clarke silver soldering the boiler for his 3½" 'Rob Roy' with some advice and assistance from Ron Collins and Richard Turner. Photo: Jim Clark

With this sort of enthusiasm, raising steam by Gary will be here sooner rather than later!

Tom Winterbourn



## Paul James: A man of many interests

After completing the usual five-year apprenticeship as a heavy duty diesel mechanic and another similar period working in this field, I had the opportunity to join the Education Department in 1972.

As I am a practical-minded person and always making projects, this career change suited me well and I soon found myself heading for Narrogin Agricultural College, where I assisted in the teaching of farm mechanics, welding fabrication and farm construction.

On my return to Perth, I undertook and completed a formal two-year teaching qualification on a part-time basis while teaching at Thornlie High School.

Over the next 37-plus years, I taught in several schools throughout the southern suburbs, finally retiring from full time work in 2005.

My working career saw me engaging in a large range of subject areas, including those associated with wood, metal, building, drawing, mechanics, welding and electronics. Personal projects have included a diverse range of things such as furniture, a grandfather clock, sheds, metal patios, VW-powered dune buggies, major house renovations and recently a foray into steam modelling.

Shortly after the passing of my father in 2001, I joined NDMES in an attempt to complete a freelance traction engine he had started way back in 1950. As he hailed from Wales, he had been brought up around steam winders in coal fields and, of course, steam locomotives and traction engines.

This engine was based around some 1½ inch scale blueprint drawings of a Fowler model he had obtained from Boltons in Sydney. His biggest issue was the manufacture of the copper boiler, as he was always unsure about providing sufficient heat for silver soldering. He did, however, draw and build the basic structure of this 3 inch scale engine.

Since joining NDMES, I have completed a 3½” “Hielan Lassie” Pacific (photo below) and have been heavily involved in club activities, including several years as secretary and three years as president.



In September last year I decided to attempt the completion of the traction engine, but not having a full set of drawings has provided me with a challenge. To this point I have completed the remaking of the smoke box and front end and am now nearing completion of the almost non-existent tender and water pump. As this will be a true freelance engine, the partly fabricated cylinders and valve design still have to be detailed.

Thanks to the Wednesday boiler group, the boiler has also been completed. This necessitated the remaking of most parts to conform with the AMBSC copper boiler code. It has now had its initial hydraulic test.

The intention was to incorporate piston valves and Walschaerts valve gear and hopefully with some help from club members, in particular Ron Collins, this will eventuate. From the accompanying photo above, it can be seen that the gearing has been positioned. Wheels are complete, as are several other components in preparation for assembly.

I might add that while this project has been progressing, I have digressed a little to make a vertical boiler in the hope that I can run some Stuart Turner engines completed by my father.

Thanks go to the club members who have had input up to this point and, of course, one hopes for a completion date, perhaps mid-2018. Remember — Rome wasn't built in a day! (Who said that?!)  
**Paul James.**





## Dark clouds – but not in the sky!

DESPITE perfect weather, the August public run day was not without some foreboding dark clouds as we set up for the day's run – we couldn't locate the Eftpos machine! Most of our clients now like to pay with plastic, but without the machine we visualised the day being a public charity run, as Cathy could hardly charge those with cash and not those without!

But believing it would come to light, we asked those wanting to pay with plastic to do so on their way out. This vital piece of equipment was eventually located (well after start time) and our honest clients with cards did indeed pay an exit fee via Eftpos!

The day eventually turned out to be a good revenue generator, which was just as well, as there will be no revenue from the September run, proceeds from which will be donated to the Cancer Council.

The club's 7¼" steamer was given its first run for some time and performed well. The day also marked a welcome return to active duty in the canteen by Jean Crawford following her hip replacement.

Our pictures this month concentrate more on people as the locos rarely change from month to month.

Right: Paul Costall takes time out to explain the workings of Firefly to Suzy and son Harry (2½).

*All photos: Tom Winterbourn*



Left: Pete Harding tops up Bushfly's tanks so Damien Outram can restart his train.



Left: Guard Bob Hutt (at rear) gives the all clear for his train to depart the station.



Right: "Hello, my name is Shirley!" The Ocean Reef resident, originally from Surabaya, Indonesia, dropped in on her own to pursue her love of trains. She is pictured with treasurer David Edmunds.

## Garden railway update

Richard Turner brought along his latest loco for a steaming at the July club run day.

The loco is based on an 0-6-2 tender sugar cane loco from Queensland.

Also present (see photo at right) was Clive Jarman with his AME design Edwin 0-4-0T and Steve Reeves with his Baldwin 4-6-0PT, based on a 10-12-D.

The photo was taken by Tom Winterbourn using Steve's camera.

Work is now progressing on the second of three circuits on the raised track.

