

THE MAGAZINE FOR MODEL ENGINEERS

ENGINEERING in Miniature

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OBSERVATION
CAR IN 5-INCH
GAUGE**



**BUILD IN MOTION: IMPROVING A
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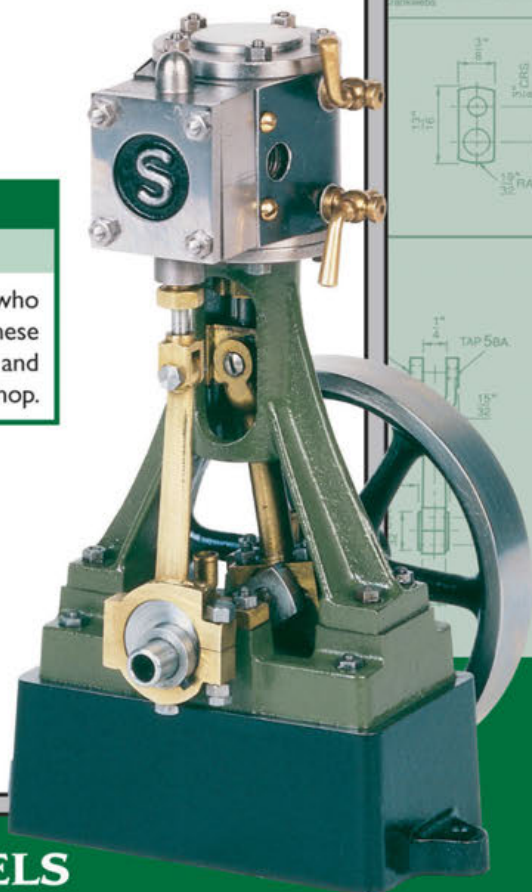
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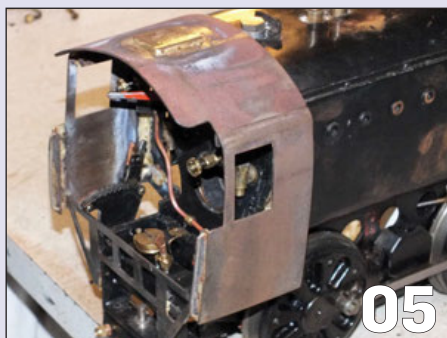
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EDITORIAL

Looking forward to the annual show...

Welcome to the October edition of **EIM** – October already? Well yes, and of course a very important month in the world of the model engineer and for this magazine.

October traditionally sees the holding of the Midlands Model Engineering Exhibition sponsored by **EIM**, and a show very firmly connected to this magazine – the Midlands show was founded back in the 1970s by the late Chris Deith, at around the same time that he published the very first edition of **EIM**, and the two have been closely related ever since.

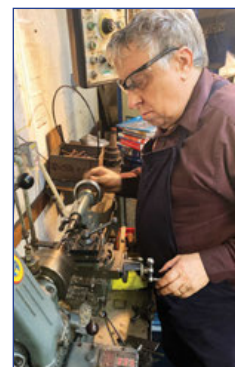
There is an argument that the Midlands show has never been more important than today, particularly for model engineering fans in the southern half of the UK. Once there were two annual shows in the London area, one of them organised by Meridienne Exhibitions that produces the Midland event. Sadly we haven't seen a London show since before the Covid pandemic and with the ever-increasing costs of doing anything around the capital it seems unlikely that we'll be going to another in the foreseeable future.

For a while after the return to post-Covid normality, of a fashion, it seemed that the Midland show would be the only major national model engineering exhibition, until the emergence earlier this year of a revived Harrogate show which no doubt was particularly welcomed by those enthusiasts based in the north. We haven't been officially told that Harrogate will be back next year but the inaugural event was well received so we can hope.

The Midlands show, however, retains its prominence, and in your editor's eye is as vital an event as it is enjoyable. It's at shows like this that model engineers get to meet up, stock up on all their essential bits from the trade stands and have a good chat with like-minded souls while admiring absolutely superb examples of models on show, and hopefully being inspired to do some more building of their own! I'll certainly be there on at least a couple of the days and I hope to catch up with plenty of **EIM** readers.

Andrew Charman – Editor

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Editor: Andrew Charman Technical Editor: Harry Billmore

Email: andrew.charman@warnersgroup.co.uk Tel: 01938 810592

Editorial address: 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD

Web: www.engineeringinminiature.co.uk

Facebook: www.facebook.com/engineeringinminiature

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FOR SUBSCRIPTION QUERIES call 01778 392465 – the editor does not handle subscriptions.

Publisher: Steve Cole
Email: stevec@warnersgroup.co.uk
Design & Production: Andrew Charman

Multimedia sales manager: Sarah Jarman
Tel: 01778 392055
Email: sarah.jarman@warnersgroup.co.uk
Advertising design: Amie Carter
Email: amiec@warnersgroup.co.uk
Ad production: Allison Mould
Tel: 01778 395002
Email: allison.mould@warnersgroup.co.uk
Marketing manager: Carly Dudge
Tel: 01778 391440
Email: carlyd@warnersgroup.co.uk

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FRONT COVER

While running one's loco on the club track may be the norm for many of us, there's nothing better than having our own garden line, if the space is available. But if you build your own line you will need infrastructure and that can include bridges such as the one young Tobin is traversing here, and which his grandad describes how to build in this issue.

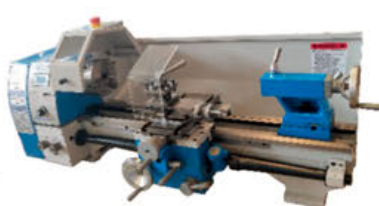


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Spindle bore: 20mm
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Range of spindle speeds: 100-2250mm
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Price: £694



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W 2 Axis DRO - Price: £2,280



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cross feed - BRUSHLESS MOTOR

SPECIFICATION:

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Weight: 230Kg

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W 2 Axis DRO - Price: £3,150



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AMAVM32LV

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The Tank Engine that never was...

Nick concludes his short tale of his 3½-inch gauge 'might-have-been' Southern Railway Q1 tank locomotive, by converting it back to a tender loco...

BY NICK FEAST Part Three of Three



In the previous two articles I described how I created a Southern Railway locomotive in model form that never materialized in reality, what would have been a more practical and predictable alternative to Bulleid's over ambitious 'Leader' project.

The interruption of Covid resulted in my 0-6-4 Q1 tank seeing very little use on the track, so having sold one of my two 0-6-0 Q1 tender engines I decided that perhaps another tender engine would be a more practical machine after all! The additional weight and size of the tank loco made it less easy to manoeuvre and transport, while the additional water tank and less-accessible cab controls added to the argument.

Early in 2023 I took the hacksaw to the loco and started to rebuild it as an 0-6-0 tender engine, almost repeating what Maunsell had done almost a century ago when he decided to 'detankify' (or should it be 'tenderize'?) the 'River' class 2-6-4

PHOTO 25:

Everything behind cab will be chopped off, rear buffers will be recycled.

PHOTO 26:

With cab removed line for cutting can be marked. Pad on right is support which took the bogie load.

PHOTO 27: The cab layout before dismantling.

All photos by the author



tank engines. In **Photo 25** I have removed the side tanks, bunker and trailing bogie. The cab roof is off and I have worked out where the frames should be severed in **Photo 26**.

The cut will be pretty much where the frame extensions were added in the first place. A new drag beam will be needed, although I hope to reuse the displacement lubricator oil tank and as many controls as possible. In the event I ended up remaking almost every piece of pipework on the engine!

As one door closes

Photo 27 shows the cab controls as they were on the tank engine, having two injectors fed by the two steam valves above the regulator. The firehole doors were of the butterfly type but these had not proven as successful as I had hoped so these were changed for a one-piece drop-

down door which was weighted to stay in the closed position.

The cab was removed as this was not the correct dimension for the tender engine and a new roof would also be needed. The list of work was getting longer! I made use of some 16-gauge mild steel that had been lying around for some time; I don't see the need to use brass on platework such as this. **Photo 28** shows the material for the cab sides and the template, this needs to have a small allowance for the fact that the cab sides are curved, unique on a freight engine I believe.

In **Photo 29** I am joining up the chain-drilled holes using a coping-saw blade, the material is well weathered having been stored for some time. It is bit over-scale in thickness but usefully robust on an engine that may be transported a lot.



28



In **Photo 30** I am filing the cab side to shape, lining up the top of the work with the horizontal line marked on the workshop wall. I mark out the work as well but I find this helps to get the job square in the vice. There is always plenty of filing required!

The cab sides have small returns on them where the handrails are mounted and because the sides are curved it's not easy to just bend them, so I braze them on after forming the sides. In **Photo 31** I am using the 'third-hand clamp' to hold the return section in place for brazing.

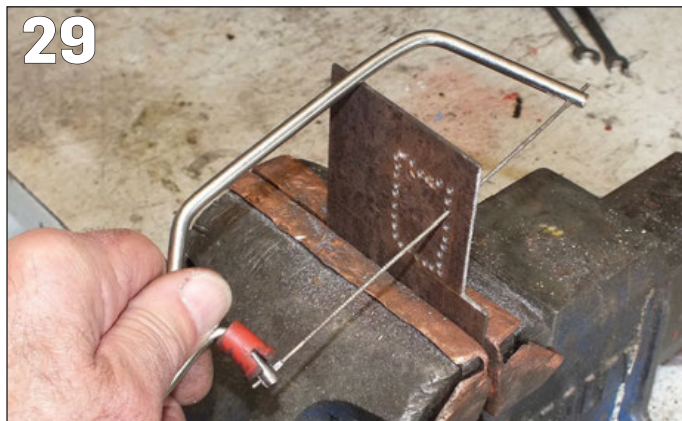
Photo 32 shows the left cab side with handrail and return and the plate for the roof hinge bars brazed on. The frame modifications for the tank engine conversion forced me to build a

slightly different drag beam from the original, but the vital dimensions remain the same so that the tender coupling and water connections are all compatible with my other Q1.

Photo 33 shows construction of the new cab underway. The cab front profile has a bracket attached and the rear cab support has been attached to the rear of the main frames. A simple pole reverser will be retained from the tank-engine version rather than the wheel reverser as used originally, this has to be set rather low to the floor to line up with the existing reach rod.

In **Photo 34** the cab is taking shape – I have to recreate the pipework which will differ from the tank version with just the one injector and an axle pump in place of the other.

29

**PHOTO 28:**

The cab sides and template.

PHOTO 29:

Traditional way of cutting out sheet metal not too time consuming with right tools.

PHOTO 30:

Lining up against a sight line.

PHOTO 31:

Nick's long-lived device for holding small parts in position.

PHOTO 32:

Cab side complete, holes for lifting roof linkage. Window frames could be added by builder keen on scale details.

PHOTO 33:

Cab support takes shape.

A tidy cab

I also wanted to tidy up the pipes around the oil reservoir to hide them all under the cab floor and also to incorporate a heat exchanger in the condenser pipe for the displacement lubricator feed. This is to avoid the sight feed filling with oil emulsion as the day goes on.

Photo 35 shows the hinged cab roof in place and some pipework done. The left-side injector steam valve on the manifold has been replaced by the blower valve, which feeds via a hollow stay on the right side of the backhead, while the lubricator feed is carried through the boiler on the left side. It is clear from this view just how big the Q1 boiler was relative to the Southern loading gauge, which pretty much follows the profile of the cab roof.

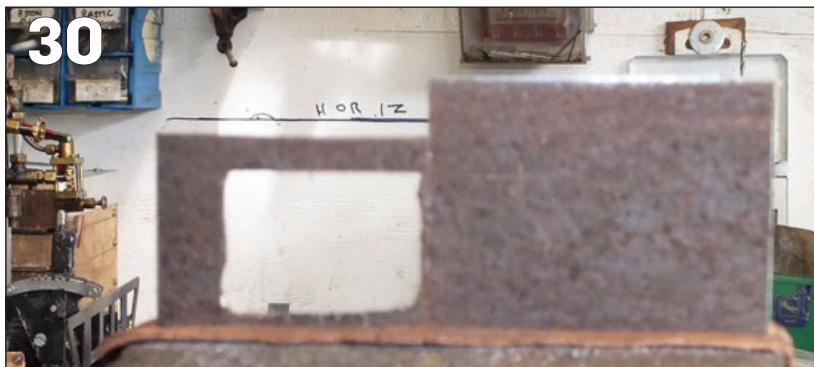
Photo 36 shows the oil tank and the pipe unions I made up to try and reduce the headroom needed, so that everything can be fitted under the cab floor. The two disconnected pipes on the right will attach to a small pedestal incorporating the whistle valve – I ran out of space to fit it in the usual position within the top manifold owing to a connection for the steam brake being added. Not true to the prototype, but convenient for driving.

In **Photo 37** I am pointing out the pipe section feeding steam to the injector – I have used a piece of electrical cable of similar diameter to the copper pipe required. This is easily bent and cut to the profile needed and is then used to indicate the exact length of copper pipe required.

In **Photo 38** I have silver soldered the fitting on to one end and screwed it to a steel mandrel so that the tube can be bent to the correct shape.

Photo 39 is a stage in the construction of the condenser for the lubricator steam feed. The connections at each end are the inlet and outlet from the boiler to the oil tank, the top and bottom connections are the connections for the axle pump feed to the boiler clack. I have managed to get about two coils of small bore tube inside the body, the end can now be pushed in and soldered.

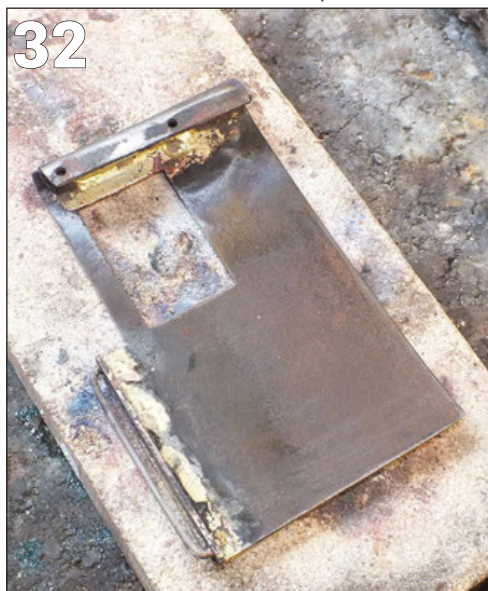
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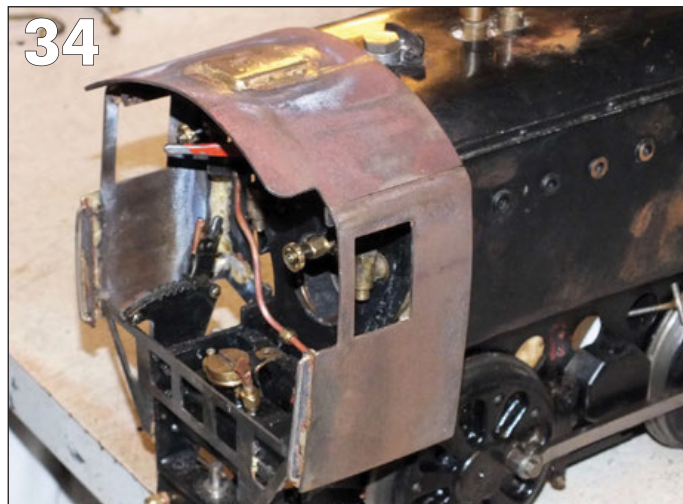
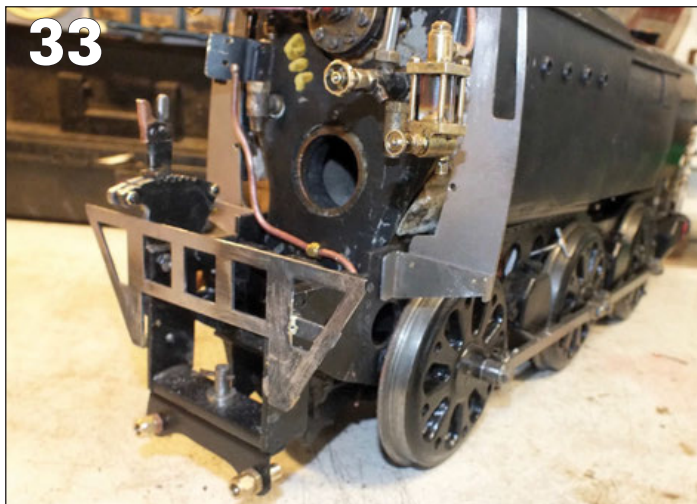


Photo 40 shows the unit in place, occupying the same position on the loco as the AWS (Automatic Warning System) vacuum reservoir on the full-size engine, when fitted. Unfortunately I do not have a photo available of a full-size loco showing this. Not all Q1s had the British Railways AWS system added, if you wish to have an authentic model of a particular loco then photographic research is required.

The best source of information is John Scott-Morgan's book *The Story of the Q1s* or copies of the *British Railways Illustrated* magazine from January, March and May 2008 which contain a large number of photos of the class including 33010, originally C10 as I have now numbered my loco. Followers of 'Thomas' will know this is the loco characterised as 'Neville' in the popular children's TV series.

Through the kink

On the full-size loco the vacuum brake pipe had to be modified with a kink when the AWS was fitted. The preserved Q1 no. C1 (33001) now at the National Railway Museum in York originally had AWS fitted in BR days ▶

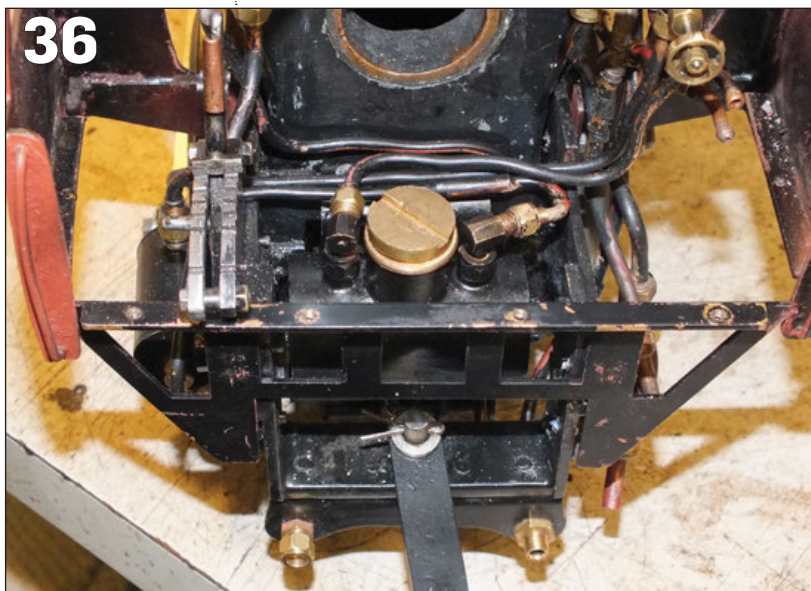
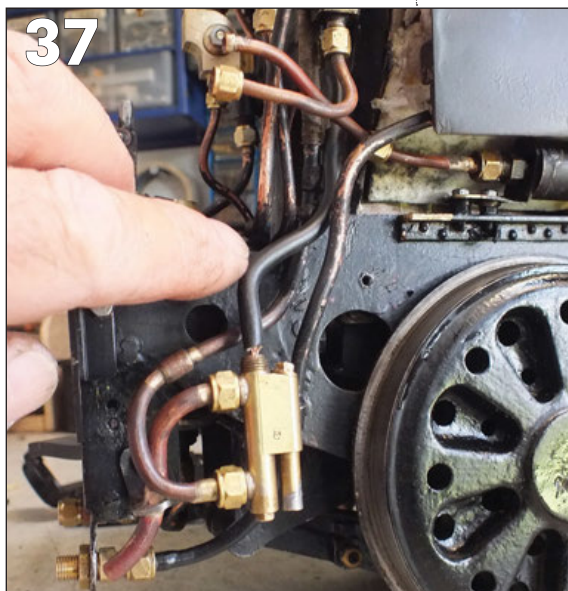
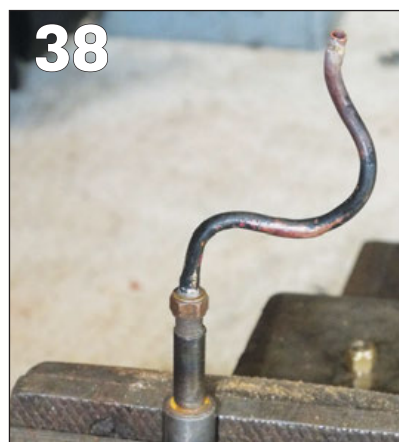
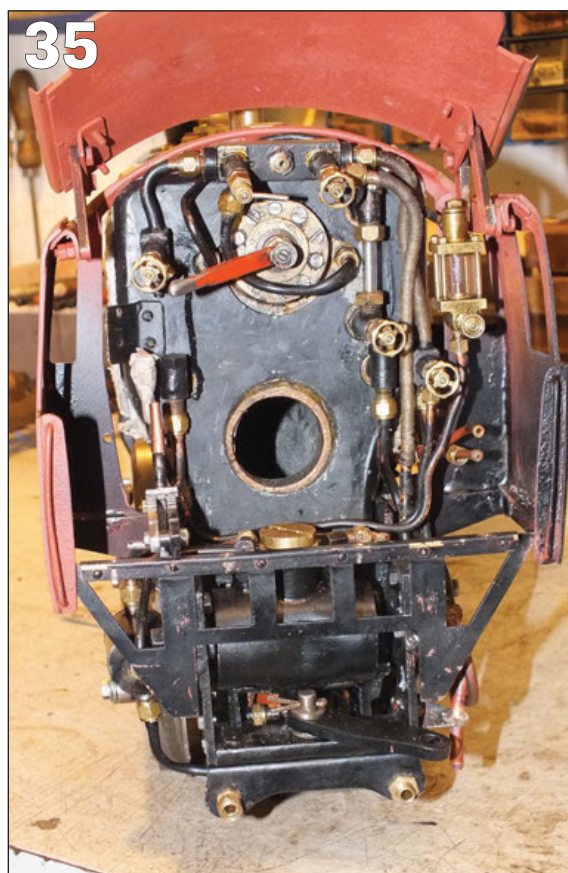
PHOTO 34: Cab roof tried for fit and dummy ventilator added.