**Steve Reeves**





## July 30: A day to savour!

THE weather forecasters do a marvellous job generally, but they got it wrong on July 30. Despite the forecast rain, the day dawned bright, even if a little cool, and our patrons made their way to the Balcatta track in their hundreds for our public run.

It was one of our best days yet in terms of revenue and stand-in “office staff” Kathy Costall and Suzanne Smith did an excellent job in welcoming our guests, taking their money (!) and selling soft drinks and coffee.

The picnic grounds were again full and humming and passengers waited for rides over the bridge and down into the picnic grounds at times. Four trains operated on both the GLT and raised track. And the complimentary comments made by many passengers as they left were most heartening.

There was also a strong turnout by members, making the day enjoyable for all concerned.

**Tom Winterbourn**



Happy debutants: Kathy Costall takes another Eftpos entrance fee, watched by Suzanne Smith. They did an excellent job in the ticket office/canteen on a very busy day, deputising for the other Cathy — McCafferty. And the pic was not staged, as they didn't know it was being taken! All photos: Tom Winterbourn



Left: AMRA WA president John Maker and daughter Ashley enjoyed a day at NDMS.



Above: Scot Andrews and Black Betty by-pass the station.



Left: Pete Maschette on a hot dog run.



Above: Damien Outram drives Allen Ward's ever-reliable "Waterloo".



Left: Clive Chapman and Andy Davis cater for the "inner man".



Towards the end of the run, "Black Betty's" fire clogged up so she and the three carriages were pushed into the station by David Robinson's "diesel" — seven carriages in all!



## It's all a fabrication!

by Jim Clark

No, this is not an article about Fake News, but about genuine fabrication (if there is such a thing!)

I have recently become interested (thanks to the boiler group...) in building a 5" gauge model of the Cornwall, a 2-2-2 "Crewe-type" loco that was built for the L. & N.W.R. in 1847 to a design by Francis Trevithick. The original design was a variant of the large single-wheel driven locos of the Crampton type of that time. The driving axle passed through a recess in the top of the underhung boiler, which was complicated, small and presumably a poor performer.

As a result, it was completely rebuilt by Ramsbottom in 1858 to its current 2-2-2 arrangement, with a conventional boiler above the driving axle. One of the attractive features that remain are the huge single driving wheels, 8' 6" in diameter. Loco 3020 "Cornwall" is now preserved at the UK National Rail Museum in York.

On to the fabrication bit — I had some outline drawings, some descriptions and some photos of the loco as it currently stands. A search of model engineering and internet sites did not reveal any scaled plans or castings and no indication that anyone else has built a model of this loco, although I'm sure it has been done. The closest appears to be the "Problem" class which does have plans, castings etc. available — this is similar, but not quite the same. So after some more thought, I decided that I would build Cornwall based on the outline drawings and photos, and that I would fabricate everything rather than making or buying any castings. The first challenge was the wheels.

The method I chose is based on the wheel fabrication technique described in "Building the New Shay" by Kozo Hiraoka, except I simplified the assembly jig by cutting slots into a short length of pipe to form a round comb that simply drops over the spokes to hold them in place for brazing. As the wheels for locos of this era were often made up with wrought iron spokes, not castings, I used standard flat bar which produced thin, straight spokes similar to the original. This fabrication technique could also be used with tapered spokes if desired, just more machining required.

To minimise the amount of swarf, I chose suitable sized hollow bar for the tyres and a piece of standard round bar for the hubs. The hollow bar was supplied pre-cut into discs. The tyres were then machined to the finished AALS profile and the hubs turned, but the axle hole was left under size.

On to the brazing hearth, where the machined parts were fluxed up and brazed using 245 silver solder for good joint penetration. I did this in two stages, first brazing the spokes to the tyre, then removing the round jig while still hot in order to get access to braze the hub on to the spokes.

The final operation was to mount the completed wheel back in the lathe with the outer tyre running true, then bore out the axle hole to final size and clean up the hub. This ensures that the wheel runs true on the axle regardless of any small misalignments during brazing.

**Jim Clark**



A study of elegant wheels—in the background is Ron Collins' new 7 $\frac{1}{4}$ " Crampton, in front are the wheels for Jim Clark's new 5" Cornwall. Both original locos date from the 1840s.

First step — after drawing up the wheels to scale, turning slices of K1045 hollow bar into wheel tyres to the AALS profile.



Next step — A full set of machined tyres and hubs, with spokes all cut to correct length. The round jig which holds the spokes in place for brazing is shown at the lower left.



Last step — The completed wheel after silver brazing. It just needs a little clean-up with files and emery, then ready for painting.