PHOTO 35: Cab structure complete, pipework underway.

PHOTO 36: Swivel connectors for oil tank required to ensure flat floor. The filler will poke through a hole in the floor.

PHOTO 37: injector is positioned as per the prototype; the whistle is visible above the frame plate.

PHOTO 38: Steel mandrel used to hold pipe for bending.



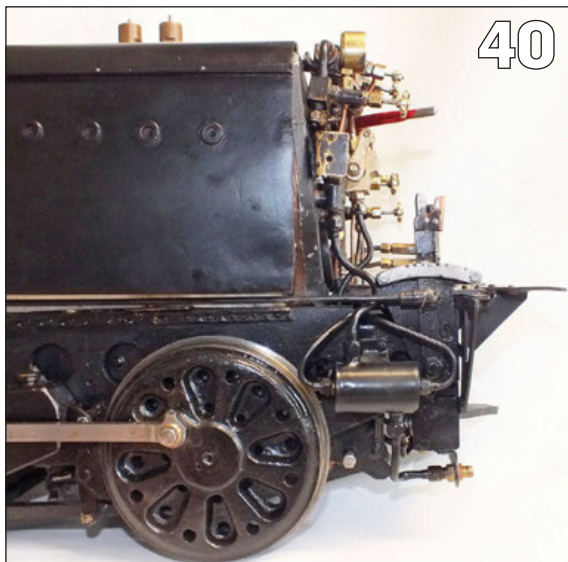


PHOTO 39: Shell of heat exchanger can see full boiler pressure as axle pump feeds water supply. Test before fitting.

PHOTO 40: Prototype AWS vacuum reservoir is similar in size and position.

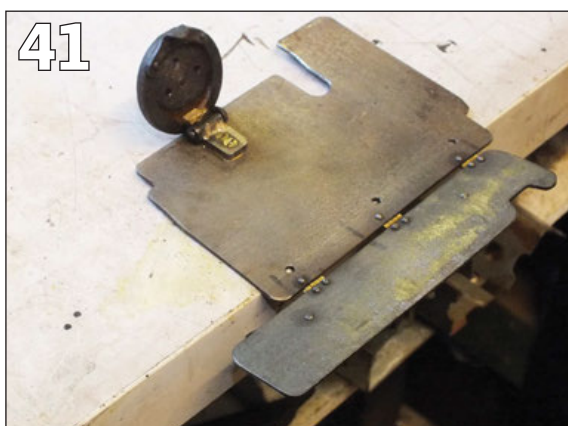
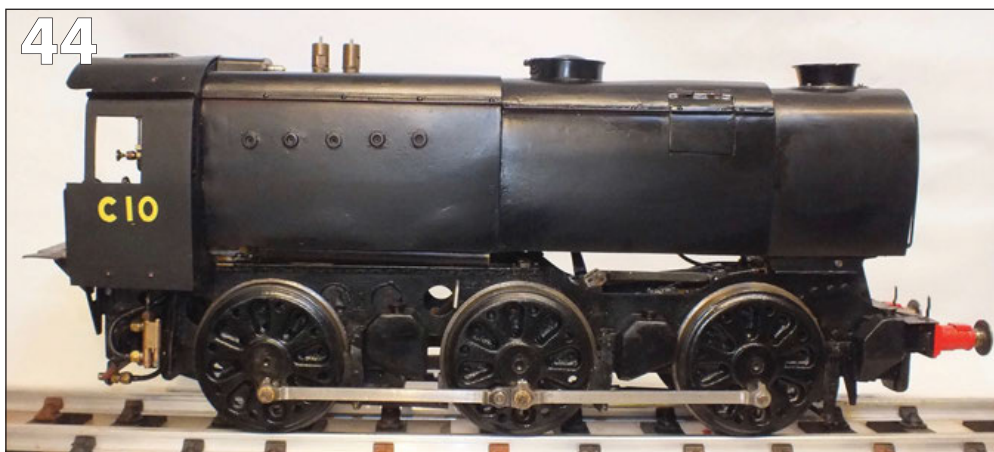


PHOTO 41: Much of cab floor omitted to clear reverser stand, cutaways also needed for the pipework.

PHOTO 42: Glycerin used for sight-feed glass, some use brine.

PHOTO 43: This part of boiler casing gained two more boiler washout plug covers later on. Access door to the steam reverser would have been there from building, bottom left of the view here.

PHOTO 44: The loco has now gone full circle, ready for the track.



but it has not been refitted during preservation, however the kink in the vacuum pipe remains.

I omitted the vacuum pipes and a few other details such as footsteps, sander pipes and tender brakes when producing the original drawings back in 2008 in order to keep the loco as simple as possible yet retain the distinctive look of the Q1. A few part-built locos turn up on auction sites but I think it's fair to say that most people who have embarked on a 'Charlie', as the Q1 is known, have been able to complete the build!

Photo 41 shows the cab floor, also in mild steel, with the firehole door and fall plate attached. There is a steel block attached to the reverse side of the door, not visible in this view, which holds the door shut under gravity.

The original design has correct sliding doors but occasionally these can jam if bits of coal get stuck behind them, so I am trying this option. The butterfly doors I tried on the tank engine were also fiddly – I toyed with steam operation as on the full-sized 'Ajax' doors but couldn't get such a small steam cylinder to work.

In **Photo 42** the cab is complete and I have loaded up the syringe with glycerin to fill the sight-feed chamber. The brass pedestal on the right is the whistle-valve housing with a carbon-filled polymer operating button. The steam-brake valve is on the left just below the regulator handle.

Plain for now

Photo 43 shows the cab-side view with the condenser tank fitted, while **Photo 44** is the unmistakable Q1 side view of the finished loco, returned to its original state. Some may notice that it has plain side rods instead of fluted; this was the choice of the original builder who perhaps didn't relish the milling sequences required to achieve the authentic appearance. In the guise of a tank engine that never existed I feel this was reasonable but once this loco has had a few laps of the track I might dust off my spare set of laser-cut rods in the cupboard and make the correct set. However a 16-feed Silvertown lubricator from a 9F in need of overhaul arrived at the weekend so the Q1 might have to wait a while... **EIM**

■ Parts and drawings for Nick's Q1 tank loco design are available from Polly Model Engineering, www.pollymodelengineering.co.uk.

Parts 1 and 2 of this series appeared in the August and September 2023 issues of **EIM**. To download a digital edition or order a printed copy of the issue go to www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or call 01778 392484.

A L&NWR Observation Coach in 5-inch gauge

Scale rolling stock is a popular part of miniature rail engineering these days and Andrew has done an excellent job creating an example of a well-known carriage.

BY ANDREW WALLER



Having just completed my fourth steam engine I was looking for something a bit different for my next project. I had admired many items of rolling stock at exhibitions, and indeed at some private railways. The standard of detail on the bodywork and interior was always exceptional, but the detail below the running board was not always as good.

As someone who had spent the first 14 years of my working life in railway carriage works (firstly at Derby, then later at Wolverton) I found this disappointing and a little irritating. So – the project was born. It would have to be a railway coach with full brake work and working bolsters on the bogies, and underframe detail.

Preservation inspiration

Which prototype to choose? I have been a member of the Bluebell Railway since the very early '60s. In 1963 the Bluebell purchased a unique survivor, a London & North Western Railway (L&NWR) Observation Coach. The coach was one of three built in 1913 at Wolverton Works for use in North Wales on the Blaenau Ffestiniog and Llanberis branches. They were effectively standard 57-foot long

ABOVE: The finished L&NWR carriage, an impressive build.

BELOW: The bogies boast some fine detail.

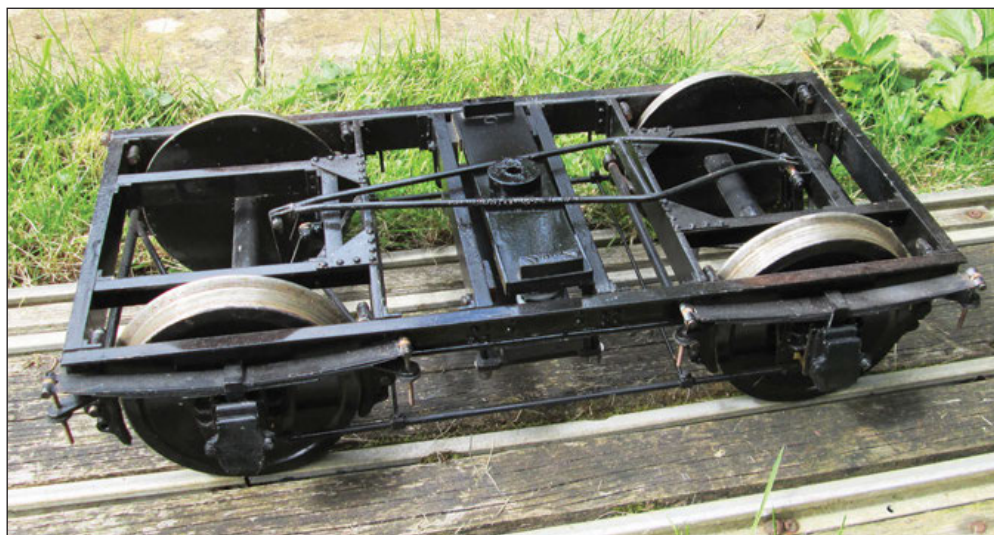
All photos by the author

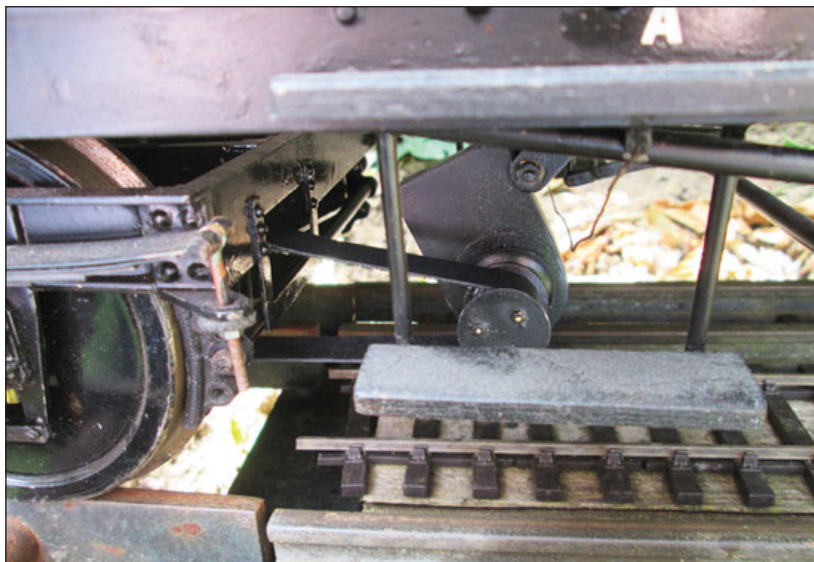
L&NWR coaches on standard 9ft wheelbase bogies but were constructed as fully open with glazed ends and a handbrake and vacuum brake valve fitted for the use of a guard.

On the Bluebell this brake valve had proved a godsend on the line's lightly-used services as they could run a one-coach train with high capacity (the vehicle had 72 seats), while the coach was very popular with the public because of the extensive glazing. As an ex-Wolverton man it

seemed a no-brainer to try and make a model of this coach in its current guise in the handsome L&NWR plum and spilt milk livery.

Next problem – detailed drawings of the vehicle. I had a 4mm drawing published in the 1960s by a Bluebell member. This provided the basic details, but not the detail I needed for the bogies and underframe. The L&NWR Society publishes a book on vehicles produced around this time. Again, the drawings are mainly aimed





LEFT: Dynamo, belt and string for brake release – the 'A' on the underframe shows the string position.

BELOW LEFT: The correct 'LMS 1913' builder's plate – the 'S' marks the steam valve location.

CLOCKWISE FROM TOP RIGHT:

A made-up single flip-back seat. The problem was that many seats were needed... With so much glazing present populating the carriage was an essential move. The guard started life as a vicar. Now he wears LB&SC – or Bluebell Railway, uniform. The finished carriage posed with Andrew's Adams Radial tank, recreating a once well-known Bluebell rake.

at OO and O-gauge modellers, but although there were no drawings specific to the Observation Coaches, there were dimensioned drawings of a number of details which proved useful.

Drawing together

I did trawl the National Railway Museum site and found a couple of items, but this was lockdown time and access was severely restricted. The Historical Model Railway Society did have copies of full-size drawings of a standard LMS bogie (similar to the L&NWR bogie) and from another source I managed to get a copy of the diagram published in 1911 for the proposed coaches.

The latter proved you need to take great care with old drawings like these. It was beautifully dimensioned but if you scaled the known dimensions printed on the drawing they all came out at different ratios. I'm guessing it was actually just a sketch probably given to a junior draughtsman to knock up for the proposal.

This drawing also showed 68 fixed seats in the coach. The production versions had 72 tram-type seats with

flip-over backs so that passengers could always face the direction they wanted to.

All this was somewhat frustrating as many years ago when I worked at Wolverton, I could probably have gone to the drawing stores deep under the main offices and had a quiet word with the clerk there and later be shown a pile of relevant drawings all printed on beautiful linen paper. The site is now buried under a Tesco!

Copious photos were then trawled through including some published by the Bluebell, some of my own, and some from internet sources. From all this I was able to make sketches of what I needed and work on the project could start.

I had originally intended to make a fully framed underframe. The killer here was cost. There are brass sections available on the internet for RSJs but not having Jeff Bezos-level resources I made a major compromise. The solebars were made from an aluminium section (bought from Wickes!) and trimmed to size using a slitting saw on my milling machine.

The buffer beams were steel bar

and the frame was lined on the inside with ¼-inch brass angle to take a 9mm plywood insert. This worked as the floor for the inside of the coach and the base on which to mount all the underframe details.

The bogie frames, similarly, were cut from 20mm steel tube. This, of course, 'banana-ed' when cut and then had to be heat-treated and straightened. Also the L&NWR didn't use standard steel sections but ones which had a small bulbous portion on the lower edge. This was created in miniature by adding some half-round brass beading.

Print to the rescue

I was concerned at how I was going to produce some of the detailed parts both on the bogies and the coach frame. In the event I was rescued by a friend and another member of our local model engineering society who was getting into 3D printing. For the bogies I produced sketches of the axleboxes, brake hangers and brake blocks which he then converted into CAD drawings followed by 3D-printed products. The only drawback was that the material wasn't very strong mechanically so on the axleboxes I had to fit them with bronze bearings and line the sliding faces with some thin brass section.

The dynamo was scaled up from photographs. It is, of course, non-working but I wanted it to have a running belt fitted onto the bogie pulley wheel. So the dynamo pulley is mounted on a miniature bearing so that it can rotate freely. The battery boxes were also scaled up from photos and the adjustable truss rods from drawings and photos.

The main body was sketched from scaled-up OO-scale drawings. I had intended to cut these out myself, but the quote from Model Engineers Laser (no connection) was so reasonable it was daft not to let them do it. After a few iterations with the drawings they duly produced the sides and ends that I required.

The doorways are inset and I made these. They were then all soft-soldered together including brackets at the base so that they could be screwed onto the plywood floor. The beading on the sides was cut from thin plywood and glued to the sides.

The body was then painted prior to being glazed with thin clear plastic. This was followed by the inside being progressively lined with thin ply with suitably scored grooves to simulate matchboarding, which was then stained and varnished.

The full-size vehicle is heated with steam radiators fitted in strips along the bottom edge of the inner body sides. These were simulated by cutting



innumerable slots, spaced using a jig, with a piercing saw into machined brass strips.

The seats were a bit more of a challenge. They are, as noted above, tram-type seats with throw-over backs. I originally made one seat end from soldered brass pieces with the intention of getting a friend to mould the remaining 71 that I needed in whitemetal. Very sadly my friend was one of the people that didn't recover from Covid so I ended up making jigs and fixtures to produce the brass components and then an aluminium fixture to soft-solder the bits together.

The seats and seat backs were formed from softwood and the frame pieces from thin brass strips. Fortunately when the Bluebell rebuilt the coach the moquette on the seats had been replaced the heavily patterned moquette on the seats with a plain royal blue version. This was relatively easy to model as I just had to find the right colour of spray paint.

Bulk production

One of the problems with modelling coaches is that you often don't need one or two examples of a particular item (as you would when building an engine) but loads of them – 36 seat assemblies (with 72 ends) in this case.

Other multiple items required were the luggage rack brackets. Again I made one in brass and another friend then produced them in quantity in whitemetal.

Further detail items, including some electric switch boxes on the end of the coach, handles on the seat ends, the guard's handbrake wheel and the torpedo vents on the coach roof were all made using the kind services of my 3D-printing friend.

The final problem was the roof. The coach by its very nature is completely open, so unlike a compartment coach there is nowhere to support the roof structure except at the ends. I made a brass frame out of brass bar with the brass being rolled to form the roof shape and this was then soldered to struts running along the cantrail and ridge of the roof, a bit like the wooden structure used on the full-size vehicle.

The outer surface was then built up using strips of thin ply (a bit like the planking on a full-size wooden roof) which was then glued all together. The outer surface was covered with good-quality paper (glued on).

I wanted to fit lights to the vehicle so I installed some strip LEDs inside connected to a battery mounted between the battery boxes on the underframe. The strips came with a remote control so that the lights could be switched on and off without



touching anything on the vehicle. The result was actually quite a subdued light level but as anyone who has been in the 'Obo' whilst going through Sharpthorne Tunnel will profess, this is true to prototype.

The whole internal assembly was then also lined with heavy-duty paper to cover all the assemblies. The roof assembly was strong enough to make removable to allow access to the inside of the coach.

The final touch was to add some passengers. Fortunately many doll's house figures are 1/12th scale – effectively the same as 5-inch gauge – so a small number were purchased and adapted to fit in the coach. The most 'butchered' was the train guard who was made from a vicar. He 'lost' his cup of tea and gained a red tie and a hat (LB&SCR style, as per Bluebell uniform) and now sits opposite the handbrake wheel and guard's brake valve handle attending to his duties.

To complete the project I posed the coach up with my Adams radial tank loco as could be seen on the Bluebell many years ago. Now what do I make next? **EIM**



Sub500 – a pair of 5-inch gauge electric locos

Julian continues with the construction of the transmission for the project that he and Rich began as something for the grandchildren, and their club then adopted.

BY RICH WIGHTMAN & JULIAN HARRISON Part Five of a short series



Last month we began the build of the transmission in our sub-£500 budget locomotive by constructing the box in which the sprockets and spindles will sit. We now need to build some adjustment into the assembly to tension the drive chain to the axle.

Looking at the plans for the baseplate (Figure 20) you will see four pairs of holes labelled A and B. They all need to sit above the two centre stretcher plates. Holes labelled A are drilled 4.1mm and will be used when fitting the transmission to the locomotive. Holes labelled B need to be drilled 3.3mm and tapped M4 ready for later use.

Re-assemble the plates by bolting them onto the baseplate. If you wish you can use countersunk M4 bolts fixed into countersink holes in the base to allow the transmission to sit closer to the stretchers, but it is not really necessary. Once adjusted you will find the assembly lifts off the stretchers enough to clear standard bolt heads. Do not buy countersunk bolts just for doing this job – I had some in stock so used them on one of our transmissions but found later they were not necessary.

Spindles and sprockets

With the plates assembled we can now make and fit the spindles and sprockets. Let's do the front drive spindle first since this is the easy one. This one merely needs to support and join sprockets two and three, namely the 36T (tooth) and the 12T. If they are not already bored to size they need this doing now.

If you have used 8mm bearings bore or drill and ream to 8mm and if they are 10mm bore or drill and ream to 10mm. Drill through the plain collars of the sprockets in three equidistant places at 90 degrees to the hole for the shaft. These holes should go to the centre of your previously drilled hole. Drill and tap the hole M5.

The spindles we used were a couple of M8 stainless bolts, about 80mm long. This may seem a little



big but there is a good reason. I needed a plain shank just under two inches long which these 80mm bolts gave. I cut off the excess leaving half an inch or so of thread and cleaned up the end.

This bolt goes through the outer bearing, through the two sprockets and then through the opposite bearing. If you don't have access to any of these bolts use an equivalent length of round bar tapped on both ends and use two nuts.

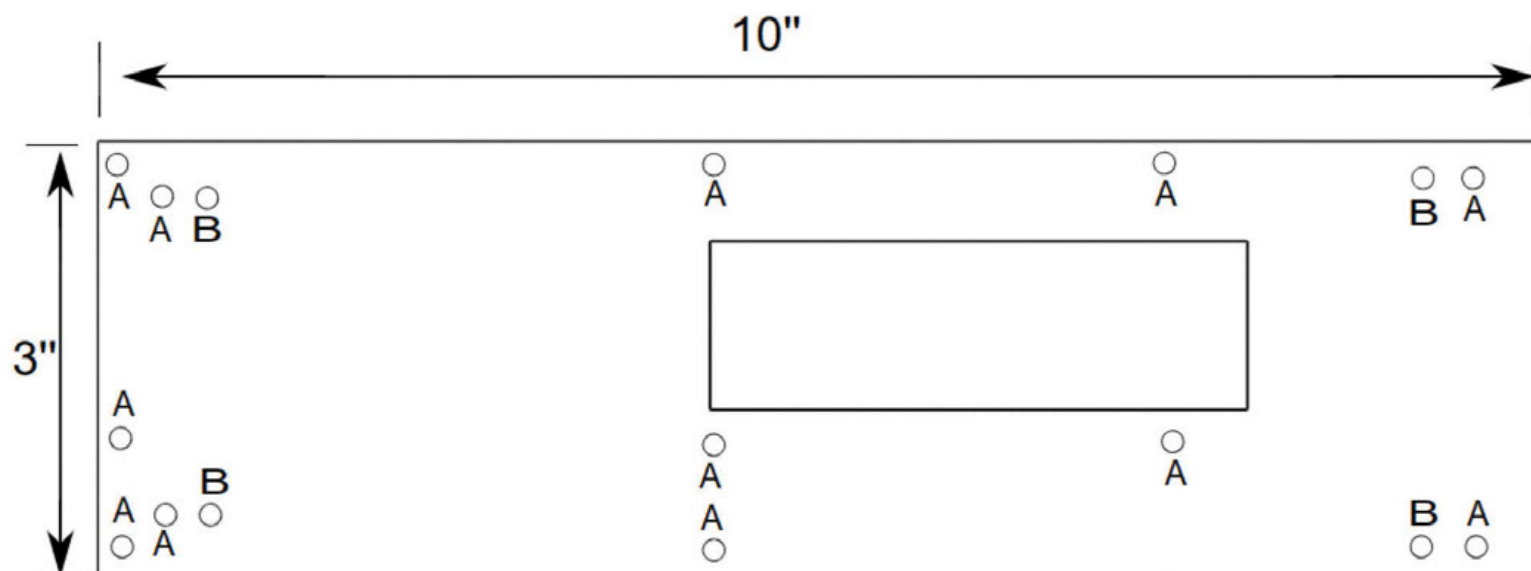
With the spindle temporarily located move the two sprockets so their chains will not clash with each other. I suggest you put the 36t sprocket two as close to the left bearing plate as possible. There will be gaps between the two sprockets and between the sprockets and the bearings.

Either find some tube with an 8 or 10mm bore (to suit whichever bearings you have used) or find a suitable piece of bar and drill it in the lathe. Whichever you choose cut pieces to loosely fit the gaps. Once they are all fitted put a nyloc nut on the end of the spindle to stop it working its way out.

We now need to secure the sprockets to the spindle starting with the 12T. Tighten an M5 stainless-steel grub screw into one of the previously drilled holes. This will hold it in position while we fit the next ones.

Drill through the other two holes with a 4mm drill to put a locating spot in the spindle of about 2mm deep. This small hole will locate the



**FIGURE 20**

Transmission baseplate
1-off 3-inch x $\frac{3}{4}$ -inch steel plate
(drawing approx three-quarters full-size)

“They must have thread lock on them otherwise they will work themselves loose very quickly. I accidentally missed one and it came out within minutes...”

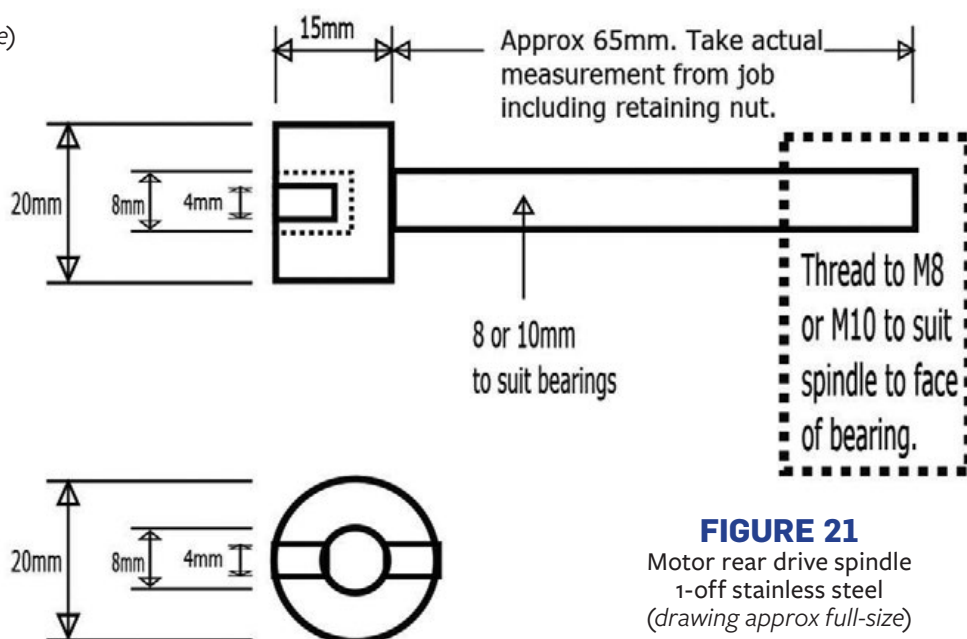
grub screws and allow them to grip the spindle.

Screw these two M5 grub screws in tightly after coating them with some thread-lock liquid. Remove the first grub screw and drill this hole in the same way. Replace this grub screw with thread lock. They must have thread lock on them otherwise they will work themselves loose very quickly. I accidentally missed one and it came out within minutes. These grub screws need only be about 8mm long.

Deep issue

The 36T spindle will have a larger collar which causes its own problems. If you screw a grub screw all the way into the longer holes there is a chance that while tightening it up the hex key will strip the hex socket of the grub screw. If this happens you may not be able to fully secure the grub screw and may also not be able to remove it.

I chose to use stainless-steel cap

**FIGURE 21**

Motor rear drive spindle
1-off stainless steel
(drawing approx full-size)

head bolts which had been sharpened to produce a similar end profile to the grub screws. These are fitted in the same way as the grub screws, again drilling the spindle. The bolt's length is enough to allow the point to tighten onto the spindle with a small gap remaining under the head for clearance.

That is the front drive spindle finished so we can now move on to the rear spindle (Figure 21). A bolt cannot be used for this spindle for the following reason. The mobility-scooter motors we are using do not have any bearings that can take any side pressure. On the mobility scooters they sit in a motor mount on their gearbox and drive the end of a spindle that has its own bearings. This spindle has a slot across it that

locates with the end of the motor driveshaft pin.

We have to reproduce this in our transmission but don't worry it is not as complicated a job as it sounds. We have already done half of the work with the rear bearings and the motor mounting plate.

Making the spindle is a simple machining job carried out first in the lathe then in the mill. Chuck a short length of round stainless steel bar in the chuck with three inches sticking out. We initially used mild steel but the motor wore the slot out very quickly. We replaced it with stainless steel but you could use any other very hard steels.

The bar needs to be about 20-25mm thick. Use the lathe to turn the first two and a half inches

PHOTO 69:

Machining down the rear drive spindle on the lathe.

PHOTO 70:

The rear spindle needs a slot cut in its end, here being done on the mill.

All photos and diagrams by the authors

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correctly orientated – the rounded end should point forward in the direction of movement of the tensioned side of the chain. So long as the round end points forward on the top section of chain here it will be correct as this is the most used direction, forwards.

Top plate

The transmission now needs fitting to the frames but only once the top plate is fitted. The top plate on both our locomotives was made using a sheet of 8mm plywood. If you wish you can use a sheet of brass, steel or aluminium but plywood is easily adequate for this job. Ply is the cheaper option as you can buy a sheet big enough to build your chosen body later if you so wish.

The sheet is cut to a rectangle to fit directly on top of the frames as shown in **Photo 74**. The body brackets that were earlier fitted to the frames are used to secure the top plate but initially just hold it in place with four bolts.

Draw a line across the top directly above the centre axle. Place the transmission on the top with the front bearings directly above the line just drawn towards the left-hand side. The motor and transmission unit should be lined up on the top along the line of the central axle and parallel to the side of the top plate.

Draw on the top plate around the outside of the baseplate to allow the transmission to sit directly on the steel top stretchers. Remove the top plate and cut out the hole just marked. It can be made slightly larger than the markings to allow for any slight adjustments later.

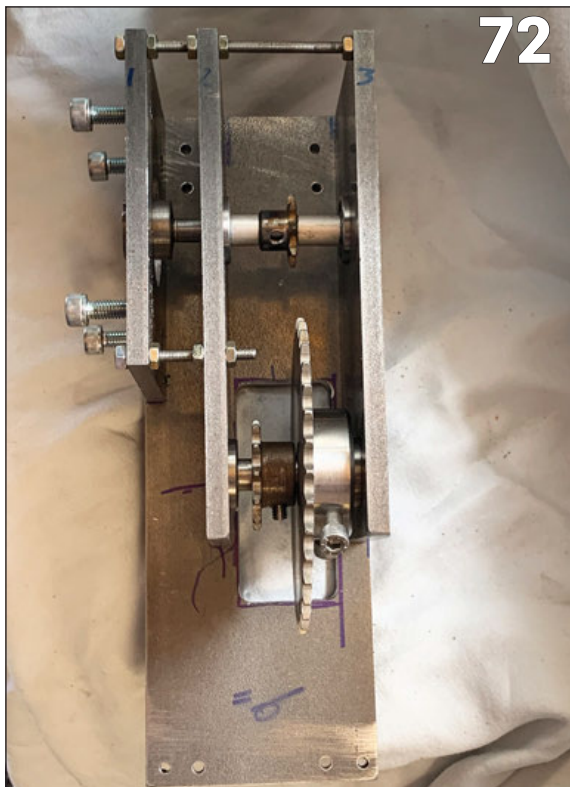
Fix the top plate down using all the brackets. It is worth using countersunk bolts to fit the top plate so they are all flush with the top surface. Sit the transmission back on the top in its correct position and using a suitable drill mark through the previously drilled fixing holes in the baseplate. Only drill through the 4.1mm holes to mark the positions on the stretchers.

Remove the transmission and drill the marked holes 3.3mm and tap M4. Replace the transmission and put M4 bolts through these holes into the top stretchers. Leave them loose for now.

The holes next to them that were earlier tapped to M4 need some M4 bolts screwing in to press against the stretchers. Eventually these will all be used to adjust the level of the transmission to tension the drive chain, which now needs to be fitted.

Flip the whole loco upside down. Place a length of chain around sprocket three on the drive spindle

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accurately down to 8mm or 10mm to suit the bearings you have used. This needs to be accurate so it is a good fit in the two rear bearings. **Photo 69** shows the spindle turned to size.

Remove from the lathe and cut off at 3¼ inches. Put back into the lathe using the length you have just machined leaving the cut end sticking out. Now machine the cut face to reduce the full-width portion down to a half-inch long.

Drill down the centre with a 6mm hole for a depth of ONLY 10mm – if you go too deep you will weaken it while if you go deep enough you would drill right to the 8mm end and the head will twist off under load.

Remove from the lathe and clamp into the vice of a mill with the end face you have just machined pointing directly up towards the tool. Using a 4mm milling tool centre it and then cut a slot all the way across the head.

Photo 70 shows this being done. It needs to be about 7mm deep to accommodate the cross pin on the motor spindle. In the absence of a mill a hacksaw and file will do an acceptable job. It should look like **Photo 71** when completed.

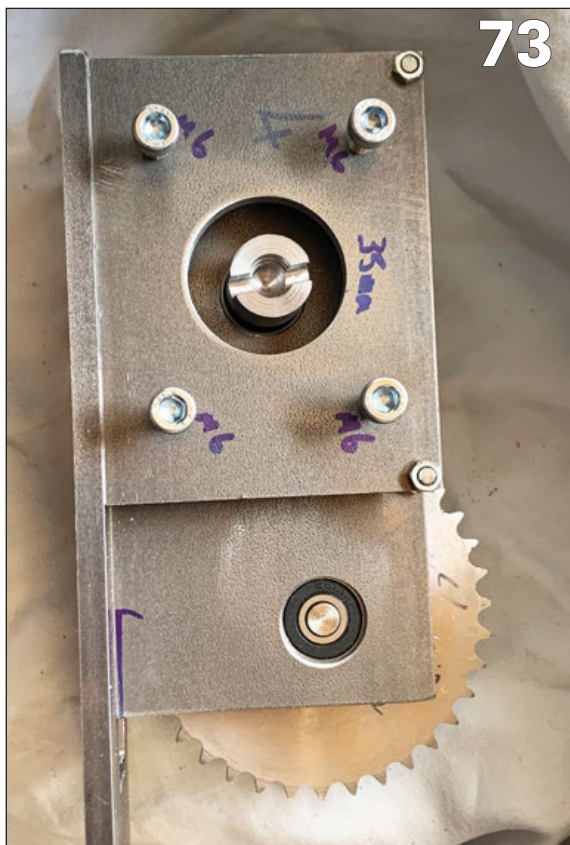
Lining up

The spindle can now be pushed through the bearings and sprocket one. Line up the sprocket with the 36T sprocket. The best way to do this is to just drop a length of chain over the two sprockets. Like we did earlier with the front spindle, either use some suitable tube or drill some metal rod to create two spacers to hold the sprocket in line.

As with the front sprockets drill and insert the M5 grub screws using thread-lock liquid. Your transmission should now look like the ones in **Photo 72** and **73** though these still have a couple of grub screws to be fitted.

The motor can now be bolted onto its mounting plate with the shaft and its cross-pin engaged with the head of the spindle. Cut and fit a suitable length of chain around the 36T motor sprocket and secure with a suitable joining link. The link is a horseshoe shape and should be

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and sprocket four on the axle and secure with the correct link connector. Remember to orientate the link for forward motion.

Flip the locomotive back onto its wheels and using the four bolts that press against the stretchers lift the transmission until the drive chain stops sagging.

The chain must not be too tight – it must just fit but not be under tension, indeed there must be a very slight slackness to it. Chains should never be too tight as they will then bind on their sprockets. Movement of the chain on one of the longer lengths between the sprockets should be of a level about the thickness of the chain. In use the chain will stretch which is why we have the adjustment built in.

While setting the adjusters turn the axle which will line up sprocket four with sprocket three. Once the adjusters have been set tighten the bolts next to them to hold the transmission in place. Now flip the loco back over.

Working on the chain

We now need to fit the chains linking the front and rear axles to the centre drive axle. On the centre axle there should be two 15T sprockets that you fitted before the wheels were pressed on. Using grub screws secure them following the same method used for the sprockets in the transmission, not forgetting the thread lock. Fit them roughly in the middle of the axle, placed about 20mm apart. This gap will allow some clearance between the chains. Do not secure the others yet.

Cut two lengths of chain and fit them to the front and rear axle sprockets, securing with joint links and making sure that the horseshoe of the split link is fitted in the right direction for forward motion. Ensure you cut the chains to the correct length to make them fairly tight. This length was set by the spacings earlier chosen for the axleboxes. Don't worry that they are tight as they will stretch very quickly once the loco is run.

Turn the centre axle a couple of revolutions by hand to line up the sprockets on the other axles. Once they have aligned themselves secure them with grub screws the same as the other sprockets.

The last one to align and secure is the 16T sprocket four, mounted on the centre axle. Align it by turning the centre axle. Once the sprocket has moved to align itself with the chain secure it with grub screws.

When using all these grub screws remember to drill a spot hole through the threaded holes and to



"The loco does have its own noise and does sound sort of like a locomotive... enough to make adding any sound systems unnecessary..."

PHOTO 71:

The completed rear motor spindle ready for fitting.

PHOTO 72:

The transmission box following assembly of the components.

PHOTO 73:

Looking from the motor-mounting side of the transmission box.

PHOTO 74:

The top plate, which will be the body baseplate, is made from ply.

PHOTO 75:

Baseplate fitted and painted, and the transmission then fitted to it.



use thread-lock fluid on them all otherwise they will vibrate loose and fall out. **EIM**

Natural noise

This concludes the building of the frames and the fitting of all the drive systems. An unplanned consequence of using the chain and sprocket drive is the noise that results – along with the audio note produced by the motor the loco does have its own noise and does sound sort of like a locomotive. It is enough to make adding any sound systems an unnecessary complication.

Now is a good time to paint the top plate as can be seen in **Photo 75**. It is now time to move to the electrical systems to make it all work.

Julian will describe the electrics, including the control panel, in the next episode of this build.

Parts one to four of this series appeared in the June to September 2023 editions of **EIM**. To download digital back issues or order printed copies go to www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or call 01778 392484.



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Diesel in distress

Self-destructing windows, an inaccessible bolt, a chuck that's seen better days and a diesel that doesn't want to go – just another month on the Welsh coast for our Harry...

BY HARRY BILLMORE

With the busy summer intensive timetable on the Fairbourne Railway in full swing, I have been attending to lots of little jobs, and finally starting the major overhaul of 'Gwrl', our 1994-built Hunslet four-wheel diesel, which I have been wanting to do since I first started at the line due to the state of the poor loco.

I was able to do this because I had finished off the work on our recently acquired and regauged to 12¼-inch Simplex – the last bit was to bend and fit the sanding pipes and complete a bit of training with those members of the staff who will be using the loco daily to shunt the carriages in and out of their shed every day. Handily, I was on loco driving duties for a week, so I could pull Gwrl into the workshop and use the Simplex with Gwrl as a back-up without having to stop working on a major project.

As well as driving for the week I also ended up doing a bit of carpentry – one of the carriage droplights came apart on a customer and the bottom section basically fell off due to it being rotten. Our normal volunteer carpenter was on holiday so I got to exercise my wood-butchery skills.

Not so good wood

I am not a natural woodworker, I find that it does all sorts of strange things, usually right when I don't want it too (*Yup, I second that! Ed*). However I



persevered and after a lot of sawing, planing, routing and a reasonable amount of cursing, a just about acceptable bottom rail for the droplight was produced. With this fitted and a few days driving in some decidedly varied weather, I could then start the work on Gwrl.

The first bit of investigation was to drain the radiator – I removed the drain plug and absolutely nothing came out... I checked the level in the radiator and this was full, so I instantly knew what had happened and what was causing a lot of the issues we have been experiencing with the loco.

This assessment had to wait a little longer for confirmation, however, as at



"After a lot of sawing, planing, routing and cursing..."

this point one of the drivers came to me reporting that one of the oil pipes on the axleboxes of our Darjeeling loco 'Sherpa' had come adrift.

This proved to be a difficult repair, not due to the nature of what had gone wrong, but due to the complete lack of



PHOTO 1: New sand pipe bottom sections in place on the Simplex.

PHOTO 2: A carriage droplight repair needed.

PHOTO 3: New frame piece let in, not bad for someone who describes himself as a terrible wood butcher!

PHOTO 4: Gwril's radiator is full...

PHOTO 5: ...but on removing the drain plug nothing comes out.

PHOTO 6: Sherpa's broken axlebox oil feed.

PHOTO 7: Bolt removed and the stub of copper left in the end.

PHOTO 8: The chunk left in the end of the flexi pipe – clearly it's sat against the wheel and worn through.

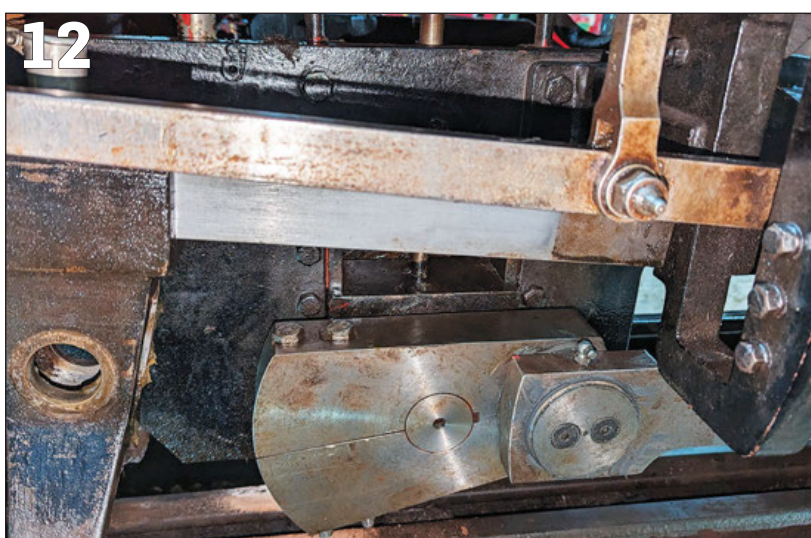
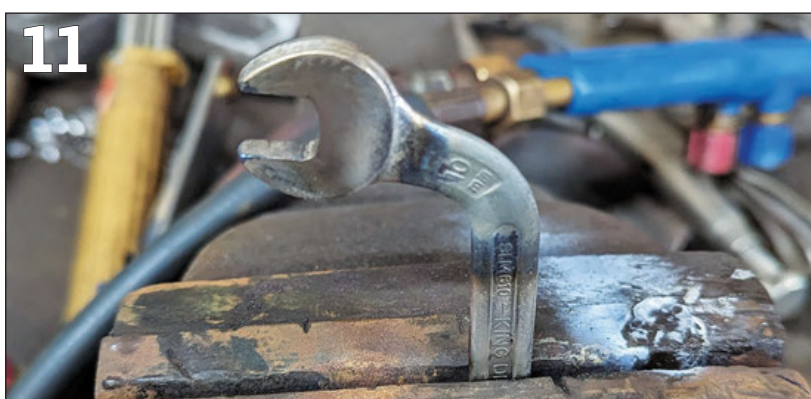
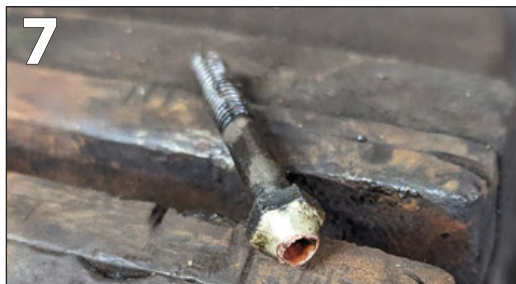
PHOTO 9: New piece of copper pipe silver soldered on – the solder filled the hole down the middle so Harry had to drill it out.