Photos: Jim Clark



## Silver solder on tin or lead based solders by Keith de Graauw

There was recently some discussion at the boiler group with differing views on whether 245 Silver Solder (245) would adhere to tin and lead based solders. A way to find out was to conduct a trial and record the results. The approach used was to observe if 245 (45% silver) solder would adhere to BROMIC 50% tin / 50% lead (50Sn/50Pb) and BROMIC 99% tin / 1% copper (99Sn/1Cu) solders, and secondly to conduct a strength comparison of the resulting mixes.



The photo above shows the five test samples used. Three would use no combination of soft solder to silver solder and two would have a combination of silver solder to soft solder. The process used was to apply TradeFlame Lead Free Plumbing Flux to four sample surfaces and then soft solder a butt joint using 50Sn/50Pb and 99Sn/1Cu and also only apply a coating of each to the two remaining sample surfaces.



Above left: 50Sn/50Pb sample ready for soldering, above right are the 99Sn/1Cu samples.

The next step was to clean any remaining TradeFlame flux off the soft soldered coating surfaces and apply Consolidated Alloys (CA) 602 silver brazing flux over the top of the soft solder and the straight 245 sample pieces. The final phase was to apply 245 silver solder onto the 50Sn/50Pb and 99Sn/1Cu surfaces and also do a butt joint using straight 245 for comparison.

**Adherence observation:** The heat from 245 silver soldering to the 50Sn/50Pb coated sample seemed to make the lead overheat a bit and bubble slightly. However, it appears from the test samples that the 245 silver solder did seem to mix with both soft solders.

The test samples are shown in the following photos.

50Sn/50Pb  
butt joint samples:  
Left sample is the soft  
solder only, right sample  
shows the combination  
with 245 silver solder.

Photos: Keith de Graauw



99Sn/1Cu  
butt joint samples:  
Left sample is the soft  
solder only, right  
sample shows the  
combination with 245  
silver solder.



Straight 245 silver  
solder butt joint  
sample.



**Strength comparison:** As shown in the photo below, a strength comparison test was conducted at the July General Meeting using a small torque wrench with clamping arrangement to try and break the butt soldered joints. The sample pieces were held in a smooth jaw vice. The success of this trial is questionable as the sample pieces kept slipping out of the torque wrench clamping arrangement and the vice jaws. *(continued on page 12)*



## Silver solder tests (cont...) by Keith de Graauw

The first table shows some very approximate values that were recorded in this test process:

Solder Alloy	Breaking Torque NM	Solder Alloy	Breaking Torque NM
50Sn/50Pb	12	99Sn/1Cu	6
50Sn/50Pb+SS	21	99Sn/1Cu+SS	8
245 Silver Solder	Exceeded 44 NM and kept slipping out of the vice		

A point of interest from the above strength comparison is that the samples containing more tin seemed to break at a lower torque. This raised some interest as it was generally thought that more tin would break at a higher torque value. From the internet it was found that pure tin melts at 232 °C and pure lead melts at 327 °C. Also found was some data from the Alasir Enterprises ([www.alasir.com](http://www.alasir.com)) – Solder Alloys: Physical and Mechanical Properties as shown below, which indicates the higher tin (Sn) levels had a lower Tensile Strength:

Solder Alloy	Melting Point °C	Tensile Strength at break kgf/cm <sup>2</sup>	Brinell Hardness
Sn50/Pb50 (alloy #116)	183/212	420	14
Sn99.3/Cu0.7 (alloy #244) (Note: not Sn99/Cu1)	227	300	14

However, two different types of tin based soft solders were compared in this trial — one had lead and the other copper. If we used different ratios of tin and only lead, then it seems from the Alasir website that more tin will generally tend to add greater strength to the solder. Below is some further data from Alasir:

Solder Alloy	Melting Point °C	Tensile Strength at break kgf/cm <sup>2</sup>	Brinell Hardness
Sn90/Pb10 (alloy #118)	183/213	490	No data
Sn60/Pb40 (alloy #109)	183/191	535	16
Sn50/Pb50 (alloy #116)	183/212	420	14
Sn20/Pb80 (alloy #149)	183/280	340	11
Sn05/Pb95 (alloy #171)	308/312	280	8

A further internet review from Wikipedia ([www.en.wikipedia.org](http://www.en.wikipedia.org)) under the Lead Solder section also indicates that the greater the tin concentration, the greater the solder's tensile strength and shear strengths. Unfortunately no specific material properties were found for the BROMIC 50% tin / 50% lead (50Sn/50Pb) and BROMIC 99% tin / 1% copper (99Sn/1Cu) solders that were used in our tests.

Results from the experiment seems to indicate that joints can be made by applying silver solder over soft solder with an element of bonding strength. However, the application of silver solder over soft solder will result in a joint that is far less strong than using only silver solder.

**Keith de Graauw**

### DISCLAIMER



Northern Districts Model Engineering Society (Perth) Inc.

All correspondence to:-  
PO Box 681  
Balcatta  
Western Australia 6914  
[www.ndmes.net](http://www.ndmes.net)

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