PHOTO 10: Bolt fits in behind the bar in top of the axlebox, definitely difficult to get to!

PHOTO 11: Small tooling modifications were required...

PHOTO 12: Having dropped the connecting rod off Harry had slightly better access!

All photos by the author



access to get the broken part out. The oil feed pipe had broken off just above where I had silver-soldered it into the hollow bolt that both holds the axlebox crown in place and supplies the oil to the top of the crown.

This bolt sits behind the rod that goes up to the suspension and is just inside the overhand of the tyre on the wheel, so is inaccessible from either the front or top. Combined with this, it was on the front-left axlebox, so was also behind the connecting rod, a coupling rod and occasionally a crank web as well.

The removal proved relatively straightforward with the use of a socket, two universal joints and quite a lot of patience – this then allowed me to assess what had happened. I concluded it had likely vibrated loose a little bit and the copper had then just rubbed against the wheel until it had worn through completely.

I then set about de-soldering the stub that was left in, before soldering a new length of pipe in place. Unfortunately a bit of solder ended up spreading across the hole in the bolt, so I drilled this out with the aid of a small vice that I made years ago and have been modifying for all sorts of jobs over the years.

With this done I could then try and refit the bolt – the first attempt using the socket didn't work as the length of pipe prevented the socket from reaching the bolt head.

Tool for the job

I then started messing about with an open-ended spanner, gradually modifying it to reach around the suspension push rod, then modifying it some more to actually be able to turn the bolt. I have since added this spanner to my ever-growing pile of modified tools that might come in handy again some time.

With Sherpa repaired and back in ►



traffic, I could then get back to Gwrl. Before I stripped the radiator off and got water everywhere, I had a good look around the loco and took the drive chains off – this revealed one of the drive sprockets on the hydraulic motor had stripped the sprocket teeth completely and all that was left were smoothed out bumps. Both of the axle drive sprockets were well on their way to being just as worn.

The wheels were also both worn and had evidently been running on the 15-inch gauge rail on our dual-gauge section which runs for the first few hundred yards out of Fairbourne. Some of this rail is of a different profile to the 12¼-inch rails and sits higher as a result. Running on it had driven the edge of the wheel over and caused a ring shard to form.

With all these extra elements to the potential workload added, I then



PHOTO 13: The final, butchered tooling that was required to tighten the bolt.

PHOTO 14: The bolt in and flexi pipe refitted.

removed the radiator and my suspicions were confirmed – it was full of rust and crud. This was without doubt due to no antifreeze having been added to it for many years and as a result the block rusting and filling the radiator with rusty rubbish.

Foot spa on the move

A slightly random interlude to the Gwrl investigation was to sort out the railway's open carriages which resembled mobile paddling pools. Normally these carriages never see a lot of rain (because we don't run them in bad weather if we can help it) so it's not been a problem up until this summer. But we have had several days in a row of unseasonal monsoon rains which have filled up the footwells with water that was not draining away. The addition of some carefully placed drain holes sorted that out quickly.

The next thing to do to Gwrl was to remove the wheels and decide how best to sort them out, so the loco was lifted and placed on accommodation bogies. This then allowed me to examine the wheel bearings properly and look over the sprocket situation.

I found that three out of the four bearings had play in them and all four bearing seals had failed, so I am going to replace all of them as they are just off-the-shelf components. The axle ends, however, looked like they had been dressed with a grinder at some point in the past. There's not a lot I can do about that so they will stay like that for now.

I ended up deciding to cut off the sprockets on the axles – the only other way to remove them would be to press the wheel off, then press the sprockets

PHOTO 15:

A few days out driving 'Russell' provided an opportunity to try out the pie warmer, otherwise known as the manifold.

PHOTO 16:

Gwrl's very worn axle sprocket.

PHOTO 17:

Gwrl's even more worn motor sprocket – the railway has definitely got its money's worth out of this one.



PHOTO 18: The radiator top hose fitting, mostly full of gunk.

PHOTO 19:

Along with the wheel profiles being worn, the edge of the wheel on one side has been badly rolled over due to running on the 15-inch rail.





PHOTO 20: With the chains removed, the simple but very effective drive layout is visible.



PHOTO 21: One of the open coaches doing a very good impression of a mobile paddling pool, before drain holes were added.

off before pressing the wheel back on again. The wheels had already been moved on the axles when the loco was regauged from 2ft after the line acquired it in 2007, and I didn't particularly want to do it again as the process will eventually affect the press-fit until it becomes unusable.

PHOTO 22: Gwrl has been lifted and the first wheel set has been removed.

It's worth noting the different-sized sprockets fitted to the axles – this is so you can easily change the

PHOTO 23: The axle end looks like it's had a bit of grinder treatment at some point.

PHOTO 24: Using the oxy-acetylene cutting gear to split the sprockets off the axle.

PHOTO 25: The sprockets on the floor.

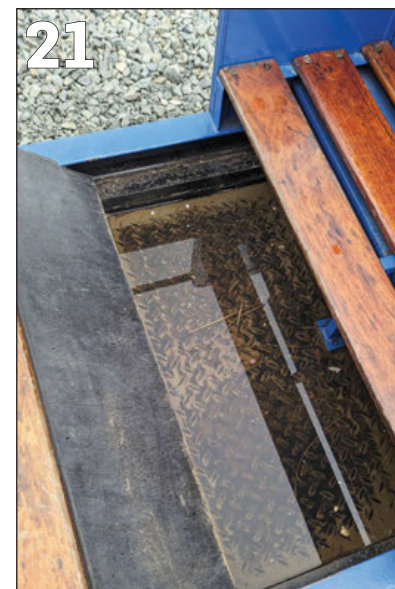
PHOTO 26: The axle appears to be in pretty good condition.



gearing of the loco by simply changing the chains over to the other axle and therefore lining up with the different sized sprocket, quite a neat idea. I will machine up some clamp-on sprocket carriers when the wheels go back under the loco. Some careful use of the oxy-acetylene cutting torch and a set of wedges had the sprockets off with only a small nick to the axles.

Chuck conundrum

I was about to set the first wheel set into our big Colchester Mascot 2600 lathe when I realised I finally had time to chase a nagging error in its

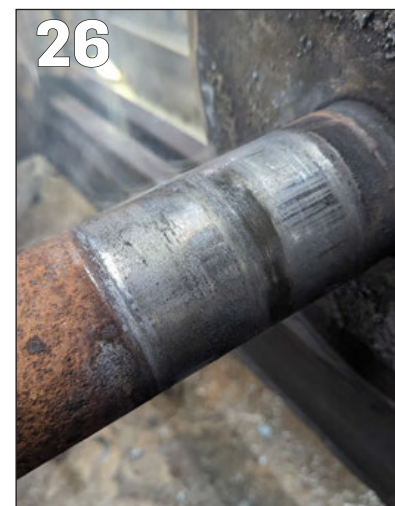


three-jaw chuck. It had never been particularly accurate in all the time I've used it, so I set about chasing down the error and improving it.

The first thing I did was to measure the run-out on the outside of the chuck – but this did not prove particularly useful as the chuck has had an extremely hard life and is covered in dings and scrapes. I therefore decided to remove the chuck from its backing plate to see if there was anything interesting behind it – what I found was a lot of rust, some potential rust jacking and a huge amount of packed-in swarf.

All of this I cleaned off before polishing all the mating surfaces with Scotch-Brite before reassembling it all. Unfortunately the error on the chuck had not changed at all, so I then set about re-machining the jaws – I used the ring I had machined previously for our other lathe to clamp the jaws externally so I could use a boring bar to take a little off and true them up.

This process slightly reduced the error but not by a huge amount, so the last-ditch effort was to clamp the jaws at their rear ends onto a piece of machined round stock, photo 31





"On inspection I discovered it had spat one key out while another taper lock had grenaded itself into several pieces..."



shows this clearly, and to then use the boring bar up until this plug, before removing it and machining off the pip a little more than the rest of the jaws.

Once again this improved things a little, but having done all of this work and fully examined the chuck, I discovered that the ways in which the jaws run were extremely worn while the scroll was also incredibly badly worn with big chunks missing from it.

White flag

At this point I admitted defeat! I have now ordered a new chuck to replace this one – which to be fair, had apparently outlasted two previous lathes – and hopefully the problem will finally be sorted! As a short-term fix I simply mounted the four-jaw chuck, which is in rather better condition, on the lathe and will use

this until the new three-jaw arrives.

Just as I was about to lift the first wheel set into the lathe I was summoned to the Simplex, to be told it had stopped driving. On inspection I discovered it had spat one key out while another taper lock had grenaded itself into several pieces.

I quickly turned the loco into a single-axle drive diesel with the triangular-shaped chain removed and a little more slack added to allow for differences in adhesion between the axles. Having done that I have ordered new taper locks, which will hopefully be here quickly and I can turn it back into a two-axle drive loco once more!

So long as I have a bit of luck and some more peace and quiet, I will actually be able to report on the machining of at least one of Gwrl's wheels in my next article! **EIM**

PHOTO 27:

Trying to sort out an inaccuracy with the three-jaw chuck on the Colchester Mascot lathe.

PHOTO 28:

The lathe backing plate doesn't look too great.

PHOTO 29:

Rust-jacking could be a possible cause of the issue.

PHOTO 30:

Remachining the chuck jaws using the outer ring method...

PHOTO 31:

...and then trying the inner ring method.

PHOTO 32:

Swarf imprints on the four-jaw chuck registering face are signs of a hard, uncared-for life.

PHOTO 33:

One of the Simplex taper lock bushes which has grenaded itself.

PHOTO 34: The Simplex is now a single-axle drive loco until new parts arrive.



Lockdown Bridge

Dave describes how he turned an accidental pond on his 5-inch gauge garden railway into a proper one – by building a bridge over it...

BY DAVETHESTEAM

In 2006 when the Brambles Light Railway was laid across the back lawn, in front of the workshop, we needed an embankment to avoid a gradient of about 1 in 40. The 5-inch gauge line was staked out to 1 in 100, with our existing but now unused shed base as a reference point – we didn't fancy breaking up several tons of concrete!

We needed a cutting two feet deep in the front garden, and an embankment at about a foot high at its peak across half the back lawn. But unfortunately by building the embankment we unwittingly created a dam, behind which a large body of water would collect during heavy rain.

So effective was this piece of water retention that the lawn in the area never dried out properly without several weeks of warm dry weather. An unfortunate side-effect of this was the embankment subsiding and making negotiating this part of the track a bit harder work for our Maxitrak Simplicity, which was the only running loco we had at the time.

A digression – some people don't like metric dimensions and some don't like a mix. I was fortunate enough to do my ONC and HNC during the change to metric so I am happy using either or both – it's just a dimension. Material these days is metric but I usually treat 25mm as 1-inch and 20mm as $\frac{3}{4}$ -inch if I am fabricating.

If it's precision stuff like machining then of course I use the appropriate system. I apologise for the resulting mixture of dimensions in this feature, but this became inevitable because of the way my head works.



Digging in

The first stage of remedial works was to cut a short piece out of the embankment (Photo 1), at the lowest point and to lay a land drain under the lawn and downhill towards the boundary. Photo 1 also shows the steel strip we use for edging the trackbed. We moved and enlarged the greenhouse at the same time.

The track was supported across the gap using two pieces of box section laid on some flat strip about 3 inches x 15 inches placed across the embankment under the ends of the box section (Photo 2). This got over the water problem, the gradient we had learned to deal with and the railway ran like this for several years. The original idea was to turn the gap

ABOVE: Doing the job, looking the part – the finished bridge.

PHOTO 1: The original cutting through the embankment.

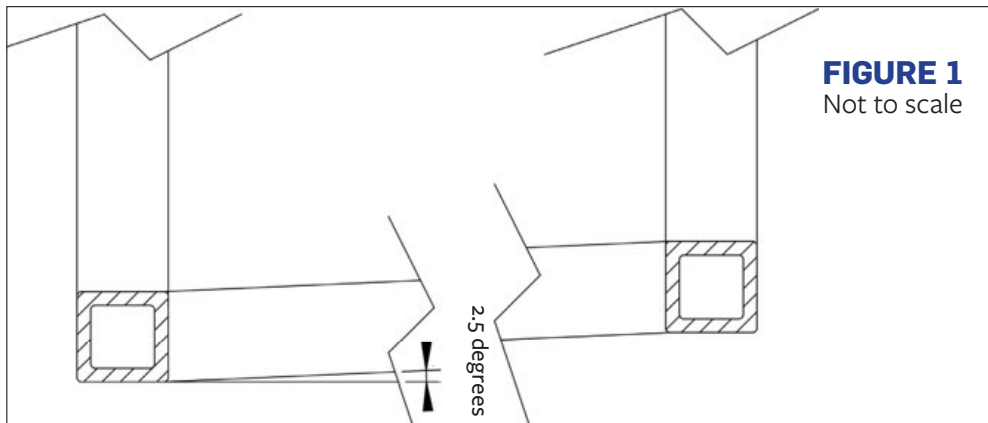
PHOTO 2: Track removed for the bridge.

All photos by the author

into a sort of underpass by building some brick facings each side and making a proper job of supporting the track. However the Director of Horticultural Affairs had other ideas.

We already had one pond, which was not big but quite deep and full of wildlife including newts and dragonfly nymphs. Adding another shallow pond was planned to be more of a feature and allow birds to bathe safely and maybe attract more wildlife. Since the 'gap' was now going to be 5 feet (1.5 metres) or so a better bridge would be required. What bad luck! – I might have to build a girder bridge! ▶





A bridge this size needed some thinking about, especially as it was on a curve and would need some super-elevation. I did start a CAD drawing but in the end I abandoned it. As the required design became clearer it was quicker to arrange the metal and weld it than do a drawing.

Roll with it

It is not easy to properly curve relatively heavy metal sections but fortunately a friend of my daughter's has a rolling machine. I decided to make the frame out of 20 x 20 x 3 steel box section, but some of the superstructure was made from 20 x 20 x 2 as I ran out of 3mm thick material and some 2mm was available.

The rolling of the base sections and the top rails was done on a quid pro quo basis, in other words with no quids changing hands. Without this I doubt that the bridge could have been completed very quickly unless requiring an extensive budget, which we didn't have.

One fixed feature of the bridge was that it had to use the curved rails from the removed section of track to avoid having to modify the rest of the track. This fixed the length and radius.

All the curves on the railway are just under 1.5 metres long, 15 feet (4.5 metres) radius at the centre of the sleepers and 1/20th of a circle. The exception is the track across the drive which is made to fit for length but still

of 15 feet radius, it is also much more robustly constructed and 'car proof'.

Luckily the bridge was started before Covid hit – I had all the material, the curved sections and a lot of the prep work done. The bridge became a lockdown project and is now known as 'Lockdown Bridge' and is painted in a colour dubbed 'Lockdown Bridge Red'. It does have a proper RAL number but it's not as easy to remember as the name...

Trying to deal with the super elevation on a curved bridge was interesting. You can't make it flat and tip it, as it just doesn't work! To help illustrate this **Figure 1** shows the layout of the sleepers and lower sections. If you can think of the sleepers taking the dished shape of an old wooden wagon wheel you will have the correct configuration.

Having decided on a centre curve of 15 feet to match the existing rails the base and superstructure top sections had been rolled to 13 feet 8 inches for the inside and 16 feet 4 inches on the outside to produce a bridge 32 inches wide, helping to avoid bruised knees when passing over it. Super elevation was decided at 2.5 degrees, experience has shown that this is a shade too much. The tipping feeling is slightly disconcerting if you stop on the bridge but it is fine at about 5 mph. If I was repeating the exercise I would go for 1.5 degrees.

Back to the construction! The

FIGURE 1
Not to scale

"Trying to deal with the super elevation on a curved bridge was interesting – you can't make it flat and tip it, as it just doesn't work..."

cross-pieces were used as sleepers, it just made life easier and didn't require complicated fixings for fitting a separately sleepereed section of track. These were cut to length with the 2.5-degree angle on each end – my friendly local factory let me use its chop saw to achieve this, otherwise I'd still be cutting them with a hacksaw!

The cross-pieces were drilled and tapped M5 to take stainless steel pan-head screws to hold the PNP rail chairs I use. The screws are a tight fit in the rail chairs, which helps to keep them in position. The cross-pieces were then fitted to the rails to make sure everything stayed in alignment.

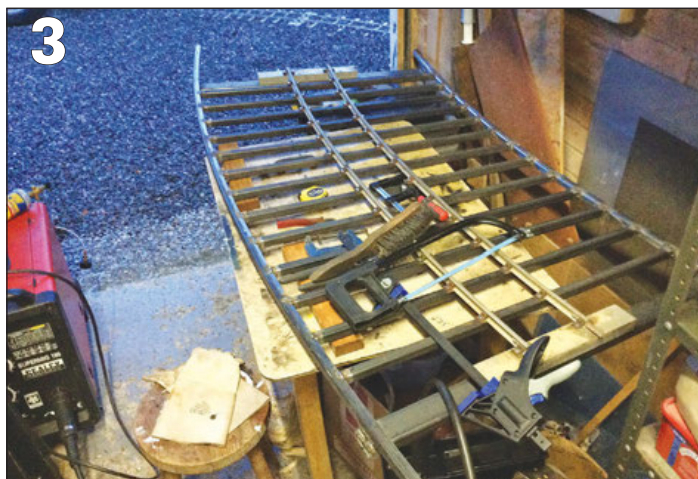
The inner base section was clamped to an old ('50s or '60s) kitchen table with proper wood and Formica construction – it's still flat after about 60 years. It is the only thing I have which is big enough and flat enough to do this type of work.

The outer section was clamped on packers at the correct height to get the 2.5-degree super-elevation. The cross-pieces were carefully adjusted on the rail to get the correct spacing and radial position, then placed in position between the curved inner and outer sections with suitable packings to hold them at the correct height to match the outer section. The inner curved section was laid flat on the table (**Photo 3**).

After carefully re-checking the positioning the cross-pieces were then tack-welded to both base sections at the ends. With this sort of work never start at one end and work to the other, it will distort and stretch. Do the ends, the middle and then the middle of the remaining joins then 'ditto repeato' as LBSC used to say. This way nothing will distort much and cause problems. Components were held in place with clamps as the build progressed.

Spit and span

During construction my welding skills were revealed to be only slightly better than hopeless, I'd show you a picture if it wasn't so embarrassing!



The welds were strong enough but looked like they had been thrown on from a few feet away! Spit welding is the phrase usually used – cue much grinding and fettling, thankfully reducing greatly as I got better.

With hindsight (wonderful stuff!) I think the main problem was that I used 0.6mm wire rather than 0.8mm as I had most of this. It wasn't capable of carrying the current for welding the 3mm wall box. Note to self – use the correct wire next time!

The cross-pieces at the ends of the bridge were left until last as I needed to use the double-width sleepers I use for my rail joints, so 50 x 25 box section was welded across the underneath of the base sections where the end sleepers of the track would be. Spacers were necessary to get the top of the 50 x 25 cross-pieces to the right height to support the 1-inch thick sleepers. The lower curved sections were left long to allow trimming when the track was fitted and checked.

Another digression – double-width sleeper rail joints: when I started the railway I bought some secondhand rail at a very good price to 'help the budget'. The ends of many of these rails had bent downwards where the only (inadequate) support at the join was the fishplates joining them together. This feature must have made the track interesting to run on.

I shortened the rail to give 1.5-metre long straights and slightly under 1.5-metre curves at 4.5-metre radius, 20 curves per circle or 18 degrees per piece. This got rid of the damaged ends and made the track a bit like laying a OO-scale model railway with fixed-size pieces of track.

In order to prevent this droop happening on the BLR I designed a rail joint with a wide sleeper on which the chairs were fitted, butted together right at the ends of the rails on a double-width sleeper. The overhang is now about 1/8-inch or 3mm. There has been no sign of any wear or droop at the joints.

With the lower layer welded and track fitted I cut off the extra curved



FIGURE 1:

Cross-section of the design to achieve the super-elevation.

PHOTO 3:

Constructing the lower deck.

PHOTO 4:

Inside the superstructure – our author asks that readers ignore the junk!

PHOTO 5: The lower deck end pieces are added.

PHOTO 6: The basic bridge tidied up and ready for paint.

PHOTO 7:

Painting begins by etch priming the metal.

box from the ends of the lower section, leaving a short piece of section protruding to make the end look a bit nicer with the superstructure added.

I cut the verticals and welded them to the base sections, then the top sections to the verticals (Photo 4). Having got a reasonably rigid structure I decided to use the curved pieces that had been cut off the base and top sections as the angled pieces at the ends. Whilst the curve is not obvious I do think it seems to improve the appearance compared with straight pieces (Photo 5).

Painting the Forth Bridge

After a lot of fettling and tidying up of welds and capping the open ends of the box section in various places it was ready for painting (Photo 6). I have a couple of favourite paints, Tractol 329 and Craftmaster enamels. The Tractol I tend to use for larger items, the Craftmaster is ideal for a real gloss finish but needs more care avoiding dust to get a good finish. There are plenty of other good paints out there, my favourites don't have to be yours!

I always brush, I don't have spraying equipment. Tractol from the tin tends to be too thick for brushing, resulting in thick coats and consequent runs. The trick I use is to

add 10 per cent of the correct type of Xylene thinners. This results in a much thinner coat of paint which becomes touch-dry quickly and goes hard overnight. Craftmaster should not be thinned if brushed.

For either paint I use very fine-bristled brushes from an art shop, the extra expense is fully justified and if you clean the brushes properly each time they will last extremely well. I painted the bridge outside on a still day but not in the sun and had no noticeable trouble with dust spoiling the finish.

On metal always use etch primer (Photo 7), followed by an undercoat and then as many coats of colour as necessary to get a good finish. Rub down lightly between coats (Photo 8).

Don't try and short-cut the number of stages with Tractol if you use etch primer, I have done so and ended up with hardening times of days. Incidentally I painted our kitchen doors with Tractol, it produces a good shiny finish which shows enough of the grain to stop it looking like a mirror and it's tough as nails!

Painting was relatively easy. In order to avoid damage to recently painted surfaces I finished the top of the bridge completely and allowed it to harden properly for a few days



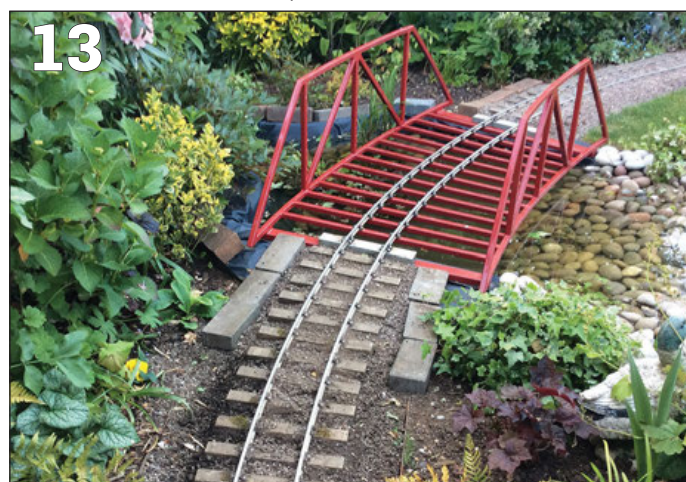


PHOTO 8: Finish-painted in a fetching shade of red..

PHOTO 9: First bridge pier in place.

PHOTO 10: Second pier completed.

PHOTO 11: Now the bridge spans a gap.

PHOTO 12: Next step, create the pond – the liner is in place.

PHOTO 13: The pond is finished and the track ballasted.

PHOTO 14: First test crossing...

PHOTO 15: After deciding the bridge was too close to the pond, extra height was added to the piers.

PHOTO 16: Lifting the embankment edging to suit.

PHOTO 17: More pond liner...

PHOTO 18: The trackbed past the greenhouse is ready for rail...

PHOTO 19: ...as is the route up to the now higher bridge.

before inverting it to paint the underneath. In spite of my previous precautions I still ended up with runs – it is best to let them dry thoroughly, no matter how long it takes, and then sand them off and re-coat.

Well that's pretty much it for the bridge itself, but it needed something to hold it up! Having failed to find a local supplier of rigid sky hooks I thought brick pavers might be easier to find. These are dense, frost-proof and available in a couple of different colours depending on whether you want them to fade into the background (charcoal) or make a feature of them (brick red). We went for the latter, mainly because the builder's merchant delivered about 500 of the brick-red ones instead of charcoal! We decided to stick with the red as trying to return 500 pavers would have caused problems and delays. We still think it looks nice.

We don't use cement or concrete in the garden, it just makes things too permanent, requires a lot of preparation and is expensive. So at the end of April 2020 we dug down until we were a bit below the lowest level of the pond and put in a row of pavers aligned along the track, to provide a base for the bridge piers.

The level of this layer was carefully measured so that the stack of pavers up



to the bridge ended up at the correct height for track on the embankment. These were laid and carefully 'bashed' (a technical term) into place with a plastic soft-blow mallet.

It's not quite as simple as this – careful scraping of the ground prior to bashing was required to get the row of bricks level along the track and at 2.5 degrees across it to get the super-elevation so that the track was correctly tipped and the sides of the bridge were vertical (Photo 9). The mallet is about 3lb (1.5kg) in weight, has a plastic face and is filled with steel shot to make it a dead blow rather than hard. A 3lb club hammer is the same weight but will pulverise the paver, I didn't try this!

Elevated view

We had thought that the bridge would end up too near the water level to look 'right' but didn't want a second civil engineering job raising the embankment straight after this one. This proved to be true, so as a separate exercise the following year we decided we would lift the bridge and raise the embankment by two levels of pavers.

I didn't want to use cement to hold anything together so I employed that well-known glue named after a large primate, like that seen in a 1933 film waving Fay Wray around at the top of

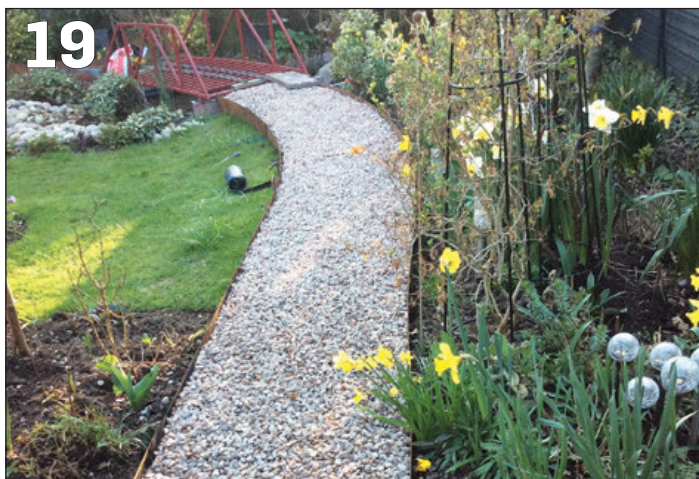
the Empire State building. It worked well but when using this glue you need to weigh everything down very well or it floats around as the glue 'foams'. The photos show the construction.

Once all was dry and the bridge laid in place to check everything lined up correctly it was time to dig out the pond. Photos 10-12 show how this was done. A bit of tidying up ensued then the bridge was put in place and the track connected and ballasted (Photos 13-14). This took until May 2020.

Whilst lining the pond we placed the bridge in position with the extra two courses of brick rested in place to get the pond liner long enough to reach over these courses when the piers were raised. This extra length was then hidden in the end of the embankment until needed.

In December 2020 the next major civil engineering was started – this was quite a lot of work and wasn't completed until April the following year. We started by removing the track from the embankments each side of the bridge and the bridge itself. More primate glue and pavers saw the bridge at a much more suitable height, (Photo 15). The pond was not disturbed during this work.

Re-aligning the edging to get a 1 in 100 uphill gradient towards the bridge proved a bit fiddly, then infilling with



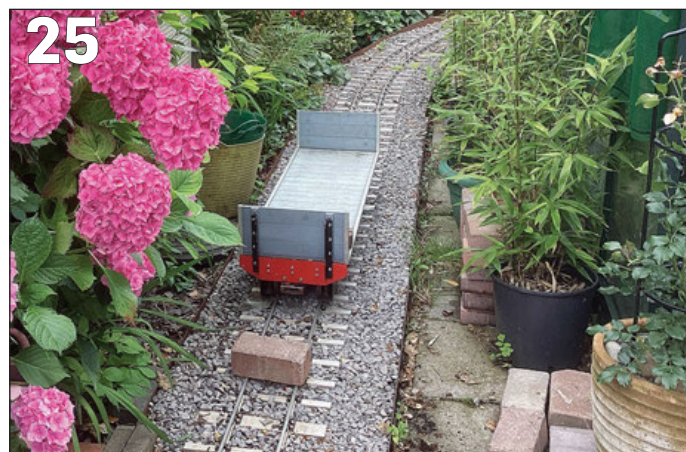
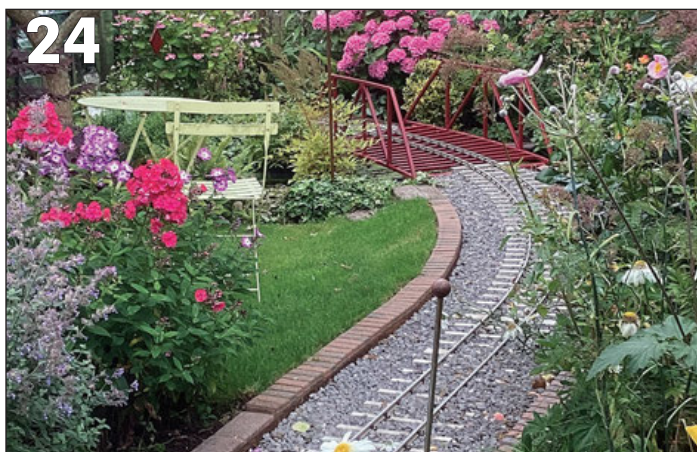


PHOTO 20:
Edging and steps
for crossing
the track.

PHOTO 21:
Edging extended
across footpath.

PHOTO 22:
New landscape
fabric and ballast
were added.

PHOTO 23:
The re-laid
track looking
away from the
embankment.

PHOTO 24:
The footpath
side finished.

PHOTO 25:
The greenhouse
side of the
embankment.

all sorts of stuff commenced. We used lots of pottery crocks, spare bricks, soil and some cheap 'end-of-range' square pavers from our local builders merchant (Photos 16-17).

Photo 17 shows some pond liner in place to stop ballast getting behind the piers and pushing it inwards. Landscape fabric was put on top of this lot followed by the ballast which was renewed using 10-14mm grey limestone (Photos 18-19).

Growing pains

We had a lot of trouble with the original 6mm chippings which absorbed soil and produced an ideal medium for all sorts of things to grow in, mostly 'pain in the rear' weeds but including some forget-me-nots, which was nice. We had skimmed too much on the depth of ballast and the landscape fabric didn't quite cover from edge to edge. Some of the 6mm chippings were re-used on various parts of the track but the solid stuff was left in place. Hopefully the rebuilt embankment will look nice for a bit longer this time.

We ran like this for a while but the steel strip used for the edging was not held in place well enough for permanent use. Pavers were put in as an edging to keep the garden and lawn out of the ballast – again the picture (Photo 20) shows the arrangement

better than a lot of words. Bashing was used to settle the pavers in place, backed up with 12mm steel bar pegs about 400mm long where appropriate, for example where the ground was soft and/or the pavers were mostly above the original ground level. So far the rows of pavers have not moved.

At the beginning of 2023 it was necessary to re-ballast the track from the end of the embankment to the corner of the house. This section of track was the worst by far for soil creeping up from underneath, where we had not been careful enough with the landscaping fabric and had left gaps. This section needed serious weeding literally every couple of weeks – if you want seeds to grow just mix 6mm grit and clay!

Remedial work involved more digging out of old ballast, new landscape fabric and new ballast. The last pieces of edging at the end of the embankment and across the footpath followed (Photos 21-22).

The finished crossing is shown in Photo 23 with the ballast across the footpath built up to rail level to make it a bit less of a trip hazard. Photo 24 shows the finished embankment between the bridge and the crossing and Photo 25 shows the greenhouse side of the embankment as yet without edging. This will have to wait for next year, I want to play trains! **EIM**



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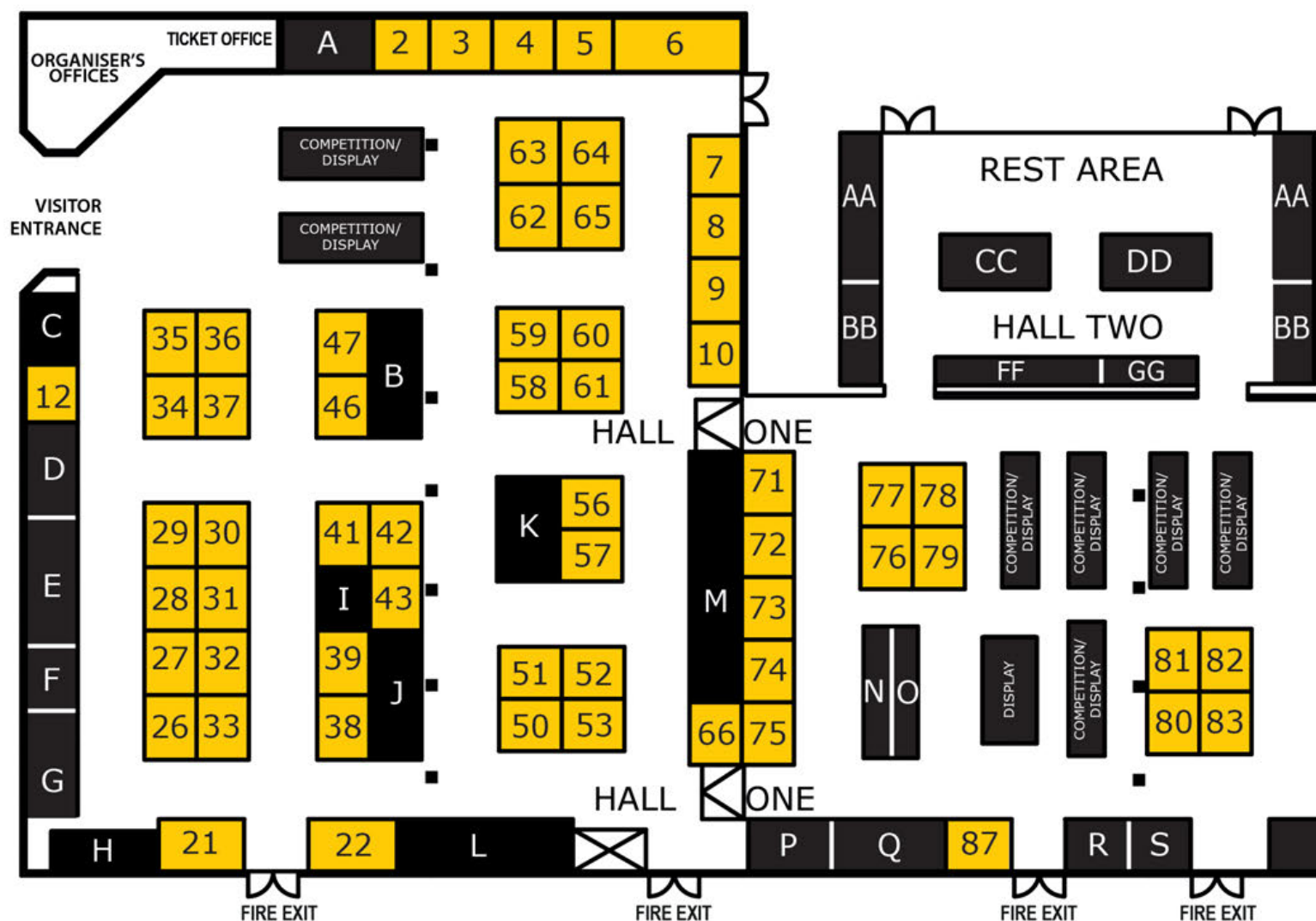
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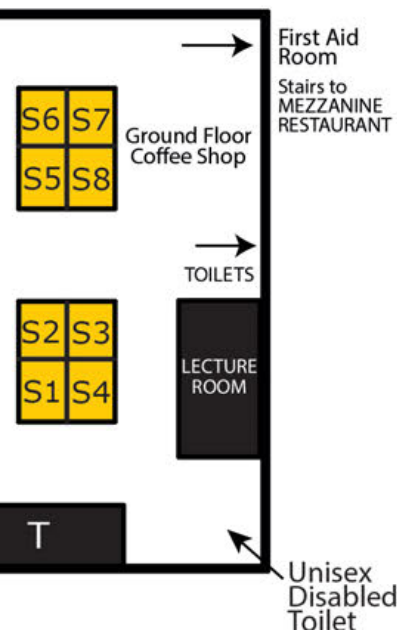
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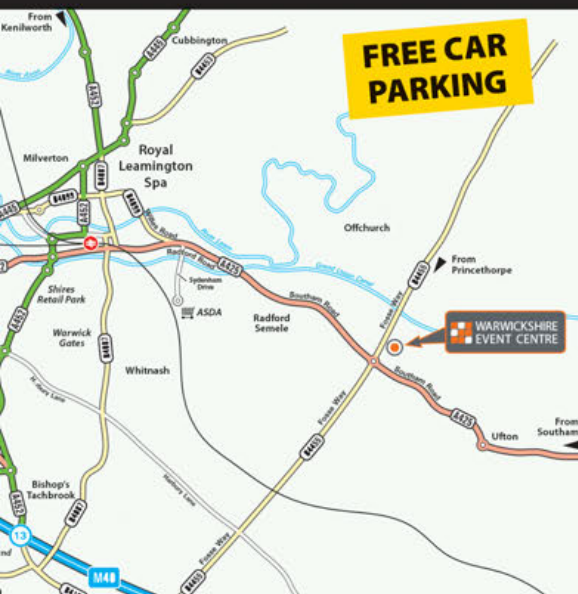
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2023 is the 125th Anniversary of the Society of Model & Experimental Engineers. The Society will celebrate this milestone with a special stand which incorporates a collection of historic models, workshop demonstrations and promotion of its current activities.

Model Engineer and Model Engineers' Workshop are excited to be part of this year's Midlands Model Engineering Exhibition. To celebrate, they will be hosting a series of talks covering a wide range of topics by some of our authors. Come along and meet some of the people who help make your favourite magazines so good!

LECTURE PROGRAMME

Thursday 12th October

Time	Lecture Topic	Presented By
1.00pm	A development in steam injector design	Roger Froud
2.15pm	3D printing for model engineers	Neil Wyatt

Friday 13th October

Time	Lecture Topic	Presented By
11.15am	Designing and building model stationary engines	Stew Hart
1.00pm	The remarkable Jim Crebbin and his experimental locomotives	Roger Backhouse
2.15pm	A dummies guide to steam engine valve gear	Duncan Webster

Saturday 14th October

Time	Lecture Topic	Presented By
11.15am	Why metals behave the way they do	Bob Reeve
1.00pm	Powder coating in the home workshop	Chris Gabel
2.15pm	Hear the Earth: how to design and build a seismometer	Mark Noel

Sunday 15th October

Time	Lecture Topic	Presented By
11.15am	Why a CNC milling machine is so useful	Roger Froud
2.00pm	PRESENTATION OF AWARDS	

Book your tickets at www.midlandsmodeleengineering.co.uk

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How to design a loco...

How does one come up with the concept for a new steam locomotive built to do a job of work? **EIM** asked the Perrygrove Railway, which has done just that...

BY ANDREW CHARMAN

Designing a brand-new steam locomotive, as opposed to replicating a classic design, is quite a challenge, especially if one is creating an engine that will be expected to 'pull its weight' on an anything-but-easy line.

So what does it take to come up with the right design? To try and find out back at the end of April **EIM** took a trip to the Forest of Dean and the first day of the Perrygrove Railway's Gala – we were there because this was a very special day, the unveiling of a brand-new locomotive built especially for the 15-inch gauge line.

Now for those readers who don't know the Perrygrove, it was opened in 1996 by then owners Michael and Frances Crofts, and while it is marketed as a family day out with tree houses, playgrounds and the like for the youngsters, they surround what is a fascinating, challenging railway. Just over 1300 metres long, it climbs in a series of reverse loops, effectively a modern-day version of the 'minimum gauge' concept pioneered in the 19th century by Sir Arthur Heywood. Throw in a fascinatingly varied fleet of locomotives and you have the elements of a day out that will be as enjoyable for the typical **EIM** reader as for their children or grandchildren...

Big scale - same criteria

Now one thing the Perrygrove is not, is miniature – this is proper narrow gauge on the 15-inch, and the new loco one of the largest, certainly tallest, ever to run on the line. The principles behind its construction, however, are little different to any model engineering club deciding that they need a heavy hauler to take the strain during public running days on their 5 or 7¼-inch track, and instead of going down the route of choosing a long-established design that's been built so many times before, they want to create something new, designed specifically for the job in hand.

The loco fleet at the Perrygrove in the past has even included a Garratt, which your editor got to try driving back in 2013. That engine is long gone but today's fleet includes three steam locos. The 0-6-0 'Spirit of Adventure' and 0-6-2 'Anne' are both examples of the prolific designs built by the Exmoor Steam Railway in Devon, though the 2004-built Anne is 10



"They want to create something new, designed specifically for the job in hand..."

ABOVE: 'Mr. Wallworth' – the Perrygrove Railway's new loco, specifically designed for the job in hand.

RIGHT: Crew of the new loco will enjoy spacious surroundings

All photos by the author

years younger than Spirit, which was the line's first loco. The 2-6-2T 'Lydia', built in 2008 by Alan Keef Ltd, is the most powerful Perrygrove loco and also the most popular with visitors.

There are also two diesels in operation and a third slowly being constructed, plus a scale version of an

American Cagney 0-4-0 which is run for fun – so quite a fleet, why would the line need another? Especially as Perrygrove owner David Nelson-Brown told **EIM** that the new loco represents a "little bit terrifying" £100,000 investment.

Basically it's all about security –





ABOVE: Bagnall-Price valve gear is a new departure for the Perrygrove line.

BELOW: Compressor for air-braking system neatly concealed between the outside frames.

BELOW RIGHT: Past experience to draw on included this impressive Garratt loco, here being handled by a somewhat ham-fisted driver in 2013...

FACING PAGE TOP AND UPPER RIGHT: The sheer breadth of 15-inch gauge came be seen in these two pictures. Perrygrove Gala visitors 'Sian' and 'Count Louis' are two very differently sized tender locos, despite the fact that both once worked together on the Fairbourne Railway in the mid-Wales line's 15-inch gauge days. And then Sian is duly dwarfed by Perrygrove resident 'Lydia'...

FACING PAGE RIGHT: Front-end view of the newcomer, a traditional Bagnall Sipat look.

FACING PAGE FAR RIGHT: Back to the shed on Gala day – the Perrygrove's newest and tallest loco will have to wait a little longer before starting to prove itself.



while the line has quite a loco fleet they are all privately owned and like the Garratt, could depart in the future – Perrygrove needed its own loco. Having decided this like many miniature railway operators David looked first on the used market – though he quickly decided this was not going to provide what he wanted.

No used solution

There were locos available in what is the deceptively small world of 15-inch gauge, but locos that were either too big, too small or simply not right for the unique demands of Perrygrove. Certainly proper miniature engines such as at the Romney or Bure Valley lines would not fit the bill; "we needed something big and chunky."

So a new-build was decided upon, and North Bay Railway Engineering, of Darlington, contracted to do the work. Since 2016 North Bay has built a small batch of new locomotives to the 'Sipat' design, a small 0-4-0 produced by Bagnall from the late 19th century. The first NBRE version was to 20-inch gauge for its then sister miniature railway in Scarborough, and there have been later 2ft gauge versions.

The Sipat design, now proven in

modern form, seemed a good place to start, but David was keen to ensure he got exactly what he needed, and so played a key role in the design process. He started by deciding what was good and not so good about the three existing engines, along with former Perrygrove residents and locos that have visited the line.

"We sat down with a big sheet of paper and asked such questions as what's the best engine to work in the wet, for pulling heavy trains, for maintenance, and from a crew's perspective," he told **EIM**.

The result of this exercise was a conclusion that Spirit of Adventure best suited most of the design criteria – but David did not want to simply have another Exmoor-type loco. The new engine would be modelled on Spirit's key dimensions, "but also with a few refinements from some of the other engines here. You have not seen an engine that looks like this one anywhere else.

Post-coal world

A key design consideration that possibly has not been so important to previous loco designers, but will assume even more prominence in future, was the likelihood that coal as a fuel will not be around much longer.

Making the loco an oil burner was quickly dismissed, however. "It's obvious that as soon as green campaigners have dealt with the coal issue they will go after oil, so that would be a waste of time.

"There's a lot of work within the industry to create green alternatives to coal, and there's enough investment going into that to reassure me that it will behave in the same way as coal. So if you build an engine designed for coal the chances are it will run on the alternative products.

"We are very small railway burning 15 tons of coal a year. On this day alone the Severn Valley and North York Moors Railways have towed more than 15 tons of coal in bunkers and tenders around their railways, so



the problem of coal will not be solved by me but by the big players. I'm not actually that worried for the long-term viability, because there will be some form of 'coal'."

Best combination

The new engine is an 0-6-0 saddle tank with 5½ x 8 inch cylinders, a 180psi boiler, and 14½-inch diameter wheels. "The cylinders are the same as on Lydia but significantly bigger than Spirit and Ann, the wheels the same as Spirit and Ann but slightly smaller than Lydia, so proportionally the cylinders are a lot bigger compared to the wheels and we should have a lot more power as a result. The 180psi boiler, meanwhile, is just under Lydia but more than the Exmoor locos."

"Every time we got a drawing we took it in the engine shed and measured the component against those on our three other engines to see how it compared. The engine has 10 per cent more coal capacity than Spirit, about the same water capacity as Anne and about the same smokebox volume – the firebox grate is almost identical to Lydia... We knew we were getting an engine that was proportionally in keeping with the others, and the others are a success so we had half a chance that this would do the job."

The newcomer has one element not seen before on a Perrygrove loco, the Bagnall-Price design of valve gear. The reason again is the line's route – David is also heavily involved with the standard gauge Bodmin & Wenford Railway where he looks after the industrial tank locos Alf and Judy, both fitted with Bagnall-Price gear. "I know it has high torque and is very good at low speed, hillclimbing and pulling dead loads, so it ticked all the boxes of what we wanted."



"It has high torque and is very good at low speed, hillclimbing and pulling dead loads, so it ticked all the boxes..."

Neat touches include the hiding of the compressor for the air-braking system between the frames, while the cab is certainly one of the most spacious yet experienced by the Perrygrove line's drivers.

Sadly, as is often the case with these things, while the loco was revealed at the Gala it was not, as planned, in steam – last-minute delays restricted it to display-only status. The work still needed included to the valve gear, piping and some fixtures and fittings, but David was happy with 'Mr Hallworth' – the loco is named in memory of Tony Hallworth, a

prominent figure on the Bodmin line.

"We are very pleased with the work (North Bay) has done on it," he said. "It's a very happy medium across our engines, but we will have to wait and see if it's a success..." **EIM**

■ Details of opening days on the Perrygrove Railway can be found at www.perrygrove.co.uk. The October edition of **EIM**'s sister magazine *Narrow Gauge World* will carry a feature on the Perrygrove providing a more extensive description of the line and revealing some exciting plans for future expansion...



Tricks of the trade...

This month's selection of readers' tips and tricks focuses on socket storage, accurate vice alignment on a mill and keeping files sharp...

New storage for an old socket set

I expect a lot of our readers have socket sets among their workshop tools (*writes David Coney*), so here is a way to reorganise them, if the internal 'template' has long since broken and been thrown away.

This article is meant for (model) engineers working at the larger scales, and people working with narrow gauge locos, the socket set I am improving here is meant for usage as above, and also for cars/motor cycles and the like.

My socket set (having within it ½-inch drive A/F, Metric, and Whitworth sockets) was obtained in the late 1960s – originally it had a plastic template in the tin to keep everything in place.

This plastic template has long since broken and been thrown away, and thereafter all the bits and pieces have rolled around in the metal case, and individual sockets have been difficult to pick out when they have been needed.

A colleague of mine put me onto socket rails, see **Photo 1**, that can be bought on eBay for a reasonable price (*other online auction sites are available! Ed*). I opted to purchase the

rails with the capacity for 14 sockets (of ½-inch square drive).

These provide a neat and tidy way of accommodating the sockets in the original metal case, while the other bits and pieces can be fixed down in the case using tool clips (**Photo 2**) – these are obtainable from your local hardware store.

The socket rails lie loosely in the metal case while the tool clips holding everything else use nuts and bolts to hold them in place, though pop rivets could also be used.

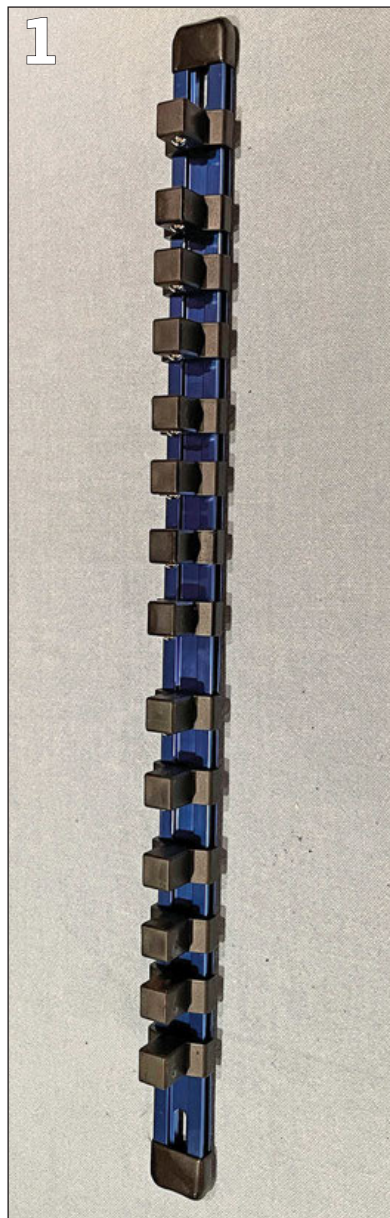
Photo 3 shows the finished job – I managed to get everything that was originally in the set, into the redesigned case, apart from the torque wrench. I even found the correct hammer-finish blue paint to give the case finish an update. All-in-all a satisfying job.

PHOTO 1: Socket rails, a simple and inexpensive storage solution.

PHOTO 2: Tool clips secure everything else in place.

PHOTO 3: Ancient but revived socket set, good for a few years yet.

Photos by David Coney



A clean file is a sharp file...

A tip someone gave me many years ago to stop files from pinning when filing soft materials (*writes Mike Warren*) was to keep a lump of chalk on the bench and before using the file to rub chalk into each side.

Doing this will prevent soft metal filings sticking in the teeth and on trying the technique I have found this to generally be so.

Do not let files get wet though as this will promote rust quite quickly.

Some ad-vice on accurate mill alignment

Further to some recent articles in **EIM** relating to vice alignment on the milling machine (*writes Mike Warren*) I here tender my solutions which may make real engineers twitch, but which I have found to be accurate enough to mill a $\frac{3}{32}$ -inch slot in the edge of $\frac{1}{8}$ -inch material over a 9-inch length without breaking out either side.

First find a convenient length of ground round bar and clamp it down to the table, having located it in one of the clamping slots.

Traverse the table and check with a DTI (dial-test indicator) that it is true. Place the vice upside down over the bar and clamp tight.

Then mill off the end of the vice, removing as little as possible by traversing the table – preferably full depth or at least as much as to exceed the height of bar that you are going to use for setting the vice again.

Unclamp and remove the ground bar from the table, turn the vice over and to reset it simply place a short length of ground stock – I use $\frac{1}{2}$ -inch diameter, in the V-groove and with convenient parallels push the vice against the bar.

This only takes a moment and the vice will always be parallel with the table – for most purposes it is accurate enough.

If you want extreme accuracy you can set up with a DTI on a long length of ground bar stock held in the vice.

Swarf on draught

Another tip – for brushing out swarf from T-slots I simply cut off convenient lengths off commercially available door floor draught strips.

These make admirable and useful long brushes – put a handle on them if you must!

“My solutions may make real engineers twitch, but I have found to be accurate enough...”

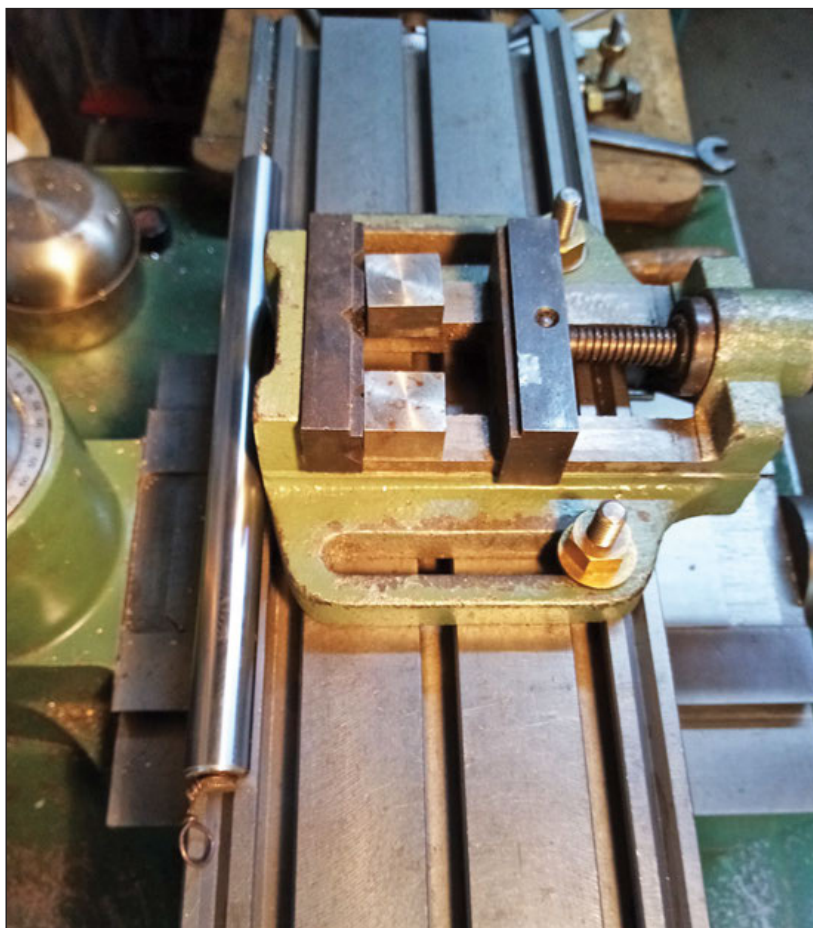
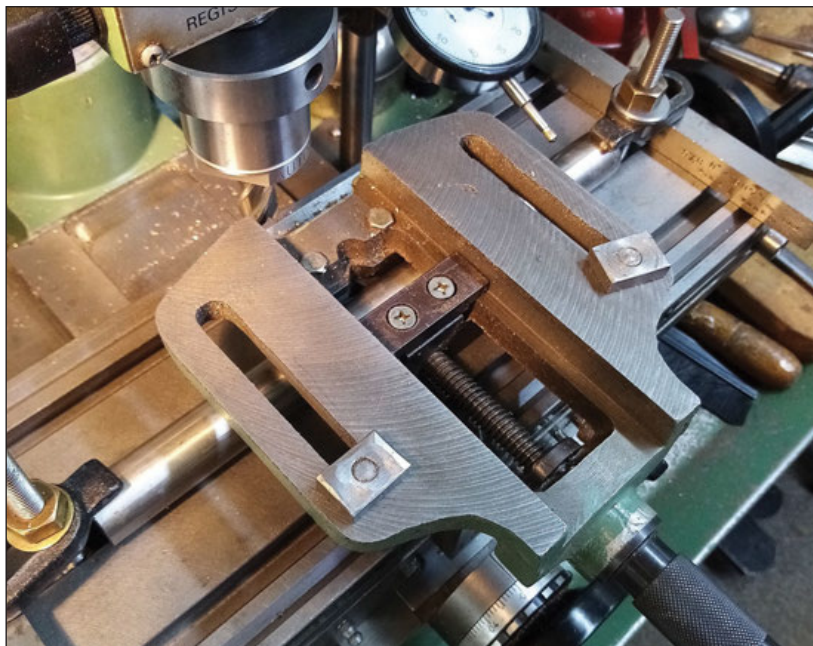
ABOVE RIGHT & RIGHT:

Mike's milling machine vice alignment tip in action – see text for details.

BELOW:

Who needs an expensive slot cleaning tool when a bit of draft excluder will do?

Photos by Mike Warren



Enjoyed these tips but think you could do better? *Engineering in Miniature* has a constant need for new features on all subjects – events to workshop techniques, loco builds to road and stationary engines, clocks and marine.

If you have completed a build you are proud of, are about to start a major project, have found a useful workshop dodge or come up with a clever little tool, we want to hear from you!

We pay for all features that appear in the magazine.

Interested? Contact editor@engineeringinminiature.co.uk

An improved Schools – building a Roedean

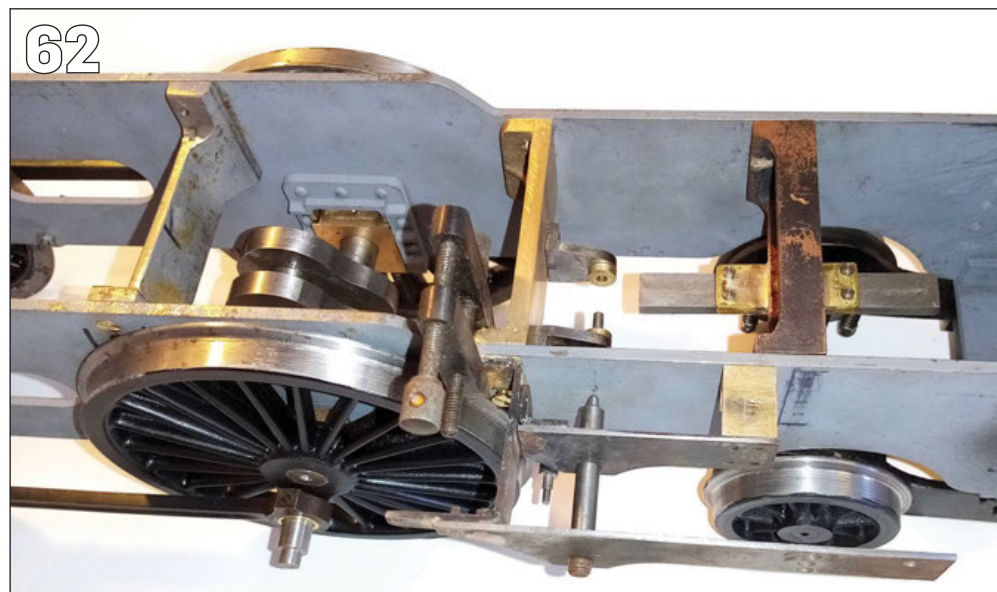
The latest episode of Nick's 3½-inch gauge locomotive project focuses on the whys and wherefores of ensuring the valve gear geometry works....

BY NICK FEAST Part Eight of a short series



LBSC's original series on the construction of this locomotive was published in the magazine *Mechanics* in 1948, and was reprinted verbatim in *Model Engineer* in 2011, yet it seems few models have actually been completed.

Checking various websites for historical drawing errors revealed little of any consequence, although there were a few non-specific comments about 'middle cylinder valve gear' and a comment about a collapsed LBSC-design firebox crown under hydraulic test. Therefore one could assume that after being in the public domain for almost 75 years any drawing errors would have come to light by now.



I think we can dismiss the boiler failure as being down to poor quality of construction – most published designs are adequately stayed, especially those by LBSC. As construction of the chassis parts continued there were a few issues, although nothing insurmountable with a bit of pondering.

The Schools design is slightly unusual in having external gear

"One can assume that after being in the public domain for almost 75 years any drawing errors would have come to light by now..."

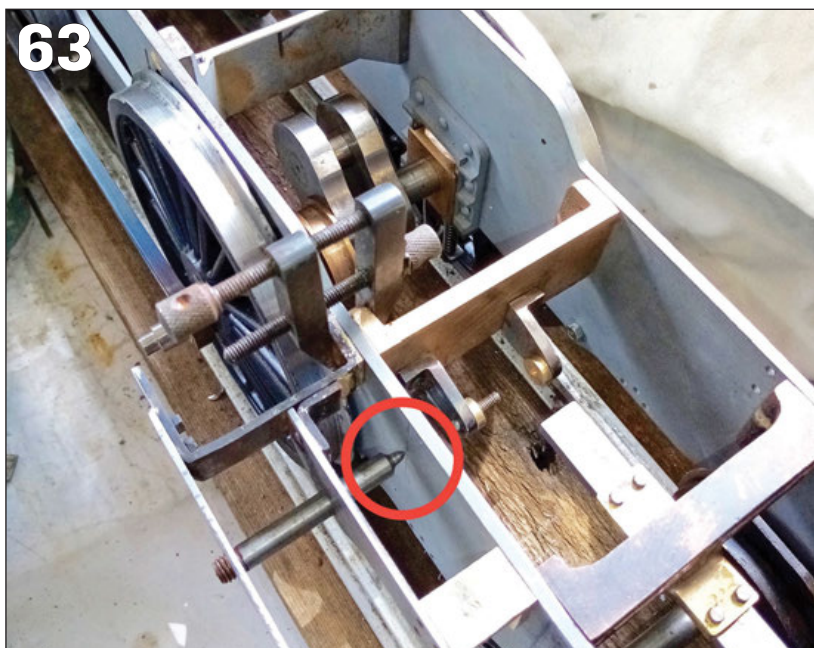
frames outboard of the main frames to support the expansion links. Once I had fitted all the frame stretchers and positioned the brackets for the middle valve gear expansion bracket, I set up the middle slide bar as shown in [Photo 62](#).

Point of the matter

The right-hand side gear frames have been assembled as per the drawings and I have made up a scriber using a short length of ¼-inch round bar with a concentric point on the end. Having already marked the correct position for the pivot point of the expansion link on the outside of the main frames I can position the gear frames correctly and mark the frames for drilling the mounting screws.

[Photo 63](#) shows another view – all three expansion link centres are in line. Once this was done construction proceeded quite quickly, partly because of the large number of parts that were laser cut and also because of lockdown – there was a lot more time available then!

[Photo 64](#) shows the completed valve gear with cylinders installed. I have relocated the mechanical boiler feed-pump to the tender using the design that I employed on my previous Q1 loco. This arrangement has proved successful over the past 16 years that



the engine has been operating despite warnings from some quarters that a tender axle-pump will not work in 3½-inch gauge. It only requires a very small feed rate to keep pace with the water consumption of the average boiler, and a tender feed pump is reciprocating at quite a rate!

There are some points that need clarifying on the LBSC drawings. Firstly on sheet 4, which describes most of the valve gear components, the drawing of the weighbar shaft is wrong – the bend to clear the bottom of the boiler is shown 90 degrees out of position, which soon becomes obvious during construction. **Photo 65** shows the shaft placed across the frames to check for positioning.

Photo 66 shows the shaft with the three lifting arms pinned in position with a dummy length of ⅛th-inch bar for alignment. The reach rod arm is still loose.

Continuing with sheet 4, the radius rods and combination levers for the inside valve gear are not drawn but they are the same as the outside ones, as the geometry for all three sets of valve gear is the same except for the inside expansion link. This is operated by the eccentric rod at a point ⅝-inch below the pivot point, whereas the outside links are longer with a dimension of ⅞th on the drawing.

Therefore it is hardly surprising that the swing of the inside link is greater than that of the other two with an almost 25 per cent difference in the geometry and the same eccentricity for the return cranks and the inside eccentric.

Unfortunately I was not able to use my old PC to run any of the valve gear programs to verify the valve events, and I was not able to find an Apple-friendly version. So £250 and a new motherboard later I have since been able to put all the figures through the Dockstader program and they seem to be reasonable but I am sure they could be improved.

What I did at the time was to lengthen the distance from the actuating point to the pivot on the centre expansion link to a distance of 0.783-inch, which actually was a bit too much as valve travel on the centre valve is now slightly less than the other two. Scale valve travel in full gear for the full-size would be 0.406 and I am getting around 0.370 on the outside cylinders and 0.300 on the middle one.

Looking ahead

There is still a slight discrepancy with the lifting linkage for the middle valve gear, as it does not seem to have the best geometry, it is not possible to get full reverse gear on the middle cylinder. In practice this is not a great

PHOTO 62:

It is essential to get the gear frames hung in the right place. The main gear frames are included with the laser-cut parts but supporting brackets have to be made.

PHOTO 63: The

red circle shows where the pivot for the expansion links lie on the main frames. A small hole can be drilled through the frames here if needed to help align the middle cylinder expansion link bearings.

PHOTO 64:

Three sets of cylinders and valve gear fitted, this part of the job virtually complete apart from repainting. There are some close clearances among all these parts but it can be made to work. Not a beginner's design though.

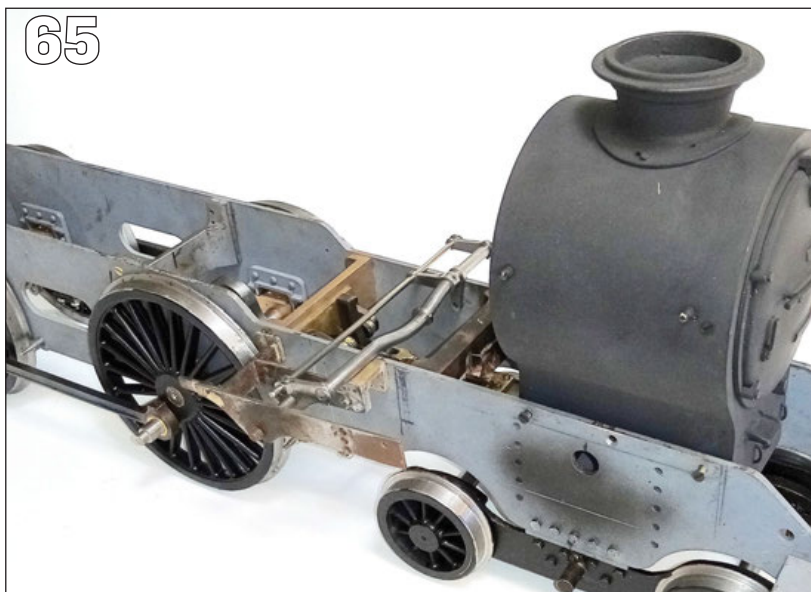
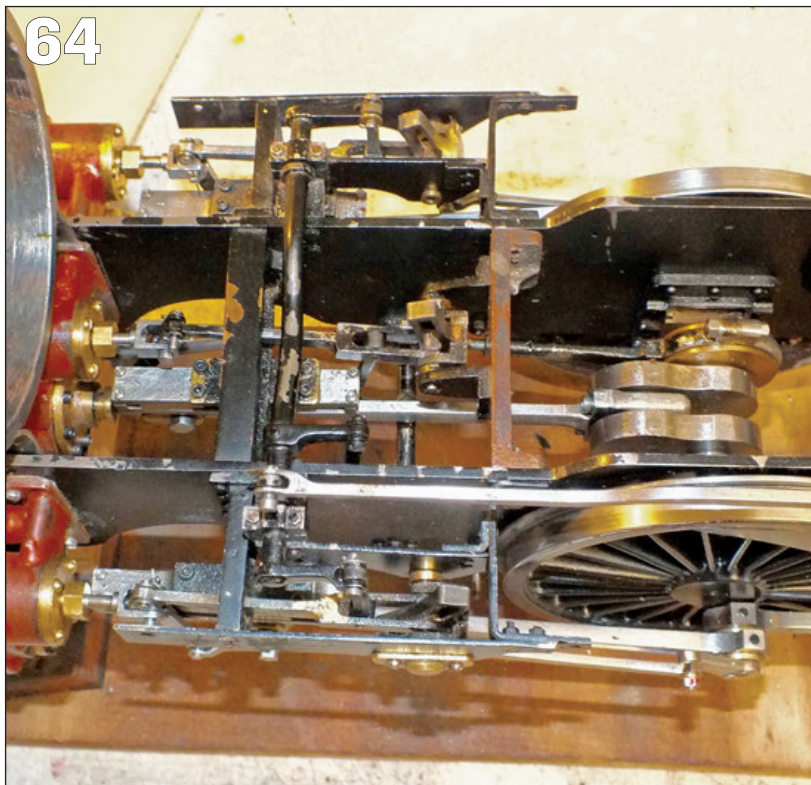
PHOTO 65:

The weighbar for the reversing gear needs to be bent to clear the boiler, make sure the bend is adequate to clear the boiler plus lagging.

PHOTO 66:

The lifting arms are firstly pinned in position then when you have tested with everything assembled it's worth silver soldering the joints as well.

Photos by the author



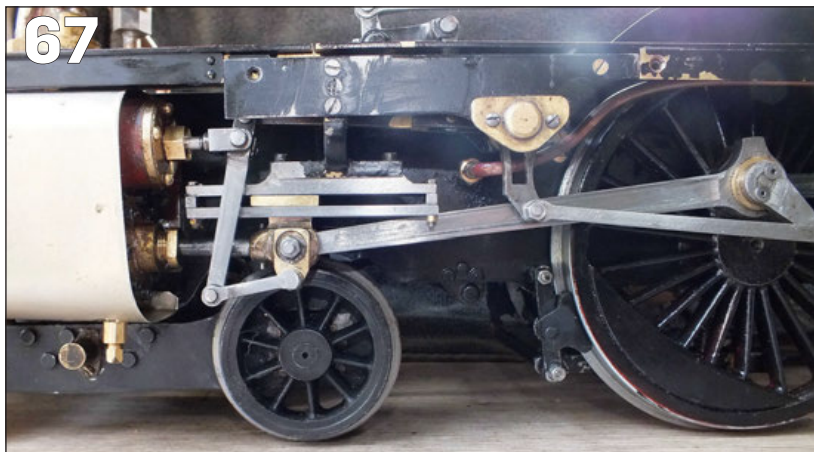
issue, it is performance 'going forward', as management speak says, that really matters!

Continuing with snags and pitfalls, it is really important that everything in the train of parts

between the axles and the cylinders is exactly where it should be.

Apart from the above I found very few problems, but I have built a few engines before. A few holes in the motion plates needed relieving to





avoid contact with the radius rods, but nothing major.

It's a trap...

Photo 67 shows a potential trap, the connecting rods have to be able to pass between the slide bars at the top of their movement, and in fact I had to shorten all the slide bar assemblies by around 1/8-inch at the back to get adequate clearance. I suspect I needed to take a little off the back of the crossheads as well.

Photo 68 is one of a set that I took in Eastleigh works when 'Cheltenham' was undergoing its last major overhaul in 2011. The clearance at the back of the slide bar assembly is clear to see, while the rarely visible front sandbox

is of interest, and the splasher for the rear bogie wheel. This latter would be almost impossible to fit on a working miniature loco owing to the need to traverse the tighter curves found on model tracks.

It seems the construction all went smoothly but there was a major problem that became apparent after the valve gear was fully assembled, which will be covered next time. **EIM**

■ Parts one to seven of this series appeared in the February to August editions of **EIM**. To download digital back issues or order printed copies go to www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or call 01778 392484.



PHOTO 67: Showing how the connecting rod needs to pass between the two bottom slide bars. Nick did not produce the correct profile for the bottom bars; it would not be too much of a job to replace them later. The gear frames and valances are not fully assembled here. Note the outer bearing housing for the expansion link and behind it the feed pipe to the left front boiler clack.

PHOTO 68: How the slide bars should look, and how LBSC drew them. This view shows useful detail of the piston rod gland, the cylinder relief valve and the front sandbox. The cylinder draincock mechanism and substantial supporting bracket are clear, the draincocks were fitted after the photos in this part of the series were taken and will be covered later.

GENERAL NEWS

HS2 grant boosts Ruislip green bid



The controversial HS2 rail project is providing funding to turn a locomotive on a 12-inch gauge line into more environmentally-friendly motive power.

A grant of £75,000 from the HS2 Community & Environment Fund is allowing the Ruislip Lido Railway in northwest London to convert Bo-bo diesel 'Graham Alexander', built in 1990 by Severn Lamb and currently fitted with a 4.5-litre Perkins diesel engine, to run on low-carbon battery power.

The work, part of a programme by the Ruislip Lido Railway Society to reduce local noise pollution and remove CO₂ emissions, is being carried out by renowned railway engineering specialist Alan Keef Ltd at its works near Ross-on-Wye, Wales.

According to the RLR's Matthew Thomas there are hopes that the rebuilt Graham Alexander, pictured at left in Alan Keef's workshops, will be back in traffic in time for Santa Special trains in December.

"We believe this project is likely to be the first narrow gauge railway in the UK to convert an existing diesel-powered locomotive to an entirely renewable energy source – the project will be a important test-bed for improving the long-term direction of narrow-gauge railway diesel fleet renewals across the UK," Matthew said.

Cathy Elliott, independent chair of the HS2 Funds, described the conversion as "a unique and creative project which highlights the flexibility the HS2 funding schemes can offer to a variety of organisations operating near to HS2's line of route."

In other news the Ruislip line has recently taken delivery of 10 new hopper wagons built by long-established miniature railway engineers Severn Lamb. The line now has 16 of these wagons in total meaning that its permanent way fleet actually outnumbers its passenger vehicle roster.

Photos: Matt Thomas/RLR



Final countdown to the big Autumn show



This issue of *EIM* includes our traditional four-page pull-out centre guide to the Midlands Model Engineering Exhibition and serves as a timely reminder that what is now without doubt the biggest event of the year is almost upon us once more.

This year's show, as ever sponsored by *EIM*, will take place from Thursday 12th to Sunday 15th October at its traditional venue of the Warwickshire Event Centre on the Fosse Way, neatly in the middle of a triangle formed by the M40, M42 and M1 motorways, and with plentiful parking on site.

As ever we are promised hundreds of models on display from rail and road steam to stationary engines, hot air engines, clocks, workshop equipment and more. Several will be competing for a range of awards, others will be on display on the many club stands, while more than 30 traders will also be present to enable visitors to stock up on those essentials for the winter workshop.

Highlights of this year's event will include an impressive display just inside the entrance door of the recently completed 10¼-inch gauge LNER P2 locomotive 'Cock O' The North', the last of five exhibition-standard scale steam locos completed by renowned builder John Wilks before he passed away in November last year. The loco, pictured below, was built entirely from works drawings and original research.

The three-cylinder model, which has been modelled in semi-streamlined form and is based at the Stapleford Miniature Railway, features a TIG-welded steel boiler with superheaters.

Big birthdays

There are some notable anniversaries being marked at this year's show, not least the 125th birthday of the SMEE, the Society of Model & Experimental Engineers (www.sm-ee.co.uk).

The Society has always had a stand at the show, displaying models and demonstrating model engineering techniques, but this year will celebrate its milestone with a larger display showing some important historic models from its large collection.

The SMEE was launched directly after the first appearance of *Model Engineer* magazine and our colleagues on the 'elder statesman' model engineering title will be with the SMEE jointly celebrating their big birthday.

The MMEE returned last year after a two-year hiatus due to the Covid pandemic, and this year's event sees a further sense of normality with the programme again including the series of lectures that were such a popular part of past events. The full programme is in the pull-out guide but subjects range from building stationary engines to injector design – we suspect the talk and demonstration of 3D printing will prove particularly popular...

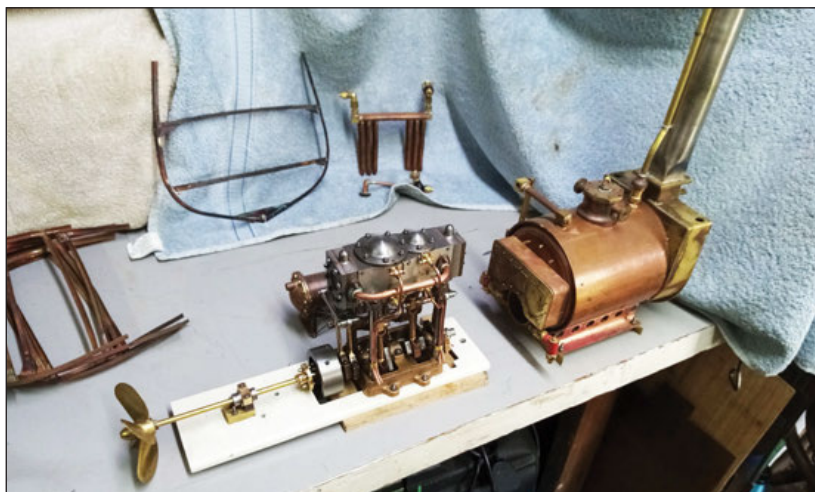
Another highlight of last year's show was the sheer quality of the locomotive competition classes, with the judges struggling mightily to separate the two leading contenders – it will be interesting to see if this year's entry causes similar problems for the judges...

As ever the area outside the halls will be just as busy, the Fosse Way Steamers traditionally putting on a good display with a wide variety of road steam engines in action.

Full details of this year's Midlands show, including ticket pre-booking facilities, can be found at www.midlandsmodelengineering.co.uk.



Marine and stationary builds are out there...



In view of your comments in last month's editorial about projects without wheels (*For those who didn't see the issue, I commented that we seem to get a majority of articles on rail-based models, some on road models, but those on stationary engines seem to have dried up and I wondered if they still held their popularity among builders – Ed*).

I think that they are out there and I enclose a photo of one of my efforts, not too far from completion for a marine compound engine, with scotch boiler with Ingolf modification and a condensing arrangement as well. The air pump remains to be constructed.

The plant is intended for a model of the 'Boadicea', a gentleman's yacht built by J Elders of Glasgow in around 1875, a photo of the model also enclosed. Amazingly on making an enquiry to the National Maritime Museum Greenwich they said they had the original builder's plans and copies were sent for a modest sum.

The model is constructed out of copper plate, the photo shows the superheater and frames which are bent up out of copper angle. Whether I ever get it finished is another matter as I have other engines – a Metro tank nearing completion together with a Britannia and various large pond yachts as well! **Mike Warren**

The Editor replies: Good to see Mike's models – he certainly is a prolific model engineer with several projects on the go at once. But sadly he did not document the build of this marine engine otherwise he would have earned himself a feature in the magazine. So if you are beginning an interesting build (especially, but by no means exclusively, of a stationary or marine engine), make sure you take lots of pictures and lots of notes, then maybe you can feature in our pages!



REVIEWS

The LMS Princess Coronation Pacifics, 1937-1956

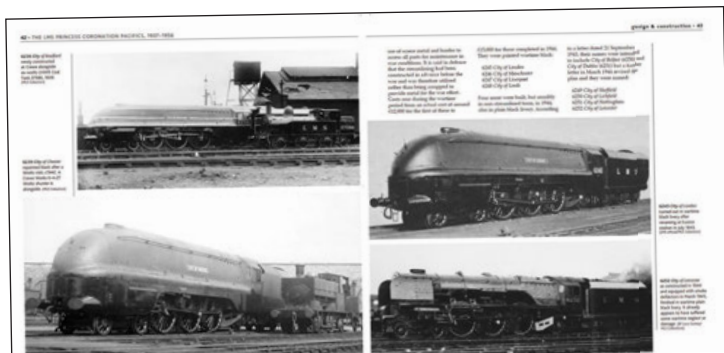
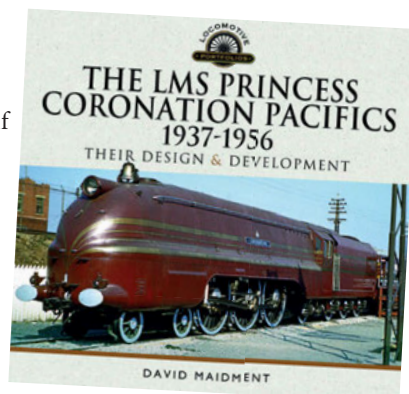
By David Maidment

No two ways about it, David Maidment is one prolific author, seeming to have a firm ambition to create a complete detailed reference library of British locomotive types. Having reviewed his title on the humble Great Western four-coupled tank in the August issue, this time we are presented with something much grander in the iconic Princess Coronation Pacifics of the London, Midland & Scottish Railway – powerful in their normal form, oh so distinctive with their streamlining which firmly 'outcurved' the rival

A4 locos of the London, North Eastern Railway.

The book covers the first half of these locos' history (the author is preparing a second volume covering their final years and preservation), and maintains the style and standard of previous volumes with the usual extensive research on the subject.

The photo content is particularly notable, extensive and well-reproduced covering all the variations and with a colour section. There are some nine general arrangement drawings included with dimensions, but as is typical of this series these are reproduced rather smaller than most **EIM** readers would probably prefer. **AC**



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Closing on the end of season

Clubs are getting the most out of their tracks as the year winds down and members start looking forward to the winter season of indoor meetings...

COMPILED BY ANDREW CHARMAN

We are heading into October – at least we will be as you read this, as your editor writes these words it's the end of August but feeling temperature-wise like we are already well into Autumn!

The month of October is traditionally for many clubs the final one of the year of running on their tracks and entertaining the public, as members look forward to a winter spent in the warmth of the workshop or in the clubhouse enjoying a programme of entertaining meetings. Not all clubs though – it's good to see more of our number running all-year round defying what the weather might decide to throw at us.

This month sees the arrival of a new edition of the **SMEE Journal** which is always packed with items of interest. One little note that caught our eye was the introduction to four new members elected to the Society between May and July – between them their engineering prowess includes watchmaking, rebuilding old cars and motorbikes, making stationary steam engines after a career as a design engineer in the motor industry and restoring an old lathe. Proof if ever it was needed that model engineering is not in the least just about making steam railway locomotives!

The SMEE will of course be playing a prime role at the **EIM**-sponsored Midlands Model Engineering Exhibition in October, in fact an even bigger role than normal as the show forms part of the Society's 125th anniversary celebrations. You are going to the show of course?...

Notable too that the **SMEE Journal**

editor Mike Tilby highlights a passage from a 1968 edition produced for the Society's 70th anniversary when the then editor was bemoaning the scarcity of articles sent in by members. "One aspect seems never to change," comments Mike, and as an editor forever imploring readers to tell us about their latest projects, I can certainly sympathise!

Facts don't replace skills

There will no doubt also be **EIM** readers who concur with **SMEE** member David Hatherill, who in a piece entitled 'In a World that time forgot' extols the appeal of non-digital technology. "My newest machine tool is my lathe," says Mike, "and even that was built in 1980."

He argues that in the age before digital electronics some fine engineering was turned out, and we concur. Yes, digital read-outs and such are time-savers but there's nothing wrong with manual adjustment and if one cannot afford the latest digital marvels one certainly should not feel at a disadvantage to those who can...

Talking of shows, major events such as the Midlands Exhibition may take centre stage but there are smaller shows that successfully promote the hobby each year, notably the Lowmex event in Lowestoft. This year's show is on 28th-29th October – dubbed as "probably the biggest model exhibition in East Anglia", it should be good if reports we have run from previous shows are a guide – models featured have gone onto major national success, notably Davinder Singh Matharu's fine 2-inch scale Fowler showman's engine. ▶



THIS PAGE: Roving **EIM** snapper Jonathan James found himself at the annual Steam Railway Weekend staged by the **Fareham and District SME** over the weekend of 29th-30th July, described by the club on its website as "a very busy couple of days!"

Trains were operating on both the raised 3½-inch and 5-inch gauge line as well as the ground-level 7¼-inch gauge line (above). The model railway was also in operation alongside various exhibition stands and stalls – on these Jonathan was particularly taken with the 'CMD Flyer No.3' (below left), a battery-electric loco built from a kit of laser-cut components and described as "a bit of fun", and 'Patricia' (below), a fine De Winton vertical-boiler locomotive which was built by club member Phil Brien.





Details of this year's show are at www.lowmex.co.uk

The latest edition of the **Bradford ME Monthly Bulletin** reports on the club taking part in the Steam Toys & Meccano Exhibition held at Armley Mills Industrial Museum in Leeds on 30th July. What a great idea for a show – youngsters these days simply can't get their heads around the fun we had at their age screwing together bits of metal with nuts and bolts to make recognisable machines, and as for steam toys...

In my 'other life' as a motoring journalist I've recently been elected the chair of Trustees of the Cloverlands Model Car Museum (www.cloverlandscarmuseum.com). This is a remarkable and growing collection of 6,000 or so models now housed in the visitor centre of the Welshpool & Llanfair Light Railway where I volunteer in the mid-Wales town that is home to **EIM Towers**.

A visitor to the museum not long ago got very excited when he spotted a Mamod steam car among the exhibits and we ended up swapping stories about the various Mamods we had as

children – the car was about the only one not in my collection, I had two traction engines, a roller and a lorry. All were fired using methylated spirits of course, not the slightly better than useless solid-fuel tablets that 'elf & safety' forced upon us at a later date. Happy days indeed...

Veteran makeover

The July-August edition of the **Southampton SME** newsletter includes the first part of a description of building LBSC's simple 3½-inch gauge 0-4-0 tank loco 'Tich', by member Ryan Norton. Now while many may wonder what's so special about documenting a basic beginner's design, I think it's good to publicise such a build as it should particularly appeal to new model engineers possibly yet to be convinced that they can indeed build their own loco.

One should remember too, that like all of the Curly Lawrence (LBSC) designs the construction of Tich was originally described a very long time ago and a new version with modern quality images is a big help to novice builders. Particularly as Ryan has also

"Youngsters these days simply can't get their heads around the fun we had at their age screwing together bits of metal with nuts and bolts to make recognisable machines..."

taken some time 3D modelling various aspects of the loco in CAD, which should certainly appeal to younger builders – well done Ryan for writing it and the Southampton editor for publishing it.

The newsletter with the hardest to pronounce name, from the **Pietermaritzburg ME** near Durban in South Africa, often contains much of interest and widely varying subject matter, and that's certainly true of the latest edition. In just eight pages as well as bringing members the latest news of goings-on at the Society's track, editor Martin Hampton manages to discuss Thomas Savery, inventor of a steam pump widely regarded as the first commercially used steam-powered device; show a nasty-looking period picture of an overturned traction engine with a comment that road accidents did not begin with the motor car; describe a quick and accurate method of making split pins, and reveal that in the UK pit ponies out-last steam engines as while the last industrial steam locos were withdrawn in 1990 at Castle Donington power station, the last pit pony did not retire from a Welsh coal mine until 1999...

Your editor loves stuff like this – returning to my stint at the model car museum I enjoy pointing at a fledgling display of very varied models in one cabinet and asking visitors what all the exhibits have in common. The answer is that they are all models of electric cars, including the first car of any sort to exceed 100kph which was a strange cigar-shaped thing called the La Jamais Contente. I also shock visitors with the fact that before the First World

Golden days at Ingfield

On a wet Saturday 22nd of July (writes **Phil Barnes**), the Ingfield Light Railway Society held a 'friends day' for members and invited guests to celebrate 50 years of there being a 10¼-inch gauge railway presence on the Ingfield Manor site, near Billingshurst in Sussex.

The railway was originally built by Keith Stratton, a teacher at the nearby Christ's Hospital school, and ran over the short distance between stations dubbed Haven Road and Ingfield Central.

The line has expanded since those early days to become the sizeable network it is today – from 1973 to 2008 it was known as the Ingfield Manor Railway before being given the name it carries today.

The gathering proved a big success despite the weather and its highlight was the initial running-in turns of a chunky looking Great Central Railway 0-6-0 'Pom-Pom' locomotive – the name is derived from the exhaust note. The loco has been built over the past three years by Dan Floyd and was only first steamed in the week prior to the event.

The 'general service' was operated by home-fleet locos 771, 47166 and 1102 which worked trains made up of a combination of wind-cutter wagons and bogie open cars.

The milestone was marked with a speech to those gathered, setting out the early history of this private line and the efforts by its late founder Keith Stratton. As with most club events, the celebration was enhanced with a special cake, washed down by copious teas and coffees!



War more electric cars were sold globally than any other type, with steam cars second most popular and petrol versions a poor third...

I think that the editor of the North London SME's *The News Sheet* has secret access to this writer's personal rail passions – having in last month's *Club & Track News* praised the covers of the previous two newsletters, we receive this month one with Beamish museum's 'Puffing Billy' adorning the cover – and oh how your editor likes ancient locos...

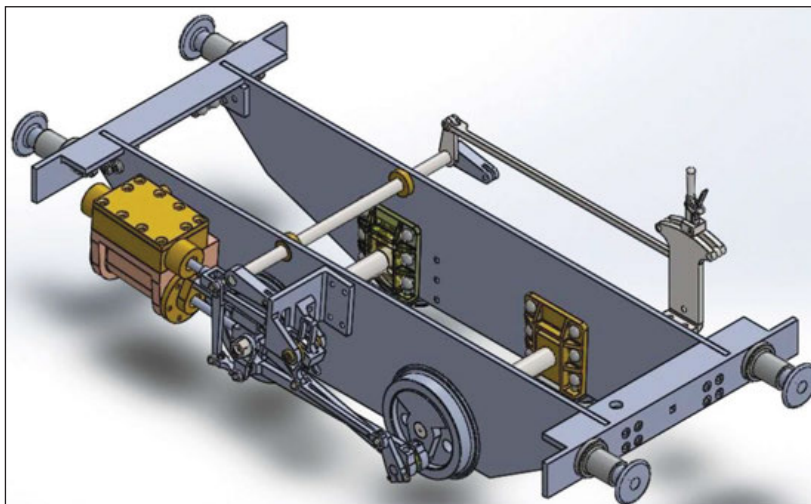
Anti-social?

Pertinent thoughts within the newsletter from the North London chairman who comments that many recent first-time visitors to the club's public running days had found out about them through Facebook, but that "personally I do not welcome the wider reach that social media can give and wish our visitors would stop posting us on it." He adds that this can make public running days a chore rather than the pleasure they have been – more enjoyment comes from hosting local people who have been visiting for many years and appreciate that it is a private club and not a commercial operation.

Interesting views – on the one hand it's a valid point, on the other without such publicity and visits will the revenue to keep the club going always be there? An ever-increasing concern in modern times, and one with no single answer...

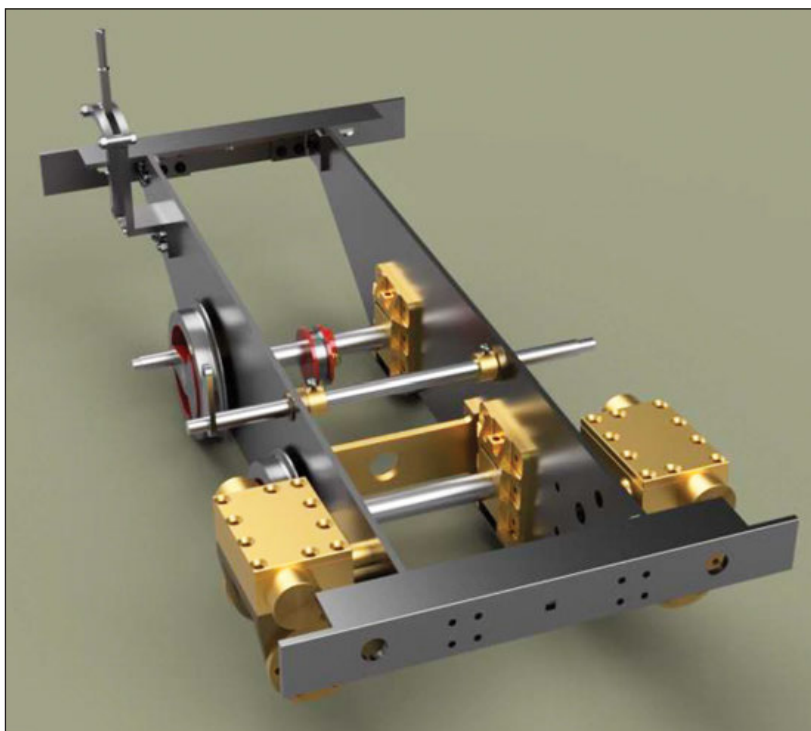
On perhaps a related note the latest edition of the *Ryedale SME* newsletter reports on the difficulty of attracting enough members to staff a recent public running session at its

"The build of Tich was described a very long time ago and a new version with modern quality images is a big help to novice builders..."



LEFT: Spotted atop a shelf by a visitor to Cloverlands Model Car Museum in Wales and sparking happy memories – the unmistakable shape of a Mamod steam car... Photo: Andrew Charman

RIGHT: Excellent CAD work in Solidworks and Fusion 360 by Southampton member Ryan Norton, bringing LBSC's classic 'Tich' design into the 21st century and hopefully sparking some appeal amongst novice builders...



LEFT: The debutant 'Pom-Pom' GCR o-6-o certainly looked the part.

ABOVE: Bit of a 1950s British Railways freight vibe as the Pom-Pom brings its trains alongside the ubiquitous 'Jinty' o-6-o.

RIGHT: It wasn't all about British Railways freight locos – the London North Eastern had a good presence at the event too....



All photos by Phil Barnes



Ryedale track, the newsletter editor pointing out that a third of the club's income comes from public running days. "I appreciate not everyone likes dealing with 'Joe Public' but the reality is, unless we get more support from the members for parties and public running... your membership fee is likely to rise considerably..."

Ryedale does very well in hosting children's birthday parties which again add to club funds – the same newsletter records one event on 9th July which saw possibly the largest number of children the club has ever accommodated in one go, more than

50, all royally entertained and the club even coming to the rescue to provide the ignition for the birthday cake. That's 50 youngsters who will go home after a memorable day with perhaps a spark lit in one or two of them...

Talking of matters online, it's perhaps a good time to remind readers that **EIM** has its own page on Facebook where we regularly post updates and share posts from the many clubs, organisations and individuals that make good use of social media to further the vocation.

Recent posts to our page have varied from latest events at clubs in

LEFT: We chose to use this photo simply because we think it epitomises the appeal of large-scale model road steam. It was sent to us by Amberley Museum in Sussex to promote its miniature steam weekend in September – unfortunately the museum always sends us such notifications just a few weeks before the events happen, which for a monthly magazine is not a lot of use! Still, the picture's nice...

Sussex and south Wales, through the latest running of the highly innovative Institute of Mechanical Engineers Railway Challenge on the Stapleford Miniature Railway, to a frankly incredible bit of film showing what happened when a motorist on discovering that the car park in Saltburn, North Yorkshire was full, simply drove onto and along the track of the Saltburn Miniature Railway – as a train was approaching... To find (and bookmark!) our page simply put 'Engineering in Miniature' into the Facebook search function.

Returning to the subject of passing on traditional skills, the North London newsletter also includes a nice bit of co-operation between Societies, reprinting a thought-provoking piece from the **Worthing & District ME** by member Dennis Holmes. The basic thrust is that more mature folk, like your editor, can easily forget that "knowledge, information, technique, skills and other attributes of life are not automatically bred into the new young person, the next generation, but have to be taught carefully and with sensitivity so that the student, on acquisition of this knowledge, has a broader, but more importantly, useful perspective of the knowledge acquired."

Dennis points out that with the removal of skills from the National Curriculum, students are now primarily concerned with factual knowledge which gets them their GCSEs and keeps them, the school and the education authority happy.

Saw or chopper?

If the slightest bit of the chain of knowledge is missing then they learn the facts but not the mastery of the subject, Dennis adds, before recounting horror stories including students trying to cut a joint in a piece of wood by using a tenon saw as a chopper, because they'd never seen a saw in use, others using ring spanners and anything else they could get their hands on as hammers... the list goes on, including a remarkable tale of someone trying to screw a hook into a wall of their new home using an electric drill...

The well-made point is, practical skills are not taught any more, and they are skills most of us will benefit from in our daily lives, not just those with a focus on engineering. As Dennis says, relying on machines and tools for every task with an absence of the skills needed to use such things leads to "partial knowledge and incomplete function."

He's so right, and perhaps it's yet another reason why we need model engineers, to keep such practical knowledge alive in an increasingly ill-informed world... **EIM**

ON THE TUBE

This is a new feature to **EIM** – the website Youtube, which encourages users to upload video clips of just about anything, is a rich source of widely varied model engineering content, but can be overwhelming to the first-time user. So each month we will be pointing readers at some clips they may find of interest. If you have seen something on Youtube that you think other readers might enjoy, then send in the link to editor@engineeringinminiature.co.uk



■ Lawrie's Mechanical Marvels is a well-known part of the online community and features many a miniature line. In this clip from the Bentley Miniature Railway Gala, held on the Sussex 7¼-inch gauge line at the end of August and featuring some 14 locomotives in action, Lawrie tries using a drone to control a train... bit.ly/3qUrihN



■ We featured the work of the Wythall Miniature Railway's veteran member Dennis Herbert in the October 2021 issue – this six-part build diary on the Wythall Youtube channel takes a detailed look at how Dennis built his superb 7¼-inch gauge GWR King class 4-6-0 that operates on the line. There's plenty of lovely workshop footage for the model engineer to enjoy... bit.ly/3sz3sIX

DIARY

EVERY SUNDAY

Bournemouth DSME public running, Littledown Pk, Bournemouth, 11am-3pm (also Wednesdays)

Bristol SMEE Public running day (October only), Ashton Court Railway, BS8 3PX noon-5pm

Gravesend MM&E public running (October only), Cascades Leisure Centre, Thong Ln, Gravesend, Kent DA12 4LG, 1-4pm

North Wilts ME public running, Coate Water Country Park, Swindon SN3 6AA, 11am-dusk (pre-booked slots on Halloween, 28th Oct)

Rochdale SMEE public running, Springfield Park, Bolton Rd (A58), Rochdale, pm.

Teeside SGR public running (October only), Preston Hall museum, Stockton-On-Tees, 1-4pm

Wakefield SMEE public running, Thornes Pk, WF2 8UD. 1-4.30pm

EVERY TUESDAY

Romney Marsh ME Track Meet, Rolfe Lane, New Romney, Kent, from noon (Until 31st Oct)

OCTOBER

- 1 Guildford ME** Small Model Steam Engine Group open meeting, Stoke Park, London Rd, Guildford, Surrey GU1 1TU, 2-5pm
- 1 Rugby ME** members running, Onley Lane, Rugby, CV22 5QD
- 1 Ryedale SME** final public running of 2023, Pottergate, Gilling East, YO62 4JJ, 12.30-4.30pm
- 1 Welling & District ME** public running, Hall Pkce Pk, Bourne Rd, Bexley, Kent DA5 1PQ, 12.30-4pm
- 4 Bradford ME** meeting, Bits & Pieces Evening, Saltaire Methodist Church, 7.30-10pm
- 4 Bristol SMEE** meeting, On the Table evening, Begbrook Social Club, BS16 1HY, 7.30pm
- 4 Leeds ME** meeting, talk on Siemens rail manufacturing plant, Darrington Golf Club, Pontefract WF8 3BP 7-9pm
- 6 North London ME** meeting, Members Work in Progress, Summers Lane, Finchley

6 Rochdale SMEE Models Competition night, Castleton Community Centre, Manchester Road, Rochdale, 7pm

7 National 2½" Gauge Association running day at **Northwest Leicestershire SME**, Whitwick, Coalville LE67 5BZ, 10am-4pm

7 Tiverton ME Saturday running at Rackenford track. Contact Chris Catley 01884 798370 (www.tivertonmodelengineering.org.uk)

8 Bradford ME public running, Northcliffe track, Shipley, BD18 3DD, members from 11.30am, public 1.30pm

8 Canterbury & Dist ME public running, Bretts Quarries, Fordwich near Canterbury, 2-4pm

8 Hereford SME Public Running, Broomy Hill Railway, Hereford HR4 0LJ, noon-4.30pm

8 Welling & District ME public running, Hall Pkce Pk, Bourne Rd, Bexley, Kent DA5 1PQ, 12.30-4pm

8 Worthing SME final public running of season, Field Place, Durrington, Worthing 2-5pm

12 Worthing SME meeting, subject tba, Field Place, Durrington, Worthing 7.30pm

12 Midlands Model Engineering

15 Exhibition, sponsored by **Engineering in Miniature**, Warwickshire Event Centre, The Fosse, nr Leamington Spa CV31 1FE. Details, ticket booking at www.midlandsmodeleengineering.co.uk

14 SMEE Digital Group online meeting, 10.30am – details from digital@sm-ee.co.uk

14 Bromsgrove SME public running, **15** Avoncroft Museum of Historic Buildings, Stoke Heath, Bromsgrove, B60 4JR 11am-3pm

15 Cardiff ME public running, Heath Park, King George V Drive East, Cardiff CF14 4AW, 1-5pm

15 Guildford ME public running, Stoke Park Railway, London Rd, Guildford, Surrey GU1 1TU, 2-5pm

15 Rugby ME public running, Onley Lane, Rugby, CV22 5QD, 11am-1pm, 2-4pm

15 York ME AGM, North Lane, Dringhouses, York YO24 2JE, 3pm

18 Bristol SMEE meeting, Steam Launches & Engines, Begbrook Social Club, BS16 1HY, 7.30pm

18 Leeds ME AGM, Darrington Golf Club, Pontefract WF8 3BP 7-9pm

20 Rochdale SMEE AGM, Castleton Community Centre, Manchester Road, Rochdale, 7pm

21 SMEE rummage sale, Marshall House, London SE24 0HW. Viewing from 11am, sale from 2pm

22 Tiverton ME Sunday running at Rackenford track. (See 7 Oct)

26 Guildford ME public running, Stoke Park Railway, London Rd, Guildford, Surrey GU1 1TU, 10am-1pm

26 Worthing SME meeting, annual auction, Field Place, Durrington, Worthing 7.30pm

28 Hereford SME Halloween Running, bonfire & fireworks, Broomy Hill Railway, Hereford HR4 0LJ, 2-6pm

28 North Wilts ME Halloween public running, Coate Water Country Park, Swindon SN3 6AA, 3.30-8.30pm

28 Bromsgrove SME public running, **29** Avoncroft Museum of Historic Buildings, Stoke Heath, Bromsgrove, B60 4JR 11am-3pm

28 Lowmex 23 – Lowestoft Model **29** Engineering & Model Making Exhibition, East Coast College, Lowestoft NR32 2NB, details at www.lowmex.co.uk

NOVEMBER

1 Bradford ME meeting, Autumn auction, Saltaire Methodist Church, 7.30-10pm

1 Bristol SMEE meeting, Use of mechatronics at Crofton pumping engines, Begbrook Social Club, BS16 1HY, 7.30pm

1 Bromsgrove SME half-term public running, Avoncroft Museum of Historic Buildings, Stoke Heath, Bromsgrove, B60 4JR 11am-3pm

1 Leeds ME meeting, members' favourite tools and gadgets, Darrington Golf Club, Pontefract WF8 3BP 7-9pm

1 Rugby ME half-term public running, Onley Lane, Rugby, CV22 5QD, 1-3pm

3 Rochdale SMEE Garden Railways by Roy Holt, Castleton Community Centre, Manchester Road, Rochdale, 7pm

4 Ryedale SME night run, Pottergate, Gilling East, YO62 4JJ

4 Tiverton ME Sunday running at Rackenford track. (See 7 Oct)

4 York ME Bonfire night Spectacular public running, fireworks display, North Lane, Dringhouses, York YO24 2JE, 3pm-9pm

4 Small Gauge Festival, Sydney

5 LSLS, Anthony Road, West Ryde, Sydney, Australia, details at www.sls.asn.au

7 Romney Marsh ME meeting, Bits & Pieces & Bring & Buy, Rolfe Lane, New Romney, Kent, 7.30pm

12 Worthing SME meeting, subject tba, Field Place, Durrington, Worthing 7.30pm

14 Bristol SMEE meeting, Meccano a history, Begbrook Social Club, BS16 1HY, 7.30pm

17 Rochdale SMEE general meeting, Castleton Community Centre, Manchester Road, Rochdale, 7pm

19 Tiverton ME Sunday running at Rackenford track. (See 7 Oct)

21 Romney Marsh ME meeting, Railways of Colonel Stephens by Doug Lindsey, Rolfe Lane, New Romney, Kent, 7.30pm

PLEASE NOTE all outside events and public running are subject to weather – please check with Society concerned before travelling to an event.

Details for inclusion in this diary must be received at the editorial office (see page 3) at least EIGHT weeks prior to publication. Please ensure that full information is given, including the full address of every event being held. Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions in these listings.

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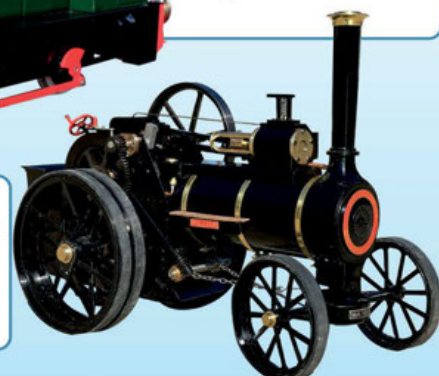
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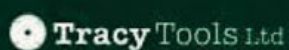
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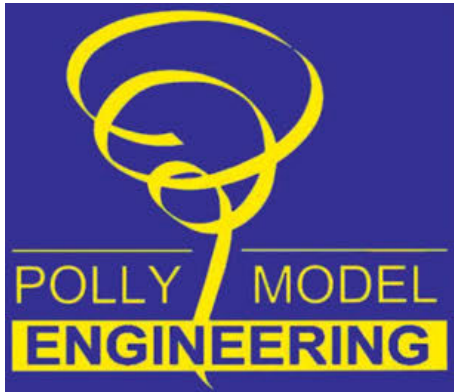
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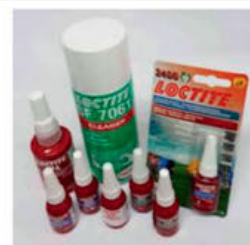


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